Government of The People's Republic of Bangladesh
Local Government Engineering Department

Technical Assistance on Integrated Solid Waste Management Improvement Project

Preparation and Design Consultancy Services

Environment and Social Impact Assessment (ESIA)

RANGPUR CITY CORPORATION

ASIAN INFRASTRUCTURE INVESTMENT BANK

Waste Concern Consultant

IPE GLOBAL

AQUA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF RANGPUR CITY CORPORATION SUBPROJECT

Table of Contents

List of Tables

List of Figures

Abbreviations

ADB	-	Asian Development Bank
AH	-	Affected Household
AIE	-	Assessment of Impact on Environment
AP	-	Affected Person
AQG	-	Air Quality Guideline
ASIE	-	Assessment of Social Impact on Environment
BECA		Bangladesh Environment Conservation Act
BOD_5	-	5-day Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
CPC	-	Commune People's Committee
CSSWM	-	Common System for Solid Waste Management
DCARC	-	District Compensation Assistance and Resettlement Committee
DCS	-	Distributed Control System
DEI	-	Division of Economy and Infrastructure
DENR	-	Division of Environmental and Natural Resource
DHPS	-	Department of Housing and Public Services
DHPU	-	Department of Housing and Public Utilities
DMS	-	Detailed Measurement Survey
DO	-	Dissolved Oxygen
DoE	-	Department of Environment
DONRE	-	Department of Natural Resources and Environment
DPC	-	District People's Committee
DPHE	-	Department of Public Health Engineering
EARF	-	Environmental Assessment and Review Framework
ECA	-	Environmental Conservation Act
ECC	-	Environmental Clearance Certificate
ECR	-	Environmental Conservation Rules
EE	-	Ecological Expertise
EHS	-	Environmental, Health and Safety
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EP	-	Executive Power
EPSM	-	Environment and Plan of Social Management
ESIA	-	Environment and Social Impact Assessment
ESMS	-	Environmental and Social Management Systems
ETP	-	Effluent Treatment Plant
EU	-	European Union
FS and CD	-	Feasibility Study and Conceptual Design
GE		Gender Equality
GHG	-	Greenhouse Gas
GIS	-	Geographic Information System
GRC	-	Grievance Redressal Cell
GRM	-	Grievance Redress Mechanism
HDPE	-	High Density Poly Ethylene
ICPMU	-	Investment and Construction Project Management Unit
IEE	-	Initial Environmental Examination
LCC	-	Location Clearance Certificate
LFG	-	Landfill Gases
LGED	-	Local Government Engineering Department
MED	-	Ministry of Economic Development
MENR	-	Ministry of Ecology and Natural Resources
MLGRDC	-	Ministry of Local Government, Rural Development, and Cooperatives
NGO	-	Non-Government Organization

O&M	-	Operations and Maintenance
OFID	-	OPEC Fund for International Development
OI	-	Operational Instructions
PMU	-	Project Management Unit
PPTA	-	Project Preparatory Technical Assistance
REA	-	Rapid Environmental Assessment
RP	-	Resettlement Plan
SEP	-	State Ecological Program
SIA	-	Social Impact Assessment
SEA	-	Sexually Exploitation and Abuse
SH		Sexually Harassment
SPS	-	Safeguard Policy Statement
TSS	-	Total Suspended Solids
SWM	-	Solid Waste Management
SWMC	-	Solid Waste Management Company
TECG	-	Thermal Effect Creating Gases
TOR	-	Terms of Reference
TSP	-	Total Suspended Particles
UEIP	-	Urgent Ecological Investment Project
USEPA	-	United States Environmental Protection Agency
WB	-	World Bank
WHO	-	World Health Organization
WTE	-	Waste to Energy

GLOSSARY

Adverse impact: An impact that is considered undesirable.
Ambient air: Surrounding air.
Aquatic: Growing or living in or near water.
Arsenic: Arsenic is a chemical element with symbol "As", and atomic number 33. Arsenic occurs in many minerals, usually in conjunction with sulfur and metals, and also as a pure elemental crystal. Arsenic is a metalloid.
Bangla: Bengali language.
Baseline (or Existing) Conditions: The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e., the 'No-development Option'.
Bazar: Market
Beel: A "back swamp" or depression. It can be either perennial or seasonal.
Beneficial impacts: Impacts, which are considered to be desirable and useful.
Biological diversity: The variety of life forms, the different plants, animals and micro-organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity
Biological Oxygen Demand (BOD): The amount of dissolved oxygen, consumed in a biological process, which degrades the organic matter in water.
Consultation: The process of seeking the views of interested or affected stakeholders and engaging them in constructive two-way dialogue.
Crore: 10 million (=100 lakh)
Ecology: Science, which studies relationships and interaction between organisms and their environment.
Ecological factor: Any part or condition of the environment that influences the life of one or more organisms.
Ecosystem: A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.
Emission: The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.
Endangered species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.
Environmental effects: The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.
Environmental enhancement: An international change, which amplifies the anticipated positive impact of the project on an environmental component.
Environmental impact assessment (EIA)/Environmental assessment: The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from a proposed development and its reasonable alternatives, sometimes known as environmental assessment.
Environmental Impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.
Environmental Management Plan (EMP): A plan to undertake an array of follow-up activities which provide for the sound environmental management of a project/intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized; and sustainable development is ensured.
Environmental management: Managing the productive use of natural resources without reducing their productivity and quality.
Erosion: Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation: The process of looking back at what has been really done or accomplished.
Fauna: A collective term denoting the animals occurring in a particular region or period.
Field Reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.
Flora: All of the plants found in a given area.
Flood Plain: Areas of relatively low-lying land seasonally inundated by overspill from adjacent rivers, lakes and natural depressions.
Habitat: The natural home or environment for a plant or animal.
Household: A household is defined as a dwelling unit where one or more persons live and eat together with common cooking arrangement. Persons living in the same dwelling unit by having separate cooking arrangements constitute separate households.
Important Environmental Component (IEC): These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.
Initial Environmental Assessment/ Evaluation: Preliminary analysis undertaken to ascertain whether there are sufficient likely significant adverse impacts to warrant a "full" EIA. In some countries, use of initial assessment forms a meaning of "screening" proposed projects.
Katcha: Poor quality, poorly built
Khal: Small Channel, Canal.
Khas, Khash: Belongs to government (e.g., land)
Land use: Types include agriculture, horticulture, settlement, pisciculture and industries.
Mauza: A Bangla word for the smallest government administrative area corresponding to a village revenue unit.
Madrasah*:* Islamic college
Magnitude: The degree of change in an important environmental component that results from a project activity. It refers to the size of the impacts and could be either beneficial or adverse.
Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.
Mouza: Government-recognized land area
Natural Gas: Flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.
Negative Impact: Negative Change from the existing situation due to the project.
pH: pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pH of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water.
Public involvement/ Public consultation: A range of techniques that can be used to inform, consult, or interact with stakeholders affected/to be affected by a proposal.
Pucca: Good quality, well built, solid
Reversible impact: An environmental impact that recovers either through natural process or with human assistance (e.g., cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built).
Risk analysis: A technique used to determine the likelihood or chance of hazardous events occurring (such as the release of a certain quantity of a toxic gas) and the likely consequences.
Stakeholders: Those who may be potentially affected by a proposal e.g. local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or take an interest in it.
Social impact assessment: The component of EIA concerned with changes in the structure and functioning of social orderings. In particular the changes that a development would create in: social relationship; community (population, structure, stability etc.); people's quality and way of life; language; ritual; political/economic processes; attitudes/values.
Socio-economic: The human environment, which includes social and economic components that are not termed biophysical.
Sustainability: Applied to positive impacts only and could be of three different types sustainable, sustainable with mitigation and non-sustainable

Taka: Unit of Bangladeshi currency.
Terrestrial: Living on land.
Thana: Sub-district level of government administration, comprising several unions under a district.
Union: Smallest unit of local self-government comprising several villages.
Upazila: Sub-district name. Upazila was introduced in 1982.
Wildlife: Organism that can survive without any artificial help. The four general types are: mammals, amphibians, reptiles and birds.
Wildlife Habitat: An area maintained as an undisturbed breeding ground for wild fauna. The habitat is protected for the continued well-being of the resident and migratory fauna.

Zila: Bengali word of district.

WEIGHTS AND MEASURES

Ha	-	Hectare
Km	-	Kilometer
M	-	Meter
Mm	-	Millimeter

NOTES

(i) In this report, "$" refers to US dollars.
(ii) BDT refers to Bangladeshi Taka

EXECUTIVE SUMMARY

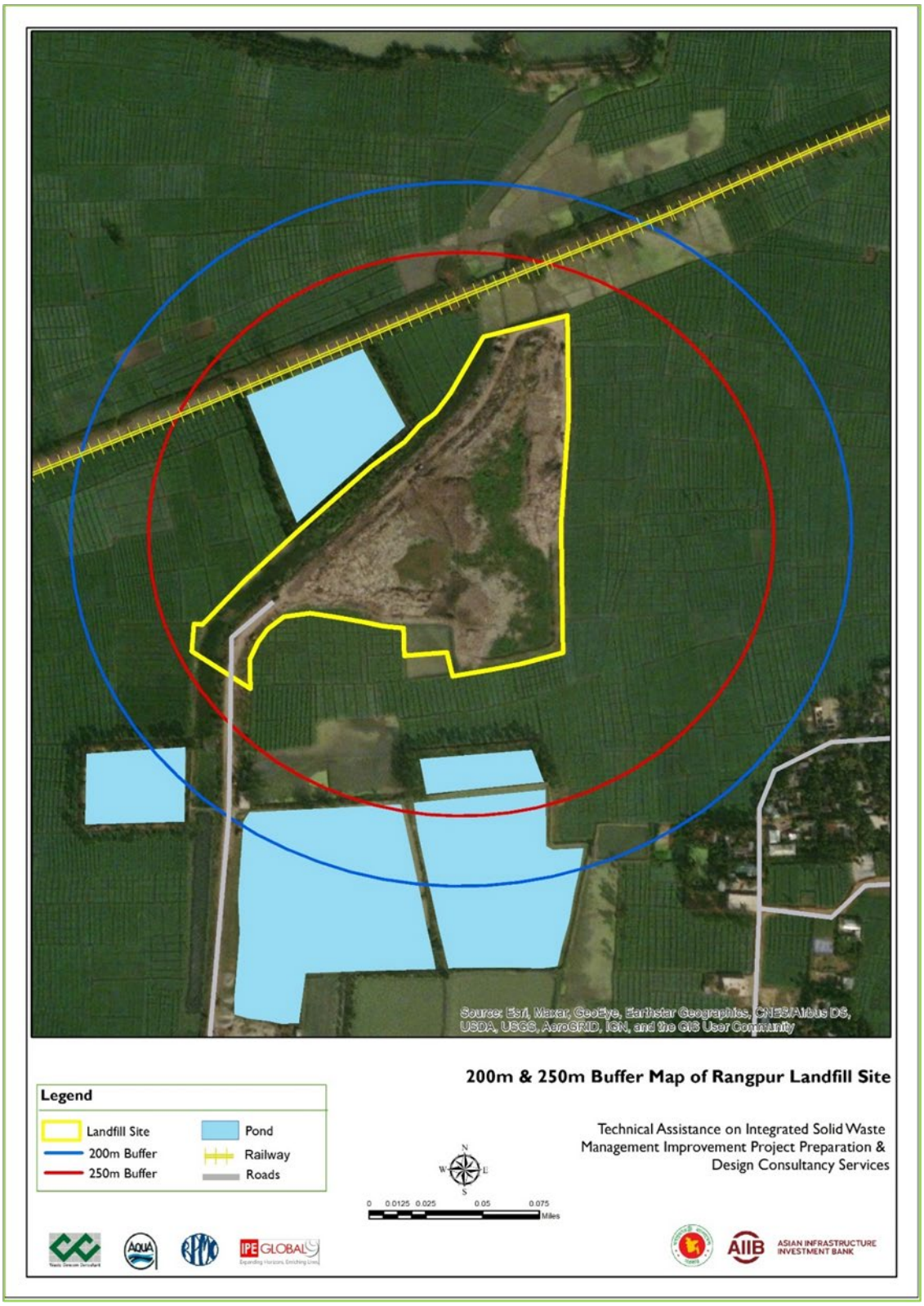
The current Integrated Solid Waste Management Improvement Project (ISWMIP), supported by the AIIB, will improve the SWM system in the selected municipal areas. This will help: (i) improve public health and quality of life by reducing exposure to pollutants and disease vectors associated with solid waste; (ii) strengthen the government's capacity to plan for and implement effective waste management services; and (iii) improve SWM practices in the country, encouraging waste minimization, recycling, and segregation at source. The project is aligned with the Government of Bangladesh (GoB)'s priorities for providing sustainable urban infrastructure. The country is, in particular, facing an immense challenge in its solid waste management. The project would directly contribute to one of the key objectives of the 8th Five Year Plan and the long-term Perspective Plan for 2021-2041, that is to improve the urban environment and quality of life.

The subproject aims to establish an integrated landfill and resource recovery facility, improve secondary storage of waste by introducing containerized storage system, and improve five existing roads in Rangpur City Corporation (RpCC) connecting the landfill site. The land for establishing the integrated landfill and resource recovery facility is owned by the City Corporation authority. This land was acquired by the government and handed over to RpCC. Currently, the land is free from any unauthorized occupancy. Five existing roads (Road from RK Road to Kolabari Dumping Yard, Road from Mahigonj Shahidminar to Gosaibari Road, Road from Bokhtiarpur Bridge to Kopat Bridge, Road from 20MW Power Plant to Morichtari, and Road from Kashbag Govt. Pry. School to Balatari Mosque) of 8.265 km connected to the proposed landfill area will be improved without any widening. These roads are also free from any unauthorized occupancy. The project plans to construct five STSs in five convenient locations within the city corporation area. RpCC authority has selected five locations through consultation with the local communities for the mentioned five STSs and their construction which are well-connected by roadway. The selected locations are (i) New Jummapara in ward no. 23 (for STS-1), (ii) Mahadevpur (for STS-2) in ward no. 26, (iii) Satgara Masuapara in ward no. 17 (for STS-3), (iv) New Master Para in ward no. 25 (STS-4), and (v) Tajhat (STS-5) in ward no. 28. (for STS-5). The selected locations for the STSs are also free from any unauthorized occupancy. Land for the proposed STSs are owned by the RpCC.

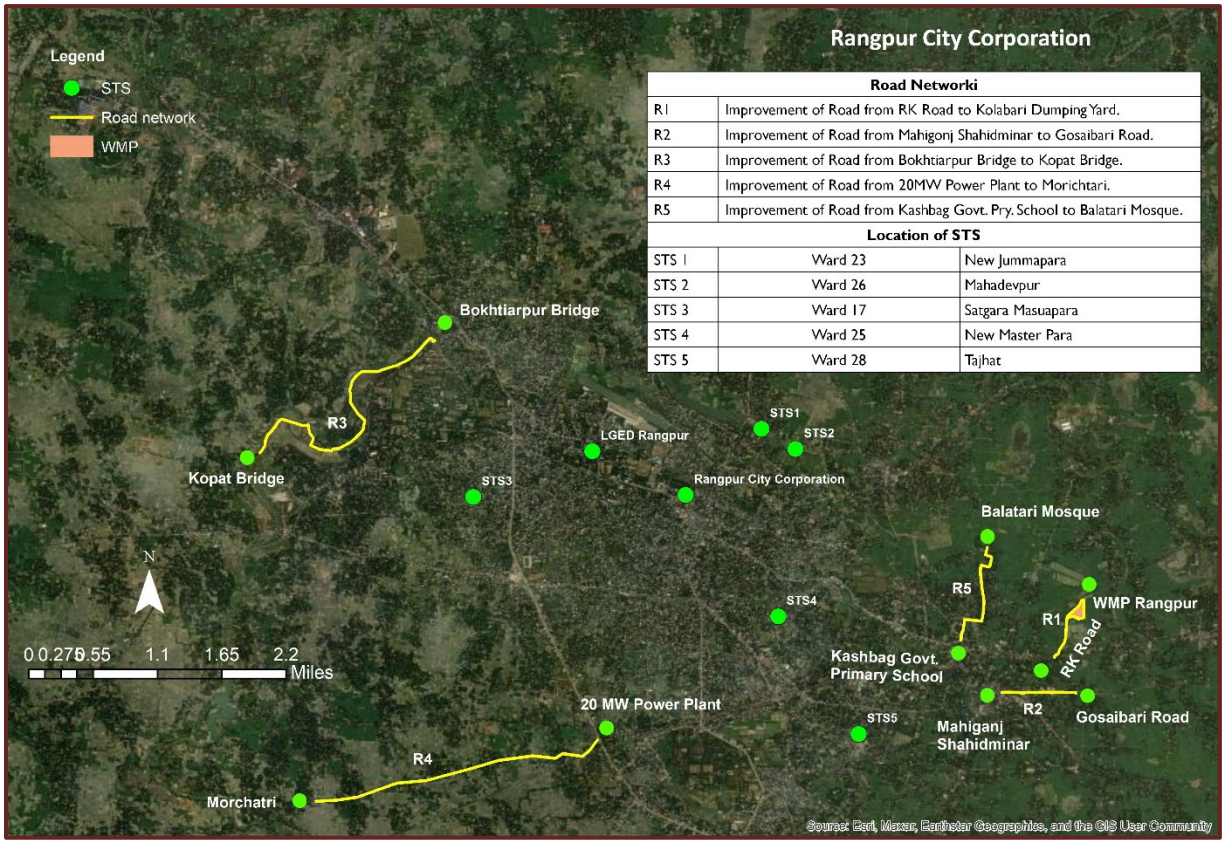
According to AIIB guidelines, the Rangpur City Corporation subproject will require a comprehensive ESIA following the ESMPF addressing the environmental and social standards to ensure that the subproject is environmentally sound and sustainable. As part of the AIIB funding guidelines, an Environmental and Social Impact Assessment (ESIA) should be carried out to address the environmental and social issues of the subproject following operational procedures, policies, guidelines, and statements set by the AIIB. According to the Environmental Conservation Rules (ECR), 2023 of the Department of Environment (DoE), Bangladesh, the subproject will fall under the "**Red Category**" and it on the Red list in ECR'23 (Schedule-1, Sl-66 of Red Category: Municipality Landfill Site).

Sl. No.	SWM Components	Category (ECR'2023)	Overall Assessment
1	Landfill of Municipality	Red	Red category subproject
2	Compost Plant (>5MTs)	Orange	
3	Pyrolysis	Orange	
4	Material Recovery Facilities (MRF)	-	
5	Secondary Transfer Station of City Corporation	Yellow	

The subproject is located at the landfill site of the Rangpur City Corporation, which is in ward no 29. Geographically it is located at 25.739168° north and 89.301455° east. The below Satellite image depicts Location of landfill site and compliance with environment rules, and the Locations of the proposed landfill site and STSs, and the alignments of the connecting roads proposed for improvement for the RpCC subproject.



Location Map of Landfill Site and Compliance with Environment Rules



Locations of the landfill site and STSs and alignment of the connecting road for the landfill site

To improve the solid waste management situation of Rangpur City Corporation following interventions have been planned:

- Compost Plant
- Pyrolysis Plant
- Material Recovery Facility
- Landfill Cells and Leachate Treatment Facility

The contractor and operator will be primarily responsible for preparing the Site-Specific Environmental Management Plan (SEMP) following the risks associated with the subproject's preconstruction, construction & operation stages. During construction, the contractor will be guided by the SEMP. This shall be based on the subproject's ESMP with details on staff, resources, implementation schedules, and monitoring procedures. The table below shows the environmental and social risks associated with the Integrated Solid Waste Management Improvement Project of Rangpur City Corporation.

Subproject Activities	Environmental and Social Risk
Preconstruction Stage	
1.1 Location impacts of the plant	Nearby communities may be affected due to increased pollution during construction and operation.
1.2 Incorporation of all mitigation measures in the design	The efficiency of the plant operation.
1.3 Natural calamities	There is a threat of inundation due to flooding during monsoon due to excessive rain.
1.4 Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.

Subproject Activities	Environmental and Social Risk
1.5 Permits, clearances, no objection certificate (NOC), etc.	Failure to obtain environmental clearance and NOCs, etc., can result in design revisions and/or stoppage of works.
1.6 Preparation of SEMP	Expect minor impacts during the construction period only, and mitigation measures are addressed.
1.7 SEMP implementation training	Irreversible impact on the environment, workers, and community
Construction Stage	
2.1 Physical and cultural heritage	Construction works will be on the existing landfill site, thus risk for chance finds is very low.
2.2 Excavations	Potential erosion, dust generation, and accident. The impacts are negative but short-term, site-specific within a relatively small area, and reversible by mitigation measures.
2.3 Waste management	Oil, grease, etc., from construction machinery; hazardous and solid waste from waste construction material and food; the impacts are negative but short-term, site-specific within a relatively small area, and reversible by mitigation measures.
2.4 Water quality (surface and groundwater)	Trenching and excavation, runoff from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall, which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area, and reversible by mitigation measures.
2.5 Soil disturbance	The construction activities may cause soil degradation problems in the areas of the plant, access road, etc.
2.6 Air Quality	Air pollution due to construction activities. The impacts are negative but short-term, impacts within a relatively small area, and reversible by mitigation measures.
2.7 Noise level	Construction activities will be nearby settlements. A temporary increase in noise level may be caused by excavation equipment and the transportation of equipment, materials, and people. The impact is short-term and within a relatively small area, and reversible by mitigation measures.
2.8 Biodiversity	▪ Clearing of existing vegetation may result in loss of associated ecological habitats and their fauna. ▪ Noise, vibrations, and intrusive activities related to construction works may scare away animals remaining onsite after vegetation clearance.
2.9 Socio-economic status	Manpower may be employed from the local community during the construction and operation stage. Thus, the potential impact is positive and long-term.
2.10 Provision of worker facilities	Inconvenience to the communities due to the presence of workers; solid waste and sanitary discharges from worker camps.
2.11 Occupational Health and Safety	Occupational hazards can arise during work. Potential impacts are negative and long-term but reversible by mitigation measures.
	Health Risk of construction workers due to COVID-19
2.12 Community Health and Safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area, and reversible by mitigation measures.
2.13 Site reinstatement	Damage due to debris, spoils, excess construction materials
Operation Stage	
3.1 Health and Safety Risks of Workers	Risk to the health of workers working in plant operation and maintenance, workers may suffer infectious diseases due to hazardous waste workers/operators may have accident risk of operation and maintenance of the landfill and resource recovery facility
3.2 Efficient working of integrated solid waste management activities	Inefficient working of integrated solid waste management activities may cause poor quality of treatment and management of solid waste and may cause environmental, health, and safety risk to workers and the environment.
3.3 Air Quality	The ambient air quality of the landfill Area.
3.4 Socio-economic aspect	▪ Visual impacts. ▪ Impacts on community health.

Subproject Activities	Environmental and Social Risk
	▪ Employment.
3.6 Traffic management	▪ Random parking of vehicles and unplanned loading/unloading areas can lead to traffic congestion for compost and recyclable transport

In order to identify households, businesses, and individuals affected due to the implementation of the sub-project have been identified through social surveys, field visits, consultation meetings, and observations. The list of the affected entities with livelihood impact due to the implementation of integrated landfill and resource recovery project along with the improvement of access roads is shown below:

Social Impact Assessment in the Construction and Operation Phase of Landfill Site							
Sl No.	Affected Entities	Construction Phase			Operation and Maintenance Phase		Remarks
		No. Affected	Compensation	Engaged in work	Engaged	Work field	
1	Waste Pickers	12	√	√	√	Engage in MRF	Will be absorbed by the municipality
2	Vangari Shop	2	√	√	√	Better Livelihood	Transfer and Reconstruction Grants will be made before the construction phase
3	Whole Seller Shops in Landfill Area	4	√	√	√	Better Livelihood	Transfer and Reconstruction Grants will be made before the construction phase
4	Affected Pond	5	√	X	X	To be compensated by resettlement	Based on the decision of DOE and the Municipality

Social Impact Assessment in the Construction and Operation Phase of One Connecting Road							
Sl No.	Affected Entities	Construction Phase			Operation and Maintenance Phase		Remarks
		No. Affected	Compensation	Engaged in work	Engaged	Work field	
1	Small shop, Restaurant, Pharmacy & Business Enterprise along the connecting road	83	√	X	X	X	Compensation payment for income loss will be made before the construction phase

For the RpCC subproject, the Compensation Provision under Livelihood Restoration Program has been estimated at Tk. 20,998,035 (Tk. 7,564,035 for landfill site improvement and Tk. 13,434,000 for connecting road improvement). The Project Director of ISWMIP will allocate the compensation payable, and CC authority will disburse the compensation to the PAPs under the supervision of the social safeguard team of the supervision consultant of the project. A social survey was conducted in December 2022 and a road survey was conducted in June 2023. The quoted numbers regarding the affected categories are currently considered an estimate, and their numbers will be updated six months before the commencement of civil works to reflect the fluidity of the waste-picking ecosystem and the change in the commercial establishments along the connecting roads. No person will be eligible for any Livelihood Restoration Compensation after the update. During the social and road survey, GPS coordinates are taken for the affected entities. This GPS location will be used to verify and update the affected persons during compensation payment for livelihood restoration. The entitlement matrix and the project-affected persons' compensation are detailed in the livelihood restoration plan report of the Rangpur City Corporation subproject.

In addition to payment of compensation to the affected persons, it is recommended to arrange capacity-building training for the affected persons along with the arrangement of health camps annually. The estimated training and health camp budget is shown in the Livelihood Restoration Plan.

A copy of the ESMP shall be kept onsite during the construction period at all times. The ESMP shall be made binding on the contractor operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance. LGED has fully endorsed the ESMP and is committed to implementing all the mitigation measures. Rangpur City Corporation will also ensure that the work is carried out in an environmentally acceptable manner and that the monitoring and reporting are completed in a compliant and timely fashion, acceptable to DOE.

The stakeholders are involved in developing the ESIA through discussions onsite, and public consultation, after which views expressed are incorporated into the ESIA. This ESIA will be made available to a wider audience via the Rangpur City Corporation, LGED, and AIIB websites. Free printed copies of the executive summary documents in Bangla and English will be made accessible to the general public. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the ESIA to ensure any public grievances are addressed quickly.

1. INTRODUCTION

1.1 Background

Bangladesh is one of the fastest urbanizing and most densely populated countries in the region, putting great pressure on basic urban services and infrastructure. Solid Waste Management (SWM) has been one of the major urban challenges in the country given its rapid urban growth. Despite the Government's efforts in improving the SWM system, waste collection and disposal capacity is still limited. Less than half of total waste generated is collected, while uncollected waste is often informally burned, buried, or illegally dumped in streets, public spaces, drainage channels, and waterways. This has resulted not only in public health hazards and the contamination of the environment, including air, water, and soil, but also the blocking of major drainage channels and sewerage networks

The current Integrated Solid Waste Management Improvement Project (ISWMIP) supported by the AIIB, will improve the SWM system in the selected municipal areas. This will help: (i) improve public health and quality of life by reducing exposure to pollutants and disease vectors associated with solid waste; (ii) strengthen the government's capacity to plan for and implement effective waste management services; and (iii) improve SWM practices in the country, encouraging waste minimization, recycling, and segregation at source. The project is aligned to the Government of Bangladesh (GoB)'s priorities for providing sustainable urban infrastructure. The country is, in particular, facing an immense challenge in its solid waste management. The project would directly contribute to one of the key objectives of the 8th Five Year Plan and the long-term Perspective Plan for 2021-2041, that is to improve the urban environment and quality of life.

The GoB has received a Project Preparation Special Fund (PSF) from AIIB to support the preparation of proposed ISWMIP for consideration of USD500 million AIIB financing. The investment shall be undertaken in a phased manner with a likely investment size for Phase I of USD 150 million. The PSF is being implemented by the Local Government Engineering Department (LGED) under the Local Government Division (LGD), the Ministry of Local Government Rural Development and Co-operatives (MLGRDC).

The project will function under the overall guidance of a Steering Committee (SC) which will be chaired by the Secretary, Local Government Division (LGD), the Ministry of Local Government Rural Development and Co-operatives (MLGRDC). The SC will play a significant role in high-level decision making, ensure seamless coordination among the various governmental actors, and accelerate the implementation of the proposed activities under various Components. The SC will comprise representatives from various Ministries.

The LGED has adopted the ESMPF[1] findings, which lays out the requirements for the environmental and social impact assessment, environmental management plans, best management practices, and social management plans, for the ULBs where sites for ISWM are finalized and for the ULB areas once the ISWM areas are identified. This ESIA report of Rangour City Corporation has been prepared following the ESMPF policies, guidelines and procedures to be integrated into the design and implementation of component 1, 2, 3 & 4 respectively, under the proposed project.

1.2 ISWMIP Components

The ISWMIP has four components as mentioned below:

- ***Component 1: Waste Collection and Transportation.*** This will help improve and optimize solid waste collection and transport services in selected Urban Local Bodies (ULBs), including collection containers and fleet, mechanical cleaning equipment, and transfer stations etc.
- ***Component 2: Waste Processing and Disposal Systems.*** This will finance prioritized waste processing and disposal infrastructure, including closure of polluted landfill sites, construction

[1] LGED would like to express its deepest appreciation to all those who have provided the support and cooperation in completing the ESMPF report. A special gratitude is being conveyed to the concerned officials of AIIB for their invaluable cooperation and continued sharing of information. Further, it's a matter of gratefulness to put on record the services so kindly extended by Consulting Firms and others involved in the ESMPF study.

and rehabilitation of engineered sanitary landfills (standalone or regional/ clustered), and provision of facilities related to composting, resource recovery, and waste-to-energy.

- ***Component 3: Project Management and Supervision Support.*** This will support in the areas of project management, monitoring and evaluation, procurement, financial management, and environmental and social safeguards (including public awareness campaigns and public consultation), and provision of support with respect to supervision and maintenance of infrastructure investments.
- ***Component 4: Policy Support and Capacity Building.*** This will support: (i) improvement of the SWM sector policy and legal framework; (ii) policy and guideline development related to waste minimization and recycling, private sector participation, inclusion of informal workers, and multi-jurisdictional waste management; and (iii) institutional capacity strengthening for relevant central and local agencies in SWM.

1.3 Scope of the ESIA

The detailed scope of the ESIA study is as outlined below:

- Screening of the Subproject based on applicable Environmental and Social Management Planning Framework (ESMPF) based on reconnaissance survey and field-based assessment of AIIB's Environmental and Social Standards (ESSs) of the Environmental and Social Framework (ESF);
- Scoping for the ESIA study by identifying the applicable ESSs;
- Development of a regulatory, policy and administrative framework relevant to the Subproject;
- Monitoring, analysis and reporting of the environmental and social baseline data of the study area including consultation with local communities and other stakeholders;
- Assessment of the environmental impacts of the Subproject in the study area;
- Assessment of social impacts on the local community as well as subproject affected people (if any) and any other stakeholders, which have been identified during the social consultation process;
- Identification of potential risks and hazards including environmental, socio-cultural, public health hazards due to the development of Rangpur City Corporation Subproject;
- Formulation of an Environment and Social Management Plan and associated/specific mitigation plans for identified impacts and effective risk management especially for the protection of the natural environment of the subproject area; and
- Formulation of Stakeholder Consultation and Grievance Redress Mechanism for the Subproject.

1.4 Approach and Methodology of The ESIA Study

a. 1.4.1 Categorization of the Subproject

According to the Environmental Conservation Rules (ECR), 2023 of the Department of Environment (DoE), Bangladesh, the subproject will fall under "**Red Category**" and it on the Red list in ECR 2023 (Schedule-1, Sl-66: Landfill of Municipality). Therefore, it is mandatory to conduct an Environmental Impact Assessment (ESIA) for obtaining an environmental clearance certificate. The EIA approval from the DoE has been obtained. According to AIIB, this subproject will require a comprehensive ESIA following the ESMPF addressing the three Environmental and Social Standards to ensure that the subproject is environmentally sound and sustainable. There is difference in subproject categorization as per AIIB ESS and GOB rules (ECR-2023).

1. Scoping

Scoping was done for:

- Categorization of the subproject according to ECR 2023 and the AIIB ESSs.
- Identifying and procuring institutional information.

- Information collection through discussions/meetings with AIIB, LGED, Rangpur City Corporation etc. to define scope for the impact assessment,
- Planning and implementation of mitigation and monitoring,
- Confirmation of the applicability of the Performance Standards set forth by the AIIB as requirements of the ESS.
- Confirmation whether Resettlement Action Plan (RAP) or voluntary dispossession or negotiated settlement is required.

2. Statement of Works

The environmental and social screening of Rangpur City Corporation Subproject was performed and the basis of the screening was –

- Desk review of the relevant documents and available imagery of the subproject site and its surroundings,
- Reconnaissance survey of the site, surrounding areas, approach road and informal discussions with local stakeholders,
- Discussions with AIIB, LGED, Rangpur City Corporation, Design Consultants of the Client and Department of Environment (DoE) to update the regulatory requirements and formats/ methods, etc.

3. Reconnaissance Survey and Data Collection Scheming

- A reconnaissance survey of the site and the surrounding area was conducted in May 2022 to ascertain the extent of the study area and to identify the studies to be conducted to fulfill the requirements of the ESIA.
- Relevant information about the subproject area were gathered through detailed physical survey and measurement of environmental parameters as necessary.
- Additional information was collected from published literature and previous ESIA reports.
- In addition, data and information were also collected from different government and non-government organizations.

4. Baseline Data Collection

An environmental and social baseline survey have been carried out to gather information on the existing physicochemical, biological, and socio-economic environment of areas surrounding the proposed area. These data collection campaign was as follows:

- Identification of the monitoring locations for air, water and noise for sensitive receptors, and at key locations for water intake and outfall, etc.;
- The baseline data collection, monitoring and analysis for environmental parameters was completed during the period from end of December 2022;
- Socio-economic data collection and consultations were carried out in December 2022;
- Secondary data was also collected from different government departments, local bodies and through literature surveys etc.; and
- Stakeholder consultation was completed with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better understanding of the potential impacts, informing the public of the proposed subproject and to gain an understanding of the perspectives/concerns of the stakeholders;

5. Impact Assessment and Mitigation Measures

- Analysis of the baseline results and the incremental impacts of the subproject were assessed in accordance with the Bangladesh national guidelines for air, water and noise emissions;

standards stipulated in the Environment Conservation Rules (ECR), 2023 and amendments thereof and with reference to the AIIB's Environmental and Social Standards, AIIB's Safeguard Policies, IFC's Environmental, Health and Safety (EHS) Guidelines, including the General Guidelines;

- The impact assessment involved the prediction and evaluation of impacts from the subproject in different phases, including site preparation, construction and operation phase, decommissioning of subproject and included consideration of mitigation measures towards the same;
- Impact prediction covered residual impacts (impacts remaining after all possible mitigations have been incorporated) and took into account control measures that are part of the subproject design (e.g. acoustic enclosures for major equipment). Additional measures aimed at further avoiding, minimizing and mitigating predicted impacts were proposed where necessary or appropriate;
- Impact assessment also involved risk assessment covering hazard identification, consequence analysis and risk reduction measures and recommendations; and
- Impacts have been further classified as insignificant, minor, moderate or major based on the criteria for rating of impacts.

6. Analysis of Alternatives

Analysis of alternative options was considered to minimize impacts of the subproject while undertaking the ESIA study. The alternative options assessed in the study ranged from technology, transportation methods, subproject site and operations, including the no subproject alternative. Alternatives are considered in terms of their potential environmental impacts, the feasibility of mitigating these impacts alternatives for mitigation measures for high residual impact/risk, if any etc.

7. Management Plans and Grievance Redress Mechanism

- Environmental and Social Management Plan (ESMP) were developed for the mitigation measures suggested and included defined roles and responsibilities for implementation;
- A Grievance Redress Mechanism (GRM) was developed by the Consultant to address any complaints and concerns from all stakeholders;
- Based on the risk assessment, risk reduction measures and recommendations for a WMP, CMP, LMP, TMP, BMP were also developed; and
- ESMP also addressed the Institutional review, finalization of ESMP and grievances.

8. Information/Data Sources

Key relevant information sources have been summarized in Table 1.1

Table1-1 Key Data Sources

Parameters	Information sources	Remarks
Subproject Background, Technical details on subproject and associated components	▪ Subproject specification documents from Rangpur City Corporation ▪ Subproject Execution milestones, Landfill layout, Solid waste management system	Rangpur City Corporation provided other information required during the course of the study
Study area features and sensitivities	▪ Ground physical survey ▪ Satellite images ▪ National web portal of Bangladesh ▪ Primary data collection	Details of the satellite data used is included in Baseline Chapter
Legal framework	▪ Department of Environment ▪ IFC and AIIB documents ▪ DOE ESIA Guidelines	In discussion with the DOE and local Govt. departments, AIIB and LGED

Parameters	Information sources	Remarks
Land use /Land cover Details, Meteorology and climatic conditions	▪ Ground Physical Survey ▪ Bangladesh Meteorological Department ▪ Observatory Surface Meteorological Data	Details of the satellite data used is included in Baseline chapter, Pre-subproject land use data are collected from subproject personnel and local people.
Geology, Topography, Hydrology and Drainage	▪ Rangpur City Corporation Subproject Location Map, previous EIA reports of the project area ▪ Bangladesh Water Development Board ▪ Web portal of National Encyclopedia of Bangladesh (Banglapedia)	In association with field Observations
Natural hazards	▪ Web portal of National Encyclopedia of Bangladesh (Banglapedia) ▪ Bangladesh Meteorological Department	Included in consultation with Locals
Environmental baseline as Air quality, water quality, soil and sediment quality	▪ Primary data collection ▪ Applicable Standards from DoE, Bangladesh	Monitoring was completed from December 2022.
Ecological parameters	▪ Primary and Secondary data collection, observations, surveys and local consultations ▪ Websites of birdlife international ▪ IUCN Data base	Data collection was carried out in the month of December 2022, Endangered, critical status was checked from the website: www.iucnredlist.org
Social-economic parameters	▪ Primary data collection surveys, extensive consultations, meetings and discussions held with stakeholders ▪ Bangladesh population Census for 2011 ▪ Fisheries Census data ▪ Land Regulation Policy, Bangladesh ▪ Web portal of National Encyclopedia of Bangladesh (Banglapedia)	Primary Socio-economic Survey was carried out in month of December 2022. Details provided in baseline environmental and social conditions chapter.

1.5 Structure of the ESIA Report

The ESIA report has been prepared following the ESMPF as well as ECR 2023. The report is divided into ten (10) chapters to cover all key issues comprehensively. The report structure is as follows:

Chapter 1 of this ESIA report describes the background and objectives of the subproject. It also presents an outline of the methodology followed for carrying out ESIA.

Chapter 2 presents an overview of policy, legal and administrative framework relevant to the subproject.

Chapter 3 presents a detail description of the subproject including the major activities to be carried out during both construction and operation phases of the subproject.

Chapter 4 presents baseline information, identification and assessment of the potential environmental, ecological and socio-economic impacts of the proposed subproject, both during construction and operation phases, as well as environmental and social audit of existing industries.

Chapter 5 presents the alternative options for the proposed subproject.

Chapter 6 presents the Potential Impacts identification and Assessment including the mitigation measures for enhancement of positive impact and reduction or elimination of negative impacts.

Chapter 7 presents the Information Disclosure along with outcome of public consultations and communications carried out as a part of the environmental assessment.

Chapter 8 presents the Environmental and Social Management System (ESMS), including the Environmental and Social Management Plan (EMP) and the Monitoring Plans for both construction and operational phases along with the GAP, OHSMP, GBV, WMP, CMP, LMP, TMP, BMP.

Chapter 9 Grievance Redress Mechanism of the subproject containing the mechanism process, intake channel, registry, referral, resolution & appeals process, GRM monitoring & reporting etc.

Chapter 10 of the ESIA report presents the conclusions of the environmental assessment of the proposed subproject.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

The proposed Integrated Solid Waste Management Improvement Project will be implemented in compliance with applicable national environmental laws and regulations. Bangladesh has a wide range of laws and regulations related to environmental protection, natural resources conservation as well as social issues, which are mostly cross-sectoral and would be applicable to the proposed project. The Asian Infrastructure Improvement Bank (AIIB) also has certain Social and Environmental safeguard policies, which needs to be adhered to for the purpose of the implementation of this project. This section presents an overview of the major national environmental, social and Solid Waste Management laws, policies and regulations that are relevant and may apply to activities supported by the project, institutional arrangement and national and sub-national level, and AIIB safeguard policies.

2.2 National Environmental and Social Laws, Rules, Policies and Guidelines

Table 2-1: List of Applicable National E&S Laws, Rules, Policies and Guidelines

Sl. No.	Policies/Act/Rules	Key provisions and purpose	Applicability to the sub-projects/LGED
1.	Bangladesh Environmental Conservation Act (ECA), 1995	This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. According to this act (Section 12), no industrial unit or project shall be established or undertaken without obtaining, in a manner prescribed by the accompanying Rules, an Environmental Clearance Certificate (ECC) from the Director General of DoE.	Yes, sub-projects have to get ECC.
2.	Bangladesh Environmental Conservation Rules (ECR), 2023	The Rule 5 classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categories are: Green, Yellow, Orange and Red. The ECR 2023 describes the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed units or projects.	Yes, LGED sub-projects will fall under Red category, hence require ESIA approved by the DoE and have to deposit prescribe fees according to the schedule 7 to obtain ECC.
3.	Bangladesh Environment Court Act, 2010	Bangladesh Environment Court Act, 2010 has been enacted to resolve the disputes and establishing justice over environmental and social damage raised due to any development activities.	According to this act, government can take legal actions if any environmental problem occurs due to ISWMI subproject interventions.
4.	The Protection and Conservation of Fish Act (1950)	This Act provides power to the government to: make and apply rules to protect fisheries; prohibit or regulate erection and use of fixed engines; and construction of temporary or permanent weirs, dams, bunds, embankments and other structures.	Yes, as the sub-projects includes Waste Collection and Transportation, Waste Processing and Disposal Systems etc. which has potential risk for Air and water pollution, habitat alternation, hinder of natural flow/migration.
5.	Protection and Conservation of Fish Rules (1985)	Section 6 states, "No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters.	Yes, during construction and operation of the sub-projects.

Sl. No.	Policies/Act/Rules	Key provisions and purpose	Applicability to the sub-projects/LGED
6.	Bangladesh Wildlife (Protection and Preservation) Act 2012	The Act protects 1,307 species of plants and animals, including 32 species of amphibian, 154 species of reptile, 113 species of mammal, 52 species of fish, 32 species of coral, 137 species of mollusk, 22 species of crustacean, 24 species of insect, six species of rodent, 41 species of plant and 13 species of orchid. Of these, eight amphibian, 58 reptile, 41 bird, and 40 mammal species are listed as endangered in the IUCN Red Data Book (2000, updated in 2015).	Yes, the sub-projects area might have presence of these listed threatened animals.
7.	Biodiversity Act, 2017	It provides for the creation of the National Committee and the Biodiversity Management and Surveillance Committees at local levels (i.e., Districts, Upazilas, Municipalities, and Unions). In general, all these committees are mandated to: assist the Government in implementing the National Biodiversity Strategy and Action Plan (NBSAP) and to visit the biodiversity enriched areas in their respective territories; and, monitor the progress of implementation of the NBSAP.	Yes, all sub-projects need to include these local committees, so that they can monitor project impact on the local biodiversity.
8.	Forest Act 1927 (Amendment 2000)	The act empowers the government to regulate the felling, extraction, and transport of forest produce in the country.	Yes, sub-projects will include felling of trees and social forestry.
9.	Embankment and Drainage Act, 1952	The Act consolidates the laws relating to embankments and drainage providing provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion or other damage by water.	Yes, sub-projects will include interventions in the water bodies, construction of bridges, ghats, etc.
10.	Bangladesh Water Act, 2013	As per this Act, all forms of water (e.g., surface water, ground water, sea water, rain water and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. Without prior permission issued by the Executive Committee, no individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they will be allowed to build any structure that impede the natural flow of rivers and creeks.	Yes, LGED is permitted to implement water projects covering impact area below 1000 hectare (<1000 ha).
11.	Bangladesh Labor Act, 2006	It provides the guidance of employer's extent of responsibility and workmen's extent of right to get compensation in case of injury by accident while working.	Yes, sub-projects require substantial labor from local and external areas.
12.	Bangladesh National Building Code, 2006	The BNBC clearly sets out the constructional responsibilities according to which the relevant authority of a particular construction site shall adopt some precautionary measures to ensure the safety of the workmen. The Code also clarifies the issue of safety of workmen during construction.	Yes, sub-projects will include construction of STS, Landfill Sites, etc.
13.	The Noise Pollution Control Rules, 2006	The Noise Pollution Control Rules have been established in order to manage noise generating activities which have the potential to impact the health and wellbeing of workers and the surrounding communities.	Yes, many activities of sub-projects will be performed under the densely populated areas.
14.	Road Transport Act, 2018	The new Road Transport Act 2018 has finally come into effect at the start of November. After the long-standing Motor Vehicle Ordinance of 1983, the new	Yes, sub-projects will use heavy vehicles, deploy drivers and

Sl. No.	Policies/Act/Rules	Key provisions and purpose	Applicability to the sub-projects/LGED
		act introduces a myriad of updated laws and adds new definitions for what constitutes an offence, with most of the fines and punishments receiving major bumps.	operators of machineries.
15.	Solid Waste Management Rules 2021	These rules require (i) source segregation of waste into dry and wet waste, (ii) standards for composting, (iii) an-aerobic digestion and waste-to-energy projects, (iv) guidelines for landfilling, and (v) standards for the placement of secondary storage bins, and primary and secondary collection of waste. Promotion of 3Rs, site selection criteria for landfills, recycling plants, and applicable environmental standards are typically articulated by MoEF&CC. For landfill site selection and construction of large-scale organic waste recycling plants, an environmental impact assessment would also be overseen by the environmental agency. MoEF&CC also monitors the local government's performance for compliance of such rules and environmental regulations.	Yes, Subproject will be well guided by the SWM rules.
16.	Rules for Removal of Wrecks and Obstructions in inland Navigable Water Ways (1973)	Rules for removal of wrecks and obstructions	Yes, if obstruct natural canals/rivers or any other natural water ways (includes seasonal water bodies).
17.	The Water Supply and Sanitation Act (1996)	Regulates the management and control of water supply and sanitation in urban areas.	Yes, sub-projects will include construction of water supply and sanitation facilities
18.	The Ground Water Management Ordinance (1985)	Describes the management of ground water resources and licensing of tube wells	Yes, construction sites of the sub-projects may require deep tube wells for meeting up water use.
19.	The Antiquities Act (1968)	Describes the preservation of cultural heritage, historic monuments and protected sites	Yes, sub-projects areas may have elements of cultural, historic and protected value.
20.	Acquisition and Requisition of Immovable Property Act, 2017	The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property.	Yes, both acquisition and requisition of land, and other properties would require by the sub-projects.

2.3 Environmental and Social Policy of AIIB

The AIIB Environmental and Social Framework (ESF), 2016 (AIIB, 2016) (Amended February 2019 and May 2021) provides an overview of the AIIB concerning (a) environmental and social sustainability; and (b) its role in meeting the challenge of sustainable development in Asia. The complete objectives of development are framed within the ESF in terms of both local impacts, and global challenges, especially in climate change. The ESF provides general specifications, standards and objectives that clients should adhere to during project preparation and implementation. Thus, the ESF attaches importance to country regulatory systems as sources of legally binding procedures and standards.

The Environmental and Social Policy (ESP) in the ESF comprises essential environmental and social requirements for each project and is accompanied by:

(a) Three associated mandatory Environmental and Social Standards (ESSs) setting out requirements applicable to clients on, respectively,

i. ESS-1: Environmental and Social Assessment and Management,

ii. ESS-2: Land Acquisition and Involuntary Resettlement and

iii. ESS-3: Indigenous Peoples;

(b) An Environmental and Social Exclusion List (ESEL); and

(c) A Glossary of certain terms used in the ESP and ESSs.

The three ESSs mentioned in the ESP are, ESS 1: implementation of environmental and social assessment and management, ESS 2: prevent/minimize involuntary resettlement and ESS 3: protection of vulnerable/indigenous people. These standards require clients to implement structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. Together, the ESP and the ESSs comprise an environmental and social management approach designed to:

i. ensure environmental and social screening and categorization,

ii. analyze future project environmental and social threats, and impacts;

iii. identify measures to prevent, reduce, mitigate, cover or make up for project environmental and social impacts;

iv. provide a process to consult the public on environmental and social risks and impacts of projects and to disclose information.

The AIIB classifies all its projects into four categories.

- The project is categorized as Category A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented and requires the client to conduct an Environmental and Social Impact Assessment (ESIA) with Environmental and Social Management Plan (ESMP).
- A project is categorized as Category B when: it has a limited potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are site-specific; and can be successfully managed using good practice in an operational setting and requires clients to conduct an initial review of the environmental and social implications of the project.
- A project is categorized C when it is likely to have minimal or no adverse environmental and social impacts and the client is required to prepare a review of the environmental and social aspects of the Project.
- A project is categorized FI if the financing structure involves the provision of funds to a financial intermediary (FI) for the project, whereby the bank delegates to the FI the decision-making on the use of the bank funds, including the selection, appraisal, approval and monitoring of bank-financed subprojects. The bank requires the FI to develop and apply an appropriate ESMS that is proportional to the environmental and social risks associated with the bank-supported portfolio, is consistent with this ESP, excludes from Bank support activities covered in the ESEL and incorporates applicable provisions of the ESSs.

AIIB requires the client to establish, in accordance with the ESP and applicable ESSs, a suitable grievance mechanism to receive and facilitate resolution of the concerns or complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability. People who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the ESP may also submit complaints to the Bank's oversight mechanism in accordance with the policies and procedures to be established by the Bank for such mechanism.

ESF 2016 (amended in 2019) has also provisions for identify measures to avoid, minimize, or mitigate potentially adverse impacts on and risks to physical, biological, socioeconomic and cultural resources,

safety of both workers and affected community and natural resources during the design, construction, operation, and decommissioning of the project.

All AIIB funded Investment Project Financing are required to follow the Environmental and Social Framework (ESF) consisting three (3) Environmental and Social Standards (ESS). These ESSs set out their requirement for the borrowers relating to the identification and assessment of environmental and social risks and impacts associated with any project. The ESSs supports the borrowers in achieving good international practice relating to environmental and social sustainability, assist them in fulfilling their national and international environmental and social obligations, enhance transparency and accountability and ensure sustainable development outcome through ongoing stakeholder engagement.

2.4 Environmental Clearance Process

The ECR, 2023 provides a basic framework for environmental evaluation of proposed projects in all sectors and establishes procedures. Accordingly, the project proponent should first obtain a location clearance and conduct the appropriate study to obtain environmental clearance of the project. Any project constructed in Bangladesh must obtain an Environmental Clearance Certificate (ECC) before its operation.

Similar to Environmental Screening process of the projects, Rule 5 of ECR has classified the projects into following four categories based on the site conditions and the impacts on the environment. The projects are categorized under four categories they are: Green, Yellow, Orange and Red. Various industries/projects falling under each category have been listed in schedule-1 of the ECR. According to the Rules of the ECC to all existing and proposed industrial units and projects, which are falling in the green category without undergoing EIA. However, for category Yellow, Orange and for Red projects require location clearance certificate and followed by issuing of ECC upon the satisfactory submission of the required documents.

For getting location and environmental clearances, the project proponent of concerned project should apply to the concerned Divisional Officer of DoE by filling Form-3 as per the rules given in the ECR. They should accompany with the following documents:

- Application through prescribed form-3 under ECR 2023
- Prescribed fee under the schedule of ECR 2023
- Report on Feasibility of the industrial unit or project
- Initial Environmental Examination (IEE) Report or EIA as per the Terms of Reference Provided by the DoE
- EMP for the proposed project
- No Objection Certificates (NOC) from the Local Authorities.
- Emergency plan relating adverse environmental impact and plan for mitigation of the effect of pollution
- Outline of Relocation and rehabilitation plan
- Other necessary information (based on the type of the project)

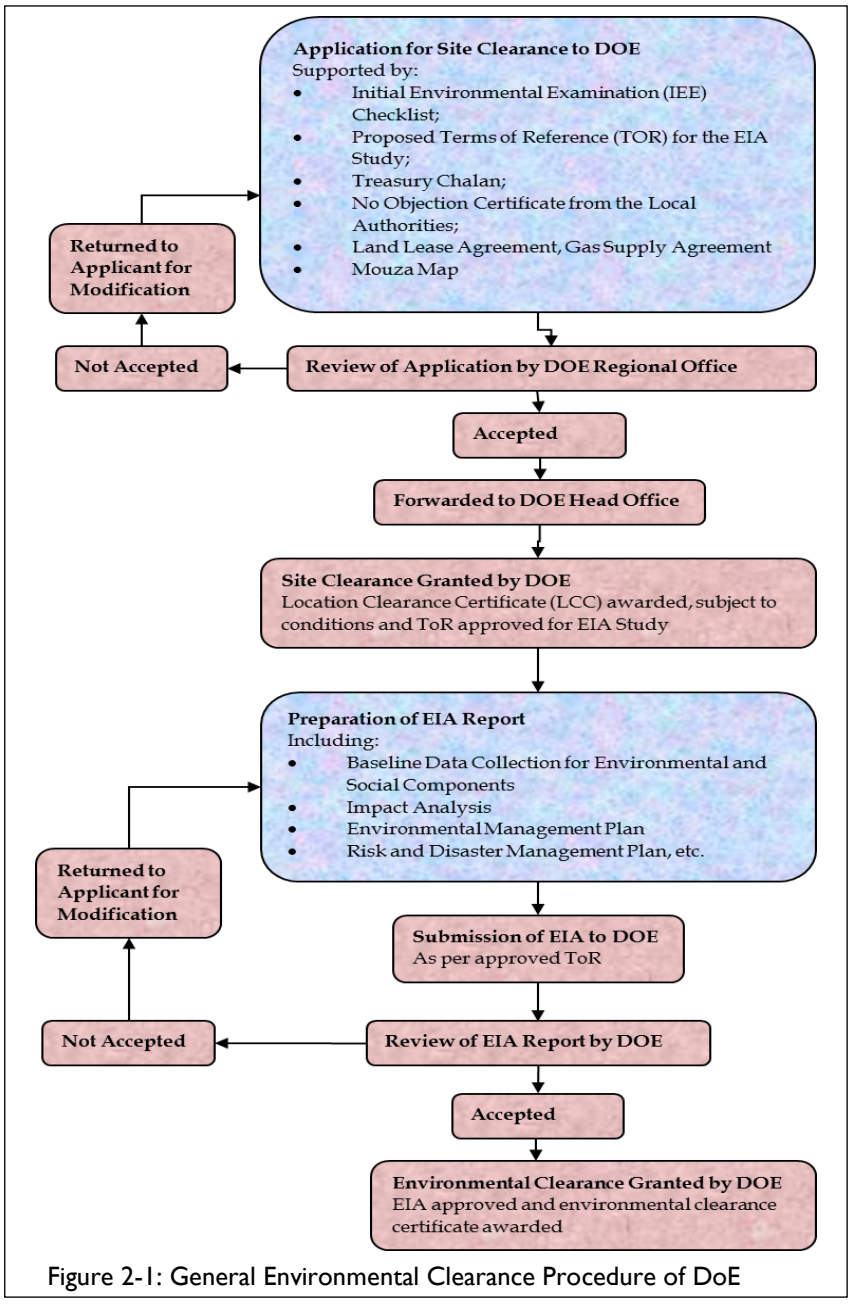


Figure 2-1: General Environmental Clearance Procedure of DoE

The environmental clearance is one-year validity for the Projects which come under the Red Category. The environmental clearance process as per the DoE, Ministry of Environment and Forests, Government of Bangladesh is shown in Figure 2-1.

As part of the ECC application, a detailed IEE/ EIA with EMP satisfactory to the DoE must be prepared. The project is considered to have some negative environmental impacts. Therefore, the project requires having an EIA Report along with EMP which has to be accepted by DoE as part of the LCC & ECC Issuance. Under the ECR 2023, DoE has 30 days to respond after reviewing documents from the receipt of the ECC application for a Red category project. Submission of any further materials would be carried out, as per requirement of DoE toward obtaining the LCC and ECC. Steps to be followed for obtaining the ECC for this SWM project are shown in Figure-2.1. Additionally, Detailed Flow Diagram for ECC for Red Category Projects is shown as below Figure-2.2.

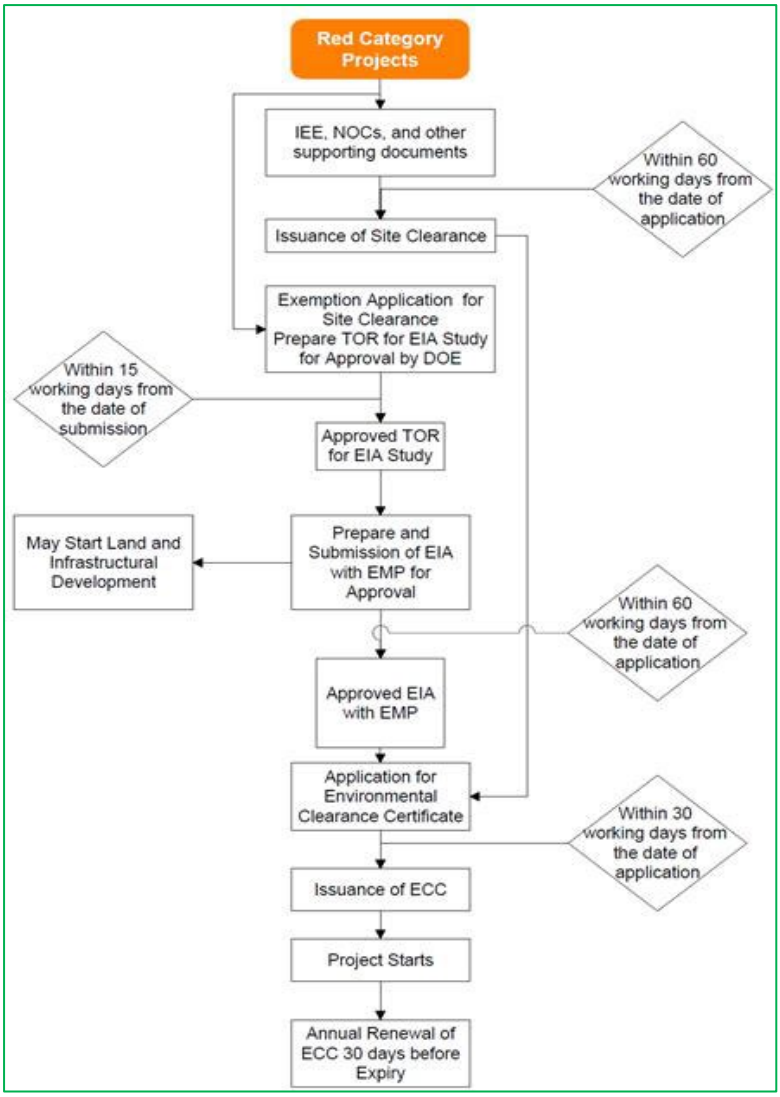


Figure 2-2: Environmental Clearance Procedure for Red Category Subproject

In addition to ECA 1995 and ECR 2023 there are a number of other policies, plans, and strategies, which need to be considered in the project. The detailed description of all these relevant legislations is provided afterward in section 2.2 of this report.

2.5 Rangpur City Corporation Subproject Category as per ECR 2023

In the first week of March 2023 the ECR 2023 has been gazette and published for the use of the project works Bangladesh. This Rangpur City Corporation subproject has Landfill site; Compost Plant (>5MTs); Pyrolysis; Material Recovery Facilities (MRF); Secondary Transfer Station (STS) improvement, Medical Treatment Facility and Refuse-Derived Fuel (RDF) activities. According to the Environmental Conservation Rules (ECR), 2023 of the Department of Environment (DoE), Bangladesh, the subproject will fall under "Red Category" and it on the Red list in ECR'23 (Schedule-1, Sl-66 of Red Category: Municipality Landfill Site).

Table 2-2: Categorization of Rangpur City Corporation subproject according to ECR 2023

Sl. No.	SWM Components	Category (ECR'2023)	Overall Assessment
1	Landfill of Municipality	Red	Red category subproject
2	Compost Plant (>5MTs)	Orange	
3	Pyrolysis	Orange	
4	Material Recovery Facilities (MRF)	-	
5	Secondary Transfer Station of City Corporation	Yellow	
6	Medical Waste Treatment Facility	Orange	

2.6 Applicable Environmental Standards and Guidelines

The following quality standard of compost mentioned in the Table 2.1 should be ensured for safe use of compost.

Table 2-3: Physical Properties of Compost

SL No.	Parameters	Standard
1	Color	Dark brown to black
2	Physical condition	Non-granular form
3	Odor	Absence of foul odor
4	Moisture Content	Maximum 20%
5	Inert materials	Maximum 1%

Table 2-4: Chemical Properties of Compost

SL No.	Parameters	Standard
1	pH	6.0 - 8.5
2	Organic Carbon	10 – 25%
3	Nitrogen, N	0.5 – 4.0%
4	Carbon and Nitrogen ratio (C:N)	Maximum 20:1
5	Phosphorus, P	0.5 – 3.0%
6	Potassium, K	0.5 – 3.0%
7	Sulfur, S	0.1 – 0.5%
8	Zinc, Zn	Maximum 0.1%
9	Copper, Cu	Maximum 0.05%
10	Chromium, Cr	Maximum 50 ppm
11	Cadmium, Cd	Maximum 5 ppm
12	Lead, Pb	Maximum 30 ppm
13	Nickel, Ni	Maximum 30 ppm

Note: Final products of compost will not be used in food grain production if the above-mentioned parameters values exceed the standard values but these products can be used in other crops.

Standard Quality of Treated Leachate

Table 2-5: Discharge Standards for processed solid waste

SL. No	Parameters	Unit	Standard (At source) (Maximum limit except pH)	
			Inland Ground Water	Sewerage drain
1	pH	-	6 - 9	6 - 9
2	BOD_5 at 20^0C	mg/l	30	250
3	COD	mg/l	250	-
4	Suspended Solids (SS)		100	600
5	Total Dissolved Solids (TDS inorganic)	mg/l	2100	2100
6	Ammoniacal Nitrogen	mg/l	50	50
7	Total Kjeldahl Nitrogen	mg/l	100	-
8	Arsenic, As	mg/l	0.2	0.2
9	Mercury, Hg	mg/l	0.01	0.01

SL. No	Parameters	Unit	Standard (At source) (Maximum limit except pH)	
			Inland Ground Water	Sewerage drain
10	Lead, Pb	mg/l	0.1	1.0
11	Cadmium, Cd	mg/l	2.0	1.0
12	Total Cr	mg/l	2.0	2.0
13	Copper, Cu	mg/l	3.0	3.0
14	Zinc, Zn	mg/l	5.0	15.0
15	Nickel, Ni	mg/l	3.0	3.0
16	Cyanide, CN	mg/l	0.2	2.0
17	Cl^-	mg/l	1000	1000
18	F^-	mg/l	2.0	1.5
19	Phenol (also called carbolic acid) C_6H_5OH	mg/l	1.0	5.0

Emission Standard of Solid Waste Incinerator

Table 2-6 Stack Emission Standard from Incineration

SL. No.	Parameters	Average Time	Maximum Presence Limit (mg/Nm^3)
1	Particulate matter	1 hour	30
		24 hours	20
2	Carbon Monoxide	1 hour	100
		24 hours	80
3	Nitrogen Oxide	1 hour	300
		24 hours	250
4	Sulfur Dioxide	1 hour	100
		24 hours	80
5	HCL	1 hour	60
		24 hours	50
6	Mercury	0.5-8 hour	0.05
7	Cadmium and Thallium	0.5-8 hour	0.1
8	Antimony, As, Pb, Cr, Cobalt, Cu, Mn and Nickel	0.5-8 hour	0.5
9	Hydrogen Fluoride	0.5 hour	1.0
10	Dioxin and Furan	6-8 hours	0.1 ng TEQ/Nm^3

Water Quality Monitoring Standard

Table 2-7 Potable Water Standard of Landfill Ground Water

SL. No.	Parameters	Unit	Standard (Maximum Presence Limit except pH)
1	Arsenic	mg/l	0.05
2	Cadmium	mg/l	0.003
3	Chromium hexavalent	mg/l	0.05
4	Copper	mg/l	1.5
5	Fluoride	mg/l	1.0
6	Lead	mg/l	0.01
7	Mercury	mg/l	0.001
8	Nitrate as NO_3	mg/l	45.0
9	pH	mg/l	6.5 – 8.5
10	Fe	mg/l	0.3 – 1.0
11	Total Dissolved Solids	mg/l	1000
12	Chloride	mg/l	250
13	Sulfates as SO_4	mg/l	250
14	Color	Hazen unit	15

Source: Schedule-2 (Kh) of ECR 2023

Ambient Air Quality Monitoring Standards

Table 2-8 Ambient Air Quality Standard Baseline information of the Subproject

Air Pollutants	Standard Value	Average time
(1)	(2)	(3)
Carbon Monoxide (CO)	05 milligram/cubic meter	8 hours
	20 milligram/cubic meter	1 hour
Lead (Pb)	0.25 microgram/cubic meter	Yearly
	0.50 microgram/cubic meter	24 hours
Nitrogen Dioxide (NO_2)	40 microgram/cubic meter	Yearly
	80 microgram/cubic meter	24 hours
Particulate Matter $_{10}$ (PM_{10})	50 microgram/cubic meter	Yearly
	150 microgram/cubic meter	24 hours
Particulate Matter $_{2.5}$ ($PM_{2.5}$)	35 microgram/cubic meter	Yearly
	65 microgram/cubic meter	24 hours
Ozone (O_3)	180 microgram/cubic meter	1 hour
	100 microgram/cubic meter	8 hours
Sulfur Dioxide (SO_2)	250 microgram/cubic meter	1 hour
	80 microgram/cubic meter	24 hours
Ammonia (NH_3)	100 microgram/cubic meter	Yearly
	400 microgram/cubic meter	24 hours

Source: Schedule-1 of Air Pollution (Control) Rules 2022

2.7 Conventions, Treaties and Protocols

Table 2-9: International Conventions, Treaties and Protocols

International Environmental Agreement	Signed Year & Place	Details	Relevance with the project
United Nations Framework Convention on Climate Change (UNFCCC)	4-14 June 1992 (Rio de Janeiro, Brazil & New York, United States)	Parties to take precautionary measures to anticipate prevent or minimize the causes of climate change and mitigate its adverse effects.	The project is subject to the impact of climate change. Engineering designs of the subproject consider climate change impacts, such as flooding and temperature rise.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	22 March 1989 (Basel, Switzerland)	The treaty was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs).	In May 2019 to an amendment of the Basel Convention plastic waste is presumed as hazardous material. Recycling of plastic waste is one of the significant provisions of the project.
Convention on Biological Diversity	5 June 1992 (Rio De Janeiro, Brazil)	The Convention has three main goals: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources.	The project will have a prominence on protection and conservation of biological diversity for the area rich with biological resources. A Biodiversity Management Plan will be prepared and implemented to comply with the provision.

3. DESCRIPTION OF THE PROJECT

3.1 Background

Municipal solid waste landfills (MSWLFs) receive household waste. MSWLFs can also receive non-hazardous sludge, industrial solid waste, and construction and demolition debris. Modern landfills are well-engineered facilities that are located, designed, operated, and monitored to ensure compliance with government regulations. Solid waste landfills must be designed to protect the environment from contaminants which may be present in the solid waste stream. The landfill siting plan prevents the siting of landfills in environmentally-sensitive areas while on-site environmental monitoring systems monitor for any sign of groundwater contamination and for landfill gas, and provides additional safeguards. In addition, many new landfills collect potentially harmful landfill gas emissions and convert the gas into energy. This chapter provides a comprehensive but brief discussion on all aspects associated with landfill design, construction and operation. Siting, regulations and other important steps that need to happen before design stage are also presented in brief. Information on monitoring and post closure requirements is discussed at the other chapter. It should be noted that discussions provided on landfill design are qualitative as they do not include detailed designs. Readers are encouraged to refer to references included for detailed information on landfill designs.

3.2 Key features of the Subproject

3.2.1 Waste Quantum and Generation rates

There is no data available regarding the total amount of solid waste generated in the city corporation. The data on waste generation has been established from a recent survey conducted by Waste Concern during 2022-2023. The survey provides waste generation rates based on size of population of the cities. The Table 3.1 below provides population size wise domestic waste and total waste generation.

Table 3.1 Population size-wise Waste Generation

Population of ULBs	Domestic Waste Kg/cap/day	Total (including non-domestic) kg/cap/day
50,000- 100,000	0.25	0.36
100,001-200,000	0.26	0.37
200,001-300,000	0.31	0.44
300,001-500,000	0.32	0.45
500,001-10,00,000	0.36	0.51
>1,000,000	0.43	0.6

Source: Waste Concern, 2022

Based on the survey it was found that for a city with a population between 500,000-10,00,000 persons, the solid waste generation rate is estimated at around 0.36 kg/cap/day for domestic waste and 0.51 kg/cap/day for total including non-domestic waste. Accordingly, the waste generation has been estimated for the city corporation for 2021 and projected till 2045. The waste generation of the city corporation projected for the year 2025, 2035 and 2045 is provided in the table.

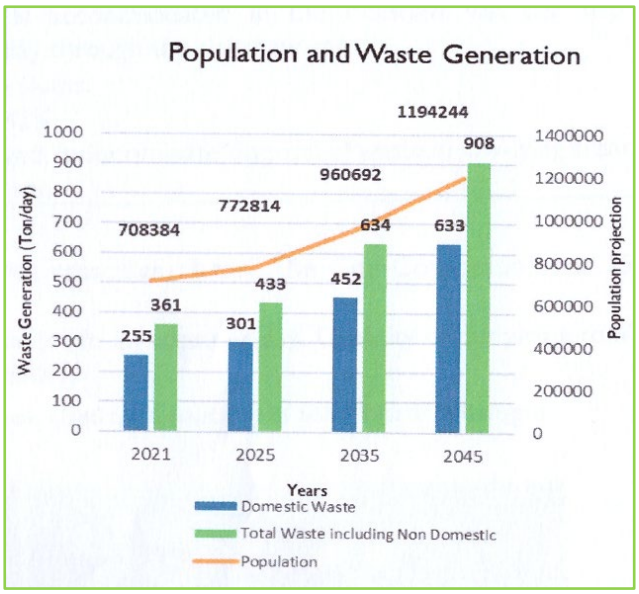


Figure 3.1 Waste Generation Projections for Rangpur CC

(Source: Estimated by the Consultant, Note: Waste generation rate: 0.44kg/person/day with 5% increase in every 5 year has been considered.)

3.2.2 Physical Composition of Waste

Waste Concern study (2021) has undertaken physical composition analysis of waste by collecting samples from households, markets, and from trucks arriving at landfill sites. The following figure shows the average physical composition of solid waste for Class A city corporation; it is representative for Rangpur City Corporation which is a Class A city corporation.

It is observed that the organic waste comprises of major portion (83%) of the solid waste, followed by plastics. Other cateory of recyclables such as paper, textiles and glass, though not in considerable amount also form a part of the overall waste composition. The large quantity of degradable organic contents indicates the necessity for frequent collection and removal. This also indicates the potential of recycling of organic waste for resource recovery, such as composting and waste to energy projects using biological process.

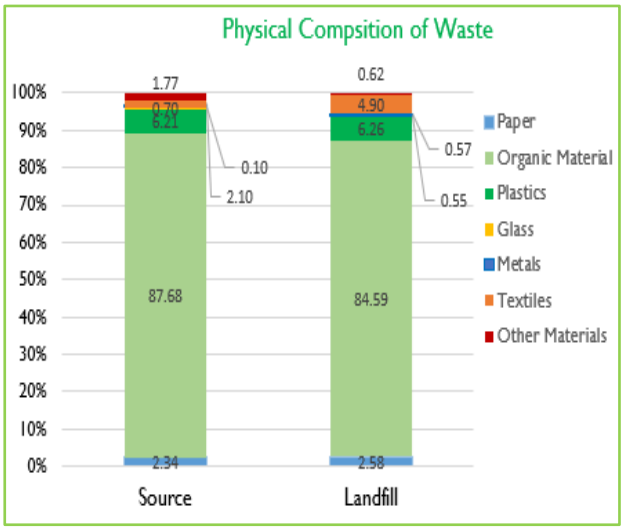


Figure 3.2 Physical Composition of Solid Waste
Source: Waste Concern, 2021

3.2.3 Existing MSW Management System

Primary Collection and Transportation

The city corporation provides primary waste collection services. It is reported that approximately 21,000 households are covered by the house to house waste collection services. The door-to-door collection of waste is almost 42%. However, it is also observed that none of the HHs follow waste segregation. Segregation of recyclable waste is generally not practiced. Most of the recyclable material is disposed of along with domestic and commercial waste. Therefore, recyclable waste is generally found mixed with garbage on the streets, into the municipal bins and at the dumpsites. Majority of the residents dispose their solid waste in vacant space and open drains. This is primarily due to lack of awareness-raising programs by the city corporation or by civil society organizations. Waste from the households is collected with the help of Primary Collection Service Providers (PCSPs) from the NGOs. Waste is collected between 9 AM to 5 PM in the evening. An average 150 tons solid of waste is collected per day buy the city corporation. At present, around 144 rickshaw vans are used to collect the garbage from the HHs. The Rickshaw vans (length 1.07 m x width 0.76 m x height 0.85 m) can accommodate approximately 250 kg of waste per trip. Approximately 25 tons of waste collection per day through the rickshaw vans per trip.

