Draft

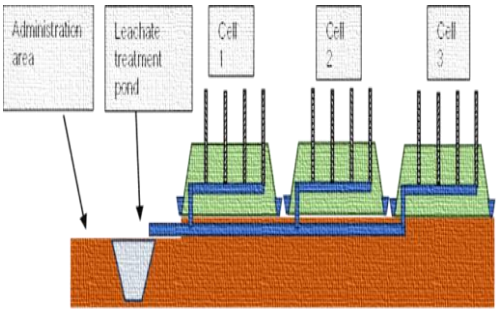
Environmental Impact Assessment (EIA)

For

Red Category subprojects

Urban Development and City Governance Project (UDCGP)

Local Government Engineering Department (LGED)



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Acronyms and Abbreviations

ARAP	Abbreviated Resettlement Action Plan
BBS	Bangladesh Bureau of Statistics
CBP	Cox's Bazar Paurashava
CC	City Corporation
CEMP	Contractor Environmental Management Plan
CSC	Construction Supervision Consultant
CuCC	Cumilla City Corporation
DOE	Department of Environment
DPP	Development Project Proposal
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
ECA	Environment Conservation Act
ECA	Ecologically Critical Area
ECR	Environment Conservation Rules
EHS	Environment, Health, and Safety
EHSO	Environment, Health, and Safety Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESFP	Environmental Safeguards Focal Person
FGD	Focus Group Discussion
GCC	Gazipur City Corporation
GOB	Government of Bangladesh
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GSB	Geographical Survey of Bangladesh
HSMP	Health and Safety Management Plan
IA	Implementing Agency
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
LCB	Local Competitive Bidding
LGED	Local Government Engineering Department
LGRC	Local Grievance Redress Committee
MOEFCC	Ministry of Environment, Forests and Climate Change
MOLE	Ministry of Labour and Employment
NCC	Narayanganj City Corporation
NEMAP	National Environmental Management Action Plan
NEP	National Environmental Policy
PA	Protected Area
PIU	Project Implementation Unit
PMU	Project Management Unit
PPE	Personal Protective Equipment
PSC	Program Steering Committee
PWD	Public Works Department
RCC	Reinforced Cement Concrete
RFP	Resettlement Policy Framework
SOU	Safeguard Oversite Unit
TMP	Traffic Management Plan
TWS	Teknaf Wildlife Sanctuary
UDCGP	Urban Development and City Governance Project
ULB	Urban Local Body
WB	World Bank

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1.0 Executive Summary

Background

Bangladesh has been in rapid urbanization during the last few decades brought about by its population growth, migration of rural population to urban areas, and the expansion of urban areas. A study on population projection of Bangladesh from 2011 to 2061 presents that urban population will have a drastic growth while the rural population growth will start to lessen from 2036-41. Such rapid urbanization demands urban governments to timely deliver quality services to its citizens more than ever. The current urban governance in Bangladesh, however, has yet to meet these urgent and increasing demands. Consequently, infrastructure development remains behind the above-mentioned rapid urbanization amidst the growing traffic congestion, insufficient and unreliable water supply, inadequate sanitation and waste management, and drainage problems.

The Government of Bangladesh and the Japan International Cooperation Agency (JICA) signed a loan agreement for the Urban Development and City Governance Project (UDCGP) (hereinafter called "the Project") on August 12, 2020, following which the GOB approved its DPP in June 2022. This project will contribute to the achievement of *SDGs Goal 11: Make cities inclusive, safe, resilient, and sustainable*.

Project Objective and Expected Outcome

The project objective is to improve urban functions by strengthening city governance related to infrastructure development in the target cities, thereby contributing to economic growth and improvement of living conditions toward sustainable cities. Specifically, the project intends to strengthen ULBs in terms of infrastructure development and the services it provides through capacity building. The project envisions that, in the long run, engineers stationed at each ULB should be able to plan in an appropriate manner and manage infrastructure development appropriately.

Implementation Arrangements of the Project

The Executing Agency at central level is the Local Government Engineering Department (LGED) where the Project Management Unit (PMU) has been established.

Implementing Agencies of the Project are: Gazipur City Corporation (GCC), Narayanganj City Corporation (NCC), Cumilla City Corporation (CuCC) and Cox's Bazar Paurashava (CBP) at which the Project Implementation Units (PIUs) have been formed.

Operation and maintenance of all infrastructure under the Project will be done by 4ULBs. The operation and maintenance system of the infrastructure in ULBs has been addressed through the capacity development activities during the Project implementation.

Objectives and purpose of this report

The Project composes 41 subprojects, and JICA, the funder of this project, classifies it as Category B which only requires an IEE according to their environmental guidelines since all 41 subprojects are small in scale, and not located in ecologically sensitive, or protected areas. However, 9 out of 41 subprojects listed in Table-1 fall under 'Red' Category in accordance with the Environmental Conservation Rules 2023 (ECR 2023). This EIA report is thus prepared for them to obtain an Environmental Clearance Certificate (ECC). Its Terms of Reference (TOR)

was approved by DOE on February 02, 2024 (Reference Number: 22.02.0000.018.72.063.23.18).

With regard to the rest subprojects that fall in 'Orange' Category, a Site Clearance Certificate was issued by the DOE as of February 11, 2024 (Reference Number: 22.02.0000.018.72.063.23.19).

Table 1: List of Red category subprojects of UDCGP

Sl. #	# Code	Name of subprojects	Quantity	Locations
Gazipur City Corporation (GCC)				
1	GCC-RB-1	Construction of Railway Overpass in Gazipur	630 m	Joydebpur Rail Crossing
2	GCC-SWM-1	Construction of new landfill site in Gazipur for solid waste management.	3.90 ha	Gacha, GCC
3	GCC-SWM-2	Improvement of collection and transportation system in Gazipur.	1 no.	Overall GCC areas
Narayanganj City Corporation (NCC)				
4	NCC-SWM-1	Construction of new landfill site in Julkuri (phase I) for solid waste management.	Landfill area: 4.4 ha	Julkhuri
5	NCC-SWM-2	Construction of new landfill site in Julkuri (phase II) for solid waste management.	Landfill area: 1.7 ha	Al-Amin Nagar
Cumilla City Corporation (CuCC)				
6	CuCC-SWM-1	Improvement of collection, transportation, and landfill site for solid waste management	Landfill area: 0.83 ha	Jhakuni Para
7	CuCC-D-4	Re-excavation of existing (2) Racecourse and Gungaijuri canals	Excavation of canal: 1,600 m, W 10 m Excavation of canal: 6,300 m, W 15 m	Racecourse and Gungaijuri
Cox's Bazar Pauroshava (CBP)				
8	CBP-SWM-1	Improvement of central solid waste management situation in Cox's Bazar (collection vehicle and heavy equipment procurement and closure of existing open dumping site in central market).	1 no.	Overall CBP areas
9	CBP-SWM-2	Development of sanitary landfill site in SM para	5.67 ha	

Note: This list is as it appears in the TOR application.

Scope and limitations of this report

Based on the analyses of 9 subprojects' site plans, technical data, each subproject's detailed design, primary and secondary data collected on the environment and social issues, field visits, local interviews and stakeholder consultations conducted in 2023 and 2024, the scope of this report covers the existing environmental and social condition of the 9 subprojects in the 4 ULBs, assessment of potential environmental and social impacts during pre-construction, construction, and operation stages; description of the environmental management plan (EMP) and environmental and social monitoring plan; stakeholders' consultation, grievance redress mechanism, and description of the legal and administrative framework.

This EIA does not provide assessment for any other/future developments or activities at the location or anywhere else within the area concern reported in this EIA document. Should any further development be planned as a result of either this Project or other related works, additional planning and assessment following the requirements of the government will be carried out separately.

LEGAL AND POLICY FRAMEWORK

The lead environmental agency in Bangladesh is the Department of Environment (DOE), under the Ministry of Environment, Forests and Climate Change (MOEFCC). DOE is charged with furthering environmental conservation, improvement of environmental standards, and control and mitigation of environmental pollution. This mandate positions DOE as a key regulator of a broad range of developments in the infrastructure, industrial and commercial sectors, including both publicly and privately funded initiatives. DOE is responsible for administering the country's central environmental law, which provides the framework for environmental impact assessment.

The Environment Conservation Act authorizes the DOE to undertake any activity to conserve and enhance the quality of the environment and to control, prevent and mitigate pollution. The DOE is designated as the regulatory body and enforcement agency for all environment-related activities.

The Environment Conservation Rules 2023 are the most important set of regulations giving procedural substance and tools of enforcement to the aims articulated in the ECA. The Rules specify standards for air quality and emissions, water quality and discharges, and noise, and establish norms enabling the inspection of industrial facilities by the DOE. Importantly, the Rules (Schedule I) lay out a standard framework for categorizing, assessing and regulating new industrial projects using a four-level typology of impact potential.

Since the Project is financed by Japanese ODA loan, it is mandated that LGED and ULBs comply with the JICA Guidelines (2010) on top of Bangladesh laws and regulations, and confirm if appropriate environmental and social considerations are taken to avoid, reduce or minimize project’s impacts on the environment and local communities and to prevent the occurrence of unacceptable adverse impacts.

This EIA report covers subprojects of road sector, drainage sector and solid waste management sector as described earlier in the above table. With updated environmental data and information on the subprojects, LGED has reconfirmed that the scope and scale of their adverse impacts do not exceed that of JICA’s Category B level although they are in RED Category of ECR 2023.

DESCRIPTION OF THE PROPOSED INFRASTRUCTURE

GCC: The construction of railway overpass under GCC-RB-1 is to solve the major traffic congestion and to facilitate the flow of traffic in one of the busiest points in Gazipur City. It is approximately 400 meters from the GCC Office. It is a 4-lane carriageway to serve the daily traffic volume. Design speed is at 40-60km/h, vertical clearance is assumed at 8.58m. The elevation of the overpass is estimated to be around 11.10 meters above railway track. Construction of new landfill site (GCC-SWM-1) has been more focused on the improvement of collection and transportation system in association with GCC-SWM-2. Due to the increase of waste generation, as well as the situation of current collection capacity, two subprojects will

tackle upon the enhancement of GCC's collection capacity by procuring the collection equipment, improving the primary collection system and the transfer stations including public awareness.

NCC: Rapid increase of the City's population has been surpassing its solid waste treatment capacity, and two subprojects (NCC-SWM-1 and NCC-SWM-2) will enhance it and improve its hygiene condition by procuring equipment, transferring the existing open dumping site in Alamin Nagar to sanitary landfill, and developing a new sanitary landfill site in Julkuri to accommodate more waste.

CuCC: In order to enhance the existing state of drainage function and reduce water logging from urban areas, the subproject (CuCC-D-4) will improve the existing canal through re-excavation which lies beside residential areas and paved road. It will also improve city residents' amenities and beautification by building walkways. Another subproject (CuCC-SWM-1) will improve the existing open dumping site which is the only place for the City to dispose waste and expand it to the surrounding area with treatment plant.

CBP: As the existing opening site at Pana Market is reaching its full capacity, one of two subprojects for CBP (CBP-SWM-1) will be implemented to transfer it to a sanitary landfill that helps extend its role for another few years, and new sanitary landfill will be developed in SM Para (CBP-SWM-2) to succeed waste disposal function from Pana Market and to accommodate a treatment plant.

Description of Baseline Environment

GCC: Gazipur District is bounded on the north by Mymensingh and Kishoreganj Districts, on the east by Narsingdi District, on the south by Naranyanganj and Dhaka Districts and on the west by the Tangail District.

All the upazilas under Gazipur district fall within the physiographic unit known as Madhupur jungle tract (*Bhawal Garh*). The Madhupur and Bhawal Jungle tract is like a scroll that has recorded the fascinating history of uplift and subsidence, of erosion and deposition, of changes in sea level, climate, and vegetation, and of man's changing patterns of occupation. GCC lies between the Banar Fault (in the east) and the Turag Fault (in the west). It lies in the earthquake Zone-II (seismic coefficient z = 0.20) according to the seismic map of Bangladesh.

The maximum mean temperature observed in GCC is between 25°C–34°C between May–August, with the minimum temperature of between 13°C–25°C in January. Monthly precipitation records clearly distinctly show a dry and rainy season.

The Madhupur tract (Bhawal Garh) is dominated by coppice sal (*shorea robusta*), garjan, (*Dipterocarpus turbinatus*) covering about 80% of the tree stands in association with sheel koroy (*Albizzia procera*), kadam (*Anthocephalus cadamba*), ajuli (*Dillenia pentagyma*), jarul (*Legerstroemia speciosa*), banian tree (*Ficus benghalensis*), ashwatha (*Ficus religlosa*), bahera (*Terminalia bellirica*), haritaki (*Terminalia chebula*) etc.

NCC: Geologically NCC lies on the edge of the Madhupur Tract and the Holocene floodplain deposits from the aquifers. Geologically it is a terrace from one to ten meters above the adjacent floodplains. The alluvial soils of these floodplains mainly consist of ridges of loamy material like silty clays and silty sands with large areas of shallow clays in the basins. The soil pattern can become more irregular close to river channels due to more recent deposits.

Regarding the youngest activities organic soils of swamps may be found locally as well as areas where the ground level has been raised using loose sands dredged and pumped from nearby rivers.

NCC is a land of mixed topography. The present urbanized areas and the levees of the Shitalakhya, the Buriganga and the Old Brahmaputra rivers are of comparatively higher elevation. Narayanganj is located mostly on the river deposits at the southern fringe of the Madhupur Tract, which is elevated Pleistocene inlier. Large parts of the city are located on this inlier, which is surrounded by very young riverine sediments occupying the surrounding valleys. The elevation of the inlier tract varies from 2 to 14 m above mean sea level, and the drainage patterns within can be either dendrites or trellis.

The annual average temperature varies from maximum 36°C to minimum 12.7°C and the average annual rainfall is 2,376 mm.

The main surface water sources of NCC are the river Sitalakhya and Dhaleswary, which flow along the two different sides of NCC. As it is an industrial-based area all the effluents and wastes are deposited here and that makes them polluted. But now also these rivers are used for fishing and sometimes for household purposes also.

CuCC: The maximum part of CuCC is a flat plain without the hilly tracks. The soil of this area is very low lying and almost perennially wet. It has predominantly deep silty soils, but it also has a significant portion of basin clays. The characteristic of this soil is dark grey or brown clays with dark grey flood coatings, some calcareous throughout some with seasonally acid topsoil and calcareous substratum within four feet. Cumilla is situated in earthquake Zone-II.

In CuCC area the river Gomoti is a prominent surface water source. Beside this there are also some sources like Guingadhari canal, Balujhuri canal, Katakhal, Nagguniya Khal, Ruhita Khal, Dhakatiya River.

From June to October, the monsoon season is warm, cloudy, and wet. The warmest month is April, the coolest is January, the wettest is July and the driest is January. This area is distinctive as a tropical-subtropical sub-humid climate. The maximum mean temperature observed in CuCC is about 25-32°C between May-August, with the minimum temperatures of between 12-15°C in January. Annual average rainfall is about 2430 mm.

CBP: Cox's Bazar has the longest sea beach in the world. Geology in Cox's Bazar is composed of sandstones, alternating with bluish-grey shales and siltstones. These sediments are probably of fluviatile origin through some of the even-bedded siltstones and shales of considerable lateral extent of shallow marine beds. The higher hill ranges occupy a narrow belt: the most common soils are strong brown, friable, silty clay loams, and silty clays, which grade into broken shale rock at 2-4 feet.

The Moheshkhali Channel, BaakKhali and Naf rivers and Bay of Bengal are the main waterways of the region. The Moheshkhali Channel flows into the Bay of Bengal near CBP and passes the northwestern boundary of the area of influence. The Bakkhali River originates from the Chittagong Hill Tracts and flows into the Bay of Bengal near CBP. Many other mountain fountains (Pahari Chora) run through the hilly hinterland. As a result, a stream network runs through the CBP area.

Generally, maximum temperature in the year reaches between the last week of March and end of May. Temperature data is recorded at station Cox's Bazar. The average maximum temperature in Cox's Bazar is 31.28°C in April and minimum is 22.0°C in January. Average rainfall in Cox's Bazar is high, around 3500mm a year. The highest rainfall is received from July to August.

Analysis of Alternative

Considering all the environmental and social aspects, the current preferred options of infrastructure improvement and new construction offer the best-balanced solutions.

GCC: Four (4) alternative alignments / schemes were considered for GCC-RB-1, and a quick assessment on each of scheme was made by considering (i) flow of traffic; (ii) traffic implications after completion; (iii) design features; (iv) estimated impact; and (v) traffic congestion during construction. As it will be constructed in the urban center of the City, impact to natural environment will remain minimum. On the other hand, there is no option not to avoid acquisition of land and structures, that will make local people affected although minimization was pursued.

Both of the existing landfills of GCC are operated in an uncontrolled insanitary manner and the amount of waste has been reaching their maximum capacities. Some candidate sites for the new landfill are proposed and not yet finalized. Therefore, Regarding the landfill site, it is difficult to be included in this subproject. Instead, GCC requires improvements in their SWM System at its earliest due to the increase of waste generation as well as situation of current collection capacity. Improvement of public awareness and participation in waste storage at households including source-segregation is also a "must" for improvement of waste collection system. Therefore, no project alternatives are applicable, and this component is best suited to the project option.

NCC: As the proposed activities for the subproject (NCC-SWM-2) will remain in the same place in the existing dumping site for improvement and expansion, no alternative option will be applicable in this regard. For the improvement, Level 3 sanitary landfill with leachate circulation system will be applied, and geomembrane / artificial liner will be installed to cover the soil, and a Leachate Treatment Plant will be constructed in the expansion area. Regarding NCC-SWM-1, the site was selected following the Solid Waste Management Rules 2021 considering 200m from the existing river, pond or water body, 500m from the regional road, 250m from the residential areas, 500m from the water supply well and 500m from the public park. It is rare to find a suitable place for landfill site in the urban center of emerging city like NCC but the selected location. Due to land scarcity, land will be acquired which is now under process as of the preparation timing of this EIA Report. For both subprojects, the best alternative design standards will be considered based on the best practice management, and semi-aerobic sanitary landfill will be chosen.

CuCC: The existing canal goes along with residential areas, commercial areas, and some important government buildings on its both sides. However, presently the entire areas go under waterlogging due to the siltation of canal with improper drainage system. There is thus no option of 'do nothing' or alternative route for CuCC-D-4 to consider but re-excavate the existing canal to improve its function and hygiene, and increase its safety level.

The proposed landfill site for CuCC-SWM-1 will be developed in Jhakunipar, which is currently used as open dumping site, intending to convert it to semi-aerobic sanitary landfill site. No alternative option is thus applicable for this subproject. On the other hand, considering its present situation, landfill shall be expanded that will require land acquisition. The embankment will be suitably constructed as well as the other structures such as rainwater drainage or gas ventilation pipes etc.

CBP: The Pana Market site will have to be closed within a few years as its remaining capacity to accept wastes has been decreasing. Doing no action is not an option but to convert it to semi-aerobic landfill (CBP-SWM-1) that enhances prompt drain of leachate and natural air circulation in landfill layer. It promotes prompt decomposition of landfilled waste and water quality of leachate much lower. In the meantime, new dumping site has been pursued and SM Para has been shortlisted for it considering the estimated amount of waste generation in the upcoming years, acceptance amount and period at the existing landfill and new landfill, socio-economic impacts caused to local communities, and environmental impacts. CBP examined different conceptual ideas depending on the land availability for CBP-SWM-2. Like the expansion plan of sanitary landfill in NCC-SWM-1 and CuCC-WM-1, a sanitary landfill with impermeable liners and leachate treatment system in addition to its recirculation system shall be applied in order not to do harm to the surrounding environment.

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEAURES

The impact categorization, anticipated impacts and mitigation measures are summarized below. The potential impacts and corresponding measures that are prescribed in order to mitigate the negative impacts or enhance positive ones for all the listed subprojects. The measures prescribed apply to the pre-construction, construction, and operations phases of the infrastructure development at CCs and Paurashava. All measures are requirements, based on the infrastructure plan as proposed at the time of preparation, whose fulfillment is assigned. All measures assigned to contractors have been reflected in bidding documents, and serve as the basis for the CEMPs, which must be prepared to cover all sites at this investment location.

AIR QUALITY

Impacts during Construction Phase: Air quality will decline by dust suppression, exhaust gas emissions from reshaping work and construction activities, frequent vehicles movement, particularly during dry season and large quantity of moving materials. While excavation in CuCC, fuel-based excavators and drum trucks will be used that could produce black smoke in the working areas and lead to contribute the degradation of local air quality.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Implement a regular routine of light spraying with water.
- All dust-generating surfaces should be treated to avoid dust reaching nuisance levels.
- Keep all soil tightly covered with tarpaulins whenever they are not in active use.
- All haul trucks should be equipped with tightly fitted tarpaulins to prevent releases of dust from dry materials during transport.
- Maintain all motorized construction equipment and all haul trucks to a high standard, most particularly their fuel and exhaust systems.

<Overpass construction>

- Construction areas and stockyard should be properly fenced, or site barricade should be installed properly.
- All construction materials including sand, cement, soil etc., must be covered up with hard polythene or tarpaulin in the stockyard, and during transportation to the site and from the site.
- After transportation of construction materials like soil, sand, bricks, cement, waste materials etc., the trucks, lorry, van wheels shall be cleaned properly before leaving the site.
- Construction materials should not be kept on the roadsides, footpath, and others and wastes cannot be allowed to store in any open place and onsite burning.
- Water sprinkle should be conducted at least twice a day on the construction site, and continuously (every hr.) during excavation, trenching

<Canal re-excavation>

- Dust generation shall be reduced, and water sprinkling carried out, especially where earthmoving, and reshaping of canal are carried out.
- Good engines should be used to reduce smoke emissions.
- Dredge materials should be properly stored and maintained properly to protect dust emissions.

Impacts during Operation Phase: Local air quality will deteriorate due to dust suppression, exhausted gas, foul odor while transportation of solid wastes to the landfill sites, and due to vehicle traffic on the road.

Mitigations:

<SWM equipment procurement>

- When operating equipment used for waste transportation, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants.
- Transport of collected waste shall not be conducted during strong winds or heavy rain.
- Cover using over the vehicles during transportation of wastes from households to secondary transfer stations (STs) to final disposal sites.
- In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.
- After disposal, vehicles and STs should be cleaned up very well without residues.
- Vehicle engines should be checked regularly, and Mobil & grease should be replaced regularly following the good industrial practices of IFC/World Bank or others etc.

<Landfill Improvement, new Landfill construction / expansion>

- Properly inspect and maintain the equipment used for reclamation to reduce emissions of air pollutants
- Clean up and sprinkle water in the on-site work yard to prevent dust and sand from being dispersed by vehicle travel.
- Landfill operations shall not be conducted during strong winds or heavy rain.

- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.

<Overpass construction>

- Water sprinkles should be conducted at least twice a day on the most congested areas at least twice a day etc.
- Reduce traffic congestion and engine idle time.

ODOR

Impacts during Construction Phase: Odor will be recognized due to the existence of waste, and when leachate is collected during reshaping and excavation works.

Mitigations:

<Landfill Improvement>

- Information about work schedules shall be well circulated to local communities.
- Adopt a semi-aerobic landfill, install leachate collection pipes, gas exhausted pipes and other facilities for circulation will accelerate decomposition of waste and prevent offensive odor

Impacts during Operation Phase: Foul or offensive odor will be generated and spread over the road and its neighborhood areas due to handling of wastes for collection, transportation and disposal to the landfill sites. Objectionable odor is expected at the sanitary landfill site when handling wastes depending on humidity, temperature and moisture content etc.

Mitigations:

<SWM equipment procurement>

- Minimize odor by adopting the International Good Practices of IFC/World Bank such as cover using over the truck, segregate the hazardous and non-hazardous wastes at the STS, and the temporary waste disposal areas should be protected and non-accessible by the local people.
- Disinfection spray can reduce the bad odor during handling of waste management.

<Landfill Improvement, new Landfill construction / expansion>

- Landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

NOISE AND VIBRATION

Impacts during Construction Phase: Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. Noise disturbance is also inevitable due to the operation of typical construction equipment and machinery.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.
- Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards.