The Figure 3.3 below shows the photograph of the Rickshaw Van used for primary collection of waste:

Current door to door van service for household waste collection

Figure 3.3 Rickshaw Van – Primary Waste Collection
Source: Consultant's Team Site Visits and Field Surveys

At present, there is no waste collection service provided by the city corporation in the slums. Slum-dwellers are currently disposing of their waste in low-lying areas or in natural drainage canals near the slums.

Secondary Collection and Transportation

The current design of the secondary storage area and collection points are not very efficient and are a source of environmental pollution. After collecting wastes from household, van drivers accumulates wastes at transfer stations or open waste collection points. There is only 1designated secondary transfer station (around 150 sq.feet with roof and walls). Waste sorting system of the authority is inefficient, as it is done manually. This makes it time consuming and not cost effective.

Example of secondary transfer station for waste collection

Example of secondary transfer station

	
Example of secondary waste storage in dilapidated condition	Example of secondary waste storage in dilapidated condition

Figure 3.4 Example of secondary waste storage for RpCC
Source: Consultant's Team Site Visits and Field Surveys

The city corporation collects waste from these secondary waste storage facilities through garbage trucks with varying capacities of 5-ton, 3-ton ,2-ton,1.5-ton. They are 25[2] in number with average age varies between 20-25 years. The maximum waste carrying capacity of current fleet is 50 trips per day. This results in total carrying capacity of 150 tons per day. Total fuel consumption per day is found to be 300 liters per day.
As such, solid waste collection efficiency is estimated at 42%. A portion of the waste (58%) remains uncollected and unmanaged and is being indiscriminately disposed in low-lying areas; this results in water logging during the monsoon season. The figure below shows the collection vehicles used for transportation of waste to the landfill site.

	
Sample truck for secondary waste collection	Sample truck for secondary waste collection

Figure 3.5 Vehicles for secondary waste transportation
Source: Consultant's Team Site Visits and Field Surveys

The table below provides an overview of the secondary collection vehicles.

Table 3.2 Existing Number and Status of Vehicles for Secondary Collection of Waste

Name of vehicles	No. of vehicles	Condition
Garbage Trucks	25	Average. 16 of the trucks are more than 20 years old requiring frequent repair.

It is also observed that majority of these vehicles in possession with the Rangpur City Corporation are more than 20 years old. The team observed that loading and unloading of waste is done manually and municipal workers involved in this activity do not use any Personal Protection Equipment's (PPEs) such as gloves and shoes for their protection.

[2] Figure taken from the Questionnaire for Enhanced Institutional Assessment for 9 Phase 1 ULBs

Waste Processing and Disposal

Currently the solid waste by the city corporation is disposed of at Goda Shimla mouza and Kolapar village situated in ward No. 29 and 1.5km south of the core commercial and residential areas. The total site area is 7.84 acres. The site was acquired as a landfill site in 2021 and all the due processes related to land acquisition complete. Site currently used as a waste disposal facility using crude dumping methods. An estimated 151.62 tons of waste disposed per day in an uncontrolled manner.

There is composting plant in which collected solid waste is processed into compost. The plant is owned by the city corporation and operated by a private sector organization. The plant was established by DOE as a CDM project. plant to Aprokashi Ltd, a private firm has the experience and License of producing and marketing of the produced compost. The Figure 3.6 below provides a snapshot of the existing site.

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Northside of the Rangpur City Corporation landfill</td><td>Eastside of the Rangpur City Corporation landfill</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Southside of the Rangpur City Corporation landfill</td><td>Westside of the Rangpur City Corporation landfill</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Middle of the Rangpur City Corporation landfill</td><td>Main Portion of the Rangpur City Corporation landfill</td></tr>
</table>

Access road to landfill site

Landfill access road side pond

Figure 3.6 Existing landfill site of Rangpur City Corporation
Source: Consultant's Team Site Visits and Field Surveys

3.2.4 Street Sweeping and Drain Cleaning

Rangpur Municipal Area	Total Length of Road (Km)
	1709.67
	Total Length of Drain (Km)
	295.53

Street sweeping and drain cleaning activities also constitute major responsibilities of the conservancy section of the city corporation. At present, sweepers in the municipalities are employed for about four to six hours starting at 7 am. Each sweeper is assigned a length of road for which he or she is responsible. Street sweepers are hired on daily basis. Road sweeping operation is likely to be manual in the foreseeable future and the basic equipment consists of brooms, shovels and handcarts. Drain cleaning constitutes of removing dirt material from the drains and letting the dug-up materials (mostly made up of grit, sand, and decayed organic material) dry on the roadsides, before collecting it for disposal.

3.3 Subproject Location

The subproject mainly located at the landfill site of the Rangpur City Corporation which is in ward no 29. Geographically it is located 25.739168° northing and 89.301455° easting. Below satellite image depicted the location of the Rangpur subproject.

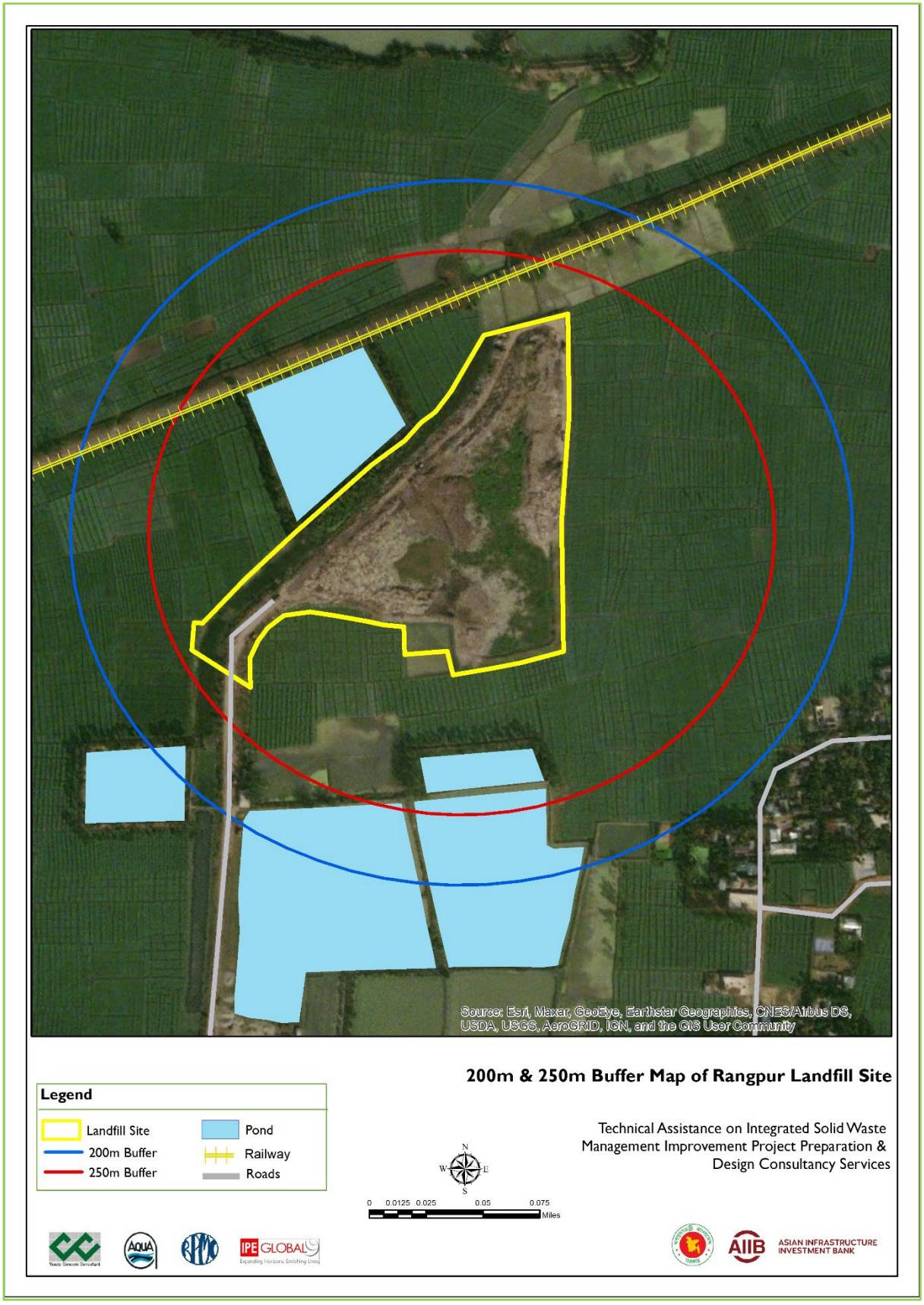


Figure 3.7 Rangpur landfill site map showing the compliance with DOE rules

3.4 Administrative Location

Rangpur is a category A city corporation in the Rangpur division of northwestern Bangladesh. It is one of the important town in the country and also serves as the headquarters of Rangpur district. Rangpur City Corporation consists of 33 wards with an area of 205.7 sq. km. **Figure 3.8** shows the administrative map of Rangpur City Corporation.

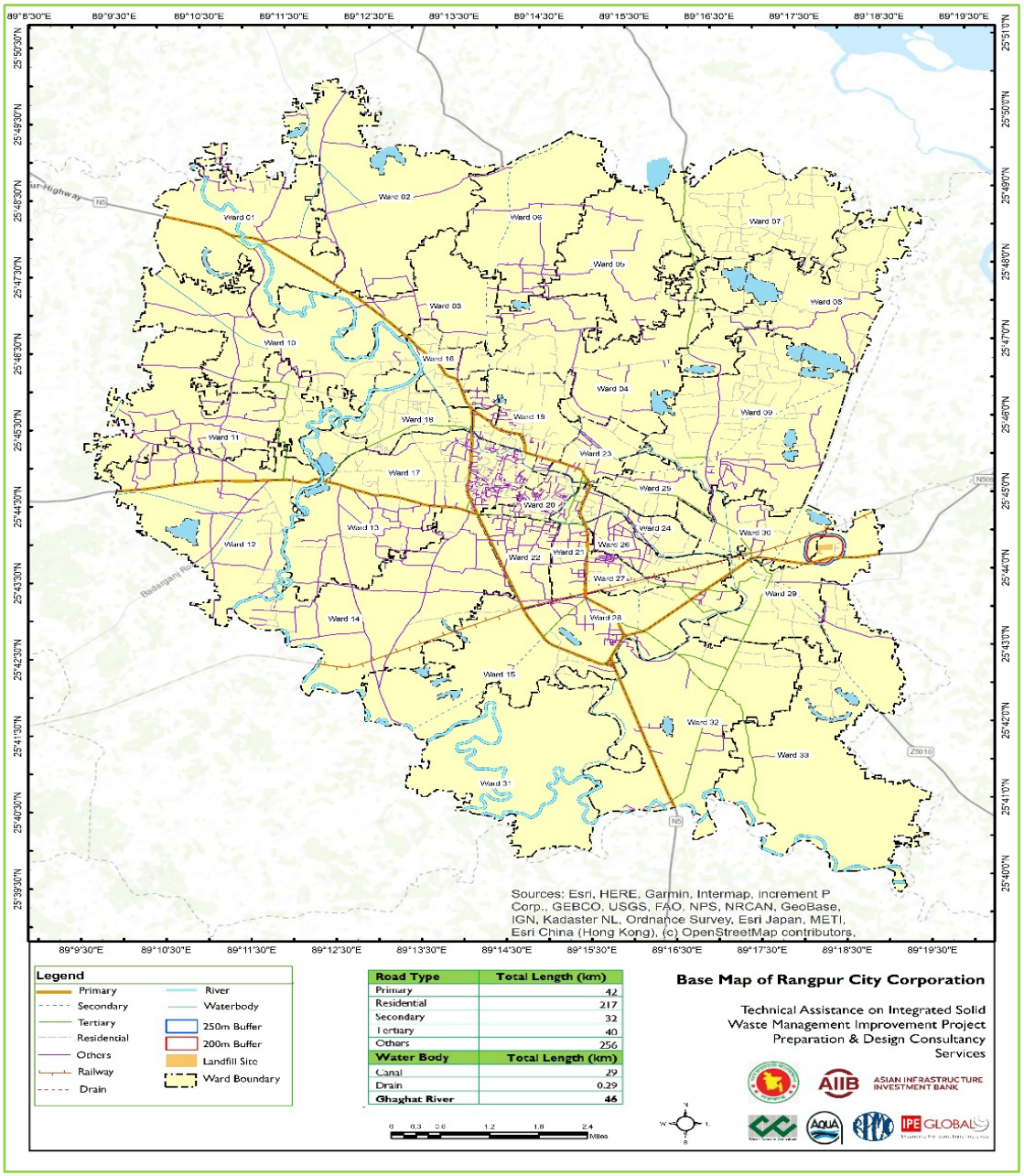


Figure 3.8 Base Map of Rangpur City Corporation

3.5 Subproject Components

To improve the solid waste management system of Rangpur City Corporation, there is a need to address both the technical elements (source separation, collection, storage, transportation, recycling, resource recovery, and disposal), as well as the governance aspects (institutional, financial, and regulatory). Addressing both set of factors is essential for a sustainable solution as mentioned in the above sections. The following intervention measures are recommended as a way forward.

3.5.1 Improving Collection of Waste

Two types of waste collection services are found in the study area, i.e., primary, and secondary waste collection. It is customary that the primary and secondary waste collection services should be compatible so that maximum efficiency can be achieved during waste collection. Unfortunately, at present the primary and secondary collection systems in Rangpur City Corporation are incompatible, resulting in multiple handling of waste, low collection efficiency, and environmental problems. The problem of waste collection becomes more acute during monsoon. The following section describes methods to improve the primary and secondary collection of waste.

The following improvements are recommended to improve the primary collection of waste in the city corporation area:

Promoting household level segregation- it is recommended to practice source segregation at household level irrespective of the category of urban areas. The approach involves only segregating waste at the household level in mainly three categories – Organic waste (Green Bin); Inorganic Recyclable waste (Yellow Bin) and Hazardous waste (Red Bin). While not a part under this project, it should be promoted by city corporation to improve the overall waste management value chain in the town.

Expansion of the house-to-house waste collection program throughout the entire town including residential, commercial buildings, and the eight slums, for a service charge. Currently, an estimated 21,000 households are covered in the house-to-house waste collection program, whereas the total number of holdings in the town is 55,171.

House-to-house waste collection is not specified in the Local Government Ordinance as a mode of waste collection. However, the Solid Waste Management Rules 2021 has recommended the collection of sources segregated waste from households. The local government ordinance instead stipulates that local government bodies shall establish a waste storage facility (community bins) at convenient locations, where the resident will be responsible for disposing of the waste as his/her responsibility. However, once the waste is disposed of in the community bins, it is the responsibility of the local government bodies to manage it. Since the house-to-house waste collection is an additional service which is preferred by the citizens, it is advisable that the city corporation should engage the private sector/NGOs/CBOs for the collection of waste from different wards; this should be done by enacting a service charge which should be fixed by the city corporation. Currently, households are paying a service charge of BDT 80-100 per month per household. Solid waste collection fees for slums should be lower than the non-slum areas.

The existing design of the rickshaw van used for the primary collection of waste is not viable since it is open and lacks a cover. During monsoon, it becomes extremely difficult to pull the rickshaw vans. Moreover, loading and unloading of waste from the rickshaw vans represents a problem. Therefore, instead of an open rickshaw van, it would be an improvement to use a modified van with six to eight containers for the collection of waste. The containers can directly discharge the waste into the closed demountable containers for secondary collection of waste.

This type of modified rickshaw van can also be used for the collection of source-separated waste (see photographs below for the design of the van, which minimizes the multiple handling of waste).

	
Existing waste collection rickshaw van without containers	Recommended waste collection rickshaw van with containers

Figure 3.9 Existing waste collection van and recommended van with containers
Source: Consultant's Assessment

Recommended improved rickshaw van with containers that can directly discharge waste into covered containers and reduce multiple handling of waste. This type of van collects segregated waste easily. Green containers can be used for organic waste while bags can be used for the collection of recyclables.

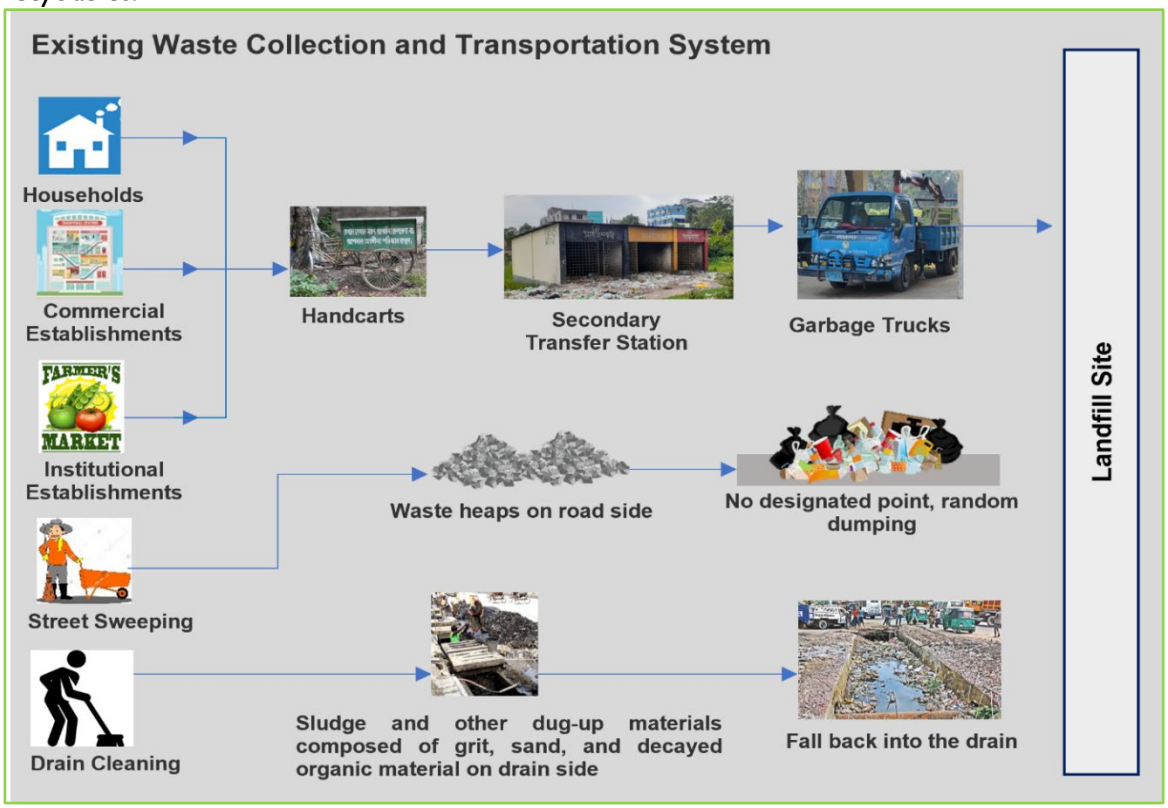


Figure 3.10 Existing waste collection and transportation system

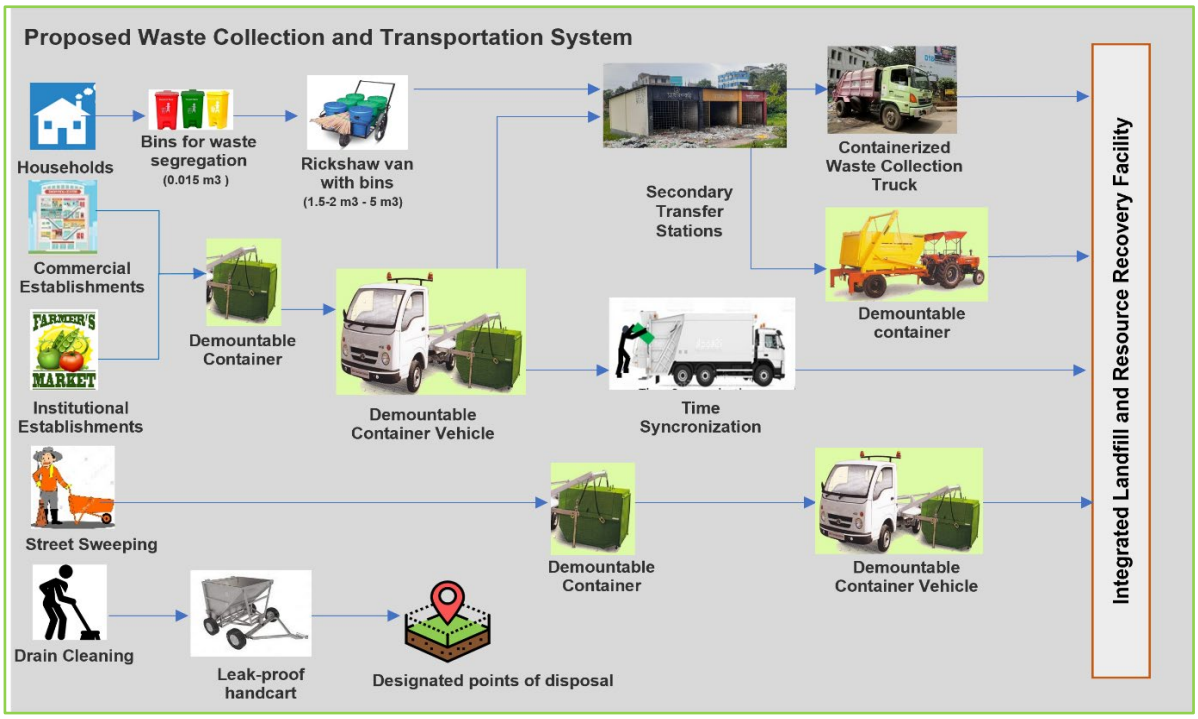


Figure 3.11 Proposed waste collection and transportation system

3.5.2 Improving Waste Storage for Secondary Collection of Waste

Currently, the city corporation has only one waste storage area for secondary collection point. The current design of the secondary storage area and the open collection points are not very efficient and are a source of environmental pollution. To improve waste storage for secondary collection, small and medium size demountable containers (1.5-2m³ to 5 m³ volume) are recommended for the city corporation. It has also been recommended to initiate house-to-house waste collection services in the city corporation using rickshaw vans with 6-8 containers and some motorized vans for commercial and market areas. The containers can then directly discharge the segregated waste into the closed demountable containers for secondary collection of waste; this will reduce multiple handling of waste. Depending upon the population of the wards, at least one container should be placed in each ward. The containers should be placed on a raised base of 9 to 12 inches to avoid water infiltration inside the containers in the case of waterlogging during the monsoon. Moreover, the containers should not be placed near the drains. The advantages of using a container system are as follows:

- Reduction in number of collection points;
- More efficient in terms of transportation;
- Less manpower is required and hence easy to monitor by conservancy inspectors;
- Reduce GHG emission by reduction of trips;
- Less environmental pollution compared to open concrete bins or open collection points;
- Less loading time for collection of waste and easy to unload;
- Avoid rainwater infiltration inside the storage container and hence less chance of leachate generation;
- Less chance of attracting rodents and flies since the containers are closed.

Figure 3.12 Proposed containerized waste collection and transportation system
Source: Consultant's Assessment

The project plans to construct five STSs in five convenient locations within the city corporation area. RpCC authority has selected five locations through consultation with the local communities for the mentioned five STSs and their construction which are well-connected by roadway. The selected locations are (i) New Jummapara in ward no. 23 (for STS-1), (ii) Mahadevpur (for STS-2) in ward no. 26, (iii) Satgara Masuapara in ward no. 17 (for STS-3), (iv) New Master Para in ward no. 25 (STS-4), and (v) Tajhat (STS-5) in ward no. 28. (for STS-5). The selected locations for the STSs are also free from any unauthorized occupancy. Land for the proposed STSs are owned by the RpCC. **Table 3.3** shows the coordinates of the selected locations for the five STSs.

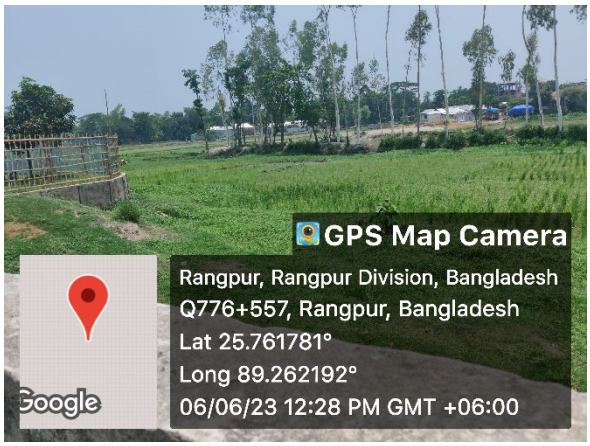
Table 3-3 : The latitude and longitude of the proposed STS in RpCC

Proposed STS	Latitude (°)	Longitude (°)
STS 1 in Ward 23	25.761781	89.262192
STS 2 in Ward 26	25.738549	89.264266
STS 3 in Ward 17	25.753322	89.226504
STS 4 in Ward 25	25.759252	89.266413
STS 5 in Ward 28	25.723962	89.274225

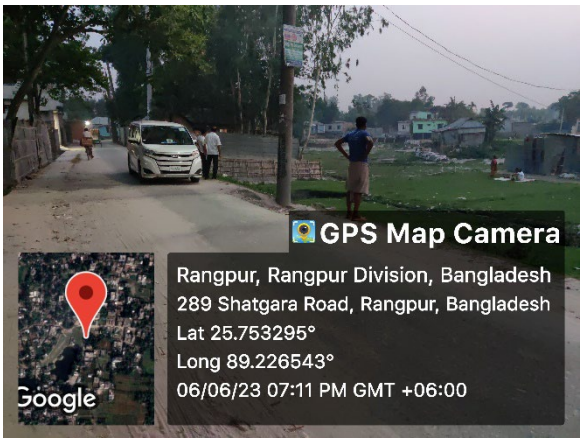
The mentioned five STSs have been selected tentatively considering the population and waste generation of the wards. Waste will be stored in the waste collection points after door-to-door collection. Then the waste collecting truck will collect the waste from waste collection points to the landfill. 5 STS have been proposed for collecting wastes from the town area. Figure 3-13 shows the locations of the proposed STSs.

Proposed location STS-2 at Mahadevpur

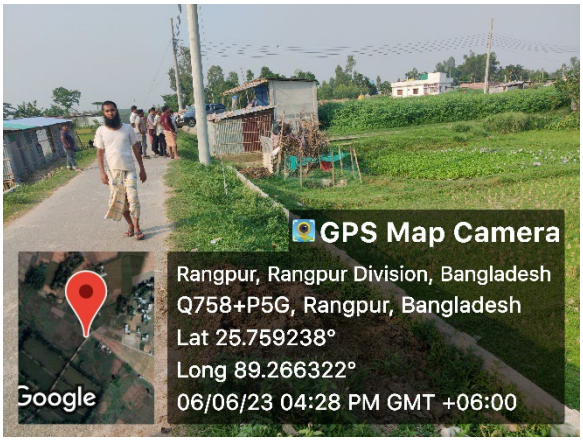
Proposed location STS-5 at Tajhat



Proposed location STS-1 at New Jummapara



Proposed location STS-3 at Satgara Masuapara



Proposed location STS-4 at New Master Para

Figure 3-13: Surrounding of Proposed STSs in Munshiganj Municipality

Location map of the integrated landfill and resource recovery facility, STSs and access road connecting the integrated landfill and resource recovery facility in Munshiganj Paurashava are shown in the maps below:

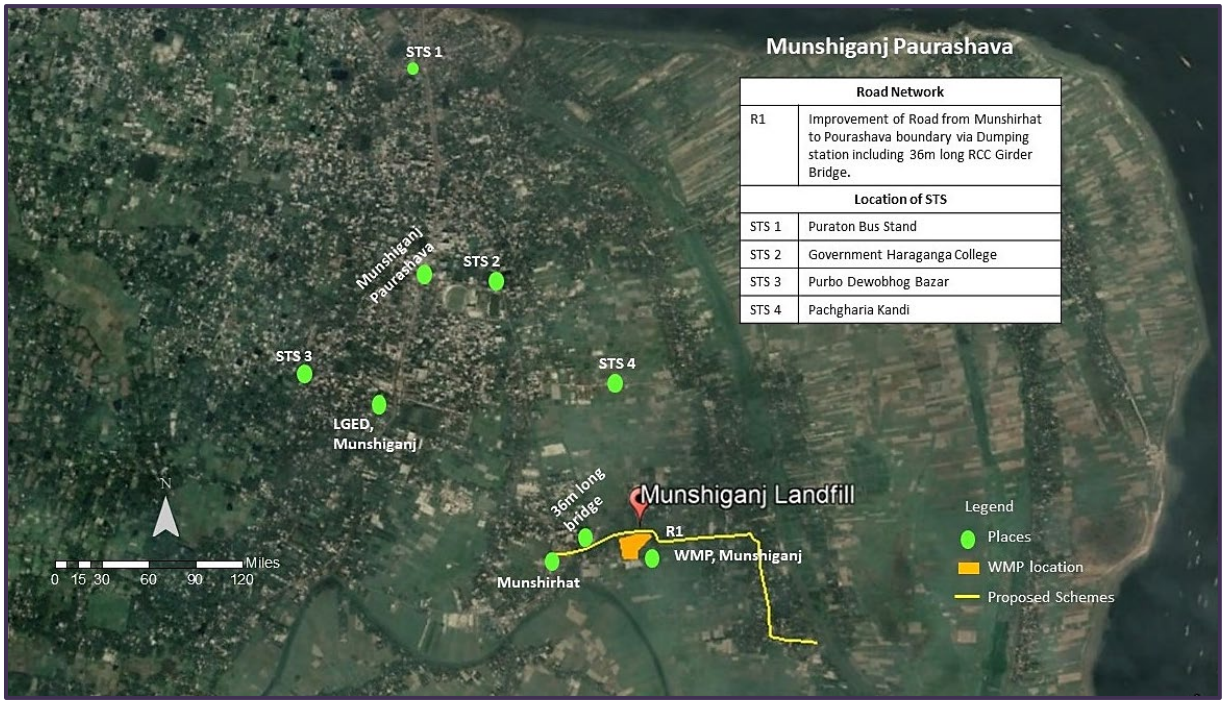


Figure 3-14: Locations of the landfill site and STSs and alignment of the connecting road for the landfill site

3.5.3 Improving Waste Transportation

In terms of total waste transportation, labor productivity, and loading time, demountable trucks with closed containers appear extremely efficient compared to open trucks in Bangladeshi conditions (see pictures below). As such, Rangpur City Corporation should move from an open truck waste collection and transportation system to demountable container trucks. Depending upon the road width, different types of demountable container trucks can be used. Currently, open trucks are being used in the city corporation for the transportation of waste. These trucks usually make 2-4 trips per day. Instead of using flat-bed open trucks, it is recommended to use small and medium-size demountable container trucks in the city corporation which make between 6-8 trips per day.

Figure 3.15: Proposed waste collection small truck to carry containers

Figure 3.16: Proposed tractor to carry demountable waste collection container

Source: ISWMIP Consultant's Assessment

3.5.4 Improving Disposal of Waste and Resource Recovery

There is one official landfill site having an area of 7.84 acres in the Rangpur City Corporation which was acquired by the city corporation in 2021. All the collected waste (amounting to 150 tons per day) is disposed of in an uncontrolled manner using crude dumping methods by the city corporation. To improve the waste disposal system, this site is urgently required to be converted into an Integrated Landfill and Resource Recovery Facility. National Strategy for Water Supply and Sanitation 2014 (updated in 2021) has recommended that by 2030, 50% of the city corporation/municipalities in the

country should have Integrated Landfill and Resource Recovery Facilities. These facilities should be based on 3R Principles.

The proposed subproject has been designed to establish an Integrated Landfill and Resource Recovery Facility (IL&RRF) in the existing landfill site of Rangpur. The facility will comprise of a composting plant, a MRF, a pyrolysis facility, leachate treatment facility as well as controlled landfilling of waste at the existing waste disposal site Baradi of Rangpur City Corporation. The subproject will be able to recycle and treat solid wastes to the tune of 230 tons/day by the year 2035 in an environmentally friendly manner. The subproject will also remove and cap the existing waste disposed of in the landfill site using the open dumping method. The existing waste will be disposed of and caped in a new cell. Apart from composting and waste recycling, the subproject will reduce GHG emission by avoiding landfilling a significant amount of biodegradable and recyclable waste. Allocation of the incoming wastes (100 tons/day in 2025) to the landfill site would be as follows:

Table 3.4 Landfill and Resource Recovery facility in Rangpur

Landfill & Resource Recovery Facility	
230 ton/day MSW (in coming in 2035):	a) 180 ton/day to Landfill cell (Landfilling)
In the coming 230 ton/day MSW calculated based on the projected population 2035: 939482 and waste generation rate: 0.51kg/person/day with 5% increase in every 5yr; waste collection rate: 75% up to 2025 - 2045; recycling rate: 30% up to 2035; 45% from 2031-2035 50%; 2036-2040-60%; and 65% 2041 onward (source: estimated by consultants)	b) 30 tons/day to Compost plant (Compost production)
	c) 15 tons/day to MRF (Recyclables)
	d) 5 tons/day for Pyrolysis (Plastic waste to oil)

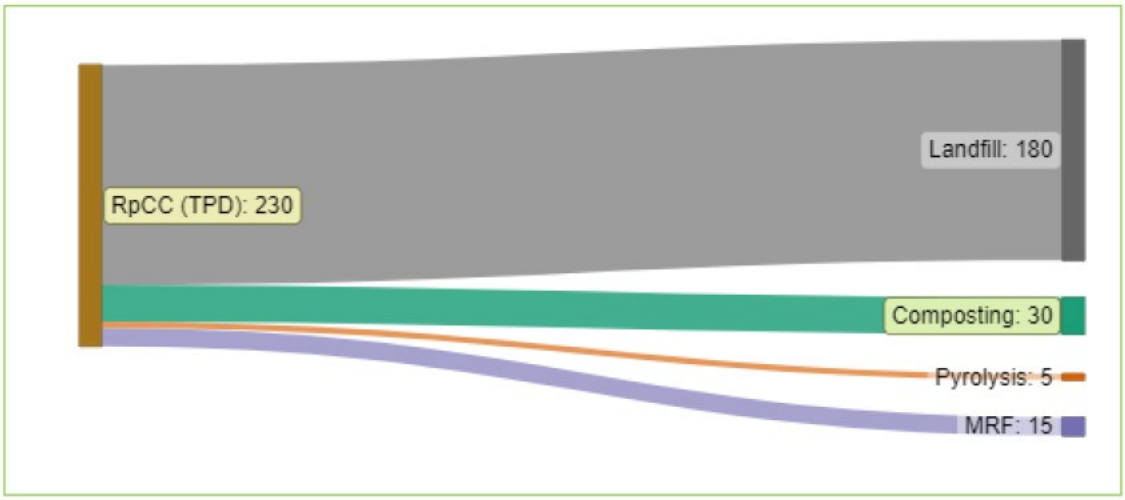
The primary objective of the proposed landfill with resource recovery facility is as follows: to provide effective control measures to prevent (or reduce as far as possible) negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, as well as the resulting risks to human health arising from landfilling of waste. The fundamental objective of the proposed facility is to enhance sustainability and promote the 3Rs of waste (reduce, reuse and recycle). The proposed design has considered the diversion and conversion of bulk part of the waste into resources (compost, plastic waste to oil and inorganic waste recycling).

The project by 2025 shall be able to divert 22% of the generated waste for composting, 15% of inorganic waste shall be recycled in the MRF, and 3% for pyrolysis (single use plastic waste to oil). In all 40% will be recycled and 60% will be landfilled in 2025 and this recycling rate shall be increased to 65% by 2045. Using this percentage of waste recycling, the proposed landfill site can be used up to 2045. The total area of the landfill site is 7.84 acres which are currently used for waste management facility. Figure 3.16 shows the layout plan of the proposed integrated landfill and resource recovery facility. Table 3.4 shows the distribution of space for different facilities.

Table 3.5 Land use plan of the proposed landfill facility in Rangpur

SL	Land Use	Area (Sq.m)
1	Capped Cell for old waste	2598.872
2	Cell 1	3025.525
3	Cell 2	3195.883
4	Compost Plant:	2202.917
5	MRF	1527.00
6	Pyrolysis Plant	245.128
7	Leachate Treatment facility	878.914
8	Office Building	147.00
9	Generator Room	62.092
10	Motor Room	15.00
11	Switch Room	15.00

SL	Land Use	Area (Sq.m)
12	Mechanical, Electrical, Workshop Room	57.461
13	Pyrolysis Plant	105.22
14	Vehicle Washing Ramp	42.377
15	Underground Water tank and pump room	9.00
16	Weigh Bridge	32.00
17	Septic Tank (3x7)	21.00
18	Leachate Storage Tank	16.635
19	Security Room + Gate	36.592
20	Road and RCC Paved	7822.099
21	Green Area	3135.00
22	Plantation	6535.047
	Total Area	**31725.762**



Source: Consultant's Assessment

Figure 3.17 Mass balance of waste to be managed in the proposed facility

Legacy Waste: It is estimated that currently 15,000 tons of solid waste is disposed per day in the landfill using open dumping method. A new cell will be made with a HDPE liner at the base of the landfill site since the groundwater table is high around the landfill site. The currently disposed waste shall be disposed in the new cell and capped.

Bio-medical Waste Management Facility: Recently, a local NGO has constructed a medical waste management facility in the old landfill site funded by JICA. As such, no intervention on medical waste management is proposed by the project.

The layout Plan of the facility is provided in the Figure 3.18 below:

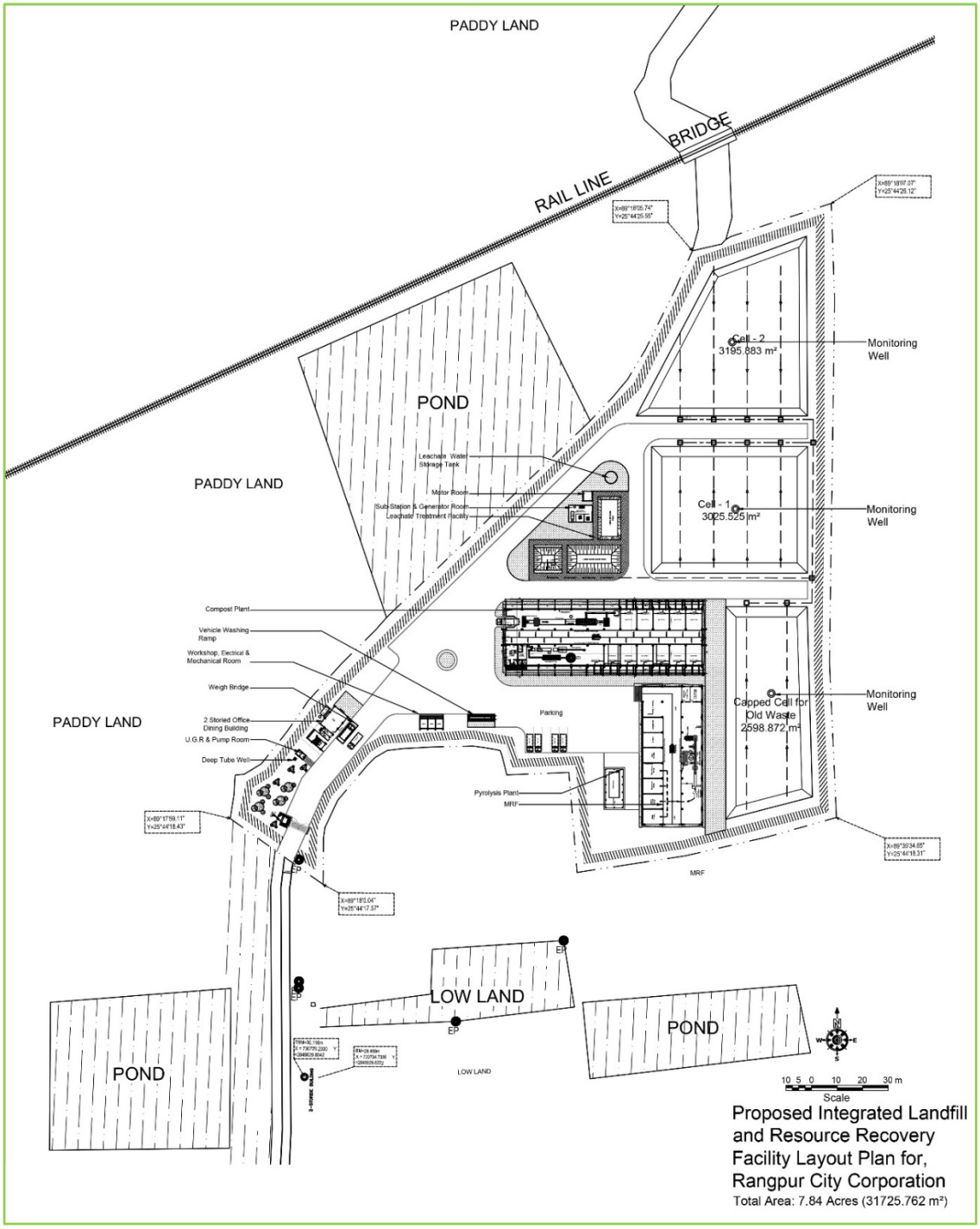


Figure 3.18 Proposed design layouts- IL&RRF for Rangpur City Corporation

3.5.5 Improving Drain Cleaning and Street Sweeping

Apart from the collection and disposal of solid waste, street sweeping and drain cleaning activities constitute major responsibilities of the conservancy section of the city corporation. Street sweeping and drain cleaning are directly related to solid waste management vis-à-vis the disposal of the dirt material removed from the drains. Generally, the common practice in the city corporation is to remove the dug-up materials on the roadsides to dry for several days before collecting them for disposal. The dug-up materials are mostly composed of grit, sand, and decayed organic material. Though it is easy and convenient to collect and dispose of the dried-up material, this practice has several shortcomings, which include:

- Sludge left on the roadside presents an unpleasant sight to the town;

- Heaps of sludge are obstructions to pedestrians and other traffic;
- Sludge is dispersed by the traffic and parts of it may fall back into the drain nullifying the cleaning effort;
- As the sludge may contain harmful bacteria and other micro-organisms, this practice may lead to the spread of diseases.

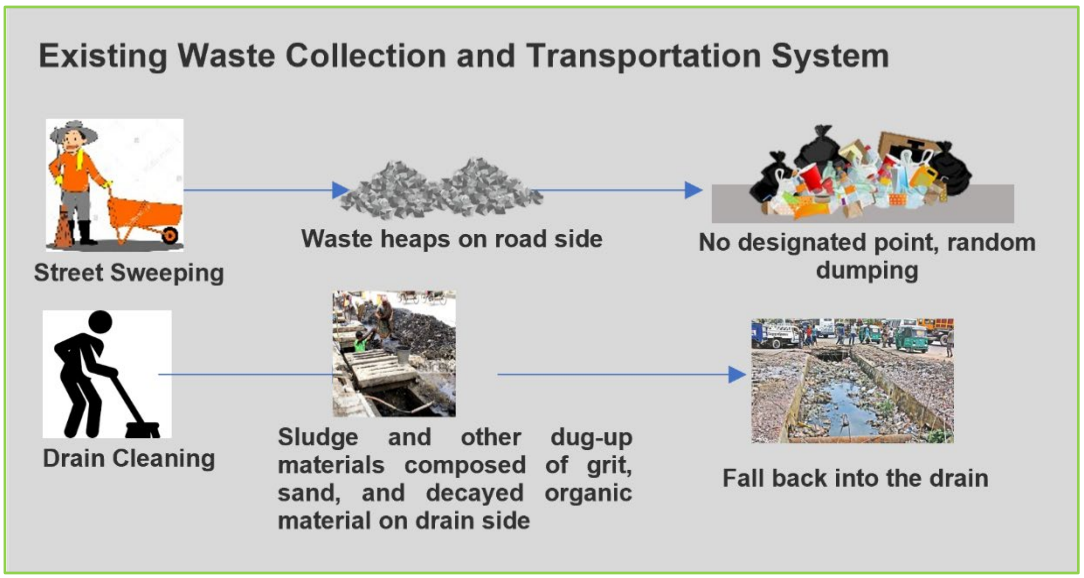


Figure 3.19 Drain cleaning in existing waste collection and transporting system

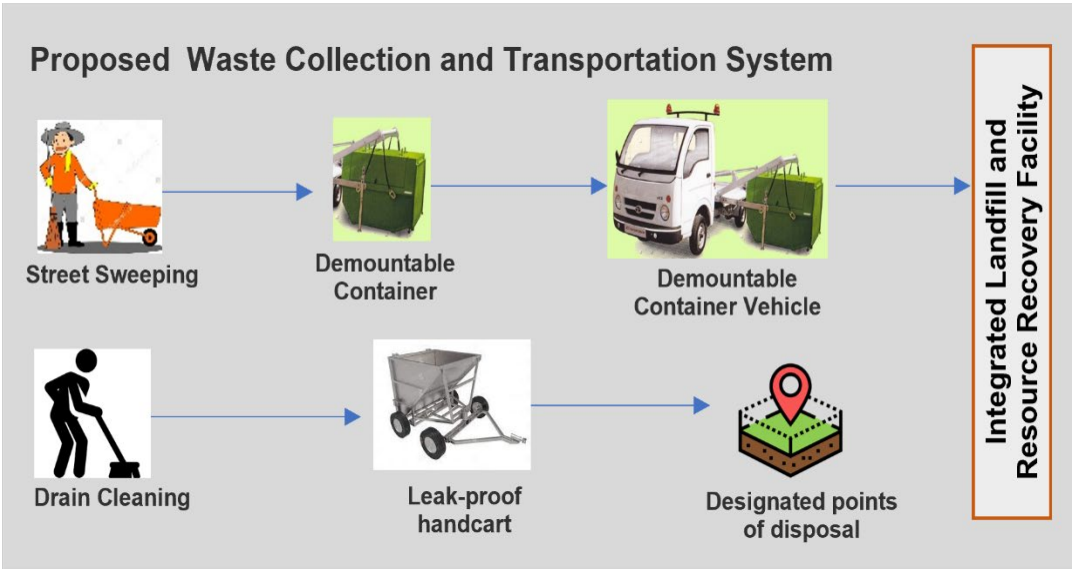


Figure 3.20 Drain cleaning in proposed waste collection and transporting system

3.6 Improving the Access Roads

The project will improve five existing roads (Road from RK Road to Kolabari Dumping Yard, Road from Mahigonj Shahidminar to Gosaibari Road, Road from Bokhtiarpur Bridge to Kopat Bridge, Road from 20MW Power Plant to Morichtari, and Road from Kashbag Govt. Pry. School to Balatari Mosque). Total length of the two road is 8.265 km which are connected to the proposed landfill area. The improvement will be limited to resurfacing of the existing track without any widening of the road. No additional land acquisition is required for the road improvement. These roads are also free from any unauthorized occupancy.

3.7 Associated and Existing Facilities

The associated and existing facilities are defined in the AIIB ESP and project ESMPF. The E&S due diligence considered project (i) associated facilities (those which are not funded by the project but whose viability and existence depend exclusively on the project and whose operation and services are essential for successful operation of the project) and; (ii) project existing facilities (those which are already established and operating, and which the project will help upgrade or rehabilitate).

Existing access roads, secondary transfer stations, container bin sites, and other waste treatment facilities linked to the landfill are considered as existing facilities. These facilities are in operation since long time following national and local regulations.

The project does not have any associated facilities.

3.8 Subproject Costing/Budget

The broad estimates for the capital expenditure of the sub-project in Rangpur is given in the Table 3.4 below. The CAPEX has been broadly estimated for four key aspects a) the equipment required for collection & transportation- includes the cost of the vehicles for primary and secondary collection and the containers for secondary collection; b) construction of the Integrated Landfill and Resource facility.

Table 3.6 CAPEX – Rangpur sub-project

Item	USD
Construction of integrated landfill and resource recovery facility (cell for capping of old waste, new cell for waste disposal, compost plant, MRF, leachate treatment plant, boundary wall, office room, car washing ramp, workshop, guard room, an electrical system including transmission, transformer, distribution and deep tubewell with a water distribution system, and five transfer stations	5,500,000
Equipment for MRF and Compost Plant	600,000
Equipment for Pyrolysis Plant	200,000
Weigh bridge (digital)	35,000
Excavator (1)	220,000
Bulldozer (1)	250,000
Front Loader (1)	225,000
Container Carrier Trucks (13)	685,750
Containers (55)	82,500
Dump Trucks (10)	449,074
144 Improved Rickshaw vans (with bins) for primary collection of waste	216,000
Aerators (6)	12,000
Pumps (10)	30,000
Total	**8,505,324**

3.8.1 Operation and Maintenance Expenses

The O&M expenses are key costs required in operationalization and management of the SWM value chain including waste collection, transportation and treatment facility in the city corporation. The table below provides an overview of the various categories of O&M costs.

Table 3.7 Components included under operating costs

Item	USD
Operational cost of door to door waste collection	630,000
Operational cost of secondary collection of waste	322,500
Operational cost of Integrated Landfill and Resource Recovery Facility	551,386
Total	1,503,886

3.9 Subproject Schedule

Substantial time is required for the subproject preparation, approval, survey, design & estimate, contract award and contract execution. Efforts needs to be made to meticulously follow the schedule should a timely implementation of work is aimed at. Normally the construction work season in Bangladesh runs from October through May (eight months). Construction works are sometimes impeded for the following reasons.

- Early floods in April/May,
- Late floods in September/October,
- Natural calamities (cyclone/tornado, excessive floods) occur in April/May and October/November.

Normally, the best construction period is only for 6 months a year (October to March). The construction period is sometimes squeezed to 4 months due to natural calamities. However, sometimes, based on time constraint or exigency, construction work may even need to be carried out in the monsoon. Besides, whenever possible, simultaneousness of activities can be ascertained and cashed in on and consequently, quantum of work can be maximized through efficient planning and adoption of best available practice. A tentative time-schedule for implementation (only as an indication) is shown Table 3.7 overleaf.

Table 3.8 Proposed implementation schedule for the Rangpur sub-project

Month	2022		2023												2024												2025											
	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Pre-feasibility Report																																						
Feasibility Report																																						
Preparation of the bid documents																																						
Tendering of the sub-project and the work order																																						
Execution of the physical work																																						
Final inspection and certification																																						

4. DESCRIPTION OF BASELINE ENVIRONMENT

4.1 Introduction

The city Rangpur is located in the north western part of Bangladesh. Rangpur is one of the major cities in Bangladesh and Rangpur division. Rangpur was declared a district headquarters on December 16, 1769, and established as a city corporation in 1869, making it one of the oldest municipalities in Bangladesh. The municipal office building was erected in 1892 under the precedence Raja Janaki Ballav, Senior Chairman of the city corporation. In 1890, the Shyamasundari canal was excavated for the improvement of the town. Sharfuddin Ahmed Jhantu was first mayor of Rangpur City Corporation.

In the month of May 2022 ISWMIP consultant team visited Rangpur City Corporation as part of the ESIA study investigating the assessment of environmental impacts. The waste dumping site of Rangpur City Corporation is bounded by Ichhamati canal on the north adjacent to the road passes by the landfill site, agricultural lowland on the south, agricultural low land on the east and agricultural low land on the west.

4.1.1 Primary Data Collection

ISWMIP team visited the subproject sites toward assessing the existing environment (physical, biological, and socioeconomic) and gathering information in respect of the proposed sites and scale of the proposed subproject. In addition to environmental survey, a separate socio-economic study was conducted to determine the demographic information, archaeological and religious places, densely populated pockets, and settlements. The methods used for primary data collection were transecting walk, field GPS measurement, photographic records, need basis environmental survey, and observations.

4.1.2 Secondary Data Collection

For comprehensive study secondary data were also collected during the mentioned site visits and were analysed based upon which interpretations were made to assess the physical, biological, and socio-economic features of the subproject area. The relevant information is presented in the subsequent paragraphs. Data for this study has been firstly collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject site. The literature survey broadly covered the following:

- Subproject details, reports, maps, and other documents available with the Waste Concern Consultants (WCC), IPE Global, RPMC, and AQUA Consultants, LGED, and Rangpur City Corporation information available at websites;
- Relevant acts and extraordinary gazettes, and guidelines issued by Government of Bangladesh agencies; and
- Literature review on land use, soil, geology, hydrology, climate, socioeconomic profiles, and environmental planning documents collected from Government of Bangladesh agencies and websites.
- Web search for literature.

4.2 Topography of Rangpur

Rangpur is one of the major metropolitan cities in the northern part of Bangladesh. It has become a metropolitan city in 2018 with a population of almost 16000000. The population of the Rangpur city corporation as of 2014 is 865,927, with male 50.91%, female 49.09%, and the literacy rate is 64.6% (BBS 2015). For the purposes of this report, the geographical coordinates of Rangpur are 25.747 deg latitude, 89.252 deg longitude, and 118 ft elevation.

The topography within 2 miles of Rangpur is essentially flat, with a maximum elevation change of 56 feet and an average elevation above sea level of 115 feet. Within 10 miles is also essentially flat (85 feet). Within 50 miles is essentially flat (650 feet). The area within 2 miles of Rangpur is covered

by grassland (36%), cropland (36%), and artificial surfaces (29%), within 10 miles by grassland (49%) and cropland (47%), and within 50 miles by cropland (55%) and grassland (36%).

Water logging is one of the major problems in the Rangpur city. In recent years most of the city has been inundated due to heavy rainfall in a short period of time during monsoon season. This year a 433 mm rainfall for 12 hours made the whole city water logged almost for 2 days. The major causes working behind this situation are weak and unplanned drainage system and topographical condition. Geographically the elevation of the main Rangpur city is lower compared to the surrounding areas which results in water logging. The drainage system was also unplanned and defective from the beginning of the formation of Rangpur city. Inadequate and poor drainage system, low maintenance and lack of dredging are making the condition worse. Unplanned building construction and increased population in locality has accelerated and prolonged the water inundation. Due to the up growing inhabitance, number of open lands and ponds are decreasing and moreover the poor drainage system is preventing the rainwater from draining away. The inactiveness and endangered condition of the Shyamasundari canal flowing throughout the city enhanced the acuteness of water logging. The sufferings in daily life have no bound among the residents due to water logging in the rainy season. The water bound people have no pure drinking water and food and have lost their valuable assets, furniture, houses, cattle and crops. This also causes physical damages to the roads and buildings as well as environmental damages. The study focuses on the recent scenarios of water logging and tries to find out and analyze the causes of water logging.

Significant amount of gravel, sand, and cement will be required for this sub-project. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures. Utilize readily available sources of materials. If contractor procures materials from existing burrow pits and quarries, ensure these conform to all relevant regulatory requirements. Borrow areas and quarries (If these are being opened up exclusively for the sub-project) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.

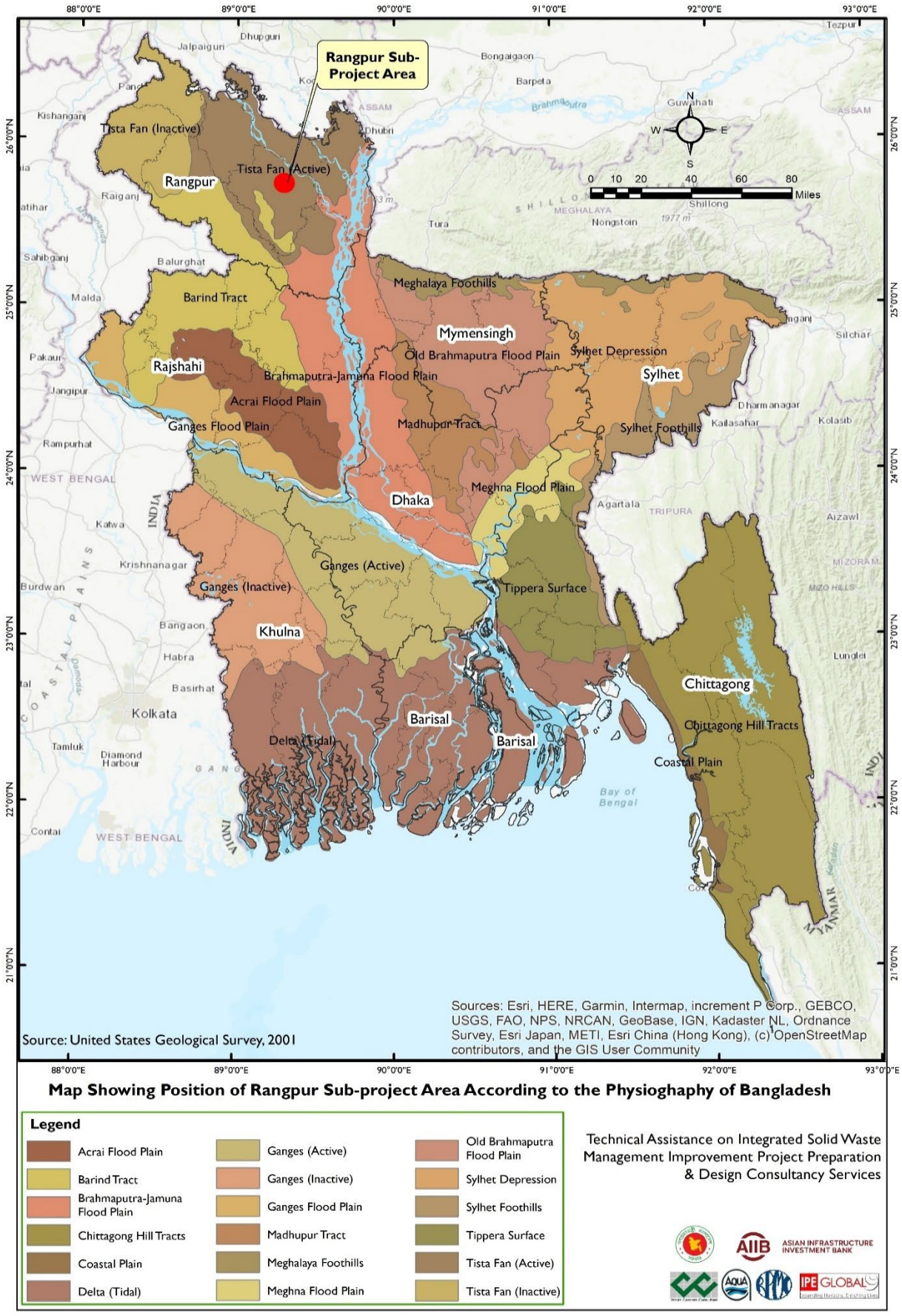


Figure 4.1 Physiography of the Rangpur City Corporation subproject area

4.3 Land use and land cover of the Rangpur City Corporation Area

Land use is defined as men's activities on land which are directly related to land. Land use has been seen as a product of interactions between a society's cultural background, skill and its physical needs in one hand and the natural potential of land on the other hand. Land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and other resulting due to land transformations. Land cover association and its temporal change is also one of the most important components of environments. Land use and its change seem to very essential for the development planning and also for a rational use of land space. To prepare land use map from any kind of image, one suitable classification system is essential. Land use classes are consisting of urban and rural areas whereas the urban areas are subjected by residential, both residential and industrial areas and the rural areas are dominated by settlements and cultivated landscapes.

Land Element-1 (Agriculture, Construction Materials): This element can be used for human settlement, for the construction of roads and highways; this element is suitable for agriculture.

Land Element-2 (Settlement): This element can be used for human settlement; it is comparatively elevated than the surrounding areas. The river bank erosion, water logging and flood problems are absent or nearly absent. This zone is found in the northwestern, western and in some parts of and southeastern central region of Rangpur area. The settlement density is high and the communication system is also very good in this element.

Land Element-3 (Agriculture, Settlement): This element is less suitable for human settlement and is moderately elevated than the surrounding areas. The soil and land configuration map shows that drainage is moderately well and morphologically this element falls in the floodplain area. This area is used for cultivation. The communication system of this element is also good and settlement density is medium to high. This element is found mainly in the central and with few other areas of Rangpur.

Land Element-4 (Pisciculture, Water Reservoir): This element is unsuitable for human settlement. Morpho-geologically this element is deeper part of flood basin and abandoned channel area. This element is highly flood affected and drainage system is poor. Water covers the areas almost throughout the year and settlement density is nil. This zone is only suitable for agriculture, surface water reservoirs and fisheries land-use.

Land Element-5 (Agriculture, Pisciculture, Water Reservoir): This element is suitable for industry because this area is highly communicated with rail, river, road etc. So, this area is suitable for industrial purpose.

The land has had a profound effect upon the natural environment thus resulting into an observable pattern in the land use/land cover over time. The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

Development and expansions of land use map depends on various geologic parameters. The geologic parameters include physiography, geomorphic condition, flooding, drainage system, slope elevation and geologic setting etc. It is essential to consider the geologic parameters before taking any developmental planning to avoid any unwanted events that create destruction to the lives or properties of mankind. So, decision maker should concern about the positions where does the planned project suit. The study was made to prepare a morpho-geological map of the Rangpur City Corporation area in northern Bangladesh using remotely sensed data and field data. Physio-graphically, Rangpur district occupy the middle part by Teesta river and the land mass of the both side of the river are flood plain. Five geomorphological units were identified from the SPOT (band 4) and Lands at TM (FCC) images. These are active channel deposit, abandoned channel deposit, natural levee deposit, flood plain deposit

and flood basin deposit. In consideration of the geomorphologic conditions, a preliminary land use map was prepared. The area is divided into five land elements which designated as no water reservoir, settlement, agriculture, pisciculture and industrial zone. This land use map will provide significant guideline for the better use of the land. The map will be helpful for geologist, engineers, planners, local administrator, agriculturist and farmer in their respective field. The following recommendation should be taken consideration for future development plan in the study area:

i) It is important to integrate geological information at early stage for land use planning in order to avoid destruction or damage of properties and lives and to avoid other environmental problem and monetary loss.
ii) The sub-soil conditions of the area should be mapped by the implementation of systematic boring program and extensive sample testing of the soil.
iii) This study work might have some lacking because of limited scope and time.

Therefore, a detailed survey should be undertaken for any further development activities in these areas.

Rangpur district experiences rapid urban growth after 1990s and this trend still encompass present growth. Assessment of land use/land cover of the study area will possibly evaluate the state and rate of change in the present decades. This assessment might help the government as well as the policy makers for integrated planning and management of present landscape and also predict and design the state of future landscape. Rangpur district area 2370.45 sq km, located in between 25°18′ and 25°57′ north latitudes and in between 88°56′ and 89°32′ east longitudes. It is bounded by Nilphamari and Lalmonirhat districts on the north, Gaibandha district on the south, Kurigram district on the east and Dinajpur district on the west.

In the physiographic point of view, the area falls in the Old Himalayan piedmont plain. Geologically, the area is lies on the north-northwestern part of the Bengal basin. The surficial of the area is classified as recent flood plain deposits. The recent flood plain deposit consists of clay, silt, fine and medium grain sand and are of relatively loose and more friable in nature. The Teesta River is the main active channel in the study area which is meandering river.

Rangpur district experiences a significant change over the 9 years of study period. This study shows major change in barren land and water body. Both these two land features showing a decreasing trend.

Table 4.1 Showing the percentage of change from 2002 - 2011

Feature	2002 (Hectares)	2011 (Hectares)	Change %
Water Body	8024.94	7557.03	-5.83%
Settlement/Build up area	154706.22	159110.82	2.84%
Vegetation	51770.97	52119.09	0.67%
Barren Land	17113.14	12828.33	-25.04%

Rangpur district regarded one of the first going districts of Bangladesh because of recent division formation. The core part of a division generally experiences higher development than any other parts. The study recognizes the trend of recent change of landscape from 2002-2011. The result is not a positive one for the area because of heavy percentage of landscape conversion. Decreasing trend of water body can be a major threat for the area. Though a certain increase in vegetation have shown in this study, but the conversion from barren land to settlement is still very high. It means the barren lands are converting into build up area rather than cultivable land. So, there still remain a significant imbalance between vegetation and build up area.

A long-term development plan should be taken to maintain and reestablish the natural balance between vegetation and urban landscape. Integrated project plan also should be introduced and applied to maintain the water context of Teesta river as well as the other water bodies. As, this study conducted with satellite images of the dry period more complicated and sophisticated study should be done using satellite images of different seasons.

4.4 Geology of Rangpur

The ESIA study area is the Rangpur City Corporation landfill area. This region occupies the relatively higher parts of Teesta floodplain formed on sediments of the rivers draining into the Rangpur catchments area. The area is mainly smooth broad ridges and basins. The area is primarily composed of raw sandy and silty alluvial deposits usually stratified either from the surface or below the cultivated topsoil. The soils are grey, heavy silt clay loams on the ridges and clays in the basins. Non-calcareous Grey Floodplain soils are the only general type. Organic matter content of soils is moderate. The reaction of soils ranges from strongly acidic to neutral.

The geomorphological units are identical on the basis of the fluvial features and their sedimentary characteristics formed in the areas. On the satellite image these are identical on the basis of the interpretation of the image elements such as the tonal variation, texture, size, shape, association etc. Geomorphic units are classified on the basis of differential erosion processes. Remotely sense data have capability to mapping geomorphic units. Most units are characterized by their distinct textural and sedimentological characteristics; however, some units either lack of distinct sedimentological characters or the characteristics have been modified by post depositional process such as weathering and biological activities. The study area has been sub-divided into five distinct morphological units based on geomorphological expression, slope characteristics, surface elevation characteristics, flooding, vegetation, surface sediment, drainage systems and genetic aspects of deposit.

Active channels have permanent water flow throughout the year. The Teesta river is the main active channel in the study area which is meandering river. On the spot panchromatic imagery, the active channel deposits have been identified by their light tone, smooth texture and morphologic position. Surface deposits are clay or silty clay which underlain by silty sand to fine sand deposits. Vegetation is also present. These channels are flooded in the rainy season and water logging persists more than six months almost every year. Thick layers of organic clay and peat are common. Organic remains in abandoned channels are found. Other abandoned channel found in Haragach, Kursha and northern part of the study area.

Natural levee deposits are linear, somewhat irregular wedge-shaped ridges of silty sand and sandy silt. They are elongated deposits parallel to the channel and developed on both sides of the river. This unit is thickest near the channel margin and thinned towards the floodplain. Slope is steep towards channel and very gently towards the floodplain. Along the bank of the river, these deposits are mostly silt and fine sand become clayey silt at the distal edge of the levee where it merges with the flood plain deposits. A natural levee found in the side of Teesta river. This unit is mostly vegetated areas. The higher elevation of this unit in comparison to the surrounding areas results high settlement. On the SPOT imagery these were identified by medium to dark gray tone, coarse texture and linear shape along the river bank.

Floodplain lies between natural levee and flood basin and is lower in elevation than those of natural levee. This is the largest unit in the study area. Floodplains have very gently slope toward the flood basin. Floodplain deposits in the study area are composed of gray silty clay to organic rich clay. Decomposed to partially decomposed grass roots and organic remains are common in the sediments of this unit. On the spot imagery floodplains are identified by medium gray tone and smooth texture. Most parts of this unit in the study area have been converted to cultivated lands, which exhibit geometric shape and even textural distribution on the satellite imagery. In the study area these units are commonly observe on side of the Tangon River.

Flood basins are featureless areas of poorly drained, flat to centrally slopping into stream depressions. Topographically flood basins are the depressed portion of the stream floodplain and oval, semi-circular or irregular in shape. These are small to large depressions in the floodplain having marshy to boggy environment. Most of the areas are usually under water round the year but few become dry during the winter. Marshes have also been mapped as flood basin. In some places of the study area the flood basins have been modified to ponds for fishery.

The flood basin deposits in the study area consists of gray to light gray organic rich clay, dark gray to blackish gray peaty clay with abundant decomposed or partially decomposed vegetal matters. Some alternations of silty layers are present in this unit. On the spot imagery the flood basins are identical by dark gray tone, no texture and irregular shape. These are monotonous featureless areas. Most flood basins are found in the eastern side of the Teesta River of the study area. However, flood basins are sparsely distributed throughout the study area.

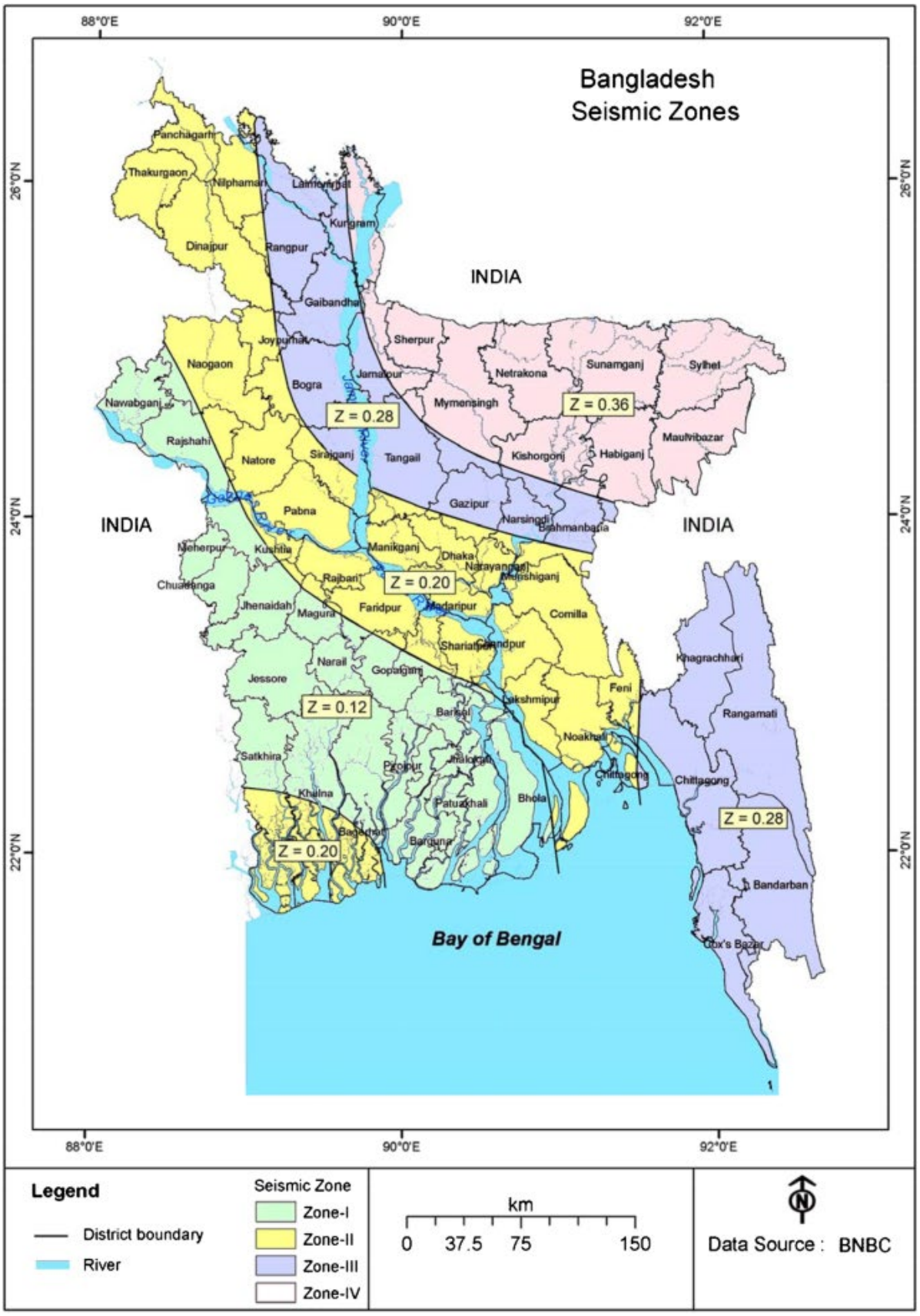


Figure 4.2 Seismic zoning in Bangladesh (Source: National Building Code, 2015)

4.5 Water Resources of Rangpur City Area

Rangpur is supposed to be an ideal city because of its six rivers. However, due to lack of proper maintenance, these rivers are now becoming a curse for city dwellers. Locals of Rangpur said that with proper maintenance and renovation, the beauty of Rangpur city will be enhanced and it will become an ideal city in the country as a tourist city.

The rivers flowing through Rangpur City Corporation area are Ghagat River, Shyamasundari, Ichhamati, Burail, Khoksa Ghagat and Alaikumari. These six rivers have different types of illegal occupation by which, water flow is severely restricted. Although some people call Shyamasundari a canal, history shows that it is also a river. It was re-excavated by King Janakiballav Sen. These rivers are dying due to pollution. Once upon a time, these rivers are now a thing of the past. Although 160 illegal occupants of Shyamasundari have been identified, still for some unknown reason, the eviction drive has stalled.

It can be seen on the ground that Khoksa Ghagat is located on the way to Satmatha in the eastern part of the city. This river has now turned into a canal. Somewhere, this river has lost its existence. Local Asaduzzaman said he had heard from his grandparents that the Khoksa Ghagat was once a mighty river. There was trade and commerce around this river. The existence of this river is under threat today due to the occupation and pollution in the course of time. The river Ichhamati is on the way to Mahiganj, known as the old river of the city, some distance away from Satmatha. It is no longer a river, nor a canal. Occupying both sides of the river, the locals have built residence over the river as of now.

Maqbool Hossain, a resident of Mahiganj, said that a saint of God came in a fish-shaped vehicle through this river in the 12th century. The area was named Mahiganj because of the fish-shaped vehicles. Mahiganj once had a river port around the Ichhamati River. It was lost long ago. The existence of Ichhamati is also being seized. Many places are full. The location of Khoksa Ghagat is even more tragic at the junction of the park which flows through the southern end of Satmatha of Rangpur city. It cannot be called a river. Even half of the drains that the city corporation has built are in the river. As a result of drainage of waste and various houses, unhealthy condition has been created in the area. Local Irfil Islam said hundreds of people were building houses on both sides of the river. Besides, many have set up businesses illegally. As a result, whatever river exists is dying due to pollution.

Meanwhile, the work of evicting 160 illegal occupants of Shyamasundari river flowing through the heart of Rangpur city has come to a halt. The survey of the canal identified 160 illegal occupants. They were informed with a notice to remove the installation before the eviction began. But due to the objections of 11 occupants, the eviction campaign is in full swing. As a result, Shyamasundari has become a curse instead of a blessing. There are 33 rivers in Rangpur district. Not a single river is in good condition. Although Teesta, Ghagat, Yamuneshri and Karatoya are big rivers, none of them are in good health.

There are three different rivers named Burail in Rangpur district. The condition of Chhota Akhira, Naleya, Sonamati, Kafrikhal, Shalmara, Mara Teesta, Ghiranai, Bullai, Manas, Baishadara, Dhaijan and Khatkhatiya rivers is also not good.

Water insufficiency during the pre-monsoon season and rapidly falling underground freshwater levels is a common scenario in the towns and cities of Bangladesh. The objective of the study is to investigate the spatiotemporal depletion of groundwater levels (GWL) in a drought-prone Rangpur district, northern region of Bangladesh. Groundwater observation well data from 1980 to 2019 was used for this purpose. Rainfall, temperature, irrigation, and land use/land cover datasets are used to assess the factors influencing groundwater level depletion. Linear regression, and the least square regression model were used to identify the trend of GWL depletion. Results show that GWL in drought-prone regions is declining rapidly because of the excessive withdrawal of groundwater and land-based reservoirs for irrigation and household needs. The declining GWL is alarming during the pre-monsoon and post-monsoon seasons due to some disproportional mismanagement in the study area. Among the rates of decline, the trend in maximum depth has a comparatively higher rate than the others. Severe withdrawal of groundwater in agriculture, a decreasing amount of annual rainfall, and degradation of climatic factors in the area are all attributed to a lowering trend in groundwater level. This map illustrates satellite-detected surface waters in Rangpur division, Bangladesh as observed from

a Sentinel-1 images acquired on 21 Jun. 2022 at 18:05 local time and using an automated analysis with machine learning method. Within the analyzed area of about 12,400 km^2, about 1,200 km^2 of lands appear to be flooded.

Bangladesh is a land of agriculture and attain near self-sufficiency in rice production. In terms of rice, national output increased over 15 million tons in the last two decades. For obtaining this self-sufficiency, groundwater accessibility is continuously increasing that results in expansion of deep and shallow tube wells. Available evidence suggests that the policy focus so far has been largely on "resource development", and not on "resource management". This has resulted in serious problems, most notably excessive drawdown in intensively irrigated areas, and the deterioration of groundwater quality. Due to this, an extensive field survey was carried out in Rangpur division (Country's Northern part) during the year of 2018 to observe the ground water table depletion status in rice field and set up some top most strategies for reviving these problems in a sustainable way. It can be suggested that attention must be given to the development and management of surface water resources to ease pressure on groundwater. Apart from that, focus should be given on optimizing crop water demand through increasing water use efficiency by adopting water conserving management strategies and practices. As per authors' suggestion, 6 basic strategies can be taken for long term sustainability of ground water management in Rangpur division. The strategies are: 1) Initiate right choice of rice varieties for the season 2) Implement modern water management technology (alternate wetting and drying (AWD), cut off Rratio) 3) Adopting irrigation scheduling 4) Introduce organic fertilization 5) Apply rain water harvesting and 6) Reservoir management.

The contamination of several trace elements (TEs) in groundwater is one of the most environmental issues associated with sustainable development in Bangladesh. Therefore, this study aims to elucidate source apportionment of contamination, and their potential health risk in Rangpur district. The results of the study showed that the average concentrations of iron, manganese and barium were exceeded the permissible limits for drinking water set by WHO and Bangladesh standards. However, the analysis for sources of contamination index: principal component analysis revealed that geogenic sources were much contributed than anthropogenic activities for elevating concentrations of TEs in the study area. An uncertainty study showed that the concentration of "As" was the most sensitive parameter affecting the potential health risk. In a whole, arsenic in drinking water may pose health impacts to some extent in local residents; thus, special attention and groundwater monitoring should focus on "As" contamination in groundwater of the study region.

4.6 Natural Hazards in Rangpur City Region

Natural hazard is a common phenomenon of Bangladesh. Rapid urbanization and multiple deprivation are making cities more prone to numerous disasters.

Rangpur city is located in a deprived zone of Bangladesh that is highly prone to earthquake and fire hazards, and the population's low level of risk perception might exasperate their vulnerability to earthquakes and fire. There is no statistically significant relationship between disaster risk perception and multiple deprivation; The concept of risk perception of hazards is associated with perceived personal risk and hazard experience, information, adjustment and proximity. Moreover, an individual's personality, the type and the context of risk, culture and the social context influence the risk perception.

Rangpur city is located in the lowest income zone, one of the most deprived areas since independence. Apart from multiple deprivation, Rangpur city is vulnerable to earthquakes and fire hazards. It is located within earthquake zones 1 and 2 and has been in the epicenter of major earthquakes.

According to government statistics for the 2004–2018 period, 1,970 people died in fires, with economic losses upwards of USD 66 million. In that same time, Rangpur division reported 16,568 fire incidents. The population of RpCC is growing rapidly, with associated increase in risk of mass fatalities due to large-scale fire accident or earthquakes.

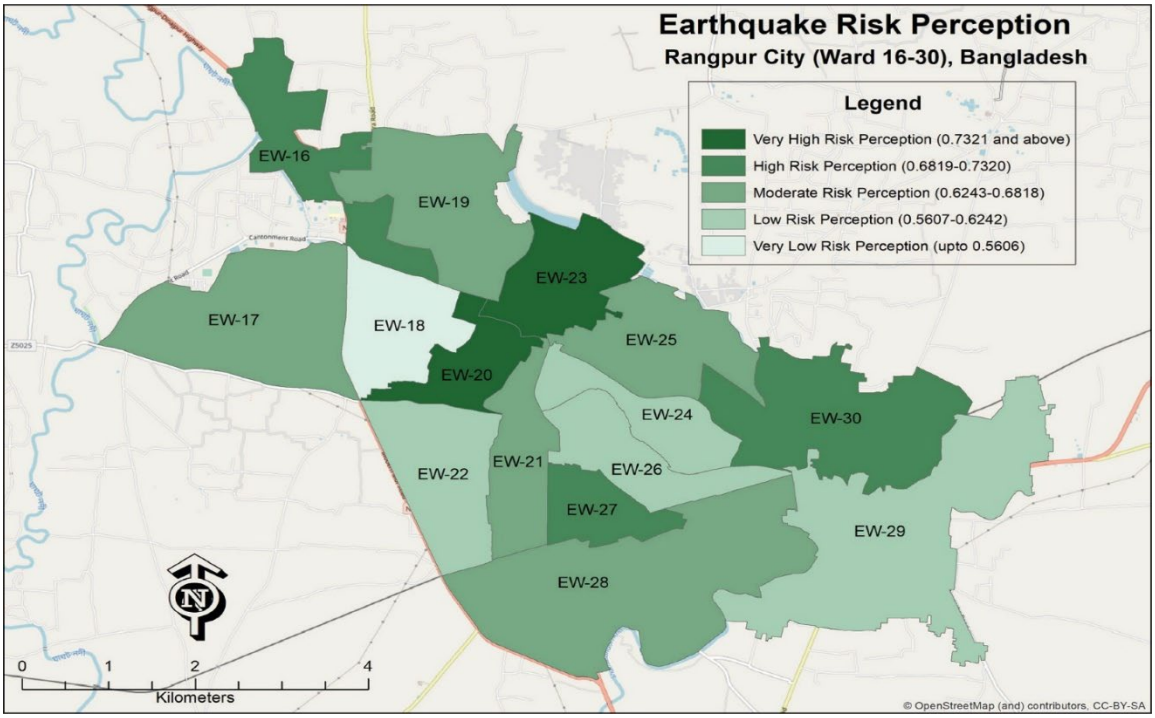


Figure 4.3 Spatial pattern of earthquake risk perception in Rangpur city

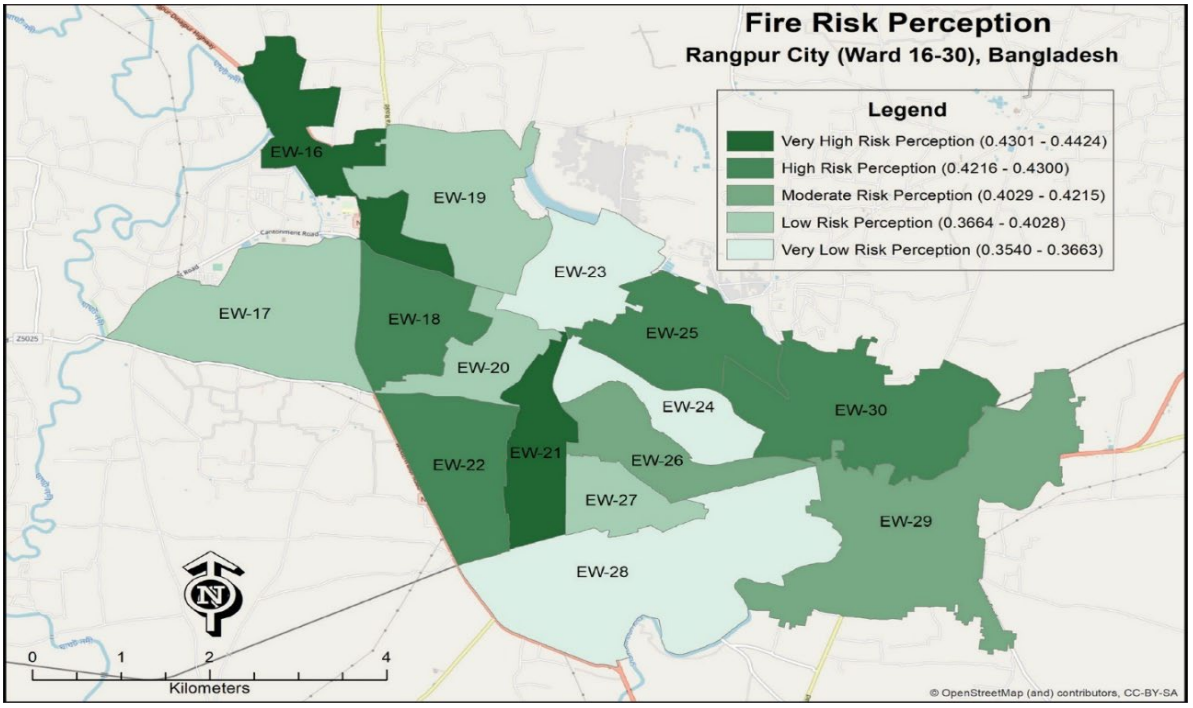


Figure 4.4 Spatial pattern of fire risk perception in Rangpur city

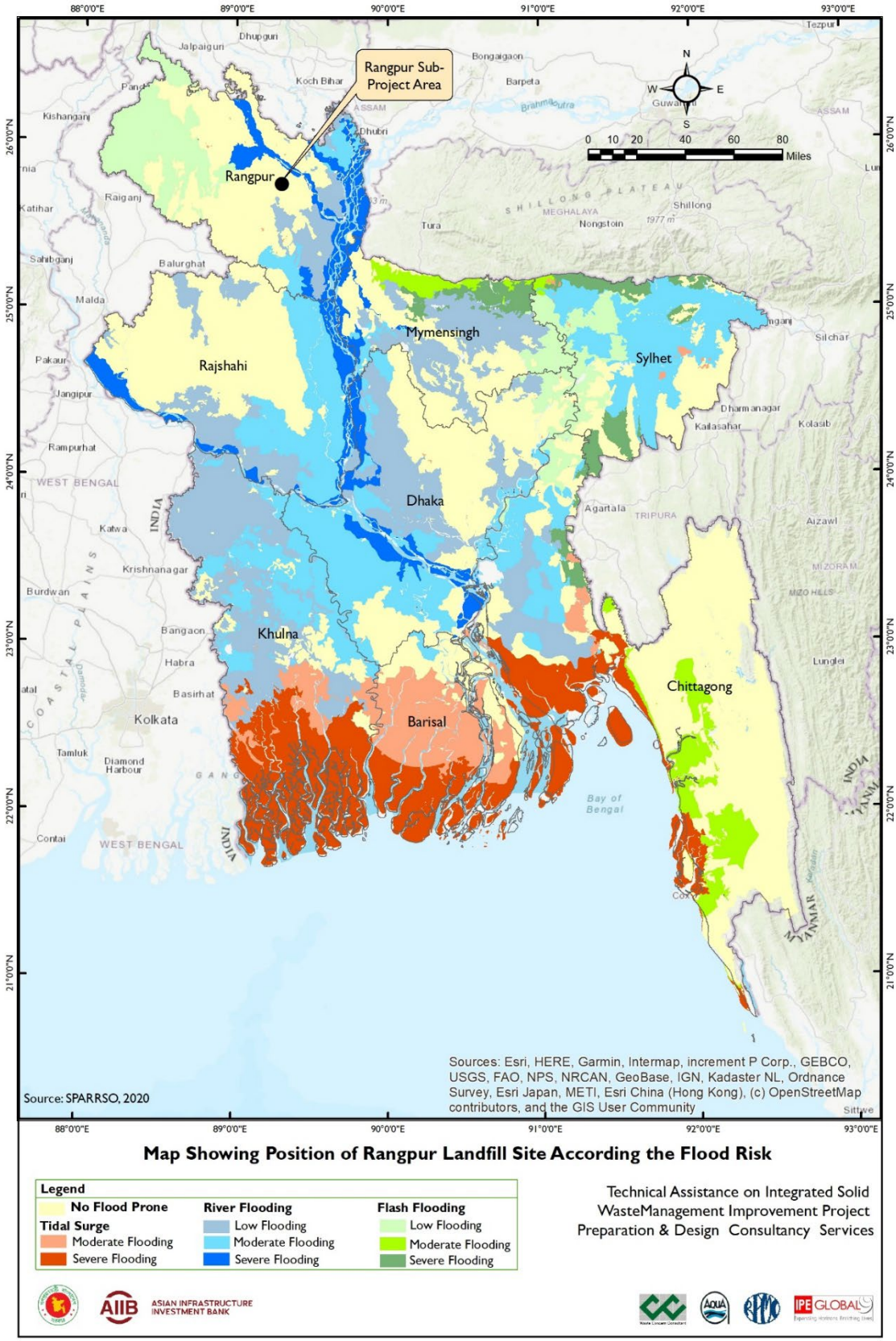


Figure 4.5 Position of Rangpur landfill site according to the flood risk

4.7 Physical Environment of Rangpur City

There were found no environmentally sensitive areas, cultural heritage site or protected site, wetlands, mangrove and estuarine. No buffer zone was observed and no special area for protecting biodiversity were noticed. The Rangpur City Corporation is located at the northern part of this country. As a major environmental issue, ecological critical area was not found. Therefore, the environment risks are not likely.

Figure 4.6 Buffer zone mentioned in Rangpur City Corporation landfill site

4.7.1 Climate of Rangpur Region

The climate of Rangpur region is tropical accompanied with monsoons and characterized by a change of four seasons. Pre-monsoon season commence from March and continues till the last week of May. The south-west monsoon lasts approximately from June to September, delineating the main rainy season. The transition period from October to November forms the post monsoon season. Dry or winter season starts from in early December which remains till end of February. The study area experiences high air temperature throughout the year with insignificant daily air temperature variations.

In Rangpur, the wet season is hot, oppressive, and mostly cloudy and the dry season is warm and mostly clear. Over the course of the year, the temperature typically varies from 51°F to 95°F and is rarely below 46°F or above 102°F.

The best times of year to visit Rangpur for hot-weather activities are from late March to early May and from mid to late October. As per discussion with local people we understood that the local residents did not observe any recent (10 years) climate events or changes. This city corporation did not face any inundation during floods of 1998, 2004, 2007, 2020. There was no record of increased temperatures like heat wave at the subproject area. The proposed solid waste management subproject will not increase social and environmental vulnerability to climate change now or in the future. It will not increase risks of flooding, subsidence or heave, or does it increase water consumption. The subproject will be designed to contribute to reducing climate risks so that greenhouse gas emission will be prevented. Tree plantation work may be suggested to incorporate green spaces to provide cooling and shade in the face of rising temperatures though this area is surrounded by agricultural lands. Field climate risk screening assessment checklist of Rangpur is provided in Appendix VI.

4.7.1.1 Temperature of Rangpur

The hot season lasts for 3.0 months, from March 20 to June 22, with an average daily high temperature above 91°F. The hottest month of the year in Rangpur is May, with an average high of 94°F and low of 78°F. The cool season lasts for 2.0 months, from December 5 to February 6, with an average daily high temperature below 77°F. The coldest month of the year in Rangpur is January, with an average low of 51°F and high of 73°F. Figure 4.9 shows the monthly average highest and lowest temperature in Rangpur. The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

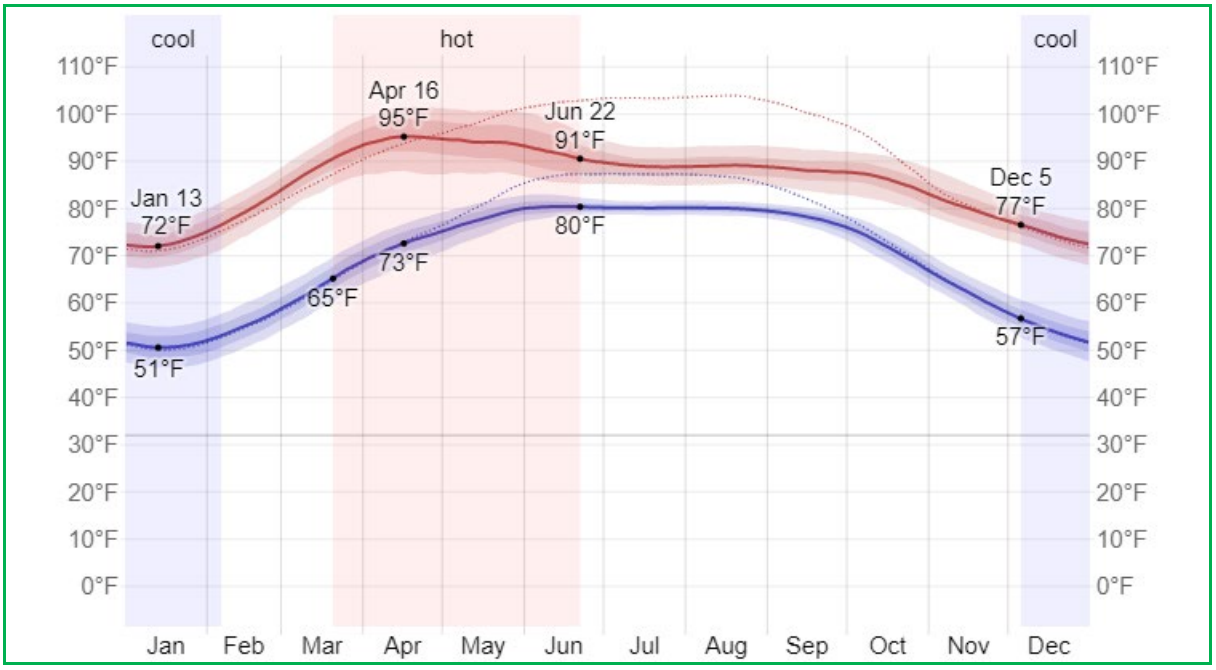


Figure 4.7 Graph showing monthly highest and lowest temperature in Rangpur
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

Table 4.2 Average monthly highest and lowest temperature in Rangpur

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp.	73°F	79°F	89°F	95°F	94°F	91°F	89°F	89°F	88°F	86°F	80°F	75°F
Medium Temp.	60°F	66°F	76°F	83°F	86°F	85°F	84°F	84°F	83°F	78°F	70°F	63°F
Low Temp.	51°F	55°F	64°F	73°F	78°F	80°F	80°F	80°F	78°F	71°F	62°F	54°F

Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

A compact characterization of the entire year of hourly average temperatures is shown in the Figure 4.8.
The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day. The average hourly temperature, color coded into bands. The shaded overlays indicate night and civil twilight.

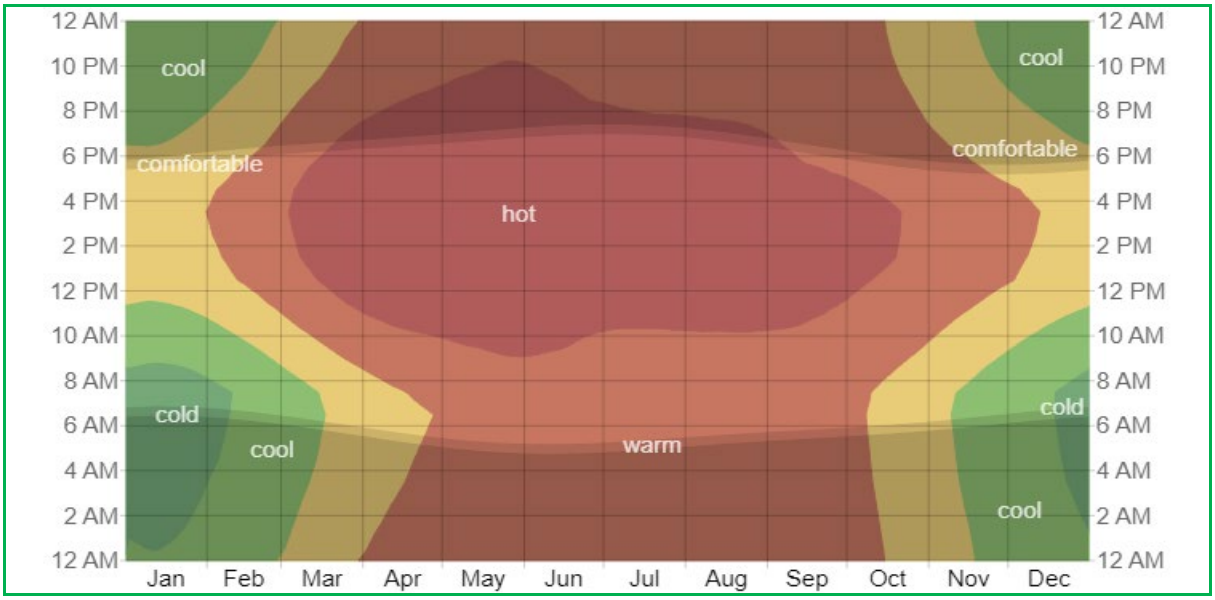


Figure 4.8 Average hourly temperature in Rangpur
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

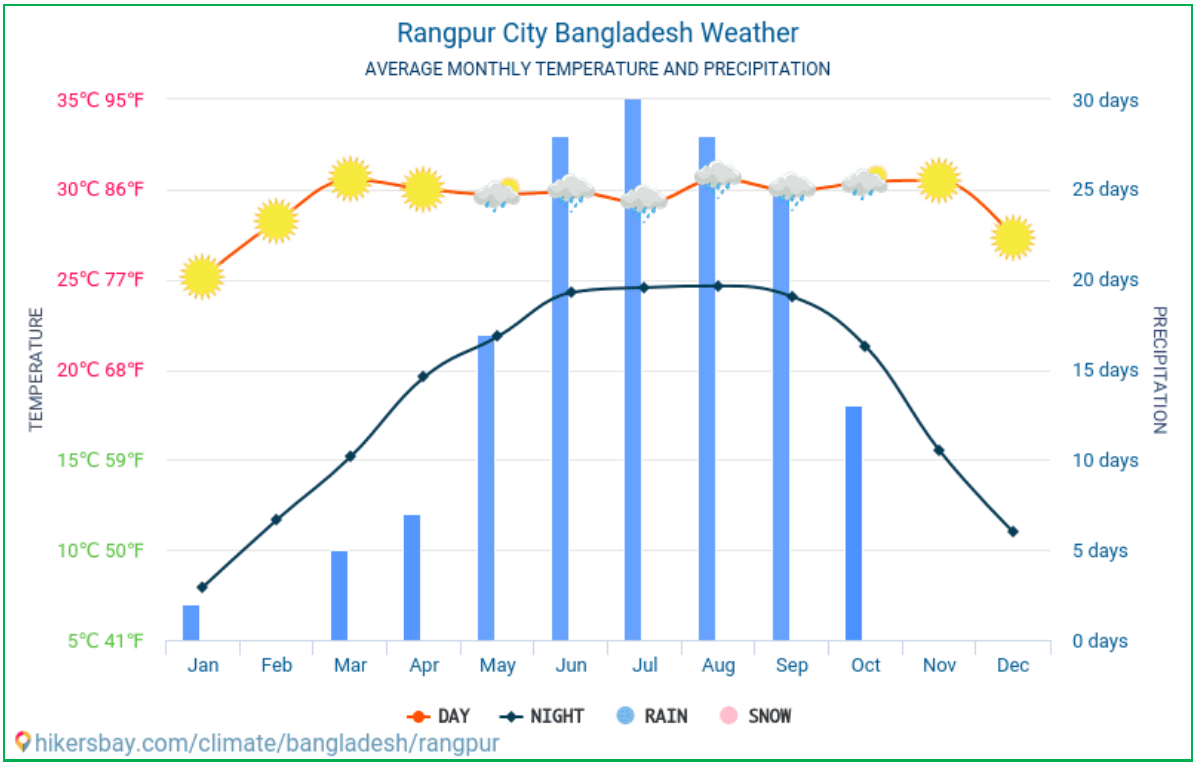


Figure 4.9 Monthly average temperature and precipitation of Rangpur 2015-2022

4.7.1.2 Rainfall of Rangpur

To show variation within the months and not just the monthly totals, it is shown that the rainfall accumulated over a sliding 31-day period centered around each day of the year. Rangpur experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 8.1 months, from March 9 to November 12, with a sliding 31-day rainfall of at least 0.5 inches. The month with the most rain in Rangpur is July, with an average rainfall of 10.6 inches.

The rainless period of the year lasts for 3.9 months, from November 12 to March 9. The month with the least rain in Rangpur is December, with an average rainfall of 0.1 inch.

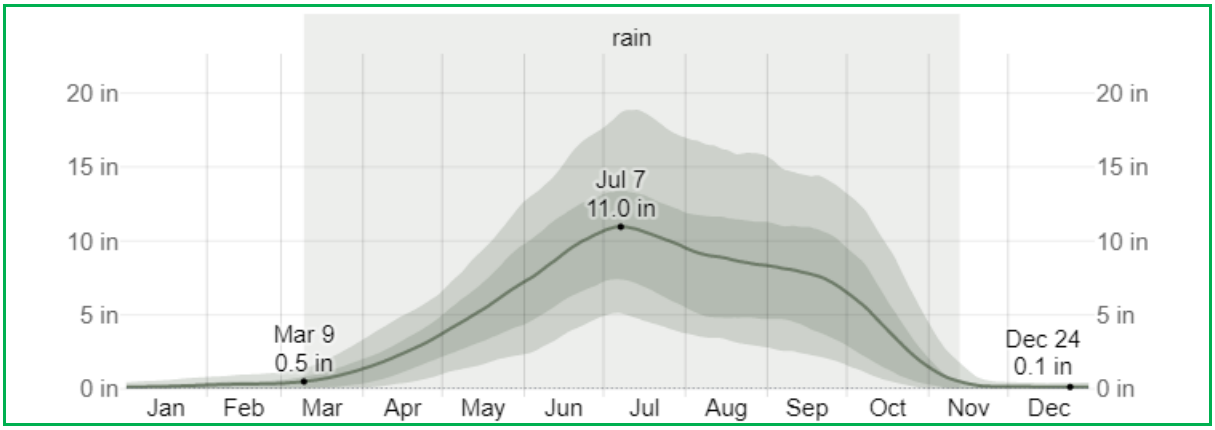


Figure 4.10 Monthly average rainfall of Rangpur region
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average snowfall. Monthly rainfall in Rangpur was 190mm in 2019 and 240mm in 2020 as per statistical year book 2021

4.7.1.3 Humidity of Rangpur Region

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. Rangpur experiences extreme seasonal variation in the perceived humidity.

The muggier period of the year lasts for 7.0 months, from April 13 to November 14, during which time the comfort level is muggy, oppressive, or miserable at least 25% of the time. The month with the fewest muggy days in Rangpur is February, with 0.0 days that are muggy or worse. The percentage of time spent at various humidity comfort levels, categorized by dew point.

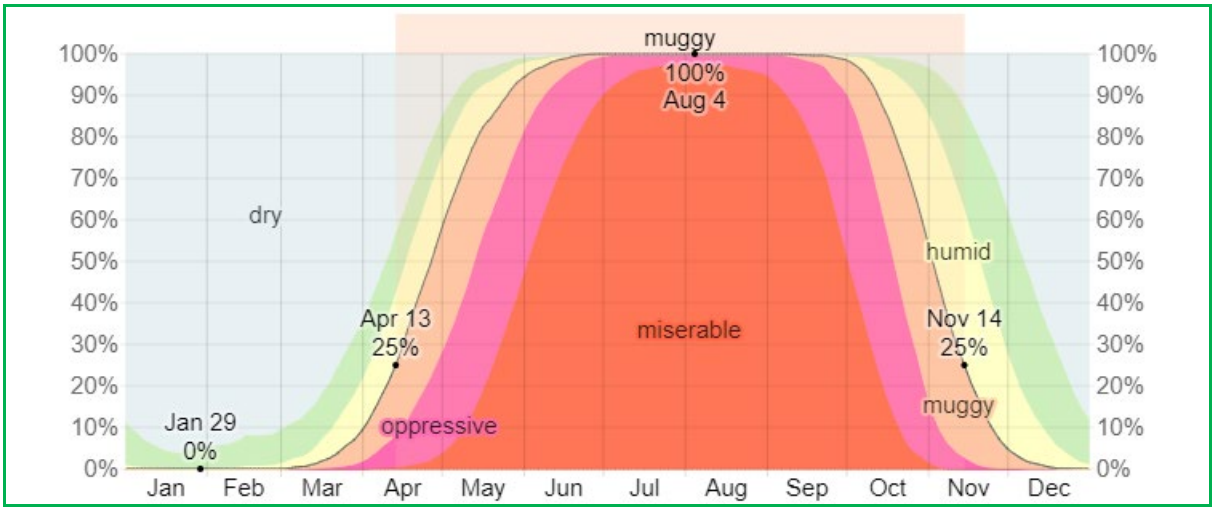


Figure 4.11 Monthly average humidity comfort levels in Rangpur region
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

4.7.1.4 Wind Flow of Rangpur Region

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local

topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

a) Average Wind Speed in Rangpur

The average hourly wind speed in Rangpur experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 6.0 months, from March 4 to September 4, with average wind speeds of more than 6.1 miles per hour. The windiest month of the year in Rangpur is June, with an average hourly wind speed of 12.55km per hour. The calmer time of year lasts for 6.0 months, from September 4 to March 4. The calmest month of the year in Rangpur is December, with an average hourly wind speed of 6.92km per hour. The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands.

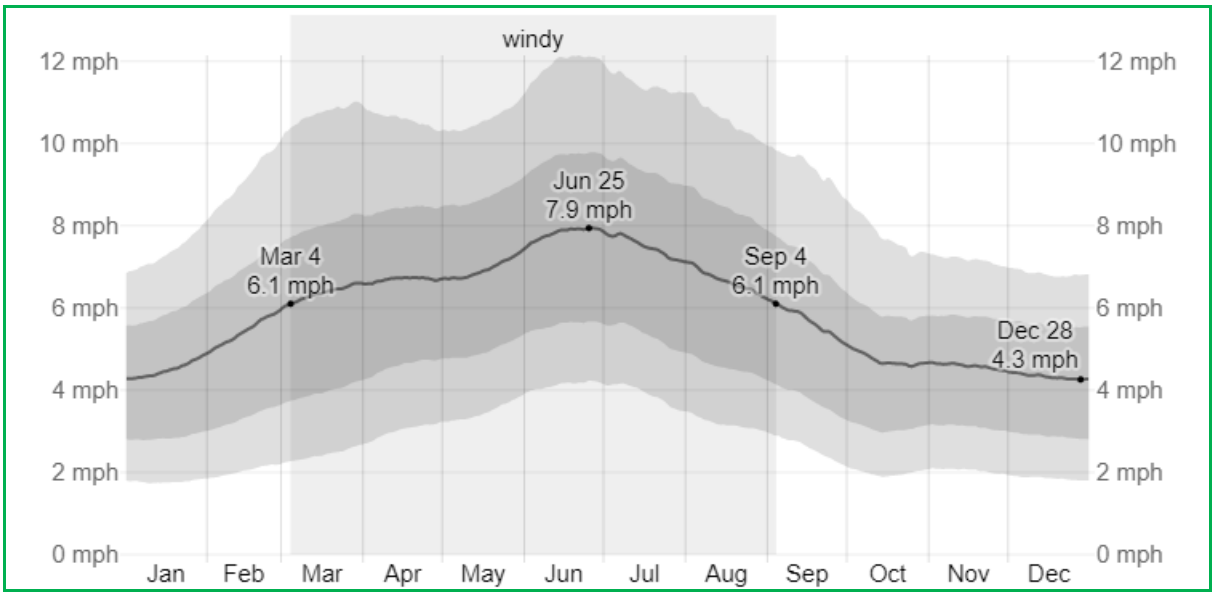


Figure 4.12 Average wind speed in Rangpur
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

b) Wind Direction in Rangpur

The predominant average hourly wind direction in Rangpur varies throughout the year.
The wind is most often from the west for 2.5 months, from January 20 to April 6, with a peak percentage of 52% on March 2. The wind is most often from the east for 4.1 weeks, from April 6 to May 5 and for 4.0 months, from September 21 to January 20, with a peak percentage of 42% on May 3. The wind is most often from the south for 4.5 months, from May 5 to September 21, with a peak percentage of 62% on June 15. The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.0 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).

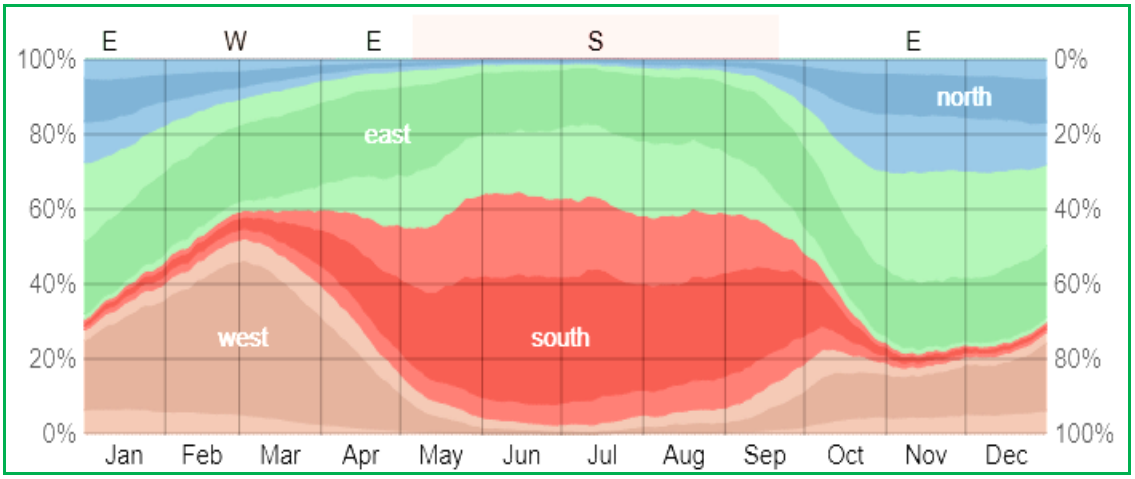


Figure 4.13 Monthly wind direction in Rangpur
Source: https://weatherspark.com/y/111709/Average-Weather-in-Rangpur-Bangladesh-Year-Round

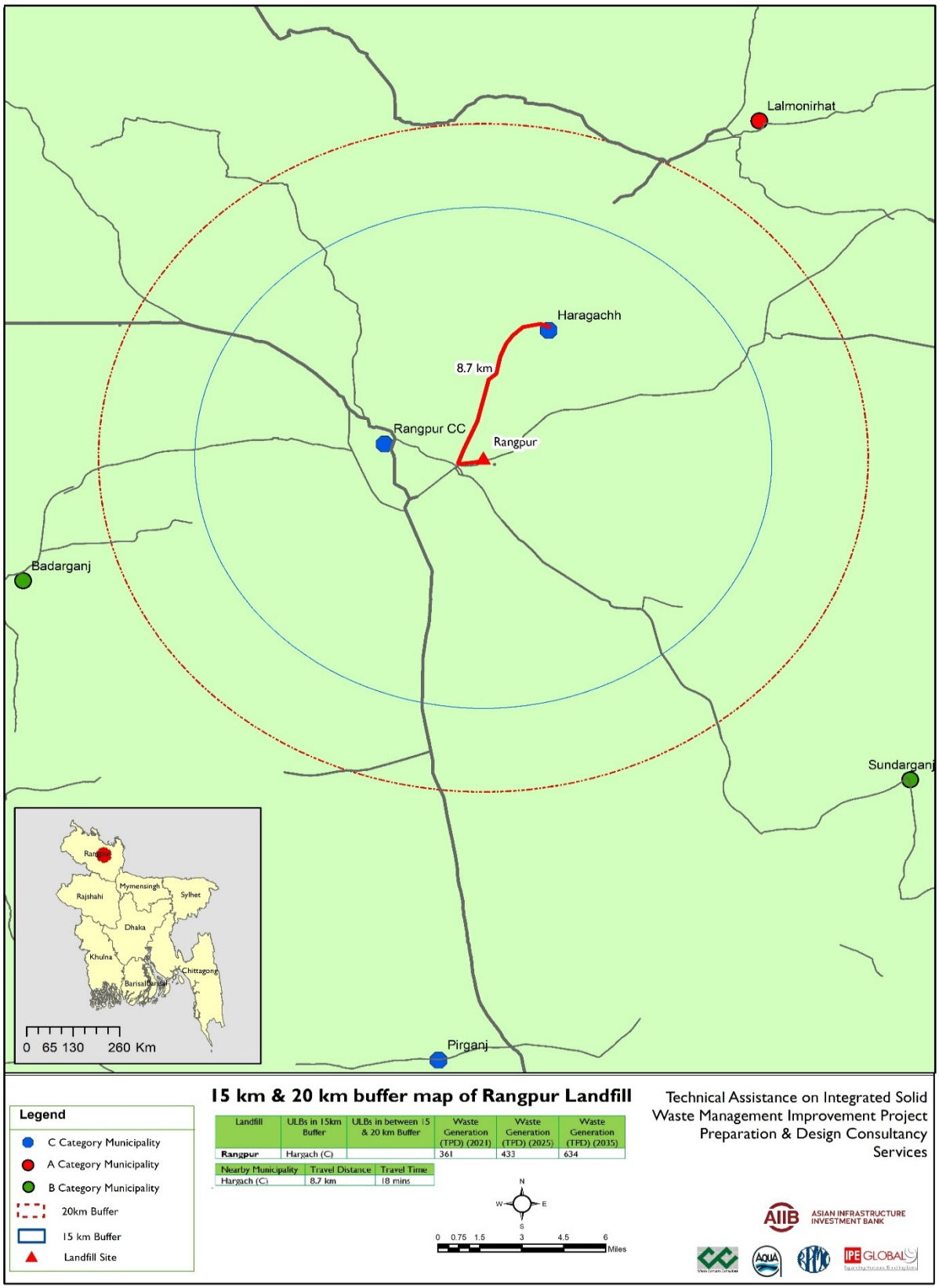


Figure 4.14 Map of 15 Km & 29 Km buffer area in RpCC landfill site

4.8 Biological Environment of Rangpur City Corporation Area

4.8.1 Habitats

Habitat refers to the place or the location where an organism (or a biological population) lives, resides or exists. The term *habitat* came from the Latin *"habitātus",* meaning "having been inhabited"

In ecology, a habitat is where a species of organism lives or thrives. It is the natural environment of that species. It is where it will derive its food, shelter, and mate for reproduction. It is where the species will attempt to be as adaptive as possible. Habitats may be an open geographical area or a specific site (e.g., a rotten log, a hollow tree, or inside a tree bark). They may be terrestrial or aquatic. Examples of terrestrial habitats are forest, grassland, steppe, and desert. Aquatic habitats include freshwater, aquatic water, and brackish water. Geographically, habitats may be classified into the following types: polar, temperate, subtropical, or tropical.

The aquatic systems include the coastline of the Bay of Bengal, the Ganges River and their tributaries, other freshwater rivers, Khals, wetlands (*beel*), oxbow lakes (*baor*), ponds, borrow-pits along roads and railways, and lakes.

4.8.2 Aquatic Life

Aquatic life includes aquatic plants (flora) and aquatic animals (fauna). Dhol Kolmi, Kolmi, water hyacinth, Halencha etc., as plant and snail, fishes, bull frog, tortoise, water birds among animal species are found common in aquatic habitat. Major fishes in the open water of the subproject area are carps (Rui, Catla, Mrigal, Ghania, Kalbasu, Kalia), cat fish (Tengra, Boal, Pangas, Aor, Bacha) and snake head (Shol, Gazar, Taki). Most fishes breed in the monsoon period.

4.8.3 Terrestrial Habitats

Bangladesh was once rich in wildlife species and is an important transition zone between Indo-China, the Himalayas and the rest of the Indian subcontinent. The tropical moist forests were botanically amongst the richest in the Indian subcontinent, and they also supported the greatest diversity of mammals and a high diversity of birds. In recent times, although the endemism is low and the species richness is relatively large for the small area of Bangladesh, the population size of most of the species has declined drastically. Eighteen species of wildlife are now extinct from Bangladesh. Among them are several internationally threatened species such as the three species of Asian rhinoceros, and also the Banteng, nilgai, swamp deer, pink headed duck, Bengal florican and mugger crocodile. The project area has a wide variety of biodiversity, in which the biota encountered during ecological survey is compared with the whole country data. It was observed that 380 vertebrates (approximately one quarter of the Bangladesh species) are found in the subproject area and that the survival status of 53 of them, based on the IUCN Red Lists, is in a critical stage. The role of the area for migrating birds (winter visitors) is demonstrated by the observation of 24 species.

The subproject area vegetation can be broadly classified into upland, grassland, and aquatic. The composition of vegetation and distribution of species on the land and in the water has created diverse terrestrial and aquatic ecosystems.

4.8.4 Flora and Fauna in the subproject area

There had been extensive field survey during the study to assess and also quantify to certain extent flora and fauna richness. These concentrated among others, on the wild life (amphibians, reptiles, birds and mammals), separately on fishes and also a floral species (Grass, shrubs, and timber/fuel wood trees and fruit trees). Findings of the survey have been presented in **table 4.3-table 4.8,** respectively.

Table 4.3 Amphibian faunal species in the Rangpur study area

Sl. No.	Bangla Name	English Name	Scientific Name
1	Kuno Bang	Common Toad	*Bufo melanostictus*
2	Sona Bang	Bull Frog	*Rana tigrina*
3	Bang	Skipper Frog	*Rana cyanophyctis*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Table 4.4 Reptilian faunal species in the Rangpur study area

Sl. No.	Bangla Name	English Name	Scientific Name
1	Matia Shap	Water snake	*Enhydris enhydris*
2	Painnya Shap/Huriya	Smooth Water Snake	*Enhudris entydris*
3	Ghorial	Ghorial	*Gavialis gangeticus*
4	Tokkhok	Gecko	*Gecko gecko*
5	Goda Tik Tiki	House Lizard	*Hemidactylus*
6	Kochchhop	Tortoise	*Kachuga tecta*
7	Kasim	Flap – shell turtle	*Lissemys punctata*
8	Gokhra sap	Cobra	*Naja*
9	Daras sap	Rat snake	*Ptyas mucosus*
10	Atail Kacho	Blind snake	*Typlina porrectus*
11	Kalo gui	Monitor lizard	*Varanus bengalensis*
12	Dora sap	Water snake	*Xenochrophis piscator*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Table 4.5 Aves faunal species in the Rangpur study area

Sl. No.	Bangla Name	English Name	Scientific Name
1	Jhuti salik	Jungle myna	*Acridotheres fuscus*
2	Bhat salik	Common myna	*Acridotheres tristis*
3	Machranga	Common Kingfisher	*Alcedo atthis*
4	Kani bok	Pond heron	*Ardeola grayii*
5	Nol bok	Grey heron	*Ardea cinerea*
6	Pecha	Spotted owlet	*Athena brama*
7	Boro bok	Great egret	*Bubulcus ibis*
8	Doyal	Magpie robin	*Copsychus saularis*
9	Dar kak	Jungle crow	*Corvus macrorynchos*
10	Pati kak	House crow	*Corvus splendens*
11	Bali hans	Lesser whistling teal	*Dendrocygna javanica*
12	Finga	Black drongo	*Dicrurus macrocercus*
13	Kadtheibra	Wood pecker	*Dinopium javanese*
14	Boro Kak	Great Egret	*Egretta albe*
15	Choto Bak	Small Egret	*Egretta gazetta*

Sl. No.	Bangla Name	English Name	Scientific Name
16	Sada cheel	Black – wing kite	*Elanus cacruleus*
17	Kokil	Koel	*Eudynamys scolopacca*
18	Baz	Kestrel	*Falco tinnunculus*
19	Dahuk	Water hen	*Gallicrex cinerea*
20	Shonkho cheel	Brahminy kite	*Haliaster indus*
21	Ababil	Common swallow	*Hirundo rustica*
22	Lal bok	Cinnamon bittern	*Ixobrychus cinnanmeocus*
23	Suichora	Common Bee eater	*Merops leschenaulti*
24	Bhuban cheel	Black kite	*Milvus migrans*
25	Nishi bok	Night heron	*Nyucticorax nycticorax*
26	Tuntuni	Tailor bird	*Orthotomus sutorius*
27	Choroi	House sparrow	*Passer domesticus*
28	Pancowri	Little cormorant	*Phalacrocorax carto*
29	Teya	Perakeet	*Psittacula krameri*
30	Bulbul	Red-vented bulbul	*Pycnonotus jacosus*
31	Mala gugu	Ring dove	*Streptopila decaocto*
32	Gu Salik	Pied myna	*Sturnus contra*
33	Chakha	Ruddy Shelduck	*Tadorna ferruginea*
34	Lokki Pecha	Bran owl	*Tyto alba*
35	Hot titi	Red-wattled lapwing	*Vanellus indicus*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Table 4.6 Mammalian faunal species in the Rangpur study area

SL. No.	Bangla Name	English Name	Scientific Name
1	Lal Indur	Bandicoot rat	*Bandicota bengalensis*
2	Kat Birali	Squirrel	*Callosciurus pygeugthrus*
3	Shial	Jackal	*Canis aurcus indicus*
4	Badur	Short nosed fruit Bat	*Cynopterus spinex*
5	Beji	Mongoose	*Herpestes edwardsi*
6	Udd	Otter	*Lutra lutra*
7	Idur	Field mouse	*Mus booduga*
8	Nengti Idur	House Mouse	*Mus musculus*
9	Sehsu	Gangetic dolphin	*Platanista gangetica*
10	Boro Badur	Giant Flying Fox	*Pteropus giganteus*
11	Chika	shrew	*Suncus murinus*
12	Bagdasha	Large civet	*Viverra zibela*
13	Khaksial	Fox	*Vulpes bengalensis*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Table 4.7 Fish faunal species in the Rangpur study area

Sl. No.	Bangla Name	English Name	Scientific Name
1	Mola	Indian Carplet	*Amblypharyngodon mola*
2	Koi	Climbing perch	*Anabas testudineus*
3	Catla	Major Carp	*Catla catla*
4	Bara/Nama chanda	Glass perch	*Chanda nama*
5	Choto chanda	Glass perch	*Chanda ranga*
6	Gazar	Mural snakehead	*Channa marulius*
7	Taki	Snakehead	*Channa punctatus*
8	Shol	Snakehead	*Channa striatus*
9	Mrigel	Major Carp	*Cirrhinus cirrhosus*
10	Tatkini	Minor carp	*Cirrhinus reba*
11	Magur	Catfish	*Clarias batrachus*
12	Khalisha	Goramy	*Colisa fasiatus*
13	Kachki	Ganga River Sprat	*Corica soborna*
14	Grass carp	Grass carp	*Ctenopharyngodon idellus*
15	Carpiu	Common carp	*Cyprinus carpio*
16	Bashpata	Sole	*Cynoglossys lingula*
17	Darkina	Esomus	*Esomus danricus*
18	Vacha	*Vacha*	*Eutropiichthys vacha*
19	Baila	Tank Goby	*Glossogobiu giuris*
20	Chapila	Herrings	*Gudusia chapra*
21	Loita	Bombyduck	*Harpodon nehereus*
22	Shingi	Stinging catfish	*Heteropneustes fossilis*
23	Silver carp	Silver carp	*Hypophthalmichthes molitrix*
24	Kalibous	Major carp	*Labeo calbasu*
25	Rui	Major Carp	*Labeo rohita*
26	Koral	Giant perch	*Lates calcarifer*
27	Gutum	Loach	*Lepidocephalus guntea*
28	Icha	Prawn	*Macrobrachium malcolmsoni*
29	Tara baim	Spiny eel	*Macrognathus aculeatus*
30	Baim	Zigzag Eel	*Mastacembelus armatus*
31	Gochi baim	Spiny eel	*Mastacembelus pancalus*
32	Ayre	Long whiskered Catfish	*Mistus aor*
33	Kuchia	Mud eel	*Monopterus cuchia*
34	Tengra	Days mystus	*Mystus vittatus*
35	Nona-tengra	Catfish	*Mystu gulio*
26	Guni/Ghuitta tengra	Catfish	*Mystus tengra*
37	Meni	Mud perch	*Nandus nandus*
38	Foli	Feather backs	*Natopterus notopterus*
39	Chitol	Feather backs	*Natopterus chitala*
40	Chela	Chela	*Onygaster phulo*
41	Kani pabda	Butter catfish	*Ompok bimaculatus*
42	Telapia	Tilapia	*Oreochromis niloticus*
43	Poa	Jew fish	*Pama pama*
44	Pangash	River catfish	*Pangasius pangasius*
45	Batasi	Indian Potasi	*Pscudeutropicus atberinoides*
46	Punti	Barb	*Puntius stigma*
47	Sar Puti	Barb	*Puntius sophore*
48	Shar punti	Silver barb	*Puntius sarana*

Sl. No.	Bangla Name	English Name	Scientific Name
49	Tit Punti	Barb	*Puntius ticto*
50	Thaipunti	Thaibarb	*Puntius gonionotus*
51	Rita	River catfish	*Rita rita*
52	Bata	Mullet	*Rhinomugil corsula*
53	Elisha	Hilsa shad	*Tenualosa ilisha*
54	Potka	Puffe fish	*Tetradon cutcutia*
55	Faisha	Anchony	*Thryssa mystex*
56	Boal	Giant Catfish	*Wallago attu*
57	Mola	Freshwater gars	*Xenentodon cancila*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Table 4.8 Floral species in the Rangpur study area

Sl. No.	Bangla Name	English Name	Type of plant	Scientific Name
1	Dheros	Lady's finger	Vegetable	*Abelmoschus esculentus*
2	Babla	Acacia	Timber, Fuel	*Acacia auriculiformis*
3	Akashmoni	*Akashmoni*	Timber, Fuel	*Acacia moniliformis*
4	Sobeda	*Sobeda*	Fruit	*Achras sapota*
5	Bel	Wood apple	Fruit, Timber	*Aegle marmelos*
6	Koroi	Koroi	Timber, Fuel	*Albizia procera*
7	Mankachu	Arum	Vegetable	*Alocasia indica*
8	Ata	Custard-apple	Fruit	*Anona squamosa*
9	Kadam	*Kadam*	Flower, timber	*Anthocephalus chinesis*
10	Supari	Betel Nut	Fruity, Timber	*Areca catechu*
11	Kanthal	Jack fruit	Fruit, Timber	*Artocarpus heterophyllus*
12	Kamranga	Star Fruit	Fruit	*Averrhoea carmobola*
13	Nim	Margosa	Timber, Fuel	*Azadirachta indica*
14	Puishak	*Puishak*	Vegetable	*Basella alba*
15	Chalkumra	Gourd	Vegetable	*Benincasa hispida*
16	Shimul	Silk-cotton tree	Cotton	*Bombax ceiba*
17	Tal	Palm tree	Fruit	*Borassus flabellifer*
18	Bet	Cane	Furniture	*Calamus viminalis*
19	Akanda	Sun-plant	Medicinal	*Calotropis gigantia*
20	Kachamarich	Green Paper	Vegetable	*Capsicum annum*
21	Pepe	Papaya	Fruit	*Carica papaya*
22	Kalkasunde	*Kalkasunde*	Medicinal	*Cassia sophera*
23	Jambura	*Jambura*	Fruit	*Citrus grandis*

Sl. No.	Bangla Name	English Name	Type of plant	Scientific Name
24	Telakochu	*Telakochu*	Medicinal	*Coccinea cordifolia*
25	Narikel, Dab	Coconut	Fruit, Oil	*Cocos nucifera*
26	Patabahar	Crotons	Decoration	*Codiacum variegatum*
27	Kachu	*Kachu*	Vegetable	*Colocasia esculenta*
28	Kumra	Pumpkin	Vegetable	*Cucurbita maxima*
29	Durba, Durbaghas	Grass	Soil binder	*Cynodon dactylon*
30	Shishu	*Shishu*	Timber	*Dalbergia sisso*
31	Krishnachura	*Krishnachura*	Flower, Timber	*Delonix regia*
32	Chalta	*Chalta*	Fruit	*Dillenia indica*
33	Gab	Mangoes teen	Fruit, Timber	*Diospyros peregrina*
34	Halencha	*Halencha*	Vegetable	*Enhydro fluctuans*
35	Ghaspata	*Ghaspata*	Fuel	*Euphorbia hirta*
36	Kodbel	Elephant apple	Fruit	*Feroria elephantum*
37	Bot	Banyan tree	Fuel, Timber	*Ficus religiosa*
38	Kalmi	*Kalmi*	Vegetable, Fuel	*Ipomoea aquatica*
39	Dhol kalmi	*Dholkalmi*	Fuel	*Ipomoea fistulosa*
40	Lichu	Litchi	Fruit	*Lichi chinensis*
41	Aam	Mango tree	Fruit, Timber	*Mangifera indica*
42	Sajna	Drumstick	Vegetable	*Moringa oleifera*
43	Shapla	Water Lily	National Flower	*Nymphaea nouchali*
44	Tulshi	Holy basil	Medicinal	*Ocimumsanctum*
45	Dhan	Paddy	Crop	*Oryza sativa*
46	Khajur	Date tree	Fruit, Timber	*Phoenix sylvestris*
47	Debdaru, Saralgoch	Kind of pine	Fuel, Timber	*Polyalthia longifolia*
48	Peyara	Guava	Fruit	*Psidium guajava*
49	Veranda	Castor-oil plant	Oil	*Ricinus communis*
50	Mandar	Coral tree	Coral fruit, Fuel	*Rrythrina variegata*
51	Nalkhagra	Reed	Fuel	*Saccaharum spontaneum*
52	Raintree	Rain Tree	Timber	*Samanea saman*
53	Mehogini	Mahogany	Timber	*Swietenia mahagoni*
54	Jam	Black Berry	Timber	*Syjygium grandis*
55	Tetul	Tamarind-tree	Timber, Fuel	*Tamarindus indicus*
56	Shal	*Shal*	Timber	*Tectona grandis*
57	Arjun	*Arjun*	Medicinal	*Terminalia arjuna*
58	Hogla	*Hogla*	Fuel	*Typha angustata*
59	Hoglapata	*Hogla*	Fuel	*Typha elephantina*
60	Barbati	Bean	Vegetable	*Vigna chinensis*
61	Nishinda	*Nishinda*	Medicinal	*Vitex negundo*

Sl. No.	Bangla Name	English Name	Type of plant	Scientific Name
62	Khudipana	Duck weed	Fish Feed	*Wolffia arrhiza*
63	Mainakata	*Mainakata*	Medicinal	*Xeromphis spinosa*
64	Baroi	Berry	Fruit	*Zizyphus jujuba*
65	Kul	Jujube	Fruit, timber	*Zizyphus mauritiana*

Source: Field Survey by ESIA Team of ISWMIP, 2022

Activities are not being located in the nearby area of Rangpur City Corporation. There are no protected areas in or around sub-project sites, and no known areas of ecological interest. Detail design shows there are no trees at the sites that need to be removed.

- No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist.
- All efforts shall be made to preserve trees by evaluation of minor design adjustments/ alternatives (as applicable) to save trees.
- Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation.
- Prevent workers or any other person from removing and damaging any flora (plant/ vegetation) and fauna (animal) including fishing in any water body in the sub-project vicinity.
- Prohibit employees from poaching wildlife and cutting of trees for firewood.
- Plantation of trees at the surrounding landfill and approach road embankment and maintain the saplings for the duration of contract.

4.9 Ambient Air Quality of RpCC Landfill Area

The atmospheric air is basically polluted with hazardous substances emitted in the environment by the oil and gas production, oil extraction, oil and chemistry, energy, machine building and other industrial enterprises and vehicles.

The highest concentration of contaminating substances in the atmospheric air is observed during the unfavorable meteorological condition period (June–September). At this time, inversion and windless weather processes are repeated often in the above ground atmospheric layers and this has a direct impact on the collection of chemical compounds in the above ground air masses. Mainly natural (climate, relief, temperature, etc.) and anthropogenic factors have a direct impact on the formation of the background chemical composition of atmospheric precipitation.

Annually tones of solid substances, sulfur dioxide, carbon dioxide, of nitrogen oxide and carbon hydrogen are emitted in atmosphere by the industrial enterprises located in city area. Besides, tones of different hydrochloric compounds enter the atmosphere during the evaporation processes taking place in the river. The impact of these wastes on the chemical composition of precipitation on the city area is of local scale, but their background chemical composition is mainly formed in the area of the country.

As the evaporation processes have a miserable impact on other chemical substances including nitrates, ammonium, phosphates and magnesium concentrations their indicators usually do not change during the year. Ambient air quality measurement location is shown in the Figure 4.15.

	
Beside Rangpur City Corporation Landfill Site	Inside Rangpur City Corporation Landfill Site

Figure 4.15 Ambient air quality measurement pictures and locations

The baseline survey program related to the atmospheric air quality include the following:

PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3 and Methane

PM_{10} (Particulate Matter 10)

Particulate Matter are inhalable pollutant particles with a diameter less than 10 micrometers. Particles that are larger than 2.5 micrometers can be deposited in airways, resulting in health issues. Exposure can result in eye and throat irritation, coughing or difficulty breathing, and aggravated asthma. More frequent and excessive exposure can result in more serious health effects.

$PM_{2.5}$ (Particulate Matter 2.5)

Fine Particulate Matter are inhalable pollutant particles with a diameter less than 2.5 micrometers that can enter the lungs and bloodstream, resulting in serious health issues. The most severe impacts are on the lungs and heart. Exposure can result in coughing or difficulty breathing, aggravated asthma, and the development of chronic respiratory disease.

NO_2 (Nitrogen Dioxide)

Breathing in high levels of Nitrogen Dioxide increases the risk of respiratory problems. Coughing and difficulty breathing are common and more serious health issues such as respiratory infections can occur with longer exposure.

SO_2 (Sulfur Dioxide)

Exposure to Sulfur Dioxide can lead to throat and eye irritation and aggravate asthma as well as chronic bronchitis.

CO (Carbon Monoxide)

Carbon Monoxide is a colorless and odorless gas and when inhaled at high levels can cause headache, nausea, dizziness, and vomiting. Repeated long-term exposure can lead to heart disease

O_3 (Ozone)

Ground-level Ozone can aggravate existing respiratory diseases and also lead to throat irritation, headaches, and chest pain.

CH_4 (Methane)

Methane (CH_4) is a hydrocarbon that is a primary component of natural gas. Methane is also a greenhouse gas (GHG), so its presence in the atmosphere affects the earth's temperature and climate system. Methane is emitted from a variety of anthropogenic (human-influenced) and natural sources.

In city corporation area the combustion of fuels in motor vehicles produces mainly carbon dioxide and nitrogen. Some fuel remains unburnt or partially burnt. This results in the additional presence in exhaust emissions of hydrocarbons and other organic compounds, together with carbon monoxide and carbon soot. At the high temperatures and pressure some nitrogen is oxidized to form various oxides of nitrogen. Carbon monoxide and NO_x have implications for health and plant life is regarded as pollution. Since the landfill site is located in urban areas, hence pollution level is distributed over vast urban area and the concentration would be a minimum. The air quality data is presented in Table 4.9 & Table 4.10.

Table 4.9 Ambient air quality sampling locations at Rangpur City Corporation

Sl. No.	Sampling Code	Sampling Location	Geographic Coordinates	
			Latitude (N)	Longitude (E)
1	AAQ1	Beside Rangpur City Corporation Landfill Site	25.738792 N	89.300348 E
2	AAQ2	Inside Rangpur City Corporation Landfill Site	25.738913 N	89.301045 E

Table 4.10 Air quality test results of Rangpur City Corporation subproject

Parameter	Unit	Method	AAQ1	AAQ2	DOE Air Quality Standard*
Carbon Monoxide (CO)	ppm	Jacob and Hochheiser	0	15.99	20 (1hr) 5 (8hr)
Particulate Matter (PM_{10})	$\mu g/m^3$	Gravimetric	174.70 (8hr)	257.24 (8hr)	150 (24hr) 50 (Annual)
Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	Gravimetric	152.18 (8hr)	209.41 (8hr)	65 (24hr) 35 (Annual)
Sulfur Dioxide (SO_2)	$\mu g/m^3$	West-Geake	0	126.44	250 (1hr) 80 (24hr)
Ammonia (NH_3)	$\mu g/m^3$	Ammonia meter	0	0.178	400 (24hr) 100 (Annual)
Methane (CH_4)	%	IR methodology	0	0.28	N/A

*Landfill and surrounding area Air Quality Standard as per Gazette of Ministry of Environment, Forest and Climate Change (MEFCC) published on 23 December 2021.

Carbon Monoxide

Eight (8) hourly CO concentrations were reportedly low (15.99 ppm) at the monitoring location AAQ2 while comparing with the Bangladesh Standards of 8 hourly bases (9ppm). The carbon monoxide in the atmosphere comes from human activities including motor traffic, other combustion of fossil fuels, and burn waste. The variation of CO value in the sampling locations are very minimum. Sampling location AAQ1(value found 0ppm) and AAQ2 (value found 15.99 ppm). However, the CO concentration has been found below the national standard level for all the sampling location.

Particulate Matter 10 (PM_{10})

PM_{10} had been measured and the data was represented for the 8 hours' period. From the testing data, it was observed that in all the two points, PM_{10} value was higher than the national standard level of

Bangladesh. The lowest concentration (174.70µg/m³) was found in AAQ1. Highest concentration (257.24µg/m³) was found in AAQ2. As a result, concentration of particulate matters is normally higher in this point (AAQ2) than the other point (AAQ1) though all the values are higher than the standard (150 µg/m³) level.

Particulate Matter 2.5 ($PM_{2.5}$)

The 8 hourly $PM_{2.5}$ concentrations in ambient air quality in the sampling area was recorded from the range of 152.18– 209.41µg/m3. The maximum $PM_{2.5}$ concentration was reported at (AAQ2) was 209.41µg/m³. The minimum $PM_{2.5}$ concentration was reported at (AAQ1) was 152.41µg/m³. All the monitoring locations' results were higher than the 24-hourly National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ in Bangladesh. The high concentration of $PM_{2.5}$ especially due to the anthropogenic activity and windblown dust. However, from the overall observation from the data analysis, $PM_{2.5}$ is found to be at bad condition during the dry period with comparison with the Bangladeshi standard.

Sulphur-Dioxide (SO_2)

The SO_2 concentration was recorded 126.44µg/m³ in AAQ2 location. Concentration of SO_2 is reported nil at AAQ1. The highest value of SO_2 was found in AAQ2 and lowest value was recoded in AAQ1. SO_2 concentrations for all locations were reported well below 250µg/m³, which is National Ambient Air Quality Standard (NAAQS) for SO_2 in Bangladesh.

Ammonia (NH_3)

The NH_3 concentration was recorded 0.178µg/m³ in AAQ2 location. Concentration of SO_2 is reported nil at AAQ1. The highest value of SO_2 was found in AAQ2 and lowest value was recoded 0µg/m³ in AAQ1. SO_2 concentrations for all locations were reported well below 250µg/m³, which is National Ambient Air Quality Standard (NAAQS) for SO_2 in Bangladesh.

Methane (CH_4)

The CH_4 concentration was recorded 0.28% in AAQ2 location. Concentration of CH_4 is reported nil at AAQ1. The highest value of CH_4 was found in AAQ2 and lowest value was recoded 0% in AAQ1. No national standard of CH_4 concentration for air was found.

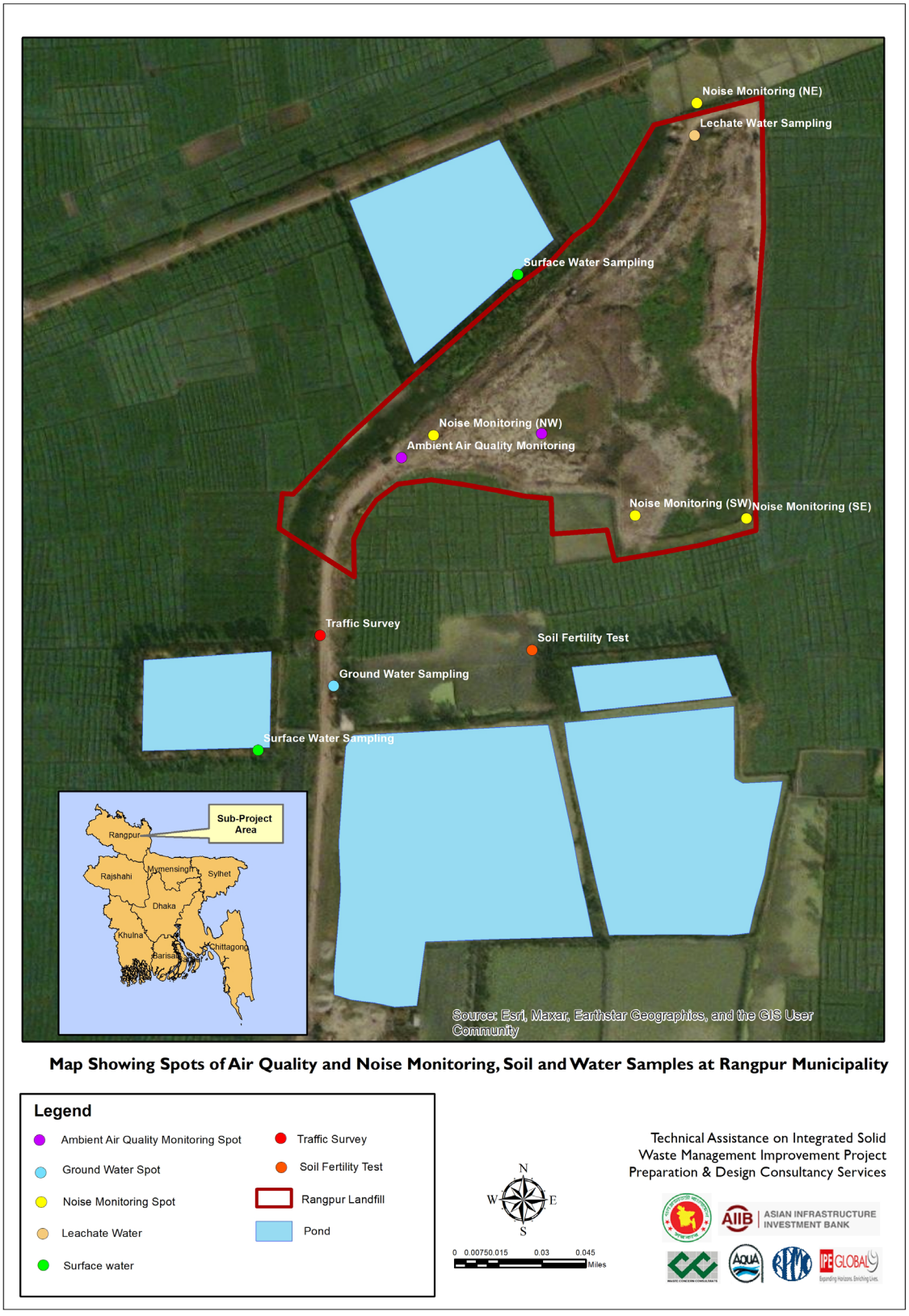


Figure 4.16 Map showing environmental quality parameters sampling spots

4.10 Surface and Ground Water Quality of the Subproject Area

Trenching and excavation, run-off from stockpiled materials, and contamination from fuels and lubricants may result to silt-laden runoff during rainfall that may cause siltation and reduction in the quality of adjacent bodies of water. However, the site is located in the middle of agricultural land and there are no water bodies along the approach road ROW. The nearest water body from the SLF site is the local Khal which is connected with Ichhamati river Therefore, the expected impacts are moderate negative but short term, site-specific within a relatively small area and reversible by mitigation measures.

- Prepare and implement a spoils management plan.
- Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with city corporation local authority on designated disposal areas.
- All earthworks must to be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff.
- Location for stockyards for construction materials shall be identified at least 300m away from watercourses.
- Place storage areas for fuels and lubricants away from any drainage leading to water bodies.
- Take all precautions to minimize the wastage of water in the construction activities.
- Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system.
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies.
- Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low-lying areas.
- While working across or close to any water body, the flow of water must not be obstructed.
- Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross drainage channels.
- Monitor water quality according to the environmental management plan.

4.10.1 Surface Water Quality of the Subproject Area

Water grab samples are "single point in time" measurements. They only relate to the sampling point (water column) at the instant the sample is taken. Water samples have the shortest temporal (time) and spatial (area/location) coverage of all measurements taken by the consultant team.

Table 4.11 Surface water sampling locations and GPS coordinates at Rangpur CC

Sl. No.	Sampling Code	Name of Sampling Point	Geographic Coordinates	
01.	SWQ1	Pond, Rangpur Landfill area	25.737337 N	89.299634 E
02.	SWQ2	Pond, Dolphin Hatchery near Rangpur Landfill site	25.739703 N,	89.300927 E

Table 4.12 Surface water quality parameters analysis data of Rangpur CC

Parameter	Unit	SWQ1 Results	SWQ2 Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Faecal coliforms	CFU/100ml	130	4600	-	-	Membrane Filtration
pH	-	6.50	6.92	6.5-8.5	6.5-8.5	Electronic (pH Meter)

Parameter	Unit	SWQ1 Results	SWQ2 Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Total dissolved solids (TDS)	mg/L	196.2	76.5	1000	<1000	Electrical Conductivity
Total Alkalinity as $CaCO_3$	mg/L	50.0	65.0	-	-	Titrimetric
Biochemical Oxygen Demand (BOD_5, 20^0C)	mg/L	38.0	12.0	0.2	-	5-Day BOD Test
Nitrate (NO_3)	mg/L	1.96	2.60	10	<45	Ion Chromatography
Iron	mg/L	2.36	0.69	0.3-1.0	<0.3	FAAS
Sulphate	mg/l	39.17	13.49	400	<400	Ion Chromatography
Total Suspended Solids (TSS)	mg/L	192.0	250.0	10	-	Gravimetric
Arsenic	mg/l	0.00113	0.00167	0.05	0.01	HGAAS

Reference of Standard: Ministry of Environment, Forest and Climate Change notification related to Environment Conservation Rules, 1997. Schedule10 (Inland Surface Water). No preservative was used but ice box was used at sampling time because sample drop at laboratory within 24 hours from water sampling.

Faecal coliforms (FC)

The acceptable range of Faecal coliform set by the DoE is 0. The Faecal coliform value was found 130 CFU/100ml in SWQ1 and that of SQW2 was found 4600 CFU/100ml. The Faecal coliform value found very higher in respect of DOE standard which is 0/100ml.

pH

The acceptable range of pH set by the DoE is between 6.5 and 8.5. This is the range, which indicates adequate protection to the life of freshwater fish and bottom dwelling invertebrates. The pH value was found 6.50, 6.92 in SWQ1 and SWQ2 respectively. The pH value followed both Bangladesh standards (ECR, 1997) and WHO guideline.

Total Dissolved Solids (TDS)

The concentration of Total Dissolved Solid (TDS) of surface water was found 196.2mg/l & 76.5mg/l in SWQ1 and SWQ2 respectively. The highest concentration had been found at SWQ1 and lowest concentration was found in SWQ2. Both the values found within Bangladesh and WHO standard. There is stipulated standard of surface water in Bangladesh and that is 1000mg/l as per guideline of DOE for TDS.

Total Alkalinity as $CaCO_3$

The standard for surface water for Total Alkalinity as $CaCO_3$ is not available. The concentration of total alkalinity as $CaCO_3$ of sampled surface water SWQ1 was found 50.0 mg/l. The total alkalinity value of SWQ2 was found 65.0mg/l. The test result showed that the Total Alkalinity value of Rangpur landfill site was found within the limit though the standard value is unknown.

Biochemical Oxygen Demand (BOD_5)

BOD_5 in sample SWQ1 was found 38.0mg/l which is very higher than standard level as per ECR'97. This value of sample SWQ2 was also found higher (12.0mg/l. The stipulated standard for BOD_5 in Bangladesh is 0.2mg/L. Higher BOD_5 indicates more oxygen was required, which is less for oxygen-demanding species to feed on and signifies lower water quality. Inversely, low BOD_5 means less oxygen is being removed from water. Runoff carrying wastes from streets and sidewalks; nutrients from fertilizers; leaves, grass, and paper from residential areas, are all contributors to increase oxygen demand.