<Overpass construction>

- Bricks and stone crushers will not be allowed within 500m of the silent zone areas classified by the Noise Pollution (Control) Rule 2006.
- Mixer machine or other equipment cannot be allowed to use in the construction site from 07PM to 07AM.
- Except the mixer machine, bricks and stone crushers, the other equipment can be used in the construction sites with specified construction schedule and after receiving approval from the relevant organizations.
- Workers should use earplug during working in the high noise generation sites.
- Noise barriers should be installed over the site and rubber pads can be used on motor engines or other equipment etc.

<Canal re-excavation>

- Working hours should be limited to daytime only (07AM to 07PM)
- No hydraulic horns shall be permitted within the working areas.
- Maintained equipment and vehicles regularly, oil and grease changing can reduce the noise generations from the motor engines and vehicles

Impacts during Operation Phase: Noise and vibration will occur due to the use of heavy equipment and vehicles for waste transportation in the city and at landfill sites. Noise pollution and vibration near the overpass will result from movement of vehicles and blowing of horns.

Mitigations:

<SWM equipment procurement, landfill Improvement, new Landfill construction / expansion>

- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites.

<SWM equipment procurement>

- Keep all haul trucks in good repair, and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.

<Overpass>

- Noise barriers should be installed over the site to reduce the noise intensity etc.

SURFACE WATER

Impacts during Construction Phase: There exists leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that might have contaminated surface waterbodies nearby. Excavation works and other construction activities may also cause leachate flow in the open dumping sites, and discharged water turbid and contaminated by suspended solids, accidental spillage of hazardous liquid waste, oils, fuels, paints, chemicals etc. Spoiled materials and soils can further contaminate the neighboring surface water body if they are not treated and eroded into it.

Regarding overpass construction in GCC, surface water pollution may occur to nearby ponds and ditches. drainage congestion may result from possible blockage to natural flow of drainage water. The project site is close to the low-lying areas of the BRRI and opposite site of the rail crossing areas, which needs particular attention during monsoon when drainage becomes a major concern.

High turbidity during excavation work in CuCC will cause deterioration of the DO. It will have impacts on the aquatic environment also.

Mitigations:

<Landfill Improvement>

- Embankment shall be developed beforehand not to discharge leachate outside of the boundary.

<Landfill Improvement, new Landfill construction / expansion>

- Perform visual observations to prevent, detect early and address water turbidity
- Arrange construction site drainage to prevent concentration of surface runoff from exposed soils and materials stockpiles
- Protect disturbed soil from rain by keeping exposed areas covered with mulches, fiber mats and other temporary coverings
- Keep all stockpiles of erodible materials covered with tarpaulins whenever they are not in active use
- Install and regularly maintain sediment traps in site runoff channels
- Use a steel tray to exchange oil, mobile and grease from engine to prevent oil spillage
- Store fuels and other noxious fluids within roofed, rain-exclusive containment structures.
- Maintain a regimen of systematic daily checks of all motorized equipment and tanks to detect leaks, so they can be promptly repaired; and
- Train all workers involved in refueling, equipment servicing and moving containers on proper spill prevention and response

<Overpass construction>

- Provide adequate drainage of storm water and diversion channel
- Ensure facilities for pumping of congested water
- Ensure adequate monitoring of drainage effects, especially during monsoon season
- Install sediment basins to trap sediments in storm water prior to discharge to surface water

<Overpass & canal re-excavation>

- Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land.
- Replant vegetation when soils have been exposed or disturbed

<Canal re-excavation>

- Dredge material shall be managed outside of the excavation sites, disposed at an open area.
- Ensure proper handling of lubricating oil and fuel
- Collect, treat, and dispose of spills properly
- Maintain proper slope to protect erosion
- Remove all construction waste, and demolition waste daily.

Impacts during Operation Phase: If cover is not used on the truck during transportation of solid wastes from households to landfill sites, it will mix with surface water system by different kinds of surface runoff and contaminate the surface water system.

Leachate is generally not discharged externally in the leachate re-circulation system. However, when precipitation exceeds the pump capacity, leachate is released as overflow water.

Surface water quality will be improved after canal re-excavation n CuCC. However, if operation and maintenance is not undertaken properly, local people can dispose of their daily waste to the canal directly, which will lead to contaminate surface water quality greatly.

Mitigations:

<SWM equipment procurement>

- Waste must be transported by covered van or vehicles with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources.
- Overload shall not be allowed to carry more wastes in one trip, and maintained it strictly.

<Landfill Improvement>

- Properly inspect and maintain rain drains well to ensure it lets flow the designed amount of water in cyclones, floodings and heavy rains.
- Regularly monitor water quality in the surrounding area to identify if there is any environmental impact on the surrounding community.

<Canal re-excavation>

- Prohibit any kind of wastes to be disposed of directly to the canals.
- Clean the canals to remove waste at least once a year.
- Build awareness among local communities to keep the canals without dumping any wastes
- Enforced by the city corporation to look after the canal year around

<u>GROUNDWATER QUALITY</u>

Impacts during Construction Phase: The existing leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that most likely have contaminated groundwater. Excavation works and other construction activities may cause leachate to flow into soil and further contaminate groundwater.

Groundwater quality will deteriorate in all construction sites if liquid wastes reaching to the groundwater sources from the labor camp and construction site, mainly toilets and kitchen wastes can be responsible for groundwater contamination in the working areas. Same is true during the establishment of other necessary auxiliary facilities like building, car washing facilities, weigh bridge, road networks and others infrastructure.

Mitigations:

<Landfill Improvement>

- A trench shall be made in the landfill site to install leachate collection pipes

<Landfill Improvement, new Landfill construction / expansion>

- Keep groundwater quality in the surrounding area monitored during improvement work to make sure the subproject does not deteriorate it.

(6) SOIL CONTAMINATION

Impacts during Construction Phase: Soil will be contaminated when polluted surface water is infiltrated into the ground. It is also caused by rain, flood.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

Same as groundwater.

SEDIMENT

Impacts during Construction Phase: Around 296,250 m3 dredge materials would be produced while re-excavating the existing canal, which is 7,900 m length, with 3 m depth, and width 12.2 m.

- A comprehensive management plan for dredge materials should be developed before commencement of excavation works.
- Dredge materials should be stored separately, preferring the open space to the nearest locations.
- Dredge materials should be used to develop the walkways for public interest.
- Dredging materials should not be kept for a long period. Within a short period, dredge materials should be used for improvement of walkways
- Loose materials should be kept by covering up with hard tarpaulin to protect dust emissions etc.

WASTE

Impacts during Construction Phase: Construction waste will generate both hazardous and non-hazardous waste in the construction sites and camps.

Regarding overpass construction in GCC, demolition of the existing structures will produce a huge quantity of debris, which would have to be properly disposed of. Problems related to sanitation and solid waste may result from improper / inappropriate facilities at the labor sheds.

Overall, as large numbers of workers are likely to be involved in different construction activities, lack of proper sanitation facilities for project people, including the labor / construction workers

and absence of proper solid waste (e.g., food waste, construction debris) facilities may create an unhealthy environment (including water pollution) within and around the project sites.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Collect and dispose of the construction wastes or other wastes generated by the construction works
- Reduce, recycle or reuse the construction wastes generated by the construction works (e.g., segregate recyclable construction wastes such as rebar, concrete, cement, debris, etc., and sell).
- Put waste bins in different parts of the construction areas to collect small pieces of construction waste.
- Make sure a part of dumping site to be available for day-to-day waste disposal, for local people not to explore other areas.

<Overpass construction & canal re-excavation>

- Enough dustbins and spittoons shall be provided at convenient places, and these shall be maintained in a clean and hygienic condition.
- No person shall throw any dirt or spit within the premises of labor camp, storage yards and construction except in such dustbins and spittoons.
- Three color coated dustbins should be used at the construction site, for an example, green color dust bin will be used for kitchen wastes, yellow color dustbin for plastic wastes and red color dustbin for hazardous wastes like empty packet of chemicals, oil and grease and others.
- Construction waste should be re-cycled or sold locally to reduce the volume of waste in the construction sites etc.

<Canal re-excavation>

- Sufficient no of wastebins should be placed in the working areas, particularly along the canal sides.
- CuCC conservancy department should collect waste in the daytime and dispose of in the landfill sites.

Impacts during Operation Phase: Solid waste will generate both hazardous and non-hazardous wastes and will cause health impacts to the workers if proper preventive measures will not be undertaken by them during collection, transportation and disposal to the landfill sites. Waste can accidentally drop from transportation vehicles while moving and at landfill sites, which creates nuisance.

Mitigations:

<SWM equipment procurement>

- Waste must be transported by covered van or vehicles should be covered with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources.
- Overload will not be allowed to carry more waste in one trip and maintained it strictly.
- Waste segregation should be carried out following the International Standard Practices of IFC/World Bank and necessary PPE should be used by the workers.

- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

<Landfill Improvement>

- Transport of waste and landfill operations shall be refrained during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.

SOIL EROSION

Impacts during Construction Phase: Soil erosion may occur as the site for improvement is situated beside waterbody and the Bankkhali River in CBP. Surface runoff will frequently occur during monsoon season that will cause soil erosion at the landfill site.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Soil erosion can be minimized or controlled by slope stabilization.
- Determine the boundaries of the landfill site and reshape slopes to develop an embankment.
- Drainage system shall be developed and properly maintained at the sites.

IMPACT ON LOCAL HABITATS

Impacts during Construction Phase: Excessive noise and frequent vehicle movement and labor influx can cause negative affects to the local terrestrial habitats. Impact on surrounding flora and other fauna is anticipated. As for canal re-excavation, due to high noise generation, local terrestrial species will be disturbed and shift their location from the excavation site to another safer place. Aquatic ecosystem will be impacted largely due to high content of TDS, lowering the DO level and other excessive SS content in the working areas.

(Note) Regarding CBP-SWM-1, the impact will be lower significance and lower chance of occurring as the construction activities will be taken place in urban area.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- When selecting construction methods, etc., reflect the latest knowledge and adopt construction methods that reduce environmental impact as much as possible.
- If there is a risk of water turbidity spreading, anti-pollution membranes should be deployed.
- Perform visual observations to prevent, detect early and address water turbidity and soil contamination.

<Overpass construction>

- Avoid the disturbance to the local ecosystem, construction works should be limited to only daytime (07AM to 07PM).
- If trees are required to be cleared from the site, the necessary replantation plan shall be executed properly.
- High noise generating equipment and machines shall be used only in the daytime.

- Cover using on the storage materials to protect water pollution by surface runoff.

<Overpass construction & canal re-excavation>

- Any kind of haunting, trapping, killing and poaching wildlife species will be punishable offense and strictly prohibited at the construction sites, storage yards and labor camps.

<Canal re-excavation>

- Any kind of debris should be removed from the canal site.
- Dredge materials should be protected from surface runoff.
- Re-excavation should be carried out by small sections to avoid the larger impacts to the aquatic resources.

Impacts during Operation Phase: The impact on the local habitat is not significant. However, due to waste transportation to the landfill site during night-time, the nocturnal animals will be wounded, dead or disturbed by hydraulic horn and vehicle movement.

If surface water quality gets contamination due to kinds of human intervention, it will impact the canal aquatic ecosystem and local fish species, and aquatic ecosystems will decline.

Mitigations:

<SWM equipment procurement>

- Waste disposal should be limited with daytime.
- If it requires night-time disposal, the vehicle speed should be less than 30 KM/hr. and hydraulic horns will be prohibited.
- No haunting, trapping and killing of wild species are allowed etc.

<Canal re-excavation>

- Generated waste should be collected by the conservancy department of CuCC regularly, sweeping the sides to keep neat and clean in the canal areas regularly.
- Conduct regular inspections to protect the contamination of surface water systems
- Protect waste dumping to the canals directly
- Conduct awareness session among the local community should be encouraged etc.

<u>GREENHOUSE GAS EMISSION</u>

Impacts during Construction Phase: Greenhouse gas (carbon dioxide) emissions or generation occur in association with the operation of construction equipment and the operation of vehicles transporting materials and equipment

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated.
- For construction equipment and vehicles used to transport materials and equipment, we will strive to adopt environmentally friendly models with low emissions, thereby reducing the generation of greenhouse gases, etc.

- Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions.
- Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.

Impacts during Operation Phase & Mitigations: Same as AIR QUALITY.

LAND ACQUISITION

Impacts during Pre-construction Phase: Local livelihood activities (farming, fishing, etc.) will be affected due to land acquisition for new construction of landfill, especially in CBP. Social conflict may occur in the process of land acquisition. As for canal re-excavation in CuCC, private land will be acquired.

Mitigations:

<New landfill construction>

- A study on losses and damages should be conducted relating to the disruptions of local economy before commencing the construction works.
- Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities
- Inform the affected people of the land acquisition schedule

<Canal re-excavation>

- Compensation shall be paid in accordance with the ARIPA 2017 for land acquisition.
- Top-up payment shall be made for the losses of income and livelihood means in accordance with JICA Guidelines for Environmental and Social Considerations (2010).

LOCAL ECONOMY AND LIVELIHOODS

Impacts during Construction Phase: Livelihood activities on the open dumping sites will be affected and small-scale businesses on the roadside will be disrupted. Those who lose their land / livelihood means due to land acquisition may remain in difficult situations. Loss of income could result from inability to perform certain income generating activities during construction period, particularly close proximity of markets / shops / offices will be remained close due to safety considerations.

Mitigations:

<Landfill Improvement>

- A study on losses and damage should be conducted relating to the disruptions of local economy before commencing the construction works.
- Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities.

<Landfill Improvement, new Landfill construction / expansion>

- Give priority to employing local people in the construction work (either on a contractual or daily basis) to maximize the project's benefits to the local community.

<Overpass construction>

- Avoid important festival times (e.g., Eid) for stoppage of commercial activities to minimize loss.
- Provide alternative job opportunities for the affected people; employ such people in project work where possible.
- Implement the compensation plan for local people who lost their livelihood options etc.

SOCIAL CONFLICT

Impacts during Construction Phase: Conflict between migrant laborers and local people may occur.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Inform the work schedule and put signboard of construction information
- Conduct awareness session among workers to prevent unnecessary conflict

COMMUNITY HEALTH AND SAFETY

Impacts during Construction Phase: Conflict between migrant laborers, local people and waste pickers at the open dumping site. Temporary influxes of migrant laborers may increase the risk of transmitted diseases among local people. Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue etc.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Inform the work schedule and put signboard of construction information
- Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods
- Conduct awareness session among workers to reduce the risk of infectious diseases
- Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases.
- Always make emergency vehicles available

<Overpass construction & canal re-excavation>

- Site barricading should be ensured properly
- Using light at the construction site, particularly, excavation and trenching site at night-time.
- Construction schedules should be shared with the local people.
- Alternative routes should be made accessible for the local people if the current road cannot be accessible by the local people.
- Flagman should be employed at the construction site
- Vehicle speed should be limited to 30-40KM/hr. at the construction site.
- No hydraulic horns should be allowed at the construction sites
- Danger sign should be posted both sides of the overpass areas

- Regular consultation should be taken with the local people etc.

Impacts during Operation Phase: Waste transportation to the sanitary landfill sites may bring vectors such as rats, cockroaches, flies, ants and others, which can spread into the immediate area. These vectors can freely move around the area and may find their way to buildings and areas adjacent to the landfill. They may trigger sudden occurrence of illnesses and unacceptable conditions among people of weak resistance and children in the landfill sites and its adjacent areas.

Mitigations:

< Landfill Improvement, new Landfill construction / expansion>

- Conduct awareness session among local people to reduce the risk of infectious diseases and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods

LOCAL TRAFFIC AND ACCIDENTS (PUBLIC SAFETY)

Impacts during Construction Phase: Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to heavy traffic and vehicles used in the construction work.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- Prepare a traffic management plan (TMP) prior to the commencement of the construction work
- Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.
- Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction
- Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites.
- Keep several staff members standing on the street to ensure pedestrians' safety

<Overpass construction>

- Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings.
- Schedule deliveries of material/ equipment during non-school hours and after regular working hours
- Depute flagman for traffic control, and
- Arrange for signal light at night

Impacts during Operation Phase: Given the high traffic volume of waste transportation, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate

significance. Elevated risks of collisions and accidents between transportation vehicles and pedestrians and between vehicles. As per overpass, total traffic plying may increase due to the trips diverted from the exhausted rail-crossing section. Moreover, the bettered LOS for vehicular traffic, private cars, trucks, three-wheelers, auto-rickshaws etc. will also lead to induced traffic volume and an increase in the total number of trips through this corridor. It is of paramount importance to improve the junction operation of the road network which will ultimately dictate the overall capacity of the network.

Mitigations:

<SWM equipment procurement>

- Limit the vehicle speed to 25/30 km/hr during waste transportation.
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.

<Overpass>

- Provide adequate traffic lights, signals, personnel for controlling traffic over existing roads, level crossings.
- Depute flagman for traffic control
- Arrange signal light at night

OCCUPATIONAL HEALTH AND SAFETY

Impacts during Construction Phase: There exists substantial amount of leachate in the open dumping sites, which is a threat to workers' human health. Gaseous products are in the atmosphere and contaminate air quality that also impact health condition of workers. Landfill gas carries foul odor that is very objectionable and irritating. Working in smoky and dusty conditions at open dumps, infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals, puncture wounds leading to tetanus, hepatitis, and possible HIV infection, injuries at dumps due to surface subsidence, underground fires, and slides, headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide, and carbon monoxide concentrations; and Lead poisoning from burning of materials with lead-containing batteries, paints, and solders.

Overall, land development and civil works can generate substantial amounts of dust particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM10) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site. Frequent vehicle movement at the site can also risk the workers' health and safety. Risks to workers' health and safety also come from improper work site practices.

Mitigations:

<Landfill Improvement, new Landfill construction / expansion>

- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2025.
- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Provide regular safety training for all workers construction, and at regular intervals thereafter.

- Provide task-appropriate PPE to all workers and enforce its use.
- Conduct a toolbox meeting every morning upon commencement of work.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.
- Provide appropriate facilities at workers' camp.

<Overpass construction & canal re-excavation>

- Ensuring safety during demolition of existing structures
- Ensuring safety of trains and rail lines during construction of overpass over rail tracks through proper design of formwork/ centering
- Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering
- Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction
- Site barricade, depute flagman is essential in the construction sites.
- Use safety harness while working at height.
- Appropriate scaffolding should be ensured during construction of overpass
- PPE (hard boots, helmet, gloves, life vest, goggles etc.) should be accessible for all workers and must be used during construction works.
- No PPE no work should be maintained at the site
- Working hours should be limited to only daytime (07AM to 07PM).
- Emergency vehicles should be available at the site
- In the construction sites, arrangements shall be made at a suitable point to supply sufficient purified potable water for all workers employed therein.
- All water supply points shall be legibly marked with "Potable water" in Bangla.
- Enough sanitary toilets and washrooms shall be provided at suitable places so that the workers employed therein at the time of work may use them easily.
- Toilets and washrooms shall be provided separately for male and female workers.
- Toilets and washrooms shall be adequately lit, and ventilated, and water shall be always provided.
- Toilets and washrooms shall be always maintained in a clean and sanitary condition with suitable detergents and disinfectants by contractors.
- First-Aid Medicine Box should be available with full of primary medicines at the site.
- Eye-shield use during electrical works mainly wielding.
- Other appropriate measures should be also undertaken based on field conditions.

Impacts during Operation Phase: Worker's health and safety will be at risks due to handling, collection, transportation and disposal of solid wastes to the landfill sites, and at landfill site. It will include contagious disease, falls, sleeps, car accidents etc. Risks to workers' health and safety from improper work site practices

Mitigations:

<SWM equipment procurement>

- ULBs shall include in the drivers' contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2015.
- Provide drivers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take a rest.
- Provide regular safety training for all drivers, and at regular intervals thereafter.

- Provide task-appropriate PPE to all drivers and enforce its use.

< Landfill Improvement, new Landfill construction / expansion>

- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Flammable material should be kept away from fire in the site.
- Fire extinguishers or sand for extinguisher should be installed in the site
- Duration of outdoor work should be shortened as much as possible by taking moderate rest and drinking water.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.

LABOR CONDITION (including child labor, forced labor and gender-based violence)

Impacts during Construction Phase: Child labor is very common in the construction sites due to paying low wage and working for a longer period. Force labor will occur at the construction sites by the contractors and their sub-contractors. Force labor will work for a longer period without paying overtime and food allowance that couldn't be allowed at the site. Gender based violence will normally occur with female workers which includes sexual violence, lower wages and mental torture by the contractors and its subcontractors.

Mitigations:

- Strictly ban the employment of children below 18 years old
- Force labor shall not be permitted at the construction site also.
- Keep laborers' IDs with their employment record

ENVIRONMENTAL MANAGEMENT PLAN

The EIA process adopted in this study involves identification of the key impacts on natural and social environment and evaluation of the significant impacts along with recommendation of initiative measures as well as listing of unresolved environmental issues. The EIA includes collection of baseline information, setting of boundaries, impact assessment, suggestion of mitigation measures and alternative sites providing an environmental management plan. This EIA study adopted an environmental assessment that is stipulated in ECR 2023 and explains the direction, intensity, extent, duration of impact, timing of impact, nature of impact and cumulatively of the possible impacts, if they are not mitigated. This was done to capture the complex environmental impact pathway of construction projects.

The Environmental Management Plan (EMP) for the project defines mitigation and monitoring measures and identifies the institutions, responsibilities and mechanisms that will ensure their implementation. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during pre-construction, construction, and operation phases of the project, to manage adverse impacts.

Effective implementation of the EMP relies on inputs from multiple entities, spanning the pre-construction, construction and operation phases of the project. Specific tasks are identified and assigned, but the roles and responsibilities are explained in general terms below, beginning with an outline of the entities that are to be involved.

Table 2: EMP implementation responsibilities

Entity	Responsibilities in EMP Implementation
Project Management Units (PMU) at LGED	• Ensure EMP provisions are fully reflected in civil works bid documents • Work with CSCs to develop and deliver periodic EHS training for PIU, contractors, sub-contractors and their workers to ensure effective EMP implementation during the operation period • Prepare operations and maintenance procedures for facilities under construction, ensuring their compliance with the EMP • Collect and collate progress reports and environmental monitoring reports from each ULB to assemble comprehensive quarterly monitoring reports for submission to JICA; • Administer the GRM
Project Implementation Unit (PIU) at ULBs	• Ensure that EMP implementation is recognized as a critical element of overall project implementation • Oversee rigorous review of bids and prioritize selection of contractors with strong environmental compliance track records • Review and approve CEMPs and quarterly environmental monitoring reports submitted by contractors • Coordinate with PMUs as needed to ensure smooth implementation of EMP • Oversee the safeguards compliance process for all investment sites under the PMU's control, liaising with the contractors • Prepare and submit quarterly progress reports • Chair Local GRC to address Level 2 grievances regarding project implementation activities • Oversee the safeguards compliance process for the investment sites
Construction Supervision Consultants (CSC)	• Conduct regular monitoring of conditions on site, including compliance with prescribed mitigation strategies, and submit EHS monitoring reports on a monthly basis to PMU • Identify training needs, develop and deliver trainings • Support PMUs in obtaining environmental clearances and renewals • Guide and assist PMUs in monitoring of CEMP implementation and site conditions, including preparation of quarterly progress reports • Direct and supervise actions by contractors as needed • Collaborate with PIU on development of safeguards training for contractors / sub-contractors and their workers
Contractors	• Conduct regular monitoring of conditions on site, including compliance with prescribed mitigation strategies, and submit EHS monitoring reports on a monthly basis to PIU • Prepare and implement CEMP for each site, based on EMP prescriptions and international best practices • Conduct quarterly EHS monitoring on all sites under their control and submit quarterly monitoring reports to CSC for review • Implement corrective actions as directed by PIU and CSC

ENVIRONMENTAL MONITORING PLAN

Environmental monitoring and inspection will consist of: (i) environmental impact monitoring; and (ii) EMP performance verification (compliance monitoring). Environmental impact monitoring will assess the degree to which the project environmental management and mitigation measures are successful in avoiding impacts to the biophysical environment and the socio-economic environment during the project's construction and operation phases. The PMU will conduct performance verification during pre-construction and construction phases, after which this will become the responsibility of the Implementing Agencies. Details of the monitoring requirements and tasks covering all sites are compiled in an Environmental Monitoring Table (EMoT), presented in the tables below.

Periodic environmental monitoring reports will be prepared by the Consultant and reviewed by the PMU. The report will be prepared based on (i) monthly progress reports submitted by the

contractors, which will include monitoring data collected by the contractor(s) and reviewing by the consultant and as well as PMU. The environmental monitoring reports will refer to national standards of air quality, surface water quality, groundwater quality, noise level, soil quality etc. as appropriate.