Nitrate (NO_3)

Nitrate value in sample SWQ1 had been found 1.96mg/l and that of SWQ2 was found 2.60mg/l. Both the values were found within the Bangladesh standard value and WHO standard value. The stipulated standard value for nitrate in Bangladesh is 10 mg/l and that of WHO is <45mg/l for surface water.

Iron (Fe)

The iron concentration in the sampling point SWQ1 was found 2.36mg/l and in SWQ2 it was found 0.96mg/l. Both the values were more than the standard level (0.3-1.0mg/l) as per ECR'97 and the WHO standards (<0.3mg/l). The abundance of major irons largely depends upon the nature of rocks, climatic conditions, and mobility. The infinite complex surface and subsurface physicochemical environments also influence the ion distribution.

Sulphate (SO_4)

Sulphate, normally found in air, water and soil, is one of the oxides of Sulphur in the presence of oxygen. Due to its higher solubility in water, sulphate is found at very high concentration in many groundwater and surface water system. This process often occurs when sulfide minerals are mined.

Sulphate value in sample SWQ1 had been found 39.17mg/l and that of SWQ2 was found 13.49mg/l. Both the values were found within the Bangladesh standard value and WHO standard value. The stipulated standard value for Sulphate in Bangladesh is 400 mg/l and that of WHO is <400mg/l for surface water.

Total Suspended Solids (TSS)

The concentration of total suspended solid (TSS) of surface water SWQ1 was found 192.0mg/l and that of SWQ2 was found 250.0 mg/l respectively. The highest concentration had been found at SWQ3 and lowest concentration was found in SWQ2. There is stipulated standard in Bangladesh for surface water and that is 150mg/l as per guideline of DOE for TSS.

Arsenic (As)

Arsenic concentration of all the two surface water samples SWQ1 & SWQ2 were found 0.00113mg/l & 0.00167mg/l respectively and are within the national and WHO standards. The standard value of Arsenic is 0.05mg/l as per ECR'97 and that of WHO standard is 0.01mg/l. Abundance of iron and manganese minerals triggers higher concentration of Arsenic. Arsenic concentration in surface water can be attributed to the presence of calcareous and calc-silicate rocks. Sulfide minerals like arsenopyrite and pyrites, which gives higher levels of Arsenic contamination in the surface water. Arsenic also can be released into surface water because of human activities, such as various uses in industry, in animal feed, and as a pesticide. Arsenic rich water occurs mainly in the shallow water would curtail the arsenic levels to some extent. In surface water supplies, arsenic poses a problem because it is toxic at low levels and is a known carcinogen.

SWQ1

SWQ2

Figure 4.17 Surface water sampling pictures at RpCC landfill site

4.10.2 Ground Water Quality

Two representative samples of groundwater points at Rangpur CC landfill area were collected on 18.**01.2023** to analyze Faecal coliforms, pH, Total Dissolved Solids (TDS), Total Alkalinity as $CaCO_3$, Biochemical Oxygen Demand (BOD_5), Nitrate (NO_3), Iron (Fe), Sulphate (SO_4), Total suspended Solids (TSS) and Arsenic (As). The analyses of the parameters have been done in Laboratory of Environmental Health, ICDDRB, Mohakhali, Dhaka, and the result dated 06.02.2023 has been placed in the report. One ground water sample (GWQ) was collected from the Rangpur City Corporation landfill site. For the ground water quality monitoring, surrounding area of the ROW had been taken into consideration. Sampling location of the ground water is given in Table 4.13 and Figure 4.19**.** Water sample was collected as grab water sample in a standard sampling bottle and 500 ml sterilized clean PET bottle for complete physicochemical and bacteriological tests respectively. The sample was tested and analyzed as per different standard procedure/methods in the Laboratory of Environmental Health, ICDDR, B, Dhaka. The methodology for the ground water testing and tested results is given in the Table 4.14.

Table 4.13 Ground water sampling location and GPS coordinates at Rangpur CC

Sl. No.	Sampling Code	Name of the Point	Geographic Coordinate	
			Latitude (N)	Longitude €
01.	GWQ	Rangpur CC Landfill site tube-well	25.737657 N	89.300010 E

Table 4.14 Ground water quality parameters analysis data of Rangpur CC

Parameter	Unit	GWQ Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Faecal coliforms	CFU/100ml	0	0	0	Membrane Filtration
pH	-	6.60	6.5-8.5	6.5-8.5	Electronic (pH Meter)
Total dissolved solids (TDS)	mg/l	75.9	1000	<1000	Electrical Conductivity
Total Alkalinity as $CaCO_3$	mg/l	75.0	-	-	Titrimetric
Biochemical Oxygen Demand (BOD_5, 20^0C	mg/l	<2.0	0.2	-	5-Day BOD Test
Nitrate (NO_3)	mg/l	3.26	10	<45	Ion Chromatography
Iron	mg/l	<0.1	0.3-1.0	<0.3	FAAS

Parameter	Unit	GWQ Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Sulphate	mg/l	2.28	400	<400	Ion Chromatography
Total Suspended Solids (TSS)	mg/l	<10.0	150	-	Gravimetric
Arsenic	mg/l	0.00428	0.05	0.01	HGAAS

Reference of Standard: Ministry of Environment and Forest, Notification related to Environment Conservation Rules, 1997. Schedule 3.

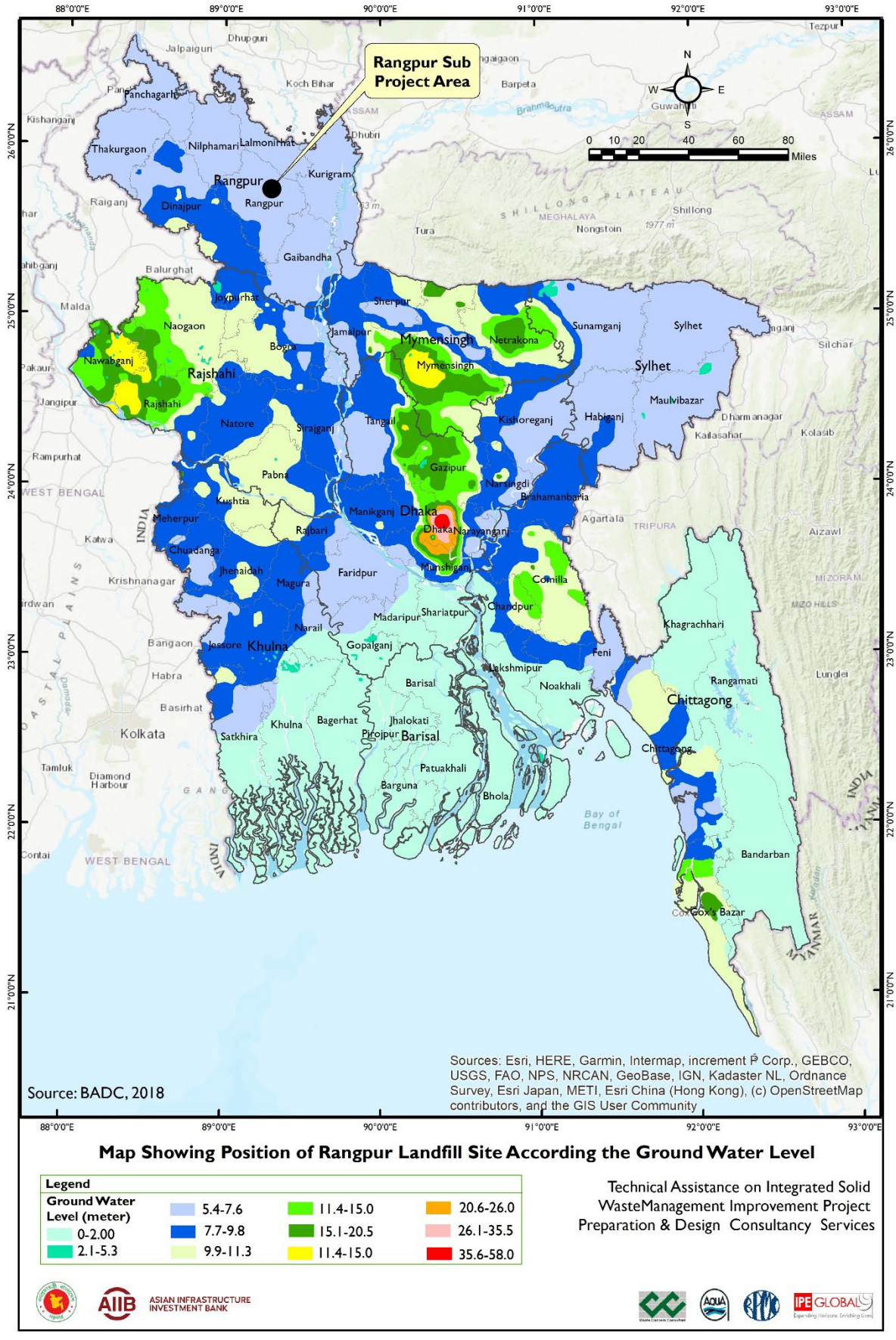


Figure 4.18 Map showing the Rangpur landfill site ground water level

	
Sample Collection Step-1	Sample Collection Step-2

Figure 4.19 Ground water sampling pictures of RpCC landfill site tube well

Faecal Coliforms (FC)

The acceptable range of Faecal coliform set by the DoE is 0/100ml. No Faecal coliforms was found in the sampled ground water (Tube well water) of Rangpur City Corporation landfill area. The Faecal coliform value complied with the DOE standard.

pH

The acceptable range of pH set by the DoE is between 6.5 and 8.5. This is the range, which indicates adequate protection to the life of human being. The pH value was found 6.60. The pH value follows both Bangladesh standards (ECR, 1997) and WHO guideline.

Total Dissolved Solid (TDS)

The standard for ground water for Total Dissolved Solids is 1000mg/L. The concentration of Total Dissolved Solid (TDS) of sampled ground water (GWQ) was found 75.9 mg/l. Test result showed that the TDS value of Rangpur landfill site was found within the national standard.

Total Alkalinity as $CaCO_3$

The standard for ground water for Total Alkalinity as $CaCO_3$ is not available. The concentration of Total Alkalinity as $CaCO_3$ of sampled ground water (GWQ) was found 75.0 mg/l. Test result showed that the Total Alkalinity value of Rangpur landfill site was found within the national standard though standard value is not available.

Biochemical Oxygen Demand (BOD_5)

BOD_5 value in the sample was found <2.0 which is within the standard level as per ECR'97. The stipulated standard for BOD_5 in Bangladesh is 0.2mg/l. Higher BOD_5 indicates more oxygen was required, which is less for oxygen-demanding species to feed on and signifies lower water quality. Inversely, low BOD means less oxygen is being removed from water. Runoff carrying wastes from streets and sidewalks; nutrients from fertilizers; leaves, grass, and paper from residential areas, are all contributors to increase oxygen demand.

Nitrate (NO_3)

Nitrate value in the sample (GWQ) had been found 3.26mg/l. The stipulated standard for Nitrate in Bangladesh is 10 mg/l and as per WHO guideline is <45mg/l.

Iron (Fe)

The iron concentration in the sampled ground water was found <0.1mg/l. The iron concentration in the sampling point was less than the standard level (0.3-1.0mg/l) as per ECR'97 and the WHO standards (<0.3mg/l). The abundance of major irons largely depends upon the nature of rocks, climatic

conditions, and mobility. The infinite complex surface and subsurface physicochemical environments also influence the ion distribution.

Sulphate (SO_4)

Sulphate, normally found in air, water and soil, is one of the oxides of Sulphur in the presence of oxygen. Due to its higher solubility in water, sulphate is found at very high concentration in many groundwater and surface water system. This process often occurs when sulfide minerals are mined. Sulphate value in sample GWQ was found 2.28mg/l. The value was found within the Bangladesh standard value and WHO standard value. The stipulated standard value for Sulphate in Bangladesh is 400 mg/l and that of WHO is <400mg/l for surface water.

Total Suspended Solids (TSS)

The concentration of Total Suspended Solid (TSS) of sampled ground water (GWQ) was found <10.0mg/l. There is stipulated standard in Bangladesh and that is 10mg/l as per guideline of DOE for ground water TSS.

Arsenic (As)

Arsenic concentration of drinking water sample was found within the national standard and WHO standard. The value of Arsenic of the sampled water (GWQ) was found 0.00428mg/l which is within the national and WHO standards. The standard value of Arsenic is 0.05mg/l as per ECR'97 and that of WHO standard is 0.01mg/l. Abundance of iron and manganese minerals triggers higher concentration of Arsenic. Arsenic concentration in ground water can be attributed to the presence of calcareous and calc-silicate rocks. Sulfide minerals like arsenopyrite and pyrites, which gives higher levels of Arsenic contamination in the ground water. Arsenic also can be released into groundwater because of human activities, such as various uses in industry, in animal feed, and as a pesticide. Arsenic rich water occurs mainly in the shallow ground water, deep tube wells more than 150 meters deep would curtail the arsenic levels to some extent. In drinking-water supplies, arsenic poses a problem because it is toxic at low levels and is a known carcinogen.

4.11 Leachate Water Quality of Rangpur City Corporation Landfill

Table 4.15 Leachate water sampling locations with coordinates at Rangpur CC

Sl. No.	Sampling Code	Name of the Point	Geographic Coordinates	
			Latitude (N)	Longitude (E)
01.	LWQ1	Inside Landfill	25.740396 N	89.301805 E

Table 4.16 Leachate water quality parameters analysis data of Rangpur CC

Parameter	Unit	LWQ Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Faecal coliforms	CFU/100ml	2300	-	-	Membrane Filtration
pH	-	8.25	6-9	-	Electronic (pH Meter)
Total dissolved solids (TDS)	mg/L	9150.0	2100	-	Electrical Conductivity
Biochemical Oxygen Demand ($BOD_{5,}$ 20^0C)	mg/L	1635.0	50	-	5-Day BOD Test

Parameter	Unit	LWQ Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
Nitrate (NO_3)	mg/L	150.16	10	-	Ion Chromatography
Total Alkalinity as $CaCO_3$	mg/l	5800.0	-	-	Titrimetric
Total Suspended Solids (TSS)	mg/l	174.0	150	-	Gravimetric
Iron (Fe)	mg/l	3.35	2	-	FAAS
Arsenic (As)	mg/l	0.0037	0.2	-	HGAAS
Sulphate (SO_4)	mg/l	105.68	-	-	Ion Chromatography

Reference of Standard: Ministry of Environment, Forest and Climate Change notification related to Environment Conservation Rules, 1997. Schedule10 (Inland Surface Water). No preservative was used but ice box was used at sampling time because sample drop at laboratory within 24 hours from water sampling.

Faecal Coliforms (FC)

The acceptable range of Faecal coliform set by the DoE is 0/100ml. Faecal coliforms found in the sampled leachate water (Landfill) of Rangpur City Corporation landfill area was 2300/100ml. The Faecal coliform value is very high and does not comply with the DOE standard.

pH

The acceptable range of pH set by the DoE is between 6-9. This is the range, which indicates adequate protection to the life of freshwater fish and bottom dwelling invertebrates. The pH value was found 8.25. The pH value follows Bangladesh standards (ECR, 1997).

Total Dissolved Solids (TDS)

The standard for leachate water for Total Dissolved Solids is 2100mg/l. The concentration of Total Dissolved Solid (TDS) of sampled leachate water Quality (LWQ) was found 9150mg/l. Test result showed that the TDS value of Rangpur landfill site was found very higher than the national standard.

Biochemical Oxygen Demand (BOD_5)

The standard value of BOD_5 as per ECR'97 is 50mg/l. BOD_5 value in sampled leachate water was found very higher than the standard level as per ECR'97. The stipulated standard of BOD_5 for leachate WATER in Bangladesh is 1635mg/L. Higher BOD_5 indicates more oxygen was required, which is less for oxygen-demanding species to feed on and signifies lower water quality. Inversely, low BOD_5 means less oxygen is being removed from water. Runoff carrying wastes from streets and sidewalks; nutrients from fertilizers; leaves, grass, and paper from residential areas, are all contributors to increase oxygen demand.

Nitrate (NO_3)

Nitrate value in sample had been found 150.16mg/l. The stipulated standard for nitrate in Bangladesh is 10 mg/l.

Total Alkalinity as $CaCO_3$

The standard for leachate water for Total Alkalinity as $CaCO_3$ is not available. The concentration of Total Alkalinity as $CaCO_3$ of sampled leachate water (LWQ) was found 5800mg/l. Test result showed that the Total Alkalinity value of Rangpur landfill site was found may be higher than the national standard value though national standard value is not available.

Total Suspended Solids (TSS)

The concentration of Total Suspended Solid (TSS) of leachate water was found a74mg/l. The highest concentration had been found at SWQ3 and lowest concentration was found in SWQ2. The stipulated standard for TSS in leachate water in Bangladesh 150mg/l as per guideline of DOE.

Iron (Fe)

The iron concentration in the sampled leachate water was found 3.35mg/l. The iron concentration in the sampling point was more than the standard level (2mg/l) as per ECR'97. The abundance of major irons largely depends upon the nature of rocks, climatic conditions, and mobility. The infinite complex surface and subsurface physicochemical environments also influence the ion distribution.

Arsenic (As)

Arsenic concentration of leachate water sample was found within the national standard. The value of Arsenic of the sampled water (LWQ) was found 0.0037mg/l which is within the national standards. The standard value of Arsenic is 0.2mg/l as per ECR'97 standard. Abundance of iron and manganese minerals triggers higher concentration of Arsenic. Arsenic concentration in ground water can be attributed to the presence of calcareous and calc-silicate rocks. Sulfide minerals like arsenopyrite and pyrites, which gives higher levels of Arsenic contamination in the ground water. Arsenic also can be released into groundwater because of human activities, such as various uses in industry, in animal feed, and as a pesticide. Arsenic rich water occurs mainly in the shallow ground water, deep tube wells more than 150 meters deep would curtail the arsenic levels to some extent. In drinking-water supplies, arsenic poses a problem because it is toxic at low levels and is a known carcinogen.

Sulphate (SO_4)

Sulphate, normally found in air, water and soil, is one of the oxides of Sulphur in the presence of oxygen. Due to its higher solubility in water, sulphate is found at very high concentration in many groundwater and surface water system. This process often occurs when sulfide minerals are mined. Sulphate value in sample leachate water (LWQ) was found 105.68mg/l. The value was found cannot be compared with the Bangladesh standard value and WHO standard value as such standards are not available. The stipulated standard value for Sulphate in Bangladesh is 400 mg/l and that of WHO is <400mg/l for surface water.

	
Leachate Water Sampling Photograph	Leachate Water Sampling Photograph

Figure 4.20 Leachate water sampling photograph of Rangpur Landfill Site

Figure 4.21 Groundwater (L), surface water (M 2 bottles) and leachate water (R)

4.12 Landfill Site Soil Quality

The use of soils around dumpsites in rural and urban areas in Bangladesh is common for food production especially vegetables. However, most people use such soils without knowledge of the risk of heavy metal uptake by plants. Therefore, the evaluation of heavy metal contamination is an important component of risk assessment at waste dumpsites. Hence, this study was conducted in Rangpur City Corporation to determine the risk of heavy metal pollution and physicochemical properties of soils at a waste dumpsite. Two (2) soil samples from Rangpur City Corporation landfill site were collected from a depth of 0–30 cm depth within the 2 demarcated zones of the dumpsite. Physicochemical properties and heavy metals (e.g., zinc) were analysed to determine their concentrations in the collected soil samples. From the result, significant differences in soil chemical properties were observed. The results revealed that the soil at the dumpsite is heavily contaminated as opposed to less than 0.55 mg kg^{-1} for the remaining heavy metals (Zn). However, heavy metals contamination at the various sampling locations of the dumpsite were within the permissible limits recommended by DOE/FAO/WHO. There is the need for regular monitoring and decontamination of the dumpsite before use for agricultural activities.

Soils sampled at the Rangpur City Corporation waste dumpsite was recorded variable nutritive contents. Analysis of soil physicochemical properties revealed that mean soil pH values recorded at the dumpsite ranged from 5.8, which is optimum for microbial activities and nutrient uptake. Higher recorded N, P, K, S, Zn, B were as a result of the disposal of household and agricultural wastes at the dumpsite. The high nutrient content at the dump-site location especially the organic carbon and exchangeable bases.

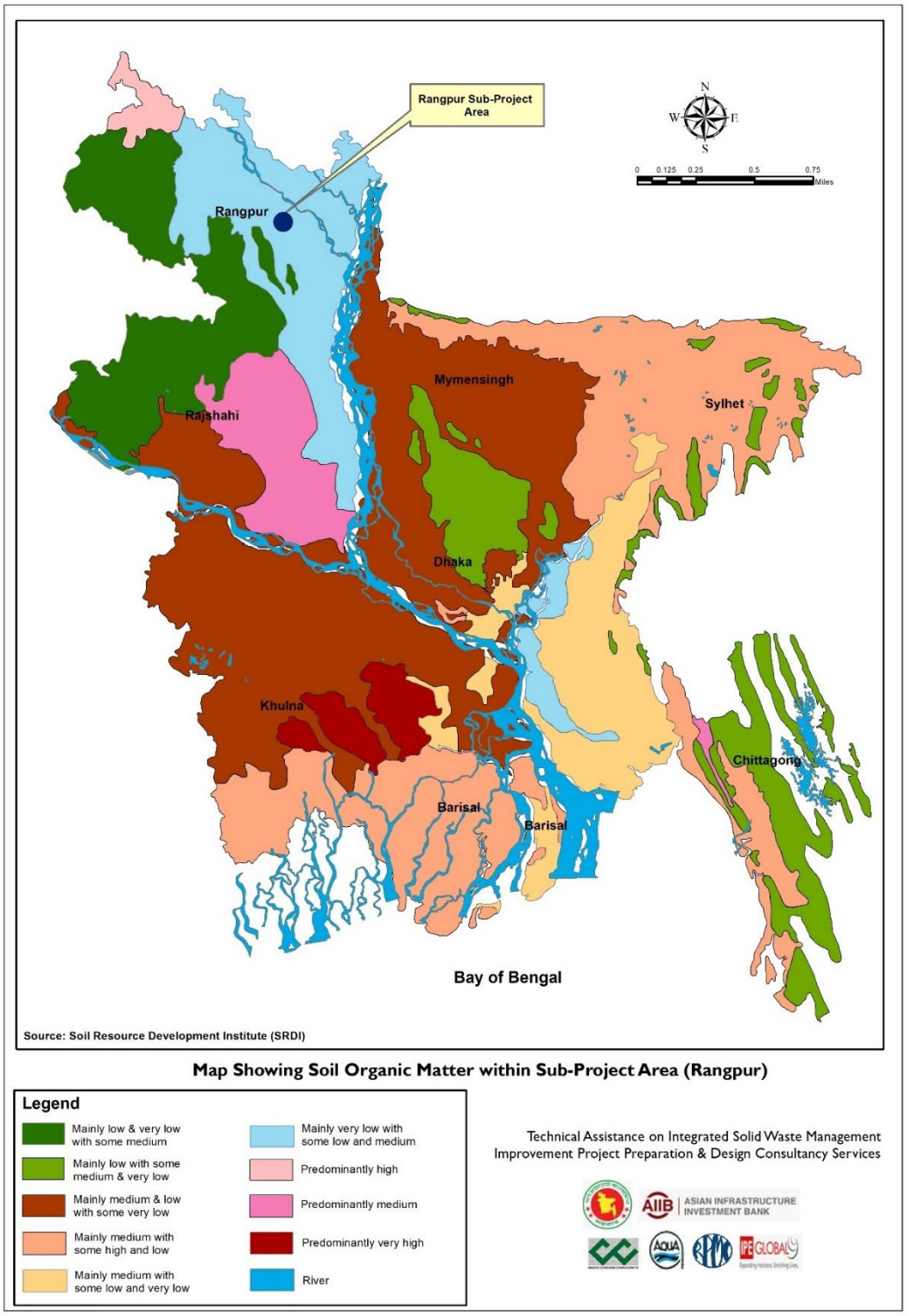


Figure 4.22 Map showing soil organic matter of Rangpur CC subproject area

significantly impacted on soil bulk density, porosity and nutrient availability at the dumpsite. Analysed soils at the dumpsite soils showed the presence of Total Nitrogen (N), Phosphate (P), Potassium (K), Sulfur (S), Zinc (Zn) and Boron (B). The dump-site location generally recorded the highest concentration of Sulfur (S). Besides, the soils at the dumpsite are heavily contaminated with Chromium as opposed to less than (<) 0.55 mg kg^{-1} for the remaining heavy metals (Pb, Ni, Cu and Zn). The high level of Ni content in the soil is attributed to the presence of metallic substances in the earth crust, as well as Ni bearing waste. Also, the heavy metals at all the sampling locations of the dumpsite were within the permissible limits of the DOE/ FAO/WHO. The geo-accumulation index of the down-site

and dump-site were moderately to strongly contaminated with metals of Pb, Cd, and Zn, except Ni which was moderately contaminated at such sites. The findings from this study suggests that the soils around the dumpsite are not suitable for agricultural activities due to leaching of heavy metal beyond 40m which may be picked up by food crops. However, these heavy metal contaminants were all below the permissible limits for agricultural soils. There is the need for regular monitoring and awareness creation by the DOE to ensure segregation of waste before dumping to reduce increased levels of the contaminants (heavy metals) at the dumpsite, which may pose serious health risks. Alternatively, remediation technologies (e.g., phytoremediation) could be introduced at the site to help decontaminate the dumpsite, especially Ni).

Table 4.17 Soil quality sampling locations at Rangpur CC

Sl. No.	Sampling Code	Name of the Point	Geographic Coordinate	
			Latitude (N)	Longitude (E)
01.	SQ1	Outside Landfill site	25.737836^0 N	89.300996^0 E

Table 4.18 Soil quality parameters analysis data of RpCC landfill site

Parameter	Unit	SQ1 Results	Government Specification (Maximum Allowable Limit)	Method	Remarks
pH	-	5.8	NA	1:2.5 Glass Electrode Method	
Moisture	%	30.12	NA	Gravimetric Method	
Organic Matter	%	2.62	NA	Wet Oxidation Method	
Total N	%	0.11	NA	Kjeldahl Method	
Phosphorus(P)	mg/kg soil	7.54	NA	Olsen Method and Bray & Kurtz Method	
Potassium (K)	meq/100g soil	0.22	NA	NH_4OAc Extraction Method	
Sulfur (S)	mg/kg soil	26.36	NA	Calcium Dihydrogen Phosphate Extraction Method	
Boron (B)	mg/kg soil	0.28	NA	Calcium Chloride Extraction Method	
Copper (Cu)	mg/kg soil	5.13	NA	DPTA Extraction Method	
Nickel (Ni)	mg/kg soil	25.40	NA	Nitric Acid Digestion Method	
Cadmium (Cd)	mg/kg soil	0.00	NA	Nitric Acid Digestion Method	
Lead (Pb)	mg/kg soil	4.09	NA	Nitric Acid Digestion Method	
Chromium (Cr)	mg/kg soil	22.51	NA	Nitric Acid Digestion Method	
Zinc (Zn)	mg/kg soil	0.62	NA	DPTA Extraction Method	

Reference of Standard: Ministry of Environment, Forest and Climate Change notification related to Environment Conservation Rules, 1997. Schedule10 (Inland Surface Water). No preservative was used but ice box was used at sampling time because sample drop at laboratory within 24 hours from water sampling.

	
Sample collection step-1	Sample collection step-2

Figure 4.23 Soil sample collection photographs of Rangpur landfill site

pH

pH decides the amount of hydrogen present in the soil sample and ranges from 0-14. Low pH indicates sour of soil. High pH is salty soil. The pH of collected soil sample was 5.8. The soil pH should be within the limits of 6-8.5. Leachate is acidic in nature and will reduce the pH of soil. Therefore, soil pH less than 8.5 are suitable for solid waste. The acceptable range of surface water pH set by the DoE is between 6.5 and 8.5.

Moisture Content (MC)

During the operation of a landfill, significant quantities of moisture may infiltrate the facility, with the infiltration volume dependent upon both soil cover design and operational practices. A simulation model can be developed to represent the construction of a landfill and the associated moisture control options. Cell building pattern is shown to be operational variable that potentially have a significant impact upon moisture content buildup within a landfill facility. Generally, soil moisture will range from 10% to 45%, but can be higher during and after watering. When the initial moisture content of waste is greater than 50%, the squeezed leachate becomes the primary source of total leachate generation rate. Rangpur City Corporation landfill area shows 30.12% moisture content. The collected soil sample shows moisture content is within the limit.

Organic Matter (OM)

Organic matter of the soil includes animal and plant waste with rate of decomposition. Its limitation is less than 0.5 %. Rangpur City Corporation landfill area shows higher organic matter (2.62%) in the soil and microbial activity is also less due to less water holding capacity so that soil is unsuitable for crop production and suitable for solid waste disposal.

Total Nitrogen (Total N)

Nitrogen is one of the macro nutrients of the soil. The available nitrogen is dependent on varying degree of soil microbial decomposition. It is found 0.11%. The limitation of N is 110-220kg/ac. The N content of soil sample is below the limitation is due to less N fixation in the soil and less microbial decomposition taken in soil. So that all collected soil sample are not suitable for crop production and suitable for solid waste dumping.

Phosphorus (P)

Phosphorus acts as co-limiting factor of eco-system productivity. It is limited to less than 9 kg/ha. Rangpur City Corporation landfill area shows 7.54mg/kg soil of P present in the soil is favorable for crop grow and suitable for solid waste dumping, because excess phosphorous will runoff, interflow and cause ground water and surface water pollution.

Potassium (K)

Potassium is the main source of nutrients to plant growth. This is from runoff of agricultural field. The potassium is found 0.22meq/100g soil. The limitation of K is less than 120kg/ha. Soil has less K not supply nutrient to grow plant and the water holding capacity of the soil become less. Leaching of leachate is less and less cause of ground water contamination.

Sulphur (S)

It is a macronutrient and—like nitrogen, phosphorus, potassium, calcium, and magnesium—must be available in relatively large amounts for good crop growth. Sulphur (S) found in RpCC is 26.36mg/kg soil. Total sulfur concentrations in plants normally vary from 0.1 to 0.3% but under some conditions may range from a low of 0.05% to a high of 0.9% (Blanchar, 1986).

Boron (B)

Boron (B) was found 0.28 mg /kg soil of a day. It is therefore unlikely that the boron found in the contaminated soil would pose a health risk if ingested. Problems with boron toxicity can occur when crops sensitive to boron toxicity are planted with boron fertilizers present or sprayed with liquids containing boron.

Copper (Cu)

Copper (Cu) was found 5.13mg /kg soil of a day. It is therefore unlikely that the boron found in the contaminated soil would pose a health risk if ingested. Total Cu in soils commonly ranges between 1 to 40 mg/kg soil, but the Cu concentration dissolved in the soil solution is much lower. The availability of Cu in soils for plant uptake is affected by the following characteristics: Organic matter. Copper is more tightly bound to organic matter than any other micronutrient.

Nickel (Ni)

Nickel in Soils and Plants brings together discussions on Ni as a trace element and as a micronutrient essential for plant growth and its role in plant physiology. It analyzes the biogeochemistry of Ni at the soil plant interface. Nickel (Ni) was found 25.40mg /kg soil of a day. It is therefore unlikely that the boron found in the contaminated soil would pose a health risk if ingested.

Cadmium (Cd)

Cadmium (Cd) was found 0.00mg /kg soil. It is deposited onto the earth below by rain or falling out of the air. Once on the ground, cadmium moves easily through soil layers and is taken up into the food chain by uptake by plants such as leafy vegetables, root crops, cereals and grains (ATSDR 1999).

Lead (Pb)

Lead naturally occurs in soil at low levels. Lead (Pb) was found 4.09 mg/kg soil. An acceptable level of 600 mg/kg soil of lead in soil suggested as a "safe" level would contribute no more than 5 micrograms/dl to total blood lead of children under 12 years of age.

Chromium (Cr)

Chromium levels in soil vary according to area and the degree of contamination from anthropogenic chromium sources. Test on soil has shown chromium concentration 22.51 mg/kg soil.

Zinc (Zn)

Concentration of Zinc (Zn) found is 0.62mg/kg soil. Concentrations of zinc can be high in soils from contaminated sites, such as waste dumps. Concentrations above 150 mg Zn/kg corresponded to severe stunting, whiles concentrations as high as 900 mg Zn/kg were measured in severely affected plants. In soil, a DTPA-extractable Zn concentration above 10 mg/kg is considered potentially harmful in acid soils.

Ideally, sites should be located in silt and clay soils that restrict leachate and gas movement. A landfill constructed over a permeable formation such as gravel, sand or fractured bedrock can pose a significant threat to groundwater quality.

4.13 Acoustic Environment in Rangpur City Corporation

Sub-project components are in the middle of agricultural land and located far away from the city corporation core area. The nearest village is located approximately 500 m far from the proposed location. Additionally, the location is also 500m away from the RHD road. So, the noise level at the sub-project site is very minimum. Further, the volume of traffic that passes through these sections is not significant and traffic jams are not frequent. However vehicular movement can be considered as major cause of noise pollution.

The baseline noise level will be measured by the sub-project contractors prior to commencement of work. The results will be provided in the Quarterly Environmental Monitoring Report and all other measurements during implementation will be reported as part of ESMP implementation.

4.13.1 Existing Traffic Noise of Rangpur City Corporation

The sources of noise from a traffic stream can be separated into two components. The first is generated by the engine, exhaust system and transmission, and is the dominant noise source when traffic is not freely flowing, particularly from heavy vehicles which contribute most low frequency noise. Noise levels will vary primarily according to engine speed rather than vehicle speed. The second noise source component is generated from the interaction of tires, with the road surface and is the dominant noise source under free flow noise conditions at moderate to high road speeds and contributes a significant proportion of high frequency noise. Noise levels will vary depending on vehicle speed, the road surface and whether the surface is wet or dry.

The noise from a stream of traffic at a reception point at any one instant is an aggregation of noise from each of many vehicles at various distances. Among factors which influence a basic traffic noise level are traffic flow, speed and composition, road gradient and road surface characteristics. The noise level at a particular reception point will also be affected by other factors among which are distance from the noise source, the nature of the intervening ground surface and the present of obstructions.

Under the Rangpur City Corporation subproject, the construction activities will be far from settlements, sensitive receptors and areas from small-scale businesses. Temporary increase in noise level and vibrations may be caused by excavation equipment and the transportation of equipment, materials, and people. However, the proposed sub-project situated out of core area and impact is short-term, site-specific and within a relatively small area. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.

- Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times.
- Plan activities in consultation with local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.
- Use of high noise generating equipment shall be stopped during night time.
- Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions and ensure that these are maintained to manufacturers' specifications at all times.
- All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required).
- Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10m or more from the vehicle/s.
- If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection.

- Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.

4.13.2 Noise Level Measurement at Rangpur City Landfill site

To get up to date noise quality data near the proposed landfill sites, the noise level was measured. Noise measurement location and co-ordinates are given in Table 4.23 and Result of the monitoring of the noise level data presented in Table 4.24.

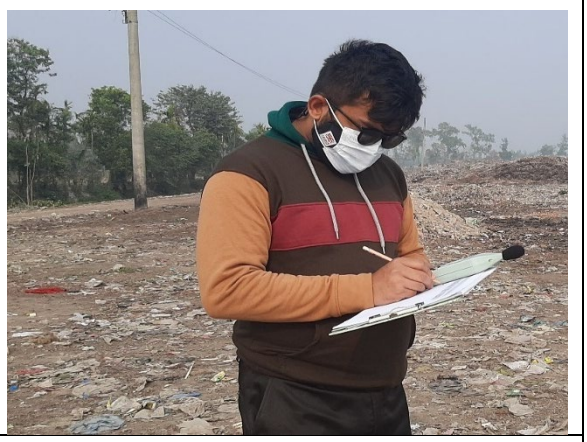
A total of 4 (four) Ambient Noise level (NL) measuring locations had been selected for the monitoring to understand the condition of the noise level at Rangpur CC. These locations had been considered based on the potential sources of the construction activities and the nearest receptors.

Noise level measurement data were collected during both day and night-time. The sound level meter was mounted on a tripod at 1.5m above ground level and at least 3.5m away from any sound-reflecting surfaces. The measurements were made using a noise data logger. The SLM (Sound Level Meter) was calibrated before the noise monitoring survey. The sound level had recorded in the form of A-weighted equivalent continuous sound pressure level (Leq) values with the use of A-weighting filters in the noise measuring instrument. Noise level measurement data had been collected 8 hours in the day time with 2-minute interval and 4 hours at Night time with a 2-minute interval. Then noise level data were analyzed to Leq (day) and Leq (night). Noise level measurement location of Rangpur city corporation landfill site is shown in the Figure 4.25.

ANL1 at the approach road towards landfill site

ANL2 southside landfill area

ANL3 on the service road of landfill



ANL4 beginning of the landfill area

Figure 4.24 Noise level measurement photographs of Rangpur CC landfill site

The Ambient Noise standards in Bangladesh as per the Department of Environment suggest standards for different categories of areas (Table 4.19)

Table 4.19 Standard for ambient noise level

Sl. No.	Category of areas	Standards determined at dBA unit	
		Day	Night
1	Silent zone	50	40
2	Residential area	55	45
3	Mixed area	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Reference of Standard: Ministry of Environment and Forest, Notification related to Environment Conservation Rules, 1997, Schedule 4 and subsequent amendments in 2006.

According to the area, the most part would fall under the 'Residential area' category.

- Notes:

a. The time from 6 a.m. to 9 p.m. counted as daytime.

b. The time from 9 p.m. to 6 a.m. counted as nighttime

The sampling points are listed in the Table 4.20 below.

Table 4.20 Ambient noise level measurement locations at Rangpur CC

Sl. No.	Sampling Code	Name of the Point	Geographic Coordinates	
			Latitude (N)	Longitude (E)
01.	ANL1	Rangpur City Corporation Landfill Site	25.738904 N	89.300507 E
02.	ANL2	Rangpur City Corporation Landfill Site	25.740556 N	89.301816 E
03	ANL3	Rangpur City Corporation Landfill Site	25.7384676 N	89.3020205 E
04	ANL4	Rangpur City Corporation Landfill Site	25.738505 N	89.301510 E

Table 4.21 Ambient noise level analysis data of Rangpur City Corporation

Site Location ID	Site Condition	Day Time (LAeq) dBA.	Nighttime (LAeq) dBA.	DOE Standard
ANL1	Preconstruction Stage	62.30	57.80	At residential area ❖ Day time 55 dBA ❖ Night time 45 dBA
ANL2	Preconstruction Stage	69.0	57.25	
ANL3	Preconstruction Stage	64.70	59.30	
ANL4	Preconstruction Stage	66.55	59.30	

4.13.2.1 Noise Data Interpretation

Noise level was measured in three different locations comprising of mixed areas according to Bangladesh standards. The average day and nighttime noise level found higher than the DOE standard level. This was because of heavy truck movement.

4.14 Agroecological Resources of Rangpur

Agroecological zone is a zone which has a unique combination of physiographic, soil, hydrological and agroclimatic characteristics. Thirty agroecological zones (AEZ), 88 sub-zones (sub-regions) and 535 agroecological units have been identified in Bangladesh on the basis of important differences in physiography, soil, hydrological and agroclimatic characteristics. Agroecological zoning helps classify regions where a particular crop may or may not be grown. Most of greater Rangpur fall under Teesta Meander Floodplain agroecological zone and partly under Active Teesta Floodplain agroecological zone. Agroecological Resources of Rangpur is shown in Figure 4.26.

Land use: The net cropped area of the Rangpur region is 696,420 ha. Crops occupying the particular land for round the year were considered under annual crops. The major annual crops reported in the region were pineapple, sugarcane, banana, papaya, betel leaf, ginger and turmeric. The annual crops area in different upazila ranged from 20 to 2,610 ha. The annual crops area accounted only 2% of the net cropped area (NCA) in the region. At a glance the region possesses about 6% single cropped area (SCA), 64% double cropped area (DCA), 27% triple cropped area (TCA). The quadruple cropped area (QCA) also exists as a very negligible portion (0.03%) and is limited in only two Upazila viz Gangachara and Rowmari. The SCA had the major share of NCA in Pirganj Upazilas of Rangpur district; Chilmari and Nagesawari of Kurigram district; Sundarganj, Fulchhari and Sadar Upazila of Gaibandha district followed by corresponding double cropped area (DCA). Pirgachha Upazila of Rangpur district, Palashbari of Gaibandha, Saidpur and Dimla of Nilphamari had no single cropped area at all. Most of the Upazila were dominated by DCA. The exceptions are Gangachara Upazila of Rangpur district where triple cropped area is the dominating one (Table 1). The area, which could not be defined under SCA, DCA (double cropped area), TCA (triple cropped area) or QCA (quadruple cropped area) was considered as other whose coverage is less than 1% of the NCA (net cropped area).

Cropping patterns of Rangpur: In total 134 cropping patterns were observed in Rangpur region of which five cropping patterns with exclusive rice crop covers over 58% of the NCA. There were 49 cropping patterns with exclusive non-rice crop covering over 6% of the NCA. Rest of the NCA i.e., about 36% area is covered by 80 rice - non-rice cropping patterns.

Rice and non-rice crops at a glance: Rice are the only crop round the year in five cropping patterns. It comprises 58.32% of the NCA (net cropped area) in the region. Among them single rice and double rice represent around 4.12% and 54.20% respectively. There is no triple rice area in Rangpur region. It reflects the unparallel dominance of rice in the cropping systems in Rangpur region. In case of individual pattern Boro−Fallow−T. Aman has the highest coverage (53.33%) and was recorded in all 35 Upazila. The second dominant pattern single Boro area occupied 4.07% of NCA which was reported in 28 Upazila. Single T. Aman covered 0.05% area with its existence in Rangpur Sadar Upazila only.

In the current investigation, 49 cropping patterns were identified that was free from rice. Aggregate of the 49 patterns have had 6.41% of NCA. In critical comparison is clear that exclusive rice area is about nine folds of exclusive non-rice area. In Rangpur region crop diversity is much wider than that of other regions like Sylhet and Chittagong where exclusive rice area covers 37 folds and 23-fold, respectively, of exclusive non-rice area. Appropriate cropping patterns may facilitate maximum possible land utilization as well as efficient use of other scarce resources in a sustainable manner. Diversified cropping pattern may be an option for the farmers as a cropping strategy against risks (Mandal and Bezbaruah, 2013). Typology of different cropping systems is the base for the managers of these systems to intensify production.

Major crops are vegetable, maize, groundnut, chili, jute, tobacco, wheat, onion, potato, millet (Cheena), sweet potato, lentil, garlic, blackgram, sesame, ginger/turmeric, and other patterns.

Non-rice cereal crops: Thirty-five cropping patterns holding different non-rice cereal crops viz maize, wheat, millets (Cheena and Kaon) which in-together covered 15.82% of NCA. Among them two cropping patterns viz Maize−Fallow−T. Aman and Wheat−Jute−T. Aman jointly occupied 8.65% of NCA. Maize is covering the largest area whereas millet is cultivated in the smallest area. After Maize, wheat is widely cultivated cereal crops under diversified cropping systems in Rangpur region. There were 21 patterns based on maize, which all-together covers 81,130 ha of land (11.65% of NCA) in the region. Wheat was leading 11 cropping patterns with an area coverage of 26,925 ha (3.87% of NCA). In Bangladesh there is a vast market of wheat for human consumption and maize seeds for feed industries. Local production of wheat and maize is extremely insignificant to meet up the demand. The situation is increasing our dependency on import causing a great pressure on foreign currency (BBS, 2014). Loam and sandy-loam soil of the comparative dry area is very suitable for maize cultivation. Wheat cultivation with its better yield in this region is specially favoured by long winter season that is normally unavailable in southern parts of the country. Light textured soil with low water holding capacity as well as less availability of irrigation water are driving forces that discourage the farmers for modern Boro cultivation. During the harvesting period of wheat, the crop is privileged by clear sun-shine and low humidity. All these are the factors for which this area is dominated by maize and wheat cropping systems (FAO, 1988).

Table 4.22 Cropping patterns with exclusive rice in Rangpur region, 2014-15

SL.	Cropping pattern	Area (ha)	% Of NCA	Frequency (no. of Upazila)
01	Boro−Fallow−T. Aman	371370	53.33	35
02	Boro−Fallow−Fallow	28320	4.07	28
03	Boro−Aus−T. Aman	5640	0.81	13
04	Fallow−Fallow−T. Aman	350	0.05	1
05	Boro−Sesbania−T. Aman	480	0.07	3
	Total	406160	58.32	-

Vegetables and spices crops: Sixty-three cropping patterns have been reported from Rangpur district. Potato and other vegetables of Rabi, Kharif-I and Kharif-II; spices (chili, onion, garlic, coriander and black cumin) are included in this list. Total area for vegetables and spices crops in the region is 127,455 ha (18.30% of NCA). The most contributing cropping pattern is Potato−Boro−T. Aman covering 5.16% of NCA, which is distributed over 22 upazila. The second one is Potato−Maize−T. Aman covering 1.83% of NCA. Year-round vegetables here is the most available pattern recorded in 25 upazila out of 35. For availability of irrigation water in dry season, supply of modern varieties of

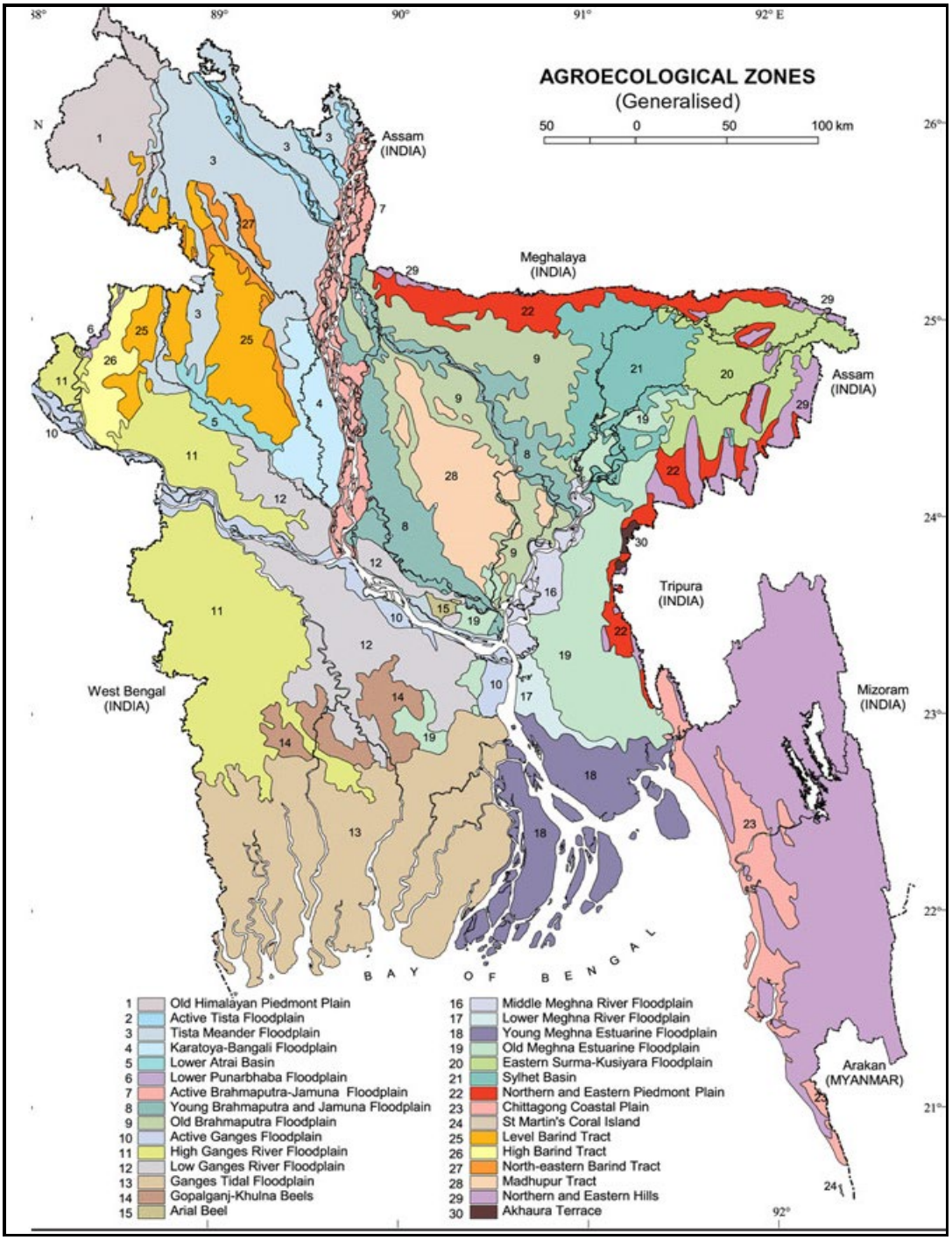


Figure 4.25 Agroecological zones of Bangladesh

various crops, skilled technology transfer system, knowledge on modern crop management practices, high market value of fresh vegetables, good communication and marketing facilities enhanced the extensive production of various types of vegetables in Rangpur region (FAO, 1988). Vegetables like Colocasia, okra, Amaranthus, brinjal, cucurbits, etc. are grown in medium upland adjacent to rice fields during rainy season and potato, sweet gourd, Cole crops, leafy vegetables etc. are grown during winter season.

Pulses and oil-seed crops: Forty-three cropping patterns are holding different pulses and oilseed crops. Among them mustard is covering the largest area. Nine cropping patterns of mustard all together cover 29,210 ha (4.19% of NCA). The second largest area is covered by groundnut. There were five cropping patterns for groundnut, which unitedly has a coverage of 3,460 ha (0.50% of NCA).

Other pulses and oil seed crops hold a number of cropping patterns, however, with non-significant coverage for each individual. Oil is an essential ingredient of human food and also for feed industries. The country is almost dependent on import for oil. Mustard is a very potential crop that can be grown widely in various parts of the country (BBS, 2014). At present, the lion-share of mustard cultivation is related to the land for double rice. If technology transfer activities are strengthened much more area of the aforesaid category will be possible to make room for the mustard crop (FAO, 1988).

Most dominant cropping pattern: Boro−Fallow−T. Aman was the most dominant cropping pattern in Rangpur region. It covers 53.33% of NCA in the region and is available in almost all upazilas. The highest area under this cropping was recorded 23,200 ha in Sundarganj upazila which represents 6.25% of the total Boro−Fallow−T. Aman area of the region.

Figure 4.26 Key Informant interview in Rangpur Divitional Agri. Extension Office

4.15 livestock and Poultry of Rangpur District

4.15.1 Livestock of Rangpur District

Deputy Director of Divisional Livestock Department, Rangpur Dr. Sheikh Azizur Rahman said farming of livestock has become lucrative in recent years. Due to growing demand and congenial atmosphere, a good number of people under the region, are getting interested in rearing cattle including, goat and sheep. Production of animal fodder like straw as well as grass has also increased in the district. The department is also providing adequate supports including necessary advices as well as technical assistances to the cattle farmers in order to boost up production of meat in the district.

There are around 353,610 sacrificial animals of some 25071 farmers in the district. The demand for sacrificial animals is around 216,370 while some 132,315 will be surplus which can be transported to other districts for sale, said Rangpur livestock department sources. There are around 1000 farms in the Mahiganj area of Rangpur city. Many of the farm owners' rear bulls besides the dairy.

Farmers said cattle fattening has become very costly and challenging as the feed prices are double in the local markets. The farmers in flood-affected areas are facing a fodder crisis for their cattle. Many of them took loans from banks and different agencies on high interest for cattle farming and are unsure about getting their investment back.

Talking to BSS, Training Officer of the Department of Livestock, Rangpur Md. Babul Hossain said cattle farms and farmers have produced three lakh 53 thousand and 700 bullocks, cows, oxen, claves, buffalos, goats and sheep as sacrificial animals in the district.

Due to good profit and huge demand hundreds of people of rural areas are getting interested in cattle farming in recent times and thus are changing their financial condition. It is learnt that during last three years production of meat increased significantly in this district. According to Divisional Livestock office, Rangpur sources, around 2,81,000 tonnes of meat were produced in in Rangpur district.

Musfiqur Rahman, a cattle trader cum middleman at Lalbag of Rangpur city said the import of cattle including bulls and goats is increasing in local markets. The number of inter-districts cattle traders is found very thin in the market as the transport cost has increased this year. Cattle prices in the local markets are not high compared to last year, he added.

Sources informed that the government has taken adequate steps to encourage farming of different animals in the villages and char areas of the district in recent years. A good number of domestic animal farms have also been set up across the area during the last few years. The animals include cow, buffalo, goat and sheep. Adequate numbers of livestock physicians' teams are working in the sacrificial animal markets at the upazila and district levels to check health conditions of sacrificial animals.

Livestock office sources said with the aim to expand farm animals farming across the region, some artificial insemination sub-centers and points have been set up in this district which are playing significant role in producing developed species of cattle across the region.

The char people in river basin areas are facing severe troubles in the flood with their domestic animals. Cattle rearing is a source of income for them. Vast track of meadows and fodder polls in the villages went under flood water resulting cattle feed crisis.

Table 4.23 Information of livestock of Rangpur district from 2015 to 2021

Year	Cattle	Buffalos	Goats	Sheep
2015	10,32,000	4,596	5,76,000	90,000
2016	10,41,000	4,513	5,88,000	92,000
2017	11,56,000	4,454	6,01,000	95,000
2018	12,35,000	4,226	6,32,000	1,00,000
2019	12,49,820	4,112	6,96,103	1,42,308
2020	13,12,311	4,317	7,30,908	1,49,423
2021	13,77,927	4,533	7,67,453	1,56,894

Source: District Livestock Office, Rangpur (Collected on 18 January 2023)

Table 4.24 Meat and milk production of Rangpur district in the year 2019 -2020

Sl. No.	Name of the Produces	Unit	Demand	Production	Surplus/ Deficit
1	Milk	Lakh M.T.	2.37	2.81	0.44
2	Meat	Lakh M.T.	1.31	2.03	0.72
3	Eggs	Number	31 crore 25 lakh	37 crore 25 lakh	6 crores
As per demand of milk 250ml/cap/day, meat 120gm/cap/day and eggs 104pieces/cap/year					

Source: District Livestock Office, Rangpur (Collected on 18 January 2023)

Figure 4.27 AM dairy farm, Nurpur, Rangpur Sadar

4.15.2 Poultry of Rangpur District

Shahjalal Khandaker, Deputy Director of Rangpur Livestock Department, said poultry industry in Rangpur is now working to meet national demand beyond regional boundaries. The development of poultry industry in Rangpur district in the last 10 years has changed the economic picture of the region. In order to continue the trend of development of this poultry industry, the prices of all kinds of industrial based products starting from poultry feed should be kept at a tolerable level. Only then will the number of farms increase and the problem of unemployment will be solved.

Rangpur region is advancing faster than other regions of the country in terms of setting up of modern feed mills, hatcheries and poultry farms. However, farmers are frustrated over the increasing price of chicken feed, unavailability of fair egg price, and complications in getting incentives. Although the price of broiler chicken has gone up a bit, they are not getting the fair price for layer chicken eggs. Farmers are more interested in raising layer chickens especially for egg production. However, most of the times they have to count the losses due to the collapse in the egg market due to middlemen. As a result, the dream of farmers and traders to lead the poultry industry of Rangpur region to the future is being shattered.

Farmers said that without poultry industry, it would not have been possible to meet the demand for eggs and chicken meat of the people of the country. Poultry has caused a silent revolution. This industry has not only met the demand for animal meat but has also created employment and alleviated human poverty. In order to meet the demand of the future, on the one hand we have to increase commercial production and on the other hand we have to think about the protection of small farmers.

Visiting on spot it has been seen that different types of broiler and layer chicken farms have been established in different parts of Rangpur city. Many times, there is profit, but sometimes there is a huge amount of loss due to various reasons. Although there is some profit in rearing broiler chickens at present, they say that the losses in layer chickens are being calculated as the egg market has gone into the hands of middlemen. Besides, the price of chicken feed has almost doubled in the last four months.

However, there are some success stories in this industry as well. Maryam Begum has become successful in sorting her life out by running a chicken farm. The chicken farm built in Dhap Sardarpara area of Rangpur city has changed her fortune. After building a broiler farm in 2015, she did not have to look back. Even after providing for the family expenses including the education of her children, excluding the expenses of raising chickens, her monthly income has increased.

On the other hand, there are some tragic stories as well. Ruhul Moazzem had set up a layer chicken farm in Burirhat Bahadur Singh area of the city. At present there are seven thousand chickens in his farm. Although he started the farm ha has to count the losses every month to meet the expenses as the price of chicken feed has gone up and the market for eggs has not been good. Ruhul Moazzem said that at the end of last year, the price of chicken feed was less than at the end of this year. The price of the same feed has increased. At present the farmers are counting losses as the middlemen are the reaping huge benefits from this business. The farmers are losing their interest in this sector due to these reasons.

Rangpur livestock office says there are more than 7,000 poultry farms in the division. Of these, 2,800 are of layer chickens and about 4,000 are of broiler chickens. The total number of chickens is about 3 crores. Although the egg production target is 143 crore pieces, the production is only 140 crore pieces. Egg production was one tenth of the production target only 10 years ago.

Figure 4.28 Poultry photographs taken from Rangpur City Corporation market

Table 4.25 Information of poultry of Rangpur district from 2015 to 2021

Year	Unit	Chickens	Ducks
2015	Number	34,97,000	7,34,000
2016	"	35,41,000	7,52,000
2017	"	35,53,000	7,86,000
2018	"	35,85,000	8,10,000
2019	"	51,44,371	95,31,32
2020	"	54,01,589	10,00,788
2021	"	56,71,669	10,50,828

Source: District Livestock Office, Rangpur (Collected on 18 January 2023)

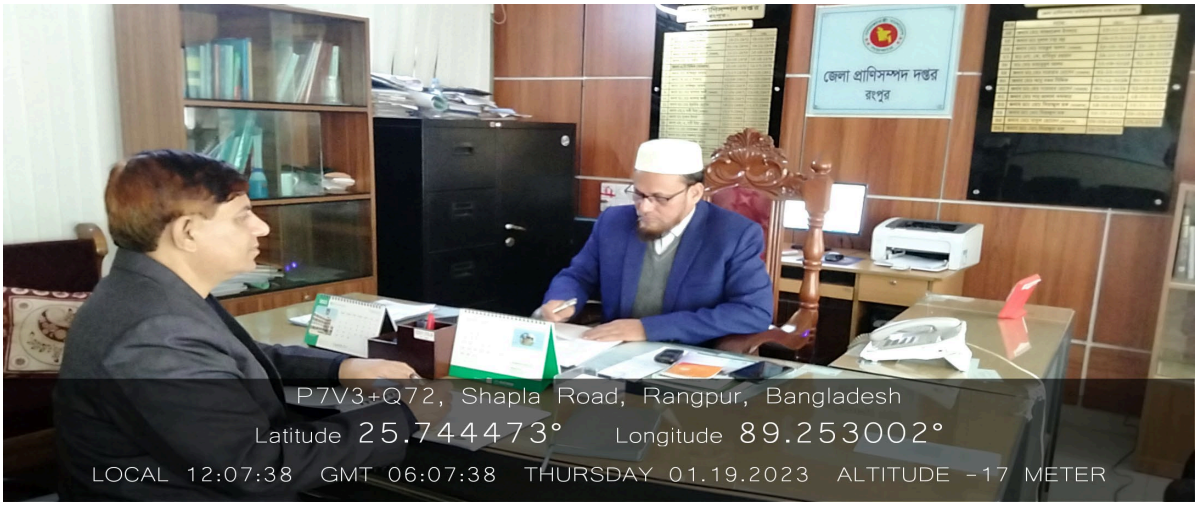


Figure 4.29 Key informant interview in Rangpur District Livestock Office

4.16 Fisheries Resources of Rangpur District

The habitat of native species of fish is in natural water bodies such as canals, beels, river channels, borrow pit etc. But the natural habitat of native species of fish is under threat today as the navigability of rivers, canals and beels is declining and the water holding capacity of natural reservoirs is declining. Officially, there are 12fish sanctuaries in Rangpur district but they are less than required. Some of native fish species are Pabda, Gulsa, Shing, Magur. Apart from this, carp-mixed, carp-galda and Pangas fish culture activities are being implemented. The fishery project will play an important role in the production of native species of fish in Rangpur district by providing training and setting up of exhibition ponds.

Figure 4.30 Key Informant Interview in Rangpur Divitional Fisherires Office

Despite various steps taken by the authority concerned to increase fish production in Rangpur district, scarcity of fish has been prevailing across the region in recent years. According to district fisheries office sources, production of fish is around 41796 tonnes in the district against its demand of total 634,095 tonnes of fish in eight upazila under the region. As a result, the deficit is 21,299 tonnes of fish. The production target is yet to be fulfilled in the region owing to lack of water bodies, poor water flow in the rivers, non-utilization of ponds, use of current net and application of chemical fertilizers on croplands. There are about 200 beels, a good number of rivers, water bodies and around 18,000 hectares of low lands in the district where fish is being cultivated. But still the total production of fish

is not an adequate to meet the demand of the consumers. Sources alleged that death of fish caused soaring price of the same in the markets. Supply of different species of fishes like Sharpunti, Bata, Kaliboush, Baghaaire, Pabda, Bime, Koi, Magur, Shing is very scanty in markets. At present supply of fishes is scanty against its demand and it is being sold at exorbitant prices. Prices of most of the fishes are beyond the buying capacity of common people. District fisheries official sources said to meet the required demands of fishes in the district the department has taken various measures which include farming of fish fry. Fish farming in paddy field, in cages and in abandoned water bodies, to encourage farming of fish in different open water bodies at personal initiative.

Figure 4.31 Photos of different open water fish species taken from Rangpur

Fisheries experts at a discussion in Rangpur have said continuous increase in fish production in last ten years is cutting poverty and meeting nutrition of people on way to achieve the sustainable development goals (SDGs), reports BSS.

District Fisheries Officer Barun Chandra Biswas said that farmers produced 53,053 tonnes fish during the last 2018-2019 FY in the district against annual demand of 63,095 tonnes. Fish production is increasing by 3,500 tonnes on an average annually in the district that will achieve self-reliance in fish by next couple of years.

Acting Divisional Commissioner Md. Zakir Hossain called for ensuring best utilization of all water bodies and transferring latest technologies to farmers to enhance fish production for meeting nutrition of the population to build a healthier nation and attain the SDGs.

Figure 4.32 Photos of different closed water fish species taken from Rangpur

Table 4.26 Rangpur district fisheries resources information at a glance

Water Bodies	Number	Area (ha)	Production (M. Ton)
Ponds	42339	8450	42474
Beels	259	2013.6	3796
Rice Field	3186	2375	3024
Floodplain	N/A	22025	11859
Rivers	06	2250	653
Borrow pits	97	53	263

Source: District Fisheries Office, Rangpur (Information Collected on 19 January 2023)

Table 4.27 Rangpur district fish production information at a glance

SL. No.	Description of Fish	Production	Unit
1	Carp fish	54602.42	Metric Ton
2	Pangas fish	272.40	Metric Ton
3	Golda P.L.	300000	Piece
4	Golda Chingri	4.38	Metric Ton
5	Pabda fish	48.43 M. Tons	Metric Ton

SL. No.	Description of Fish	Production	Unit
6	Shing & Magur fish	470.71 M. Tons	Metric Ton
7	Telapia fish	2403.81	Metric Ton
8	Koi fish	183.98	Metric Ton
9	Gulsa / Tengra fish	7.0	Metric Ton
10	Other fishes	4075.87	Metric Ton
	Yearly total fish production	62069.0	Metric Ton
	Yearly total fish demand	63096.0	Metric Ton
	Yearly total fish deficit	1027.0	Metric Ton

Source: District Fisher Office, Rangpur (Information Collected on 19 January 2023)

4.17 Ecological Resources of Rangpur District

Ecological resources are natural resources that provide certain necessary but overlooked system maintenance functions within ecosystems. Environmental economics is in search of an appropriate analysis framework to determine economic values of such resources. Natural resources are important because they supply us with the things we need to live: food, shelter, and energy. Without natural resources, we would not be able to survive on this planet. They provide us with the food necessary for survival and fuel used in our everyday lives.

4.17.1 Ecologically Critical Areas of Bangladesh

Biodiversity is defined as the number and types of plants and animals that exist in a particular area or in the world generally. Protecting the biodiversity is of utmost importance in today's world. Similarly, in Bangladesh, the biodiversity of which is in fact an excellent combination of forestry, hills and aquatic ecosystems, the issue of conservation has become essential. Since the advancement of industrial activities, a sharp decline has been recorded in the number of species living in this beautiful country. The worrying state of such destruction has become apparent when the 2015 IUCN Red list of Bangladesh declared that, among 1619 species of seven wildlife groups, 31 species are already extinct and 390 others are threatened with extinction.

In this context, the flagship legislation on environmental protection, the Bangladesh Environment Conservation Act (BECA) of 1995 has empowered the Government to declare an area facing environmentally critical situation to be an Ecologically Critical Area under Section 5. To make such a declaration, the Government must be satisfied that due to degradation of environment, the ecosystem of that given area has reached or is threatened to reach a critical state or condition. Therefore, an Ecologically Critical Area (ECA) is an area in Bangladesh, which, being enriched with unique biodiversity or being environmentally significant, needs protection from destructive activities or conservation and is basically an environmentally protected zone defined by the legal authorities.

The legal mandates under the BECA empower the Ministry of Environment, Forests and Climate Change to determine which of the territories require this special recognition in order to be protected. Rule 3 of the Environment Conservation Rules, 1997, therefore, determines that the following factors must be considered while declaring any ECA: a) human habitat, b) ancient monument, c) archeological site, d) forest sanctuary, e) national park, f) game reserve, g) wild animals' habitat, h) wetland, i) mangrove, j) forest area, k) biodiversity of that area along with other relevant factors. Through the years 1999, 2001, 2009, 2015 and 2016 the following areas have been declared as ECAs in the country (Table 4.28):

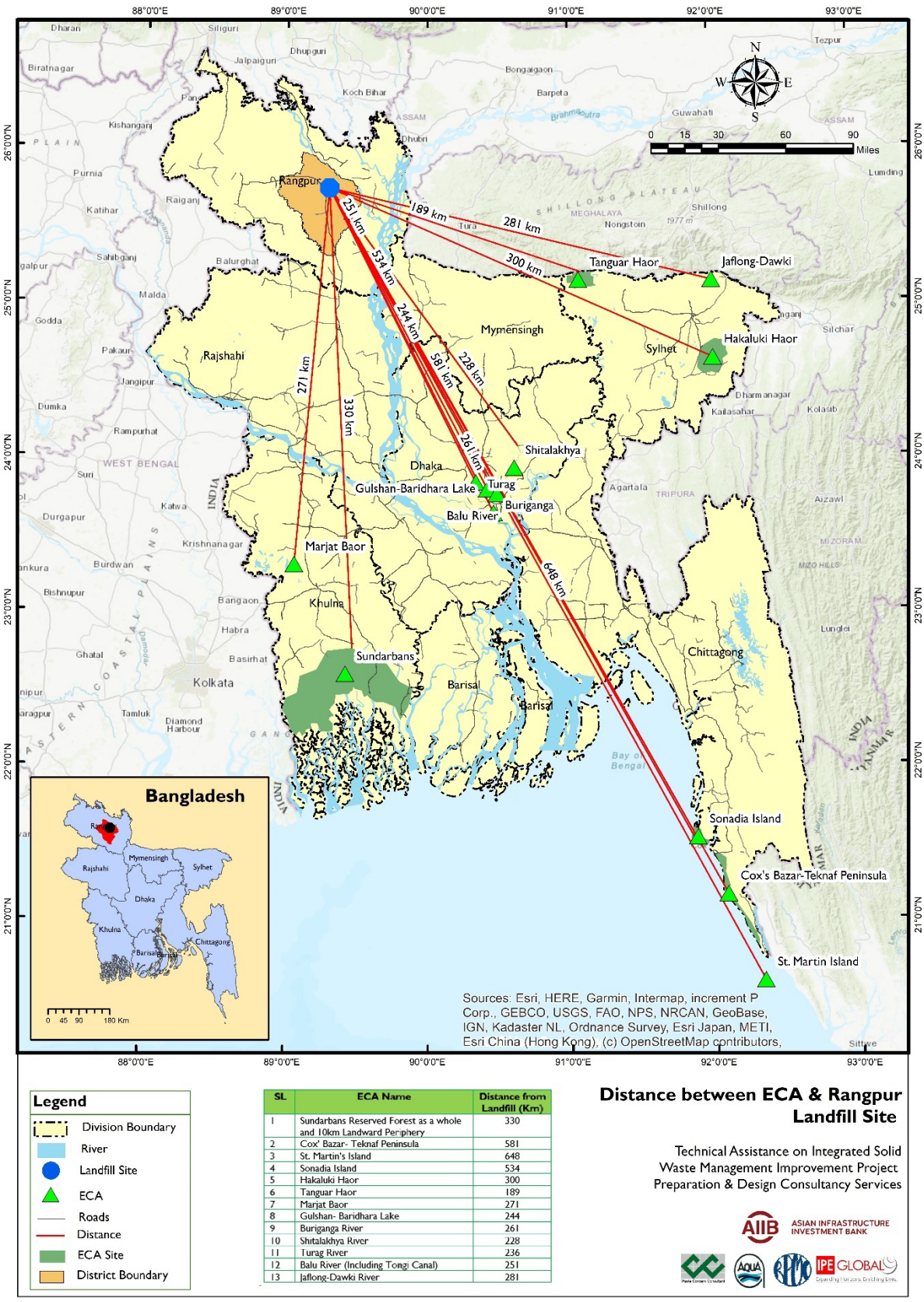
Table 4.28 Declared Ecologically Critical Areas (ECAs) of Bangladesh

Name of the ECA	Category of Ecosystem	Location (Zilla)
Sundarbans	The outside of Sundarbans Reserved Forest at 10 km extent	Bagerhat, Khulna, Saatkhira, Pirojpur, Borguna
Cox's Bazar–Teknaf Sea beach	Village, Agricultural Land, Hills, Forest	Cox's Bazar
Saint Martin's Island	Coastal Waterways, Oceanic Island with Corals	Cox's Bazar
Sonadia Island	Mangrove forests	Cox's Bazar
Hakaluki Haor	Haor (Watershed)	Sylhet, Moulvibazar
Tanguar Haor	Haor (Watershed)	Sunamganj
Marjat Baor	Oxbow Lake	Jhenaidah
Gulshan-Baridhara Lake	Urban Lake	Dhaka
Buriganga River	River	Beside Dhaka Metropolitan
Turag River	River	Beside Dhaka Metropolitan
Balu River	River	Beside Dhaka Metropolitan
Sitalakshya River	River	Beside Dhaka Metropolitan and Narayanganj
Jaflang-Dauki River	River and the surrounding area of 500 metres	Sylhet
Halda River	River and the surrounding area of 500 metres	Chattogram, Khagrachhari

The legal requirements under BECA compel the concerned authorities to ban certain activities within the ECAs, which are: - felling or collecting trees, hunting, catching or killing wildlife, industrial establishment, fishing, and other activities that might affect fish or aquatic life. In general, any activity that could destroy the natural characteristics of soil or water in these areas are to be prevented under this law.

To address the extreme events of extinction, the Government of Bangladesh has also taken some institutional steps which include area-based observation, project implementations and awareness-raising program. The Department of Environment, which is the technical arm of the Ministry, reports quite a few engaging activities that have been undertaken to protect and conserve the ECAs of Bangladesh.

The subproject is out of the 13 Ecological Critical Areas identified by the Department of Environment (DoE) shown in Figure-4-33. There are no reserve forest/biodiversity conservation areas in and around the Rangpur City Corporation subproject area. For this subproject, the Biodiversity Assessment Plan is not required.



SL	ECA Name	Distance from Landfill (Km)
1	Sundarbans Reserved Forest as a whole and 10km Landward Periphery	330
2	Cox' Bazar- Teknaf Peninsula	581
3	St. Martin's Island	648
4	Sonadia Island	534
5	Hakaluki Haor	300
6	Tanguar Haor	189
7	Marjat Baor	271
8	Gulshan- Baridhara Lake	244
9	Buriganga River	261
10	Shitalakhya River	228
11	Turag River	236
12	Balu River (Including Tongi Canal)	251
13	Jaflong-Dawki River	281

Distance between ECA & Rangpur Landfill Site

Technical Assistance on Integrated Solid Waste Management Improvement Project
Preparation & Design Consultancy Services

Figure 4.33 Ecologically Critical Area and Subproject Rangpur City Corporation

4.18 Socio-economic Resources of Rangpur District

Rangpur City Corporation (RpCC) is one of the twelve city corporations in Bangladesh and is located in the Rangpur division, northern region of the country. The geographical coordinates of Rangpur City Corporation are 25.56° North and 89.25° East. Rangpur became a City Corporation from Municipality on 28 June 2012 with an area of 205.7 km^2, and is divided into 33 Wards. According to the Rangpur City Corporation published data, the population of the Rangpur City Corporation area as of 2017 was 796,556, with 398,282 male and 398,274 females. The population density is of 3,872 people per km_2 and the literacy rate of RpCC is 65%. The total number of households in RpCC is about 124,7642, and the total holding number is 51,163, which includes both private (50,705) and government (458) holding. RpCC also has 49 slums comprising of about 8% of the total population of the city.