Table 3: Overall Environmental and Social Monitoring Plan

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
Land acquisition / Land use change	**Method:** Interviews with affected people **Location:** Construction planned site (GCC-RB-1, NCC-SWM-1, CuCC-D-4, CuCC-SWM-1, CBP-SWM-2) **Parameters:** Records of affected livelihoods, Number of complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	PIU (ULB) As required
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month
Odor	**Method:** Sensory test results (odor index) **Location:** Construction site perimeters nearest to residences; by side of main roads (NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1) **Parameters:** Workers, residents	Contractor Once a month
	Method: Interviews with residents and record monitoring **Location:** Construction site perimeters nearest to residences; by side of main roads (NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1) **Parameters:** Number of complaints from the local communities	Contractor Daily (ad-hoc)
Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Surface water pollution	**Method**: Visual inspection; interview workers as needed **Location**: Construction site (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants	Contractor Daily
	Method: Measurement **Location**: Construction site (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	Contractor Once a month

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Groundwater quality	**Method:** Measurement **Location**: Construction site (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Groundwater quality (e.g., As, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease)	Contractor Once a month
Soil contamination	**Method:** Measurement **Location**: Construction site (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Soil quality (e.g., pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease)	Contractor Once a month
Sediment	**Method:** Visual inspection and records **Location:** Construction site (CuCC-D-4) **Parameters:** Amount of recyclable / reused sediments collected on site	Contractor Once a month
Waste	**Method:** Visual inspection and records **Location:** Construction site, Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Soil erosion	**Method:** Visual inspection and records **Location:** Construction site (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Record of construction work progress	Contractor Once a month
Loss of local habitats	**Method:** Visual inspection and records **Location:** Construction site perimeters nearest to residences; by side of main roads (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Status record of terrestrial plants and animals, water quality parameters	Contractor Quarterly
Greenhouse gas emission	Same as "Air Quality" above	Contractor Once a month
Local Economy and Livelihoods	**Method:** Inspection, Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Records of affected livelihoods, and employment record of local people by the project etc.	Contractor As required
Social Conflict	**Method:** Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	Contractor As required
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of complaints from the local communities,	Contractor Daily (ad-hoc)

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
	Number of grievances and reconciliations	
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, Copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp (NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	Contractor Biannually
OPERATION PHASE		
Air quality	**Method:** Measurement **Location:** At perimeters nearest to residences; by side of main roads (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	City Corporation Quarterly
Odor	**Method:** Interviews with residents and record monitoring **Location:** At perimeter nearest to residences; by side of main roads (GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of complaints from the local communities	City Corporation Quarterly
Noise and Vibration	**Method:** Measurement **Location:** At perimeter of subproject site nearest to residences (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	City Corporation Quarterly
	Method: Interviews with residents **Location:** At perimeter of subproject site nearest to residences (GCC-RB-1, GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of local complaints	City Corporation Quarterly

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Surface water	**Method:** Measurement **Location**: The subproject site (GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	City Corporation Quarterly
Waste	**Method:** Visual inspection, site cleaning, interview with local people **Location:** The subproject site office (GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Site Condition, Number of complaints from local communities (if any).	City Corporation Quarterly
Impact on Local Habitats	**Method:** Interview with local people, and physical inspection **Location:** At perimeter of canal sites nearest to residences (GCC-SWM-1, GCC-SWM-2, CuCC-D-4) **Parameters:** Measurement	City Corporation Quarterly
Greenhouse Gasses	Same as air quality	City Corporation Quarterly
Community Health	**Method:** Interviews with local communities **Location:** Residences nearby (NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of complaints from the local communities, Number of awareness session for local people	City Corporation Quarterly
Traffic and Transport (Public health and safety)	**Method:** Inspection; and interviews with passengers and local people **Location:** Railway Overpass areas (GCC-RB-1, GCC-SWM-1, GCC-SWM-2) **Parameters:** Records of safety training or awareness meetings, Number of accidents and their details etc.	City Corporation Quarterly
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** The subproject site office (GCC-SWM-1, GCC-SWM-2, NCC-SWM-1, NCC-SWM-2, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Records of safety training and relevant meetings, Number of labor accidents and their details, Number of diseases among workers and their details	City Corporation Quarterly

Contractors will bear the direct costs of all mitigation measures during construction, which will be included in the tender and contract documents; this includes features built into facility designs to prevent environmental impacts from arising.

Implementing Agencies and contractors will receive training in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation and use of the GRM, occupational and community health and safety, and other environmental management topics.

STAKEHOLDER ENGAGEMENT

As an integral part of the environmental and social assessment process, public consultation meetings were held in each ULB. The broader objective of stakeholders' participation is to strengthen the bonding between local communities and the project implementation authorities to make a better and sustainable project in the working areas.

A two-way communication strategy was used at the consultation meeting. The conversation was mostly based on questions and answers, with ULBs, participants, responses provided by LGED, and consultants from the DSM part of LGED. Mainly 3 steps were followed before commencing the consultation meeting at ULBs.

Table 4: Steps for consultation meetings

Steps heading	Procedures
Notification (Paper Circular)	▪ A notification was published in two local newspapers such as Dainik Khaborer Pata on 11 December 2023 and Dainik Juger Chinta, on December 11, 2023, before commencement of PCM at NCC. ▪ Meeting notice was published in two local newspapers such as Dainik Ajker Janata on 22 January 2024 and Dainik Mukta Balaka, on 24 January 2024 following the EIA guideline for Industry, 2021 of Department of Environment before 07 days of the consultation. ▪ Meeting notice for PCM-1 of CBP was published in two local newspapers such as Dainik Cox's Bazar on 06th December 2023 and Dainik Ruposhi Gram on the same date following the DOE EIA Guideline 2021. The circular was published 12 days (about 1 week 5 days) before the Public Consultation Meeting-1 which was held on December 18, 2023. ▪ However, PCM-1 notice was published in Daily Ruposhi Bangla, and Dainik Shironam, on 8th February 2024, the most popular local newspaper of Cumilla City Corporation. The notice was published 15 days (about 2 weeks) before the meeting.
Invitation	A formal invitation was sent to the participants, interested groups, and project affected peoples (PAPs) etc.
Participation	It means participation by interested groups, affected community people to give their concern/opinions on the proposed project activities, improve the situations, with and without project alternatives, facilitate implementation and improve compliance, consensus, and others etc.

The general Information of public consultation meeting is given in the table below.

Table 5: Primary Information of Public Consultation Meeting and Participants

Sl. No.	Venue	Date	No. of participants	Remarks
1	Afridi Convention Hall, Iktieruddin Mohammad Baktier Khilji Road, Ward no. 18, NCC.	December 14, 2023	66	Local DOE, DAE, FD, DoF, BWDB, Red Cresent, DoL, DPHE, and BIWTA, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc. PAPs, etc.
2	City Corporation Regional Office, Gacha, Gazipur, GCC.	January 31, 2024.	120	Local DAE, DoF, BFD, DOE, DoL, BRAC, SNV Netherlands, DUET, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc. PAPs etc.
3	Cumilla City Corporation (CuCC) meeting Room at CuCC.	February 13, 2024	65	Local DOE, DAE, FD, DoF, BWDB, Red Red Cresent, DoL, DPHE, community people (schoolteachers, Mosque Imam, social leaders, women leaders) and PAPs, etc.
4	Cox's Bazar Paurhashova meeting room, CBP	December 18, 2023.	53	Local DOE, DAE, FD, DoF, BWDB, Red Red Cresent, DoL, DPHE, IUCN, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc.

Note: DOE- Department of Environment, DAE- Department of Agricultural Extension, DoF- Department of Fisheries, BFD- Bangladesh Forest Department, DoL- Department of Livestock, DPHE- Department of Public Health Engineering, BIWTA- Bangladesh Inland Water Transport Authority, IUCN- International Union for Conservation of Nature, PAP- Project Affected People.

Focus group discussions (FGDs) were also held with local people in GCC, NCC, CuCC, and CBP from 2023 to 2024 regarding the project activities. The list of FGDs is given below:

Table 6: List of FGDs held at the project working areas

Sl. No	FGD location	Name of ULB	Date	No. of participants
1	Ward no. 11	CBP	30.07.2023	08
2	Ward no. 10	CBP	30.07.2023	07
3	SM Para, landfill site	CBP	05.01. 2024	08
4	Ward 21	CuCC	25.07.2023	08
5	Jhakuni para, landfill site	CuCC	25.07.2023	08
6	Medical College Road	CuCC	26.07.2023	08
7	Ward No – 18	NCC	02.08.2023	08 with 03 female participants
8	Alamin nagar landfill site	NCC	02.08.2023	08
9	Najor-Kashimpur	GCC	19.07.2023	18 with 5 female participants
10	Konabari, Notun Bazar	GCC	19.07.2023	10

PUBLIC DISCLOSURE

During the initial public consultations for EIA survey, project information was shared verbally. Continuous engagement with local communities will be essential to keep them informed and supportive, especially before and during the construction phase. Regular meetings will be held to update the community and provide information on the grievance redress mechanism. For the EIA preparation, mixed methods were used for information disclosure, including key informant interviews, focus group discussions, and public consultation meetings, tailored to the stakeholders involved. The EIA report or its summary will be disclosed on the LGED and DOE websites, and face-to-face meetings and physical copies of the report, available in English and Bengali, will be provided to ensure accessibility. The summarized reports will outline the project impacts, mitigation measures, grievance redress mechanisms, and the institutional framework for implementation.

GRIEVANCE REDRESS MECHANISM

UDCGP will implement a Grievance Redress Mechanism (GRM) to address concerns from both affected communities and construction workers during planning and construction. The GRM aims to provide an accessible, transparent, and culturally appropriate process, ensuring timely responses to grievances.

For **Community Grievances**, the GRM is structured in three levels:

- **Level 1**: A site manager or resident engineer records grievances at the project site, aiming to resolve them within seven days through investigation and consultations.
- **Level 2**: If unresolved, grievances escalate to a Local Grievance Redress Committee (LGRC), which includes local representatives and NGO members. The LGRC attempts resolution through mediation within 15 days.
- **Level 3**: Remaining issues are handled by a central-level committee led by the project director, who seeks consensus or decides by vote. If unresolved at this stage, cases may proceed to legal arbitration.

The executive engineer at Level 2 is responsible for public awareness campaigns, making contact information readily available and keeping the GRM operational throughout construction and the defects period. All grievances and resolutions will be documented and reported quarterly to JICA.

For **Worker Grievances**, a separate GRM allows construction workers to report concerns related to work conditions, health and safety, or rights violations. Workers can submit complaints to on-site personnel, who forward them to the PMU. The PMU will organize a conference call with the contractor, relevant staff, and labor representatives to resolve issues, monitored by the Environmental Safeguards Focal Person and the on-site Environment, Health, and Safety Officer to ensure fairness and prevent retaliation. Unresolved worker grievances can be escalated through the community GRM levels, with legal recourse if necessary.

Overall, both mechanisms are designed to address grievances fairly, transparently, and cost-effectively, with records maintained in a central database for monitoring and reporting.

CONCLUSION

The subprojects of UDCGP classified as a Red Category under ECR 2023 are solid waste management improvements at the ULB level, conversion of open dumps to semi-aerobic sites, new landfill construction, a railway overpass at Joydebpur, and canal re-excavation. Some of them require land acquisition, which will comply with ARIPA 2017 standards. Anticipated construction impacts include air quality deterioration, noise, limited water contamination, soil pollution, ecosystem disruption, health and safety risks, and potential social issues like economic disruption and increased local traffic. Most impacts are low-magnitude, temporary, and reversible.

The Environmental Management Plan (EMP) proposes measures to mitigate these impacts, including dust control, water protection, economic support for affected people, and continuous stakeholder engagement. During operation, leachate management at landfill sites will adhere to Solid Waste Management Rules (SWM) 2021, with ongoing monitoring of water quality and gas emissions.

Monthly monitoring of air, noise, water, and soil quality will occur during construction, transitioning to quarterly checks during the initial operational phase. Capacity-building efforts, including training and workshops for workers and stakeholders, are planned. Compensation budgets and quarterly and annual environmental audits, both internal and external, are included to ensure compliance with EMP and EMoP standards, with corrective action plans (CAPs) as needed.

2.0 General Information

2.1 Project proponent

The Executing Agency at central level is the Local Government Engineering Department (LGED) where the Project Management Unit (PMU) has been established.

Implementing Agencies of the Project are: Gazipur City Corporation (GCC), Narayanganj City Corporation (NCC), Cumilla City Corporation (CuCC) and Cox's Bazar Paurashava (CBP) at which the Project Implementation Units (PIUs) have been formed. Operation and maintenance of all infrastructure under the Project will be done by 4ULBs. It is expected that the O&M system of the infrastructure in ULBs will be addressed through implementation of the capacity development component of the Project.

General information on project proponent has given below:

Table 2-1: General Information on Project proponent

Headline	General information
Name & address of Project Proponent:	Md. Golam Mostofa, Project Director, Urban Development and City Governance Project RDEC Bhaban, LGED, Level 8, Agargaoan, Dhaka Cell Phone: 01712008716, E-mail: pd.udcgp@lged.gov.bd
Contact person for further communication.	Md. Abdur Rouf Deputy-Project Director-1. Urban Development and City Governance Project RDEC Bhaban, LGED, Level 8, Agargaoan, Dhaka Cell Phone:01711520738, E-mail: rouf2007@yahoo.com
Consultant Information:	Raymund Garcia Go, Team Leader, Design and Supervision Consultant Urban Development and City Governance Project RDEC Bhaban, LGED, Level-8, Agargaoan, Dhaka E-mail: Raymundggo@gmail.com Cell Phone: 01749509047

A muti disciplinary team was engaged to prepare the Environmental Impact Assessment (EIA) study. The information of experts has given below:

Table 2-2: List of experts associated with EIA preparation

Name of the expert(s)	Educational qualification	Professional Experiences	Areas of expertise(s)
Junko Kuwabara	B. Human Sc. in Urban Sociology in 1993, and M.Eng. in Built Environment in 2000	26 years	Environmental Expert (International)
Md. Kamrul Hasan Bhuiyan	B.Sc. (Hons), M.Sc. in Geology in 2003; and M.Sc. in Environmental Science and Management in 2021.	19 years	Environmental Expert (National).
Satoshi Higasinkhagawa	M.A in Waste Management	26 years	Solid Waste Management Expert (International)
Dr. Tariq Bin Yousuf	PhD in Solid Waste Management		Solid Waste Management (National)

Hirofumi Miyoshi	M.A in Waste Management Facilities	26 years	Landfill Expert (International)
A.H.M Abdulla Harun	M.Sc. in Environmental Science, and B.Sc. in Civil Engineering	33 years	Landfill Expert (National)

In addition, a third-party consultant team was engaged to collect baseline data from the project areas, engaging a multi-disciplinary team of data enumerators, biodiversity experts, and socioeconomic experts etc.

2.2 Structure of the report

The structure of the EIA report is briefly described below:

Chapter 1: Executive Summary	It describes summary of the project background, project description, baseline, impact evaluation, mitigation measures, monitoring plan, GRM system & Institutional arrangement and recommendations for strengthening the environmental management in the field level etc.
Chapter 2: General Information	It outlines the project proponent's primary information and communication matrix to take further communication with the PMU and others (e.g., DOE).
Chapter 3: Project Descriptions	It describes the project objectives, background, basic descriptions of subprojects, alternative analysis of alignment and technology for development of proposed subprojects, subproject wise budget and other relevant information and data as required.
Chapter 4: Environmental Baseline Conditions	It solely describes the environmental and social baseline conditions of the subproject areas, mainly physical environment, biological environment and socio-economic conditions. In addition, environmental quality parameters like air, noise and vibration, water quality, soil quality etc. Were also described in this chapter.
Chapter 5: Impact Prediction and Evaluations	This chapter outlines the overall impacts, impacts identification process, quantification, magnitude, extent and severity of impacts etc.
Chapter 6: Environmental Mitigations Measures	Under the environmental mitigation measures, mainly described the potential remedial actions for each identified impact etc.
Chapter 7: Environmental Management Plan	In this chapter focused on requirements of national rules and regulations, DOE clearance procedures, Environmental management plan based on impacts and mitigation measures suggested in chapter 5, and chapter 6, and implementation agencies roles and responsibilities. Under Environmental Monitoring Plan, mainly discussed about the monitoring parameters and frequency of monitoring and budgets to implement the environmental management plan in the field level.
Chapter 8: Stakeholder Engagement Plan	In this chapter mainly described the process of stakeholder engagement, consultation summary, and suggestions provided by the participants.
Chapter 9: Grievance Redress Mechanism	Grievance redressal procedures, establishment of GRC committee, and functioning the committees both at field level and project level etc. In addition, institutional set up also discussed in this chapter to enforcing the EMP implementation and GRM system at the field level etc.
Chapter 10: Conclusion and Recommendations	Finally, concluding the overall findings, and recommendations for execution of EMP at field level etc.

3.0 Project Description

3.1 Project Need

Bangladesh has been in rapid urbanization during the last few decades brought about by its population growth, migration of rural population to urban areas, and the expansion of urban areas. A study on population projection of Bangladesh from 2011 to 2061 presents that urban population will have a drastic growth while the rural population growth will start to lessen from 2036-41. While the 2022 census is slightly lower than the projected population, the current percentage of urban population is already higher than the estimates. Such rapid urbanization demands urban governments to timely deliver quality services to its citizens more than ever. The current urban governance in Bangladesh, however, has yet to meet these urgent and increasing demands. Consequently, infrastructure development remains behind the above-mentioned rapid urbanization amidst the growing traffic congestion, insufficient and unreliable water supply, inadequate sanitation and waste management, and drainage problems.

To mitigate such poor situations, the Government of Bangladesh (GOB) emphasized the importance of empowering the local government to play a more prominent role in local development in the 6th Five-Year Plan 2011-2015 (6FYP), 7th Five-Year Plan 2016–- 2020 (7FYP), and the latest 8th Five-Year Plan 2020-2025 (8FYP). Despite progress from the 7FYP, the 8FYP highlights several challenges faced by the Local Government Institutions (LGIs) to ensuring good governance and delivery of desired services to the people which includes: (i) unclear functions and responsibilities of LGIs, (ii) revenue discretion of LGIs and dependency on the central government, (iii) shortage of staffing, (iv) non-participation and weak accountability, (v) inadequate devolution of power for service delivery, and (vi) weak resource mobilization effort.

In this regard, the Government of Bangladesh, and the Japan International Cooperation Agency (JICA) signed a loan agreement for the Urban Development and City Governance Project (UDCGP) (hereinafter called “the Project”) on August 12, 2020, following which the GOB approved its DPP in August 2022. This project will contribute to the achievement of SDGs Goal 11: make cities inclusive, safe, resilient, and sustainable.

3.1.1 Project Objectives

The project objective is to improve urban functions by strengthening city governance related to infrastructure development in the target cities, thereby contributing to economic growth and improvement of living conditions toward sustainable cities. The Project targets four Urban Local Bodies (ULBs): Gazipur City Corporation (GCC), Narayanganj City Corporation (NCC), Cumilla City Corporation (CuCC) and Cox’s Bazar Paurashava (CBP). Specifically, the project intends to strengthen ULBs in terms of infrastructure development and the services it provides through capacity building. The project envisions that, eventually, engineers stationed at each ULBs should be able to plan in an appropriate manner and construct appropriately.

3.1.2 Specific Objectives

a. Construction of Railway Overpass in Gazipur

The benefits of the Construction of Railway Overpass project will be as follows:

- Address congestion and delays at the pinch point of the existing narrow crossing and the absence of above-grade crossings in GCC.

- Address severance issues in the center of CC caused by the railway line by providing better east-west connectivity.
- Improve accessibility for the people of GCC between the east and west parts of the city, particularly in opening access to key government, hospital and educational facilities located in the central area but east of the railway line.
- Address safety concerns of using Bazar Road (commercial district) as main road.
- Facilitate population and economic growth in and around Jadavpur, especially to the east and southeast of the railway line.
- Improve traffic distribution, network efficiency and safety.
- Allow better public transport services to serve the area, including unlocked bus routes and including potential future feeder bus services to the BRT terminal or even a future extension of the BRT.
- Form part of integrated, long term strategic and local transport and land use planning in providing additional transport infrastructure in an area of the city that will undergo considerable urban growth in the next decades.

b. Solid waste Management and Landfill sites development in GCC, NCC, CuCC and CBP

The subprojects in 04 ULBs include equipment procurement for solid waste management, improvement and expansion of existing landfill site, and development of new landfill site.

Solid waste management:

- Improve efficiency of collection
- Manage Toxic waste from Hospitals, clinic, and industry
- Recycle Solid Waste
- Increase the role of NGOs/social groups for household waste collection
- Treat industrial liquid wastes before disposal
- Introduce management of dumping /sanitary landfill

Improvement and expansion of existing landfill site

- Transfer existing open dumping site to Level 3 sanitary landfill
- Install separate rainwater drainage system and leachate collection system
- Prepare side slope with adequate compaction
- Install leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes
- Construct upward temporary roads and platform for optimum use of land for long time
- Water supply and car washing facility
- Environmental monitoring system (leachate, air and groundwater)

New Landfill site development:

- Separate rainwater drainage system and leachate collection system
- Prepare side slope with adequate compaction, soil covering
- Installing leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipe
- Construct upward temporary roads and platform for optimum use of land for long time
- Construction of Leachate Treatment Plant
- Water supply and car washing facility

- Environmental monitoring system (leachate, air and groundwater)
- Install artificial liner

c. Infrastructure Facilities: Drainage (Canal Re-excavation) in CuCC

- Improve storm water drainage & sewerage system for all areas in the city and
- identify the existing natural and man-made drains in the city and i
- Investigating the mechanisms of the drainage.

3.1.3 Benefits of the project

a. GCC-RB-1: Construction of Railway Overpass in Gazipur

The development effects of this project could be far-reaching, with potential benefits that includes:

- **Strengthened road network:** The road will strengthen the local road network of Gazipur City by providing a better connection between the different parts of the city. This will make it easier for people to get around the city, which will benefit both locals and businesses. It will strengthen road network of GCC's by joining both side of the level crossing inside the Zone 4 of Gazipur City
- **Reduced traffic congestion:** The road will also help to reduce traffic congestion in the city by providing an alternative route for vehicles. This is because the overpass will divert some of the traffic from the main road network and enable vehicles to cross the railway uninterruptedly.
- **Business:** The project will also boost business in the area by improving transportation links and making it easier for businesses to reach customers. This will be particularly beneficial for businesses industry with also impacting the education and medical sector.

  Overall, the implementation of the project title " Construction of Railway Overpass at Gazipur" will have several positive development effects. These effects will include improved connectivity, and accessibility, enhanced business, improved drainage and strengthened road network.

b. GCC-SWM-1 & GCC-SWM-2: Improvement of collection and transportation system in Gazipur

- The estimated beneficiary population is approximately 300,000 (as of 2022) and coverage area is Zone 4 under GCC-SWM-1, and Zone 1 and Zone3 under GCC-SWM-2.
- Waste collection rate is expected to be 70 % by 2030, final disposed rate 67 % and recycle and recovery rate 4 %.

c. NCC-SWM-1 & NCC-SWM-2: Construction of new landfill sites for solid waste management

- It is estimated that around 1,421,000 (including migrating population) people will be benefited for development of this landfill site covering Ward No.1 – Ward No. 18 in NCC.
- Waste collection rate is expected to be 56 % by 2030, final disposed rate 33 % and recycle and recovery rate 24 %.

e. CuCC-D-4: Re-excavation of existing (2) Racecourse and Gungaijuri canals

- In the current scenario, approximately 6000 peoples will be benefitted by the excavation and functioning works. The existing poor drainage has been causing distress to around 1000 households, subjecting them to inundation. Moreover, a cropping area of 200 acres is currently affected due to the inadequate drainage.
- Looking into the future, with the successful execution of the drainage project, the number of beneficiaries is expected to increase to 10,000 people. Furthermore, the number of households suffering from inundation will be reduced to zero, signifying a significant improvement in the living conditions of the affected residents. The affected area's vulnerability to poor drainage will also be eliminated, bringing relief to the Residential and Commercial sector.

f. CuCC-SWM-1: Improvement of collection, transportation, and landfill site for solid waste management in Jakuni Para

- 1,341,200 (including migrating population) will be benefited within the Cumilla City Corporation (CuCC)
- Waste collection rate is expected to be 70 % by 2030, final disposed rate 67 % and recycle and recovery rate 4 %.

g. CBP-SWM-1 & CBP-SWM-2: Improvement of central solid waste management situation and development of new sanitary landfill site in SM para

- A total of 2,66,000 (including migrating population) people will be directly benefited.
- Waste collection rate is expected to be 80 % by 2030, final disposed rate 70 % and recycle and recovery rate 8 %.

3.2 Project location/Areas

3.2.1 Locations of the project areas

The project has 09 subprojects in 4 ULBs of GCC, NCC, CuCC and CBP, mainly solid waste management in all 4 ULBs, flyover construction in GCC, and Canal Re-excavation in CuCC. The details depicted in Table 3-1.

Table 3-1: Subproject locations

Sl. #	# Code	Name of subprojects	Quantity	Locations
Gazipur City Corporation (GCC)				
1	GCC-RB-1	Construction of Railway Overpass in Gazipur	630 m	Joydebpur Rail Crossing
2	GCC-SWM-1	Construction of new landfill site in Gazipur for solid waste management.	3.90 ha	Gacha, GCC
3	GCC-SWM-2	Improvement of collection and transportation system in Gazipur.	1 no.	Overall GCC areas
Narayanganj City Corporation (NCC)				
4	NCC-SWM-1	Construction of new landfill site in Julkuri (phase I) for solid waste management.	Landfill area: 4.4 ha	Julkhuri
5	NCC-SWM-2	Construction of new landfill site in Julkuri (phase II) for solid waste management.	Landfill area: 1.7 ha	Al-Amin Nagar

Sl. #	# Code	Name of subprojects	Quantity	Locations
Cumilla City Corporation (CuCC)				
6	CuCC-SWM-1	Improvement of collection, transportation, and landfill site for solid waste management	Landfill area: 0.83 ha	Jhakuni Para
7	CuCC-D-4	Re-excavation of existing (2) Racecourse and Gungaijuri canals	Excavation of canal: 1,600 m, W 10 m Excavation of canal: 6,300 m, W 15 m	Racecourse and Gungaijuri
Cox's Bazar Pauroshava (CBP)				
8	CBP-SWM-1	Improvement of central solid waste management situation in Cox's Bazar (collection vehicle and heavy equipment procurement and closure of existing open dumping site in central market).	1 no.	Overall CBP areas
9	CBP-SWM-2	Development of sanitary landfill site in SM para	5.67 ha	

Source: LGED

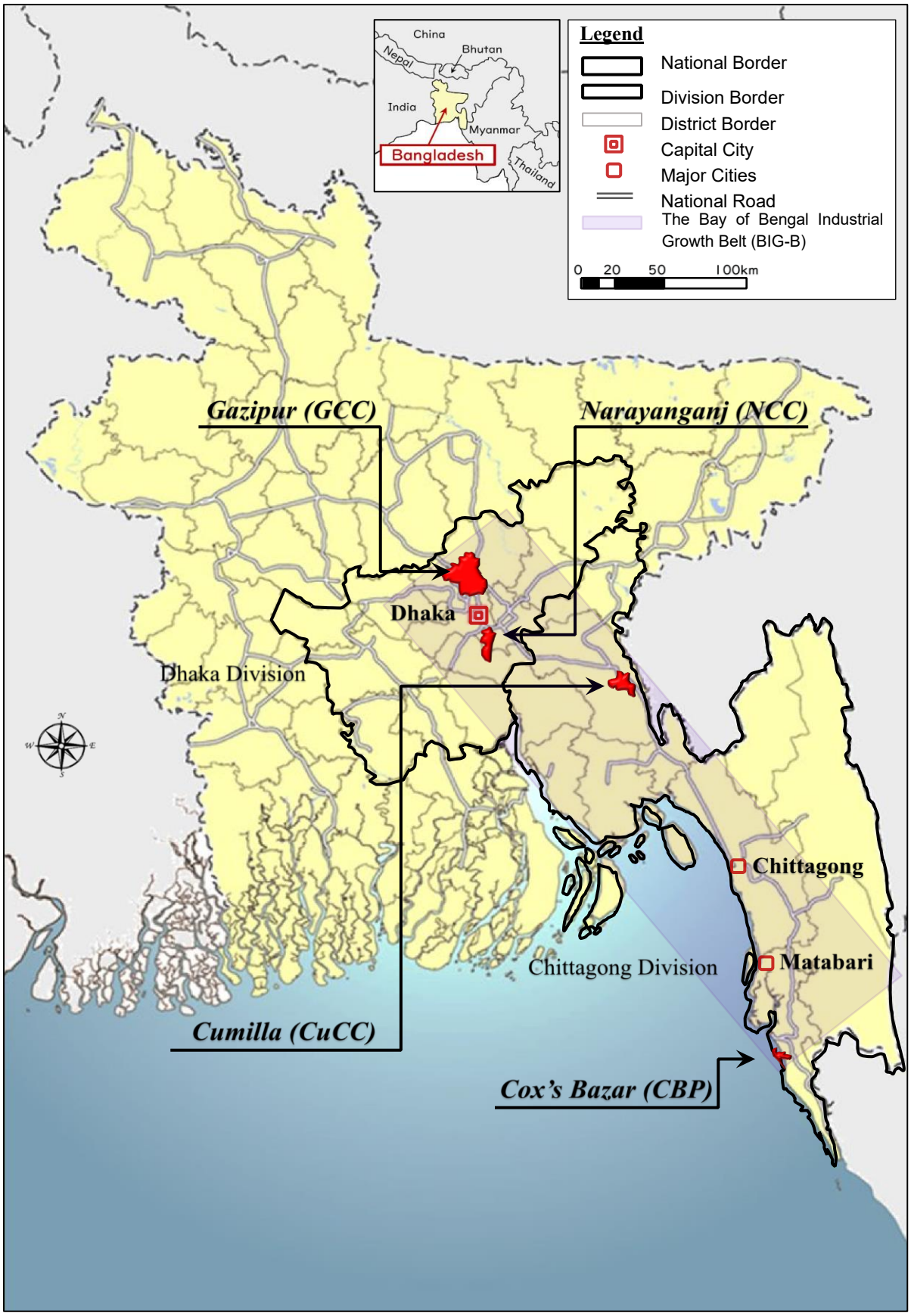


Figure 3-1: Location Map of the Project Areas

3.3 Project Description

3.3.1 GCC-RB-1: Construction of Railway Overpass in Gazipur, Joydebpur Rail crossing

3.3.1.1 Introduction

Joydebpur is an important administrative area of Gazipur City and remains as an important commercial hub. The city center, however, is split into half by the main Dhaka-Mymensingh-Bangabandu Bridge railway line which cross the Joydebpur Road. The main commercial street of Joydebpur, which runs in a roughly east-west direction through the city, passes over the railway line just to the north of the station on a level crossing. Within the area also is the GCC Compound – and the Joydebpur Junction Railway Station and railway crossing is just a few meters north-west of the City Corporation.

The Joydebpur crossing is a highly congested intersection, with an average daily traffic volume of 13,000 pcu in 2019 and a projected total of 23,700 by 2028 (source: GCC). As a result of increased traffic congestion at the railway crossing caused by more trains and motorized vehicles, pedestrians, rickshaws, buses, lorries, CNG three wheelers, and so on. To begin with, whenever a train goes through a level crossing gate, a road barrier is placed there. The train's frequent crossings (60-70 per day) produce significant automobile traffic and congestion in the GCC.

3.3.1.2 Surrounding features

- The railway overpass connecting the east and west side of the Joydebpur road overpassing the railway line near the Joydebpur Station.
- The construction of the Bus Rapid Transit already reached the west side near the Joydebpur crossing – but has taken up the center portion of the Joydebpur road.
- Shimultoly Road, on the other hand, which connects perpendicular to Joydebpur road, has already been widened and further increase in traffic flow in expected in the area.
- On the around of the project sites, there are some business/commercial, education, hospital, and religious zones coupled by the presence of rail station, the City Corporation, and the Bangladesh Rice Research Institute.

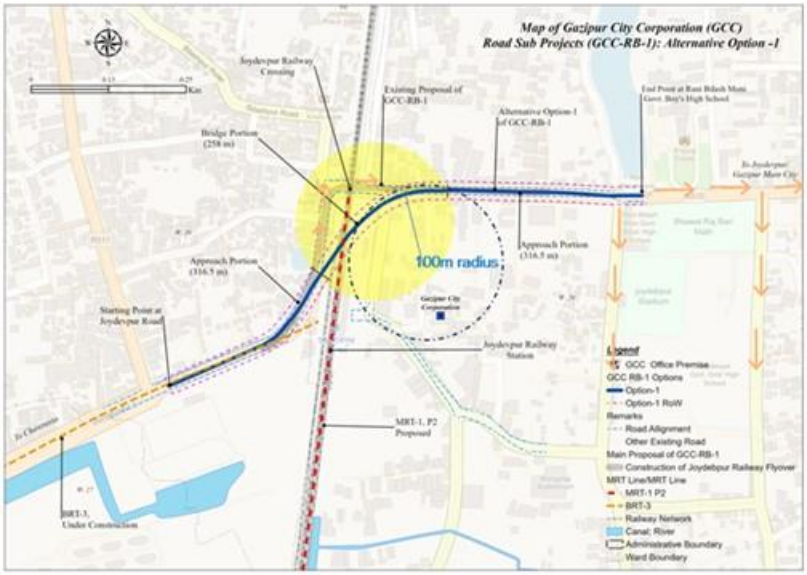
Figure 3-2: Present traffic volume in the rail-crossing of Jadavpur

3.3.1.3 Project Alternative Analysis

In collaboration with GCC, four (4) alternative alignments/schemes were considered, and a quick assessment on each of scheme was made based on the following parameters:

- flow of traffic and traffic implications after completion,
- design features,
- estimated impact (land acquisition needed and structures/people affected), and
- traffic congestion implications during construction,

a. Alternative Alignment 1



FLOW OF TRAFFIC

- Chowrasta-Joydebpur Rd

TRAFFIC IMPLICATION

- Reduce traffic build up at level crossing.

DESIGN FEAURES

- Around 100m radius curvature
- 258m Bridge + 316m approach (both sides)

ESTIMATED IMPACT

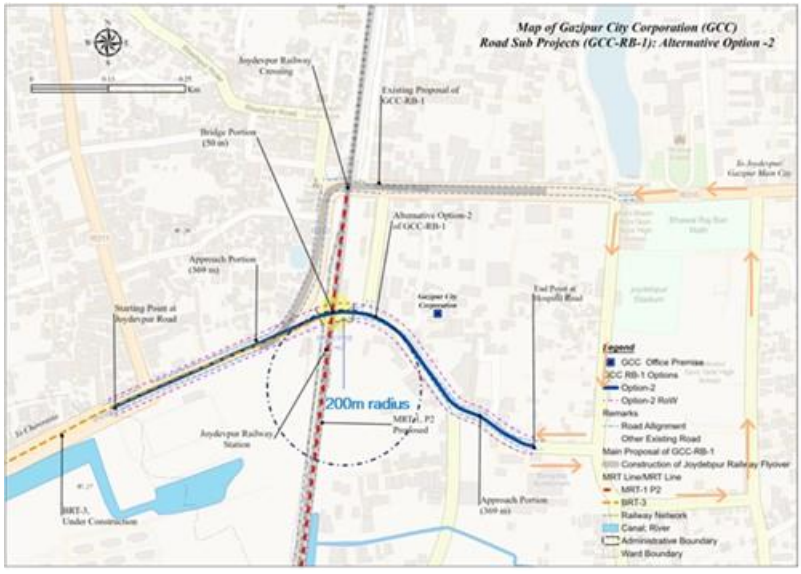
- ~0.93ha Land acquisition
- ~58 structures affected

TRAFFIC DURING CONSTRUCTION

- Traffic congestion will intensify during construction.

Figure 3-3: Alternative alignment 1

b. Alternative Alignment 2



FLOW OF TRAFFIC

- Chowrasta- Hospital Rd

REMARKS

- Increase traffic build up at hospital and adjacent Rd
- Vehicles need to use adjacent Rd to get to Joydebpur Rd.

DESIGN FEAURES

- Around 200m radius curvature
- 50 m Bridge + 369m approach (both sides)

ESTIMATED IMPACT

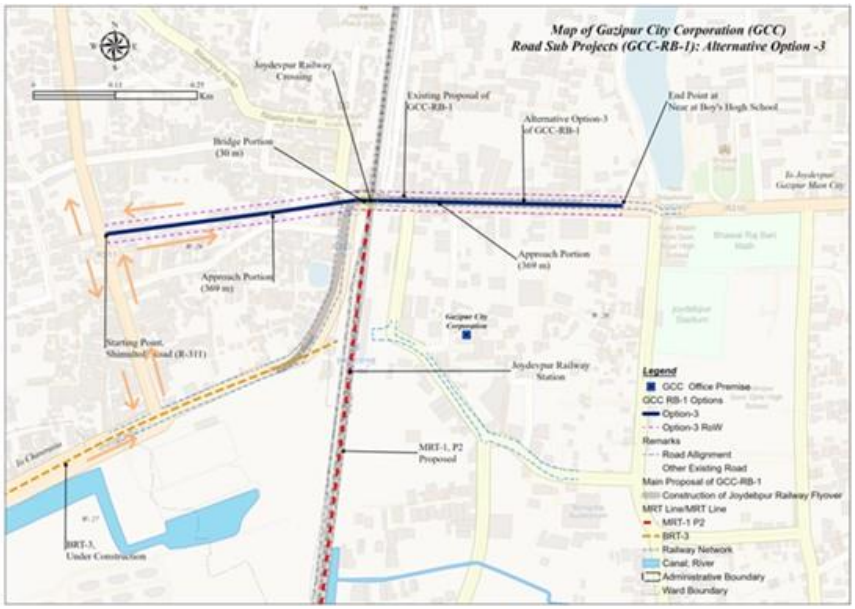
- ~1.18ha Land acquisition
- ~55 structures affected

TRAFFIC DURING CONSTRUCTION

- Traffic congestion will increase once construction at the left side of the railway commences.

Figure 3-4: Alternative alignment 2

c. Alternative Alignment-3



FLOW OF TRAFFIC

- Shimultoly-Joydebpur Rd

REMARKS

- Traffic build up at Shimultoly Rd.
- Reduce traffic congestion at level crossing at Joydebpur Rd.

DESIGN FEAURES

- 30m Bridge + 369m approach (both sides)

ESTIMATED IMPACT

- ~1.7ha Land acquisition
- ~68 structures affected

TRAFFIC DURING CONSTRUCTION

- Traffic congestion will increase once construction at the right side of the railway commences.

Figure 3-5: Alternative alignment-3

d. Alternative Alignment 4

FLOW OF TRAFFIC

- Shipbari more- Rothkhola cattle market

REMARKS

- Traffic build up at rotkhola sadar and adjacent roads.
- Reduce traffic congestion at level crossing at Joydebpur Rd.

DESIGN FEAURES

- 50m Bridge + 400 and 400m approach (both sides)

ESTIMATED IMPACT

- ~1.0-1.5 ha Land acquisition
- ~23structures affected

TRAFFIC DURING CONSTRUCTION

- Traffic congestion may slightly increase during construction of approach at left side of railway.

Figure 3-6: Alternative alignment-4

e. Preferred Alignment

The discussion with GCC, and other stakeholders, it was assessed the alternative alignments on multiple criteria concluded that the 4th alternative alignment is more feasible.

				
► **Flow of traffic**	► Chowrasta-Joydebpur Rd.	► Chowrasta-Hospital Rd.	► Shimultoly-Joydebpur Rd.	► Shibbari mor-Rothkhola Cattle Market
► **Traffic Implication**	► Reduce traffic build up at level crossing	► Increase traffic build up at hospital and adjacent Rd. Vehicles need to use adjacent Rd to Joydebpur Rd.	► Traffic builds up at Shimultoly Rd. Reduce traffic congestion at level crossing at Joydebpur Rd.	► Traffic builds up at Rothkhola Sadar and adjacent roads. Reduce traffic congestion at level crossing at Joydebpur Rd.
► **Design features**	► Around 100m radius curvature, ► 258m bridge +316m approach (both sides)	► Around 200m radius curvature. ► 50m bridge + 369m approach (both sides)	► 30m bridge+369m approach (both sides)	► 30m bridge+400m approach (both sides)
► **Estimated Impacts**	► 0.93-ha land acquisition will require. ► 58 structures will be affected. ► 200 people will be affected.	► 1.18-ha land acquisition will require. ► 55 structures will be affected. ► 200 people will be affected.	► 1.7-ha land acquisition will require. ► 68 structures will be affected. ► 200 people will be affected.	► 1.0-1.5 ha land acquisition will be required. ► 23 structures will be affected. ► 50 people one will be affected.
► **Traffic during construction**	► Traffic congestion will intensify during construction.	► Traffic congestion will increase once construction at the left side of the railway commences.	► Traffic congestion will increase once construction at the right side of the railway commences.	► Traffic congestion may increase at the approach at left side of railway during construction.

Figure 3-7: Alternative Analysis of Project Options for Flyover (Railway crossing) at Joydebpur, Gazipur City Corporation

f. Justification of Preferred Alignment

The preferred alignment, which was suggested by GCC, commences at the Joydebpur Road, passes over a section of BRRI and Railway, and concludes at the Rothkhola Hospital Road. This alignment requires careful design of the overpass due to the following:

- The west approach along Joydebpur Road need to take into consideration the newly constructed BRT line which is right in the middle of the Joydebpur Road.
- Inclusion of u-loop (U-turn) at Joydebpur Road before the west approach (to enable vehicles from Shimultoly Road to enter the overpass).
- The east approach is along the Hospital Road and ends perpendicular to Rathkhola Sadar Hospital Road. As such, alignment of Hospital Road needs to be adjusted for the needed approach while minimize the need for acquiring land and affecting peoples/structures.
- Further, intersection at Rathkhola Sadar Hospital Road needs to be carefully studied given that currently it is already a 3-way road junction of 2-lane carriageway roads. The introduction of the overpass with high traffic volume in this intersection will later cause traffic congest in the area. As such, Rathkhola Sadar Hospital Road needs to be improved (i.e., road widening). Making Rathkhola Sadar Hospital Road a one-way road may also mitigate the potential traffic congestion in the area.

3.3.1.4 Project Activities

This subproject was considered to solve the major traffic congestion in that area as it is one of the busiest points in Gazipur city. The subproject area is approximately 400 meters from the Gazipur City Corporation office. Initial alignment of the subproject area done during the Preparatory Study is shown in the below figure 2-1. The subproject details are given below:

- A 4-lane carriageway is required to serve the estimated average daily traffic volume.
- Road geometries shall be designed following local standards – and where there is none, international standards – as well as best industry practices for urban areas (i.e., design speed at 40-60km/h, vertical grade at 3.00%, K value at 20).
- Vertical clearance is initially assumed at 8.58m (data taken from preparatory survey for Chattogram - Cox's Bazar Highway Improvement Project).
- The elevation of the overpass is estimated to be around 11.10 meters above railway track (to cover for the girder height, bridge slab, pavement, etc.).
- 30 m 4-lanes bridge
- 300 m 4-lanes approach on each side
- Other road features to facilitate the flow of traffic (i.e., u-loop along Joydebpur road, T-junction/roundabout at Joydebpur Road and Shimultoly Road intersection, T-junction/roundabout at Rothkhola Sadar Hospital Road intersection).

3.3.1.5 Development Effects

The development effects of this project could be far-reaching, with potential benefits that includes:

- **Strengthened road network:** The road will strengthen the local road network of Gazipur City by providing a better connection between the different parts of the city. This will make it easier for people to get around the city, which will benefit both locals and businesses. It will strengthen road network of GCC's by joining both side of the level crossing inside the Zone 4 of Gazipur City

- **Reduced traffic congestion:** The road will also help to reduce traffic congestion in the city by providing an alternative route for vehicles. This is because the overpass will divert some of the traffic from the main road network and enable vehicles to cross the railway uninterruptedly.
- **Business:** The project will also boost business in the area by improving transportation links and making it easier for businesses to reach customers. This will be particularly beneficial for businesses industry with also impacting the education and medical sector.

Figure 3-8: Conceptual design of flyover at Jadavpur rail crossing

3.3.1.6 Implementation Schedule

	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Apr-May 2023
	Engineering and Technical Survey	Oct 2023-Oct 2024
	DP Preparation, Presentation, and Approval	Sep-Dec 2023
2	Detailed Engineering Design (including cost estimates, technical specifications, and tender documents)	Sep 2024 – Feb 2025
3	Subproject Tender	May 2025
4	Road Construction and Site Development	Aug 2025 – Dec 2027
5	O&M (setting up and training)	July - Dec 2027

3.3.1.7 Project Effectiveness

The main objectives of the Construction of Railway Overpass project will be as follows - To address congestion and delays at the pinch point of the existing narrow crossing and the absence of above-grade crossings in GCC. To address severance issues in the center of CC caused by the railway line by providing better east-west connectivity.

- To improve accessibility for the people of GCC between the east and west parts of the city, particularly in opening access to key government, hospital and educational facilities located in the central area but east of the railway line.
- To address safety concerns of using Bazar Road (commercial district) as main road.
- To facilitate population and economic growth in and around Joydebpur, especially to the east and southeast of the railway line. To improve traffic distribution, network efficiency and safety. To allow better public transport services to serve the area including unlock bus routes and including potential future feeder bus services to the BRT terminal or even a future extension of the BRT.
- To form part of integrated, long term strategic and local transport and land use planning in providing additional transport infrastructure in an area of the city that will undergo considerable urban growth in the next decades.

3.3.2 GCC-SWM-1: Construction of new landfill site in Gazipur for solid waste management

3.3.2.1 Background of the Subproject

Gazipur City Corporation, located in the Dhaka Division of Bangladesh, is the governing body responsible for managing and governing the city of Gazipur. As a crucial administrative entity, it plays a pivotal role in providing essential services and maintaining the city's infrastructure and public amenities. The corporation is entrusted with various responsibilities, including waste management, road maintenance, urban planning, and development projects, aimed at enhancing the living standards of its residents.

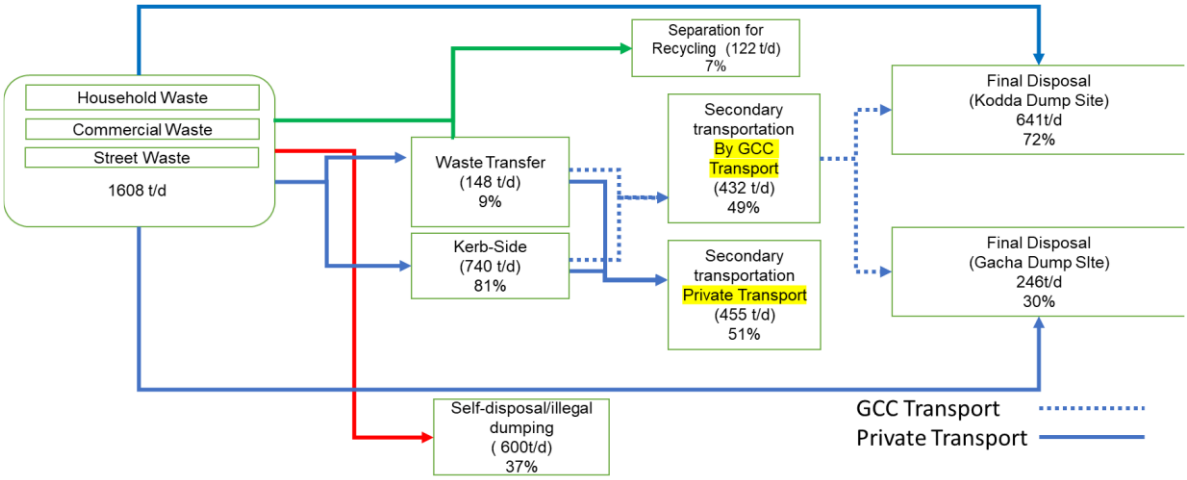
Solid Waste Management is one of the mandated responsibilities of the City Corporations in accordance with the Local Government (City Corporations) Act 2009, which is endorsed by the Solid Waste Management Rules 2021. Aside from the waste separated for recycling by the informal sector, currently, GCC is dumping their collected waste in two open dumping sites: Kodda and Gassa.