The current metro area population of Rangpur in 2022 is 425,000, a 2.16% increase from 2021. The metro area population of Rangpur in 2021 was 416,000, a 2.21% increase from 2020. The metro area population of Rangpur in 2020 was 407,000, a 2.01% increase from 2019. Following a socio-economic survey carried out in the month of 2022, potentially affected people, socio-economic activities and agricultural activities were identified in the subproject area.

Like all villages in Rangpur, economic life is dominated by agriculture which focuses on both food and perennial crops. The dominant food crops are bananas, rice, maize and market garden crops in particular, okra, aubergines, chili peppers, etc.) The non-autochthonous and immigrant groups are also engaged in livestock breeding (poultry) and fishing. Informal trading is mainly carried out in the area of Rangpur market which opens daily although the main trading day is Friday.
The Rangpur City Corporation receives its electricity supply from the national grid. A registered nurse provides ordinary and specialized consultations, especially in pediatrics and gynecology. The most common diseases are malaria, tuberculosis, intestinal amoebiasis, dysentery, diarrhoea, bronchitis and STI/HIV-AIDS as well as anaemia and malnutrition in children. Telecommunications mainly comprise mobile phone operators and one local radio station. Bus, minibus and motorcycles are the main mode of transport in the city. Only the main roads linking district and Upazila level are paved while the village roads are surfaced with gravel.

Rangpur City Corporation has their own land for waste dumping. Considering the social environment, it can be stated that this subproject will not cause any dislocation or involuntary resettlement of the local people. As a result, no conflicts will be caused due to land use. There are no any ethnic minorities and indigenous people.

Poor class social groups or poor neighborhoods consistently excluded from the formal solid waste service. Child labors are not employed by Rangpur City Corporation but the waste pickers are children. The poor children are victims of health hazards. The existing landfill site is the property of Rangpur City Corporation. Political and ethnic issues are not associated with the waste disposal site. So, there is no social conflicts with land acquisition. As Rangpur City Corporation is the owner of this land, so no land use conflict is expected. Regarding practice of coping mechanisms (community support, safety nets, insurance mechanisms) used by workers, there is no such evidence of practicing of copying mechanisms in the Rangpur City Corporation. There are also some adult people who collect non-disposable waste materials for selling in the vendor to meet up their livelihood. The west pickers will lose their income if this improved waste management system is implemented. Bad odor and housing problems as mentioned by neighboring residents were also observed. Political or ethnic issues associated with sharing a waste disposal site are not applicable. Practice of coping mechanisms (community support, safety nets, insurance mechanisms) used by workers were not reported by the local people.

Rangpur City Corporation (RCC) is a divisional town of the northern part of Bangladesh. It is one of the key commercial hubs of the country and also serves as the headquarters of Rangpur district as well Rangpur division. Rangpur is the seventh largest city corporation in the country. Rangpur municipality consists of 33 wards with an area of 205.7 sq. km. Landfill site is situated at ward 29.

This section presents the socio-economic profile of the affected persons. This will include brief description of gender profile, religion, education, income, occupation and affected property for the project intervention. The SES was conducted ESIA report for Rangpur City Corporation. However, based on the report, LGED will prepare a Livelihood/Resettlement Plan where updated socio-economic information's will be provided.

The Table 4.29 below shows that 49 people were interviewed during SES who are dependent with waste handling for their livelihood purpose and this chapter is prepared based on their information's collected from primary data.

Table 4.29 Respondents of the Rangpur City Corporation social baseline survey

Occupation	Frequency	Percent
Landfill Tokai	12	24.5
Town Area Tokai	3	6.1
Ferriwala	6	12.2
Van Driver	9	18.4
Landfill Vangari Shop	2	4.1
Town Area Vangari Shop	10	20.4
Whole Seller	4	8.2
Broker	3	6.1
Total	**49**	**100.0**

Uncontrolled waste dumping

Whole seller

Town Van driver

Town Vangari Shop

Figure- 4.34: Photos of the social survey of vangari shop in RpCC Area

Figure- 4.35: Social survey map of Rangpur sub-project area

During preparation of ESIA, LGED has conducted stakeholder consultation meeting, individual consultation meetings with waste pickers, Vangari shops, van drivers, wholesalers, Ferriwala. Individual consultation also conducted with different stakeholders including restaurant owners and users; local administration, local people, owner of private clinic, female stakeholder etc. consisting of approximately 120 people. Baseline information collected from the consultation meetings are given in the Table 4.30 below:

Table 4.30 Socio-economic baseline of the project area

Sector	Baseline condition
Household	According to BBS 2011, Total about 1,02,998 persons. The population of the municipality in 2021 is estimated to be around 249,062 persons. Total number of holdings in the town is about 35,917 whereas 14,102 households are covered in the house-to-house waste collection program. Uncollected waste has been dumped at pond side, road side and unused land of the town which creates public nuisance, foul odor and different public health hazards. Local dwellers are opined that implementation of the solid waste management plant will have positive reflection on cleanliness, environment and public health.
Hotel/Restaurant Sector	According to the local people and Pourashava around 25 restaurants are operating their business. About 2000 people are depended on this sector for their livelihood purpose. However, income from this sector is satisfactory to maintain their normal livelihood. One of the main barriers of this business is management of generated solid waste from kitchen, disposable utensils, recyclable waste like plastic bottle, polythene, reasons of low income from this sector is narrow. Cent percent of the stakeholders expressed that implementation of a modern solid waste management system will accelerate upgrading the livelihood of the related sector people to improvements.
Local traders	Around 50% local traders (wholesaler of different goods) opined that rejected packing papers, paper boxes, plastic boxes etc. crest hazardous situation in their business house and go-downs. They can't preserve sufficient necessary items which is a barrier for their business. Local traders expressed that construction of a solid waste management plant/system will minimize their problem.
Hospital	According to the Pourashava Authority 2 government hospital and 41 private hospitals are operational in the town. Management of medical waste is a main problem for the hospitals. This problem create frustration to the patient and visitors. It is one of the causes to go near big town for better health service. Association of hospital authority opined that Implementation of the solid waste management system will have positive impact on their health service.
Educational Institutes	Local people opined that uncontrolled waste dumping beside the educational institutes creates health hazards for the students. They added implementation of a waste management system will have a better reflection on the student's health.

4.18.1 General Socio-economic profile of the people of the proposed subproject

Almost all of the respondents are male except some female Tokai in landfill (58.3%) & in the town (33.3%). The following Table 4.31 shows the gender distribution of the respondents.

Table 4.31 Occupation wise gender distribution

Gender	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
Male	41.7	66.7	100	100	100	100	100	100
Female	58.3	33.3	0	0	0	0	0	0

Most of the respondents are illiterate except town area Vangari shop owner and wholesalers. Primary education is noticeable in town area Vangari shop owners, wholesaler and brokers. Moreover, 50% of the landfill Vangari are SSC pass. None of the respondents are higher level education from HSC. Following Table 4.32 shows the education level of the surveyed people.

Table 4.32 Education level of the respondents

Education level	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
Illiterate	83.3	100	83.3	77.8	50.0	20.0	25.0	33.3
Primary	16.7	0	16.7	22.2	0	70.0	50.0	66.7
JSC	0	0	0	0	0	10.0	25.0	0
SSC	0	0	0	0	50.0	0	0	0
HSC	0	0	0	0	0	0	0	0
Graduate	0	0	0	0	0	0	0	0
Masters	0	0	0	0	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Except these surveyed people some of their family members are also involved waste management related works. The following Table 4.33 shows the scenario of the involvement of other family members to the waste management related works.

Table 4.33 Involvement of any other persons of the family in waste recycling work

Response	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
Yes	0	0	16.7	22.2	30.0	10.0	25.0	0
No	100	100	83.3	77.8	70.0	90.0	75.0	100

4.18.2 Status of the Waste Management Related Occupation

Some of the respondents choose these works considering high income source specially town area Tokai, van driver and landfill Vangari shop owners. Whereas, landfill Tokai, Ferriwala and town area Vangari shop owners prefer these job as other jobs are not available. Following Table 4.34 shows the scenario of the reasons to choose these occupations.

Table 4.34 Reasons of choosing these occupation

Income Source	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
High income source	0	0	0	0	0	14.3	100	0
Familiar Work	66.7	0	33.3	55.6	50.0	71.4	0	66.7
Other work is not available	33.3	100	66.7	44.4	50.0	14.3	0	33.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Most of the tokai, Ferriwala are doing their works for recent years, whereas broker and Vangari shop owners are doing their work for long time. Table 4.35 shows distribution of the duration of their engagement with these works.

Table 4.35 Duration of the engagement with these works

Years	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
1 - 5	62.5	50.0	44.4	25.0	0	9.1	50.0	0
6-10	0	25.0	0	12.5	37.5	9.1	25.0	0
11-15	12.5	8.3	0	37.5	25.0	27.3	0	50.0
16-20	12.5	16.7	22.2	12.5	25.0	36.3	0	0
More than 20	12.5	0	33.4	12.5	12.5	18.2	25.0	50.0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Most of the respondents work 6 days in a week few of them work the whole week. Surprisingly, all the van drivers work for the whole week. The following Table 4.36 shows the scenario.

Table 4.36 Working group and weekly working days

Days	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
3	0	0	0	11.1	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	100	0	100.0	0	0	100.0	25.0	0
7	0	100.0	0	88.9	100.0	0	75.0	100.0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4.37 shows that 50% Ferriwala expend 3-6 hours in a day for their work. And van drivers work less hours than Ferriwala. Among the respondents, their highest working hours is below 13 hours.

Table 4.37 Duration of work in a day

Hours	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
3-6	0	33.3	50.0	22.2	0	0	0	0
7-9	100	66.7	33.4	66.7	100	40.0	75.0	66.7
10-12	0	0	16.6	11.1	0	60.0	25.0	33.3
13-15	0	0	0	0	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Monthly income and expenditure of maximum respondents are in 5000-10000 BDT range. Income & Expenditure are usually highest of the town Vangari shop owners. On the other hand, expenditure among the respondents is highest of the wholesaler. The following Tables 4.38 show the monthly income and expenditure of the respondents.

Table 4.38 Monthly income of the respondents

Income Range	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
5000-10000	36.4	100.0	33.3	22.2	0	0	0	0
10001-15000	63.6	0	16.7	22.2	50.0	0	0	66.7
15001-20000	0	0	50.0	44.4	0	0	33.3	33.3
20001-35000	0	0	0	11.2	0	0	0	0
35001-50000	0	0	0	0	0	20.0	0	0
More than 50000	0	0	0	0	50.0	80.0	66.7	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4.39 Monthly expenditure of the respondents

Expenditure Range	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
5000-10000	81.8	100	33.3	22.2	0	0	0	0
10001-15000	18.2	0	66.7	22.2	50.0	0	0	100
15001-20000	0	0	0	44.4	0	0	0	0

Expenditure Range	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
20001-35000	0	0	0	11.2	0	0	0	0
35001-50000	0	0	0	0	50.0	30.0	0	0
More than 50000	0	0	0	0	0	70.0	100	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

4.18.3 Socio Economic Profile of Affected People

5 ponds and some farmlands are located at 250m radius from the landfill site. Livelihood of that two activity will be affected if DOE declares it buffer zone. Total 6 persons including the 4 owners of the pond and 2 gatekeepers will be affected during construction period. Other than these 12-landfill site Tokai, 2 Vangari shop and 4 whole sellers will be affected. Monthly income of the affected pond owners and the gate keepers is shown in following Table 4.40.

Table 4.40 Monthly income from the affected community person

Sl. No	Monthly Income (BDT) from the affected community person	No of Affected HH	Percentage
1	25,000- 35,000	2	33.33
2	40,000 – 80,000	2	33.33
3	00-10,000	2	33.33
	Total	6	100

Affected fish farm

Affected fish farm

Affected fish firm

Affected fish Hatchery

Figure 4.36 Photos of the affected livelihood near landfill area of RpCC

Table 4.41 Demographic details of affected population

Sl. No	Category of Affected Persons	Male	Female	Total
1	Affected community person	6	-	6
2	Whole seller	4	-	4
5	Landfill site Tokai	12	5	12
6	Landfill site Vangari shop	2	-	2
	Total	24	5	24

Table 4.42 Monthly income of the affected tokai, van driver, vangari shop

Income Range	Landfill Tokai (%)	Van Driver (%)	Landfill Vangari Shop (%)	Wholesaler (%)	Broker (%)
5000-10000	36.4	22.2	0	0	0
10001-15000	63.6	22.2	50.0	0	66.7
15001-20000	0	44.4	0	33.3	33.3
20001-35000	0	11.2	0	0	0
35001-50000	0	0	0	0	0
More than 50000	0	0	50.0	66.7	0
Total	**100**	**100**	**100**	**100**	**100**

Table 4.43: Monthly expenditure of the persons to be affected by the subproject

Expenditure Range	Landfill Tokai (%)	Van Driver (%)	Landfill Vangari Shop (%)	Wholesaler (%)	Broker (%)
5000-10000	81.8	22.2	0	0	0
10001-15000	18.2	22.2	50.0	0	100
15001-20000	0	44.4	0	0	0
20001-35000	0	11.2	0	0	0
35001-50000	0	0	50.0	0	0
More than 50000	0	0	0	100	0
Total	**100**	**100**	**100**	**100**	**100**

The survey along both sides of the connecting roads reveals that the average monthly income of the business owners is Taka 26,361 where the lowest income is Taka 5,000 and the highest income is Taka 141,000. Detail status is shown in **Table 4.44**.

Table 4.44: Average Monthly Income of the Business Owners along the Connecting Roads

Income Range (BDT)	No. of the Owners	Percentage of the Owners
Up to 5000	2	2.41
5001-10000	16	19.28
10001-15000	20	24.10
15001-20000	11	13.25
20001-35000	19	22.89
35001-50000	7	8.43
More than 50000	8	9.64
Total	**83**	**100.00**

Source: Road Survey, June 2023

Altogether 17 employees/staff work in 10 shops out of the 83. Their average monthly income is Taka 15,191 where the lowest income is Taka 9,000 and the highest income is Taka 22,500. Detail status is shown in **Table 4.45**.

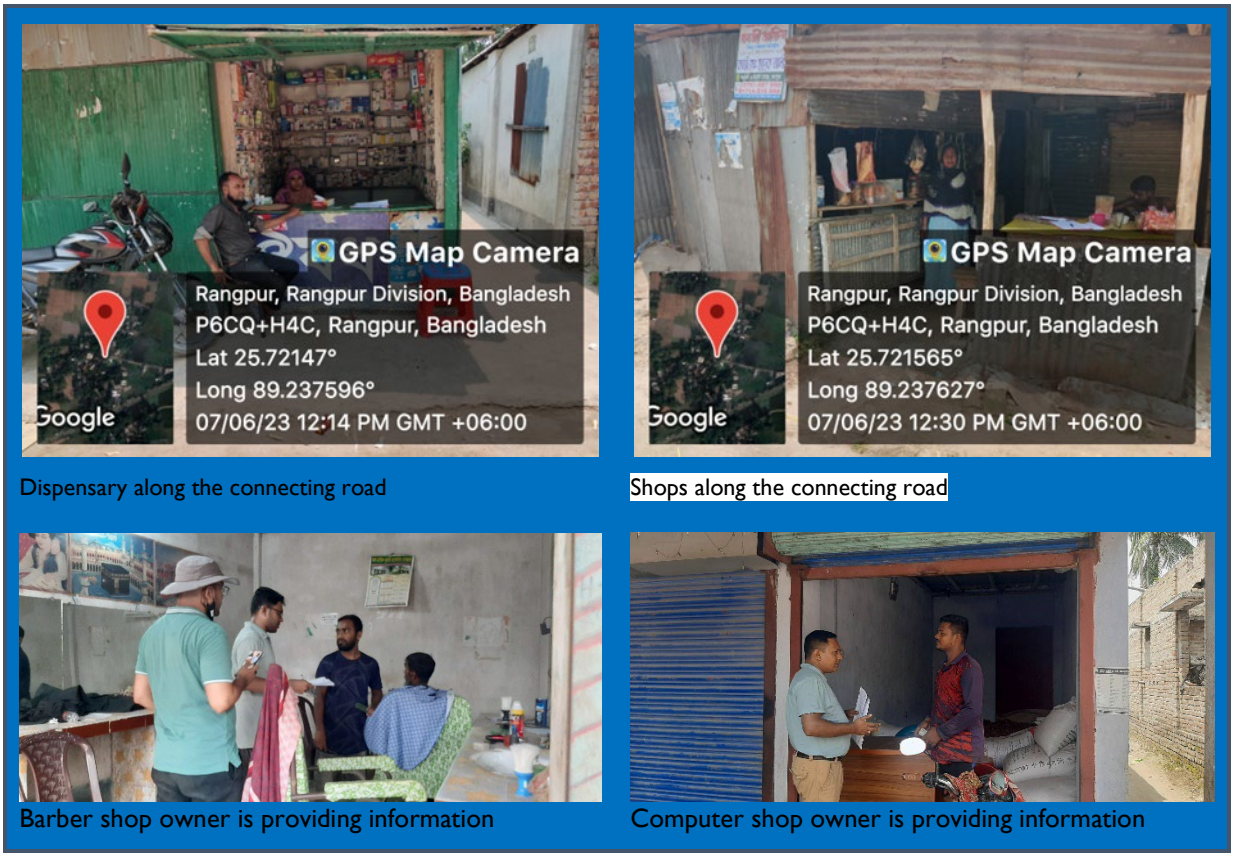
Table 4.45: Average Monthly Income of the Business Shop Employees/Staff along the Connecting Roads

Income Range (BDT)	No. of the Employee/Staff	Percentage of the Employee/Staff
Up to 5000	2	20
5000-10000	4	40
10001-15000	4	40
15001-20000	0	0
20001-35000	0	0
35001-50000	0	0
More than 50000	0	0
Total	**10**	**100.00**

The table below shows the details about the types of businesses located along both sides of the connecting roads proposed for improvement under the subproject.

Table 4-46: Types of businesses located along the connecting roads

Sl. No.	Type of Business	No. of Shops	% of Shops
1	Grocery Shop/Variety Store/Stationary	41	49
2	Small Restaurant/Tea Stall	20	24
3	Garage/Cycle & Rickshaw Parts	3	4
4	Agro Feed/Fertilizer Dealer	2	2
5	Electrician/Electronics	2	2
6	Iron/poultry shop	2	2
7	Pharmacy	2	2
8	Banana store	1	1
9	Confectionary	1	1
10	Dealership of Rice	1	1
11	Fruit selling shop	1	1
12	Hardware shop	1	1
13	Library shop	1	1
14	Mattress pad	1	1
15	Barber Shop	1	1
16	Shoe shop	1	1
17	Tailor	1	1
18	Yarn Shop	1	1
Total		**83**	**100**



Dispensary along the connecting road

Shops along the connecting road

Barber shop owner is providing information

Computer shop owner is providing information

Figure 4.37 Photos of the affected entities along the connecting roads of RpCC

4.18.4 Religion of the potential affected Population

Table 4.48 represents that most of the project affected people are following the Muslim religion (95.8%). Among the affected 24 persons, one (4.2%) is following the Hindu religion. No other religious people have been found as the project affected people.

Table 4.47: Religion distribution of the potential affected population

SL No.	Religion	Male	Female
1.	Muslim	23	-
2.	Hindu	1	-
3.	Others	-	-

4.18.5 Risks of Diseases Associated with the Current Occupation

Responses received indicate that most of the respondents are aware about waste handling related diseases.

Table 4.48: Knowledge about waste related diseases and hygiene

Response	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
Yes	100	100	100	100	100	90.0	100	100
No	0	0	0	0	0	10.0	0	0

Used to wash hand with soap after working and before taking food

Among the respondents 91.7% of landfill Tokai used to wash hand with soap before taking food and after work whereas town area Tokai (100%) used to do it. 50% landfill Vangari shop owner is less awarded for using soap before taking food and after work which has shown in the following Table 4.49.

Table 4.49: Used to hand wash with soap

Response	Landfill Tokai (%)	Town Area Tokai (%)	Ferriwala (%)	Van Driver (%)	Landfill Vangari Shop (%)	Town Area Vangari Shop (%)	Wholesaler (%)	Broker (%)
Yes	91.7	100	100	77.8	50.0	80.0	50.0	66.7
No	8.3	0	0	22.2	50.0	20.0	50.0	33.3

Awareness being considered as a prime preventive measure; the survey included a check of respondents' sufferings about waste handling related diseases in particular. The **Table 4.50** indicate that 49% get injured while doing their work which is the highest and irritation of eyes by 6.1% is the lowest sufferings. Problem of taking breath is also a prime health hazard which is showing the table below.

Table 4.50: Types of health hazard they faced while doing their work

Faced Health Hazard	Yes (%)	No (%)
Problem in taking breath	10.2	89.8
Have skin disease	6.1	93.9
Irritation in eyes	6.1	93.9
Get injured	49.0	51.0
Infection in any body part	0	100
Pain (Neck, backbone, hand, waist etc.)	40.8	59.2

4.18.6 Health Condition of the Landfill Waste Pickers (Tokai)

This section presents the health condition of the landfill tokai based on the social survey findings. As mentioned earlier, the total number of landfill tokais is twelve (12). The survey findings reveal that the tokais suffered from different types of diseases during the last one year. About 50% of them suffered from fever and more than 33% from other types of diseases. **Table 4.51** shows the types of diseases affecting landfill waste pickers.

Table 4.51: Types of diseases suffered by the waste pickers in last one year

Sl. No.	Types of Diseases	% of the Waste Pickers
1	Fever	50.00
2	Others	33.33

Source: Social Survey, December 2022

Apart from the diseases mentioned in **Table 4.51**, the waste pickers are exposed to occupational hazards as shown in **Table 4.52**.

Table 4.52: Types of health hazards faced by the waste pickers

Sl. No.	Types of Health Hazards	% of the Waste Pickers
1	Have skin disease	17
2	Get injured	67
3	Pain (Neck, backbone, hand, waist etc.)	42

Source: Social Survey, December 2022

Due to health issues, waste pickers cannot work on average for two days in a month. Based on their average monthly income of BDT 6,800, it has been calculated that they are to lose an average income of BDT 486 for this two-day sickness. Moreover, in addition to their income loss for two days, they spend BDT 163 on average for their medical treatment purpose. Thus, their total average loss per month due to income loss plus expenditure for medical treatment is BDT 649. The maximum loss is BDT 1,234, which is 8.23% of their maximum monthly income of BDT 15,000 and 9.54% of their monthly average income of BDT 6,800, respectively.

Under the project, a skill enhancement program for waste pickers shall be organized involving NGOs. It will help them to minimize occupational health hazards from their current occupation. The project plans to hire waste pickers to work in the MRF to be constructed under the project.

4.18.7 COVID-19 Situation in the Project Influence Area

With the outbreak/spread of COVID-19, people have been mandated by national or local law to exercise social distancing, and specifically to avoid public gatherings to prevent and reduce the risk of the virus transmission. Various restrictive measures have been adopted including some imposing strict restrictions, when necessary, on public gatherings, meetings and people's movement, and others advising against public group events. At the same time, the general public has become increasingly aware and concerned about the risks of transmission, particularly through social interactions at large gatherings.

4.19 Transportation System of Rangpur City

Rangpur city streets do not reach to function at its satisfactory level. Different classes of vehicles such as cars, vans, buses, tracks, auto– rickshaw, motorcycles, by- cycles, bullock carts, etc. are found to use the common roadway facilities without segregation on most of the roads. A better transportation circulation system is very much important for every nation and its rapid demand of economic, industrial, trade etc. The efficiency of an urban transport system is greatly influenced by its circulation management system. Circulation management is very important for efficient functioning of road transport. The urban transportation problem is actually a complex bundle of interrelated problems. They can be grouped into three categories: congestion, mobility, and ancillary impacts. Traffic congestion, delays, noisy and unpleasant traffic way, anxiety for road accident, inaccessible and unpleasant pedestrian ways, these are common problems for every street. The city corporation is located in the north-western part of Bangladesh. The present area is 203.19 Sq. Km and population are about 10 Lac. The population of the Rangpur city corporation as of 2014 was 865,927, with male 50.91%, female 49.09% (BBS 2015). Effective traffic and transportation management system are required at CBD area in Rangpur city. To increase the capacity and to ensure condition for smooth traffic movement immediate attention is required for the streets. The study will out the existing deficiencies of the traffic management system. Important Intersections at CBD Area a) Jahj Company Intersection b) Payirachottor Intersection c) Supermarket Intersection d) Townhall Intersection.

Traffic and transportation management is a major challenge for a city in Bangladesh. Moreover, this challenge is so critical to managing of traffic and transport at a Central Business Area (CBD) in a city like Rangpur. The main objectives of this ESIA study are to find out the present problems of traffic and transportation system and find out the way of an effective solution. So, the angle of different intersections, flow analysis of roads, level of service (LOS) analysis of selective roads and physical feature analysis at the CBD area is conducted for this ESIA study. To find out the condition of traffic and transportation at CBD area different type of survey have been done like traffic volume survey, physical feature survey, delay time survey, parking survey. Collected data was analyzed by using GIS software, Google Sketch-up software. The main problems at the CBD area are informal occupancy, violet setback rules, no minimum sight distance for a vehicle, lack of proper use of footpath, inappropriate channelization of vehicles.

4.20 Livelihood Restoration of the Subproject Affected Entities

Based on the socioeconomic condition of the affected peoples of this subproject detailed out in Section 4.20, a separate livelihood restoration plan has been developed by the consultant. The Livelihood Restoration dealt with the income generating assistance to the affected persons includes both short and medium-term strategies required to be taken. Short-term income restoration strategies are for immediate assistance during relocation and include the following:

- Compensation for land, structures, and all other affected/ lost assets is paid in full before a construction activity begins;
- PAPs losing entire structures are entitled to shifting and reconstruction allowance (cash) for moving to the alternative premise for re-establishing house/business
- Shifting allowance for households based on the actual cost of moving/unloading
- Sixty days" advance notice to harvest standing seasonal crops, if harvest is not possible, compensation for a share of standing crops at market rates
- Business owners/tenants including farmers earning a livelihood from crops and experiencing loss of income are entitled to a one-time lump sum grant of one-month income based on the nature and type of losses assessed on a case-to-case basis or on minimum wage rates, whichever is more.
- For vulnerable groups, additional subsistence allowance equal to their average three months income Tk. 15,000 per vulnerable household for restoring or enhancing their livelihood. Vulnerable households will be prioritized in any project employment

For the RpCC subproject, the Compensation Provision under Livelihood Restoration Program has been estimated at Tk. 20,998,035 (Tk. 7,564,035 for landfill site improvement and Tk. 13,434,000 for connecting road improvement). The Project Director of ISWMIP will allocate the compensation payable, and CC authority will disburse the compensation to the PAPs under the supervision of the social safeguard team of the supervision consultant of the project. A social survey was conducted in December 2022 and a road survey was conducted in June 2023. The quoted numbers regarding the affected categories are currently considered an estimate, and their numbers will be updated six months before the commencement of civil works to reflect the fluidity of the waste-picking ecosystem and the change in the commercial establishments along the connecting roads. No person will be eligible for any Livelihood Restoration Compensation after the update. During the social and road survey, GPS coordinates are taken for the affected entities. This GPS location will be used to verify and update the affected persons during compensation payment for livelihood restoration. The entitlement matrix and the project affected persons compensation are detailed out in the livelihood restoration plan report of Rangpur City Corporation subproject. The social impact assessment is briefly listed in the matrix below which comprises construction, operation & maintenance phases of the subproject.

In addition to payment of compensation to the affected persons, it is recommended to arrange capacity-building training for the affected persons along with the arrangement of health camps annually. The estimated training and health camp budget is shown in the Livelihood Restoration Plan.

Table 4.53: Social Impact Assessment of Rangpur City Corporation Subproject

Social Impact Assessment in Construction and Operation Phase of Landfill Site							
Sl No.	**Affected Entities**	**Construction Phase**			**Operation and Maintenance Phase**		**Remarks**
		No. Affected	**Compensation**	**Engaged in work**	**Engaged**	**Work field**	
1	Waste Pickers	12	√	√	√	Engage in MRF	Will be absorbed by the municipality
2	Vangari Shop	2	√	√	√	Better Livelihood	Transfer and Reconstruction Grants will be made before the construction phase
3	Whole Seller Shops in Landfill Area	4	√	√	√	Better Livelihood	Transfer and Reconstruction Grants will be made before the construction phase
4	Affected Pond	5	√	X	Pending	To be compensated by resettlement	Based on the decision of DOE and Municipality
Social Impact Assessment in the Construction and Operation Phase of One Connecting Road							
Sl No.	**Affected Entities**	**Construction Phase**			**Operation and Maintenance Phase**		**Remarks**
		No. Affected	**Compensation**	**Engaged in work**	**Engaged**	**Work field**	
1	Small shop, Restaurant, Pharmacy & Business Enterprise along the connecting road	83	√	X	X	X	Compensation payment for income loss will be made before the construction phase

5. ALTERNATIVE ANALYSIS

5.1 General

The alternatives analysis for this subproject was conducted early in the subproject inception to examine feasible alternatives; alternative site locations, designs; or alternative ways of dealing with environmental and social impacts. The alternatives considered are discussed below in some detail.

5.2 Location of the RpCC Subproject

Due to land scarcity in the town, seeking an alternative site for establishing the new landfill is quite difficult. Also, land acquisition is now most difficult part of the Rangpur City Corporation considering the subproject nature and land availability.

Like any other project, the subproject site was selected based on economic, technical, social, environmental, and regulatory issues. These criteria have been assessed qualitatively, as landfill area is comparatively small. The criteria used are given in the Table-5.1.

Table 5-1: Criteria used in the Selection of Subproject Site

Sl	Criteria	Justification for the Selected Site
1.	Availability of the land	In the Rangpur City Corporation, land scarcity is very common and availability of suitable land for the subproject siting is a major concern. In the selected site land is still available at relatively better condition. The existing landfill site is the property of Rangpur City Corporation hence no land use conflict is expected. The existing landfill site will be utilized to construct the Integrated Landfill and Resource Recovery Facility. There are no social conflicts with land acquisition.
2.	Regulatory Environment	The site is complying with the SWM Rules of 2021. However, two vangari shops, 4 whole seller shops and five ponds have been found within 200m and 250m buffer area of the site.
3.	Availability of basic infrastructure	All basic infrastructure i.e., roads, power connection, fuel supply etc. are available in the area.
4.	Water availability	Municipal water supply is available.
5.	Wastewater disposal	Wastewater will be generated from the plant operation shall be collected, treated and reused.
6.	Environmental, Ecological and social Impacts	This subproject will have very low environmental, ecological, and social Impact as analyzed in this report; so that it will be acceptable to the local population.
7.	Availability of labor	The locality has a pool of labor which can be employed at subproject construction works. On some highly skill labor and professional must be brought in from the Rangpur City Corporation area.
8.	Availability of by product disposal	The project will produce compost, diesel and recyclable items that will sold.

A total of 4 categories of attributes have been chosen for evaluation of the site. The details of the parameters and the rationale for selection of the site have been provided in Table-5.2. The selected attributes are as follows:

(i) Site accessibility;
(ii) Distance from nearby receptors;
(iii) Environmental sensitivity; and
(iv) Socio-economics;

Table 5-2: Rationale for Site Selection

Sl. No.	Attribute	Parameter	Rationale for Site Selection	Justification for proposed Site selection
1	Accessibility	Road	The site should be accessible for transport of waste from the source of generation till the selected plant site.	The present location is accessible from the waste collection area.
2		Distance from the collection area	The distance of the selected site should not be more than 5km from Main Roads. Also, the access roads should not be passing from densely populated residential areas.	The site is well situated at well-established road which is less populated.
3	Distance from nearby receptors	Use of site by nearby residents	The present usage pattern of the site should be evaluated in order to determine whether the site is in use at present for agriculture/ settlements.	The site is currently used as waste disposal site.
4		Land use/ zoning	The existing land cover depicts the economic importance of the site. The site shall be more suitable for setting up of the waste management plant if there is less economic importance of the site.	There is less economic importance of the land as it is not used for agriculture and residential purpose. The site is already in use for waste disposal.
5		Public acceptability	The acceptance of the people in the nearby residential areas plays a very important role in setting of the project.	The acceptance of local councilor has been obtained for selection of the site.
6	Environmental sensitivity	Environmentally critical area	The selected site should not fall into environmentally critical area.	The proposed site does not fall in ECA.
7	Socioeconomics	Health	There should not be any chronic health diseases in the adjoining areas due to prevailing air quality.	There are no prevalent chronic diseases in the area.
8		Odor	The technology selection for the waste management plant should be such that there shall not be any air pollution issues in 2 km radius.	The site is currently used as open dump site. The sub project will improve the local environmental situation with the activities to meet the standards prescribed in SWM Rules 21.

The proposed site has therefore been chosen for setting up of the proposed integrated landfill and resource recovery plant because of its accessibility and the location in less populated area.

5.3 Technology Choice

Rangpur City Corporation subproject has proposed the following interventions:

- Modified van to cover all the households (including slums);
- Improved rickshaw van with bins and secondary storage containers for direct loading;

- Improved rickshaw van with bins and covered secondary storage point/transfer station/tractor-trailers with direct loading facility;
- Improved demountable container truck;
- Integrated controlled landfill with resource recovery facility (landfill, composting facility, pyrolysis plant, and leachate treatment ponds);
- Proper equipment with standard of service for removal of street sweepings and drain cleaning;
- All kind of technology shall be supportive to the Solid Waste Management Rules 2021.

5.4 No Project Scenario

A 'no project' scenario would lead to magnification of the problems related to waste collection and management, soil quality, water quality, odor and air quality and drainage congestion related issues. It will also lead to development of unhygienic conditions in the Rangpur City Corporation due to poor the waste treatment and management system, from the households and the other solid waste sources. Therefore, it will pose threat to environment and health of the residents of the municipality. Hence, this alternative is undesirable as the development will be unplanned and will lack the basic infrastructure facilities leading to pollution and contamination.

6. POTENTIAL IMPACT IDENTIFICATION AND ASSESSMENT

6.1 Introduction

This section will identify and assess the potential effects that such a project will have on its immediate surroundings upon implementation. The aim is to take account of all of the likely but important environmental/project impacts and interactions, making sure those indirect and cumulative effects, which may be potentially significant, are not inadvertently omitted.

6.1 Methodology

The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors, described below.

Impact Magnitude- The potential impacts of the subproject have been categorized as major, moderate, minor and negligible based on consideration of the parameters such as: i) duration of the impact; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria. These magnitude categories are defined in Table-6.1.

Table 6.1: Parameters for Determining Magnitude

Parameter	Major	Medium/Moderate	Minor	Negligible
Duration of potential impact	Long term (more than 35 years)	Medium Term Lifespan of the project (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate Project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

Sensitivity of Receptor- The sensitivity of a receptor has been determined based on review of the population (including proximity/numbers/vulnerability) and presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity in relation to the topic. Criteria for determining receptor sensitivity of the subproject's potential impacts are outlined in Table-6.2.

Table 6.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	Vulnerable receptor with little or no capacity to absorb proposed changes
Severe	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

Assigning Significance- Following the determination of impact magnitude and sensitivity of the receiving environment or potential receptors, the significance of each potential impact has been established using the impact significance matrix shown below in Table-6.3.

Table 6.3: Significance of Impact Criteria

Magnitude of Potential Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Moderate	Negligible
Medium	High	High	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

6.3 Impacts of the Existing Baseline Condition

6.3.1 Air pollution

Open burning is commonly practiced in the dumpsite of Rangpur City Corporation in order to reduce waste volume. The fires generally burn very slowly, lasting over substantial periods of time and allowing the quantity and concentration of pollutants to buildup. Open burning of wastes releases toxic pollutants in the air which creates greater public health hazard. In addition, indiscriminate burning in dumpsite can exacerbate soil pollution, water pollution and loss of agricultural production.

Figure 6.1 Air Pollution observed in dumpsite of Rangpur City Corporation

6.3.2 Water pollution

The landfill site construction works could have the following negative impacts on surface water:

- Disruption of the watercourse hydraulic system through modification of the terrain and diversion of a tributary of the river; and

- Deterioration of surface water quality by a possible increase in sedimentary loads and the infiltration of organic matter into the run-off water flowing into rivers. Excavation and foundation laying works could create groundwater pollution through the infiltration of hazardous products (hydrocarbons, oil and grease, etc.)

6.3.3 Odor

Odor pollution is a serious nuisance to the local community of resides in the vicinity of dumpsite. In spite of the low population density in the area, passengers and pedestrians passing the dumpsite experience the stinky air.

6.3.4 Biological environment

Many local and migratory birds and other animals use the dumpsite of the Rangpur City Corporation as a feeding ground. Consumption of food from garbage can have both physical and toxicological implications on those animals. When birds feed on the site they are already drifting away from their natural diet. By eating landfill waste, they inevitably ingest plastic, aluminum, drywall and other common materials, many of which can be deadly. Cattles have been seen to consume food from the dumpsite, which may result entrance of plastic into the food chain of human being.

6.4 Screening out Areas of No Significant Impact

From the preliminary design and results of the rapid environmental assessment, it is clear that implementation of this subproject will not have major negative impacts because activities will be localized/site-specific and short in duration. Moreover, subproject construction will be conducted within a relatively small area with a short-time frame. Because of these, some aspects of the environment that are not expected to be significantly affected by the construction process have been screened out and will not be mentioned further in assessing the impacts of the construction process (Table-6.4).

Table 6.4: Fields in which the subproject is not expected to have significant impacts

Field	Rationale
Topography, geology and landforms	Required amount of materials will not cause alteration of topography and landforms.
Land use	There are no major changes in any areas to be affected by the subproject.
Tourism	Tourists mostly drive by the villages located as these are located on the highway.

6.5 Summary of Impacts

In addition to the impact identified in above for the technology's vision, design and planning, subproject's other potential impacts on the key environmental parameters have been assessed and their significance determined using the methodology described above. A summary of the potential impacts of the subproject on the key environmental parameters and significance of these impacts are presented in Table-6.5.

Table 6.5: Summary of the potential impacts other than identified in Table-6.1

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance after Mitigation
Environmental Impacts During Pre-Construction Phase								
Location impacts of the plant	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Natural calamities	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Sources of materials	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Testing of water quality	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Permits, clearances, NOC etc.	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
EMP implementation training	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Environmental Impacts During Construction Phase								
Physical and cultural heritage	Short term	Local	Yes	Occasional	Minor	Low	Negligible	Negligible
Excavations	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Waste management	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Water quality	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Air quality	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Noise level	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Biodiversity	Short term	Local	Yes	Likely	Minor	Mild	Moderate	Negligible
Socio-economic status	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Livelihood Impacts	Short Term	Local	Yes	Certain	Medium	Mild	High	Negligible
Provision of worker facilities	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Worker's health and safety	Long Term	Local	Yes	Certain	Major	Severe	High	Negligible
Community health and safety	Short term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Site Reinstatement	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Environmental Impacts During O&M Phase								
Health and safety risk of workers at plant	Long Term	Local	Yes	Certain	Major	Severe	High	Negligible
Efficient working of plant	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Water quality	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Biodiversity	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Air emission and odor	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance after Mitigation
Reuse and disposal of compost	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Traffic management	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible
Socio-economic aspect	Long term	Local	Yes	Certain	Medium	Mild	Moderate	Negligible

6.5.1 Anticipated Impacts of Pre-Construction Phase

Planning principles and design considerations will be incorporated in the site planning process whenever possible. The potential adverse impacts that are associated with planning and design are listed in Table-6.6.

Table 6.6: Anticipated Impacts of Pre-Construction Phase

Field	Impacts
Location impacts of subproject	Nearby community may be affected due to increased pollution during construction and operation.
Design of the subproject	Impacts to the livelihood of the Project affected people (Reference of Livelihood Restoration Plan)
Natural calamities	Subproject location is major flood prone and heavy storm area.
Sources of materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.
Permits, clearances, no objection certificate (NOC) etc.	Failure to obtain necessary permits and NOCs, etc. can result in design revisions and/or stoppage of works.
ESMP implementation training	Irreversible impact to the environment, workers, and community.

6.5.2 Anticipated Impacts of Construction Phase

The impacts during construction shall include generic construction related impacts associated with construction activities. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements. These are not expected to be significant, and can be addressed through adoption of good engineering and construction practices and construction methods. The potential adverse impacts that are associated with construction activities are listed in Table-6.7.

Table 6.7: Anticipated Impacts of Construction Phase

Field	Impacts
Physical and Cultural Heritage	Construction works will be on existing Landfill Site, thus risk for chance finds is very low.
Excavations	Potential erosion, dust generation, and accident. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.
Waste management	• Oil, grease etc. from construction machinery; • Hazardous and solid waste from waste construction material and food;
Water quality (surface and groundwater)	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.
Soil disturbance	The construction activities may cause soil degradation problems in the areas of plant etc.
Air Quality	Air pollution due to construction activities. The impacts are negative but short-term, impacts within a relatively small area and reversible by mitigation measures.
Noise Level	Construction activities will be nearby settlements. Temporary increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials and people. The impact is short-term and within a relatively small area and reversible by mitigation measures.
Biodiversity	• Clearing of existing vegetation may result in loss of associated ecological habitats and their fauna. • Noise, vibrations, and intrusive activities related to construction works may scare away animals remaining onsite after vegetation clearance.

Field	Impacts
Socio-economic status	• Manpower may be employed from local community during the construction and operation stage. Thus, potential impact is positive and long-term.
Provision of Worker Facilities	• Inconvenience to the communities due to presence of workers; • Solid waste and sanitary discharges from worker camps.
Occupational Health and Safety	Occupational hazards which can arise during work. Potential impacts are negative and long-term but reversible by mitigation measures.
	Health risk of construction workers due to COVID-19
Community health and safety	Construction works will impede the access of some residents in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.
Site reinstatement	Damage due to debris, spoils, excess construction materials

6.5.7 Anticipated Impacts of Operation Phase

Rangpur City Corporation shall be responsible for Operation and Maintenance of the subproject. In order to make the environmentally sustainable some mitigation measures are proposed to be integrated in the subproject design so that adverse impact will be minimize while on the other hand beneficial impact will be enhanced. Success of the proposed mitigation measures in the subproject's design needs to be monitored during operational stage as mentioned earlier. However. Still there are certain environmental risks from the operation of the subproject, most notably are handling of Solid waste compost plant, MRF, pyrolysis plant, leachate treatment plant etc. which can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the operating agency establishes a procedure to routinely check the operation and integrity of the plant, and to implement rapid and effective repairs where necessary. However, there is also an occupational health risk to workers engaged in plant maintenance activities. The potential impacts that are associated with the operational activities are listed down in Table-6.8.

Table 6.8: Anticipated Impacts of Operation Phase

Field	Impacts
Health and safety risk of workers	Risk of health of workers working in plant operation and maintenance, workers may suffer infectious diseases due to feedstock handling. Workers/plant operators may have accident risk of operation and maintenance of Incinerator Plant.
Efficient working of the plats and MRF	Inefficient working of plant may cause poor quality of treatment and resulting under treatment of solid waste may cause environment, health and safety risk to workers and environment.
Air emission	• Ambient Air quality of the subproject
Traffic management	• Random parking of vehicles and unplanned loading / unloading areas can lead to traffic congestion for distilled water transport
Socio-economic aspect	• Visual impacts. • Impacts on community health. • Employment.

6.6 Cumulative Impact Assessment

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

- of any potential residual project effects that may occur incrementally overtime;
- consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the project;

- potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed subproject; and
- future developments that are reasonably foreseeable and sufficiently certain to proceed

The project has identified the valued components as water quality, air quality, acoustic environment, socioeconomic and socio-community components, and human health and safety. There are no foreseeable projects that will overlap with the subproject. The spatial boundary of the subproject are the areas where the facilities (transfer stations, composting plant, associated medical waste management facilities, faecal sludge management facilities and controlled landfill) is located. The temporal boundary can be considered as the whole Rajngpur City Corporation area.

The infrastructures will be (i) designed to the current best practice standard and in line with the current LGED guidelines for a10-year design period;(ii) built that the floods do not damage them; and (iii) drains of the facilities are to be kept free from wastes and siltation.

Water quality. Due to nature of the subproject, there is risk of contaminating ground water and nearby bodies of water during O&M phase. However, the infrastructures have been designed ensuring impermeability of surfaces by having concrete surfaces for the transfer stations and composting plant while HDPE/clay liners for the controlled landfill. Drains within the facilities will also ensure wastewater generated during operations will be treated and diverted away from any channel leading to agricultural lands, water bodies, and water sources/tube wells. Short-term negative impacts are possible but can be mitigated through design and implementation of ESMP. Potential residual effects is considered to be negligible.

Air quality. Emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites during construction and O&M phases; these impacts will be short-term and localized to the immediate vicinity of controlled landfill site. Greenhouse gas (GHG)emissions may increase as a result of the subproject activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, land filling of residual wastes). Given the subproject's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

Acoustic environment. Noise levels during construction and O&M activities in immediate proximity of work sites are expected to increase. The duration of exposure will be relatively brief and imperceptible. The exposure represents a temporary, localized, adverse residual effect of low significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction and O&M activities. The overall significance rating of potential residual effects is considered to be negligible.

Socioeconomic and socio-community. Concerns on existing provisions for pedestrians, other forms of transport, and over-all impact on livability particularly nearby the transfer stations and composting plant will occur spatially during construction and O&M activities. Traffic movement will be improved once the construction activities are completed. Since the subproject involves small-scale facilities, it will not conflict with existing or planned land use. O&M manuals for the facilities, comprehensive capacity building, and community involvement to be provided under ISWMIP will ensure efficient operation of the facilities and acceptability by the stakeholders. However, following improvement in infrastructures and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance Rangpur City Corporation area. This can be considered a long-term cumulative benefit of the subproject.

Given the scale of the project it is likely that a number of local people will obtain at least temporary socio-economic benefits, by gaining employment in the construction workforce, and thus raising their levels of income. In addition, a significant number of employments will be generated associated with the O&M of the facilities to be developed under the subprojects. These benefits can bring wider social gains if they are directed at vulnerable groups.

Community and workers health and safety. No adverse residual effects to human health will occur as a result of construction or O&M activities, and mitigation measures are in place to ensure

public and worker safety, and will be closely monitored. While exposure to elevated noise levels, fugitive dust and common air pollutants will occur in proximity to worksites, due to their short-term and localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

Upon completion of the subproject, the socio-community will be the major beneficiaries of this subproject. With the improved solid waste management facilities, additional vehicles and workers PPE, they will be provided with reliable and climate-resilient municipal services. In addition to improved environmental conditions, the subproject will reduce occurrence of diseases and people would spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health. These are considered a long- term cumulative benefit.

Therefore, the project will benefit the public by contributing to the long-term improvement of municipal services and community livability in Rangpur City Corporation area.

7. INFORMATION DISCLOSURE, STAKEHOLDER ENGAGEMENT

7.1 Introduction

The information disclosure, consultation and stakeholder engagement process for this subproject is to disclose, inform, consult, engage, collaborate and empower the communities and other local stakeholders from the planning to implementation at the Rangpur City Corporation. Consultation and participation have been undertaken to achieve specific objectives at subproject identification, planning, design, implementation and evaluation stages. Disclosure, consultation and participation (DCP) of the affected persons and beneficiaries in project planning and implementation are the keys to success of any project. The DCP creates opportunities for them to voice their opinions and concerns and offers opportunities to participate in the project design, planning and implementation processes. The Safeguard Policy of AIIB emphasizes upon ensuring formulation and execution of development projects in compliance with environmental and social safeguards, which requires the executing agency to conduct meaningful consultation with displaced persons, their host communities, and civil society organizations. Consultation process encompasses timely disclosure of relevant and adequate information to the project stakeholders and thereby promotes transparency, sustainability and opportunities for amicable conflicts management reducing the risks of project implementation delays.

7.2 Objective of Stakeholder Engagement

The objectives of engaging stakeholders during the ESIA process as well as throughout the subproject implementation includes:

- **Ensuring Understanding:** An open, inclusive and transparent process of engagement and communication will be undertaken by the IPDC (Inclusive Participation, Discloser, and Consultation) to ensure that stakeholders are well informed about the proposed development. Information will be disclosed as early and as comprehensively as possible.

- **Involving Stakeholders in the Assessment:** Stakeholders were included in the scoping of issues, the assessment of impacts, and management/mitigation measures defined in the ESIA report. They also played an important role in providing local knowledge and information for the social baseline and informing the social impact assessment.

- **Building Relationships:** Through supporting open dialogue, engagement will help to establish and maintain a productive relationship between the IPDC team and stakeholders. This supported not only an effective ESIA, but also will strengthen the future relationships between the IPDC and stakeholders.

- **Managing Expectations:** It is important to ensure that the proposed subproject does not create, or allow, unrealistic expectations to develop among stakeholders about potential Project benefits. The engagement process will serve as a mechanism for understanding and managing stakeholder and community expectations, by disseminating accurate information in an easily understandable manner.

- **Ensuring Compliance:** The process is designed to ensure compliance with both local regulatory requirements and international best practice.

7.3 Approach and Methodology of Stakeholder Engagement

The stakeholder engagement activities will provide stakeholder groups with relevant information and opportunities to voice their views on issues that matter to them/affect them. The mechanism of information dissemination should be simple and be accessible to all. Two of the important means that have been followed until now include briefing material and organization of community consultation sessions. The briefing material (all to be prepared in local language) can be in the form of

(a) brochures (including project information, details of entitlements including compensation and assistance to be given to the PAPs; grievance mechanism) that can be kept in the offices of local self-government (gram parishad office) and project office;

(b) posters to be displayed at prominent locations and

(c) leaflets that can be distributed in the subproject areas.

Consultation meetings should also be organized at regular intervals by the project to acquaint the communities, target group beneficiaries and affected persons of the following:

- Timeline and progress of the subproject by components.
- Information on beneficiary participation.
- Information of involuntary displacement, compensation and entitlements.
- Information of participation of small ethnic communities.
- Timeline for acquisition of land using voluntary donation, direct purchase and any other voluntary approach.

In addition, opinion and consensus of the community needs to be sought for livelihood transformation, relocation of any community assets and involuntary resettlement management. Information disclosure procedures are mandated to provide citizen eccentric information as well as all documentation necessary for addressing any queries. Disclosure of information will enhance governance and accountability specifically with respect to strengthening of monitoring indicators to help the AIIB monitor compliance with the agreements and assess impact on outcomes. However, it is to be noted that only digital, internet, social media etc. will be followed where face to face interaction can be conducted by following the COVID-19 protocols until COVID -19 situation improves. Other on-line based platforms can also be used, such as web-conferencing, webinar presentations, web-based meetings, Internet surveys/polls etc. especially due to COVID -19 related restrictions.

The stakeholder engagement activities that Rangpur City Corporation authority will undertake for their project. The activity's types and their frequency are adapted to the three main project stages: project preparation (including design, procurement of contractors and supplies), construction, and operation and maintenance. The methods used would vary according to the target audience and would include:

- Public/community meetings, separate meetings for women and vulnerable
- Face-to-face meetings
- Focus Group Discussions/Key Informant Interviews
- Workshop with the Experts
- Surveys, polls etc.
- Interviewing stakeholders and relevant organizations
- Mass/social media communication (as needed)
- Disclosure of written information: brochures, posters, fliers, Rangpur City Corporation and LGED website

7.4 Stakeholder Engagement Plan

The consultation should continue throughout the project cycle to achieve highest scale of effectiveness of resettlement implementation. Several additional rounds of consultations with affected persons will be required during RP implementation. The next round of consultations will be required prior to start of compensation payment and assistance. For the benefit of the community in general and affected persons in particular, the RP should be made available at LGED local offices and at city corporation. For continued consultations, the following steps are envisaged:

- Key features of the ESIA particularly the Environmental and Social awareness and institutional arrangements for grievance redress should be summarized in a leaflet and distributed among

the DPs and their communities along the subproject corridor.

- LGED will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders to encourage the participation of the APs in ESIA implementation.
- Attempts should be made to ensure that vulnerable groups understand the process and take their specific needs are considered.
- Final safeguard documents will be placed in LGED and AIIB websites before implementation of the subproject, whose reference link has to be shown in the summarized leaflet.

The stakeholder engagement plan is listed in Table -7.1 below.

Table 7.1 Stakeholder engagement plan of the RpCC subproject

Stakeholders	Category of stakeholder	Brief profile	Overall influence on Subproject	Basis of Influence Rating
Subproject Management				
Rangpur City Corporation Subproject	Primary	Rangpur City Corporation is the primary Subproject proponent own a controlling stake of 100% in the Subproject	Highest	▪ Are the primary Subproject proponents? ▪ Responsible for operation of this Subproject ▪ Primary financial beneficiaries ▪ Responsible for all the Subproject related risks and impact liabilities
Community				
Local Community	Primary	Primarily includes adjacent community to the Rangpur City Corporation subproject area.	Medium	▪ No major restrictions around the Subproject site especially with respect to grazing land ▪ Subproject bring development to the area ▪ in employment opportunities and preference in job ▪ Minimize impact
Regulatory/Administrative Authorities & Agencies				
Local Government Engineering Department (LGED)	Primary	LGED is the primary government executing authority for the construction of all ISWMIP subprojects	High	▪ Are the primary Subproject executing authority ▪ Responsible for construction of this Subproject ▪ Responsible for all the Subproject related risks and impact liabilities of construction stage
Department of Environment, Bangladesh	Primary	The Department of Environment is the primary government regulatory authority for	High	▪ Responsible for monitoring Subproject's Environmental compliance throughout the Subproject lifecycle

Stakeholders	Category of stakeholder	Brief profile	Overall influence on Subproject	Basis of Influence Rating
		Environmental protection in Bangladesh.		
Other Regulatory & Permitting Authorities	Primary	DAE, DOF	High	▪ Agencies required for obtaining permits and licenses for operation of the Subproject ▪ Primary involvement during operation phases
Political Administration				
Thana (sub–District Level) Political Administration	Secondary	Elected representative of people at sub-district level for a fixed tenure	Medium	▪ Key linkage between the community and the Subproject proponent
Ward Councilor/ leaders & local representatives	Secondary	Elected representative at union level i.e., village level for a fixed tenure	Medium	▪ Plays important role in providing public opinion and sentiment on the Subproject ▪ Empowered to provide consent and authorization for establishment of Subproject on behalf of the community

Detail of FGDs, KIIs and Stakeholder Consultation meeting are listed in Table-7.2.

Table 7.2 FGDs, KIIs and stakeholder consultation meeting details of Rangpur CC

Sl. No.	Meeting Type	Group Identity	Discussed Issue	Meeting Venue	Meeting Date	No. of Participants
1	Individual discussion with the affected people	Affected people of the community	Loss of livelihoods (Inside the buffer zone)	Spot discussion inside the buffer zone.	18 and 19 January 2023	6
2	Individual Interview	Income loser group (Waste picker inside the landfill)	Loss of income	Spot discussion inside the landfill.	18 and 19 January 2023	12
3	Individual discussion	Waste picker inside the town	Income survey	Spot discussion inside the town.	18 and 19 January 2023	3
4	Individual Interview	Income loser group (Vangari shop located beside the landfill)	Loss of income	Spot discussion beside the landfill.	18 January 2023	2

Sl. No.	Meeting Type	Group Identity	Discussed Issue	Meeting Venue	Meeting Date	No. of Participants
5	Individual interview	Vangari shop located inside the town)	Income survey	Spot discussion inside the town.	19 January 2023	10
6	Individual interview	Affected Van Driver (inside the town	Income Survey	Spot discussion inside the town.	19 January 2023	9
7	Individual interview	Ferriwala group	Income survey	Spot discussion inside the town.	19 January 2023	6
8	Individual interview	Income loser group (Whole seller shop located beside the landfill)	Loss of income	Spot discussion inside the town.	18 January 2023	4
9	Individual interview	Broker group	Income survey	Spot discussion inside the town.	18 and 19 January 2023	3
10	FGD	Male and Female group (Enlisted Street sweeper of the Rangpur city corporation)	Development of livelihood	Sweeper Colony		17

One Focus Group Discussion (FGD) was conducted with 17 sweepers in the sweeper colony of Sathmatha, Rangpur City Corporation, besides the landfill area. Among them, six were female, and 11 were male. All of them are from the Harizon community. Additionally FGDs for five proposed Secondary Transfer Stations (STSs) were conducted at five different selected locations of Rangpur City Corporation (RpCC) from 6 to 7 June 2023. Altogether, 73 participants attended these 5 FGDs, of which 55 were from the local communities and 16 officials from RpCC. Out of the total community participants, more than 16% were female. Interviews were also conducted with individual groups from the project area. The participants were from different groups like businessmen, NGOs, housewives, teachers, and service holders. Apart from the participants above, Municipality officials and the members of the consultant team were present. Figure below show the photographs of the meetings. Detailed documentation including attendance sheets are provided in the Livelihood Restoration Plan.

Photographs of Focus group discussions and Consultation Meeting of Stakeholders

7.5 Public Consultation Meetings

In the FGDs and stakeholder consultation meeting, maximum efforts have been given to get feedback from the participants on their views on the nature of environmental (physical, ecological and social) impacts. Subsequently, their suggestions about the ways to mitigate the adverse impacts and enhance beneficial impacts for the proposed Rangpur City Corporation ISWMIP's subproject were also recorded. People who participated in the public consultations were found to be enthusiastic in sharing their views. The participants expressed their opinions and concerns regarding the different issues including the socioeconomic condition of people in their localities, possible impact of the proposed Rangpur City Corporation subproject on the existing local environment and in their lives and livelihood. They also suggested mitigation measures to address the adverse impacts. The major findings of the Stakeholder Consultations, FGD & KIIs for the Rangpur CC subproject are summarized below:

(i) General opinion regarding the proposed ISWMIP's Subproject

- ✓ Most of the participants know the ISWMI Subproject at their locality before interaction with the field ESIA team, which indicates that proper information has been disseminated to them, though the upcoming interventions are unknown to them.
- ✓ Most participants displayed their supportive attitude for ISWMIP with some concerns such as
    - o Waste to Gas generation and raw materials of road construction;
    - o Noticed the positive and negative sides of the Subproject from their perspective. For example, people's life and livelihood have changed, new employment opportunities have come up, air, noise and water pollution potential have increased, etc.
- ✓ Local Representatives believes that more participation could be possible in various ways such as
    - o Administrative / institutional support as and when necessary,
    - o Worker safety during road crossing,
- ✓ Ward councilor opined that public awareness should be increased to educate the households about the waste segregation at source as well as appropriate disposal of the wastes at the allocated waste bins or secondary transfer stations.

(iii) Expectation of Local People

- ✓ Ensure local recruitment as per skill & non-skill qualifications.
- ✓ Ensure pollution (Air, Noise, Water, Solid Waste) free safe environment in and around the Subproject area.

7.6 Public Disclosure

Distribution of the disclosure materials will be through making them available online under the COVID-19 situation. Upon improvement of the situation, distributions of the disclosure materials will be through making them available at venues and locations frequented by the community and places to which public have unhindered access in the usual manner. Free printed copies of the executive summary of the ES documents in Bangla and English will be made accessible for the general public at the following locations:

- LGED Headquarters, Agargaon, Dhaka
- Affected District Administration office
- Rangpur City Corporation Office
- Local NGO offices;
- Other designated public locations to ensure wide dissemination of the materials.
- Newspapers, posters, radio, television.
- Information centers and exhibitions or other visual displays.
- Brochures, leaflets, posters, nontechnical summary documents and reports.
- Official correspondence, meetings

The final ESIA report should be made available at accessible places stated above, and the executive summary should be translated into local language (Bangla) and posted in the LGED and AIIB websites. The final ESIA document will be shared with AIIB for clearance and disclosure according to its procedure. As a part of the disclosure, all versions (Bangla and English) should be made available at the subproject office in addition to LGED's website. Focus group discussion and public consultation meeting attendances is attached as Appendix XIV.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Introduction

The primary objective of the environmental and social management plan (ESMP) is to record environmental and social impacts resulting from the sub-project activities and to ensure implementation of the identified "mitigation measures", in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operational phases of the sub-projects.

8.2 Mitigation Measures For E&S Impacts

8.2.1 During Preconstruction

Based on the possible impacts during pre-construction phase, mitigation measures have been suggested for the proposed subproject. A set of mitigation measures against possible environmental and social impacts due to an improvement project at its pre-construction phase is proposed in the following Table 8.1.

Table 8-1: Proposed mitigation/enhancement measures during pre-construction phase of construction, rehabilitation and maintenance of infrastructure project under LGED.

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
Commercial Structures	▪ Loss of commercial structures; ▪ Dust pollution; ▪ Loss of income and livelihoods.	▪ Avoid the housing and commercial structure during the finalization of the alignment and location of the bridge; ▪ Proper compensation should be given before starting the removal or dismantling works; ▪ Create job opportunities for the PAPs. ▪ Water spraying on the bear surface or dust pollution source;	Contractor	LGED
Loss of vegetation/ tree	▪ Accident risk during removal of trees/vegetation's in the project sites; ▪ Birds and others species can migrate from the trees/vegetations; ▪ Impacts on the local climatic condition.	▪ Prior to start construction, all vegetation should be removed from the proposed construction sites with the consultation of the local relevant authorities; ▪ Avoid disturbance and careful during construction vehicle and equipment movement; ▪ Proper H&S measures (use of appropriate PPE such as hand gloves, safety shoes and helmet) for the workers should be taken during removal of trees, bushes & crops; ▪ To mitigate the ecological impact, tree plantation plan can be considered in the design & accordingly tree plantation will be done in an appropriate location to be determined by the LGED after consultation with the concerned authority; ▪ Proper H&S measures (use of appropriate PPE such as hand gloves, safety shoes and helmet) for	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
		the workers should be taken during removal of trees, bushes & crops; ▪ To mitigate the ecological impact, tree plantation plan can be considered in the design & accordingly tree plantation will be done in an appropriate location to be determined by the LGED after consultation with the concerned authority; ▪ The engineer shall approve such felling; only when the proponent secures receive a "clearance" for such felling from the LGED, as applicable; ▪ Tree felling, if unavoidable, shall be done only after compensatory plantation of at least two saplings for every tree cut is done; ▪ During the tree removal from the proposed construction sites diameter at best height (DBH) of the trees is 6 inches, only such trees should be considered by the contractor for compensation and plantation; ▪ Tree plantation at the suitable locations after completion of the construction activities.		
Removal of Utilities	▪ Vulnerable for workers health and safety; ▪ During movement of heavy Construction machineries equipment's can damage the utility services if not previously removed; ▪ Due to carelessness or incautiousness death from sudden electric shocks may occur.	▪ Prior to start construction, the utility services (electrical cables, telephone line, water supply pipeline, gas supply pipeline and internet line) if applicable should be shifted with the consultation of the relevant organizations; ▪ Inform the local community before starting removal or demolishing work; ▪ Carefully remove the utilities that are connected to any structures; ▪ Proper Health and safety measures for the workers should be taken during shifting of these lines to avoid any incidents.	Contractor	LGED
Dismantling	▪ Dust pollution in the construction site; ▪ Health hazard for the workers and community during dismantling works; ▪ Noise level increase;	▪ Notify the adjacent community before starting the demolishing work; ▪ During the removal or demolition of existing structures if required will be fully removed by the contractor; ▪ Spraying of water in the dry land or from where there is a possibility to generate dust;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
	▪ Vibration effects on the structures on the surrounding of the project area; ▪ Surface water contamination, blockage of navigation and drainage, impacts on aquatic animal; ▪ A detail of the dismantling plan is also given in the Annex-C.	▪ Banned fishing, swimming, boat movement activities in the construction sites, if applicable; ▪ Proper H&S measures for the workers such as using of appropriate PPE (helmet, Earplug, musk, safety shoes, hand gloves etc.) should be taken to avoid any accidents; ▪ Construct noise barrier around the dismantling site; ▪ Stop the engine when it is not required; ▪ Monitor Noise level as per DoE guidelines; ▪ Impact wise mitigation measures are given.		
Setting up labour camps	▪ Land encroachment; ▪ Solid and liquid waste from the labour camp	▪ Labour camp should be constructed at a distance from the water bodies; ▪ Avoid productive land and away from the settlement during the selection of land for the setup of labour camp; ▪ No solid and liquid waste discharge into the water bodies; ▪ Instruct workers to maintain clean environment in the camps.	Contractor	LGED

8.2.2 During Construction

Possible environmental impacts during construction phase from the project construction, rehabilitation and maintenance activities have been identified. For mitigating the possible environmental impacts during construction phase mitigation measures are given in the following Table 8.2.

Table 8-2: Proposed mitigation/enhancement measures during Construction phase of project construction, rehabilitation and maintenance program under LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
Air Pollution	▪ Construction vehicular traffic: Air quality can be affected by vehicle exhaust emissions and combustion of fuels ▪ Construction equipment: Air quality can be adversely affected by emissions from construction machineries and combustion of fuels;	▪ Fit vehicles with appropriate exhaust systems and emission control devices; ▪ Maintain vehicles and construction equipment in good working condition including regular servicing; ▪ Operate the vehicles in a fuel-efficient manner; ▪ Impose speed limits at 30 km/hour on vehicle movement at the worksite to reduce dust emissions;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	▪ Construction activities: Dust generation from earth excavation, earth & sand stockpiles during dry period.	▪ Control the movement of construction traffic in the access road; ▪ Focus special attention on containing the emissions from generators; ▪ Construction equipment causing excess pollution (e.g. visible smoke) will be banned from construction sites immediately prior to usage; ▪ Water spray to the dry earth/material stockpiles, access roads and bare soils as and when required to minimize the potential for environmental nuisance due to dust; ▪ Increase the watering frequency during periods of high risk (e.g. high winds); ▪ Stored materials such as: excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their wind drifted; ▪ Restore disturbed areas as soon as possible by vegetation; ▪ Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations; ▪ The Air quality monitoring should be carried out by the contractor following the National Air Quality Standard ▪ (Schedule-I Standards for Ambient Air Quality, Air Pollution (Control) Rules 2022. .		
Noise Pollution	▪ Construction vehicular traffic: Vibration and	▪ Strict measures for noise pollution control need to be undertaken	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	Noise quality will be deteriorated due to vehicular traffic. ▪ Construction equipment: Noise and vibration will have an impact on adjacent surrounding residents. Construction activity: Noise will have an impact on adjacent residents.	during construction activities; ▪ Create noise barrier and consider the minimum noise levels at sensitive receptor sites (e.g. dense residential area, schools, mosques, health centers etc.); ▪ Stone breaking machine should be confined within a temporary shed so that noise pollution could be kept minimum; ▪ Protection devices (ear plugs or ear muffs) shall be provided to the workers operating in the vicinity of high noise generating machines during construction; ▪ Construction equipment and vehicles shall be fitted with silencers and maintained properly; ▪ Instruction to the drivers to avoid unnecessary horn; ▪ The Noise level monitoring should be carried out by the contractor following the National Noise Quality Standard (Noise Pollution (control) rules 2006). ▪ Vibration monitoring should be carried out by the contractor.		
Ground Water Pollution	▪ Contamination of groundwater due to Pollution lack of septic tanks or mobile toilets; ▪ Accidental spillage of hazardous liquid from the construction camps.	▪ The contractor will make arrangement for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected; ▪ Handling and storage of the potential contaminants has to be organized under strict condition to avoid water pollution during construction; ▪ Handling of hazardous liquid should be done	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		carefully by the designated experienced person; ▪ Handling and storage of the potential contaminants should be done by the experienced workers. Proper monitoring should be done by the experienced person; ▪ The Ground water quality monitoring should be carried out by the contractor following the National Water Quality Standard (Schedule-2 (kh): Standards for Potable Water, ECR, 2023).		
Surface Water Pollution	▪ Construction & general wastes from the construction sites; ▪ Oil spill from the construction vehicles and construction camp can affect on fishes and aquatic wildlife (such as snakes, frogs etc.)	▪ Contractor should prepare Waste Management Plan and follow it properly during the construction period; ▪ Any wastes should not be throwing into the river/khal/canal other than dump into the designated waste dumping area; ▪ Store the oil and petroleum product in a separate location cover by a concrete structure; ▪ Handling of hazardous liquid should be done carefully by the designated experienced person; ▪ Monitor the surface water by testing in designated Laboratory should be done by the Contractor following the National Water Quality Standard (Schedule-2 (ka (I)): Standards for Inland Surface Water, ECR, 2023).		
Land/ Soil Pollution	▪ Decrease the production capacity of agricultural land;	▪ Avoid the productive land, agricultural land, archaeological sites, protected area, forest	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	▪ Land or soil erosion from water or wind; ▪ Sediment pollution and increase the turbidity; ▪ Reduction the microorganism.	area, natural habitat etc.; ▪ Land/soil quality should be ensured by the contractor to fill the abutment area and approach road; ▪ Soil from fallow land should be used in earthwork in approach road; ▪ Re-vegetation the exposed area as early as possible to reduce the soil erosion; ▪ Create barrier for reducing the sedimentation into the water bodies; ▪ The Land or soil quality test should be carried out by the contractor.		
Waste (Solid, Liquid and Hazardous) Pollution Organic waste: remaining foods, leafs, papers, straw, fruit cover etc. Inorganic waste: Polythene, Glasses, Synthetic paper, plastic etc. Hazardous waste: Paint, fuel, chemicals, oil, petroleum products, bitumen etc.	▪ Improper storage and handling of construction & general liquid waste such as fuels, lubricants, chemicals and hazardous liquid onsite, and potential spills from these liquid materials may harm the environment and health of construction workers. ▪ Improper storage and handling of construction & general solid wastes.	▪ The contractor will minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes); ▪ Any wastes should not be throwing into the river/khal/canal other than dump in to the designated waste dumping area; ▪ Handling of hazardous liquid should be done carefully by the designated experienced person; ▪ Organic waste should be managed by composting method. A concrete chamber with 3 rooms is needed to be provided. In one room organic waste should be dumped and another room inorganic waste will be dumped. When the room will be filled then covered by earth. Then dump to the third room. After 6- month organic waste will be	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		converted into fertilizer and will be used by the farmers; ▪ Inorganic waste should be given to the authorized vendor for free of cost for recycling; ▪ Accidental spillage of hazardous waste should be managed by spreading wood powder on the surface of the oil and this powder mixed with oil must store in a designated concrete room; ▪ Provide appropriate PPE to the construction personnel for handle construction materials; ▪ Make sure all containers, drums and tanks that are used for storage are in good condition; ▪ Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution; ▪ Waste water monitoring should be carried out by the contractor, following the national standard (Schedule-10: Standard for waste from Industrial units or Projects waste).		
Hydrological Regime	▪ Drainage congestion and flood at the site.	▪ A detailed hydrological and morphological study of the site (in case of landfill and waste to energy plant) should be conducted; ▪ Proper design and construction accordingly to accommodate flood level; ▪ Wastes should not be disposed near any water body. All waste depending on its	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		characteristics, should be disposed of in a controlled manner.		
Drainage Congestion	▪ Construction of diversion road on the river/ Khal/canal create drainage congestion; ▪ Stockpiling of construction materials in the river/khal/canal also create drainage congestion.	▪ Immediately remove all the construction debris from the construction site as well as from the water bodies in a planned way; ▪ Duration of stockpiling should be minimized as much as possible; ▪ Avoid the encroachment of the water bodies; ▪ Protect water bodies from sediment loads by silt screen or bubble curtains or another barrier; ▪ Construction activity should be recommended during the dry season; ▪ Construction workers shall be instructed to protect water resources;	Contractor	LGED
Erosion and Siltation	▪ Bank erosion at the project site will loss of lands; ▪ Vulnerable for the structures; ▪ Increase turbidity and impact on aquatic life; ▪ Loss of productive land, structures, resources.	▪ Introduce bank protection activities; ▪ Use of geo-bag, stone and concrete to construct the protection wall; ▪ Plantation more vegetation to reduce surface soil erosion and enhancement of the soil compactness and stability.	Contractor	LGED
Road Traffic and Accidents	▪ Increased traffic use of narrow access road by construction vehicle will affect the movement of normal road traffics and the safety of the road users specially the students	▪ Proper Traffic Management Plan (TMP) should be prepared by the contractor during starting of construction & follow it strictly; ▪ In this TMP, the road safety measures such as speed breakers, warning signs/lights, road safety signs, flagman etc. should be included to ensure uninterrupted traffic;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		▪ Movement specially at nearby the educational (Schools, colleges, Madrasha etc.), community infrastructure (mosques, graveyards, Prayer Ground etc.) and health complex; ▪ In addition, BRTA traffic rules and regulations should be strictly followed; ▪ Divert traffic to follow alternative routes to avoid traffic jams; ▪ Avoid talking with mobile during driving.		
Quarries and Borrow Pits	▪ Increased noise level caused by blasting, movement of construction vehicles; ▪ Increased noise level will be impacted on the local community; ▪ Air pollution due to diesel fumes and dust generation resulting from the presence of construction machinery and site cleaning activities.	▪ Create noise barrier around the construction site; ▪ Stop unnecessary engine operation in the construction site; ▪ Maintain vehicles and construction equipment in good working condition including regular servicing; ▪ Control the movement of construction traffic in the access road; ▪ Construction equipment causing excess pollution (e.g. visible smoke) will be banned from construction sites immediately prior to usage; ▪ Water spray to the dry earth/material stockpiles, access roads and bare soils as and when required to minimize the potential for environmental nuisance due to dust; ▪ Stored materials such as: excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their wind drifted; ▪ Restore disturbed areas as soon as possible by vegetation.	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
Landscape and Aesthetics	▪ Excavation of borrow pits, stock piling of construction materials, placing of construction equipment and parking of construction vehicles; ▪ Presence of construction camps, equipment and their activities; ▪ Movement of construction vehicles on the existing road network and temporary haul roads;	▪ Parking of construction vehicles and stockpiling of construction materials/excavated earth should be done in systematic way to avoid the damaging of aesthetics of the site; ▪ Duration of stockpiling should be minimized as much as possible; ▪ Vegetation plantation after complete of the construction work; ▪ Completely remove the construction on camp facilities, equipment's and their activities; ▪ Limit the speed of the vehicles and cover the vehicles during the movement or transportation of materials on the existing road network and temporary haul road; ▪ Plantation of trees at the construction site after completion of the construction activities immediately.	Contractor	LGED
Occupational Health and Safety	▪ Campsites for construction workers and Safety are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	▪ Construction workers camp shall be located at least 500 m away from the nearest habitation; ▪ Consider the location of construction camps away from communities in order to avoid social conflicts; ▪ Create awareness among the camp users on health and safety requirements to be maintained and code of conduct.	Contractor	LGED
	▪ Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate	▪ Adequate housing for all workers should be provided avoiding over crowing; ▪ Safe and reliable water supply; ▪ Hygienic sanitary facilities and sewerage system.	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	substandard living standards and health hazards			
	▪ Management of wastes is crucial to minimize impacts on the environment.	▪ Ensure proper collection and disposal of solid wastes within the construction camps; ▪ Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at sources; ▪ Dispose organic wastes in a designated safe place on daily basis; ▪ The organic wastes should be always covered with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, etc. are not attracted; ▪ Locate the garbage pit/waste disposal site minimum 500m away from the resident area so that people are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places.	Contractor	LGED
	▪ There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices.	▪ Provide adequate health care and sanitation facilities within the construction sites;	Contractor	LGED
	▪ There will be an increased risk of work crews spreading sexually transmitted infections and HIV/ AIDS.	▪ Train all construction workers in basic sanitation and health care issues and safety matters and on the specific hazards of their work; ▪ Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information,	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		education and communication for all workers on regular basis; ▪ Regular mosquito repellant spraying during monsoon periods.		
	▪ Health risk of construction workers due to COVID-19	▪ Prepare the health and safety guidance for COVID-19 at work sites and get approval from MWMU; ▪ Strictly follow and implement the H&S guidance for COVID-19 at worksite; ▪ Everyone entering the worksite must wear a mask, gloves and hard shoes. ▪ At the entrance of the worksite/camp site every personnel must wash their hands for 20 second with maintaining a distance of at least 1m (3 ft) from each other; ▪ Discourage site personnel to gather and gossip at any time, rather encourage physical distance while chatting/discussing. ▪ Ensure sufficient stock of soap, sanitizer, washing facility and safe water at the workers' dwelling (both camp site and home). ▪ Encourage frequent hand washing and social distancing at campsite. ▪ Ensure personal distance at least 1 meter (3 feet), preferably 2m (6ft) during lunch, dinner and prayer. ▪ Train workers on how to properly put on, use/wear, and take off protective clothing and equipment. Make these trainings mandatory at worksites and provide 10-15 minutes of a workday for such	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		'training and encouragement' activities.		
	▪ Construction work may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths.	▪ Provide the workers a safe and healthy work environment; ▪ Provide appropriate PPE for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields and ear protection; ▪ Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones; ▪ Appoint an environment, health and safety manager to look after the health and safety of the workers; ▪ Inform the local authorities responsible for health, religious and security before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.	Contractor	LGED
	▪ Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victim.	▪ Provide health care facilities and first aid facilities are readily available; ▪ Document and report occupational accidents, diseases, and incidents and actions taken; ▪ Identify potential hazards to workers, particularly those that may be life threatening and provide necessary preventive and protective measures; ▪ Provide awareness to the construction drivers to strictly follow the driving rules;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		▪ Provide adequate lighting in the construction area and along the roads in the construction site.		
Community Health and Safety	▪ Accidents on the approach road and construction site; ▪ Noise and dust pollution; ▪ Communicable diseases can spread among the local community.	▪ Prior to start the construction activities contractor will be informed the local community; ▪ Instruct the drivers and limit the speed of the vehicles; ▪ Regular health checkup of the workers and awareness training about the communicable diseases; ▪ Proper lighting at the project site during the night time; ▪ Avoid unnecessary noise pollution; ▪ Spraying water in the dry surface to reduce the dust pollution ▪ Provide proper access control to the project site and unauthorized entry to the project site will be controlled.	Contractor	LGED
Impacts on Archaeological/ Historical/ Social/ Cultural/ Religious Sites	▪ Air and dust pollution; ▪ Noise level may create uncomforted; ▪ Vibration can affect social/ cultural/ religious sites.	▪ Create temporary barrier around the project site; ▪ Regular spraying of water in the construction site and approach road to reduce the dust emission; ▪ Control the speed limit about 30 km/hour in the construction site and approach road; ▪ Construction activities should be continued during day time only; ▪ Carefully handling of construction machineries and equipment's near the sensitive receptors near the project site.	Contractor	LGED
Housing and Commercial Structures	▪ Air and dust pollution;	▪ Spraying water on the dry surface to reduce dust pollution;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	▪ Noise level may create uncomforted; ▪ Loss of income and employment; ▪ Mental stress; ▪ Resettlement or removal due to realignment of approach road; ▪ Vibration can affect on structures.	▪ Create noise barrier around the construction sites; ▪ Limit the speed of vehicles in the construction site; ▪ Prior notice to the local inhabitants for resettlement issues if required; ▪ Compensation should be given to the PAPs in-time according to RP; ▪ Realignment of approach road if required; ▪ Job opportunities for the PAPS and priority should be given; ▪ Plantation of trees in an appropriate location will be determined by the LGED after consultation with the concern authority (Forest Department).		
Flora and Fauna	▪ Dust will be generated during earthwork and deposited on the leaves of nearby trees; this will abduct the growth of trees. ▪ Construction activities will increase sediment loading of streams and changes in turbidity will impact adversely upon fishes and aquatic animals. ▪ Diversion at bridge site will act as barriers to the migration of fishes and aquatic animals. ▪ Noise generation from the construction vehicles and equipment's can create disturbance for	▪ Proper construction management plan should be introduced in the Contractor LGED construction sites; ▪ Regular water spraying in the dry area from where there is a possibility to dust pollution; ▪ Proper management plan for the waste management in the construction sites; ▪ Construction work should be preferred during dry season; ▪ No disturbance for aquatic animal and keep provision for the fish movement; ▪ Diversion road should be removed properly as soon as possible; ▪ Construction activities should be continued during day time only; ▪ Create noise barrier and avoid unnecessary machineries and equipment's operation;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
	the birds and wildlife;	▪ Vegetation plantation after compilation of the construction work; ▪ Construction workers shall be instructed to protect natural resources, flora and fauna, including wild animals and aquatic life, hunting and unauthorized fishing are prohibited; ▪ Natural river/khal/canal will be reinstated after completion of construction works; ▪ Fingerling (fish) can be released to the river/khal/canal near the bridge site to boost up the fish resources.		
Disturbance to Wildlife Movement	▪ Noise from construction machineries and vehicles, movement of workers likely to be disturb the movement of wildlife; ▪ Permanent migration may occur from the area; ▪ Increase of mortality due to collision with vehicles;	▪ Instruct workers and contractors to avoid harassment and Contractor LGED disturbance of wildlife; ▪ Schedule activities to avoid disturbance of wildlife during critical periods of the day (e.g., night) or year (e.g., periods of breeding, nesting); ▪ Turn off all unnecessary lighting at night; ▪ Maintain noise-reduction devices (e.g., mufflers) in good working order on vehicles and construction equipment; ▪ Temporary fencing around the construction site during construction period; ▪ Educate workers regarding the occurrence of important resources in the area and the importance of their protection, including the appropriate regulatory requirements;	Contractor	LGED

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigate Measures	Responsibility	
			Implementation	Supervision
		▪ Regular monitoring of the death and disturbance of wildlife in the construction site.		
Fisheries and other Aquatic Animals	▪ Increase turbidity and siltation can spawning beds for fish; ▪ Noise from pile driving activities, aquatic animals including fishes will be affected; ▪ Turbid water can reduce the infiltration of sunlight into deep water.	▪ Construction activities is preferred during the dry season; ▪ Careful handling of construction waste in the construction site; ▪ Introduction of land/soil erosion and dust control practices in the construction site; ▪ Provide adequate space for movement and safe passage of fishes and other aquatic animals; ▪ Schedule activities to avoid disturbance of fish and aquatic anima during critical periods of the day (e.g., night) or year (e.g., periods of breeding); ▪ Turn off all unnecessary lighting at night to avoid attracting and disturbance of fishes; ▪ Maintain noise-reduction devices (e.g., mufflers) in good working order on vehicles and construction equipment; ▪ Regular monitoring the fish death and disturbance of fish and aquatic animals in the construction site; ▪ Fingerling (fish) can be released to the river/khal near the bridge site to boost up the fish resources	Contractor	LGED

8.2.3 During Operation

Based on the possible environmental impacts identified, a list of mitigation measures has been suggested for operation phase in table 8.3 in order to reduce the negative effects.