3.3.2.2 Current waste management status

Solid waste generation in GCC is estimated at 1,164 tons of household waste, 208 tons of commercial waste, and 111 tons of street waste.

Source of Solid Waste	Estimated Daily Solid Waste in GCC (2023)
Household	1,164 ton
Commercial (kitchen market, restaurant, hotel, community center, office, shop)	208 ton
Street (from sweeping)	111 ton
Industrial Waste	125 ton
Total	1,608 ton

Waste is collected from each household (primary collection) using door-to-door collection method. It is either rickshaw vans (blue lines in the figure below) or secondary transportation vehicle (green line) with which waste is collected. Some of the generated waste is directly discharged at transfer points, or directly carried to the current open dumping sites (Kodda and Gacha).



Source: Conservancy Section, GCC.

Figure 3-9: Flow of waste in GCC with estimated daily volume

However, according to the waste collection data provided by the conservancy section, it is only around 55% of the generated waste that reaches the designated landfills, and around 37% of the generated solid waste in GCC is estimated to be dumped elsewhere. Major reasons are: i) people often throw their waste on the road. Although street sweepers are engaged by GCC, swept materials are not collected daily, and scattering of waste in the city is very visible and most are left unattended; ii) the waste collected from households is dumped and kept at secondary transfer points for long time, due to inappropriate transferring method and lack of capacity of secondary transportation.

3.3.2.3 Project Alternative Analysis

Both of the existing landfills of GCC are operated in an uncontrolled insanitary manner and the amount of waste has been reaching their maximum capacities. Some candidate sites for the new landfill are proposed and not yet finalized. Therefore, Regarding the landfill site, it is difficult to be included in this subproject.

GCC requires improvements in their SWM System as follows:

Due to the increase of waste generation as well as situation of current collection capacity, it is necessary to increase the collection capacity by procuring the collection equipment, improving primary collection system and the transfer stations, and increasing public awareness. The subproject shall have a keen eye on the increase of waste collection coverage area by proper planning and implementation of waste storage, primary collection, transfer and transport and by enhancing capacity building of the waste management department. The public awareness and participation in waste storage at households including source-segregation is a “must” for improvement of waste collection system.

3.3.2.4 Project Activities

The subproject consists of the following components for the Improvements of collection and transportation system:

- Provision of Waste Collection Bins with Source Segregation Facility at Household Level

- Provision of Waste Collection Bins with Source Segregation Facility at Commercial Establishments
- Provision of Mechanized Rickshaw Vans
- Construction of Transfer Station
- Improvement of Dumping Site
- Public Information, Education, Communication (IEC) Activities

The estimated beneficiary population is approximately 300,000 as of 2022 and coverage area is three wards in Zone 4.

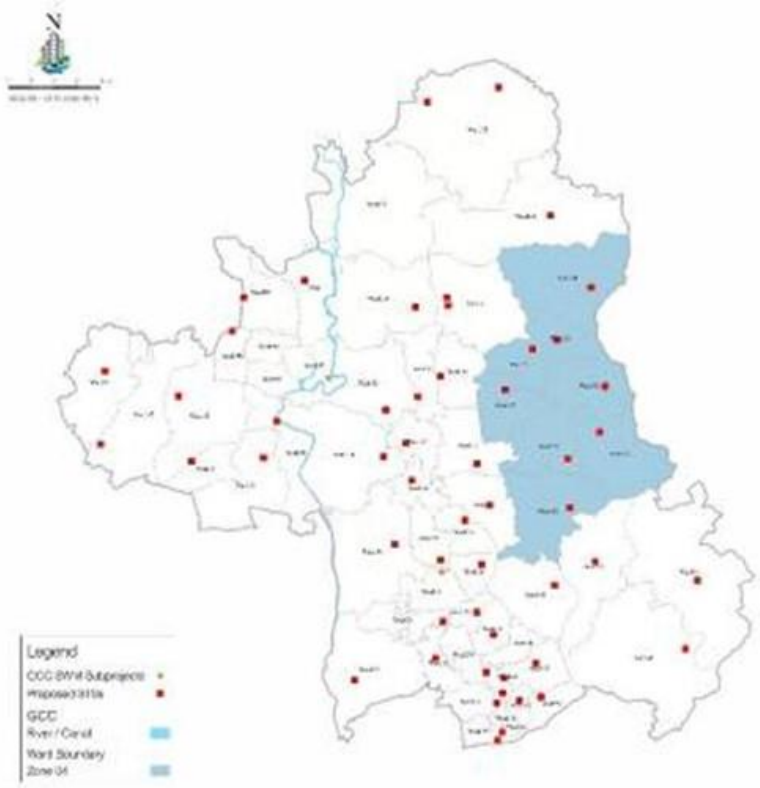


Figure 3-10: Proposed Sites of STSs in Zone 4 (Gazipur Zone)

3.3.2.5 Implementation Schedule

	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	2023, 2024
	Engineering and Technical Survey	-
	DP Preparation, Presentation, and Approval	Oct 2024
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Oct to Nov 2024
3	Subproject Tender	Dec 2024
4	Site Development	Mar 2025 - Mar 2026
5	O&M (setting up and training)	Oct 2026 - Mar 2026

3.3.2.6 Project Evaluation/ Effectiveness

Work Items	Base line (2023)	Target Year (2030)	Project Evaluations
Collection rate of waste (%)	63	70	-
Final Disposed Rate (%)	60	67	-
Recycle and Recovery (%)	3	4	-

3.3.3 GCC-SWM-2: Improvement of collection and transportation system in Gazipur

3.3.3.1 Background of the Subproject

As described in 3.3.2.1, there has been a huge space for improvement in waste collection and transportation system in GCC. GCC has developed a Solid Waste Management Plan under the Urban Development Plan for its Area with the technical support of Consultancy Research Testing Service (CRTS), Department of Civil Engineering, Dhaka University of Engineering and Technology (DUET), Gazipur. In the Urban Development Plan, four issues related to SWM are identified, namely:

- Conventional and improper Solid Waste Management System,
- Unhygienic and open dumping place in the city,
- Recycling by informal sector is not organized and regulated, and
- Lacking community participation.

The guiding principles for the Solid Waste Management Plan are:

- Principle 01: Minimizing the generation of waste
- Principle 02: Maximizing resource recovery and recycling
- Principle 03: Ensuring environmentally sound disposal of waste
- Principle 04: Promoting public awareness and participation in waste reduction efforts
- Principle 05: Enhancing overall sustainability of waste management practices

3.3.3.2 Current waste management status

Same as 3.3.2.2.

3.3.3.3 Project Alternative Analysis

The subproject will build the collection and transportation capacity of solid waste in GCC areas. Therefore, no project alternatives applicable and this component is best suited to the project option. Without the project option, no project activities are applicable. So, the project activities are required to increase the capacity of solid waste management in GCC areas, and they are expected to be effective in achieving the overall project objectives.

3.3.3.4 Project Activities

Due to the increase of waste generation, as well as the situation of current collection capacity, it is necessary to increase the collection capacity by the procurement of the collection equipment, improvement of primary collection system and improvement of the transfer station including public awareness. The subproject is considered the increase of waste collection coverage area by proper planning and implementation of proper waste storage, primary collection, transfer and transport and by enhancing capacity building of the waste management department. The public awareness and participation in waste storage at households including source-segregation is must for improvement of waste collection system.

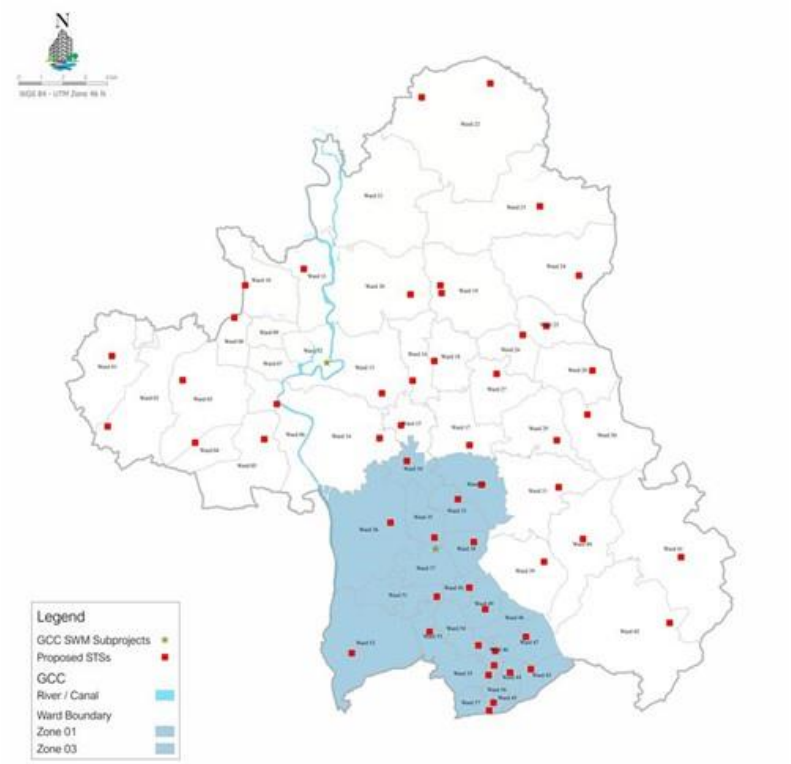


Figure 3-11: Proposed Sites of STSs in Zone 1 and Zone3 (Tongi and Gassa Zones)

3.3.3.5 Implementation Schedule

	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	2023, 2024
	Engineering and Technical Survey	-
	DP Preparation, Presentation, and Approval	Oct 2024
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Oct-Dec 2024
3	Subproject Tender	Dec 2024
4	Site Development and Construction	Mar 2025 - Mar 2026
5	O&M (setting up and training)	Oct 2026 - Mar 2026

3.3.3.6 Project Evaluation/ Effectiveness

Due to the implementation of this subproject, the collection and transportation system will be strengthened and significantly increased the collection rate in the target year (2028).

Work Items	Base line (2023)	Target Year (2030)	Project Evaluations
Collection rate of waste (%)	63	70	-
Final Disposed Rate (%)	60	67	
Recycle and Recovery (%)	3	4	

.

3.3.4 NCC-SWM-1: Construction of new landfill site in Julkuri (phase I) for solid waste management

3.3.4.1 Introduction

Narayanganj is a fast-urbanizing city in the country, located on the banks of the River Shitalakshya and the River Buriganga, close to the capital of Dhaka. It is an industrial centre famous for its jute mills and textiles and a prominent river port. Given its proximity to Dhaka, Narayanganj is a key contributor and driver of the regional economy and employment. Almost all the structures of the important roads are used for commercial establishments which generate additional traffic and result in congestion. The footpaths and some parts of the lanes, by-lanes are occupied by shops and trading activities. This generates a huge amount of solid waste. Due to narrow space in the roads, the commercial establishments are keeping their wastes on the roadside for municipal collection. There are no street bins on the main roads; so, the pedestrians throw their waste here and there. Part of it goes to the roadside drainage system. Due to improper management, it has resulted in poor sanitary conditions, environmental pollution and health hazards.

3.3.4.2 Current SWM Status

Solid waste generation in NCC is estimated at approximately 567 tons of household waste, 94 tons of commercial waste, and 50 tons of street waste. The city currently has a door-to-door waste collection system covering about 80% of the city, which have a big contribution to the waste collection system. However, the collection and transfer of waste is not efficient or sanitary.

Source of Solid Waste	Estimated Daily Solid Waste in NCC (2023), ton
Household	567 ton
Commercial (kitchen market, restaurant, hotel, community center, office, shop)	94 ton
Street (from sweeping)	50 ton
Total	711 ton

The waste is collected from each household (primary collection) using door-to-door collection method. Street sweepers are also engaged by NCC. Waste scatterings along the road of this city is many. Amongst the reasons scattering waste is that the unload of waste from primary collection remains in scattering situation for secondary transportation for long time. Mainly it takes a long time for transferring waste in the transfer station due to inappropriate transfer method and lack of capacity of secondary transportation.

Waste collected is transported to two temporary open dumping sites. The waste from Narayanganj and Kadamrasul is dumped near the 3rd Shitalakshya bridge, and waste from Shiddhirganj area is brought to Alamin-Nagar Landfill. The waste is mainly collected by rickshaw van as primary collection (blue line) and directly collected by secondary transportation vehicle (green line). Some of the generated waste is directly discharged into transfer points. According to the waste collection data provided by the conservancy section, the waste collection efficiency is 63%. The existing waste flow diagram is given below:

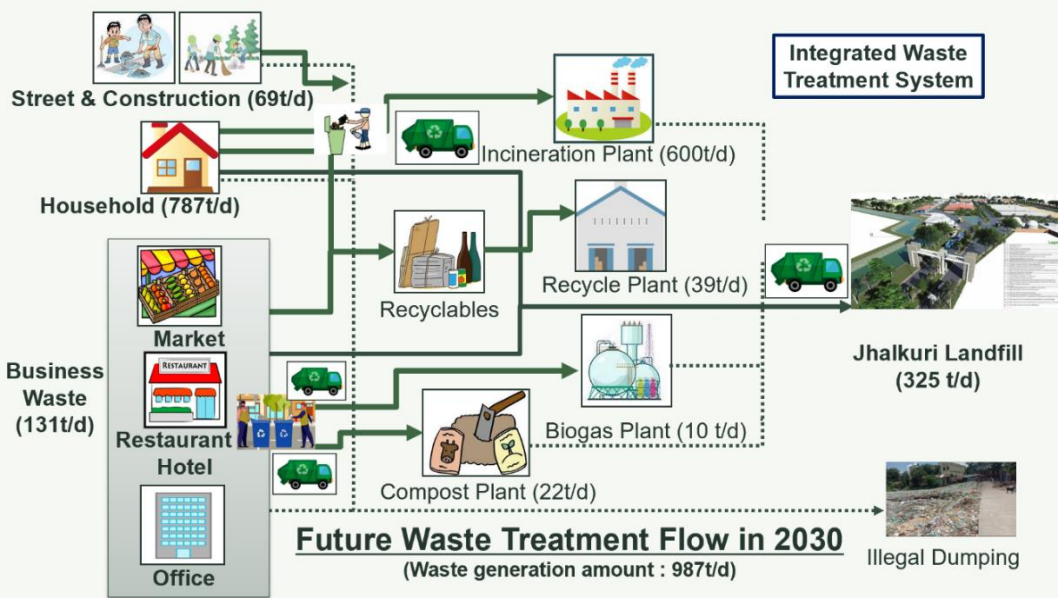
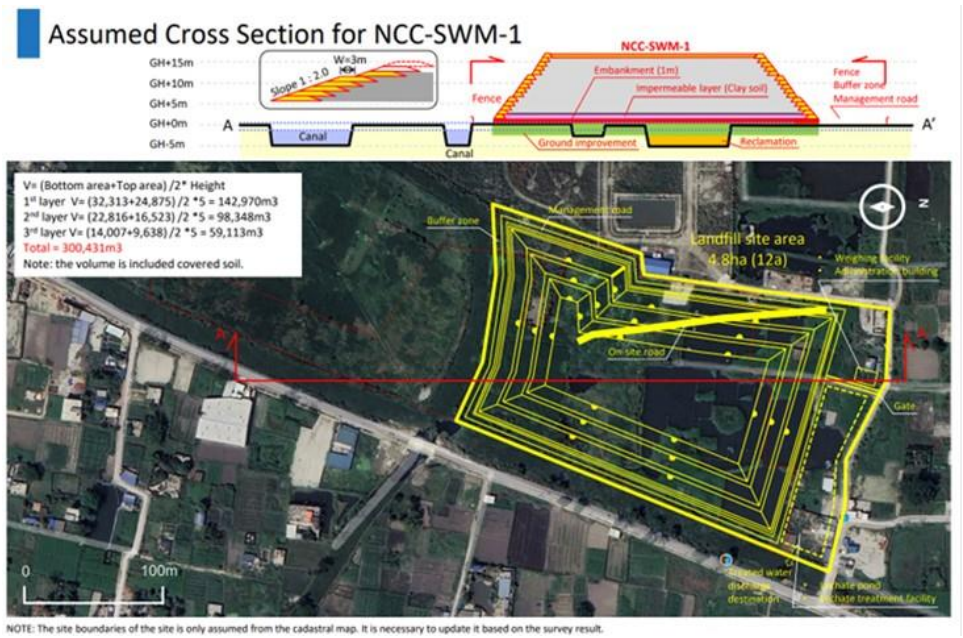


Figure 3-12: Waste Management Flow (2023), NCC

3.3.4.3 Project Alternative Analysis

The site was selected following the Solid Waste Management Rules 2021 considering 200m from the existing river, pond or water body, 500m from the regional road, 250m from the residential areas, 500m from the water supply well and 500m from the public park. Regarding best practice management, the best alternative design standards will be considered in this subproject. The site was near the existing waste to energy site of NCC. Due to land scarcity, land will be acquired which is now under process in the Ministry of Local Government, Rural Development and Cooperatives (LGRDC) for administrative approval.



Justification:

Total volume-300.431 m3 including covered soil.

1st layer capacity: 142.970m3

2nd layer capacity: 98.348m3

3rd layer capacity: 59.113m3

Total Tenure: 20 years.

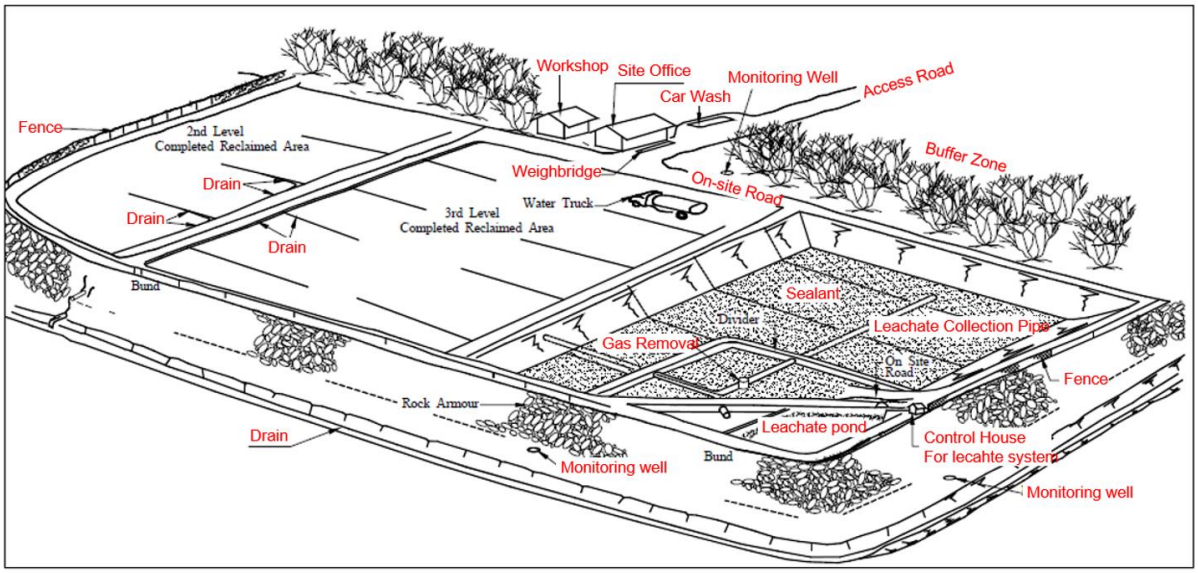
Figure 3-13: Best Alternative Option for NCC-SWM-1 site

Considering the situation of NCC such as high rainfall condition, semi-aerobic landfill method shall be applied like the landfill sites in DNCC and DSCC. It is a kind of sanitary landfill that prevents the release of offensive odors into the surrounding areas, collects leachate to safeguard surface and groundwater resources and provides beautification as part of the site management and operation. It promotes prompt drain of leachate and natural air circulation in landfill layer. It will also help prompt decomposition of landfilled waste and water quality of leachate much lower than anaerobic landfill system without high operation cost like aerobic landfill method. It is Level 4 sanitary landfill with leachate treatment system, impermeable liners and leachate circulation system that will be developed for this new one.

3.3.4.4 Project Activities

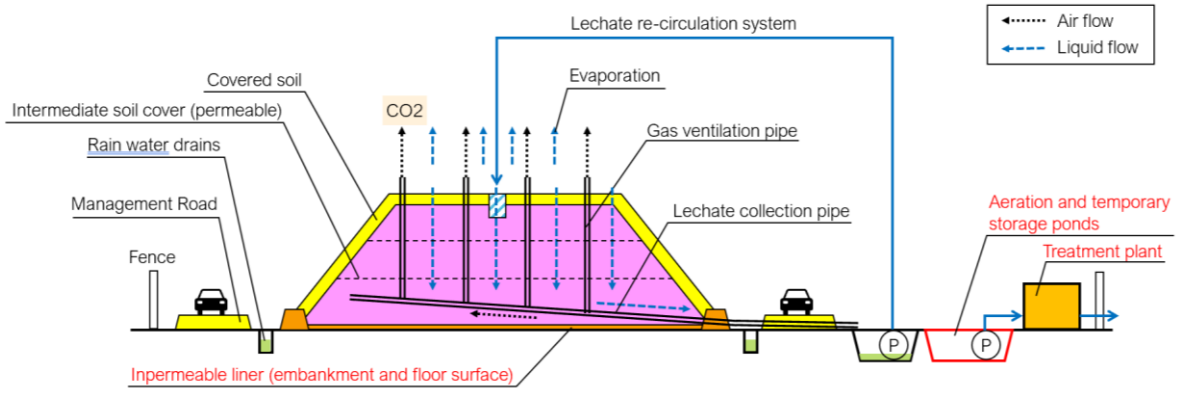
The project activities are mainly as follows:

- Development of landfill area and embankment
- Separate rainwater drainage system and leachate collection system.
- Preparation of side slope with adequate compaction, put soil covering on it.
- Installing leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes.
- Construction of platform for optimum use of land for long time.
- Construction of Leachate Treatment Plant.
- Water supply and car washing facility
- Introduce Environmental monitoring system (leachate, air and groundwater)
- Geomembrane / Artificial liner installation and other facilities will be constructed in proposed extension area.



Source: LGED

Figure 3-14: Sanitary Landfill System (Concept)



Source: LGED

Figure 3-15: Concept Design of semi-aerobic landfill with mechanical treatment (new landfill)

Estimated Beneficiary Population 2029 is 1,421,000 (including migrating population), and coverage Area is Ward No.1 – Ward No. 18 in NCC.

The existing condition of the proposed site is given below. There is no park, tube well or airport within the project area.

Important receptors	Distance from the site
Households	190m
Religious Institute (Mosque)	300 m
Surface water body (mainly canal)	400m
Educational Institute (School)	600 m
Major Road	1.9 km

3.3.4.5 Implementation Schedule

	Activities	Timeline
1	Definite Plan	Jan-Feb 2024
	Project Reconnaissance and Preliminary Assessment	June 2023
	Engineering and Technical Survey	Mar-Apr 2024
	DP Preparation, Presentation, and Approval	Mar 2024
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Nov 2024 – Jan 2025
3	Subproject Tender	May 2025
4	Site Development and Construction	Aug 2025- Aug 2027
5	O&M (setting up and training)	Mar 2027- Aug 2027

3.3.4.6 Project Evaluation / Effectiveness

Work Items	Base line (2023)	Target Year (2030)	Project Evaluations
Collection rate of waste (%)	51	56	-
Final Disposed Rate (%)	48	33	
Recycle and Recovery (%)	4	24	

3.3.5 NCC-SWM-2: Construction of new landfill site in Julkuri (phase II-Alamin nagar) for solid waste management, Al-Amin Nagar, Ward-18

3.3.5.1 Introduction

As narrated in 3.3.4.2, the collected waste in NCC is transported to two temporary open dumping sites, of which Alamin-Nagar site accommodates wastes from Shiddhirganj area. It is a de-fact open dumping site spontaneously developed without technical or environmental considerations. It deteriorates the city landscape, and the fact that there is no fence around the site risks passers-by's safety. The site is adjacent to residential areas, close to a mosque, playground, open field and canal. As they reside nearby, local people suffer from bad odors due to the existence of waste and there is no choice but to live in non-hygienic condition. Waste dumped at Alamin-Nagar has invited pests such as rats, cockroaches, flies, ants and others, which move around the site and the areas adjacent to the site. There exists leachate generated from the existing wastes with high organic content and high ammoniacal nitrogen content in the open dumping site.

Considering the current situation of the open dumping site, its improvement is the most priority for the betterment of the entire city.

Figure 3-16: Alamin Nagar Open Dump Site (February 2024)

3.3.5.2 Current SWM Status

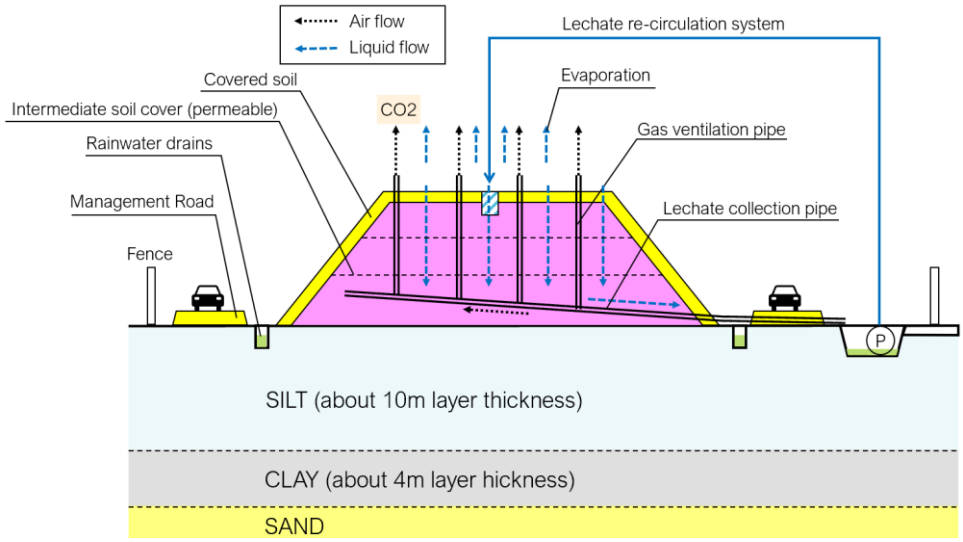
Same as 3.3.4.2.

3.3.5.3 Project Alternative Analysis

The proposed landfill site will be developed in the existing site, currently used as an open dumping site which will be converted to a semi-aerobic sanitary landfill site. As the proposed

activities will remain in the same place in the existing dumping site for improvement and expansion, typically, no alternative option will be applicable in this regard.

For the improvement part, Level 3 sanitary landfill with leachate circulation system will be applied as shown in the following figure.



Source: LGED

Figure 3-17: Concept Design of semi-aerobic landfill with recirculation system for improvement of existing site

As for the expansion part, geomembrane / artificial liner will be installed to cover the soil, and a Leachate Treatment Plant will be constructed as shown in Figure 3-14 and Figure 3-15.

3.3.5.4 Project Activities

The subproject is the Improvement and expansion of the existing landfill site in Alamin Nagar. Tentative details are as follows:

- Construction of all facilities (i.e., control/admin building, weigh bridge, water supply and car wash, power supply and generators) to improve existing open dumpsite into Level 3 sanitary landfill (uses leachate recirculation system).
- O&M (up to full closure) by CUCC.

The site is adjacent to residential areas in the north and east, close to one mosque located on the south side, playground on the west, open field on the south sides and canal on the north side which is 100 m away from the landfill site. However, no land acquisition is required. The existing condition of the landfill site is given below:

Important receptors	Distance from the site
Household	5 m
Religious Institute (Mosque)	90 m
Surface water body (mainly canal)	100 m
Educational Institute (School)	300 m
Playground	5 m

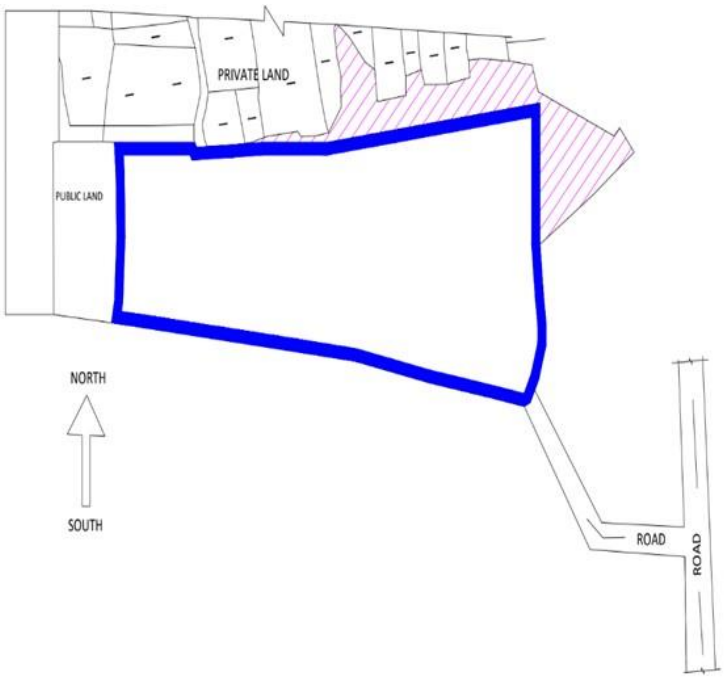


Figure 3-18: Outline of Alamin Nagar Open Dump Site

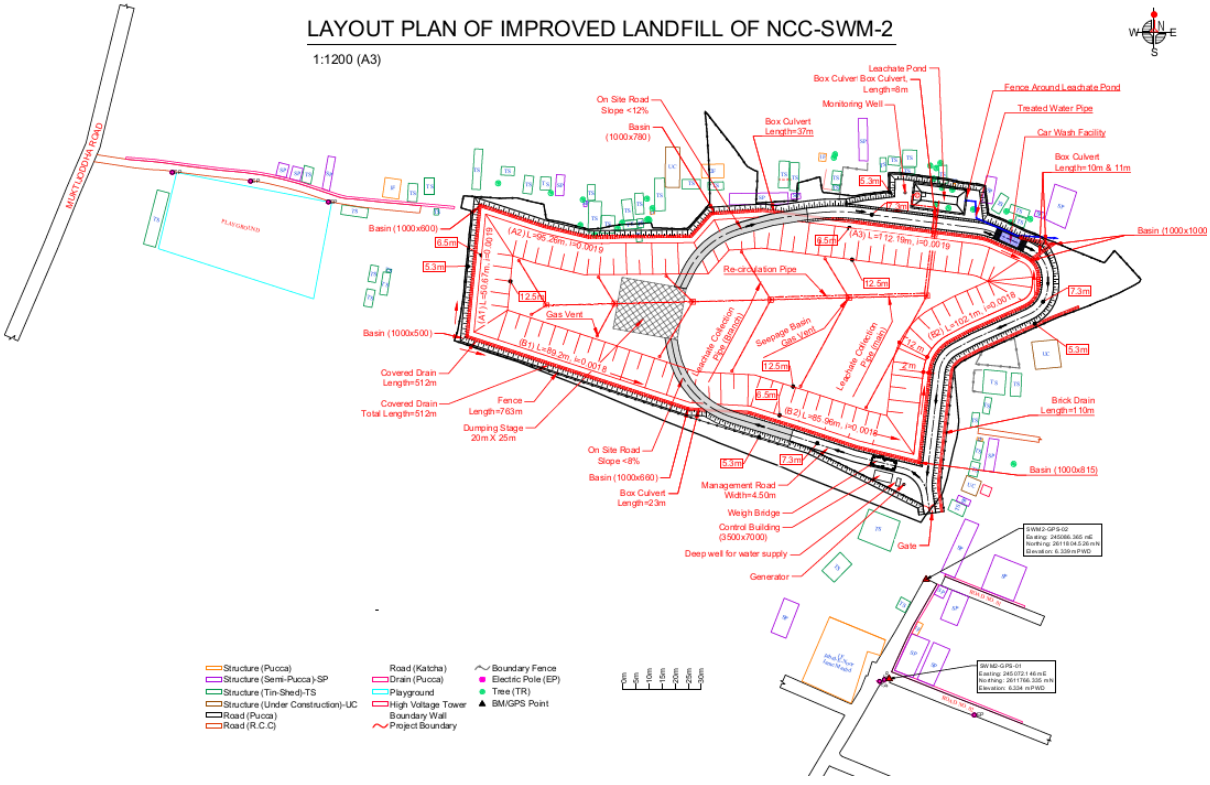


Figure 3-19: Layout Plan of Alamin Nagar landfill site development

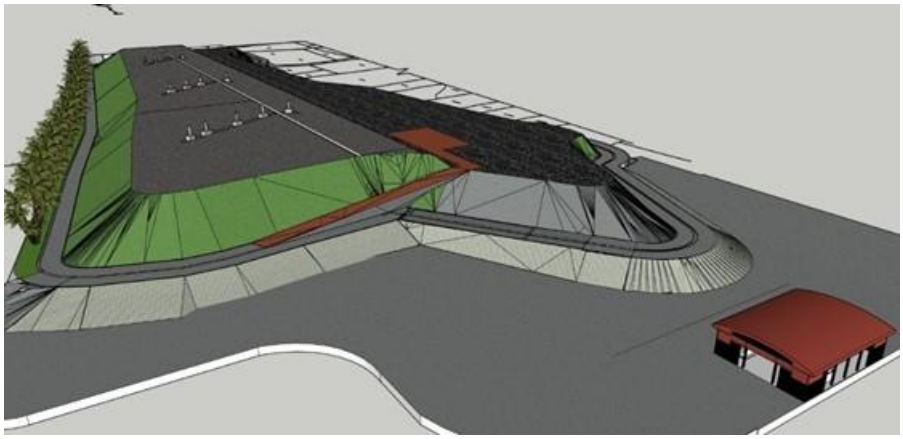


Figure 3-20: 3-D view of landfill site development

3.3.5.5 Implementation Schedule

No.	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Jan – Oct 2024
	Engineering and Technical Survey	Jan – Oct 2024
	DP Preparation, Presentation, and Approval	Mar 2024
2	Detailed Engineering Design (including cost estimates, technical specifications, and tender documents)	Apr-Nov 2024
3	Subproject Tender	Feb 2025
4	Site Development and Construction	May 2025 – May 2027
5	O&M (setting up and training)	Nov 2026- May 2027

3.3.5.6 Project Evaluation / Effectiveness

Work Items	Base line (2023)	Target Year (2030)	Project Evaluations
Collection rate of waste (%)	51	56	-
Final Disposed Rate (%)	48	33	-
Recycle and Recovery (%)	4	24	-

3.3.6 CuCC-SWM-1: Improvement of collection, transportation, and landfill site for solid waste management, Jhakuni Para

3.3.6.1 Introduction

Cumilla City Corporation, located in the Chittagong Division of Bangladesh, is the governing body responsible for managing and governing the city of Cumilla. As a crucial administrative entity, it plays a pivotal role in providing essential services and maintaining the city's infrastructure and public amenities. The corporation is entrusted with various responsibilities, including waste management, road maintenance, urban planning, and development projects, aimed at enhancing the living standards of its residents.

Aside from the waste separated for recycling, currently, CuCC dumps their collected waste in a 5-acre landfill (an open dumping site) at Jagannathpur. Only around 63% of the generated waste reaches the designated landfill. It is estimated that around 27% of the generated solid waste in CuCC are dumped elsewhere. Further, scattering of waste in the city is also very visible and most are left unattended.

3.3.6.2 Current SWM Status

Solid waste generation in CuCC is estimated at 145.41 tons of household waste, 35 tons of commercial waste, and 18.63 tons of street waste.

Source of Solid Waste	Estimated Daily Solid Waste in CuCC (2023) (unit: ton)
Household	145.41 (73 %)
Commercial (kitchen market, restaurant, hotel, community center, office, shop)	35 (17.5%)
Street (from sweeping)	18.63 (9.36%)
Total	199.04

The waste is collected from each household (primary collection) using door-to-door collection method. Street sweepers are also engaged by CuCC. Waste scatterings along the road of this city is many. Amongst the reasons scattering waste is that the unload of waste from primary collection remains in scattering situation for secondary transportation for long time. Mainly it takes a long time to transferring waste to the transfer station due to inappropriate transfer method and lack of capacity of secondary transportation.

Waste collected is transported to the current open dumping site in Jhakunipara at Jagannathpur union outside the CuCC area. The waste is mainly collected by rickshaw van as primary collection (blue line) and directly collected by secondary transportation vehicle (green line). Some of the generated waste is directly discharged into transfer points. According to the waste collection data provided by the conservancy section, the waste collection efficiency is 63%.

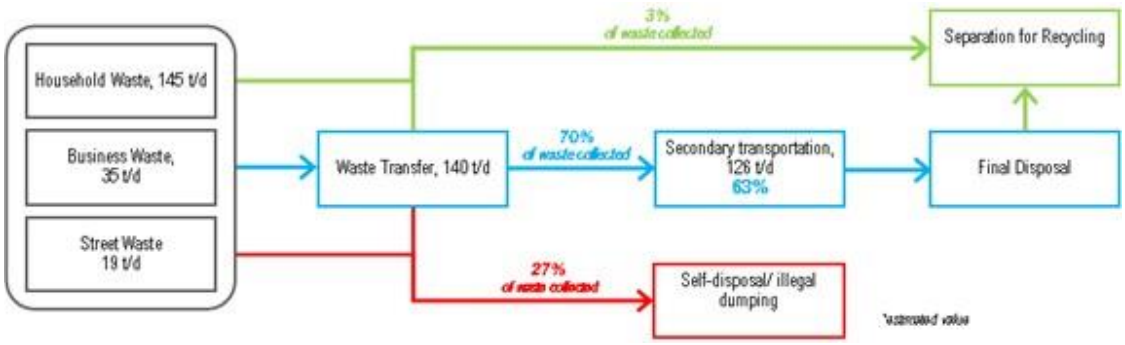


Figure 3-21: Flow of waste in CuCC with estimated daily volume

3.3.6.3 Project Alternative Analysis

The existing landfill of Cumilla is at Jhakunipara in Zakunipara at Jagannathpur union outside the CuCC area, and the proposed landfill site will be developed there, which is currently used as open dumping site, intending to convert it to semi-aerobic sanitary landfill site. No alternative option is thus applicable for this subproject. On the other hand, considering the situation of the current open dumping site, landfill shall be expanded that will require land acquisition. The area for landfill site is limited but there are areas to be landfilled if the embankment is suitably constructed as well as the other structures such as rainwater drainage or gas ventilation pipes etc.

Figure 3-22: Existing landfill site at Jhakuni Para

Considering the situation of CuCC such as high rainfall condition, semi-aerobic landfill method should be applied among various types of landfill methods. Like NCC-SWM-2, Level 3 sanitary landfill with leachate circulation system will be applied to improve the existing site as in Figure

3-17, whereas Level 4 sanitary landfill will be developed for the expansion area (see Figure 3-14 and Figure 3-15).

Figure 3-23: Existing condition at Jhakunipara Dump Site

3.3.6.4 Project Activities

Estimated Beneficiary Population in 2028 is estimated to be 1,341,200 (including migrating population) that covers all CuCC areas.

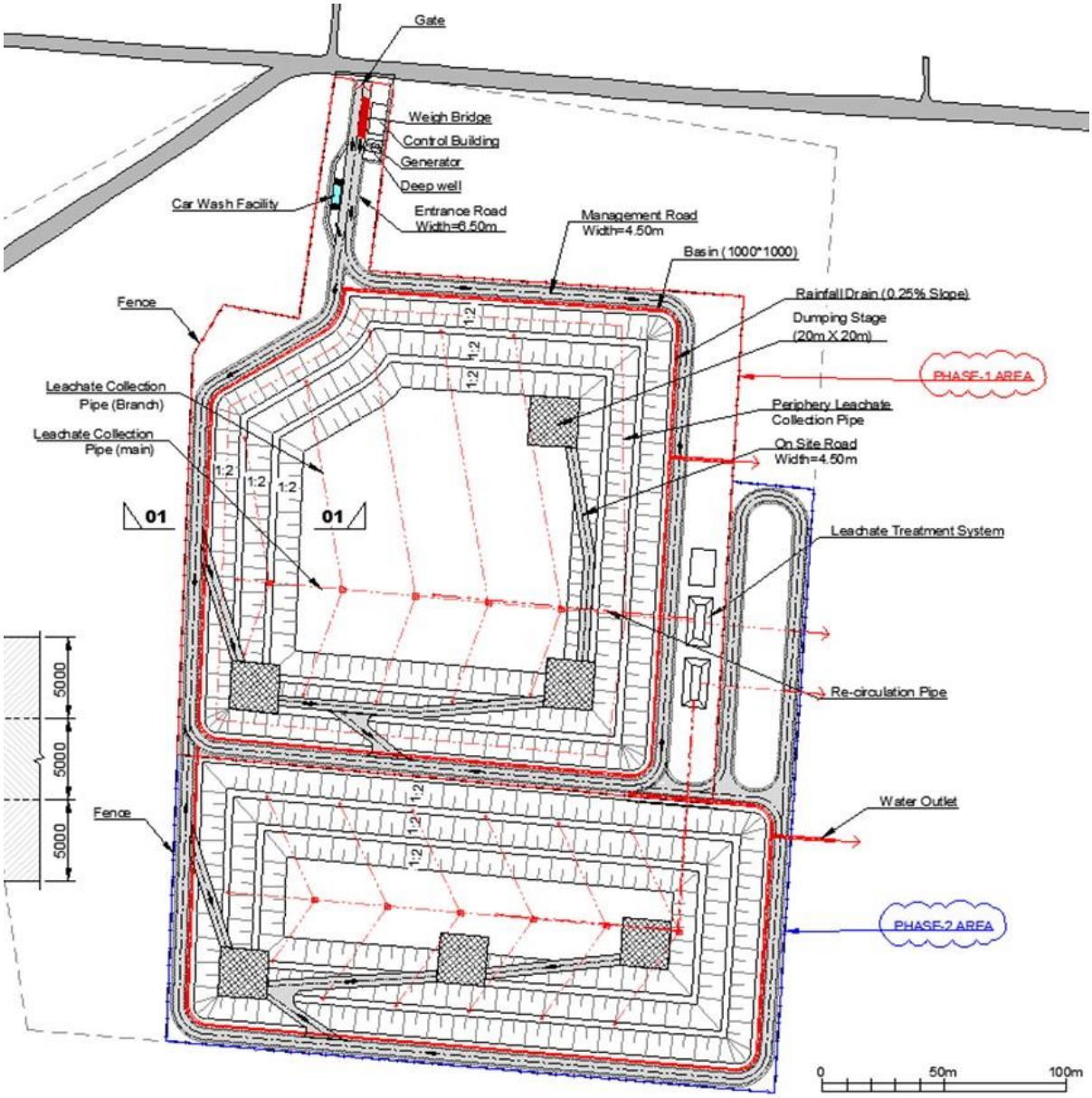
The subproject consists of the following components:

Component 1: Improvement of collection and transportation system. Tentative details are as follows:

- Provision of Waste Collection Bins with Source Segregation Facility at Household Level
- Provision of Waste Collection Bins with Source Segregation Facility at Commercial Establishments
- Provision of Mechanized Rickshaw Vans
- Improvement of Transfer Station
- Public Information, Education, Communication (IEC) Activities

Component 2: Improvement and expansion of current dumping site toward sanitary landfill. Tentative details are as follows:

- Phase 1: construction of all facilities (i.e., control/admin building, weigh bridge, water supply and car wash, power supply and generators) to improve existing open dumpsite into Level 3 sanitary landfill (uses leachate recirculation system) plus construction of leachate treatment system (for Level 4 sanitary landfill). O&M (up to partial closure) by CUCC.
- Phase 2: construction of Level 4 sanitary landfill - new cell (includes liners), management road (extension), drainage (extension), connection to leachate treatment system. O&M (up to partial closure) by CUCC.
- Phase 3 – O&M (up to full closure) by CUCC.



Note: The plan remains tentative and is subject to change.

Figure 3-24: Basic Plan of CuCC Sanitary Landfill

The nearest residential area is 90 m away from the site. The distance from Gomati River is 770 m, and that from Bibir Bazar Highway is 90 m. There is no park, tube well or airport within the project site.

Important receptors	Distance from the site
Households	90 m
Surface water body (Gomati R**iver)**	770 m
Highway (N101)	90 m

3.3.6.5 Implementation Schedule:

Sl. NO	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Aug-Sept 2023
	Engineering and Technical Survey	Jan – Mar 2024
	DP Preparation, Presentation, and Approval	Oct 2023
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Nov 2024 – Jan 2025
3	Subproject Tender	May 2025
4	Site Development and Construction	Aug 2025 – Aug 2027
5	O&M (setting up and training)	Mar 2027-Aug 2027

3.3.6.6 Project Evaluation / Effectiveness

Work Items	Base line (2023)	Target Year (2030)	Project Evaluations
Collection rate of waste (%)	63	70	-
Final Disposed Rate (%)	60	67	
Recycle and Recovery (%)	3	4	

3.3.7 CuCC-D-4: Re-excavation of existing (2) Racecourse and Gungaijuri canals

3.3.7.1 Background

Figure 3-25: Present Condition of the Target Area

The subproject will start from the Northwest side of Satora area - from junction DC Banglo Road to Noapara Soap Factory (1600m) and Noapara Soap Factory to Dhaka Chittagong Highway Bridge (6300m). It will cover residential areas, commercial areas, and some important government buildings on both sides of this canal, but present the entire areas go under waterlogging due to the siltation of canal results of improper drainage system in the project areas, waterlogging occurs in that area. That's why the canal is required for re-excavation.

Figure 3-26: Current condition of the proposed sub-project

3.3.7.2 Project Alternative Analysis

The project's goal is to enhance the canal's existing state by reducing water logging from urban areas by excavating or re-excavating. The positions of the canal are established; the east side is used by pedestrians since it has a paved road and residential areas; the west side of the canal, on the other hand, has been left unoccupied and is now home to encroachers. Therefore, following re-excavation, walkways will be built on the west side to improve city residents' amenities and beautification. The subproject's attractive design and execution will also free the city from water logging during the monsoon and increase the likelihood of occurrence.

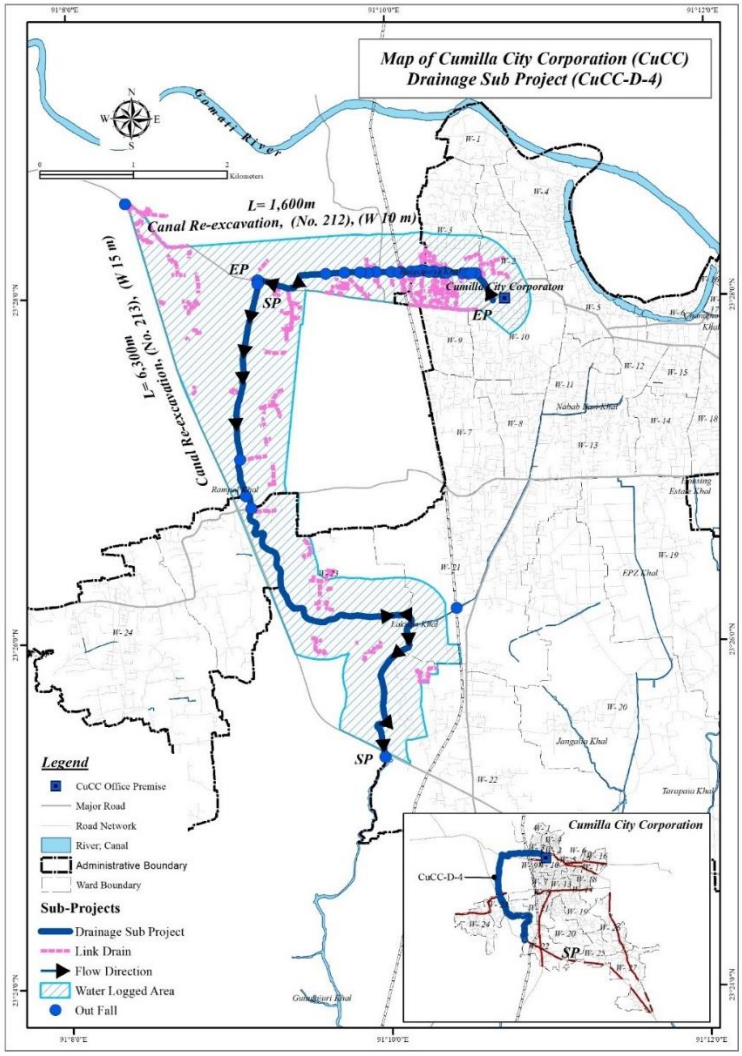


Figure 3-27: CuCC-D4: Drainage Subproject at Ward (2,3,21,22 ,23) and out of city corporation

3.3.7.3 Project Activities

The length of the canal re-excavation is 7900-meter which starts from Reacecourse DC Banglo road to Nowapara soap factory (length: 1600m) and from Nowapara soap factory to Dhaka Chittagong Highway Bridge (length: 6300m). The alignment of the subproject areas is given in figure 2-14, and relevant photographs in Figure 2-15.