Table 8.3: Proposed mitigation/enhancement measures during Operation phase of the project construction, rehabilitation and maintenance program under Rangpur City Corporation.

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
Air Pollution	▪ Dust emission from the increasing number of vehicles in the site area; ▪ Vehicular emission from burning fuels. ▪ GHG emission from the landfill sites ▪ Moving wastes, by-and end-products (such as composts, and reyclables) may create dusts during dry season.	▪ Establish the speed breaker to limit the speed of the vehicle near the site; ▪ Increase number of plantations by adding new species of trees on the appropriate locations after consultation with the concern authority. ▪ Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) ▪ Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. ▪ Green belt will be developed around the facilities to act as a barrier for dust pollution. ▪ Minimum amount of organic waste will be sent to controlled landfill so that landfill gas formation is minimum. ▪ Use the gas vent pipe for the extraction of GHG emission; ▪ In the design of the pyrolysis plant it must ensure the exhaust treatment.	Rangpur City Corporation	Rangpur City Corporation
Surface Water Pollution	▪ Remaining construction materials may be washed by the rainfall into the water sources and lead to sedimentation and increase turbidity; ▪ Hazardous materials spilled by accidents; ▪ Soil erosion during rainy season can contaminate nearby surface water. ▪ Unmanaged leachate can contaminate the surface water ▪ Run-off from stockpiled wastes and end-products of composting which may	▪ Remaining construction materials will be completely removed from the proposed project site after completing of the construction activities; ▪ Cover the bare surface by plantation of trees/vegetation to reduce the surface soil erosion; ▪ Speed control measures close to the site to reduce the occurrence of accidents; ▪ Bank protection work can be done at the site; ▪ Avoid rainy season for continuing any development activities. ▪ Take all precautions to prevent entering of run-off into streams, water courses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. ▪ Remove all wastes, by-,and end-products immediately. ▪ Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others asper, Solid Waste Management Rules 2021.	Rangpur City Corporation	Rangpur City Corporation

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
	cause siltation and reduction in the quality of adjacent bodies of water.	▪ Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government.		
Acoustic environment	▪ Increase in noise level due to presence of workers and movement of vehicles.	▪ Plan activities in consultation with the LGED so that activities with the greatest potential to generate noise are conducted during periods of the day which will resulting least disturbance.	Rangpur City Corporation	Rangpur City Corporation
Health and safety risk of workers	▪ Risk of health of workers working in plant operation and maintenance, workers may suffer infectious diseases due to feedstock handling. ▪ Workers/plant operators may have accident risk of operation and maintenance of Incinerator Plant.	▪ Provide all the personal protective equipment like gum boots, nose mask, gloves etc. for the protection of workers. ▪ The workplace will be equipped with fire detectors, alarm systems and fire-fighting equipment. The equipment will be periodically inspected and maintained in good working condition. ▪ Providing adequate personnel facilities, including washing areas and areas to change clothes before and after work. ▪ Medical check-up will be conducted on regular basis and the health conditions will be monitored. ▪ First aid facilities required to attend immediately for meeting emergency situations will be made available at the facility. ▪ Maintaining good housekeeping in waste processing and storage areas. ▪ Fire extinguisher and firefighting facilities should be established during operation	Rangpur City Corporation	Rangpur City Corporation
Efficient working of the landfill and resource recovery facility	▪ Inefficient working of plant may cause poor quality of treatment and resulting under treatment of solid waste may cause environment, health and safety risk to workers and environment.	▪ Procedure for each step of operation shall be documented and all workers/operators shall be trained on the proper operation of each component of the plant. ▪ Although impact is likely to be minimal due to new and well-designed efficient system, it must be ensured that the facility is operating properly at all times.	Rangpur City Corporation	Rangpur City Corporation
Efficient working of Sanitary Landfill &	▪ Inefficient working of the Sanitary Landfill &	▪ Procedure for each step of operation shall be documented and all workers/operators shall be trained on the proper operation of each component of the facility.	Rangpur City Corporation	Rangpur City Corporation

Issues/ Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsibility	
			Implementation	Supervision
Resource Recovery Facility	resource recovery facility may cause environment, health and safety risk to workers and environment.			
Traffic management	▪ Random parking of vehicles and unplanned loading / unloading of wastes in the subproject areas can lead to traffic congestion	▪ A well-defined schedule and route will be followed by the waste carrying trucks; ▪ Proper signage will put up near the proposed facility giving route directions; ▪ Vehicles will be parked inside the facility premises in the designated slots; ▪ Entry and exit routes from the premises will be clearly marked; ▪ Adequate lighting and reflective boards will be put up for night time safety; ▪ A proper traffic management plan will be implemented to mitigate adverse impacts; ▪ All routes will be planned to cause minimal disturbance to local community; ▪ The vehicles will be allowed to move in the site only through dedicated entry and exit points within the site; ▪ Dedicated parking area will be provided in the facility for parking of vehicles; ▪ The speed limit of vehicles will be restricted to 20 km/hr.	Rangpur City Corporation	Rangpur City Corporation
Community health and safety	▪ Possible accumulation of waste causing health problems for community. Pests and vermin.	▪ Wet/biodegradable wastes will be emptied directly from the bins to primary collection vehicles daily and dry/non-biodegradable wastes once in a week. The number and type of bins and vehicles to be procured under the project is sufficient to ensure no accumulation of wastes in the community. ▪ Wastes will be collected regularly to prevent pests and vermin.	Rangpur City Corporation	Rangpur City Corporation
Socio-economic aspect	▪ Visual impacts. ▪ Impacts on community health. ▪ Employment.	▪ Good Solid Waste handling practices will be implemented which will greatly reduce foul smell and reduce impact from odors; ▪ Vehicles moving through community roads will be covered and the operations will be restricted to day time; ▪ Maximum efforts will be made to provide job opportunities to local residents during construction and operation phase. ▪ Awareness campaigns should be organized emphasizing the need of sorting at source, waste collection and participatory role of Citizens in Solid waste management in the City Corporation Area.	Rangpur City Corporation	Rangpur City Corporation

8.3 Environmental and Social Unit of Rangpur City Corporation

For Rangpur City Corporation sub-project to be implemented by LGED, a Project Management Unit (PMU) headed by the Project Director (PD) of this project will be formed who will oversee the project activities. An "Environmental and Social Management Unit (ESU)" within the PMU will oversee the environmental and social management issues associated with the Rangpur City Corporation subproject. The ESU should be manned by personnel competent in undertaking environmental and social screening and monitoring and will report directly to the PD. The ESU with support from relevant Rangpur City Corporation/local communities (if necessary) will carry out "Environmental/Social Screening" and "Analysis of Alternatives" of sub-projects, following the guidelines contained in the Environmental and Social Management Framework (ESMF). For second batch of the project, the project consultants (environmental and social specialists) will carry out these screening activities.

The ESU, as required, will carry out further environmental and social assessment of the sub-projects. The PMU of LGED will be responsible for implementation of EMP and preparation of quarterly reports, with support from "Environmental and Social Unit" (see Figure-8.1).

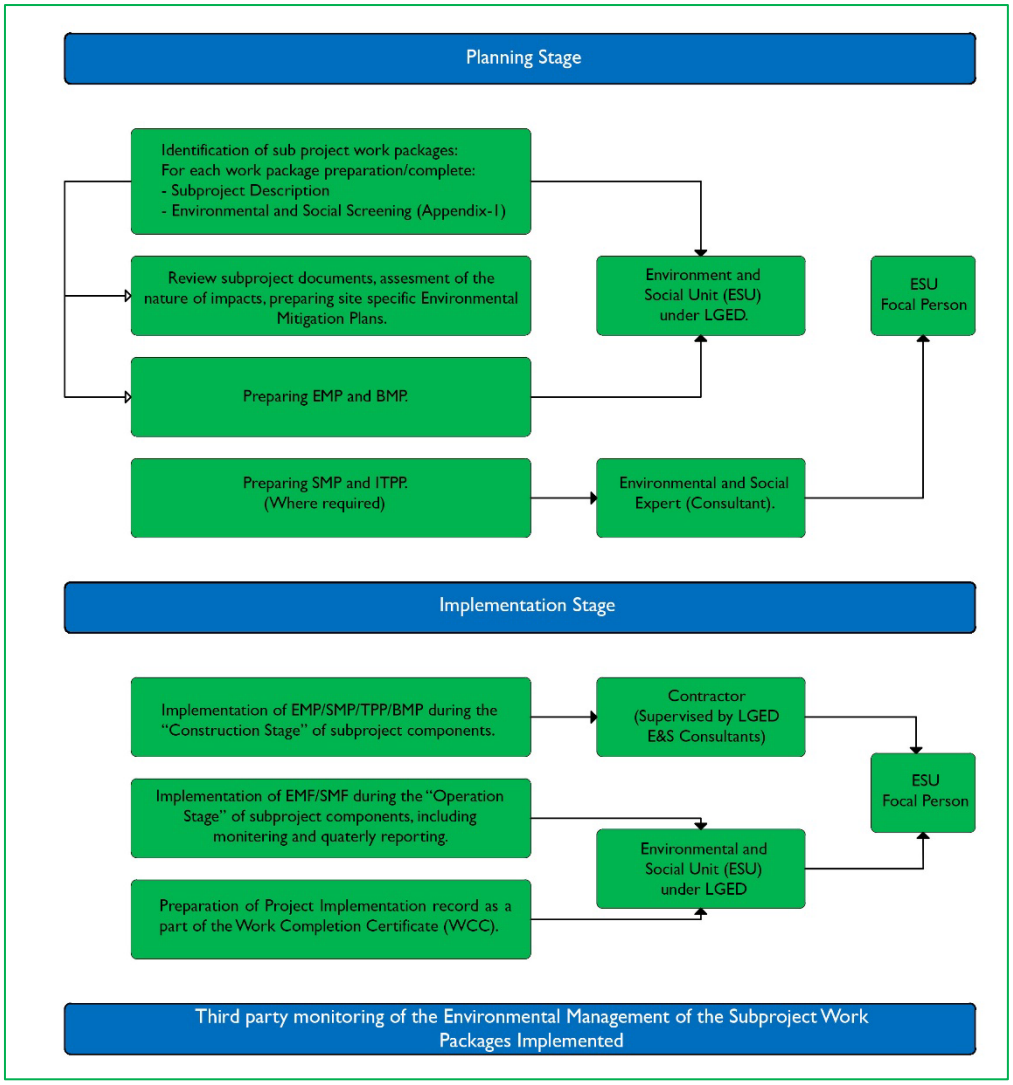


Figure 8-1: Institutional Arrangement of ISWMP

Capacity Building. Given a new ESU will be set up for the project with staff lack familiarity with E&S requirements especially international good practice those working on the project will need trainings on environmental and social safeguards in general and the specifics of management and monitoring requirements for the project. The contractors' staff would also need some training and awareness raising to ensure they fully understand the ESMP requirements. Thus, a training program will be

implemented. Training modules will be developed by PMU with support from consultants and same will be agreed with AIIB. The training modules will be delivered by the supervision consultant and will be a part of the project cost that includes institutional strengthening, capacity building and training for safeguards.

8.4 Environmental & Social Management Plan (ESMP)

8.4.1 Scope of the ESMP

The primary objective of the environmental and social management plan (ESMP) is to record environmental and social impacts resulting from the sub-project activities and to ensure implementation of the identified mitigation measures, in order to reduce adverse impacts and enhance positive impacts. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operational phases of the sub-projects.

The ESMP have developed to lay out: (a) the measures to be taken during preconstruction, construction and operation phases of a sub-project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels; (b) the actions needed to implement these measures; and (c) a monitoring plan to assess the effectiveness of the mitigation measures employed.

The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as a sub-project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. For all sub-projects to be implemented under the ISWMIP, the ESMP should be a part of the Contract Document.

The major components of the ESMP include:

- Mitigation and enhancement measures
- Monitoring plan
- Estimation of Cost of ESMP
- Institutional arrangement for implementation of ESMP

8.4.2 Work Plan & Schedule

The contractor and operator will be primarily responsible for preparing the Site-Specific Environmental Management Plan (SEMP). During construction, contractor will be guided by the SEMP. This shall be based on the subproject's ESMP with details on staff, resources, implementation schedules, and monitoring procedures. The agreed SEMP will be the basis for monitoring by ESU and supervision consultant. Inclusion in construction contract documents the provisions requiring the contractor to submit a SEMP is important since the contractor will be legally required to allocate a budget for mitigation measures implementation. The SEMP will allow ESU, construction supervision engineer to focus on what are specific items expected from the contractor regarding environmental safeguards on a day-to-day basis. With the SEMP, ESU can easily verify the associated environmental requirements each time the contractor will request approval for work schedules.

Table 8-4 Environmental Management and Monitoring Plan for the Integrated Solid Waste Management Improvement project of Rangpur City Corporation

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
1. Pre-Construction Phase							
1.1 Location impacts of the plant	Nearby community may be affected due to increased pollution during construction and operation.	The site should be selected in such a way that nearby community may have no or minimum impact such as dust, noise and access limit at construction phase and air emission and odor during operation phase due to proposed works.	Final design drawings	Prior to award of contract	Consultant	ESU	No additional cost required
1.2 Incorporation of all mitigation measures in the design	Efficiency of the plant operation.	▪ It must be ensured that contractor's design of the plant includes all proposed mitigation measured in Chapter 8 of this ESIA report.	Final design drawings	Before start of construction	Consultant	ESU	No additional cost required
1.3 Natural calamities	Plant location is in the tidal flood zone, thus, there is a threat of inundation due to tidal flood during monsoon.	▪ Highest flood level has been considered in the design. ▪ Planning of landfill at a suitable elevation above high flood level (utilizing accurate topographic survey).	Final design drawings	Prior to award of contract	Consultant	ESU	No additional cost required
1.4 Sources of materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	▪ Prioritize a site which already permitted by the authority. ▪ If other sites are necessary, it is contractor's responsibility to verify the suitability of all material sources and to obtain the approval of ESU and consultants. ▪ If additional quarries will be required after construction is started, construction contractor will obtain a written approval from ESU.	▪ Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary	During construction phase, as necessary in discussion with ESU, and Consultant.	Contractor	Consultant and ESU	No additional cost required

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
1.5 Permits, clearances, no objection certificate (NOC) etc.	Failure to obtain necessary permits and NOCs, etc. can result in design revisions and/or stoppage of works.	▪ Obtain NOC from Ward#14&16 member Rangpur City Corporation prior to start of civil works. ▪ Acknowledge in writing and provide report on compliance all obtained permits, clearance, NOCs, etc. ▪ Include in detailed design drawings and documents all conditions and provisions if necessary.	Incorporated in final design and communicated to contractors.	Prior to award of contract	Consultant	ESU	No additional cost required
1.6 Preparation of SEMP	Expecting minor impacts, during construction period only and mitigation measures are addressed.	▪ Contractor will prepare site specific environmental management plan which should be reviewed and approved by the employer at least 10 days before commencement of construction. ▪ Relevant information disclosed.	SEMP prepared, approved and disclosed	Upon completion of layout plan by contractor	**Contractor**	Consultant and ESU	No additional cost required
1.7 SEMP implementation training	Irreversible impact to the environment, workers, and community	Project manager and all key workers of contractors will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; health and safety (H&S), core labor laws, applicable environmental laws, etc.	(i) Proof of completion (ii) Posting of EMP at worksites	Before start of construction	Consultant	ESU	Cost of the training to contractor is responsibility of ESU
2. During Construction Phase							
2.1 Physical and Cultural Heritage	Construction works will be on existing Landfill Site, thus risk for chance finds is very low.	▪ Stop work immediately to allow further investigation; ▪ Prevent workers or any other persons from removing and damaging of archaeological remains.	Records of chance finds	Visual inspection by ESU on regular basis	**Contractor**	Consultant and ESU	Included in civil works contract
2.2 Excavations	Potential erosion, dust generation, and accident. The impacts are negative but short-term, site-specific	▪ The excavated earth shall always be dumped on the designated areas to be reused as needed. ▪ In the event that excavations are to be kept open overnight, lights, high visibility	Contractor's safety and security program; Location of stockpiles; Number of complaints from stakeholders;	Inspection by ESU on a regular basis;	**Contractor**	Consultant and ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
	within a relatively small area and reversible by mitigation measures.	warning signs, and barricades shall be provided.					
2.3 Waste management	Oil, grease etc. from construction machinery; Hazardous and solid waste from waste construction material and food; The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	▪ Wastes must be placed in the designated bins which must be regularly emptied. These shall remain within demarcated areas and shall be designed to prevent wastes from being blown out by wind. ▪ Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses. ▪ All waste must be removed from the site and transported to a disposal site.	Complaints from community; Regular inspection of waste management activity.	As work progresses	**Contractor**	Consultant and ESU	Included in civil works contract
2.4 Water quality (surface and groundwater)	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	▪ Every effort shall be made to ensure that any chemicals or hazardous substances do not contaminate the soil or water on-site. ▪ Care must be taken to ensure that runoff from vehicle or plant washing does not enter the surface/ground water. ▪ Site staff shall not be permitted to use any stream, river, other open water body, or natural water source adjacent to or within the designated site for them for disposing wastes. ▪ All concrete mixing must take place on a designated, impermeable surface. ▪ All substances required for vehicle maintenance and repair must be stored	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) No visible degradation to nearby drainages, *khals* or water bodies due to construction activities	Visual water quality inspection during construction	Contractor	Consultant and ESU	Included in Civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		in sealed containers until they can be disposed of from the site. ▪ Hazardous substance/ materials is to be transported in sealed containers or bags. ▪ Monitor water quality according to the environmental management plan.					
2.5 Soil disturbance	The construction activities may cause soil degradation problems in the areas of the plant, access road etc.	▪ Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecast, and actions to be taken during or after rainstorms shall be developed by the Contractor. ▪ Slope protection measures through turfing; ▪ The earthwork sites where exposed land surface is vulnerable to runoff shall be consolidated and/or covered. ▪ The material stockpile sites shall be far away from surface water bodies and areas prone to surface run-off. Loose materials shall be bagged and covered. ▪ Channels, earth bunds, netting, tarpaulin and or sand bag barriers shall be used on site to manage surface water runoff and minimize erosion. ▪ The overall slope of the works areas and construction yards shall be kept to a minimum to reduce the erosive potential of surface water flows.	Complaints from community; Vegetation cover; No visible degradation to nearby drainages, *khals* or water bodies due to soil erosion.	As work progresses	**Contractor**	Consultant and ESU	Included in civil works contract
2.6 Air Quality	Air pollution due to construction activities. The impacts are negative but short-	▪ Water spraying for dust control; ▪ Construction materials with potential for significant dust generation shall be covered;	Location of stockpiles; Number of complaints from stakeholders;	Visual air quality inspection during construction	**Contractor**	Consultant and ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
	term, impacts within a relatively small area and reversible by mitigation measures.	▪ No smoke belchers equipment; and ▪ Limiting speed of construction vehicles in access roads and work sites to maximum of 20 kph.					
2.7 Noise Level	Construction activities will be nearby settlements. Temporary increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials and people. The impact is short-term and within a relatively small area and reversible by mitigation measures.	▪ Consultation with affected people; not to operate noisy equipment during night time (22:00 – 06:00); ▪ Sound suppression for equipment; ▪ Ear protection for workers. ▪ Conduct noise quality monitoring as per EMP.	Number of complaints from stakeholders; Use of silencers in noise-producing equipment and sound barriers; Noise Quality, Equivalent Sound Pressure Level	Inspection by ESU and supervision consultants on monthly basis;	**Contractor**	Consultant and ESU	Included in civil works contract
2.8 Biodiversity	▪ Clearing of existing vegetation may result in loss of associated ecological habitats and their fauna. ▪ Noise, vibrations, and intrusive activities related to construction works may scare away animals remaining onsite after vegetation clearance.	▪ Plantation will be done at the ratio of 1 (cut): 2 (new planting) for each tree felling (if any). ▪ No trees, shrubs, or groundcover will be removed or vegetation stripped without the prior permission of the environmental specialist; ▪ While clearing vegetation it must be ensured that no wildlife injure and/or die. ▪ Harming and/or killing of any types of wildlife by the workers of the project must be prohibited.	ESU to report in writing the number of trees cut and planted twice; Number of complaints from stakeholders on disturbance of vegetation, poaching, fishing, etc.	Visual inspection by ESU and supervision consultants on monthly basis	**Contractor**	Consultant and ESU	Included in civil works contract
2.9 Socio-economic status	Manpower may be employed from local community during the construction and	▪ Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that	(i) Employment records; (ii) Records of compliance to	Visual inspection by ESU and supervision	**Contractor**	Consultant and ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
	operation stage. Thus potential impact is positive and long-term.	sometimes occur when workers are imported. ▪ Secure construction materials from local market.	Bangladesh Labor Law and other applicable standards.	consultants on monthly basis			
2.10 Provision of Worker Facilities	Inconvenience to the communities due to presence of workers; Solid waste and sanitary discharges from worker camps.	▪ Provide suitable housing, adequate supplies of potable water, and toilet and bathing facilities within the housing area. Onsite facilities for preparing food need to be provided, or food service contracted; ▪ Provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soak away, or holding tank with removal by vacuum truck. ▪ Solid waste should be collected at waste bins and disposed of properly offsite.	Site-specific H&S Plan; Records of supply of uncontaminated water; Record of H&S orientation trainings; Condition of sanitation facilities for workers	Visual inspection by ESU and supervision consultants on monthly basis	**Contractor**	Consultant and ESU	Included in civil works contract
2.11 Occupational health and safety	Occupational hazards which can arise during work. Potential impacts are negative and long-term but reversible by mitigation measures.	▪ Comply with requirements of Government of Bangladesh Labor Law and all applicable laws and standards on workers H&S. ▪ Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental safeguard specialist will help further capacity building. ▪ Ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; ▪ Arrange for readily available first aid unit including an adequate supply of	▪ Equipped first-aid stations ▪ Number of accidents ▪ Records of supply of uncontaminated water. ▪ Condition of eating areas of workers ▪ Record of H&S orientation trainings ▪ Use of PPE; ▪ % of moving equipment outfitted with audible back-up alarms	Visual inspection on regular basis	**Contractor**	Consultant and ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		sterilized dressing materials and appliances. ▪ Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; ▪ Ensure moving equipment is outfitted with audible back-up alarms; ▪ Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.	▪ Permanent sign boards for hazardous areas ▪ Signage for storage and disposal areas ▪ Condition of sanitation facilities for workers				
	Health risk of construction workers due to COVID-19	▪ Prepare the health and safety guidance for COVID-19 at work sites and get approval from MWMU; ▪ Strictly follow and implement the H&S guidance for COVID-19 at worksite; ▪ Everyone entering the worksite must wear a mask, gloves and hard shoes. ▪ At the entrance of the worksite/camp site every personnel must wash their hands for 20 second with maintaining a distance of at least 1m (3 ft) from each other; ▪ Discourage site personnel to gather and gossip at any time, rather encourage physical distance while chatting/discussing. ▪ Ensure sufficient stock of soap, sanitizer, washing facility and safe water at the workers' dwelling (both camp site and home).	▪ Record of COVID-19 protocol; ▪ Record of medical check-up; ▪ Awareness meeting records.	Visual inspection on monthly basis	**Contractor**	Consultant, ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		▪ Encourage frequent hand washing and social distancing at campsite. ▪ Ensure personal distance at least 1 meter (3 feet), preferably 2m (6ft) during lunch, dinner and prayer. ▪ Train workers on how to properly put on, use/wear, and take off protective clothing and equipment. Make these trainings mandatory at worksites and provide 10-15 minutes of a workday for such 'training and encouragement' activities.					
2.12 Community health and safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	▪ Adequate lighting, temporary fence, reflectorized barriers and signage at active work sites; ▪ Contractor's activities and movement of staff will be restricted to designated construction areas. ▪ Contractor's preparedness in emergency response; ▪ Project Affected Persons need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction.	▪ On-site record book ▪ Complaints from stakeholders ▪ GRM records	Visual inspection on monthly basis	**Contractor**	Consultant and ESU	Included in civil works contract

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		▪ Adequate dissemination of the GRM and Contractor's observance/implementation of the GRM.					
2.13 Site reinstatement	Damage due to debris, spoils, excess construction materials	▪ Remove all spoils wreckage, rubbish, or temporary structures which are no longer required; ▪ Request ESU to report in writing that worksite has been vacated and restored to pre-project conditions before acceptance of work.	ESU report in writing that (i) worksite is restored to original conditions; (ii) worker shed has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	Prior to turn-over of completed works	**Contractor**	Consultant and ESU	Included in civil works contract
3. Operation Phase							
3.1 Health and safety risk of workers	Risk of health of workers working in plant operation and maintenance, workers may suffer infectious diseases due to hazardous waste Worker's operators may have accident risk of operation and maintenance of the subproject activities.	▪ Provide all the personal protective equipment like gum boots, nose mask, gloves etc. for the protection of workers. ▪ The workplace will be equipped with fire detectors, alarm systems and fire-fighting equipment. The equipment will be periodically inspected and maintained in good working condition. ▪ Providing adequate personnel facilities, including washing areas and areas to change clothes before and after work. ▪ Medical check-up will be conducted on regular basis and the health conditions will be monitored.	▪ Regular inspection and testing of all safety features and hazard control measures and personal protective features; ▪ Ensure proper training of newly deployed worker. ▪ Record of regular health check-up for the epidemic disease and illness of related workers.	Regular monitoring weekly at the plant.	ESU	Rangpur City Corporation	Included in O&M cost

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		▪ First aid facilities required to attend immediately for meeting emergency situations will be made available at the facility. ▪ Maintaining good housekeeping in waste processing and storage areas. ▪ Fire extinguisher and firefighting facilities should be established during operation					
3.2 Efficient working of Integrated Solid waste management activities	Inefficient working of integrated Solid waste management activities may cause poor quality of treatment and management of solid waste and may cause environment, health and safety risk to workers and environment.	▪ Procedure for each step of operation shall be documented and all workers/operators shall be trained on the proper operation of each component of the Integrated Solid waste management activities. ▪ Although impact is likely to be minimal due to new and well-designed efficient system, it must be ensured that the facility is operating properly at all times.	▪ Check the Integrated Solid waste management activities regularly. ▪ Record of regular inspection of Integrated Solid waste management activities. ▪ Proper training to the operator.	Regular monitoring daily at plant.	ESU	Rangpur City Corporation	Included in O&M cost
3.3 Water Quality	Run-off from stockpiled wastes and end-products of composting which may cause siltation and reduction in the quality of adjacent bodies of water.	▪ Take all precautions to prevent entering of run-off in to streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the waterbodies. ▪ Remove all wastes, by and end-products immediately. ▪ Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and	▪ Check the Run off from Stock Piled wastes and end product of composting ▪ Test the leachate, compost quality ▪ Tests at the minimum includes measurement of temperature, pressure, contact time, spore tests, and	▪ Regular monitoring daily at plant. ▪ Daily inspection of leachate by operation and monthly inspection for first 3 years of operation. ▪ Leachate Quality monitoring to	ESU	Rangpur City Corporation	Included in O&M cost

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		chemical oxygen demand, arsenic, mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phenolic compounds and others asper Solid Waste Management Rules 2021. ▪ Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government. ▪ Monitor treated wastes quality as per Medical Wastes Rules and conditions of the ECC.	other routine tests (visual).	be done twice a year for first three years of operation			
3.4 Acoustic environment	Increase in noise level due to presence of workers and movement of vehicles. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	▪ Plan activities in consultation with Rangpur City Corporation so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.	▪ Noise level will be monitored	▪ Monthly inspection at the Landfill Area	ESU	Rangpur City Corporation	Included in O&M cost
3.5 Air Quality	Ambient Air quality of the landfill Area.	▪ Ambient Air quality will be monitored once by direct measurement from different locations of landfill area.	▪ Ambient Air quality will be monitored once by direct measurement of sensitive air pollution parameters like	Monthly inspection at the Landfill Area	ESU	Rangpur City Corporation	Included in O&M cost

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
			particulate matters (PM10, PM2.5), and SOx, NOx, CO, CH4, VOC.				
3.6. Quality of compost	Compost quality of the produced compost from the compost plant	▪ Monitore the Physical Properties and Chemical Properties of compost	▪ Color, Physical condition, Odour, Moisture content, Inert materials ▪ pH, Organic Carbon, N, C:N , P, K, S, Zn, Cu, Cr, Cd, Pb, Ni	Once in every month	ESU	Rangpur City Corporation	Included in O&M cost
3.7 Quality of Diesel (pyrolysis Oil)	Bad quality fuel burning may impact the ambient air	▪ Ensure the good quality of diesel	▪ Sulphur content, Flash point, Higher heating value, Lubricity	Monthly	ESU	Rangpur City Corporation	Included in O&M cost
3.8 Air emission	Air quality of exhaust air from Incineration Plant.	▪ Air quality will be monitored once by direct measurement of sensitive air pollution parameters like particulate matters (PM10, PM2.5), and SOx, NOx, HCl, CO. ▪ In the design of the plant, it must ensure the exhaust treatment.	• Stack emission: particulate matters (PM10, PM2.5), SOx, NOx, COx, HCl. ▪ Complaints from communities.	Stack emission: once a year in 1st year and occasionally as necessary after the 1st year. Daily inspection at the plant site.	ESU	Rangpur City Corporation	Included in O&M cost
3.9 Ash disposal	Environmental hazard and health risk to workers and other people.	▪ Ash quality control should be ensured. It can be brought to a designated area at the landfill for the disposal.	▪ Regular visual inspection at plant and disposal site	Daily	ESU	Rangpur City Corporation	Included in O&M cost
3.10 Socio-economic aspect	▪ Visual impacts. ▪ Impacts on community health. ▪ Employment.	▪ Good waste handling practices will be implemented which will greatly reduce foul smell and reduce impact from odor; ▪ Vehicles moving through community roads will be covered and the operations will be restricted to day time;	▪ Regular inspection at plant site. ▪ Proper training to the driver. ▪ Record of awareness campaign.	Weekly monitoring.	ESU	Rangpur City Corporation	Included in O&M cost

Project Activity/ Field	Impacts	Mitigation Measures	Monitoring Indicator	Frequency of Monitoring	Responsibility		Cost and Source of Funds
					Implementation	Supervision	
		▪ Maximum efforts will be made to provide job opportunities to locals. ▪ Awareness campaigns should be organized emphasizing the need of sorting at source, waste collection and participatory role of Citizens of the Rangpur City Corporation.					
3.11 Traffic management	▪ Random parking of vehicles and unplanned loading / unloading areas can lead to traffic congestion for distilled water transport	▪ A well-defined schedule and route will be followed by the waste carrying trucks; ▪ Proper signage will put up near the proposed facility giving route directions; ▪ Vehicles will be parked inside the facility premises in the designated slots; ▪ Entry and exit routes from the premises will be clearly marked; ▪ Adequate lighting and reflective boards will be put up for night time safety; ▪ A proper traffic management plan will be implemented to mitigate adverse impacts; ▪ All routes will be planned to cause minimal disturbance to local community; ▪ The vehicles will be allowed to move in the site only through dedicated entry and exit points within the site; ▪ Dedicated parking area will be provided in the facility for parking of vehicles; ▪ The speed limit of vehicles will be restricted to 20 km/hr;	▪ Check the vehicle pool. ▪ Record of regular inspection. ▪ Proper training to the driver. ▪ Record of accidents/incidents.	Regular monitoring weekly at vehicle pool.	ESU	Rangpur City Corporation	Included in O&M cost

8.5 Environmental Management and Monitoring Plan Implementation Cost (Indicative)

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

The operation phase mitigation measures are again of good operating practices, which will be the responsibility of the implementing agency (Rangpur City Corporation). The activities identified in the ESMP mainly include site inspections and informal discussions with workers and local community, and this will be the responsibility of ESU with the assistance of consultant, costs of which are part of project management.

Most of the costs associated with environmental mitigation and enhancement measures are included in the EMP budget. In consideration to the environ mental impacts and their mitigation measures for this subproject, some items need to be incorporated in the Bill of Quantity of this subproject. A substantial part of environmental costs shall be covered under civil works contract. However, exact figures of environmental costs under civil works contract are not included in this EIA. Costs of these items will be dealt elsewhere in the respective subproject component document. The environmental costs presented in Table-8.5 are tentative provisions and suggested to be incorporated in the bill of quantities of bid documents. These figures are estimated based on experience of undertaking similar works under different LGED projects and the assumption of an average of $10,000 per annum as cost of implementing ESMP mitigation measures. For the details of environmental costs under civil works contract, individual contract package bid document may be consulted. It is assumed that the environmental cost under civil works contract for each contract package will be more or less same.

Table 8-5: Tentative EMP Budget for BOQ

(The following items need to be incorporated in the Bill of Quantity of this subproject)

Cost Estimates for Environmental Management

Sl. No.	Description of Items	Unit	Quantity	Unit Rate (Tk)	Item Total (Tk)	Costs covered by
1	Environmental Monitoring (i) Air Quality, (ii) Noise level, (iii) Water quality, (iv) Sediment at work site to the entire satisfaction of engineer-in-charge.	LS			6,00,000.00	Cost included in the BoQ as Provisional sum item (non-competitive item)
2	Dust suppression measures (excluding watering for compaction) to the entire satisfaction of the engineer-in-charge.	LS			1,50,000.00	
3	Rehabilitation of ancillary sites including stockpile sites, brick crushing sites, borrow areas, workforce camp, to the entire satisfaction of the engineer-in-charge.	LS			1,00,000.00	
4	Proper disposal of camp site wastes to the entire satisfaction of the engineer-in-charge.	LS			1,00,000.00	
5	Maintain First aid box at camp site to the entire satisfaction of the Engineer-in-charge.	LS			20,000.00	
6	Miscellaneous	LS			30,000.00	
Sub-Total:					**10,00,000.00**	

Sl. No.	Description of Items	Unit	Quantity	Unit Rate (BDT)	Total Amount (BDT)	Costs covered by
7	Prevention of spillage, leakages of polluting materials to the entire satisfaction of the engineer-in-charge.					Contractor
8	Providing and maintaining adequate potable water supply facilities (Shallow Tube well) at camp site and work site to the entire satisfaction of engineer-in-charge.	Nos	4			Contractor
9	Providing and maintaining adequate sanitation facilities (both for male and female) at camp site and work site to the entire satisfaction of engineer-in-charge.	Nos	4			Contractor
10	**Traffic Management** Maintaining traffic management at worksite from time of commencement of construction activities to time of completion activities, including ensuring that the road is safe for users (this includes providing necessary barricades, warning signs/lights, guide signs, flagmen, maintaining diversion roads by cutting, filling, constructing, etc. or by any other means) in accordance with the full satisfaction of the Engineering-in-charge.					Contractor
11	**Installation of signboards/billboards** Precautionary signboards/billboards/ danger signals in appropriate places to notify people about the project	sqm	10.80			Item included in the BOQ
12	**Working labor shed:** Construction of Labor shed with C.I sheet Roofing, fencing and brick soling					Contractor
13	floor as per approved plan and to the entire satisfaction of the engineer-in-charge. **Personal Protection Equipment for Workers** Providing and maintaining appropriate (safe design, fit and comfort) personal protection equipment (PPE) to ensure the highest possible protection for employees in establishing and maintaining a safe and healthful working environment at workplace.					Contractor

Sl. No.	Description of Items	Unit	Quantity	Unit Rate (BDT)	Total Amount (BDT)	Costs covered by
14	**Removal of equipment/ surplus materials/ rubbish/temporary structures/fully reinstate** On completion of the Contract, Contractor shall remove the equipment, surplus materials, slope erosion, canal sedimentation, rubbish and temporary structures of all types and shall leave sites in clean condition to the entire satisfaction of the engineer-in-charge and local people					Contractor
15	**Occupational Health and Safety** To ensure safety of health and hazards for construction workers including -Adequate housing for all workers -Safe and reliable water supply; -Hygienic sanitary facilities and sewerage system					Contractor
16	**Community Health and Safety** To ensure safety of health and hazards on local resources and infrastructures of nearby communities					Contractor
17	**COVID-19 Health and Safety** Washable cloth face mask, disposable hand gloves, wash basin & water container, soap, alcohol-based sanitizer, pump spray, disinfectant, tissue papers, garbage bin, plastic bag, contactless temperature reader etc.					Contractor
19	Training on Environmental Management Plan, Health& Safety and COVID-19 related threat for the contractor's workforce					Consultants

The cost for Environmental Quality Tests of Various Components –Water (surface and underground), Ambient air and Noise level, and Soil quality is given in Table-8.6 below.

Table 8-6: Indicative Costs for Environmental Quality Tests (Part of EMP Budget in BOQ)

Sl. No.	Environmental Parameters	Analytical Parameter	Unit cost (BDT)	Frequency (times) /Sampling Location	Total cost (BDT)
1	Ambient Air Quality	Suspended Particulate Matter (SPM), Particulate Matter (PM 2.5), Particulate Matter (PM 10), Oxides of Sulphur (Sox), Oxides of Nitrogen (NOx), Carbon Monoxide (CO),	40,000	6 times / (Once at two locations during pre-construction and semi-annually at two locations during construction phase)	40,000x6=2,40,000
2	Stack Emission	Stack emission monitoring (SPM, SOx, NOx, HCl, COx)	40,000	Quarterly during the operation	160,000 (per annum)
2	Noise Quality	Noise Level (dB) in selected busy areas at and around the subproject *road*/bridge/khal site (under Normal Condition and with Traffic)	10,000	12 times / (Once at two locations for day and night time during pre-construction and semi-annually at two locations for day and night time during construction phase)	10,000x12=1,20,000
3	Groundwater Quality	pH, Total suspended solids (TSS), Total dissolved solids (TDS), Dissolved oxygen (DO), Arsenic (As), Iron (Fe), Chloride (Cl), Electrical Conductivity (EC), nitrate-N (NO_3-N)	20,000	6 times / (Once at two locations during pre-construction and semi-annually at two locations during construction phase)	20,000x6=1,20,000
4	Surface Water Quality	pH, Total suspended solids (TSS), Total dissolved solids (TDS), Turbidity, Dissolved oxygen (DO), Biological oxygen demand (BOD_{5days}), Chemical oxygen demand (COD), Arsenic (As), Iron (Fe), Chloride (Cl), Electrical Conductivity (EC), nitrate-N (NO_3-N, fecal and total coli-form	20,000	6 times / (Once at two locations during pre-construction and semi-annually at two locations during construction phase)	20,000x6=1,20,000

Sl. No.	Environmental Parameters	Analytical Parameter	Unit cost (BDT)	Frequency (times) /Sampling Location	Total cost (BDT)
5	**Total Cost:**				**7,20,000.00**

8.6 Monitoring and Reporting

ESU will monitor and measure the progress of ESMP implementation. The monitoring activities will correspond with the project's risks and impacts, and will be identified in the ESIA for the subproject. In addition to recording information on the work and deviation of work components from original scope ESU, and Consultant will undertake site inspections and document review to verify compliance with the ESMP and progress toward the final outcome.

Contractor will submit monthly monitoring and implementation reports to ESU, who will take follow-up actions, if necessary. ESU will submit quarterly monitoring reports to DoE. Subproject budgets will reflect the costs of monitoring and reporting requirements.

ESU will carry out the following monitoring actions to supervise project implementation:

(i) conduct periodic site visits for projects with adverse environmental or social impacts;
(ii) conduct supervision with detailed review for subproject with significant adverse social or environmental impacts;
(iii) prepare the periodic monitoring reports for DoE to ensure that adverse impacts and risks are mitigated;
(iv) work with PMU to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
(v) prepare the subproject completion report for the AIIB-ISSWMIP team that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

External E&S Monitoring. Considering the sensitivity of the project (E&S Category A), LGED will recruit an independent consultant/consulting firm (ToR to be agreed with AIIB) under the Project. This independent consultant/consulting firm will undertake independent monitoring of E&S implementation and will submit periodic (semi-annual) reports to AIIB and PMU on independent monitoring of E&S aspects.

8.1 Gender and Social Inclusion Action Plan (GAP)

8.1.1 Background

Bangladesh is one of the most populous and densely populated countries in the world. Rapid urbanization in recent years has added governance and service challenges. During the last thirty-year (1991-2021), the urban population increased by three times and total waste generation increased by 3 times as well. With rapid urbanization, particularly in municipalities and city corporation, there is even greater pressure exerted on basic urban services such as water supply, sanitation, sewage and drainage, solid waste management and urban transport. Municipality and city corporations commonly referred to as Pourashava or Urban Local Body (ULB).

Solid Waste Management (SWM) has been one of the major urban challenges in the country given its rapid urban growth. The principal objective of the Integrated Solid Waste Management Project (ISWMP) supported by the AIIB intends to improve Solid waste management system in selected municipality and city corporation areas of the country. The support aims at (i) improving public health and quality of life by reducing exposure to pollutants and diseases associated with solid waste; (ii) strengthening the government's capacity to plan for implement effective waste management services;

and (iii) improving SWM practices in the country, encouraging waste minimization, recycling, and segregation at source.

Initiating urban governance improvement, LGD and LGED with financial supportof AIIB commenced a project named Integrated Solid Waste Management Project (ISWMIP) in 30 pourashava and city corporations.

LGED will play its key role in the implementation as well as monitoring of this project. LGEDis committed and giving emphasis to mainstream gender considerations in all projects and sectors of LGED. Therefore, development of Gender Action Plan (GAP) is mandatory for each project under LGED. ISWMIP also emphasizes mainstreaming gender for ensuring gender equity. For this purpose, GAP will be introduced as an effective tool for gender mainstreaming in this project.

8.1.2 Basis for Gender Action Plan under ISWMIP

Based on the National Women Development Policy 2011, the Gender Equity Strategy of the LGED developed four (4) separate gender equity action plans for 2013-2015, covering the following sectors: 1) LGED core gender equity action plan (GES); 2) Urban sector genderequity action plan (USGEAP); 3) Rural Sector Gender Equity Action Plan (RSGEAP); and 4) Water Resource Sector Gender Equity Action Plan (WRSGEAP).

The guidelines for the preparation of the GAP will assist the ULB to understand the strategic issues, goal and objectives, preparation procedures, and implementation modality of the GAP. In order to mainstream the gender issue in urban development, it is necessary to continue the support as part of the project.

Justification: Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programs, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and program in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated.

In addressing the inequality between men and women in the sharing of power and decision- making at all levels, Governments and other actors should promote an active and visible policy of mainstreaming a gender perspective in all policies and programs so that before decisions are taken, an analysis is made of the effects on women and men, respectively. Gender Action Plan of ULB has followed National Women Development Policy 2011 and Strategy of Gender Equity adopted by LGED. Therefore, to mainstream the gender at all level of works in ULB, Gender Action Plan development and implementation is necessary by each ULB.

8.1.3 Tasks of Gender Action Plan

Gender mainstreaming is essential at the ULB level for gender equity. Gender action plan is the tool for gender mainstreaming. The following are initial steps and tasks to prepareand implement the Gender Action Plan

Task 1: Assign specific responsibilities to standing committee of Women Development for preparation of Gender Action Plan (GAP)

Task 2: One relevant officer nominated by mayor to perform the secretarial work of thestanding committee.

Task 3: ULB allocates budget for GAP implementation.

Task 4: The standing committee follows TOR as below until a regulation is prepared by theministry

Activities:

a) Hold meeting once in a month and prepare minutes on a regular basis.
b) Follow the instruction of PCO (Project Coordination Office) to prepare the Gender Action Plan (GAP) and prepare thedraft GAP.

c) Review indicative summary Gender Action Plan prepared under the project, discuss issues related / relevant to gender mainstreaming and assist ULB in the Gender Action Plan (GAP) preparation exercises.

d) Identify issues related to gender equity and ULB's role including role of community,government organization, NGOs, etc. in relation to gender and GAP activities.

e) Present the draft of GAP in the ULB, and finalize. Support implementation and monitoring of all relevant activities.

Action By:

- Gender Committee
- Standing Committee on Social Welfare and Community Center Issues

Performance Indicators:

1st Performance Indicators (PR1): GAP being fully implemented and quarterly reportprepared

2nd Performance Indicator (PR2): GAP prepared and endorsed by CSCC (Civil Society Coordination Committee). GAP being fullyimplemented and quarterly report prepared

Time Schedule:

Task 1, 2: by mid of 1st year

Task 3: by end of fiscal year

Task 4: regularly

8.1.4 Gender Action Plan for ISWMIP's Subproject Implementation

The ISWMIP has strongly emphasized the positive impacts on women and children, and no adverse impacts on women and children are expected. The positive impacts of the project on women and children can be identified as follows.

- Employment opportunities will be created for poor women through development and maintenance of infrastructures.
- Women's participation will be enhanced through:
  - Adequate representatives of women in the Civil Society Coordination Committees (CSCCs) and Ward Level Committees (WLCCs) will be ensured in all participating ULBs.
  - Gender committees headed by the female ward councilors will be formed in allparticipating ULBs.
  - The GAP will be prepared and included in Project Development Plans (PDPs) in all participating ULBs.
  - Necessary budget will be allocated to the GAP implementation in all participating ULBs.

8.1.5 Goal and Objectives of GAP

The goal of the GAP is to achieve equity between women and men and to support urban sustainable development through improved waste management in participating ULBs.

The specific objectives of the GAP are:

- To advance women's equal participation with men as decision makers in the ULB development;
- To mainstream a gender perspective in the work of the ISWMIP through the formation of Gender Committee; and
- To reduce gender inequalities in access to and control over the resources and benefits of development in the areas pertinent to the work of the subprojects.

In ISWMIP, the member of Project Implementation Unit (PIU) should include one Chief Social Welfare/Slum Development Officer who is in charge of implementation, monitoring and reporting on activities in Poverty Reduction Action Plan (PRAP) and GAP.

Gender mainstreaming is essential at the city corporation level for gender equity. GAP is thetool for gender mainstreaming. The following initial steps and tasks will be followed to prepare and implement the GAP:

8.1.6 Role for Gender Action Plan

a) Hold meeting once in a month and prepare minutes on a regular basis.
b) Follow the instruction of PCO to prepare GAP and prepare the draft GAP.
c) Review indicative Summary Gender Action Plan prepared under the project, discuss issues related / relevant to gender mainstreaming and assist ULB in GAP preparation exercises.
d) Identify issues related to gender equity and ULB's role including role of community,government organization, NGOs, etc. in relation to gender and GAP activities.
e) Present the draft of GAP in the ULB, and finalize.
f) Support implementation and monitoring of all relevant activities.

8.1.7 Relevant Organizations, Stakeholders and their role

Role of ULBs:

a) To assign specific responsibilities to Women Development Standing Committee (WDSC)
b) To nominate One relevant Officer by Mayor as a Gender Focal point (GFP) to perform the secretarial work of the standing Committee
c) To allocate the budget for GAP implementation

Roles of Women Development Standing Committee (Assigned for Gender related Activities):

- To prepare GAP of city corporation;
- To follow the instruction of PCO, GES and USGEAP of LGED during GAPpreparation;
- To prepare meeting agenda or select discussion topics for GAP and organize quarterly meeting;
- To produce meeting minutes;
- To investigate and take necessary actions for any gender related harassment issueaccording to the law; and
- To assist to implement and monitor of all gender related activities as per GAP

8.1.8 Necessary Tasks and Procedures

Contents of GAP:

In view of mainstreaming the "Gender Equity" issue and achieving the above goal and objectives in various ULB activities under the project, the GAP will be prepared in line with the GES (Gender Equity Strategy) and USGEAP of the LGED, and the National Women Development Policy 2011.

The GAP to be prepared under the Project will cover nine (9) issues as laid down in the LGED's Gender Equity Strategy. The GAP shall ensure the issue of equal contribution of male and female at all levels (planning, implementation, operation & maintenance) of urban sector projects.

The GAP consists of two (2) parts: 1) the Gender Strategy; and 2) the Gender Action Plan. The former will be prepared in Phase 1 while the latter will be prepared in phase 2.

(1) Gender Strategy

In ISWMIP, the participating ULBs will prepare a gender strategy to find ways of enhancing women's participation. The following are strategic issues that may be considered by the ULB in developing its gender strategy.

1) Policy Adoption

- Preparation of gender action plan of the ULB based on the gender action plan of urban sector of LGED, which was prepared following the national women development policy.
- Follow this guideline for gender action plan of the ULB and implement accordingly.
- Review of the ULB gender strategies subject to any amendments of national women development policy.
- Review, evaluate and update the gender action plan of the ULB and implementation guideline as applicable.

2) Institutional Arrangement

- Selection of Gender Focal Point to follow-up gender issues.
- Formation of Gender Committee at ULB level.
- Assist in preparation of the bylaws of ULB gender development committee.

3) Data/Information Collection

- Collection of male-female segregated data/information through the format as providedby Project Management Office (PCO) and PIU.
- Assembling of collected data/information.
- Send the assembled data/information to PCO and PIU.
- Assist in preparation of format containing significant indicators.

4) Monitoring and Evaluation

- Contribute in monitoring and evaluation of gender issues of ULB development
- Assist PCO and PIU in preparation and publication of annual and other reports and planin this regard.

5) Infrastructure Development

- Pursue to include necessary facilities required for women in preparation of plan and design in order to ensure women friendly infrastructure and facilities most essential for women are implemented under the projects.
- Ensure preparation of design and implementation, operation & maintenance considering necessary facilities (toilet, waiting room, ticket counter etc.) for women in bus terminal and markets.
- Keep places reserved for shops for women in the kitchen and other markets.

6) Employment and working environment

(a) Employment

- Assist in preparation of future recruitment plan of ULB.
- Reduce the existing discrimination of male-female ratio in all works under the ULB and projects under ULB
- Engage women in construction and maintenance of ULB infrastructure
- Create opportunities to implement 'equal-wage' for equal work in case of male and female labors.

- In order to increase women employment, identify income generating activities suitablefor women to engage in.

(b) Working Environment

- Keep provision of women friendly facilities (separate shades, toilets, day-care Centre) for the female laborers engaged in infrastructure construction.
- Ensure women friendly facilities (e.g. waiting room, toilets, day-care Centre etc.) in other work places.
- Maintain discipline/social safety/sexual harassment prevention.

7) Training for ULB Representatives

- Organize orientation program on gender issues for ULB elected representatives and other officers.
- Assess training needs consisting with ULB activities.
- Assist in preparation of gender related appropriate training programs & manual andarrange training coordinating with PCO and PIU.
- Undertake income generating training for women working under the ULB projects.

8) Participation of Females

- Ensure participation of female councilors and female officers/staff in preparation ofplans for ULB development activities.
- Ensure effective participation of women at all levels of preparation and implementationof project/sub-projects.
- Ensure participation of women in CSCC and WLCC activities.
- Ensure participation of women in income generating activities.

9) Women Empowerment

- Identify the areas of women empowerment at all levels of project/sub-projects implementation.
- Provide assistance to include one third women in formation of CSCC and 40% in formation of WLCC.
- Involve women at equal ratio in social development plan preparation, implementationand monitoring.
- Add supportive facilities for women laborers in tender documents.
- Monitor the issue of reservation of at least one post in ULB Mayor Panel for female councilor.
- Give directions by the project regarding inclusion of women in various committees of ULB
- Allocate particular places to women traders in kitchen markets and other markets constructed by the ULB.

10) Financing

- Undertake projects considering gender related activities and provision of necessaryfunds in this area.
- Ensure allocation of required budget considering gender related activities in level of ULB activities.

(2) Gender Action Plan

In line with the Gender Strategy, prepared by the ULB of ISWMIP, the ULB will prepare and implement a GAP for enhancing the women's participation. The GAP of the ULB will consist of

the activities under each issue of the gender strategy, indicators against each activity, timeframe for implementation of the activity and section/unit responsible for implementation of the activities. In preparation of the GAP, the PCO and the project consultantswill assist ULB.

If the activities under the GAP are properly implemented, the following benefits are expected to be achieved at ULB level to achieve the goal and objectives as mentioned earlier.

- Increase positive participation of women in local administrations and decision makingprocess.
- Increase investment for poor and disadvantaged population (most of which are women) in target ULB s.
- Improve the lifestyle of poor citizens, particularly women and disadvantagedcommunities.

It is anticipated that development and implementation of appropriate GAP by the target ULBs will greatly contribute to gender mainstreaming.
The sample format of the GAP is enclosed as Annex 3. This format is prepared based on the experiences of Urban Governance and Infrastructure Implementation Project (UGIIP). However, each ULB will add necessary modifications to the format according to its socioeconomic situations.

1) Gender Equality

Gender equality is the measurable equal representation of women and men. Gender
equality does not imply that women and men are the same, but that they have equal value andshould be accorded equal treatment.
The United Nations regards gender equality as a human right. It points out that empoweringwomen is also an indispensable tool for advancing development and reducing poverty.
Equal pay for equal work is one of the areas where gender equality is rarely seen. All too often women are paid less than men for doing the same work.

2) Gender Diversity

Diversity means variety. The word commonly refers to the cultural differences of social groups within the society. Diversity is also about recognizing, valuing and taking account of people's different backgrounds, skills, and experiences. But it doesn't mean the superiority of one over the other.

3) Gender Discrimination

Discrimination is an action or behavior that treats a person or group unfairly on the basis of race, minority or sex, especially against women. Gender discrimination, also known as sexual discrimination, is any action that specifically denies opportunities, privileges, or rewards to aperson (or a group) because of gender. Gender discrimination denies social participation or human rights to categories of people based on injustice.

4) Women Empowerment

Empowerment refers to increasing spiritual, political, social, economic strength of individual and communities. Empowerment is the process of marginalized people both women and men gaining resources, confidence, self-dignity and opportunity to take control over their lives and properties. Empowerment means being able to negotiate with and influence people and institutions with power. It is also important as an individual process, but it is most powerful for collective action. Women's empowerment is essential to end gender discrimination, reduce poverty and also achieve sustainable development.

8.1.9 Preparation process of GAP

The preparation process of GAP is presented in below.

Phase I

Step 1: Formation of Gender Committee and Selection of Gender Focal Point (GFP) as described in section 6.5 below.

Step 2: The Gender Committee at ULB level will prepare will jointly prepare ULB Gender Strategy in line with the outline explained in section 2 of this guideline document. The draft will be reviewed and approved by the Women and Children Affairs Standing Committee of the ULB Council.

Step 3: Approval of the ULB Gender Strategy by the CSCC and the Council, and inclusion of the Gender Strategy in the PDP (Project Development Plan).

Phase 2

Step 1: Gender Committee at the ULB level will prepare the draft GAP matrix after necessary additions, exclusions and amendments with justifications in favour of revisions based on the GAP matrix as shown in Appendix 5. The draft GAP matrix will be reviewed by the Women and Children Affairs Standing Committee.

Step 2: Approval of GAP by the Council and CSCC, and inclusion of the GAP in the PDP.

Step 3: The GAP to be implemented through ULB Gender Committee with assistance of project facilitators according to this guideline document. The member secretary of the Gender Committee will be responsible for operation and maintenance of the files of GAP implementation as per instructions of the mayor.

Step 4: The ULB will allocate necessary budgets for implementation of GAP and the ULB will continue such budget allocation after completion of the project.

It is worthwhile to mention that this GAP may be further updated by the ULB as and when required harmonizing with the government policy.

8.1.10 Women Development Standing Committee (WDSC)

In order to ensure women's participation and implementation and monitoring of GAP activities, each target ULB will form a gender committee headed by a female ward councilor. The committee will coordinate gender related issues and will perform its GAP work as per the terms of reference (TOR). The gender committee is expected to continue its work even after the completion of the project.

The composition of the WDSC is presented in Table 8.7**.**

Table 8.7 Composition of the gender committee

Member	Position	Description
Female Ward Councilor	Chairperson	Subject to replacement after one ortwo years according to number of reserved councilors
All other female Ward Councilors	Member	
2 or 3 male Ward Councilors	Member	Subject to replacement after one ortwo years by rotation
Health officer/ slum developmentofficer/ other concerned staff	Member Secretary	To be nominated by the mayor

8.1.11 Tasks of Gender Committee

- Hold regular monthly meetings and prepare minutes of the meeting.
- Monitor GAP activities, discuss problems concerned with gender mainstreaming, and assist the ULB in preparation of GAP and its inclusion in the PDP.
- Identify the issues related to gender equality, and identify the role of ULB including

community, government organizations, NGOs regarding gender and GAP activities.

- Presentation of the activities of the Gender Committee in the concerned forums.
- Assist ULB in implementation and monitoring of all concerned activities described in the PDP.
- Recommend budget allocation to gender issues.

The notification about the formation of the gender committee including terms of reference (TOR) shall be well circulated to all the members of the committee.

8.1.12 Selection Process of Gender Focal Point (GFP)

WDSC will select a Gender Focal Point (GFP) in consultation with the mayor. The GFP should be a person with vast knowledge and experience in gender issues and women empowerment. GFP will be a member of WDSC. It should be noted that GFP should be a well-respected person regarding to his or her attitudes and polite behavior.

8.1.13 Terms of Reference of GAP

- To take a lead role for GAP preparation and follow up implementation of GAP accordingly
- To organize regular meetings of Women Development Standing Committee and preserve the meeting minutes as per GAP.
- To take initiative to observe national and international days like 8th March and Human Rights Day etc.
- To ensure gender related agenda in ULB meetings
- To ensure women representation of existing committees of ULB
- To deal with harassment issues in legal and neutral way
- To ensure the budget allocation for implementation of GAP activities

Follow-up ensuring female representation in Ward Level Coordination Committee (WLCC) and Civil Society Coordination Committee (CSCC). The gender committee shall follow-up the issue of ensuring female representatives in WLCCs and CSCC both existing and those to be established. Ensure inclusion of one third women in formation of CSCC and 40% in formation of WLCC.

8.1.14 Follow-up ensuring female representation in standing committees

The ULB shall ensure adequate representatives of women in standing committees, while such committee will be established. The ULB shall also keep provision of at least one female in the listof Panel Mayor.

8.1.15 Implementation Schedule

All activities of GAP would be included in the implementation schedule, such as, selection of GFP, progress sharing/quarterly meeting, monitoring and assessment report and annual reportsubmission. The format is attached in Appendix X.

8.1.16 Process of GAP preparation

- WDSC will collect the basic data of men women ratio by department, representation of women in decision making process, harassment issues, promotion of women staff, equalwages, representatives of different committees, maternity leave, day care centre/ breast feeding facilities etc.

- After analyzing the data, WDSC will organize a general meeting with the head of the departments, representatives of the standing committees and NGO representatives. Mayor

will play an advisory role for this meeting.

- Based on the data analysis, appropriate initiatives will be undertaken in the GAP in accordance with the instruction of PCO, GES and USGEAP of LGED which is attached in Appendix VII and Appendix VIII. Attached sample format of GAP will be followed as prescribed format in Appendix IX.

8.1.17 Development of Gender Action Plan

Each ULB will continue to develop annual Gender Action Plan after the completion of project period. Attached GAP Matrix format will be followed during the development of action plan as shown in Appendix XI.

8.1.18 Allocation of Budgets

The ULB will allocate required budgets and continue to make the budget allocation for the GAP activities after completion of the project. A sample budget format attached in Appendix XII.

8.1.19 Preparing progress and final report

WDSC will prepare the quarterly and annual report and meeting minutes to ULB. Inthis regard, GFP will play a lead role to prepare the reports. A sample report structure is attached here as Appendix XIII.

8.2 Occupational Health and Safety Management Plan (OHSMP)

8.2.1 Health and Safety Measures During Construction

8.2.1.1 General Safety for the Workers

The contractor independently of any liability arising from the legislation shall undertake all measures, as required, to prevent accidents during construction works, as well as for the health protection and provision of first aid to employees on site. The contractor will also comply with all the relevant local regulations and provisions for ensuring health and safety during the construction phase. The works will be carried out safely and in accordance with the laws, directives and other provisions relating to health and safety of the staff.

During the construction all measures will be taken to prevent accidents to personnel and all third parties and to provide first aid to them. More specifically:

- All working positions will be equipped with drinking water and sanitation facilities (showers, toilets etc.)
- First aid stations must be available
- Positioning of signs and glowing signs which inform, warn or forbid certain actions regarding dangers in the site
- Dispensation to all staff working in the site of appropriate Personal Protection Equipment (PPE) such as helmets, goggles, masks etc.
- In case of works taking place during night, adequate lighting must be ensured in the relevant areas.

8.2.1.2 Fire Protection

For fire protection and effective response at the construction site installations and other working places, the following provisions are to be made:

- Installation of appropriate fire-fighting equipment
- Regular cleaning of sites from potentially flammable materials and proper disposal.

- ❖ No welding or other open fire activities near areas for fuel or other flammable materials storage (belonging to the worksite or other neighbouring activities).
- ❖ Safe storage of explosive materials, in accordance with relevant permits from local authorities.
- ❖ In case the use of explosives is permitted during excavation, measures are to be taken to avoid damage and accidents from the use of explosives, such as controlled blasts, explosion alarms, protective measures for adjacent installations / properties etc.

8.2.1.3 Safety Signage of Transport

Signage will be provided for works in public spaces, bearing reflecting signs. During night there will also be light signals, which will be noticeable from a distance equal to the maximum breaking distance of vehicles at the public place where the site is located. Appropriate first aid materials will be available on site.

8.2.2 Health and Safety Measures During Landfill Operation

Health and safety of workers is essential and a crucial parameter of proper landfill operation. The workers must be vaccinated as necessary (hepatitis, tetanus etc.). A work physician must be appointed by the project owner to treat workers regularly. Hot and cold water will be available at the sanitation areas, sinks and showers. Internal spaces of the administration building will be protected by appropriate screens and disinfecting mats will be placed on entrances, to avoid transfer of infectious agents by the workers' footwear. Workers will wear special clothing during work; shoes, galoshes, raincoats, helmets, gloves, masks etc., which will be washed and ironed at the site. A fully equipped first aid kit and a stretcher will be available at the locker rooms. All workers will be informed about disposal practices and operation of the landfill, including contingency situations, mainly accidents relating to biogas and leachate management.

During construction or maintenance of the biogas management system, the following measures have to be taken:

a) Workers must wear gas masks
b) Entrance of unauthorized persons and animals must be forbidden
c) Smoking should be prohibited in the vicinity of works

Machinery operators must take the following measures:

- Wear a safety belt.
- Avoid excessive speed.
- Keep machinery clean.
- Do not crush sealed containers.
- Do not leave machinery unattended.
- Keep the steps of the machinery clean.
- Use steps and handles of the machinery.
- Avoid driving on the side surfaces of the landfill.
- Never get on or off the machine during movement.
- Not moving over get the machinery to get off it
- Clean machinery before repair and maintenance.
- Keep a daily record of the machinery's operation.
- Always inspect machinery before the commencement of works.
- Inspect the place of works before the commencement of works.
- Keep the buckets and blades of machinery close to the ground.
- Lower buckets and blades of machinery to the ground during parking.
- Begin to operate machinery only after they are seated at the driver's seat.

Danger of explosion from Methane: During all operations in the waste front which involve digging in the waste (landfilling, drillings etc.) the area around the working front must be monitored for methane concentrations higher than the Lower Explosive Limit (LEL). LEL for any gas is the lowest

concentration of that gas in air that can result in an explosion if an ignition source is present. The LEL for methane is 4.4% in air (by volume). When this critical concentration of methane is reached, we say that 100% of the LEL has been reached and that there is immediate concern that an explosion could occur, particularly if the concentration develops inside a building or other confined space where ignition sources could be present. Ignition sources could be e.g., the hitting of the blade of the compactor on a metallic object. Usually, all operations in the landfill are stopped far below 4.4 % is reached.

8.3 Gender Based Violence (GBV) Prevention Plan

8.3.1 Introduction

Gender-based violence is a general term used to capture any type of violence that is rooted in exploiting unequal power relationships between genders. This can include gender norms and role expectations specific to a society as well as situational power imbalances and inequities. Gender-based violence can impact anyone, and can include intimate partner and family violence, elder abuse, sexual violence, stalking and human trafficking.

8.3.2 Country and Sector contexts

Women have been working in the solid waste management process for a long time. Which starts from clean houses, shopping malls, roads, bazaars, cities to rural areas. So, excluding them is almost impractical in the solid waste management process. Women have been working in the sector for a long time which is directly or indirectly enriching the economy of the country. Horizon women's from the lower caste Hindu community work as sweepers in municipalities. Due to their tireless work, we urban dwellers live in a clean, pollution and odor free city. Yet we do not value them socially. Their children do not get jobs even after studying. This discrimination runs almost in the society and the country. They should to be associated with gender mainstreaming. Which will play a role in the development of the project and the country's economy.

8.3.2.1 Female Labor Force Participation in Bangladesh

Bangladesh's female labor force participation (FLFP) has risen substantially yet, FLFP and quality of jobs for females are still lagging. There have been remarkable improvements in FLFP made in Bangladesh in recent decades, raising the FLFP rate from 26 percent in 2002 to 35.6 percent in 2016, benefiting from the expansion of garment manufacturing industries. Yet, by comparison, male labor force participation is much higher at over 80 percent. Moreover, the improvement in FLFP rates has hit a plateau, remaining at 36 percent in 2017. This gender disparity can be attributed to structural barriers including women's domestic burden, sex segregation in educational subject and occupation, employer discrimination, restricted mobility, limited access to trainings, lack of female friendly facilities, sexual harassment at work, limited childcare provisions. Social norms that influence and limit women's choices as well as a lack of a supportive policy environment also stunts FLFP. Moreover, female employment tends to be more concentrated in low-paid and low-productivity occupations, which are more vulnerable to technology innovation and automation in the production process. Increasing women's labor force participation and improving the quality of female employment will require more significant support for women's access to employment opportunities and high-quality skills development programs.