3.3.7.4 Implementation Schedule

Sl. No	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Apr-May 2023
	Engineering and Technical Survey	Aug 2023 – June 2024
	DP Preparation, Presentation, and Approval	Sep – Oct 2023
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Sep-Oct 2023
3	Subproject Tender	Nov 2024
4	Construction	Feb 2025 – Feb 2027
5	O&M (setting up and training)	Sep 2026 - Feb 2027

Source: LGED

3.3.8 CBP-SWM-1: Improvement of current solid waste management situation in Cox's Bazar

3.3.8.1 Introduction

Cox's Bazar is a fast-growing *pourashava* and a district town. It is located on the Bay of Bengal between Chittagong and Teknaf. The town is the most important tourism destination of Bangladesh, and one of the most vibrant urban centers in southern region. The *pourashava* covers an area of 32.9 square kilometers. It consists of 12 wards. Cox's Bazar is surrounded by the Bakkhali River to the north and east; the Bay of Bengal to the west; and by hill range to the north and south. The height of the hill range varies from 50 meters to 82 m above sea level and it terminates abruptly against the beach, creating vertical sections. A major part of the P*ourashava* area is low-lying. Due to its location between steep hills and the sea, and along a river, the low slope gradients and high groundwater table exacerbate chronic flooding and water logging in the low-lying areas. Cox's Bazar is also located in an active earthquake zone, on the boundary of two active plates, and is highly susceptible to earthquakes and related landslides.

3.3.8.2 Current Condition

Figure 3-28: Existing condition of landifll site at Kustorighat

At present waste is dumped crudely in the landfill site in the Pana market. It is close to the major road, the picturesque Kausturighat bridge, and residential neighborhoods within a 50-meter radius. It is a de-fact open dumping site spontaneously developed without technical or environmental considerations. They dump waste from the main road that creates traffic movement as well as nuisance. It deteriorates the city landscape, and the fact that there is no fence around the site risks passers-by's safety.

Table 3-2: Existing waste volume in Cox's Bazar Pauroshava

Source of Solid Waste	Amount of Solid waste CBP PS (2023)
► Household waste	► 110.47 ton (67 %)
► Commercial (Kitchen market, restaurant, hotel, community center, office, shop)	► 35 ton (22%)
► Street sweeping	► 18.63 ton (11%)
► Total	► 164.10 ton

Source: LGED

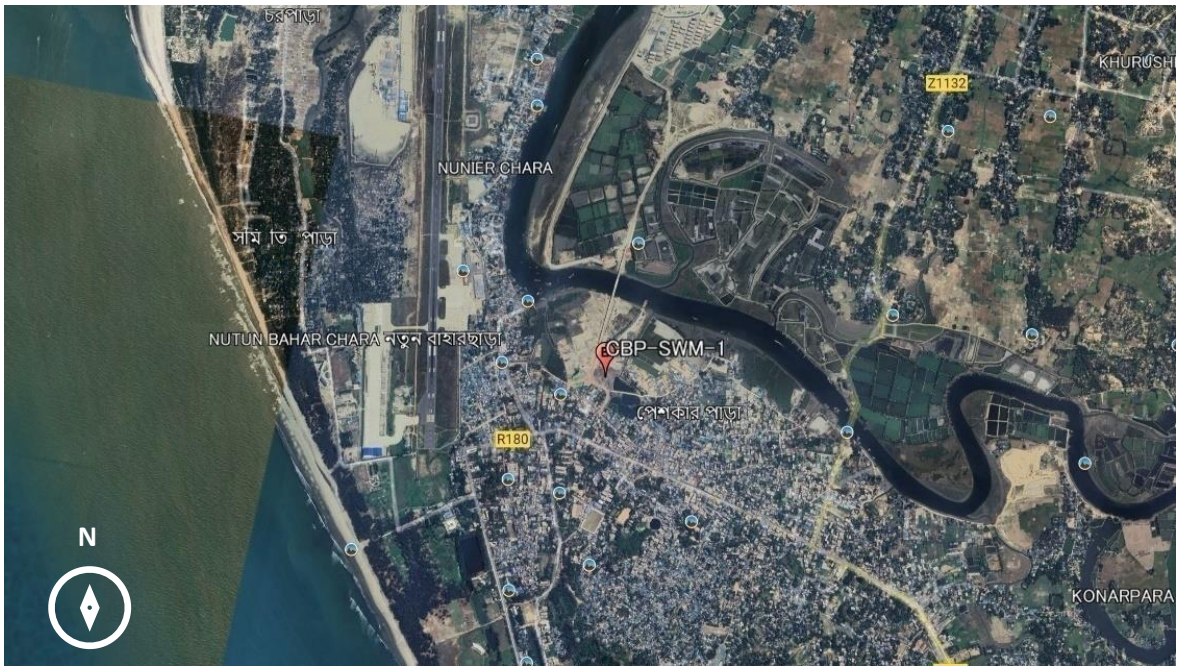
3.3.8.3 Project Alternative Analysis

The Pana Market site shall be closed within a few years as its remaining capacity to accept waste has been decreasing, and a new landfill site is awaited. However, taking no action is not an option to choose considering the degree of environmental and social impacts that remain and keep accumulated there. The planned landfill location is where it is currently used for open dumping at Kausturighat. There are various types of landfill methods. Among them, semi-aerobic landfill enhances prompt drain of leachate and natural air circulation in landfill layer. It promotes prompt decomposition of landfilled waste and water quality of leachate much lower than anaerobic landfill system without high operation cost like aerobic landfill method. Considering the situation of CBP, this open dumping site will essentially be transformed into a Level 3 sanitary landfill (with leachate recirculation system) (See Figure 3-14Figure 3-17).

3.3.8.4 Project Activities:

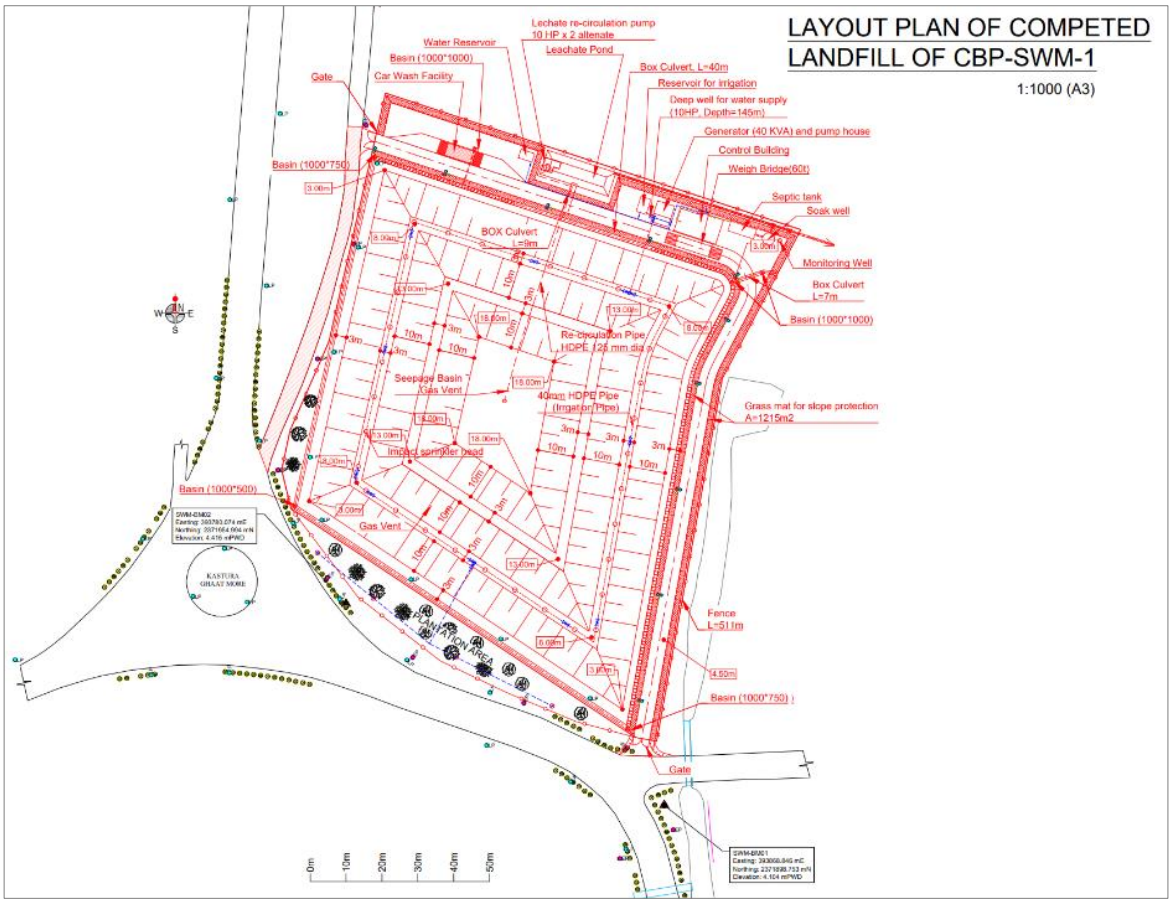
The scope of work shall be the improvement of the existing open dumping site into semi-aerobic landfill site (total area: 4.0 acres) with the following components:

- Construction of all facilities (i.e., control/admin building, weigh bridge, water supply and car wash, power supply and generators) to improve existing open dumpsite into Level 3 sanitary landfill (uses leachate recirculation system).
- O&M (up to partial closure) by CBP.



Source: LGED

Figure 3-29: Location of Existing Landfill Site



Source: LGED

Figure 3-30: Layout Plan of Completed Landfill

3.3.8.5 Implementation Schedule

Sl. No	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Aug-Sept 2023
	Engineering and Technical Survey	Jan – Nov 2024
	DP Preparation, Presentation, and Approval	Oct 2023
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Mar – Oct 2024
3	Subproject Tender	Oct 2024
4	Site Development and Construction (Phase 1)	Jan 2025 - Jan 2027
5	O&M (setting up and training)	Aug 2027-Jan 2027

Source: LGED

3.3.8.6 Project Evaluation

Item	2023	2025	2030	2035	2040
► Collection Rate (%)	76%	78%	80%	85%	90%
► Final disposal Rate (%)	75%	78%	70%	84%	88%
► Recycle & Recovery Rate (%)	6%	7%	8%	12%	14%

Source: LGED

3.3.9 CBP-SWM-2: DEVELOPMENT OF SANITARY LANDFILL SITE IN SM PARA

3.3.9.1 Introduction

Figure 3-31: Existing condition of landfill site at Kustorighat

As explained under 3.3.8.1, as large as 4.0 acres of land at Kustorighat has been used as an open dumping site, and conversion work into semi-aerobic landfill will be done under CBP-SWM-1 to promptly drain leachate, promote natural air circulation in landfill layer, decompose landfilled waste and water quality of leachate. With such technical measures and environmental considerations, waste recycling and compost, it is still anticipated that the remaining capacity of the Kustorighat site become nil in 2026. This subproject addresses a sanitary landfill site development that replaces the existing landfill site.

3.3.9.2 Current Condition:

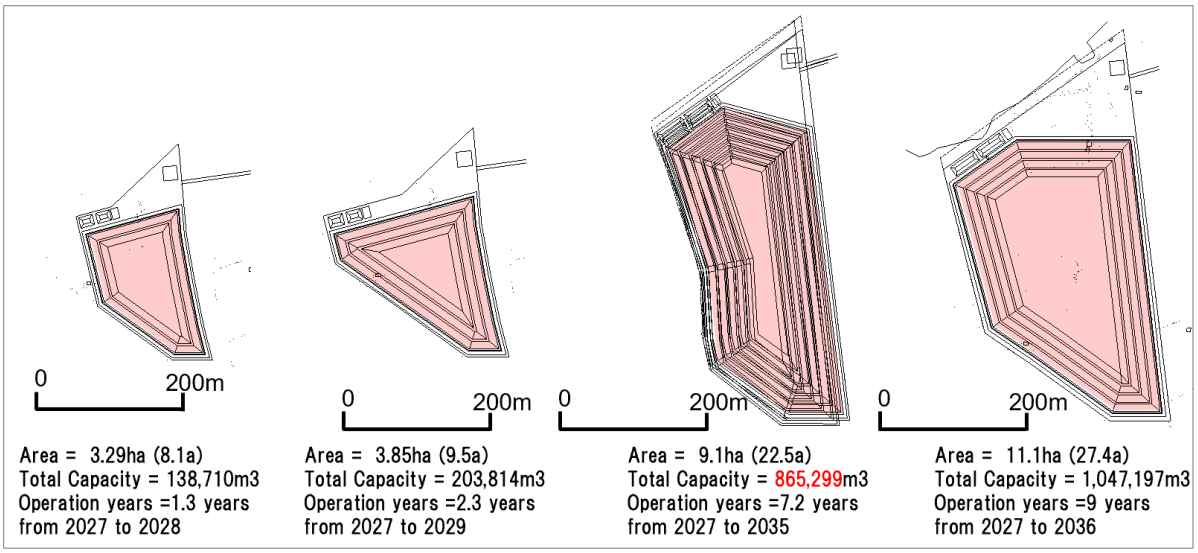
The proposed site is located in S M Para, which is around 4.5 km away from the town. SM Para site is adjacent to local farmers' home. They cultivate paddy and vegetables and collect fish.

3.3.9.3 Project Alternative Analysis:

CBP examined different conceptual ideas depending on the land availability (see Figure 3-32 below). The surrounding area of the proposed site is mainly farmland and watercourse, which has made it difficult to finalize their decision. Apart from the alternative plans and proposed land in the previous figure, they are choosing the one in Figure 3-33, considering the estimated amount of waste generation in the upcoming years, acceptance amount and period at the existing landfill and new landfill, socio-economic impacts caused to local communities, and environmental impacts. Approximately 20 acres of land will be used for landfill out of 35.5189 acres (equivalent to 14.374 ha) secured for solid waste management[1].

Like the expansion plan of sanitary landfill in NCC and CuCC, Level 4 sanitary landfill (with impermeable liners and leachate treatment system in addition to its recirculation system) shall be applied as it promotes prompt drain of leachate and natural air circulation in the layer (see Figure 3-14 and Figure 3-15).

[1] Out of 35.5189 acres, 6.9889 acres of land (highlight in orange color in Figure 3-33) has already been acquired under UGIIP-III funded by ADB. Watercourse as much as 10.50 acres (highlight in light blue color in the same figure) is currently privately owned, which shall be newly acquired under UDCGP. Deputy Commissioner's Office of Cox's Bazar owns 16.00 acres of land (yellow part bordered by red line), which shall be transferred to CBP upon official approval. The rest 2.03 acres (pink colored part) belongs to CBP.



Source: LGED

Figure 3-32: Conceptual Designs Examined

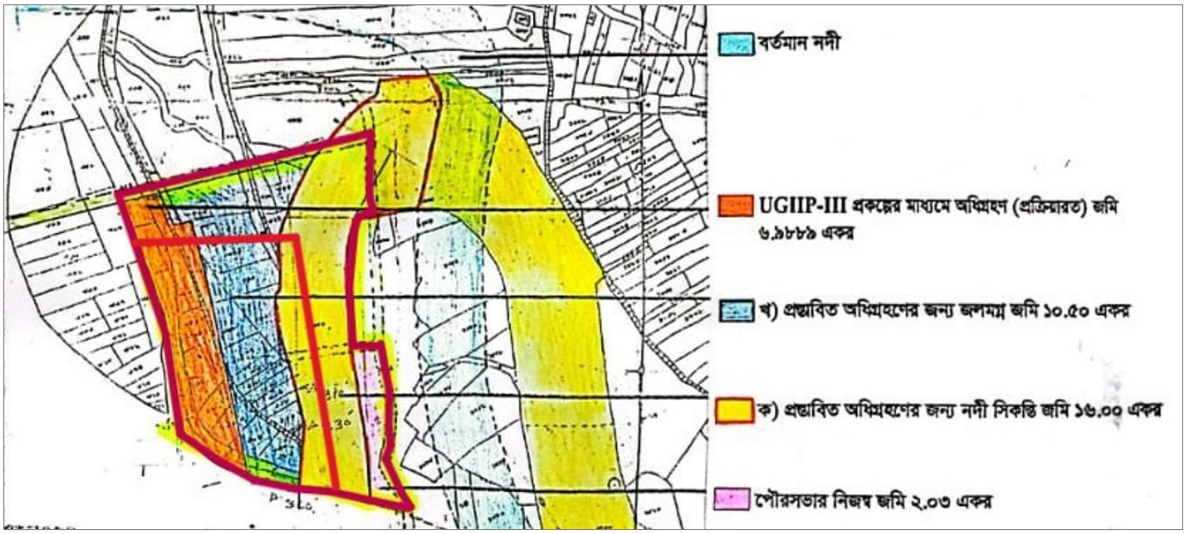


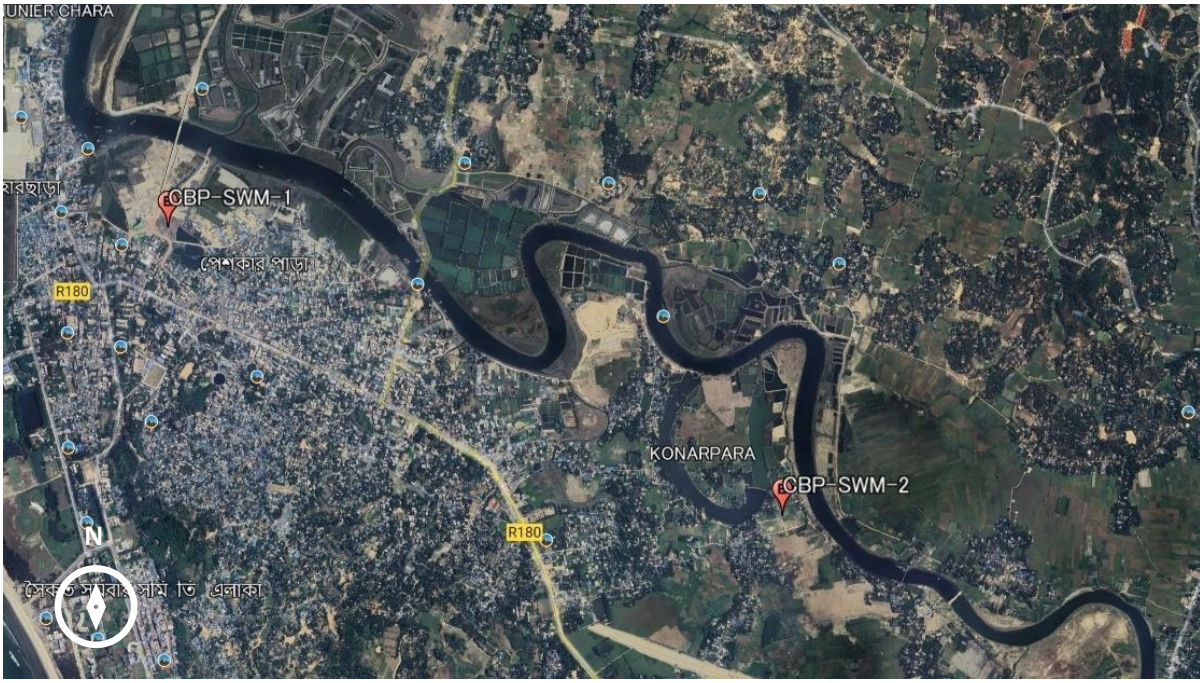
Figure 3-33: Land for New Landfill and Others

3.3.9.4 Project Activities

The project activities are mainly as follows:

- Development of landfill area and embankment
- Separate rainwater drainage system and leachate collection system.
- Preparation of side slope with adequate compaction, put soil covering on it.
- Installing leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes.
- Construction of platform for optimum use of land for long time.
- Construction of Leachate Treatment Plant.
- Water supply and car washing facility
- Introduce Environmental monitoring system (leachate, air and groundwater)

- Geomembrane / Artificial liner installation and other facilities will be constructed in the proposed extension area.



Source: LGED

Figure 3-34: Location of New Landfill Site (CBP-SWM-2)

The nearest residential area is 260 m away from the site. The distance from Bakkhali River is 770 m. There is no park, tube well or airport within the project site.

Important receptors	Distance from the site
Households	260 m
Surface water body (Bakkhali River)	770 m
Highway (R180)	1,080 m

3.3.9.5 Implementation Schedules

Sl. No	Activities	Timeline
1	Definite Plan	
	Project Reconnaissance and Preliminary Assessment	Aug-Sept 2023
	Engineering and Technical Survey	Jan - Nov 2024
	DP Preparation, Presentation, and Approval	Oct 2023
2	Detailed Engineering Design (including cost estimates, technical specifications, tender documents)	Nov – Dec 2024
3	Subproject Tender	Apr 2025
4	Site Development and Construction	Jul 2025 - Apr 2027
5	O&M (setting up and training)	Oct 2027-Apr 2027

3.3.9.6 Project Evaluation

Item	2023	2025	2030	2035	2040
► Collection Rate (%)	76%	78%	80%	85%	90%
► Final disposal Rate (%)	75%	78%	70%	84%	88%
► Recycle & Recovery Rate (%)	6%	7%	8%	12%	14%

Source: LGED

4.0 Existing Environmental Conditions

4.1 Introduction

Existing Environmental Conditions have been considered both physical and biological environmental conditions of the project sites with socio-economic status. Primary and secondary both were considered to elaborate the existing environmental baseline conditions in this section. The details have been depicted as follows.

4.2 Physical environment

The physical environment typically describes the present local condition of Topography, Geology, Geomorphology, Soil, Drainage, Hydrology and Water Resources, Weather and Climate, Air Quality, Water Quality, Noise level, and sources of environmental pollutions etc. for each individual sites of the project areas. Details are given below:

4.2.1 Gazipur City Corporation (GCC)

4.2.1.1 Topography

In general, the topography of Gazipur district is low-lying upland and drained poorly. The area is nearly sloped from west to east. The south and south-eastern part of Gazipur district is 6 meters from the mean sea level in average and the height of the western part of the ridge at Kaliakair is 30 meters (higher slope) above the mean sea level. The soil conditions in the Bhawal Garh are varied and often complex. The highest elevation is 22.5 m (Kamargaon Mouzain the Pubail Union) as measured by the Public Works Department (PWD).

The areas generally contain high lands in Gazipur, the Baria Union, some areas of the Gachha Union and the southern part of Pubail Union. Medium land in the Pubail, Gachha, and Tongi unions.[2]

The topography of the GCC area is not flat but consists of ridges separated by a close pattern of shallow baids. Such areas exist extensively throughout Joydevpur.

[2] Topographic Survey, 2005–2006: The Project for Developing Inclusive City Governance for City Corporation, Final Report Volume 5, GCC Edition, JICA, March 2014, LGED, People's Republic of Bangladesh.