8.3.2.2 Gender Based Violence in Bangladesh

Violence against women (VAW) is one type of GBV which is very prevalent in Bangladesh and is often rooted in gender inequalities and harmful gender norms. VAW in Bangladesh is still very high. Report on Violence against Women (VAW) Survey 2015 jointly conducted by the Bangladesh Bureau of Statistics (BBS) and UNFPA found that 73% of married women in Bangladesh have experienced forms of violence from their husband, 55% reported forms of violence in the past 12 months, and 50% reported physical violence in their lifetime. More than 10 million Bangladeshi women experience

physical or sexual violence every year. The numbers may be higher but societal stressors often prevent victims of rape and domestic abuse to step forward. Cybercrimes have added a new element to VAW. The Counter Terrorism Unit of Bangladesh Police reported a rapid rise in cases filed with their Cyber Crime Unit, (845 in 2018 up from 566 in 2017) of which 70% of the victims were women and children. The worst manifestation or existing forms of GBV is child marriage, also known as early marriage. Child marriage and the dowry system puts girls at particular risk of sexual, physical and psychological violence throughout their lives. Bangladesh has one of the highest early marriage rates in the world at 59 percent in 2018 (UNFPA, 2019). Early marriage nearly always results in school drop-outs or from to pursuing higher education and early child birth, and is often used as a way for trafficking young girls. This is hazardous from a health perspective and is a hindrance to academic and economic development.

8.3.2.3 Status of Gender Based Violence (GBV) in subproject

Rangpur City Corporation covers an area of 205.76 square kilometers. 7, 96,556 peoples live in the city corporation. Gender based violence is very less here as people living now are educated, religious and aware. After discussing with the man and women sweepers of Rangpur City Corporation and different levels of people in different parts of the city, I came to know that gender-based violence is very less here. City dwellers are also law abiding.

However, during the construction work in the landfill area, there is a possibility of sexual harassment of women workers and women of the host area due to the arrival of new workers from neighboring areas or outside areas. At that time the construction company should be aware and orientation of the new workers about the laws of Bangladesh regarding sexual harassment and its remedies.

8.3.2.4 Legal and Institutional Environment for GE and GBV Prevention

Existence of laws and regulations as well as mechanisms helps to address SEA/SH risks. Bangladesh has the following mechanisms for SEA/SH/GBV/VAC mitigation, prevention and response.

The National Women's Development Policy (NWDP), 2011 seeks to reduce violence; eliminate discrimination; increase access to education, health and employment; and address the special needs of older women, women with disabilities and women from indigenous and marginalized communities;

In early 2017, the Parliament of Bangladesh reviewed the Child Marriage Restraint Act 2016 to permit under-18 girls to be married under "special circumstances". This has raised serious concerns among women's groups and legal NGOs working in the country;

The multi-sectorial program on Violence against Women (MSPVAW) is being implemented jointly by the Government of Bangladesh and Government of Denmark under the Ministry of Women and Children Affairs. The project is being carried out in collaboration with the Ministry of Law, Justice and Parliamentary Affairs, Ministry of Information, Ministry of Social Welfare, Ministry of Home Affairs, Ministry of Health and Family Welfare, Ministry of Education, Ministry of Religious Affairs, Ministry of Youth and Sports and Ministry of Local Government, Rural Development and Cooperative. One of the significant components of the program is the OCC in the Medical College Hospitals (MCHs). The OCCs provides health care, police assistance, DNA test, social services, legal assistance, psychological counseling and shelter service etc. A training module for combating VAW was developed for OCC staffs, teacher, students, health assistant, family planning officers and other professions. Another intervention set up by the MSPVAW is the National Helpline Center for violence against women, a 24-hour helpline that can be accessed from land lines and mobile numbers;

A High Court decision declared in 2009 that the sexual harassment of girls and women is illegal, and issued a set of guidelines defining sexual delinquency to prevent any kind of physical, mental or sexual harassment of women, girls and children at their workplaces, educational institutions and other public places including roads across the country;

Bangladesh's laws do address the use of corporal punishment in school settings; and in 2010 the Ministry of Education released an Education Circular that forbids corporal punishment in class rooms and schools. This same ban does not, however, extend to alternative care institutions, penitentiary settings or as punishment for specific criminal offenses;

Bangladesh legislated an 'ICT Act' in 2006 to combat cybercrime and online harassments. However, the provisions of this Act are quite insufficient to undertake legal measures appropriately as it does not address gender-based violence online in a clear and effective manner. The country has also formed a 'Cybercrime Tribunal' that addresses cyber violence;

Other than NWDP, the government has enacted a number of stringent laws and policies to protect men and especially women from gender based violence (GBV) including sexual exploitation and abuse/sexual harassment (SEA/SH): The Criminal Procedure Code, 1889; The Penal Code 1860; The Evidence Act 1972; Child Marriage Restraint Act 1929; Citizenship Act 1951 (Amended 2009); Muslim Family Laws Ordinance 1961; Dowry Prohibition Act 1980; Immigration Ordinance 1982; Immigration Ordinance 1982; Family Court Ordinance 1985; Women and Children Repression Prevention Act 2000 (2003); Women and Children Repression Prevention Act 2000 (2003); Women and Children Repression Prevention Act 2000 (2003); Women and Children Repression Prevention Act 2000 (2003); Women and Children Repression Prevention Act 2000 (2003); Acid Crime Prevention Act,2002;Acid Control Act 2002;The Bangladesh Labor Act 2006;Domestic Violence (Prevention & Protection) Act 2010;Human Trafficking Deterrence and Suppression Act, 2012;The Pornography Control Act, 2012; The Hindu Marriage Registration Act 2012. Multi-Sectorial Program on Violence against Women is being implemented jointly by the Government of Bangladesh and Government of Denmark under the Ministry of Women and Children Affairs. One of the significant components of the program is the OCC (One Stop Crisis Centre) in the Medical College Hospitals (MCHs). The OCCs provide health care, police assistance, DNA test, social services, legal assistance, psychological counseling and shelter service etc. The sample labour court of conduct covering the GBS/SEA/SHA related risk is given in Appendix I.

8.3.2.5 Potential SEA/SH Risks Assessment in the subproject Areas

Considering the cluster type of project, the project is expected to have minor labor influx. Rangpur City Corporation landfill area will construct around 7.8 acre. It is expected that total labor including the skilled and unskilled will not be more than 200(approx.). The number of labors is estimated maximum 100 and among the 50% will be unskilled labor. GBV service providers functioning in Bangladesh during COVID-19 is given in Appendix II. However, based on the social assessment, few GBV risk are identified as below:

- Labor/workers have lack of knowledge on national laws and policies, and actions in case of GBV issues;
- Contractors have lack of experience in management of GBV issues;
- There is significantly more male labor than female labor in the construction sector;
- Job opportunities of local women and girls are generally limited. However, with civil work in the neighborhood, they may avail job opportunities in the project area and as a result be victims of SEA and workplace SH; (See Appendix IV).
- Higher wages for workers in the local community can lead to an increase in transactional sex including incidents of sex between laborers and minors;
- Civil work projects can cause shifts in power dynamics between community members and within households. Male jealousy, a key driver of GBV, can be triggered by labor influx on a project when workers are believed to be interacting with community women, or community women are getting better wages than their male members of the family. This may lead to abusive behavior within the homes of those affected by the project; and
- A male worker is sexually abused by his male or female boss or senior worker.

8.3.3 Gender Based Violence (GBV) Prevention Plan for Rangpur City Corporation

The GBV Prevention Plan takes a comprehensive approach to include both prevention and mitigation measures as the existing policies and measures on mitigation are limited to address GBV. The proposed project involves construction work in the project implemented areas which may have the potential GBV risks, etc. sexual exploitation and abuse, workplace sexual harassment, and non-sexual exploitation and abuse. Therefore, the purpose of this action plan is to identify the issues, stakeholders, possible service providers and assess their capacity that aid in accessing grievance redressal. The action plan will focus on some corresponding mitigation measures sensitizing the communities and other stakeholders, strengthening the institutional capacities to mitigate project related potential risk of GBV in the project affected population. A survivor centric approach will be followed all through, victim/survivors' care and providing access to different referral mechanisms are considered key aspects of this plan. The approach aims to create a supportive environment in which each survivor's rights are respected and in which the person is treated with dignity and respect. The project will include a general Code of Conduct (CoC) as well as a Labor Code of Conduct (sample given in Appendix I), covering the GBV/SEA/SH related risks for the contractors, sub-contractors, and laborers who will be employed under the project.

Table 8.8 Table Gender Based Violence Prevention Plan

Action	Activities	Indicator	Responsibility	Risk Management
Awareness raising campaign on SEA/SH in project and trainings.	Prepare relevant communication materials on GBV/SEA/SH and dissemination of these materials. Conduct 4 awareness raising workshop in the project areas: • Develop content and conduct targeted training and orientation session: • Training/orientation sessions to sensitize on importance of addressing GBV/SEA/SH risks on the project and the mechanisms that will be implemented; • Training/orientation session to sensitize other stakeholders on the importance of addressing GBV/SEA/SH risks including cyber bullying; and • The training will be targeted at stakeholders identified in SEP.	Communication material related to GBV/SEA/SH disseminated awareness raising campaign on GBV/ SEA/SH conducted among all stakeholder's number of project actors trained and oriented on GBV/SEA/SH.	PIU, GBV/Gender specialist(s).	Monitor the activities and provide additional guidance as necessary.

Action	Activities	Indicator	Responsibility	Risk Management
Capacity building for labors, contractors, sub-contractors and stakeholders on anti GBV/harassment policies.	Basic ethics and CoC; Contractors, consultants, labor, sub-contractors and community people's rights and responsibilities, positive discipline. • Prepare Code of Conduct (CoC); • Measures for dealing with GBV, complaints and reporting mechanisms, services for survivors, referral mechanisms and redress procedures; and • Topics to be covered under the trainings can be determined through consultations on training needs.	• CoC is prepared; and • All contractors, labor and relevant stakeholders are aware of the CoC.	PIU, GBV/Gender specialist(s).	Monitor the activities and provide additional guidance as necessary.
Sensitize the LGED and PIU to the importance of addressing GBV on the project, and the mechanisms that will be Implemented.	Develop deep-dive trainings to build capacity of LGED on safeguarding mechanisms including CoC, GRM, GBV response protocols on and reporting and procedures to handle cases.	Deep-dive trainings conducted.	PIU, GBV/Gender specialist(s).	Monitor the activities and provide additional guidance as necessary.
Organize stakeholder consultations with project actors and community members to inform them properly about the potential GBV risks and project activities to address GBV related issues.	Consultations carried out with different stakeholders and local communities. Share the GBV risk of the project with the relevant stakeholders. Visibly display signs around the project site (if applicable) that signal to workers and the community that the project site is an area where GBV is prohibited.	Project actors and community members sensitized.	Contractor and PIU, GBV/Gender specialist(s).	Monitor the implementation of Stakeholder Engagement Plan.

Action	Activities	Indicator	Responsibility	Risk Management
Functionalize effective GBV GRM.	As the SEP explicitly entails addressing GBV/SEA/SH, ensure beneficiaries, community members and labor are informed of GBV grievance mechanisms. Train personnel to operate GRM i.e., proper documentation for complaint registration and management; and confidential reporting with safe and ethical documenting of GBV cases. Communicate with local service provider to provide referral and support services to survivors as per Grievance Mechanism guidance on SEA/SH.	Availability of an effective GRM with multiple channels to initiate a complaint / parallel GBV.	PIU, GBV/Gender specialist(s).	Ongoing monitoring and reporting on GRM to verify it is working as intended.
Clearly define the GBV requirements and expectations in the bidding documents for contractor.	Formulate and adopt GBV informed bidding document. Inform the contractors and provide orientation Include GBV costs in the bill of quantities.	GBV requirement and expectation are adapted in bid document.	PIU-LGED and GBV/Gender specialist(s).	Review by AIIB.
Codes of Conduct (CoC) signed and understood by all those engaged in the project directly receiving project financing.	CoC finalized and agreed on. (See Annex I for sample of code of conduct) Sensitize project related staff about CoC requirements and obligations. Ensure requirements in CoCs are clearly understood by those signing. Have CoCs signed by all those with a physical presence at the project site. Disseminate CoCs (including visual illustrations) and discuss with employees and surrounding communities.	Project-related staff trained and oriented on CoC; Project-related staff who signed CoCs.	PIU-LGED and GBV/Gender specialist(s).	Review implementation during supervision missions.
Codes of Conduct (CoC) for all laborers signed and understood.	CoC finalized and agreed on. (See Annex I for sample of code of conduct) Sensitize project related workers about CoC requirements and obligations. Ensure requirements in CoCs are clearly understood by those signing. Have CoCs signed by all those with a physical presence at the project site. Disseminate CoCs (including visual illustrations) and discuss with employees and surrounding communities.	Project-related staff trained and oriented on CoC; Project-related staff who signed CoCs.	Contractor and PIU, GBV/Gender specialist(s).	Review implementation during supervision missions.
Accountability and response framework for SEA/SH allegations related to CoC in place.	Have separate, safe and easily accessible facilities for women and men working on the site. Include security measures such as ensuring adequate security personnel. Locker rooms and/or latrines should be located in separate areas, well-lit and include the ability to be locked from the inside. Visibly display signs around the project site (if applicable) that signal to	Documentation of measures taken to reduce GBV risks.	Contractor and PIU, GBV/Gender specialist(s)	Ongoing reporting

Action	Activities	Indicator	Responsibility	Risk Management
	workers and the community that the project site is an area where GBV is prohibited.			
Undertake regular M&E of progress on GBV activities.	Conduct M&E field visits. Review quarterly the action plan and progress against indicators listed Provide quarterly report.	Successful implementation of agreed GBV Action Plan (Y/N). Quarterly report.	Contractor and PIU, GBV/Gender specialist(s).	Ongoing reporting.
Improve safety of project related civil works for labor to reduce GBV risks during construction works.	• Improve lighting around project area; and • Follow up refurbishment construction activities (Safely demarcated (appropriate signage, lighting)	Clearly demarcated and well-light spaces.	PIU and contractors.	Monitor the activities and provide additional guidance as necessary.

8.3.3.1 Grievance Redress Mechanism

A 4 level GRM will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. Level- GRM is the most significant and AIIB's perspective effective functioning of the field level GRC is most significant. The GRM aims to provide a time bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

The ARIPA 2017 allows objections by the land owners to acquisitions at the beginning of the legal process. Once the objections are heard and disposed of, there is virtually no provision to address grievances and complaints that individual landowners may bring up in the later stages of the process. Since the act does not recognize them, there is no mechanism to hear and redress grievances of people who do not have legal titles to the acquired lands. As experienced in past projects, complaints and grievances may range from disputes over ownership and inheritance of the acquired lands to affected persons and assets missed by censuses, the valuation of affected assets, compensation entitlements, complains against noise, pollution, accident, GBV and other social and environmental issues.

In view of this, LGED will establish a procedure to deal with and resolve any queries as well as address complaints and grievances about any irregularities in the application of the guidelines adopted in this RAP for assessment and mitigation of social and environmental impacts through grievance redress mechanism (GRM). LGED is also planning to hire a consultant to set up a cloud based multi-channeled ways to accept feedback on the draft E&S instruments. The system will be also linked with the GRM.

The GRM will deal with complaints and grievances related to both social/resettlement and environmental issues in this project. Grievance redress committees (GRC) will be formed to receive and resolve complaints as well as grievances from aggrieved persons from the local stakeholders including the project-affected persons. LGED will provide sufficient on boarding and training for the members of the GRCs to ensure their ability to resolve grievances in an effective and efficient manner. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not pre-empt a person's right to go to the courts of law. There will be four-tier grievance redress mechanism; 1st at field level (Ward), 2nd ULB level, 3rd Project management level and final one is for ministry level. Subproject grievance redress mechanism to address SEA/SH allegation is given in Appendix III.

8.4 Waste Management Plan (WMP)

8.10.1 Introduction

Waste is inevitable because it is generated by daily human activities through discarded materials from domestic chores, agriculture, business, industry, natural and semisynthetic disasters, medical services, etc. consistent with the Bangladesh Environment Conservation Act, 1995, waste is, "any solid, liquid, gaseous, radioactive substance, the discharge, disposal, and discard of which can cause injurious changes to the environment". Management of waste is comprised of the gathering, carrying, treating or disposal of discarded materials and substances (Unnisa & Rav, 2012).

A waste management plan is a vital roadmap for businesses across all sectors. By following a well-prepared waste management plan, businesses can cut costs and reduce their environmental impact by diverting waste from landfill. Construction and demolition businesses benefit from a plan the most.

8.10.2 Objectives

- To assess the activities involved for the proposed and determine the type, nature and estimated volumes of solid waste to be generated by the subproject activities.

- To identify any potential environmental impacts from the generation of waste in the industries and industrial zone.
- To recommend appropriate solid waste handling and disposal measures/routings in accordance with the current legislative and administrative requirements
- To reduce the generation of wastes in the first place and to re-purpose and or reuse the materials for a longer time
- Recycle the solid wastes. Wastes are resources if they are properly recycled to produce other resources like water, energy, and or other materials
- To achieve higher monetary success but not at the expense of the environment. As natural resources are used for business growth, utmost care for nature is ought to be taken.
- To improve the quality-of-life people like you and me will be able to live in a much safer environment.

8.10.3 Waste Management Plan (WMP)

A WMP initially identifies key project information such as responsible figures; clients and principle contractor, and project specifics such as cost and location. Information about waste includes:

- A description of the waste types predicted to be produced over the project, such as hazardous or controlled waste.
- An estimate of the volume of waste produced over the project.
- Description of measuring methods, i.e. X number of skips, X tonnes of waste.
- The waste management method for each waste type, from how the waste will be responsibly stored to whether waste will be reused, recycled, recovered or disposed of.
- Records of waste quantities, management and collections.

A WMP should also outline how responsible people will ensure waste is handled in effective ways and in accordance with their duty of care.

8.10.4 Waste Management Plans Required by Law

The Solid Waste Management Rules 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995 of Department of Environment (DoE). The Rules define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery. The Munshiganj subproject should abide by the regulation when all the Integrated Solid Waste Management Improvement activities start constructing/operating.

The main provisions of the Solid Waste Management Rules 2021 are as follows.

- When recovering resources from waste, the principles of management that consider the waste hierarchy, such as the 3Rs, segregation, and reduction, must be followed at all stages from waste generation to the final disposal.
- Responsibilities of waste generators, consumers, and users:
    - Dispose of the waste following the regulations of authorities including local government.
    - Dispose of waste separately.
    - Do not dump, store, or burn waste outdoors.
- Responsibilities of manufacturers (*not defined) and importers of products
- Collect non-biodegradable products such as glass, plastic, polyethene, multi-layered packaging, bottles, and cans from consumers and recycle or dispose of them if appropriate.
- Determine work plans and implementation procedures for recycling and disposal.

- Ensure that EPR is properly implemented.
- Submit an annual report to the Department of Environment (DOE) on the amount of plastic recycled.
- Raise public awareness of proper waste management.
- In the case of recovery from waste, taking into account the waste hierarchy, the steps of waste management should be followed in order of rejection, waste reduction, reuse, recycling, recovery, purification, and residue management.

Any violation of the above provisions shall be subject to imprisonment for not more than two years or a fine not exceeding 200,000 BDT, or both. The Regulations also include provisions for the treatment of solid waste such as composting and energy recovery.

8.10.5 Waste Management Plan Benefits

There are many advantages to having a waste management plan, especially for construction/operational subproject. Here are some of the top benefits:

Environmental consideration

When the subproject proponent and contractors know what waste will be created and how much, they can plan recycling and reuse services accordingly, ensuring waste that can be better processed, is. This is far preferable to landfill in which greenhouse gases are created, contributing to climate change.

Effectiveness

By assessing waste volume and type prior to and continually throughout a subproject, changes can be made to orders and processes to ensure the amount of waste created is reduced. Not only will materials be used more effectively, but also less time is spent on excess materials.

Save Money

Disposing of waste at landfill can be costly, especially large amounts, so alternative management methods of recycling, reusing and recovery can save money. Additionally, by using materials more effectively and reducing the amount of waste, money is saved.

Reduce Fly-Tipping

If an effective WMP isn't in place, construction businesses or contractors may become complacent or try to cut corners in regard to waste management. Fly tipping, although a serious offence with possible fines and even prison sentences, is common for construction waste. This can have negative environmental impacts and should be avoided with proper waste management by licensed providers.

Figure 8-2: Types of Color-Coded Waste Bins

8.10.7 Proposed Solid Waste Management (SWM)

Collecting, treating, and disposing of solid material that has served its purpose or is no longer useful is discarded. SWM is also an essential service for maintaining the quality of life in Munshiganj Subproject and for ensuring better standards of health and sanitation. If properly collected from the source, SWM would reduce the number of downstream problems related to transportation and disposal of the same.

Solid waste (SW) generated in the subproject can be broadly categorized as non-hazardous waste and hazardous waste. Munshiganj subproject will keep space for solid waste disposal and will segregate waste based on type and subproject components.

- **Construction wastes:** Plastic and paper waste, chemical & oil empty drums and cartons, glass, machine scrap, wood pieces, metal and electrical waste.
- **Domestic wastes:** kitchen and wood waste, plastic, paper, floor sweepings, etc. Road sweeping & sanitary waste: human waste, etc. Garden & agriculture waste: leaves, branches, plants etc. Roads/building construction waste: earth, asphalt, concrete, brick, plaster, wood, glass, stones etc.
- **E-Waste:** Computer systems, peripheral equipment, mobile phone sets, TVs, audio sets and also household appliances biomedical waste.

WMP of Munshiganj Subproject contains the following

- A Transfer, Storage, and Disposal Facility (TSDF) of appropriate size will be constructed within the Subproject construction area. Adequate containers will be placed in different

places in each of the subproject sites for segregation and then transported to the TSDF area. It is noteworthy that only the bio-degradable wastes can be treated in the Solid Waste treatment facility.

- The entire SWM is planned to be collected and treated in the composting plant within subproject and the rejects shall be disposed to the subproject's landfill site i.e. Landfill Site of Munshiganj Municipality. A suitable area has been earmarked to handle the solid waste. All these activities are to be carried out in the TSDF area.
- Proper labelling of waste and segregation of waste needs upgrading.
- Separating store hazardous waste for disposal in hazardous waste landfills or handed over to the DoE licensed contractor for appropriate processing and disposal.
- Ensuring that waste which can be processed for recovery of material and energy does not become co-mixed with undesirable elements.
- Upgrade waste management procedures' development and proper training for the workers concerning health & safety and environmental issues (First aid, health safety, chemical handling and storage of dangerous substances) in the subproject works.
- Ensure 3R Principal and regulatory compliance.
- Waste minimization efforts based on the monitoring and analysis of segregated waste. Recycle/ reuse options after waste minimization efforts may be explored.

Table 8-9: Potentially significant Environmental Impacts during the Operational Phase and their mitigation measures

Activity/ concerned issues	Potentially significant Impacts	Proposed Mitigation Measures	Responsible Authorities	Monitoring
Disposal of waste	Improper disposal of industrial waste and raw materials may cause various hazards to the environment including **a.** exposure to biodegradable materials can produce untoward odor & bad smell that can pollute natural air, facilitate the spreading of diseases **b.** contamination of water (surface water, groundwater) **c**. waterlogging **d.** increased breeding of mosquito	**Proper disposal of waste:** The designated site should be at least 1 km away from the locality and the river bank, avoiding the area with natural vegetation. Prior permission is needed from the respective authority before selecting the site ▪ segregation of the wastes prior to disposal ▪ should be dumped in different designated landfill/pits at the dumping site after segregation of different construction materials/solid wastes ▪ all kinds of dumped waste products should be covered ▪ Proper drainage facilities should be ensured to prevent waterlogging ▪ Proper disposal of wastes and drainage of water and ensuring the cleanliness of surrounding environment water storage pool for prevention of mosquito breeding	Munshiganj Municipality	DoE

8.5 Contractor Management Plan (CMP)

8.5.1 Introduction

This CMP is intended to outline the relationship between Rangpur Subproject and the contractors, and to describe how the overall contract will be managed (i.e. describe the Contractor management processes that will be implemented by the subproject).

In further detail, the purpose of the CMP is to:

- Summarize the contractors' and subcontractors' engagement and management processes, procedures and systems used;
- Define roles and responsibilities for the beneficiary and the contractors and its Subcontractors, as well as the relationship and cooperation between all parties, with regards to all subproject activities;
- Outline the applicable subproject standards relevant to the contractors and its Subcontractors;
- Set out the processes to ensure the implementation, by the contractors and its subcontractors, of all requirements, project commitments, conditions, methods (work statement for the construction phases), and procedures applicable to them, intended to assure the execution of the Project;
- Define training requirements;
- Establish a Grievance Mechanism about other Construction Environmental and Social Management Plans (CESMPs);
- Define monitoring and reporting procedures, including Key Performance Indicators (KPIs), to monitor the performance of the contractors and its subcontractors; and
- Define intervention procedures, i. e. the way LGED will liaise with the contractors to sort out any issues, namely related with non-compliance and/or environmental and social performance.
- Contractors' environmental, social, cultural heritage management of contractors.

Any subsequent changes to the contractor engagement processes may result in changes to this CMP. Further details of the subproject itself are provided in Chapter 3 whilst information on the subproject roles and responsibilities are described in Section 8.13.7.

8.5.2 Links to Rangpur Subproject's HSE Management System

The contractors will be required to align their own HSE-MS with the subproject's one, and to develop their own detailed contractor's Environmental and Social Management Plan (CESMP), including detailed topic and/or activity-specific CESMPs, based on the ESMPF and reminder management plans provided by LGED. This will be done through "Work statement documents", which will be agreed with all contractor, for each site, where will define the special conditions.

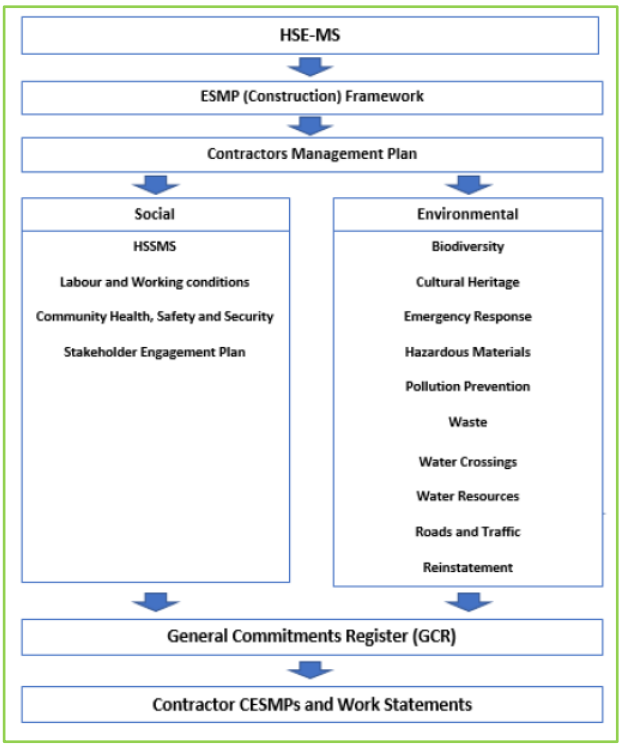


Figure 8.3 Linkage between subproject HSE-MS

8.5.3 Policies and Standards

All Contractors and its Subcontractors are subject to the conditions and obligation set out in the national legislative framework, AIIB regulations, the Environmental and Social Safeguards (ESS), and country's norms and procedures.

8.5.4 Application to the project contractors

Successful projects that involve contractors all exhibit similar characteristics. They all have clear and unambiguous contracts established that include a Statement of Work. The efforts of all contractors integrated into a cohesive project plan with all contractors understanding where their efforts fit into the overall picture. The formal and informal interfaces between the beneficiary and the contractors are documented. Before starting specific work, the contractors are granted authorization to proceed. This authorization is received, in writing, via a Work Authorization form. A formal team building process is established and implemented. These practices all contribute to reducing the risk of misunderstandings or isolationism. Each contractor will have a legally binding, written contract that defines the following items. The legal names of the parties involved in the contract will be specified.

The scope of the contracted work (contained in an attached Statement of Work), will be described on terms of:

- a clear definition of the services to be provided by the Contractor;
- responsibilities and authority limits of each party to the contract;
- a clear definition of the deliverables and minimum content to be provided by the contractor;
- any and all constraints imposed on the Contractor by LGED., such as schedule constraints; budget constraints, specific tools to be used; and
- a clear statement of requirements for quality of deliverables and services including the requirement to allow independent quality inspections of materials and processes.

Appropriate terms and conditions, which will be impose on both LGED and the contractor, will be identified. The acceptance process will be clearly identified.

Each CESMP outlines tasks to be undertaken by both LGED and its contractors. The contractors themselves will be required to develop their own detailed management plans/action plans, which will reflect the commitments in this CMP and which demonstrate how they will meet these commitments. The beneficiary will nominate the obligation of contractor to draws the Plan and indicate models for CESMPs on "Work statement document" which will be closed with all contractor for each site, where will define the special conditions and procedures.

8.5.5 Document Management

The LGED will provide the contractors management plan with attributes for all parts, requirements for contractors and also a work statement for construction phases, including models for standard documents. Contractors enter into a business partnership with Rangpur City Corporation after bidding procedures, and will provide in legal time the integrated solution for execution phases, including the economic, environmental and social approach. Contractors will present the information for all subcontractors and the procedures for verification and validation services.

8.5.6 Contractors Engagement and Management

The CMP Plan will highlight all responsibilities, requirements and work statements that are expected of the contractors and how they will be delivered to the beneficiary. The parties will establish contacts points to monitor actions and to correct any non-conformances. All the proposed solutions will be reported to Project Management Unit, management of change structure. This structure is responsible for decisions, under Project manager- management services approval, for drawing procedures able to be applied on all sites or on specific sites, and for updating the CESMP documents.

The approach to managing the subproject will be based on the following guiding principles:

PMU will establish on the bidding documents the conditions and obligation for contractors;

- A Statement of Work will be drawn by the team, jointly with each contractor taking responsibility for the services outlined in its areas of responsibility;
- effective channels of communications will be clearly defined and established within the Statement of Work document;
- Each contractor/subcontractor will have its responsibilities and authority limits clearly defined in the Statement of Work;
- Each contractor will have its deliverables and execution time identified in the Statement of Work;
- Each contractor will have the services it is responsible for providing clearly identified and described in the Statement of Work;
- All constraints imposed on the Contractor will be clearly identify in the Statement of Work, including schedule and budget constraints;
- All environmental, social, health and safety and cultural heritage constraints imposed on the contractor will be clearly identify in the Statement of Work;
- Each contractor will have requirements for quality clearly identified within the Statement of Work, including the requirement to allow independent quality inspections of materials and work processes;
- All products and services provided by the subcontractor (partners of Contractor) will be subject to the acceptance of PMU;
- Each subcontract will contain appropriate terms and conditions;
- Adequate facilities will be provided to meet the needs of the contractors, and the contractors will support subcontractors in processing invoices and payments, subject to the invoices being delivered to LGED in an acceptable format. To this end, PMU will establish format requirements for invoices in list of Standard Documents;
- The contractors will be directly responsible for their part of the contract in relation with the subproject, even for the subcontracted parts;
- The contractors will be obliged to contract only with solvable and reliable subcontractors, and only with the written approval issued by PMU, and

- ESU is responsible, for project management, for control and monitoring activities regarding constructors' actions and has overall responsibility for environmental, social, health and safety, and cultural heritage aspects of the project.

8.5.7 Roles and Responsibilities

Delivery of the project commitments referenced in this CMP is the responsibility of both LGED and its contractors. The specific responsibilities for implementation of the specific actions identified in the individual CESMPs are clearly distinguished between LGED and relevant contractors in the Appendices to the CEMPs.

Table 8.10 Mapping of functional elements between LGED and contractors

Functional Element	LGED	Contractors	Subcontractors
Project Management	X		
HSSE management	X	X	
Management of change	X	X	
Technical monitoring	X	X	
Quality assurance	X	X	
Human resources ((HR) and training	X	X	X
Economic	X	X	X
Legal	X	X	
Information technology	X	X	
Communication and Public relations	X	X	
Audit	X	X	

8.5.8 Contractors' Roles and Responsibilities

Contractor's predominant responsibility will be to ensure that all their work and staff activity is compliant with the legal provision for environment, social, safety, health and the permits provided by Rangpur City Corporation. Their responsibilities include the management of specific activities and for the surveillance of all activities on the site.

The contractors will prepare work plans in compliance with the Project's requirements.

CESMPs to be produced by the appointed contractor-

- Waste Management Plan (Include Hazardous Management Plan)
- Road and Traffic Management Plan
- HSSMS
- Pollution Prevention Management Plan
- Labour and Working Conditions Management Plan
- Emergency Response Management Plan
- Community Health and Safety Management Plan
- Reinstatement Management Plan

The contractors will be responsible for the Health and Safety Plan and Measures, regarding their own employees and sites conditions, as well workers' accommodation, under a risk analyze procedure, in accordance with legal provisions, advised by city corporation.

Contractors shall nominate the following employees:

- Representative for site coordination;
- Representatives for hsse responsibilities;
- Representatives for technical execution, budget, project phases;
- First aid competent person;
- Representative for waste management;
- Team for guarding the site; and
- Team responsible for intervention on accidental pollution events

Other details about contractor's obligations related standard documents, which have to be drawn, will be nominate on bidding documentation.

Organizational Design/Human Resources. Contractors are also responsible for developing organizational and human resource elements of the solution recommended by the subproject.

8.5.9 Methods for Successful Contractor Management

8.5.9.1 Management Practices

Successful projects that involve contractors all exhibit similar characteristics. They all have clear and unambiguous contracts established that include a Statement of Work.

The efforts of all contractors are integrated into a cohesive project plan with all contractors understanding where their efforts fit into the overall picture.

The formal and informal interfaces between the beneficiary and the contractors will be documented.

Before starting specific work, the contractors will receive an "authorization to proceed". This authorization will be provided in writing, via a Work Authorization form. Authorization will be dependent on the completion of all necessary pre-construction surveys, the approval by LGED of contractor CESMPs, all associated method statements relevant to the respective section and any further works LGED deem necessary prior to construction. Auditing requirements will be detailed and addressed in the plans listed in the Framework Management Plan.

A formal team building process is established and implemented.

These practices all contribute to reducing the risk of misunderstandings or isolationism.

8.5.9.2 Environmental and Social and Health and Safety Reporting

Each week, the contractors will prepare and deliver to the ESU weekly progress reports on environmental, social and health and safety performance. The report is to be delivery by noon on Fridays. The report will identify:

(i) Performance against kpis
(ii) Incidents within the period and investigation findings
(iii) Planned activities
(iv) A textual description of progress,
(v) A list of internal milestones attained,
(vi) A brief description of any problems encountered

8.6 Labor Management Plan (LMP)

8.6.1 Overview of labour use on the subproject

Under the AIIB Environmental and Social Standards (ESSs), on Labor and Working Conditions Labor Management Procedures (LMP) are required to be produced. The purpose of the LMP is to facilitate planning and implementation of the project. The LMP identify the main labor requirements and risks associated with the project, and help determine the resources necessary to address project labor issues. The LMP is a living document, which is initiated early in project preparation, and is reviewed and updated throughout development and implementation of the project. The project aims at responding to urgent and critical environmental issues and minimizing/mitigating public health and environmental risks. The interventions, more specifically designed towards the management and disposal of demolition waste generated from the damaged buildings and asbestos contaminated waste, rehabilitation of damaged solid waste infrastructure and technical assistance measures for their sustainable operation. In addition to the Project Management Unit (PMU) staff who will be recruited on a part-time or full-time basis throughout the Project duration, it is estimated that around 70 workers (contracted through third parties) will be employed for implementing various Project

subprojects. These workers will be local and international migrants above the age of 18. Worker distribution by activity, type, skill level and location can be found in **Table 8.10**. As for primary supply workers, defined as those suppliers who, on an ongoing basis, provide directly to the project goods or materials essential for the core functions of the project, none have been identified at this stage. However, should any be identified at a later stage during project implementation, this LMP should be updated accordingly.

Local Government Engineering Department (LGED) under Ministry of Local Government, Rural Development and Cooperatives (MLGRDC) has taken up a project for implementation of improved waste management "Integrated Solid Waste Management Improvement Project (ISWMIP)" at Rangpur City Corporation funded by the Government of Bangladesh (GoB) and Asian Infrastructure Investment Bank (AIIB).

8.6.2 Subproject construction related activities

Waste Collection and Transportation. This will help improve and optimize solid waste collection and transport services in Rangpur City Corporation, including collection containers and fleet, mechanical cleaning equipment, and transfer stations etc.

Waste Processing and Disposal Systems. This will finance prioritized waste processing and disposal infrastructure, including closure of polluted landfill sites, management of legacy waste, construction and rehabilitation of engineered sanitary landfills (standalone or regional/ clustered), and provision of facilities related to composting, resource recovery, and waste-to-energy.

8.6.3 Potential labors to be used in the subproject

Direct workers, contracted workers and community workers will be employed for the project. Two contractors may be engaged for the implementation of the project. One contractor will be engaged for construction of substations and another contractor for the constriction of transmission lines. It is assumed that contractors will not start all the construction activities at the same time. Rather contractor will start work in a site and after completing each site he will start another site. Moreover, due to the linear type of project, it is not expected that there will be high concentrate of workers at the same place and at the same time**.** So, no severe labor influx is expected. It is assumed that 20 labors will be required during normal operations and 30 labors will be required during peak operations. The nationality of labors during construction phase comprises of Foreign (maximum 4) and remaining from domestic. During operation phase, maximum 16 nos. of manpower would be of local (PGCB). So, it is expected that the total number of labors may not exceed 50 at any sub-project areas due to the phase wise activities. As the unskilled labors will be hired locally, no severe labor influx is expected at any time of the construction. It is assumed that about 50% of the labor will be migrant, for which accommodation will be required. The migrant workers and staff will be accommodated on-site at temporary labor camps or in rented houses in surrounding villages of the Project. Local workers will be employed for carrying out civil works and other masonry works. Setting up of labor camps is not envisaged during the construction phase of the Project. Moreover, temporary tent would be made near the towers and substations area to provide the security of construction machineries.

Table 8.11 Estimated subproject workers

Activity	Type of Workers	Skill Level	Estimated Number	Type/Characteristics	Location
Project Management (PMU)	Direct	Skilled	6	Supervisory Consulting / national	Landfill site
Sub-component 1.1 Waste Collection and Transportation					
Management of contaminated debris on site	Contracted	Skilled	5	Supervisory Consulting / national	Landfill site
Identification and preparation of	Contracted	Skilled & Unskilled	15	Supervisory Consulting/ national	Quarry site

Activity	Type of Workers	Skill Level	Estimated Number	Type/Characteristics	Location
disposal site for contaminated Construction and Demolition Waste (CDW)				Manual, national and international migrant Transportation (drivers) national	
Recycling of uncontaminated CDW	Contracted	Unskilled & Skilled	20	Supervisory, national Manual, national and international migrant Transportation (drivers), national	To be decided
Sub-component 1.2 Waste Processing and Disposal Systems (Rehabilitation of severely damaged solid waste management facilities serving at landfill area)					
Assessment and rehabilitation of damaged solid waste management facilities	-	-	0	-	-
Rehabilitation process for the damaged waste management facilities	Contracted	Unskilled & Skilled	20	Supervisory, national Manual, international migrant	Facilities of landfill site
Develop a detailed rehabilitation and operational plan for landfill site facilities	-	-	0	-	-
Implementation of demonstration pilot(s) on integrated solid waste management (ISWM)	Contracted	Unskilled & Skilled	10	Supervisory, national Manual, international migrant	Landfill site
Technical assistance for capacity development and public awareness	-	-	0	-	-

8.6.4 Key Labour Risk

The main labor risks identified in this subproject are associated with the Rehabilitation of Damaged Solid Waste Management Infrastructure and Management of contaminated Debris. These include:

- Disturbance of asbestos contaminated waste such as demolition work, rubble moving operations and heavy vehicular movements over contaminated waste is likely to expose operatives undertaking this work, and those in close proximity (within 20m) to the management site. Inhalation of dust, gaseous substance or aerosols from removal and transportation of asbestos material can cause serious health risks to workers.
- Occupational accidents and injuries to workers from several management activities (use of crushers and other machinery and equipment)
- Working conditions, such as excessive work hours, delayed or inadequate payment of wages and insufficient insurance coverage
- Health risks related to exposure to waste for collection, sorting, recycling and composting workers
- Accidents during removal, transportation and disposal of asbestos-contaminated waste.

- Discrimination of unequal employment opportunities likely incidents of child labour or forced labor
- Risks of labour influx and potential occurrence of gender-based violence and sexual exploitation and abuse/sexual harassment (SEA/SH) incidents
- Risks of exposure to COVID-19 contagion (See Appendix II)
- General understanding and implementation of occupation health and safety requirements
- Inadequate Grievance Mechanism (GM) to handle complaints and concerns for all the Subproject Workers.

8.7 Traffic Management Plan (TMP)

When working on roadside construction, it is important to have a traffic management plan in place to ensure the safety of both the workers and drivers in the area. A traffic management plan template can help us create a safe work zone and manage traffic flow around our construction site.

According to Safety, Health, and Welfare at Work (Construction) Regulation, to carry out any construction/maintenance work on any public roads, a contractor shall develop a traffic management plan to ensure the safety and health of the road workers and road users. A traffic management plan/temporary traffic management plan (often shortened to a "TMP" or "TTMP") is essentially a suite of documents that give details on the proposed measures which are to be implemented to ensure the safety and integrity of the road workers and road users whilst the construction work is being carried out. These documents shall be prepared by an experienced Temporary Traffic Management Designer with a valid certificate and knowledge of the current legislation.

To ensure compliance, the traffic management designer must carefully consider the characteristics of the site and develop a traffic management plan which best addresses the site constraints in a safe manner in so far as is reasonably practicable by the application of the following:

- The Traffic Signs Manual.
- Temporary Traffic Management Design Guidance.
- Temporary Traffic Management Operations.

A traffic management plan aims to promote safety and efficiency during construction activities. Having a plan can avoid potential hazards and disruptions to traffic flow. The traffic management plan should be submitted to the relevant local authority for approval prior to carrying out any roadworks on public roads.

8.7.1 Elements of the traffic management plan

A traffic management plan is a document that outlines the steps that a construction site needs to follow to manage the flow of traffic around a construction site safely. The plan should take into account the type and location of the construction, as well as the expected traffic volume.

The traffic management plan needs to cover the design, implementation, maintenance, and removal of the temporary traffic management (often shortened to "TTM") measures to minimize the risk of accidents while the roadworks activity is carried out. At a minimum, the traffic management plan shall address the following:

- Duration of Works
- Hours of Work
- Subproject Details
- Traffic Management System
- Traffic Management Layout/Drawing
- Phasing of Works

- Traffic Management Signage
- Speed Limits
- Road Level
- Design Parameters
- Site Access & Egress
- Communication and Emergency Procedure

The key elements of a traffic management plan template:

- **The type of construction work that will take place:** This is important information for drivers as it will help them know what to expect when traveling through the work zone.
- **The construction site's location:** This will help drivers plan their route and avoid the construction area if possible.
- **The expected traffic volume:** This will help us determine the necessary traffic control measures.
- **A diagram of the construction site and proposed traffic flow:** This will help drivers understand the traffic control measures that are in place.
- **The contact information for the project manager:** This is important in case there are any questions or concerns about the traffic management plan.
- **The traffic control measures that will be in place:** This includes things like road closures, detours, and lane closures.
- **Proposed measures to control traffic around the construction site:**
    - **Road closures**: We may need to close a section of the road to construction traffic. This will help ensure the safety of both drivers and workers.
    - **Detours**: We may need to set up a detour around the construction site. This will help reduce traffic congestion and allow drivers to avoid construction.
    - **Lane closures**: We may need to close a traffic lane to construction vehicles. This will help reduce the risk of accidents and ensure the safety of both drivers and workers.
    - **Traffic signs**: We will need to place traffic signs around the construction site. These signs will help drivers understand the traffic control measures that are in place.
    - **Traffic cones:** We will need to place traffic cones around the construction site. These cones will help drivers understand the traffic control measures that are in place.
    - **Barricades***:* We will need to place barricades around the construction site. These barricades will help drivers understand the traffic control measures that are in place.
- **The appropriate signatures that indicate approval of the plan:** This shows that the traffic management plan has been reviewed and approved by the relevant authorities.

The traffic management plan shall be prepared according to the latest legislation and shall be included in the Safety and Health Plan of the project.

8.7.2 The Traffic Management System

A traffic management system (traffic control method) is essentially the type of traffic control measure which is to be implemented to direct vehicles and pedestrians around the works whilst ensuring the safety of road workers. Some methods of traffic control are:

- Priority
- Stop & Go

- Two-Way Traffic
- Give & Take
- Temporary Traffic Signals
- All Stop & Convoy
- Road Closure
- Lane Closures
- Semi-Static Operations
- Mobile Lane Closures

8.7.3 Layout of a temporary traffic management layout

A temporary traffic management layout (TTML) is a drawing that outlines the traffic control measures which are to be implemented and gives details on the type of control which should be implemented, safe movement of pedestrians, type of delineation device, safety barriers, etc. Contractor should produce the highest quality traffic management layouts/drawings which come with the traffic management plans and would have a guaranteed success rate of approval from the Local Authority. All temporary traffic management layouts/drawings will be easy to read by the construction workers and can be completed at any scale required by the subproject (e.g., 1:500), and with a fast turnaround time.

8.7.4 Purpose of a Traffic Management Plan

A traffic management plan aims to promote safety and efficiency during construction activities. Having a plan can avoid potential hazards and disruptions to traffic flow. A traffic management plan should consider the construction type, location, and expected traffic volume. The plan should also outline the steps to safely manage traffic flow around the construction site.

8.7.5 Benefits of Having a Traffic Management Plan Template

The construction contractors won't realize the importance of having a traffic management plan template until they need it. A traffic management plan can promote many benefits and convenience for the construction subproject.

8.7.6 Staying Organized and on Track

A traffic management plan template ensures that the construction subproject stays organized and on track. A traffic management plan can help keep track of the different elements of the construction subproject, including the construction site's location, the expected traffic volume, and the traffic control measures in place. All this information will be readily available in one place, making it easier for contractor to ensure that the construction subproject is proceeding as planned without much traffic hindrance.

8.7.7 Avoidance of Delays

Without a clear traffic management plan, the construction project will likely experience delays. This is because it will need to take the time to develop a traffic management plan on the fly, which can take away from other aspects of the construction subproject. With a traffic management plan template, contractor can develop a traffic management plan ahead of time, which will help contractor avoid any potential delays down the road.

8.7.8 Ensuring the Safety of Drivers and Workers

One of the most important benefits of having a traffic management plan is that it can help ensure the safety of the both drivers and workers. With a traffic management plan in place, we can be sure that the appropriate traffic control measures will be in place to protect both drivers and workers from accidents. This is especially important if the construction project located on a busy road. A traffic management plan can also help workers know the traffic control measures in place, which will help them stay safe while working on the construction site.

8.7.9 Reduction of Traffic Congestion

Another benefit of having a traffic management plan is that it can help reduce traffic congestion. This is because we will be able to develop a plan that includes detours and lane closures, which can help reduce the amount of traffic going through the construction site. This will help minimize the construction project's impact on the surrounding area and make it easier for drivers to get around. As we can see, a number of benefits come with having a traffic management plan template. If we are planning a construction subproject, be sure to develop a traffic management plan to help ensure the safety of both drivers and workers and to keep our project on track.

8.7.10 Construction Traffic Control Measures

A construction traffic control measures might look like the following:

- Construction work will be taking place on main street between the hours of -
- Traffic will be diverted to side streets during construction hours.
- Drivers will be advised to use caution when driving in the area and to obey all traffic laws.
- Pedestrians will be advised to use caution when walking in the area and to obey all traffic laws.
- The construction site will be marked with signs and cones.
- Traffic control measures will be in place to ensure the safety of both drivers and workers.
- These measures will be in place until the construction subproject is completed.

These are some construction traffic control measures. Site specific traffic control measures will be based on the needs of our construction subproject.

9. GRIEVANCE REDRESS MECHANISM

9.1 General

To receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental and social safeguards performance a Grievance Redress Mechanism (GRM) has been proposed. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the pre-construction, construction and operation of the project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It will address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. It will be accessible to members of the community but also workers upon approval of the project by AIIB. The mechanism is not impeding access to the Bangladesh judicial or administrative remedies. LGED with the support of ULBs will appropriately inform the affected people about the mechanism on approval of the project.

Grievance Redress Committees (GRC) will be an instrument where the communities will exercise their basic rights of participation in the project cycle through suggestions and complaints. GRCs also be a para legal court of the sub-project at the ULB level to address local problems and complains related to social and environmental impacts as well as procurement and construction quality issues. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly without resorting to any expensive, time-consuming legal actions.

Project-affected-people (including workers) for the AIIB funded construction activities in the ISWMIP project and any other stakeholder may submit comments or complaints at any time by using the project's Grievance Redress Mechanism (GRM). The overall objectives of the GRM are to:

- Provide a transparent process for timely identification and resolution of issues affecting the project and people, including issues related to the environmental impact,resettlement and compensation program.
- Strengthen accountability to beneficiaries, including project affected people.
- Compensation payment,
- Failure to fulfill commitments,
- Poor management of construction activities,
- Accidents due to inappropriate planning of sub- project implementation
- Cultural conflicts between migrant workers and local communities,
- Disturbance due to excessive noise or other nuisance during construction or operation to unfair treatment of workers or unsafe working conditions.
- GBV and gender issues
- Complain on labor influx
- Complain or comment from different public, private and international stakeholders
- Complain, comments or suggestions from various stakeholders, labors, contractor.

The GRM will be accessible to all Internal, external, regional and international stakeholders, including affected people, workers, community members, civil society, media, vulnerable people and other interested parties. External stakeholders can use the GRM to submit complaints, feedback, queries, suggestions, or even compliments related to the overall management and implementation of the ISWMI-AIIB project. The GRM is intended to address issues and complaints in an efficient, timely, and cost-effective manner.

9.2 Grievance Redress Mechanism Process

9.2.1 Formation of GRM

The fundamental objectives of the GRM, implemented through the GRC serving as a para-legal body, areto resolve any resettlement-related grievances locally in consultation with the aggrieved party to facilitatesmooth implementation of the social and environmental action plans. Another important objective is to democratize the development process at the local level and to establish accountability to the affected people. The procedures will however not a person's right to go to the courts of law anticipate. There willbe four-tier grievance redress mechanism; 1st at local level (Ward level), 2nd District level, 3rd PMO (Project Management Office) level and final one is for ministry level. Level 1 GRM is the most significant and AIIB's perspective effective functioning of the field level GRC is most significant.

The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions. Where grievances are among the affected persons, the membership composition of the GRCs will take into account any traditional conflictresolution arrangements that communities may practice. If the aggrieved person is a female, LGED will askthe concerned female UP member (if the Sub project is located outside the ULB area) or city corporation ward councilor to participate in the hearings. Members of the GRCs will be nominated by the mayor. First level GRC will be formed in the local level where community people will be able to complain /raisegrievances directly to the field level project office. According to AIIB's perspective effective functioning, the field level GRM is most significant. NGO/Consulting firm together with Project Implementation Committee (PIC) will inform all affected people and local community about the project grievance Redress Mechanism in local language. This local GRC will ensure easy accessibility by the PAPs, local communitiesand interested stakeholders, so that any grievances can be solved directly or within a very short period oftime.

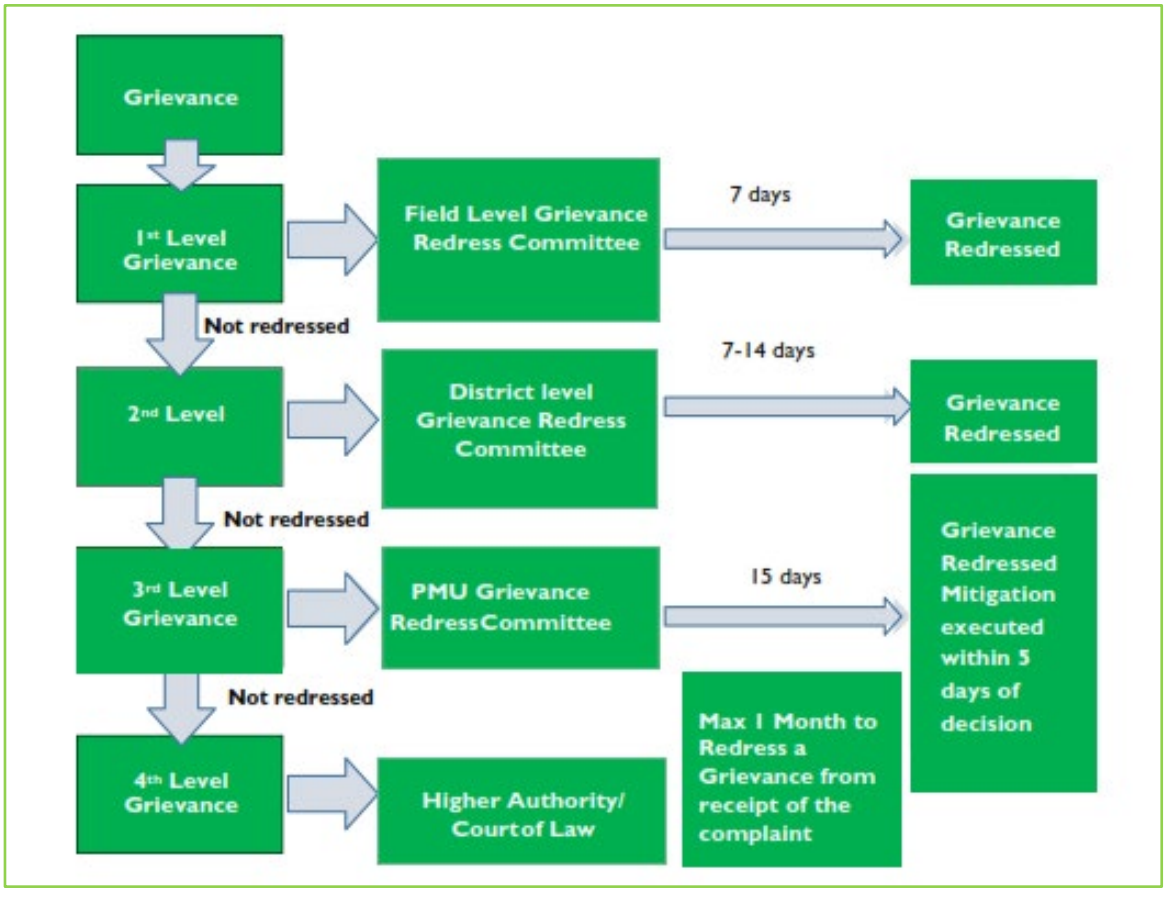


Figure 9.1 Grievance redress mechanism process

9.2.2.1 Composition of Field level GRC

Table 9.1 GRC membership at local level

SL.	Responsible persons	Position
1	Representative of the Mayor	Chairman
2	SAE of the Engineering Section of the ULB	Member Secretary
3	Social Specialist from NGO / consulting firm	Member
4	Related word Commissioner	Member
5	Teacher from Local Educational Institution	Member
6	Related female ward Councilor	Member
7	Representative from the PAP Group	Member

All complaints will be received at the Office of the XEN of the ULB. All cases at the local level will be heard within four weeks of their receipt. Grievances received through any channel will be registered and a notification of receipt with assurance of necessary review and resolution given in writing to the aggrieved persons.

9.2.2.2 Composition of District GRC

If the resolution attempt at the local level fails, the 1st level GRC will refer the complaint with the minutes of the hearings of the local GRC to district level for further review. With active assistance from the Area RP (NGO) implementing agency, the committee will decide and communicate it to the concerned GRC. Responsible staffs of ULB with the support of NGO/consulting firm will make periodic visit to the -sub project sites, interact with the communities and affected persons, and pick up issues of concerns, complaints and suggestions to register with the GRM books. The decisions on unresolved cases will be communicated to the GRC within one week of the complaint receipt.

Table 9.2 GRC membership at district level

People of City Corporation	Position in GRC
1. Mayor	Chairman
2. Chief of the Engineering Section of the ULB	Member-Secretary
3. Resettlement Officer, Management Consultant/NGO)	Member
4. Concerned Ward Commissioner	Member
5. Concerned Woman Ward Commissioner	Member
6. One representative of APs	Member
7. One representative from the civil Society	Member

9.2.2.3 Composition at PMO (Project Management Office, LGED) level GRC

If a decision at district level is again found unacceptable by the aggrieved person(s), LGED can refer the case to the PIU with the minutes of the hearings at local and district levels. PD will be the convener and senior social specialist will be the member secretary at PMO level. All the unsolved cases At the PMO level,

Decisions on unresolved cases, if any, at the PMO level will be made in no more than four weeks by an official designated by the Secretary, LGRD. A decision agreed with the aggrieved person(s) at any level of hearing will be binding upon LGED. There will be budgetary allocation for local and district committee members for participating meetings and refreshments during meeting.
To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, theconvener will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.
- Remove a recommendation by any person that may separately accompany the grievance redress application.
- Disqualify a GRC member who has made a recommendation on the application or separately before the formal hearing: Where a GRC member is removed, appoint another person in consultation with the Project Director.
- The convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this RPF and the mitigation standards, such as compensation rates established through market price surveys.

The affected persons and their communities will be informed of the project's grievance redress mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the RPF in the form of information brochures will be distributed among the affected persons. The PAPs will also be briefed on the scope of the GRC, the procedure for lodging grievances cases and the procedureof grievance resolution at the project level.

Table 9.3 Grievance redress procedures

Step of the Procedures	Functions for Determining the Resolve of Grievance
Step-1	An AP has a grievance about any part of the Land Acquisition and Resettlement Process (LARP) and assumes/finds that it cannot be resolved.
Step-2	The AP can approach the assigned Resettlement Officer/NGO will provide clarification to the AP as per RP within one day.
Step-3	If not resolved or not satisfied with the clarification given by NGO/Resettlement Officer within two days, thus, the AP can approach to the issue before GRC in writing. Resettlement Officer/ NGO staff assist the AP in producing the complains and organize hearing within 21 (twenty-one) days/ three weeks of receiving the complaints.
Step-4	GRC will scrutinize applications to resolve the complaints and cases are referred to DC through EA (Executing Agency) if beyond their mandate.
Step-5	If within its mandate, GRC sessions will be held with the aggrieved AP, minutes are recorded. If resolved, the Project Director will approve it in writing.
Step-6	If resolved, the AP may accept GRC decision, if not, he/she may file a case to the court of law for settlement.
Step-7	The GRC minutes, approved by the Project Director, are received at the Convener's Office. The approved verdict is communicated to the complaint AP in writing.

Any grievance filed with the GRC, must be reported in the annual report to the CSC who will then submit a consolidated report to AIIB via LGED.

First level GRC will be formed in the local level where community people will be able to complaint / raise grievances directly to the field level project office. According to AIIB's perspective effective functioning of the field level GRM is most significant. NGO /Consulting firm together with Project Implementation Committee (PIC) will inform all affected people and local community about the project grievance Redress Mechanism in local language. This local GRC will ensure easy accessibility by the PAPs, local communities and interested stakeholders, so that any grievances can be solved directly or within a very short period of time.

The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions. Where grievances are among

the affected persons, the membership composition of the GRCs will consider any traditional conflict resolution arrangements that communities may practice. If the aggrieved person is a female, ULB will ask the concerned female municipal ward councilor to participate in the hearings. Members of the GRCs will be nominated by the mayor.

9.3 Grievance Mechanism Intake Channels

If grievances are raised, there will be various options to submit grievances through mediums such as websites, emails, phones and other appropriate communication methods, which will berecorded and dealt with accordingly.

Multichannel cloud GRM system will be established taking the best examples and practices to diminish the need for Project-affected people to physically interact with Project staff. A training program will be arranged with different stakeholders on how to raise grievances during this pandemic. It will ensure:

a. Accept, manage and respond to feedback/grievances through calls, text, social media and emails. Feedback is automatically logged and can be accessed remotely.

b. Ready-made, off-the-shelf solution which requires minimum set-up and training to deploy and operate.

c. It will be easier to access off/on-line with/out smart phone.

d. It can be easily integrated with the spot.

9.4 Grievance Registry, Referral, Resolution and Appeals Process

To ensure impartiality and transparency, hearings on complaints at the GRC level will remain open to the public. The GRCs will record the details of the complaints and their resolution in a register, including intake details, resolution process and the closing procedures. LGED will maintain the three GRM books.

Registration Book: (1) Serial No., (2) Date of receipt, (3) Name of Complaint, (4) Gender, story and expectation, (5) Father or husband, (6) Complete address, (7) Main objection (loss of land /property or entitlements, (8) Decision of GRC, (9) Previous records of similar grievances

Resolution Book: (1) Serial No., (2) Case no., (3) Name of Complaint, (4) Complaint's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) results of hearing and field investigation, (8) Decision of GRC, (9) Progress (Pending, solved), and (10) Agreement of commitments.

Closing Book: (1) Serial No., (2) Case no., (3) Name of Complaint, (4) Decisions and response to complaints, (5) Mode and Medium of Communication, (6) Date of closing, (7) confirmation of complaint's satisfaction, and (8) Management actions to recurrence.

9.5 GRM Monitoring and Reporting

Grievance Regulation will be a continuous process during subproject implementation. The ULBs will keep records of all resolved and unsolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by IDA (International Development Association) and any other interested person/entities. The ULB will also prepare periodic reports on the grievance resolution process and publish these on their websites. LGED will consolidate reports from the ULBs on GRM and post in their website.

9.6 GRM Contact Information

Information on the project and future stakeholder engagement programs will be available on the project'swebsite and will be posted on information boards in the project office in the site office, at

the ULB office of contact regarding the stakeholder engagement program at LGED is given in the following Table 9.4.

Table 9.4 Contact regarding the stakeholder engagement program

Description	Contact details
Client:	Local Government Engineering Department (LGED)
To:	Project Director, ISWMI Project
Address:	LGED HQs, Sher-e-Bangla Nagar, Agargaon, Dhaka-1207
E-mail:	pd.iswmip@lged.gov.bd
Website:	www.lged.gov.bd
Telephone:	

9.7 Monitoring and Reporting

LGED will set up its own monitoring and evaluation (M&E) system to report quarterly involving the XENs at the District level. The RP implementing agency will primarily be responsible for collection of monitoring data on land acquisition and implementation of resettlement plans, tribal peoples plans (if any) and gender actions in the process. LGED will engage a monitoring and evaluation (M&E) consultant to assist PMO in day-to-day monitoring and management support for implementation. The DS consultant includes a senior, experienced resettlement specialist who will prepare six monthly reports on monitoring of land acquisition and implementation of resettlement plans, tribal peoples plans (if any) and gender action plans in the process. The PMO will be responsible for monitoring, reporting and evaluation, including the design of the M&E system.

The LGED program intends to strengthen the GRM through information and communication technology to ensure that all complaints including those of sexual exploitation and abuse are immediately reported to the Government. LGED will integrate the GRM on a web-based dashboard, to adequately and promptly address any potential grievance related to Gender Based Violence and SEA. The complaints registered in this system will be managed by a dedicated administrator that will liaise immediately any GBV and SEA complaints with the contractors, consultant and LGED/ PIU (project Implementation Unit, ULB) for immediate measures. If the GRM receives a case on sexual exploitation and abuse related to the project, it will be recorded, and the complainant willbe referred to the relevant assistance, if needed, for referral to any other service providers. The supervision consultant will keep the information confidential to protect privacy of GBV and SEA complainants. In cases, where the perpetrator(s) is linked to project activities then the contractor will takeappropriate actions as per the code of conduct signed by the particular person and under the effective law in Bangladesh. LGED will report activities and outcomes of GBV and SEA surveillance and management to the AIIB on a regular basis.

To ensure that grievance redress decisions are made in formal hearings and in a transparent manner the convener will apply the following guidelines:

i. A standard application format will be used for receiving grievances which will be available at the office of INGO /Consulting firm. This application format would be concurred by the PD.

ii. Reject a grievance redress application with any recommendations written on it by a GRC memberor others such as politicians and other influential persons.

iii. Remove a recommendation by any person that may separately accompany the grievance redress application.

iv. Disqualify a GRC member who has made a recommendation on the application separately beforethe formal hearing.

v. Where a GRC member is removed, appoint another person in consultation with the Project

Director.

vi. The Convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this SIA and the mitigation standards, such as compensation rates established throughmarket price surveys.

9.8 Information Disclosure, Consultation and Participation

Prior to the start of the construction, LGED or its representative will publicize the establishments of the grievance redress steps and the process, and advertise all via contact information and the grievance redress steps posted at every UP office if any, involved, as well as at busy public places in the Project corridor. The poster(s) will be in the local language(s) and posted within 30 days of the start of construction. The LGED representative will check at least monthly to ensure that the posters are prominently displayed and provide clear contact instructions and numbers. This procedure and monitoring will be reported in the semi-annual monitoring report submitted to the AIIB.

9.9 Training

(1) Land acquisition and resettlement experience in former and ongoing projects of LGED formed the basis for RPF. LGED has prior experience of dealing with land acquisition and resettlement in compliance with on Involuntary Resettlement and on Indigenous Peoples. However, the PMU/PIU staff will be oriented on preparation of resettlement plans and implementation of them at the field level. An experienced implementing agency (or NGO) will be employed for social survey and implementation of RPs.

(B) In monitoring land acquisition and RP (and TPP, if needed) implementation activities, the LGED Land Acquisition and Resettlement Specialist (LARS) at the PMU will identify any issues that may be impeding progress and coordinate them with the PD and SMOs (Social Management Officer) for actions by the XENs at the HQ, LGED level. Jointly with the DS design supervision consultant's, resettlement specialist, the LARS will design and conduct training of LGED field staff, especially those who will implement the project. on social safeguards compliance issues relating to involuntary resettlement and tribal peoples, as well as implementation of the various impact mitigation policies and measures adopted in this ISWMIP. Gender mainstreaming in project activities will be given special attention in all training and capacity building activities.

10. CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The process described in this document has assessed the environmental and social impacts of all elements of the infrastructure proposed under the Rangpur City Corporation solid waste management sub-project. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure, but no impacts were identified as being due to either the sub-project design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

This ESIA report is prepared following the guidelines of DOE and the AIIB approved ESMPF. Regardless of these and various other actions taken during the ESIA process and in developing the subproject, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of excavation work; because the secondary storage facilities (waste bins) are located in the town, some parts of which are densely populated; and because Rangpur is an area with a rich history, in which there is a high risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

During the construction phase, impacts mainly will arise from the need to dispose of large quantities of waste soil produced by excavation at the landfill site. These are common impacts of construction in and around urban areas, and there are well developed methods for their mitigation. One field in which impacts are much less is archaeology, and here the land fill site being vacant city corporation land with no historical use or habitation, there will be no case of chance finds. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example, it is proposed that the project will employ among the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and plant trees on and around completed parts of the landfill site once it is operating, to improve the appearance and provide a small ecological gain.

Once the system is operating, it will be important that Rangpur City Corporation maintains the facilities and the waste management system as a whole in proper working order, because the city environment will deteriorate rapidly from waste accumulation if the system begins to fail. The subproject will provide capacity building, public education and financial support to ensure continuation of the operating system. If waste is collected regularly from houses and city storage bins, transferred to the landfill and treated as intended, then there should be no significant negative impacts. Even the accumulation of waste to a design height of 6 m at the landfill should not be significant as waste will be compacted and covered with soil daily and when each waste cell is completed, thus limiting pests, odour and visual impacts. There are also no residential areas nearby where people could be affected by such impacts.

The main impacts of the operating waste management system will be beneficial as the general environment of the city will improve considerably as mounds of garbage are no longer evident and the appearance, smell and public health of the area improves as a result. Some people will also gain socio-economically from being employed in companies engaged to operate the system, or in the expanded city corporation manpower.

Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PMU. There will also be a longer-term survey to monitor the expected improvements in the city environment from the improved solid waste management.

Finally, stakeholders were involved in developing the ESIA through face-to-face discussions on site and a large public meeting held in the city corporation area, after which views expressed were incorporated into the ESIA and the planning and development of the subproject. The ESIA will be made available at public locations in the city and will be disclosed to a wider audience via the AIIB website. The consultation process will be continued and expanded during subproject implementation, when a nationally-recognized NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the subproject and have the opportunity to participate in its development and implementation.

10.2 Recommendations

The Project Management Unit (PMU) and Management, Design and Supervision Consultant (MDSC) will be responsible for monitoring. The MDSC will submit monthly monitoring reports to PMU and the PMU will send quarterly monitoring reports to AIIB. AIIB will post the environmental monitoring reports on their website. Therefore, the proposed sub-project is unlikely to cause significant adverse impacts and net environmental benefits to citizens of Rangpur City Corporation will be positive. The potential impacts that are associated with design, construction and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

The ESMP of this ESIA should be site specific ESMP (SESMP) including monitoring plan. During construction, the contractor will prepare contractor's Environmental Management Plan, which will include contractor's responsibility in implementing ESMP. The plan should be reviewed and approved by the employer at least 10 days before commencement of construction.

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

LGED has fully endorsed the ESMP and is committed to implement all the mitigation measures. Rangpur Municipality will also ensure that the work is carried out in an environmentally acceptable manner and the monitoring and reporting are completed in a compliant and timely fashion, acceptable to DOE.

As per Government of Bangladesh ECA, 1995 and ECR, 2023, the sub-project is categorized as "red"; and ECC must be obtained from DoE.

11. RFERENCES

Agrawal, D J and A H Kassam. 1976. The importance of multiple cropping in increasing world food supplies. A special publication No. 27, American Society of Agronomy, Madison, Wisconsin. pp. 2-3.

Agrawal, D J and A H Kassam. 1976. The importance of multiple cropping in increasing world food supplies. A special publication No. 27, American Society of Agronomy, Madison, Wisconsin. pp. 2-3.

Ahsan M. N., & Warner J. (2014). The socioeconomic vulnerability index: A pragmatic approach for assessing climate change led risks—A case study in the south-western coastal Bangladesh. *International Journal of Disaster Risk Reduction*, 8, 32–49.

Alam A., , & Bhadra L. (2019). Disaster risk reduction and the capacity building plan: Mitigation of the of impacts of climatic disasters in the coastal area of Bangladesh. *Journal of Climate Change*, 5(2), 1–7.

Ali M. H. (1998). Earthquake database and seismic zoning of Bangladesh (INCEDE Report, Vol. 11). http://cidbimena.desastres.hn/pdf/eng/doc12294/doc12294-contenido.pdf

AO, J. M., BORDOLOI, S. and OHLER, A. 2003. Amphibian fauna of Nagaland with Nineteen new records from the state including five new records for India, Zoos' Print J., 18(6), 1117 – 1125.

ASMAT, G. S. M. 2007. Update list of the amphibians of Bangladesh, Bannaprani –Bangladesh Wildlife Bull., 4 (1–2): 3.

Bangladesh Bureau of Statistics. (2013). Bangladesh Population and Housing Census 2011: Community Report-Rangpur. http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopCen2011/COMMUNITY_RANGPUR.pdf

Bangladesh Bureau of Statistics. (2015). *Census of Slum Areas and Floating Population 2014*. Retrieved from http://203.112.218.65:8008/WebTestApplication/userfiles/Image/Slum/FloatingPopulation2014.pdf

Bangladesh Bureau of Statistics. (2019). Final report on Household Income and Expenditure Survey 2016. http://www.bbs.gov.bd/site/page/648dd9f5-067b-4bcc-ba38-45bfb9b12394/Income,-Expenditure-&-Poverty

Bangladesh Fire Service and Civil Defense. (2019). Fire incident data. http://www.fireservice.gov.bd/site/page/18e08e09-ad74-4aa6-9494-84d1fdc18ad3/

Barua U., Akhter M. S., & Ansary M. A. (2016). District-wise multi-hazard zoning of Bangladesh. *Natural Hazards*, 82(3), 1895–1918.

BBS (Bangladesh Bureau of Statistics). 2014. Statistical Yearbook of Bangladesh. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

BOULENGER G. A. 1887. An account of batrachians obtained in Burma by M. L. Fea, of the Genova Civic Museum, Ann. Mus. Genoa, 2(5): 418 – 424.

BOULENGER G. A. 1890.The Fauna of British India, Including Ceylon and Burma. Reptilia and Batrachia, Taylor and Francis, London.

Brouwer R., Akter S., Brander L., & Haque E. (2007). Socioeconomic vulnerability and adaptation to environmental risk: A case study of climate change and flooding in Bangladesh. *Risk Analysis*, 27(2), 313–326.

CEGIS. (2015). Center for Environmental and Geographic Information Services (CEGIS) Data Archive.

CHAKMA, S. 2009. Humerana humerali in:Kabir, S.M.H., Ahmed, M., Ahmed, A.T.A., Rahman, A.K.A., Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., and Khondker, M. (eds.). 2009. Encyclopedia of Flora and Fauna of Bangladesh, Vol. 25. Amphibians and Reptiles. Asiatic Society of Bangladesh, Dhaka, pp. 31-32.

CHOWDHURY, M.M. 1996. Ecology of Amphibians of Bangladesh, M. Sc. Thesis (unpublished), Jhangirnagar University, Dhaka, Bangladesh.

Crop Diversification in Rangpur Region. https://www.researchgate.net/publication/327655326

Das, Anup, G I Ramkrushna, G S Yadav, J Layek, C Debnath, B U Choudhury, K P Mohaptara, S V Ngachan and S Das. 2015. Capturing traditional practices of rice based farming systems and identifying interventions for resource conservation and food security in Tripura, India. Applied Ecology and Environmental Sciences. 3(4): 100-107.

Dunbar, C.O. and Rodgers, J., Principles of Stratigraphy, Wiley International Edition. Toppan Company Ltd. Tokyo, Japan, pp. 271- 288, 1957.

FAO, 1988. Land Resources Appraisal of Bangladesh for Agricultural Development- Report 2: Agroecological regions of Bangladesh. Food and Agriculture Organization of the United Nations, Rome, Italy, 570p.

FEEROZ, M.M (ed.). 2013. Biodiversity of protected areas of Bangladesh, Vol. III: Teknaf Wildlife Sanctuary. Biotrack. Arannayk Foundation. Dhaka, Bangladesh, pp. 119-120.

FEEROZ, M.M., HASAN, M.K., and KHAN, M.M.H. 2011. Biodiversity of protected areas of Bangladesh, Vol. I. Rema-Kalenga Wildlife Sanctuary. Biotrack. Arannayk Foundation. Dhaka, Bangladesh, pp. 101-102.

Gray C. L., & Mueller V. (2012). Natural disasters and population mobility in Bangladesh. In Proceedings of the National Academy of Sciences of the United States of America (Vol. 109, pp. 6000–6005).

H. Al-Razi, M. A. Baki and S. M. I. Alam, 2014. RECORD OF HUMERANA HUMERALIS (BOULENGER 1887) FROM RANGPUR DISTRICT OF NORTH-WESTERN BANGLADESH, Bangladesh J. Zool. 42(2): 277-282, 2014

HALL, R. 1996. Reconstructing Cenozoic SE Asia, in: R. Hall and D. J. Blundel (eds.), Tectonic Evolution of Southeast Asia, Bath, UK, Geological Society Publishing House. pp.153–83

HAMILTON, W. 1979. Tectonics of the Indonesian region. United States Geological Survey Professional Papers.1078: 1 –345.

HASAN, M. K., KHAN, M. M. H. and M. M. FEEROZ. 2014. Amphibians and Reptiles of Bangladesh: A Field Guide. Arranyak Foundation. 191 pp.

Hossain L, Sarker S, Sarker N (2008). "Ecology of spotted flapshell turtle, Lissemys punctata (Lacepede, 1788) in Bangladesh". Department of Zoology, University of Dhaka. ECOPRINT. **15**: 59-67.

http//: www.sciencepublishinggroup.com/j/ijtetdoi: 10.11648/j.ijtet.20170304.15

https://www.metropolitantransferstation.com.au/blog/negative-effects-of-improper-waste-management/ Sun, 8 Oct 2017

Islam M. M., & Adri N. (2008). Fire hazard management of Dhaka city: Addressing issues relating to institutional capacity and public perception. *Jahangirnagar Planning Review*, 6(6), 57–68.

Jump up to: Auffenberg W (1981). "Behavior of Lissemys punctata in a drying lake in Rajasthan, India". Bombay **78** (3): 487-493.

Jump up to:[a b c d e] Environmental Information System (ENVIS) center of India. Zoological survey of India. Lissemys punctata. "::Indian Flap-shelled Turtle::". Archived from the original on 2010-10-29. Retrieved 2010-12-03.

Jump up to:[a b c] Ernst C, Altenburg R, Barbour R (1997). Turtles of the World. Netherlands Biodiversity Information Facility. "Turtles of the World > Species". Archived from the original on 2011-03-20. Retrieved 2010-12-03.

Karim N. (1995). Disasters in Bangladesh. *Natural Hazards*, 11(3), 247–258.

Kshirsagar, K G, S Pandey and M R Bellon. 1997. Farmers' perception, varietal characteristics and technology adoption: the case of rainfed village in eastern India. Discussion paper 5/97. Social Sciences Division, International Rice Research Institute. Los Baños, Laguna, Philippines.

LGED. (2014). Rangpur city master plan: 2014–2033. https://www.rpcc.gov.bd/city-plan/Rangpur_ city_ corporation_Master_Plan_Final_Report.pdf

Mandal, R and M P Bezbaruah. 2013. Diversification of cropping pattern: its determinants and role in flood affected agriculture of Assam Plains. Indian J. Agric. Econ. 68(2): 169-181.

Ministry of Disaster Management and Relief. (2015). Atlas: Seismic risk assessment in Bangladesh for Bogra, Dinajpur, Mymensingh, Rajshahi, Rangpur and Tangail City Corporation/Paurashava Areas, Bangladesh. In Haque S. M. (Ed.), *ATLAS, Ministry of Disaster Management and Relief*. https://www.scribd.com/document/261101665/ATLAS-Seismic-Risk-Assessment-of-Bangladesh-Bogra-Dinajpur-Mymensingh-Rajshahi-Rangpur-and-Tangail-City-Corporation-Paurashava

Minton SA Jr (1966). "A contribution to the herpetology of West Pakistan". Bulletin of the American Museum of Natural History. **134** (2): 27-184.

Moll, E.O., Platt, K., Platt, S.G., Praschag, P., and van Dijk, P.P. 2009. *Batagur baska* (Gray 1830) – northern river terrapin. In: Rhodin, A.G.J., Pritchard, P.C.H., van Dijk, P.P., Saumure, R.A., Buhlmann, K.A., Iverson, J.B., and Mittermeier, R.A. (Eds.). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs No. 5, pp. 037.1–037.10, doi: 10.3854/crm.5.037.baska.v1.2009, //iucn-tftsg.org/cbftt/.

Muttaleb, M A, S M Shahidullah, M Nasim and A Saha. 2017. Cropping systems and land use in Sylhet region. Bangladesh Rice J. 21(2): 273-288.

Muttaleb, M A, S M Shahidullah, M Nasim and A Saha. 2017. Cropping systems and land use in Sylhet region. Bangladesh Rice J. 21(2): 273-288.

Nasim, M, S M Shahidullah, A Saha, M A Muttaleb, T L Aditya, M A Ali and M S Kabir. 2017. Distribution of Crops and Cropping Patterns in Bangladesh. Bangladesh Rice J. 21(2): 1-55.

Neena, D. 1998. Interstate variation in cropping pattern in India. Indian J. Regi. Sci. 30(2): 57-69.

Paul B. K., & Bhuiyan R. H. (2010). Urban earthquake hazard: Perceived seismic risk and preparedness in Dhaka city, Bangladesh. *Disasters*, 34(2), 337–359.

Rabby Y. W., Hossain M. B., & Hasan M. U. (2019). Social vulnerability in the coastal region of Bangladesh: An investigation of social vulnerability index and scalar change effects. *International Journal of Disaster Risk Reduction*, 41, 101329.

Rahman M. Z. (2020). *Relationship Between multiple deprivation and disaster risk perception in Rangpur city, Bangladesh*. Faculty of Geo-Information Science and Earth, Observation (ITC), University of Twente. http://essay.utwente.nl/85174/

Rahman M. Z., Atun F., & Martinez J. A. (2021). Earthquake and fire hazard risk perception: A study on the emerging Rangpur city of Bangladesh. *Journal of Integrated Disaster Risk Management*, 11(1).

Rahman N., Ansary M. A., & Islam I. (2015). GIS based mapping of vulnerability to earthquake and fire hazard in Dhaka city, Bangladesh. *International Journal of Disaster Risk Reduction*, 13, 291–300.

Rao, P. R. and Suneetha, P., Land use modeling for sustainable rural development, International Journal of Science, Environment and Technology, vol. 1 (5), 519- 532, 2012.

Rashid, M H, A H Khan and M MAlam. 2005. Cropping systems dynamics in greater Khustia. J. Bangladesh Agril. Univ. 3(2): 213-238.

Reddy, G.B.O. and Maji, A.K., Delineation and characterization of geomorphological features in a part of lower maharahstra metamorphic plateau using IRS-ID LISS-III Data, Journal of the Indian Society of Remote Sensing, vol. 31 (4), 241-250, 2003.

RpCC. (2019). Introduction to Rangpur City Corporation. https://rpcc.portal.gov.bd/site/page/0046cdb2-b2a0-499e-b4cf-1c1c0e89a49d

Shahidullah, S M, M Nasim, M K Quais and A Saha. 2017. Diversity of Cropping Systems in Chittagong Region. Bangladesh Rice J. 21(2): 109-122.

Shahidullah, S M, M Nasim, M K Quais and ASaha. 2017. Diversity of Cropping Systems in Chittagong Region. Bangladesh Rice J. 21(2): 109-122.

Shriar, A J. 2000. Agricultural intensity and its measurement in frontier regions.Agroforestry Systems.49(3): 301–318.

Soil Resources Development Institute (SRDI), Land and Soil Resource Uses Prospectus in Kaunia Upazilla, Ministry of Agriculture. Agricultural farmed road, Dhaka 1215. 2001.

"Species Spotlight Vol. 17". Turtle Survival Alliance. 2019-01-31. Archived from the original on 2022-07-31. Retrieved 2021-09-26.

Transportation System Analysis at the Major Road Intersection in the CBD Area of Rangpur City, Bangladesh: International Journal of Transportation Engineering and Technology 2017; 3(4): 74-82

Yokoyama, R., Shirasawa, M. and Pike, R.J., Visualizing topography by openness: a new application of image processing to digital elevation models, Photogrammetric Engineering and Remote Sensing, vol. 68, pp. 257-265, 2002.

12. APPENDICES

Appendix I: Sample Labor Court of Conduct covering the GBV/SEA/SHA related risks

Introduction:

The Company is committed to ensuring a work environment which minimizes any negative impacts on the local environment, communities, and its workers. The company also strongly commits to creating and maintaining an environment in which Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH) have no place, and where they will not be tolerated by any employee, sub-contractor, supplier, associate, or representative of the company. The purpose of this Code of Conduct is to:

1) Create a common understanding of what constitutes Sexual exploitation and abuse, and sexual harassment;

2) Create a shared commitment to standard behaviors and guidelines for company employees to prevent, report, and respond to SEA and SH; and

3) Create understanding that breach of this code of conduct will result in disciplinary action.

Definitions

Sexual Exploitation and Abuse (SEA):

Is defined as any actual or attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse:

"The actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions.

" Sexual Harassment:

Unwelcome sexual advances, request for sexual favors, and other verbal or physical conduct of sexual nature.

Sexual Harassment versus SEA:

SEA occurs against a beneficiary or member of the community. Sexual harassment occurs between personnel/staff of an organization or company and involves any unwelcome sexual advance or unwanted verbal or physical conduct of a sexual nature. The distinction between the two is important so that agency policies and staff trainings can include specific instruction on the procedures to report each.

Consent is the choice behind a person's voluntary decision to do something. Consent for any sexual activity must be freely given, ok to withdraw, made with as much knowledge as possible, and specific to the situation. If agreement is obtained using threats, lies, coercion, or exploitation of power imbalance, it is not consent. Under this Code of Conduct consent cannot be given by anyone under the age of 18, regardless of the age of majority or age of consent locally. Mistaken belief regarding the age of the child is not a defense.

There is no consent when agreement is obtained through:

- The use of threats, force or other forms of coercion, abduction, fraud, manipulation, deception, or misrepresentation
- The use of a threat to withhold a benefit to which the person is already entitled, or
- A promise is made to the person to provide a benefit. While all forms of violence against a community resident or a co-worker are forbidden, this code of conduct is particularly concerned with the prevention and reporting of sexual exploitation and abuse (SEA) and sexual harassment which constitute gross misconduct, are grounds for termination or other consequences related to employment and employment status:

(1) Examples of sexual exploitation and abuse include, but are not limited to:

- A project worker tells women in the community that he can get them jobs related to the work site (cooking and cleaning) in exchange for sex;
- A worker that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex;
- A project worker gets drunk after being paid and rapes a local woman;
- A project worker denies passage of a woman through the site that he is working on unless she performs a sexual favor;
- A manager tells a woman applying for a job that he will only hire her if she has sex with him; and
- A worker begins a friendship with a 17-year-old girl who walks to and from school on the road where project related work is taking place. He gives her rides to school. He tells her that he loves her. They have sex.

(2) Examples of sexual harassment in a work context include, but are not limited to:

- Male staff comment on female staffs' appearances (both positive and negative) and sexual desirability;
- When a female staff member complains about comments male staff are making about her appearance, they say she is "asking for it" because of how she dresses; and
- A male manager touches a female staff members' buttocks when he passes her at work. A male staff member tells a female staff member he will get her a raise if she sends him naked photographs of herself.

Individual signed commitment (to be translated in a language understood by the person signing):

I, _____, acknowledge that sexual exploitation and abuse (SEA) and sexual harassment, are prohibited. As an (employee/contractor) of (contracted agency / sub-contracted agency) in (country), I acknowledge that SEA and SH activities on the work site, the work site surroundings, at workers' camps, or the surrounding community constitute a violation of this Code of Conduct. I understand SEA and SH activities are grounds for sanctions, penalties or potential termination of employment. Prosecution of those who commit SEA and SH may be pursued if appropriate.

I agree that while working on the subproject I will:

- Treat all persons, including children (persons under the age of 18), with respect regardless of sex, race, color, language, religion, political or other opinion, national, ethnic or social origin, gender identity, sexual orientation, property, disability, birth or other status.;
- Commit to creating an environment which prevents SEA and SH and promotes this code of conduct. In particular, I will seek to support the systems which maintain this environment;
- Not participate in SEA and SH as defined by this Code of Conduct and as defined under (country) law (and other local law, where applicable);
- Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate;
- Not participate in sexual contact or activity with anyone below the age of 18. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense. I will not participate in actions intended to build a relationship with a minor that will lead to sexual activity;
- Not solicit/engage in sexual favors in exchange for anything as described above;
- Unless there is the full consent by all parties involved, recognizing that a child is unable to give consent and a child is anyone under the age of 18, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" under this Code.

I commit to:

- Adhere to the provisions of this code of conduct both on and off the project site. Attend and actively partake in training courses related to preventing SEA and SH as requested by my employer. If I am aware of or suspect SEA and SH, at the project site or surrounding community, I understand that I am encouraged to report it to the Grievance Reporting Mechanism (GRM) or to my manager. The safety, consent, and consequences for the person who has suffered the abuse will be part of my consideration when reporting. I understand that I will be expected to maintain confidentiality on any matters related to the incident to protect the privacy and security of all those involved.

  Sanctions: I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

- Informal warning or formal warning;
- Additional training;
- Loss of salary;
- Suspension of employment (with or without payment of salary);
- Termination of employment; and

Report to the police or other authorities as warranted.

I understand that it is my responsibility to adhere to this code of conduct. That I will avoid actions or behaviors that could be construed as SEA and SH. Any such actions will be a breach this Individual Code of Conduct. I acknowledge that I have read the Individual Code of Conduct, do agree to comply with the standards contained in this document, and understand my roles and responsibilities to prevent and potentially report SEA and SHA issues. I understand that any action inconsistent with this Individual Code of Conduct or failure to act mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

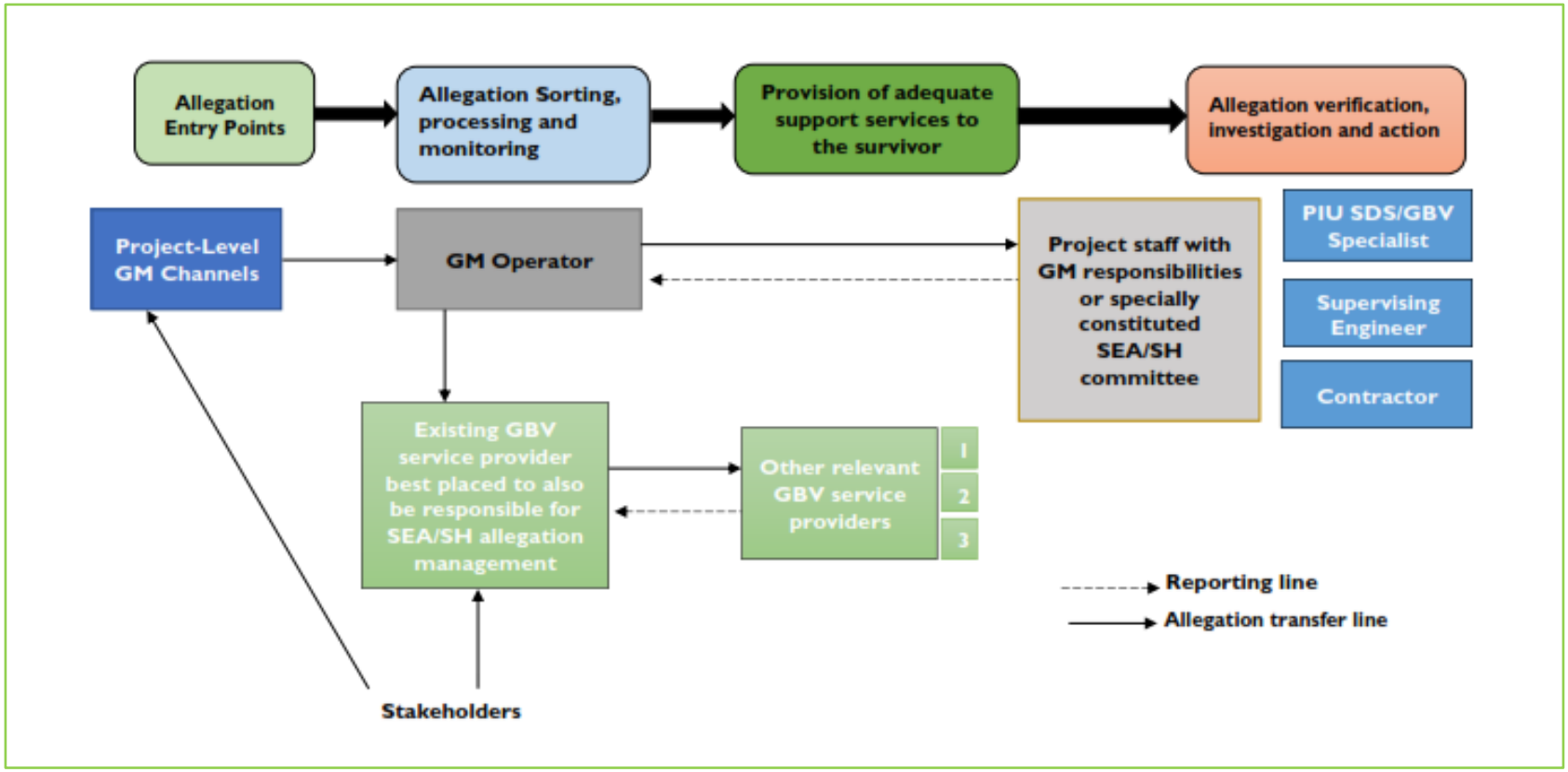
Date: _____

Appendix II: GBV service providers functioning in Bangladesh during COVID-19

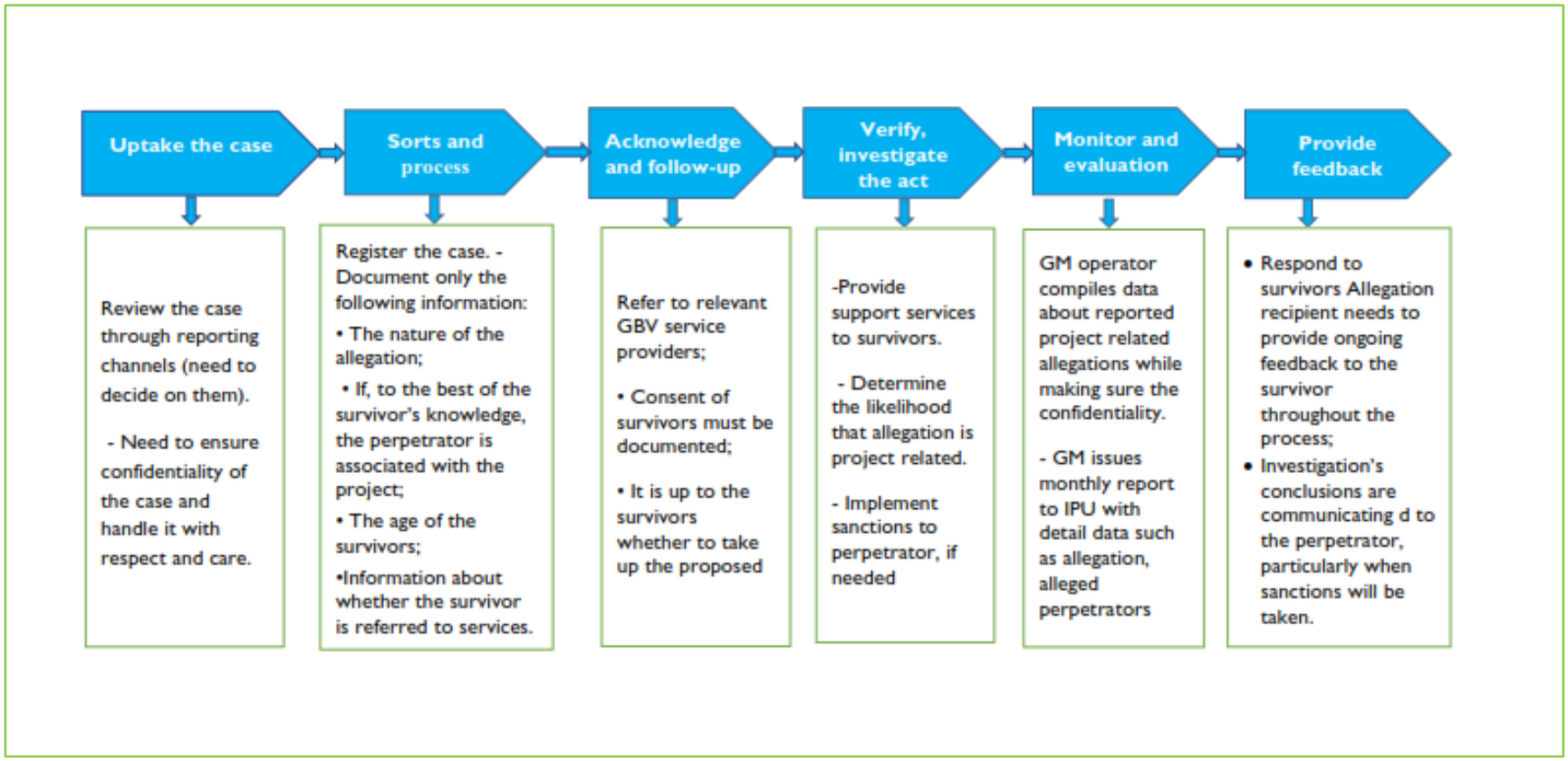
<table>
<tr><th colspan="2">Gender Based Violence service providers' particulars</th></tr>
<tr><td><u>Helplines</u>
• National Helpline Centre for Violence against Women and Children: 10921;
• Legal Aid Helpline: 16430;
• Marie Stops Bangladesh: 08000222333;
• Acid Survivors Foundation (ASF): +8801713010461;
• Bangladesh Legal Aid and Services Trust (BLAST); +8801715- 220 220;
• Ain o Salish Kendra (ASK): +8801724415677;
• Rights Jessore: +8801977182023;</td><td><u>Immediate Rescue Information</u>
➢ OCC (Medical): 109
➢ OCC(Judicial)
• Faridpur: +8801711248085;
• Sylhet: +8801716128370;
• Barisal: +8801715635866;
• Rajshahi: +8801718620310;
• Chittagong: +88018199411O6;
• Bagerhat: +8801911100177;</td></tr>
<tr><td><u>Psycho-social counseling</u>
• Marie Stops Bangladesh: 02-58152538;
• Acid Survivors Foundation (ASF): +8801713010461;
• Ministry of Women and Children Affairs (focused on COVID19 Psychosocial Counselling):
•National: 12.00-3.00:+8801715297944, 3:00-6.00: +8801727209070 6.00-9.00:+880191431785</td><td><u>Regional</u>
9.00-12.00:
• Dhaka, Dhaka Medical College Hospital (DMCH): +8801780839944;
• Barisal, Sher e Bangla Medical College and Hospital (SBMCH): +8801913566477;
• Chattogram, Chattogram Medical College and Hospital (CMCH): +880167609515 9;
• Rangpur, Rangpur Medical College and Hospital (RpMCH): +8801777337089
12.00-3.00:
• Rangpur, Rangpur Medical College and Hospital (RpMCH): +8801919137331,
• Khulna, Khulna Medical College and Hospital (KMCH): +8801723545731
3.00-6.00:
• Rajshahi, Medical College and Hospital (RMCH): +8801515621317,
• Dhaka, Dhaka Medical College and Hospital (DMCH): +8801675620992,
• Cox's Bazar Medical College and Hospital (CoxMCH): +8801847461880
6.00-9.00:
• Sylhet, Sylhet Osmani Medical College and Hospital (SOMCH): +8801766356094,
• Chattogram, Chattogram Medical College and Hospital (CMCH):+8801761362020,
• Faridpur, Faridpur Medical College and Hospital (FMCH): +8801673719894;
• Aparajita Jessore: +8801761222222-4</td></tr>
<tr><td><u>Shelters</u>
• Judicial OCC
• Faridpur: +8801711248085;
Sylhet: +8801716128370;
Barishal: +8801715635866;
Rajshahi: +8801718620310;</td><td><u>Legal Counseling</u>
• Bangladesh Legal Aid and Services Trust (BLAST): +8801715-220 220;
• Ain o Salish Kendra (ASK): +8801714-025069;</td></tr>
</table>

Gender Based Violence service providers' particulars	
Chittagong: +8801819941106; Bagerhat: +8801911100177; • Dhaka Ahsania Mission (shelter with transport) (880-2) 58155869, 9127943, 9123402, 9123420;	• Organization for Women's Development in Bangladesh (OWDEB) – Chittagong (Providing service to Ward 4,5,6 now): +8801711 – 171060 • Aparajita Jessore: +8801761222222-4

Appendix III: Subproject Grievance Redress Mechanism to address SEA/SH Allegations



Appendix IV: Operating Procedures and Response Protocol for SEA/SH Allegations



Appendix V: Field Environmental and Social Assessment Checklist of Rangpur City

A. Sub-Project Siting

SCREENING QUESTIONS	Yes	No	REMARKS
Disposal site adjacent to			
1. Environmentally sensitive areas		✓	There are no such sensitive areas
2. Cultural heritage site		✓	Cultural heritage was not observed
3. Protected Area		✓	Protected area near or around the existing dumping facility was not found.
4. Wetland		✓	No big wetland but small canal was found adjacent to the landfill site
5. Mangrove		✓	There is no mangrove forest
6. Estuarine		✓	There is no estuarine at nearby area
7. Buffer zone of protected area		✓	There is no buffer zone of protected area.
8. Special area for protecting biodiversity		✓	There is no special area for protecting biodiversity.
9. Bay		✓	This is not a coastal area or bay
10. Ecological Critical Area (ECA)		✓	There is no ecological critical area

B. Baseline Scenario

SCREENING QUESTIONS	Yes	No	REMARKS
B1. Primary collection			
• Practice of door-to-door collection system	✓		About 70% wastes are being collected from door-to-door by third party.
• Collection of waste daily	✓		Wastes are usually collected one time per day
• Service users willful to pay for waste collection	✓		Most of the service users are willful to pay to waste collectors
• Collection of medical waste	✓		About 70% by Prism NGO
• People informed of difference among organic, inorganic, and hazardous waste		✓	People are not informed about different types of wastes like organic, inorganic and hazardous
• Haphazard discharge of waste to roadside, drain, water bodies	✓		Roadside dumping is observed in most places
• Practice of curbside collection	✓		It was observed in many places in the town
• Service users currently satisfied with their existing solid waste collection points		✓	As collection points are in roadside and very dirty, polluted and odorous
• Service users aware of the need to manage solid waste better	✓		They want non-odorous better waste management system.

SCREENING QUESTIONS	Yes	No	REMARKS
• Health hazards to waste collectors	✓		Health hazards are likely as in most cases waste collectors are not well protected and use no PPE
B2. Secondary collection and transport			
• Existence of secondary transfer stations	✓		Only roadside dumping was observed. There is only one secondary transfer station fond at roadside.
• Sufficient number of secondary transfer stations		✓	Rangpur City Corporation has one secondary transfer station.
• Traffic accident due to frequent movement of vehicle		✓	There is no possibility of traffic accident as mentioned by the ULB. the vehicle movement is not frequent.
• Impacts associated with transport of wastes to the disposal site		✓	Covered dump trucks are being used in wastes transportation. So, impacts are not likely.
B3. Processing (resource recovery at source)			
• Provision of segregation		✓	All types of wastes are dumped together in landfill without any segregation.
• Use of PPE for workers		✓	Use of PPE by workers was not observed and not reported by ULBs
• Employment of child labor		✓	Waste pickers are children.
• Any social groups or poor neighborhoods consistently excluded from the formal solid waste service		✓	The poor neighborhoods are included in formal solid waste service.
B4. Disposal in landfill			
• Impairment of historical/cultural monuments/ areas and loss/damage to these site		✓	No such historical or cultural monuments were observed in Rangpur City Corporation areas.
• Degradation of aesthetic and property value loss		✓	Degradation of aesthetic and property value loss is not likely.
• Nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.		✓	There are no nearby residents that may become victims of nuisance. On the other hand, the landfill boundary is well demarcated and
• Public health hazards from odor, smoke from fire, and diseases transmitted by flies, insects, birds and rats		✓	The landfill side there are no public though improper dumping of waste in landfill site produce bad smell and create public health hazards from odor.
• Contamination of ground and/or surface water by leachate from land disposal system	✓		The dumping site is not well protected from being contamination of surroundings by leachate.
• Soil contamination by heavy metals	✓		Most likely soil contamination inside landfill may happen due to heavy metals dumping in landfill site.
• Adequate buffer zone around landfill site to alleviate nuisances	✓		In Rangpur landfill site there is no adequate buffer zone to avoid nuisances

SCREENING QUESTIONS	Yes	No	REMARKS
• Institutional and financial capabilities of the municipalities for the management of the landfill operation	✓		Rangpur City Corporation is financially and institutionally capable to manage the landfill operation.
• Explosion of toxic response from accumulated landfill gas in buildings		✓	Buildings are far from landfill area. The landfill waste is not so huge that explosion of toxic response may happen.
• Disturbance or reduction of agricultural production due to uncontrolled waste disposal	✓		Surrounding areas are agricultural land adjacent to Rangpur landfill area. So, disturbance or reduction of agricultural production is most likely.
• Complain from neighborhood residents		✓	No resident is nearby but passerby sometimes raise complaints
• Political or ethnic issues associated with sharing a waste disposal site		✓	The existing landfill site is the property of Rangpur City Corporation. So political and ethnic issues are not associated with the waste disposal site.
• Practice of coping mechanisms (community support, safety nets, insurance mechanisms) used by workers		✓	There is no such evidence of practicing of copying mechanisms in the Rangpur City Corporation.
• Contamination of air quality from incineration		✓	Contamination of air quality is not observed as there is no incineration practice in the Rangpur City Corporation.
• Health and safety hazards to workers from toxic gases and hazardous materials in the site		✓	The landfill site is not so dense with wastes that can produce toxic gases and hazardous materials surrounding the landfill area.

C. Construction (New facility)

SCREENING QUESTIONS	Yes	No	REMARKS
• Land use conflicts		✓	As Rangpur City Corporation is the owner of this land, so no land use conflict is expected.
• Issues of land acquisition		✓	In Rangpur CC no land acquisition issues are applicable as the existing acquired land owner is Rangpur CC.
• Dislocation or involuntary resettlement of people		✓	Dislocation is not applicable as no household has been found around or inside the landfill site boundary.
• Risk to occupational health & safety		✓	During construction there will not be any risk to occupational health and safety as PPE will be used by the waste transfer workers.
• Disruption of natural land contours and vegetation due to material extraction		✓	During construction land contour and vegetation will not be disrupted as this

SCREENING QUESTIONS	Yes	No	REMARKS
			is plain land and as there is no vegetation.
• Soil disturbance due to construction activities	✓		It is likely that during construction minimum soil disturbance may be happened.
• Noise pollution due to vehicular movement and heavy construction works	✓		In ISWMIP, construction noise will be minimum that will not affect people as they are far from the site. Workers will use PPE.
• Dust pollution/ air quality deterioration	✓		During construction dust /air pollution will occur due to construction works and emission from vehicles. These will need to be minimized.
• Pollution of surface and/or groundwater due to leachate from construction materials	✓		During construction surface and/or ground water pollution is very likely. So, mitigation measures will need to be taken.
• Vegetation clearance/tree felling		✓	In Rangpur CC landfill site there are no trees or vegetation. So, vegetation clearance/tree felling will not be required.
• Threat or disturbance to local biodiversity		✓	No local biodiversity observed. So, threat or disturbance to local biodiversity is not likely in this City.
• Discharge or dispose of hazardous materials	✓		During construction discharge or dispose of hazardous materials may be happened but will be minimum and localized.
• Community diseases from labor camp		✓	Consequences will be given on health, safety and hygiene in labor camp. So, if hygienic condition is maintained community diseases may be avoided.
• Violation of COVID-19 protocol because of labor camp		✓	Workers in labor camp will strictly follow the COVID-19 protocol during construction. So, such protocol will not be violated at labor camp.
• Gender violence in labor management		✓	As an alarming issue gender violence will not be happened during construction works. ULB will be careful regarding gender issue.
• Requirement for construction new road or repair existing road		✓	In Rangpur CC landfill area road is existed, so no new road will be required.
• Traffic congestion/road accidents due to transporting construction materials to the site		✓	Toward the landfill area there is a good road for vehicle movement with construction materials. So, traffic congestion is not likely.

D. Operation & Maintenance (Post project scenario)

SCREENING QUESTIONS	Yes	No	REMARKS
D1. Primary collection			
• Provision of door-to-door collection system	✓		In ISWMIP system 100% waste collection from door to door is expected
• Provision of curbside collection		✓	Provision of curbside collection will not be needed as good secondary transfer station will be developed.
• Provision of source segregation	✓		100% source segregation should be ensured. Different types of wastes will be segregated at source through using different types of colored bins. These bins would be provided to the households for keeping of different types of wastes.
• Collection of medical waste	✓		In Rangpur City Corporation area medical waste will be collected separately and will be disposed separately.
• Affect waste pickers to their income		✓	Though waste picker will lose their income source in this improved system. But they can buy and sell recyclable and reusable waste to the vendors.
• Impacts associated with waste collection system		✓	It is likely that impact may not be associated with waste collection system if the wastes are carried covered and workers use PPE properly.
D2. Secondary collection and transport			
• Provision of secondary transfer stations	✓		As provision of secondary transfer stations is the prerequisite of integrated and improved solid waste management system, so Rangpur CC should have the provision of secondary transfer stations.
• Impacts associated with transport of wastes to the disposal site		✓	Following the new improved waste management system, waste transporting dump truck should be covered properly during transportation of wastes to avoid impacts.
D3. Processing (resource recovery)			
• Provision of segregation	✓		Under ISWMIP, in waste management value chain, waste segregation at source and provision of further segregation at transfer station, if different types of wastes are found mixed. In this way 100% segregation can be ensured.
• Use of PPE for workers	✓		Rangpur City Corporation will provide Personal Protective Equipment (PPE) to the workers and will ensure their usage by the workers.
• Employment of child labor		✓	In this ISWMIP, Bangladesh Labor Act 2006 should be followed strictly to avoid child labor.
• Nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.	✓		As there are no settlements observed near neighboring areas of the proposed landfill and on the other hand as improved management system will be developed with proper mitigation

SCREENING QUESTIONS	Yes	No	REMARKS
			action, the nuisance may be avoided or can be minimized.
• Recycling and reuse of plastic and other inorganic wastes	✓		In this improved integrated solid waste management system, plastic and other inorganic wastes would be segregated at sources and recycled and reused as well.
• Treatment and management of medical waste	✓		In Rangpur CC treatment and management of medical waste would be done in this improved solid waste management system.
• Reuse and disposal of compost	✓		Reuse and disposal of compost will be done in improved waste management system.
D4. Disposal			
• Impairment of historical/cultural monuments/areas and loss/damage to these site		✓	As there are no historical or cultural monuments found near the existing landfill site. So, loss or damage will not be likely.
• Degradation of aesthetic and property value loss		✓	Degradation of aesthetic and property value loss will not be applicable as these were not observed near or adjacent to the Landfill area.
• Nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.		✓	There is no human settlement at the neighboring areas and as the site will be used with sufficient buffer zone with proper impact mitigation action, the nuisance can be avoided.
• Public health hazards from odor, smoke from fire, and diseases transmitted by flies, insects, birds and rats		✓	In this ISWMIP system these types of hazardous events can be avoided by taking adequate mitigation measures.
• Contamination of ground and/or surface water by leachate from land disposal system	✓		The landfill area is surrounded by low land where one side road and canal. So, ground and/or surface water contamination by leachate is likely. Proper protection should be done.
• Soil contamination by heavy metals		✓	In Rangpur CC landfill area soil contamination is not likely by this improved management system.
• Adequate buffer zone around landfill site to alleviate nuisances		✓	Adequate buffer zone should be maintained in this improved waste management system to alleviate nuisances.
• Development of intuitional efficiency of the municipality to operate the waste management facilities	✓		It is likely that there will have provision for capacity development training on better waste management for the municipality staffs in this waste management system.
• Contamination of air quality from incineration		✓	Incineration will not be practiced in improved waste management system as incineration contaminate air quality.
• Health and safety hazards to workers from toxic gases and hazardous materials in the site		✓	Toxic gases and hazardous materials will be prevented to protect workers from health and safety hazards.
• Increase of vehicular movement and traffic congestion		✓	After source segregation decreased amount of wastes will be carried to the landfill. So vehicular movement will not be increased and so traffic congestion may not be happened.

Appendix VI: Field Climate Risk Screening Assessment Checklist of Rangpur

Waste Management Activities	Questions on Climatic Events	Yes	No	Your comment if any
Waste Collection	Is there any high temperature that hamper waste collection?	✓		Suddenly happens
	Is there any flood that affect waste collection?		✓	Rangpur is not flood prone area
	Is there any rainfall in winter that affect waste collection?	✓		Sometimes fog also hamper waste collection
	Is there any storm surge that affect waste collection?		✓	Not reported
	Is there sea level rise that affect waste collection?		✓	Not coastal area
Waste Transfer	Is there high temperature that reduce workers waste transfer?	✓		Time to time
	Is there flood that affect waste transfer?		✓	The land is high
	Is there rainfall in winter that affect waste transfer?		✓	But occasional
	Is there flood in winter affect waste transfer?		✓	Not reported
	Is there storm surge that affect waste transfer?		✓	Not coastal area
	Is there sea level rise that affect waste?		✓	Not coastal area
Waste Transportation from secondary station	Is there high temperature that hamper waste transportation?		✓	Temperature is not so high.
	Is there flood that affect waste transportation?		✓	Little flood does not affect waste transportation.
	Is there rainfall in winter that affect waste transportation?		✓	During heavy rainfall
	Is there flood in winter affect waste transportation?		✓	No flood in winter
	Is there storm surge that affect waste transportation?		✓	No storm surge
	Is there sea level rise that affect waste transportation?		✓	It is not coastal area
	Are the transportation vehicles old that emit more GHG?	✓		Need new vehicles
Disposal in landfill	Is there high temperature that can alter waste decomposition rate?	✓		Higher temperature and less moisture could reduce decomposition rate but with adequate moisture could increase decomposition rate.

Waste Management Activities	Questions on Climatic Events	Yes	No	Your comment if any
	Is there high temperature that can lead to reduce water availability and alter site hydrology and hence leachate production?		✓	No alteration of hydrology and hence no leachate production
	Is there high temperature that can affects outdoors workers at risk from heat stress?	✓		Temperature about 38-40^{0}C
	Is there high temperature that can reduce precipitation in summer?	✓		But sometimes
	Is there flood that can inundation of landfill area?		✓	But there is chance
	Is there less precipitation in summer that can alter the waste decomposition rate?		✓	Optimal precipitation in summer
	Is there increased precipitation in winter that increase flooding occurrences?		✓	Surrounding is high enough
	Is there increased precipitation in summer that can alter the waste decomposition rate?	✓		Sometimes
	Is there increased precipitation in winter that can increase leachate production?		✓	Precipitation is optimal in winter
	Is there increased precipitation in winter that can disrupt infrastructure like access road and rail due to flooding?		✓	Minor precipitation in winter that cannot cause flooding,
	Is there increased precipitation in winter that can increase slope stability risks?		✓	The slope is fully stabled.
	Is there increased precipitation in winter that can increase risk of bunds and capping layers?		✓	There is no bunds and capping layers
	Is there increased storminess that lead to disruption of water-based waste transport?		✓	No such storm in this area.
	Is there sea level rise that leads to inundation of sites near to the coast?		✓	Not coastal area
	Is there sea level rise that leads to increased damage from storm surge for sites near to the coast?		✓	Not coastal area
Incineration	Is there incineration (waste-to-energy) practice that contribute higher levels of GHG emissions?		✓	There is no incineration practice
	Is there incineration practice that high heat in the environment?		✓	There is no incineration practice
Open burning	Is there open waste burning that can warm the air?	✓		Sometimes
	Is there open waste burning that can increased risk of fires leading to warmer air?	✓		But less risk of fires
	Is there open waste burning that can increased risk of subsidence due to drying out of soil?	✓		But less risk of subsidence
	Is there open waste burning that produce CO_2 and methane?	✓		When waste is dumped more
Controlled landfill	Is there controlled landfill that produce methane gas?		✓	There is no controlled landfill

Waste Management Activities	Questions on Climatic Events	Yes	No	Your comment if any
	Is controlled landfill contributing GHG to the atmosphere?		✓	Not applicable
	Is plastic dumped in controlled landfill that breaks down into more methane and ethylene?		✓	This is uncontrolled landfill but plastic is dumped.
Anaerobic digestion	Dose anaerobic digestion in landfill contribute climate change?		✓	Not anaerobic digestion
	Dose anaerobic digestion reduce greenhouse gas emissions?		✓	Not anaerobic digestion
Location and Design of project	Is siting and/or routing of the project or its components likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?		✓	There are no floods, no storms and no landslides but droughts occur
	Would the project design need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?		✓	But may be confirmed during design.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of subproject inputs over the life of project outputs (e.g. construction material)?		✓	But suddenly may occur in future
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of subproject output?		✓	But not confirmed that would not be happened.
Performance of project outputs	Would weather conditions likely affect the performance of subproject output throughout their design life time?		✓	If proper infrastructure is designed.
General Climatic Condition	Is there any recent (10 years) climate events, changes and observations by local residents?		✓	As per statement of local people
	Was the site inundated during floods of 1998, 2004, 2007, 2020?		✓	As per statement of local residents
	Are there any existing drainage conditions/infrastructure including drainage threats from adjacent properties?		✓	Busy road is adjacent to the site.
	Is there any high tide risk around the subproject site?		✓	Not applicable
	Is there any erosion potential on-site and adjacent the subproject site?		✓	Not reported
	Is there any storm surge around the subproject site?		✓	No records
	Are there any landslide risks from nearby topography?		✓	No evidence
	Is there any cyclone risk at the subproject area?		✓	No records

Waste Management Activities	Questions on Climatic Events	Yes	No	Your comment if any
	Is there any record of increased temperatures like heat wave at the subproject area?		✓	But rarely in past
	Are there any other climate risks noted by local residents and officials?		✓	Not reported
	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?		✓	Not expected as per local bodies
	Is the proposed solid waste management subproject likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)?		✓	Assumed
	Will climate risks affect the proposed subproject, directly or indirectly?		✓	Not likely
	Will the proposed solid waste management subproject contribute to increasing climate risks such as urban heat island effect, increase risks of flooding, subsidence or heave, or does it increase water consumption?		✓	But depends on infrastructures
	Will the proposed subproject be designed to contribute to reducing climate risks?	✓		Taking appropriate measures
	Will drainage systems be designed with sufficient capacity to cope with heavier rainfall events expected over their lifetimes, taking account of climate change?	✓		Roadside or road crossing drainage may need
	Will it be considered sustainable drainage systems (SUDS) and floodwater storage areas to manage flash flood risks more sustainably?	✓		It will be included in design
	Will the waste management system be designed to incorporate green spaces to provide cooling and shade in the face of rising temperatures?	✓		There should have option for tree plantation
	Will the proposed solid waste management subproject result in significant greenhouse gas emissions or may exacerbate climate change?		✓	If so measures should be taken.
	Will the subproject cause emission of potentially toxic volatile organics from land disposal sites?		✓	But it depends on the type of waste

Appendix VII: Gender Equity Strategy of LGED

a. Summary

The LGED's Gender Equity Strategy (GES) identified nine (9) strategic issues to be addressedin the respective sector wise gender action plans. The strategic issues are discussed hereunder.

(1) Policy adoption

All sectors, units and projects of the LGED shall prepare their own gender action plan and implementation guidelines in accordance with the Gender Equity Strategy of the LGED. The gender action plans and implementation guidelines will be reviewed by the gender and development forum (GDF) of the LGED, and revised where necessary

(2) Institutional arrangement

A gender and development forum (GDF) is established in the LGED as the main executive body for the implementation of the Gender Equity Strategy. For the sake of good governance, the GDF shall have a written or specific constitution and operation manual/bylaws. Every units and projects of the LGED shall prepare their own action plans where the GDF shall provide requiredadvice and guidance. The GDF shall review all gender-related documents including each action plan, and coordinate with all sections and units of the LGED, and establish required communication for all gender related activities.

(3) Data/information collection, monitoring and evaluation

Irrespective of sources of spheres and activities, collected data and information at all level and all projects shall be gender dis aggregated (gender sensitive). In this case, format prepared by the GDF containing key indicators shall be used. The respective project can use any other format with different indicators to meet the project requirement. Collected data/information shall be sent to GDF bi-annually. Based on this information/data, the GDF shall prepare database, through which all gender-related matters shall be monitored and evaluated. At the same time, GDF shall prepare and publish annual and any other reports using this information and shall prepare plans relevant to this. Special attention shall be given to ensure use of information technology in all respects.

(4) Infrastructure development

The infrastructure to be constructed by the LGED shall be gender-friendly. For this purpose, it is to be ensured that the separate essential facilities in all infrastructures have been incorporated in design and drawing and implemented strictly in accordance with the provision of the plan. Planning and design unit shall take necessary measures.

(5) Employment and working-environment

(a) Employment

An action plan shall have to be prepared for future employment in LGED with a view to reduce the existing difference of men and women ratio at work. In this case, the works which are more suitable for the women and the posts for those works can be kept reserved for them at higher ratio. Similar approaches may be adopted in case of employment opportunities created for development works. At the same time, needs-based training and other allied facilities may be increased so that women can acquire skills within a short time in their work fields, including self-employment. Necessary measures have to be taken for increased employment of women in development works and in establishment of equity in wages.

(b) Working-environment

Measures have to be taken to improve working environments for women in the LGED in possible areas where there is scope for such improvement.

There shall be an "internal review and resolving/mitigation committee (IRRC)" under the supervision of the GDF, which will review physical, mental and sexual harassment of personnel and beneficiary women at work places. If there is such occurrence, the IRRC will analyze the complaints of the aggrieved person as per prevailing national laws. The committee will cooperate so that the aggrieved person can receive help from the proper legal assistance as per prevailing national laws.

(1) Training

After identifying expandable working fields for women, the provision of necessary training to them shall be ensured. Gender sensitive training needs shall be identified in conformity with LGED's activities, and potential human resources will be developed by imparting training on management including training on gender and capacity building by expert trainers.

(2) Participation

The active participation by women shall be ensured in all fields. GDF shall play the lead role in ensuring women's active participation by establishing appropriate environments and providing strategic directives.

(3) Empowerment

Areas for women's empowerment at all levels of LGED (e.g. training, information and technology, income, heredity, loan, right of full control on achieved assets) shall be identified and their ratio of inclusion will be decided through proper analysis of appropriateness. At the same time, priority shall be given to the selection/placement of women at a considerable rate forensuring active and effective representation in the decision-making process at all levels particularly for any organization/committee/group. Where applicable, it can be clearly mentioned in project documents or additions made during implementation at a considerable rate for selection/placement of women. In all cases, matters related to allied facilities, creation of scope, provision of equal wages, security etc. shall be given special attention; and to ensure those issues, necessary criteria shall be incorporated in any project agreement or tender documents fixed.

(4) Financing

LGED's planning and administration unit shall adopt necessary measures to ensure regular fund flow from the government and development partners for the preparation of gender sensitive budgets and their implementation after identifying fund allocation/areas demanding finance for implementation of the gender equity strategy and its institutionalization agenda.

In order to develop gender-sensitive human resources at all sectors and in all activities of LGED, allocated budgets for training in the Annual Development Programme (ADP) shall be distributed proportionately for gender-related training through the LGED training unit.

While formulating a project, necessary budget provisions shall be made for undertaking gender-related activities. Projects shall have to be prepared in cooperation with the government and development partners keeping budget provision in favor of GDF, and also while conducting study/evaluations.

Appendix VIII: Urban Sector Gender Equity Action Plan of LGED

Summary (Sample)

ISWMIP is related to the urban sector, the Urban Sector Gender Equity ActionPlan (USGEAP), the latest set of activities of urban gender equity which was finalized on 17 July 2013 by the LGED, are highlighted below as a reference.

(1) Policy adoption

- ☐ Preparation of gender equity action plan of urban sector based on the gender equity action plan of LGED, which was prepared following the national women development policy- time frame: by June 2013.
- ☐ Preparation of implementation guideline for gender equity action plan of urban sector and implement accordingly- time frame: by December 2013.
- ☐ Contribute in review of LGED gender equity strategies subject to any amendments of national women development policy 2011- time frame: as applicable.
- ☐ Review and evaluate the gender equity action plan of urban sector and implementation guideline- time frame: as applicable.
- ☐ Update the gender equity action plan of urban sector and implementation guideline - time frame: as applicable.

(2) Institutional arrangement

- ☐ Create a permanent post of gender development officer in urban governance unit.
- ☐ Specify the respective local government institution and project based focal point-time frame: by June 2013.
- ☐ Contribute in preparation of the constitution and bylaws of LGED gender development forum- time frame: as applicable.

(3) Data/information collection, monitoring and evaluation

(a) Data/information collection

- Collection of male-female segregated data/information through the format as developed by gender development forum- time frame: twice in a year.
- Assembling of collected data/information- time frame: twice in a year.
- Send the assembled data/information to forum- time frame: twice in a year.
- Assist in preparation of format containing significant indicators by gender forum- timeframe: as applicable.

(b) Monitoring and evaluation

- Contribute in monitoring and evaluation of gender issues of urban development sector to be done by gender development forum- time frame: as applicable.
- Assist gender development forum in preparation and publication of annual or other reports and plan in this regard- time frame: as applicable.

(4) Infrastructure development

- ☐ Include necessary facilities required for women in preparation of plan & design in order to ensure women friendly infrastructure and facilities most essential for women to be implemented under the projects- time frame: shall continue.
- ☐ Ensure preparation of design and implementation, operation & maintenance considering necessary facilities (toilet, waiting room, ticket counter etc.) for women in bus terminal and markets- time frame: shall continue.

- ☐ Keep the places reserved for shops for women in the kitchen and other markets- time frame: shall continue.

(5) Employment and working-environment

(a) Employment

- Assist in preparation of future recruitment plan of LGED- time frame: as applicable.
- Reduce the existing discrimination of male-female ratio in all works under theprojects- time frame: shall continue.
- Engage women in construction of LGED and ULB infrastructure- time frame: shall continue.
- Create opportunities to implement 'equal-wage' for equal work in case of male and female laborers time frame: shall continue.
- In order to increase women employment, identify income generating activities suitable for them to engage them- time frame: shall continue.

(b) Working-environment

- Keep provision of women friendly facilities (separate shades, toilets, day-care) for the female laborers engaged in infrastructure construction- time frame: shall continue.
- Ensure women friendly facilities (e.g. waiting room, toilets, day-care centre etc.) in other work places- time frame: shall continue.
- Implement LGED guidelines on maintaining discipline/social safety/sexual harassment prevention- time frame: shall continue.

(6) Training

- ☐ Organize orientation programme on gender issues for urban sector Project Directors, Deputy Project Directors and other officers- time frame: shall continue.
- ☐ Assess training needs consisting with urban development sector activities- time frame:shall continue.
- ☐ Preparation of gender related appropriate training programme & manual and arrange training coordinating with LGED's training programme- time frame: shall continue.
- ☐ Organize trainers group having special knowledge on "gender equity"- time frame: shall continue.
- ☐ Include gender related issues in relevant training of urban sector-time frame: by December 2013.
- ☐ Undertake income generating training for women working under the project- time frame: shall continue.

(7) Participation

- ☐ Ensure participation of female councilors and female officers/staff in preparation of plans for ULB development activities- time frame: shall continue.
- ☐ Ensure effective participation at all levels of preparation of project/sub-projects- time frame: shall continue.
- ☐ Keep opportunities for more participation of women in project/sub-projects implementation- time frame: shall continue.
- ☐ Ensure participation of women in income generating activities- time frame: shall continue.

(8) Empowerment

- ☐ Identify the areas of women empowerment at all levels of project/sub-projects implementation.

- ☐ Provide project assistance to include one third women in formation of CSCC and 40% in formation of WLCC- time frame: shall continue.
- ☐ Involve women at equally ratio in social development plan preparation, implementation and monitoring- time frame: shall continue.
- ☐ Add supportive facilities for women laborers in tender documents- time frame: shallcontinue.
- ☐ Monitor the issue of reservation at least one post in ULB Mayor Panel for female councilor- time frame: shall continue.
- ☐ Give directions by the project regarding inclusion of women in various committees of UB time frame: shall continue.
- ☐ Allocate particular places to women traders in kitchen markets and other markets– time frame shall continue.

(9) Financing

- ☐ Formulate projects with support from government and development partners considering gender related activities and provision of necessary funds on this area- time frame: shall continue.
- ☐ Ensure allocation of required budget considering gender related activities in all components of project- time frame: shall continue.

Appendix IX: Sample format of the Gender Action Plan

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
1. Policy Adoption	----------	----------	CEO/ PCO, PIU,	
2. Institutional Arrangement	----------	----------	Mayor/PCO/	
3. Data/ Information collection, Monitoring & Evaluation	----------	----------	The Gender Committee (Social Welfare and the Community Center Standing Committee), /PCO	
3.a Data / Information collection				
3.b Monitoring and Evaluation	----------	----------	The Gender Committee (Social Welfare and Community Center Standing Committee)	
4. Infrastructure Development	----------	----------	SE, PCO, Design Unit	
5 Employment and Working Environment	----------	----------		
5 (a) Employment	----------	----------	CEO, PIU, Social Development Consultant	
5(b) Working Environment	----------	----------	GFP, PCO, Social Development Consultant	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
6. Training	----------	----------	The Gender Committee (Social Welfare and	
			Community Center Standing Committee), Social Development Consultant	
7.Participation	----------	----------	The Gender Committee (Social Welfare and the Community Center Standing Committee)	
8. Empowerment	----------	----------	The Gender Committee (Social Welfare and the Community Center Standing Committee)	
9.Financing	----------	----------	PCO, PIU, GFP	

Checked by Project Director:

Approved by Mayor:

Appendix X: Sample Implementation Schedule (Gantt chart)

SL	Actions	Person in charge	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<<Example>>													
	Selection of GFP													
	Progress sharing/quarterly meeting													
	Monitoring and Assessment report													
	Annual Report submission													
	Training on Gender Equality for staffs													
	International women Day observation													
	Observe International Day for the Elimination of Violence Against women and Human rights day													
	Produce IEC materials													

Appendix XI: Gender Action Plan of ISWMIP (Sample)

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
1. Policy Adoption				
1.1 Preparation of ISWMIP's Gender Equity Action Plan on the basis of Urban Sector's Gender Equity Action Plan and LGED's Gender Equity Strategy, which is prepared based on National Women Development Policy 2011	ISWMIP's Gender Equity Action Plan is prepared	February	PCO/PIU/Social Development consultant	
1.2 Preparation of implementation guideline for ISWMIP's Gender Equity Action Plan and implementation.	Implementation guideline is prepared	February	PCO/PIU/Social Development consultant	
1.3 Review and evaluate ISWMIP's Gender Equity Action Plan and implementation guideline	Review and evaluationis done	June	PCO/PIU/Social Development consultant	
1.4 Updating of ISWMIP's Gender Equity Action Plan and implementation guideline	Action Plan and implementation guideline is updated	June	PCO/PIU/Social Development consultant	
2. Institutional Arrangement				
2.1 Select PCO and PIU based Gender Focal Point	Number of Focal Point	June	PCO/PIU/social Development consultant	
2.2 Select CSCC and WLCC based Gender Focal Point	Number of Focal Point	June	PIU/Social Development consultant	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
2.3 Formation of Gender Committees headed by the Female Ward Councilor in all participating ULB	• Gender Committees established • Date of gender committee formed	June	PIU/Social Development consultant	
2.4 Hold quarterly meeting of Gender Focal Point and Gender Committee	Number and date of meeting held	Continue	PCO/PIU/Social Development consultant	
2.5 Prepare and update Gender Action Plan (GAP) and include in ULB Development Plan (PDP)	Prepared and updated GAP and included in PDP	June	PCO/PIU/Social Development consultant	
2.6 Maintain horizontal and vertical linkage on gender related issues through participating/inviting workshop/meetings/training/ campaign etc.	• Number of events held • Number of invitees • Number of participants from ULB	Continue	PIU/Social Development consultant	
2.7 Ensure equal services to women extended by women	• Number of women received services	Continue	PIU/social Development consultant	
2.8 Undertake programmes (rally, distribution of leaflets, workshop/seminar/discussion meetings, publications through electronic and print media etc.) for raising awareness on gender equity strategies	• Number of rally held • Number of leaflets • Number of otherevents	Continue	PIU/Social Development consultant	
Data/Information Collection, Monitoring & Evaluation				
2.9 Data/Information Collection				
2.9.1 Collection of gender segregated data/Information through the format as prepared by the project as well asby Gender and Development Forum (GDF)	Data/Information collected	Twice in a year	PCO/PIU/Social development consultant	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
2.9.2 Analysing of collected data/Information	Data/Information analysed	Twice in a year	PCO/PIU/Social Development consultant	
2.9.3Prepare report on the analysed data/Information to PCO and GDF respectively	Report prepared	Twice in a year	PCO/PIU/Social Development consultant	
2.9.4Send the report on the analysed data/Information to PCO and GDF respectively and to other concerned authority.	Report sent	Twice in a year	PCO/PIU/Social Development consultant	
2.10 Monitoring & Evaluation				
2.10.1 Contribute in monitoring & evaluation (M&E) of gender related issues of the project and assist in M & E while conducted by GDF, PCO & PIU	Contributed in monitoring & evaluation	As applicable	PCO/PIU/Social Development consultant	
2.10.2 Assist in preparation, publish of annual or other reports with specific recommendation and preparation of relevant plans accordingly	Assisted in preparation, publish of annual or other reports and preparation of plans	As applicable	PCO/PIU/Social Development consultant	
3. Infrastructure Development				
3.1 Inclusion of facilities (toilet, waiting room, prayer room, ticket counter, drinking water, day care centre etc.) requiredfor women in preparation of planning and design the infrastructure to be built under the project, where applicableto make such infrastructure women friendly and ensure most essential facilities for women	Number of facilities for women in planning & design of infrastructure development	Continue	PCO/design unit	
3.2 Preparations of design considering facilities (toilet, waiting room, prayer room, ticket counter, drinking water etc.) required for women in bus terminal and market and ensure implementation, operation & maintenance.	Number of infrastructures included required facilities; Ensured operation &	Continue	PCO/PIU/Social Development consultant	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
	maintenance			
3.3 Keep space/shops earmarked for women traders in kitchen market and other markets	Number of shops earmarked for women traders	Continue	PCO/PIU/Social Development consultant	
3.4 Ensure implementation of the facilities	Number of facilities implemented	Continue	PCO/PIU/Social Development consultant	
3.5 Ensure proper operation and maintenance to keep the facilities usable around the year	Number of facilities that ensured O&M	Continue	PCO/PIU/Social Development consultant	
4. Employment and Working Environment				
4.1 Employment				
4.1.1 Assist in preparation of future recruitment plan of ULB in order to minimise the gap of male-female ratio of the employed ULB staff	Assisted in preparation of recruitment plan	If applicable	PIU	
4.1.2 Identify existing discriminations of male-female ratio in all works under the project and assist to reduce such discriminations	male-female ratio	Continue	PCO/PIU/Social Development consultant	
4.1.3 Inclusion of women in infrastructure construction by the project at least by 20%	• Number of women engaged • male-female ratio	Continue	PCO/PIU/Social Development consultant	Impose condition in tender document
4.1.4 Create opportunities to implement 'equal-wage' for equal work in case of male and female labour.	• male-female wage ratio	Continue	PCO/PIU/Social Development consultant	Impose condition in tender document

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
4.1.5 Include the gender sensitive clause on women employment in the tender document for contractor to ensure effective implementation and discuss the issue in pre-bid meeting	Gender sensitive clause included	Continue	PCO/PIU/Social Development consultant	Impose condition in tender document
4.1.6 In order to increase women employment, identify suitable income generating activities to engage them	Number of women engaged in identified activities	Continue	PCO/PIU/Social Development consultant	
4.2 Working Environment				
4.2.1 Keep provision of women friendly facilities (separate shades, toilets, day-care) for the female labourers engaged in infrastructure construction	Number of works having women supportive facilities	Continue	PCO/PIU/Social Development consultant	Impose condition in tender document
4.2.2 Ensure women friendly facilities (e.g. waiting room, toilets, day-care centre etc.) in other work places	Number of work places ensured women supportive facilities	Continue	PCO/PIU/Social Development consultant	Necessary action to be taken based on the evaluation of facilities
4.2.3 Take necessary measures for maintaining discipline/social safety/ sexual harassment prevention	Implemented necessary measures	Continue	PCO/PIU/Social Development consultant	
4.2.4 Include the gender sensitive clause for maintaining working environment in the tender document for contractor to ensure effective implementation and discuss the issue in pre-bid meeting	Gender sensitive clause included	Continue	PCO/PIU/Social Development consultant	
5. Training				
5.1 Assess training needs corresponding with ISWMIP provision	Training need assessed	Continue	PCO/PIU/Social Development consultant	Need to emphasis on balanced opportunities

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
5.2 Preparation of gender related appropriate training programme & manual and arrange training coordinating with LGED's training programme	Training programme is prepared, Number of manuals, Number of completed training	Continue	PCO/PIU/Social Development consultant/TrainingUnit	Subject based training manual to be prepared
5.3 Organize trainers group having special knowledge on "gender equity" and gender action plan	Trainers group is organized and number of trainer	Continue	PCO/PIU/Social Development consultant/ Training Unit	
5.4 Include gender related issues in each relevant training of SWM I P as stipulated in DPP	Number oftraining courses included gender related issues	February	PCO/PIU/Social Development consultant/ Training Unit	
5.5 Consider the gender issue in selection of trainees for the training of ISWMIP	% of women trainees	February	PCO/PIU/Social Development consultant/ Training Unit	
5.6 Undertake income generating training (tailoring, vegetable gardening, poultry & livestock raring & vaccination etc.)for women working under the project	Number of women participated in income generating training	Continue	PCO/PIU/Social Development consultant/ Training Unit	Income generating training manual to be prepared
6. Participation				
6.1 Identify the area and scope of women participation (various committee, training & exposure visit, sub-project identification, planning, implementation and O & M)	Number of participated women	Continue	PCO/PIU/Social Development consultant	
6.2 Ensure participation of female councilors and female officers/staff in preparation of plans for ULB developmentactivities.	Number of participated women	Continue	PCO/PIU/Social Development consultant	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
6.3 Ensure effective participation at all levels of preparation of project/sub-projects	Number of women participated in preparation of project/sub-projects	Continue	PCO/PIU/Social Development consultant	
6.4 Keep opportunities for more participation of women in project/sub-projects implementation	Ratio of male-female in project implementation	Continue	PCO/PIU/Social Development consultant	
6.5 Ensure adequate representatives of women in CSCCs and WLCCs in all participating ULB	Ratio of male-female in CSCC and WLCC	Continue	PIU/Social Development consultant	
6.6 Ensure adequate representatives of women in standing committees	Ratio of male-female in standing committee	Continue	PIU/Social Development consultant	
6.7 Ensure participation of women in income generating activities	Number of women engaged in income generating activities	Continue	PCO/PIU/Social Development consultant	Gender supportive guideline forincome generating programme to be prepared and implemented
7. Empowerment				
7.1 Identify the areas of women empowerment at all levels of project/sub-projects implementation	Number of women empowerment areas identified in project/sub-projects		PCO/PIU/Social Development consultant	Organize training to identify women empowerment areas
7.2 Ensure inclusion of one third women in formation of CSCCs and 40% in formation of WLCCs	Number of women included in CSCC Number of women included in WLCC	Continue	PCO/PIU/Social Development consultant	
7.3 Involve women at equally ratio in social development plan preparation, implementation and monitoring	Male-female ratio	Continue	PCO/PIU/Social Development	

Activities under the gender strategies	Indicators	Time-frame	Responsibility	Assumptions/ Comments
			consultant	
7.4 Add supportive facilities for women labour in tender documents	Number of sub-projects included facilities for women labour in tender documents	Continue	PCO/PIU/Social Development consultant	
7.5 Monitor the issue of reservation at least one post in ULB Mayor panel for female councilor	Number of women reserved in Mayor panel	Continue	PCO/PIU/Social Development consultant	
7.6 Give directions by the project regarding inclusion of women in various committees of ULB	Number of women in various committees	Continue	PCO/PIU/Social Development consultant	
7.7 Allocate particular places to women traders in kitchen markets and other markets	Number of women allotted place/shops	Continue	PCO/PIU/Social Development consultant	
8. Financing				
8.1 Identify the area of financing for implementation/ institutionalization of gender equity action plan of ISWMIP	Number of areas identified	Continue	PCO/PIU	
8.2 Prepare gender sensitive budgets for implementation of ISWMIP.	Number of sub-projects prepared in ISWMIP considering gender & development activities	Continue	PCO/PIU	
8.3 Ensure allocation of required budget considering gender related activities in all components of project	Amount of money budgeted for gender & development activities	Continue	PCO/PIU	

Appendix XII: Sample Budget Format for GAP

SL.	Name of Activity	Activity Details	Unit/Batch/Days	Unit Cost (TK)	Total Amount	Responsible Person	Time Frame				Remarks
							1st Qrt.	2nd Qrt.	3rd Qrt.	4th Qrt.	
1	Quarterly Progress Sharing Meeting										
	Daylong event for 4 times	10 members of Gender Committee (Social Welfare and Community Center standing Committee)	4 Meetings			Gender Committee					
	Food for One day for 4 Meeting	One-time snacks for 10 Person for 4 Days	40	30	1200						
		Lunch-300/Person*40	40	300	12000						
	Logistics	Note pad, Pen, Printing Materials, VIPP Card, Poster Paper, Marker Etc. ;40/ Person	40	100	4000						
	Sub Total=				**17200**						
2	International Day Observance (8 March)										
	Rally					Gender Committee					
	Snacks for 500 Packs	500 packs; 30 TK/Packs	500	30	15000						
	IEC Materials		1	5000	5000						

SL.	Name of Activity	Activity Details	Unit/Batch/Days	Unit Cost (TK)	Total Amount	ResponsiblePerson	Time Frame				Remarks
							1st Qrt.	2nd Qrt.	3rd Qrt.	4th Qrt.	
	Logistics	Banner/ Festoon/ Leaflet etc.			5,000						
	Documentation andReporting	Printings, Bindings, Photocopy etc.			500						
	Subtotal=				**25500**						
3	**International Day for Eliminating Violence Against Women and Human Rights Day observation**										
	Rally										
	Snacks for 500 Packs	500 packs; 30 TK/Packs	500	30	15000						
	IEC Materials		1	10000	10000						
	Logistics	Banner/ Festoon/ Leaflet etc.			5,000						
	In house discussion/ Talkshow	Snacks for 30 persons	30	50	1,500						
	Documentation andReporting	Printings, Bindings, Photocopy			500						

SL.	Name of Activity	Activity Details	Unit/Batch/Days	Unit Cost (TK)	Total Amount	ResponsiblePerson	Time Frame				Remarks
							1st Qrt.	2nd Qrt.	3rd Qrt.	4th Qrt.	
	Subtotal=				**32000**						
			Total=		**74700**						

Appendix XIII: Sample Report Format for GAP

- Title of the Report Format for GAP
- Introduction
- Purpose of the Report
- Brief report of the events

SL	Name of the Events:	Objectives	No of the Participants	Discussion point of the events	Decisions of the events	Specific comments by Discussants	Remarks

Necessary Action:

Output/Result:

Challenges:

Lesson Learned:

Conclusion:

Closing Remarks:

Appendix XIV: FGD and Public Consultation Meeting Attendance Sheet of RpCC

Preparation and Design Consultancy Services for the Integrated Solid Waste Management Improvement Project (ISWMIP)

Local Government Engineering Department (LGED)

Environment, Social and Engineering aspects

Information Collection Meeting (ICM) with Officials and ULBs

Name of Pourashava/City Corporation: Rangpur

Date: 25.5.2022 Time: 3:00 PM

SL. No. (ক্রমিক)	Participant's Name (অংশ গ্রহণকারীর নাম)	Occupation (পেশা)	Mobile Number (মোবাইল নাম্বার)	Signature (স্বাক্ষর)
1.	[illegible]	[illegible]	01712-695313	
2.	মোঃ লোকমান হোসেন	[illegible]	[illegible]	
3.	[illegible]	[illegible]	01712113879	
4.	[illegible]	[illegible]	[illegible]	
5.	[illegible]	[illegible]	[illegible]	
6.	[illegible]	[illegible]	01712949372	
7.	Md. Abul Kalam Azad	Councilor	01716776688	
8.	M.A.M. Humayun Kabir	Ex-commissioner	01763-222223	
9.	[illegible]	[illegible]	[illegible]	
10.	মোঃ আইয়ুব আলী	[illegible]	01732-945983	
11.	[illegible]	[illegible]	[illegible]	
12.	[illegible]			
13.	[illegible]	[illegible]	[illegible]	
14.	[illegible]	[illegible]	01628212910	
15.	মোঃ বিপ্লব	[illegible]	01780808653	
16.	[illegible]	[illegible]	01720505377	
17.	[illegible]	[illegible]	[illegible]	
18.	[illegible]	[illegible]	[illegible]	
19.	[illegible]	[illegible]	[illegible]	

Preparation and Design Consultancy Services for the Integrated Solid Waste Management Improvement Project (ISWMIP)

Local Government Engineering Department (LGED)

Environment and Climate Change aspects

Focus Group Discussion (FGD) with ULBs

Name of Pourashava/City Corporation: Rangpur

Date: 25-5-2022 **Time:** 11:30 AM

SL. No. (ক্রমিক)	Participant's Name (অংশ গ্রহণকারীর নাম)	Occupation (পেশা)	Mobile Number (মোবাইল নাম্বার)	Signature (স্বাক্ষর)
1.	Md. Mostafizer Rahman	Mayor. RPCC	01712-695313	[signature]
2.	Md. Azam Ali	Executive Engineer	01726528107	[signature]
3.	Umme Fatima	Chief Revenue Officer	01731255732	Concerned
4.	A.A. Humayun Kabir	Ex-Commissioner	01763-222223	[signature]
5.	মোঃ লোকমান হোসেন	ব্যবসা	[illegible]	[signature]
6.	মোঃ [illegible]	ব্যবসা	01712113879	[signature]
7.	" কামরুজ্জামান [illegible]	ব্যবসা	[illegible]	[signature]
8.	মোঃ [illegible] হোসেন	[illegible]	[illegible]	[signature]
9.	মোঃ [illegible]	ব্যবসা	01712645990	[signature]
10.	মোঃ সাইদুর রহমান	চাকুরী	01761714149	[signature]
11.	মোঃ [illegible]	ব্যবসা	01678702326	[signature]
12	[illegible]	[illegible]	01722604557	[signature]
13	মোঃ নুর আলম সিদ্দিক	চাকুরী	01720505777	[signature]
14	মোঃ নাজমুল হক	চাকুরী	01707463767	[signature]
15	[illegible] রহমান	সাংবাদিক	[illegible]	[signature]

Preparation and Design Consultancy Services for the Integrated Solid Waste Management Improvement Project (ISWMIP)

Local Government Engineering Department (LGED)

Environment and Climate Change aspects

Public Consultation Meeting (PCM) with Officials

Name of Pourashava/City Corporation: Rangpur

Date: 25-5-2022 **Time:** 10.00 AM

SL. No.	Participant's Name	Designation	Mobile Number	Signature
1.	[illegible]	[illegible]	01712-695313	
2.	[illegible]	[illegible]	[illegible]	
3	[illegible]	[illegible]	01712947372	
4.	Md. Abul Kalam Azad	Councilor	01716-776688	
5	A. A. M. Hemayet Kabir	Ex. Councilor	01763-222223	
6.	[illegible]	[illegible]	[illegible]	
7.	[illegible]	[illegible]	01762803612	
8	[illegible]	[illegible]	01720505377	
9.	[illegible]	[illegible]	01794637462	
10.	[illegible]	[illegible]	[illegible]	
11.	[illegible]	[illegible]	[illegible]	
12.				
13.				
14.				