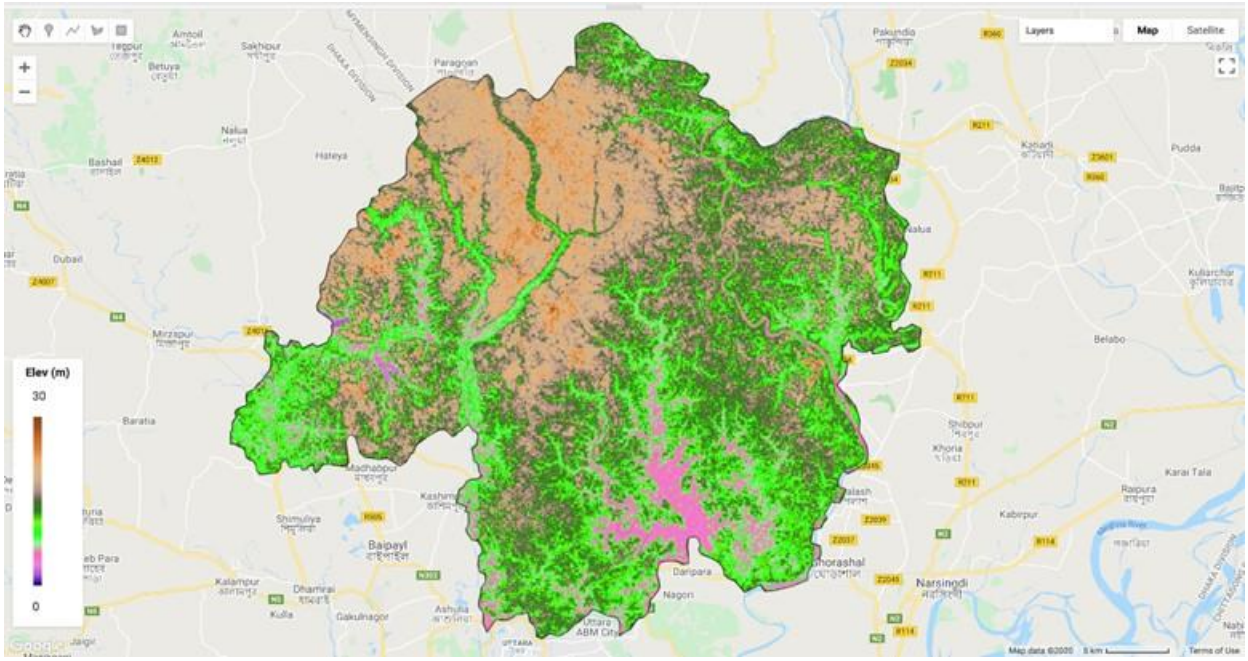


Figure 4-1: Topographical Map of GCC (DEM-digital elevation map)

(Source: Interpreted from SRTM v.4 90m database using Google Earth Engine, database: Jarvis et al. (2008)

4.2.1.2 Geology

Gazipur district is basically underlies the Madhupur Tract (Bhawal Garh), is a kind of scroll of history of upliftment and subsidence caused by geotechnic setting, variations of sea level, climate, vegetation, and human interventions. It has had a profound role in affecting this area over the past several hundred years and forming the distinctive features of the project areas. The uniformity of clay soils both laterally and vertically, suggests that they were laid down under tidal or marine conditions, and the geologic age of this formation is Dupi Tila (Miocene) age even though it is considered as of Pleistocene clay. However, past earthquakes suggest that the tectonic movement is continued by an active fault block or series of fault blocks which are slightly tilted over the southeast to western edge varied from 3-6 m above the flood level. The southeastern part is low and encroached by Old Brahmaputra floodplain sediments.

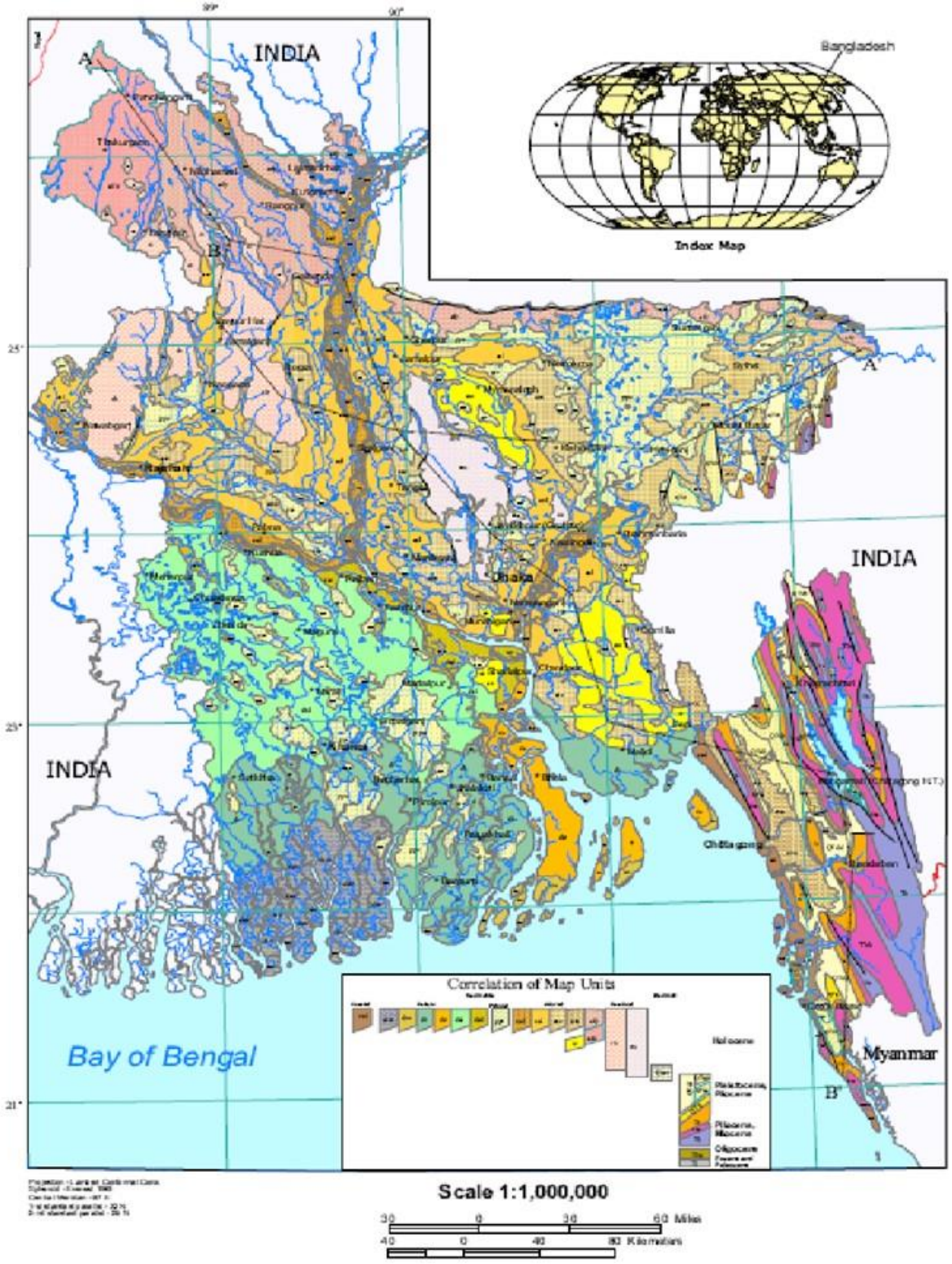
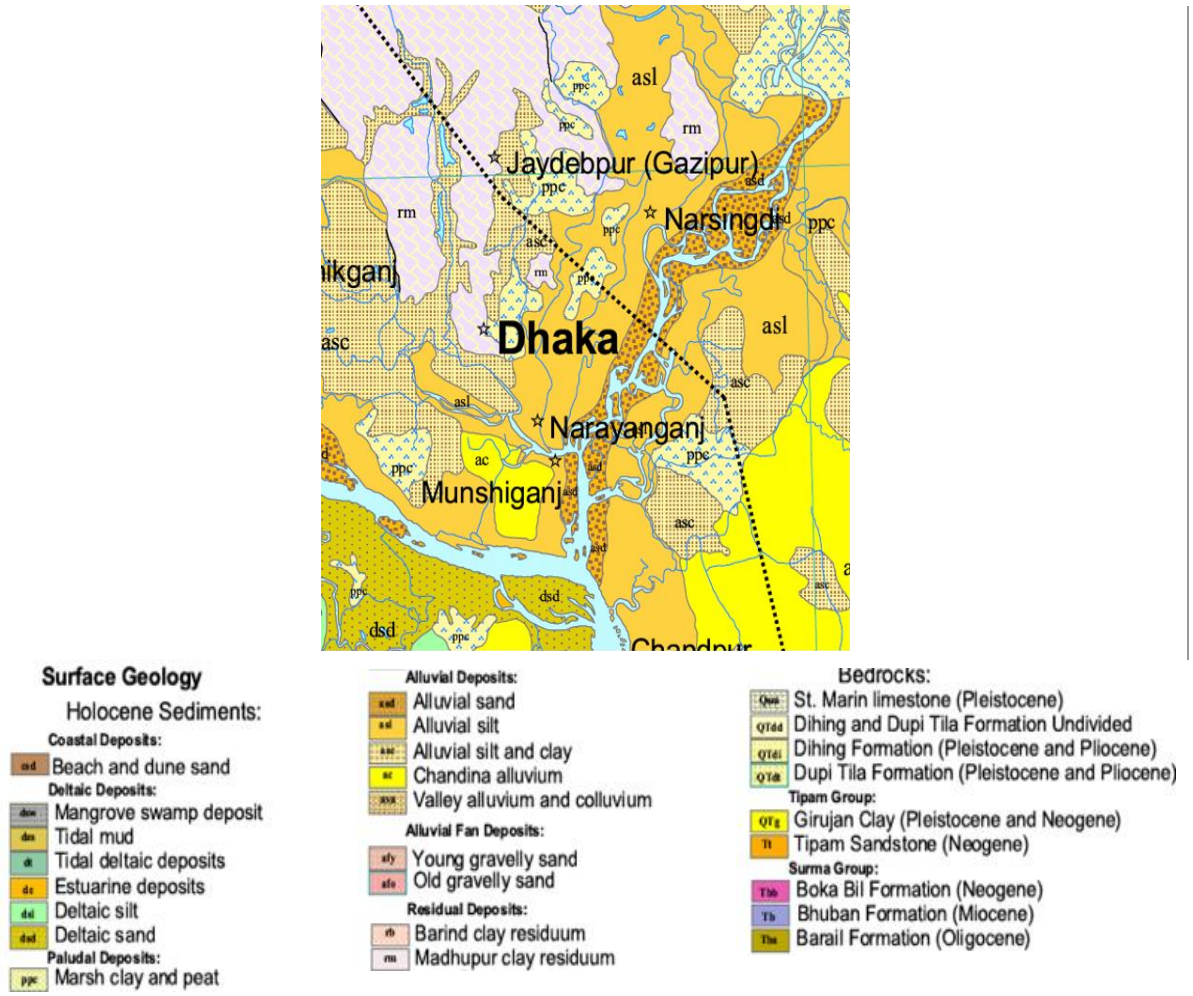


Figure 4-2: Geological Map of Bangladesh

4.2.1.3 Geomorphology

Gazipur is broadly divided into two geomorphic units, the elevated Madhupur Terrace and the adjacent low-lying flood plain. Upper Madhupur Clay deposits mainly consist of sticky clay and silty clay. Rapid expansion of the city is a growing need of the era which encourages people

to construct new and multistoried structures without considering sub-surface geology day after day. Prior to urbanization surface geomorphology and sub-surface geology should be considered for further expansion (both vertical and horizontal).



Source: Reproduced from GSB 1990

Figure 4-3: Geological formation of the GCC area

4.2.1.4 Soil Characteristics

Gazipur consists of red clays which are quite different in appearance and characteristics from adjoining flood plain. Soil is generally light grey and rather silty in nature. The soil conditions in the Madhupur tract are varied and often complex in form. Red lateritic soils at one extreme undeveloped soils of raw Pleistocene clay.

Generally, soils are brown to red brown, slightly to strongly acid, friable clay loams to clays, weathered Madhupur clay substratum to a deeper depth, extensively on the edges of broad level terraces in the Madhupur Tract, allowing of seepage of surface water into the soil.[3]

[3] IEE, Second City Region Development Project (CRDP), Gazipur City Corporation, February 2019: LGED.

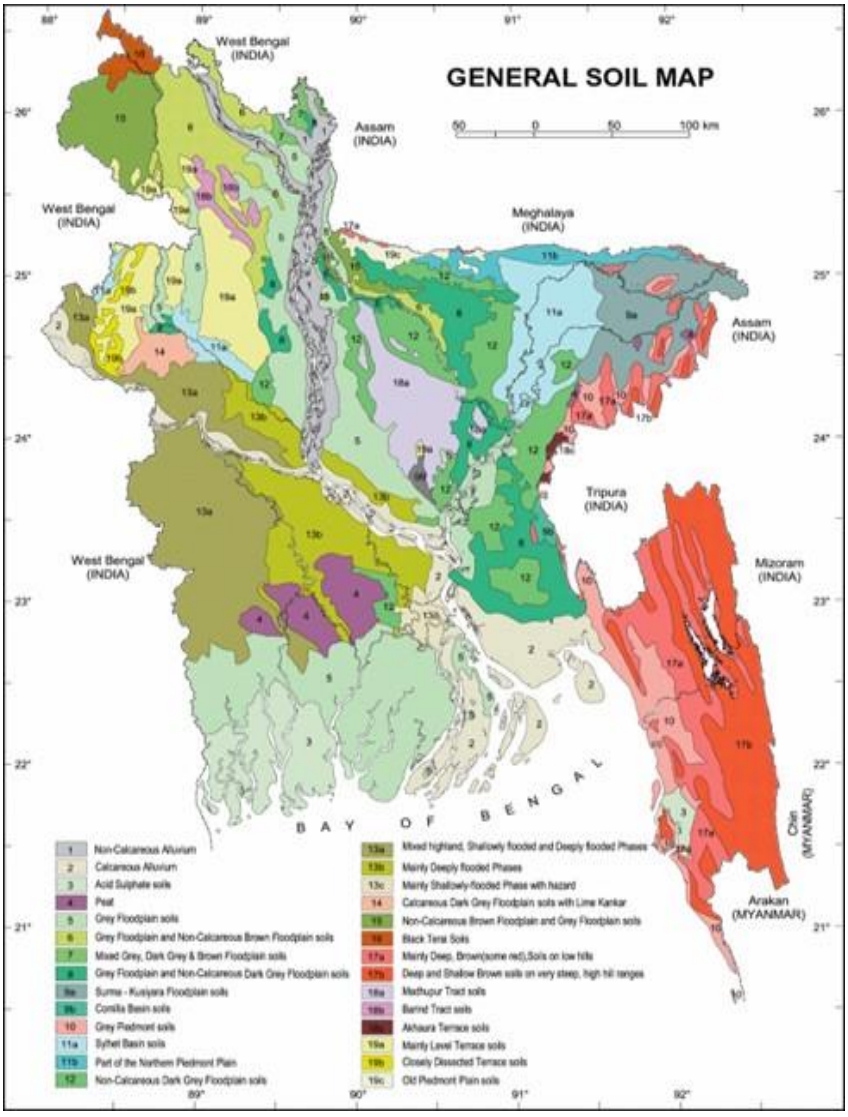


Figure 4-4: Soil Map of Bangladesh. (Source: SRDI 2019)

4.2.1.5 Drainage

The drainage system of Gazipur City Corporation is not up to the marks, like Dhaka city. Up to 2023, GCC has constructed around 670.53 km drains over the city corporation areas which are not sufficient to relief the city people from water logging during monsoon periods.

Figure 4-5: Existing drainage system of GCC

4.2.1.6 Land Use and Land Cover

The study area covers mainly four types of land such as Water body, vegetation, agricultural land and built-up areas. However, the water body mainly perennial rivers, canals/khals, ponds and ditches. The vegetation areas are mainly Sal Forest, deciduous forest, mixed forest, bamboo and agricultural land is of Crop, open field, fallow land, mixed forest lands and built-up areas of Residential, commercial, industrial, road and streets etc.

Table 4-1: Summary of Land Use and Land Covers of GCC from 1973-2021 (Sq.km)

Land Cover Types	1973 Areas	1973 (%)	1991 Areas	1991 (%)	2006 Areas	2006 (%)	2017 Areas	2017 (%)
Vegetation	145.63	46.93	84.85	37.32	24.15	6.99	57.76	16.72
Built-up area	0.0948	0.02	13.17	3.83	133.79	38.74	137.79	39.91
Water bodies	37.59	10.88	58.21	16.85	1.62	0.47	36.83	10.66
Agricultural land	162.03	42.17	89.13	42	185.81	53.8	112.99	32.71

(Source: Land Cover Classification and Change Detection Analyzing Multi-Temporal Landsat Data: A Case Study of Gazipur city, Bangladesh between 1973 and 2017. Arafat. H. M. et.al., 2019).

4.2.1.7 Hydrology and Water Resources

Surface Water System:

Gazipur is very close to Dhaka endorsed by the Turag-Buriganga River in the west and the Balu- Sitalakhya River in the east.

The major perennial river system of Gazipur district is mainly Turag and Brahmaputra which carries the city's wastewater and storm water. But the condition of these rivers is not healthy, riverbed silted out and losing the bearing capacity of monsoon water that's why GCC receives tremendous waterlogging over the monsoon periods. GCC has numerous canals, khals which are being blocked by industry, influencers, and encroachers. However, Bansi River is used for local navigation and for seasonal fishing purposes. The Danka Khal is on the West Side of the Gazipur, is mainly used by the local peoples for navigation, and other purposes. Regarding pollution load concern, Danka khal receives discharges from all the industries situated along the Joydebpur-Tangail road and Konabari Industrial Zone, which include textiles, footwear, food, chemical, pharmaceutical, detergent, and steel re-rolling mills.

Groundwater System:

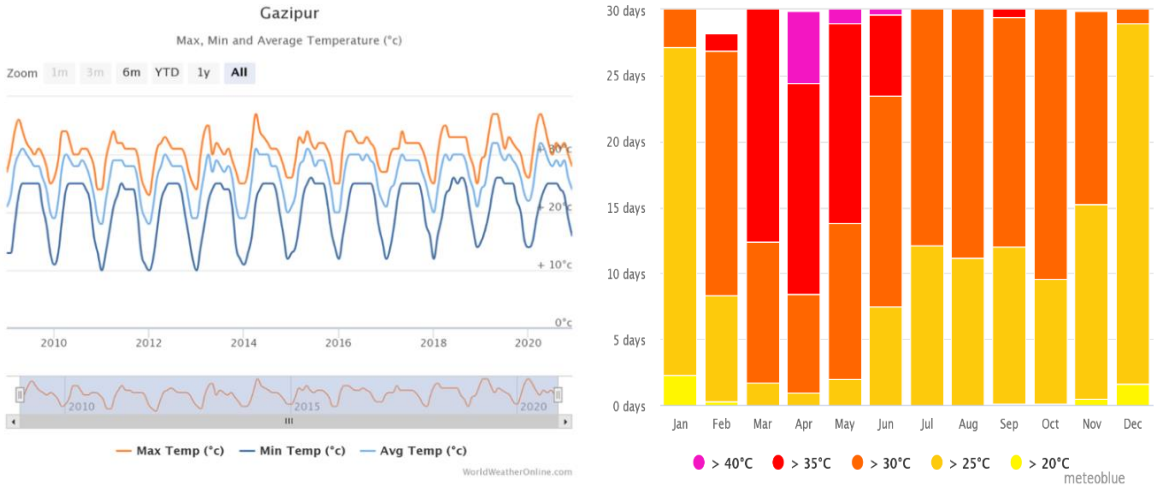
There are three main aquifers in the GCC areas, (i) an upper (composite) aquifer, which can reach depths of 50 m and covered with an upper silty clay layer of less than 20 m. (ii) A middle (main) aquifer of fine to heavy sands, which is generally 10 m to 60 m thick and in most areas is hydraulically connected with the composite aquifer above; and (iii) A deep aquifer of medium, medium-to-fine or medium-to-coarse sand, at depth of below 100 m.

4.2.1.8 Weather and Climate

a. Temperatures

As there are no meteorological stations in GCC, the data collected from the nearby stations including Dhaka station and Tangail station were studied. The monsoon starts in April or May

and continues till September to October. During the monsoon, the temperature varies between 31.8 and 34°C. The temperature falls below 14°C in winter which is spread over November to February. The highest temperature is felt during August when the temperature may be as high as 39°C. These values of temperature are derived from the temperature data from 2010 to 2020 of Bangladesh Agricultural Research Council (BARC).

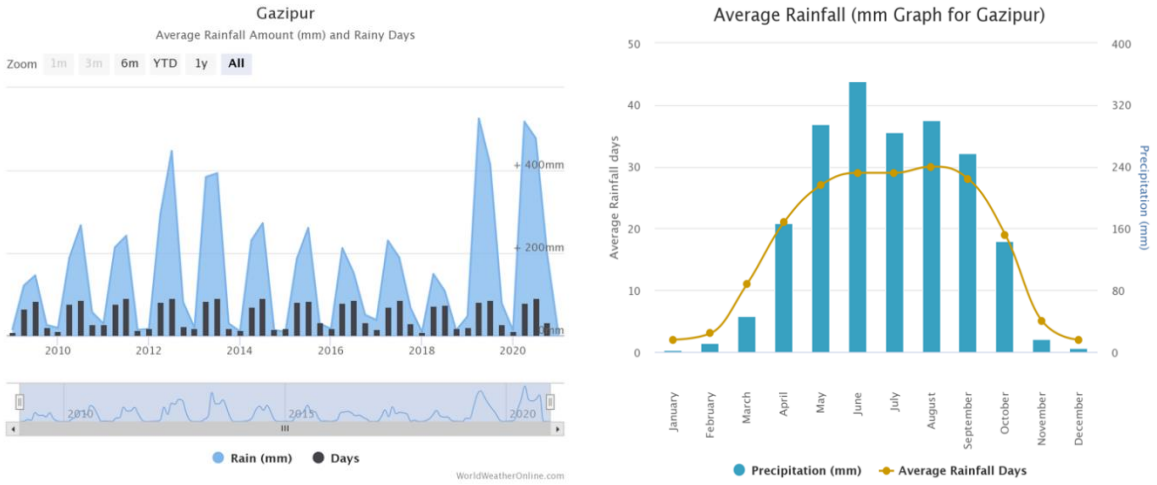


Source: http//worldweatheronline.com, and http//meteoblue.com
Note: Temperature anomaly over the year in GCC area. The record span covers 2010-2020

Figure 4-6: Historical records of Maximum, Minimum and Average Temperature in GCC area

b. Rainfall

The monsoon starts in May and continues till August to September in both stations. The maximum monthly rainfall during May to September varies from 274 mm to 387mm in the Dhaka station. At Tangail station the precipitation is the lowest in January, with an average of 6.07 mm. and the maximum in July, averaging 319.85 mm.

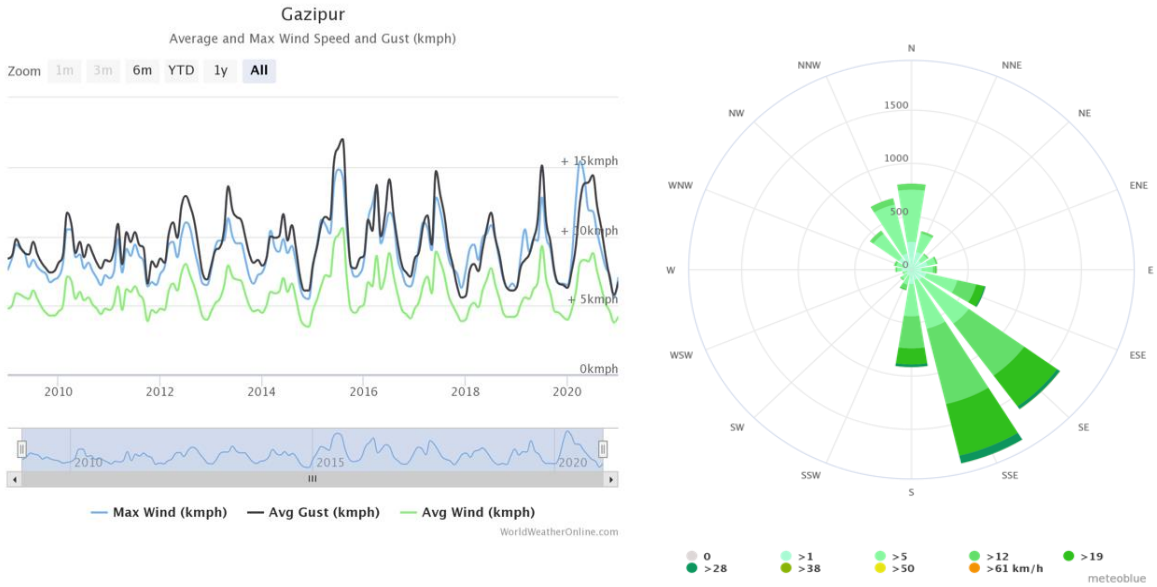


Source: http//worldweatheronline.com
Note: The record span covers 2010-2020.

Figure 4-7: Historical records rainfall in GCC area (Left); Average yearly rainfall distribution in Gazipur (Right)

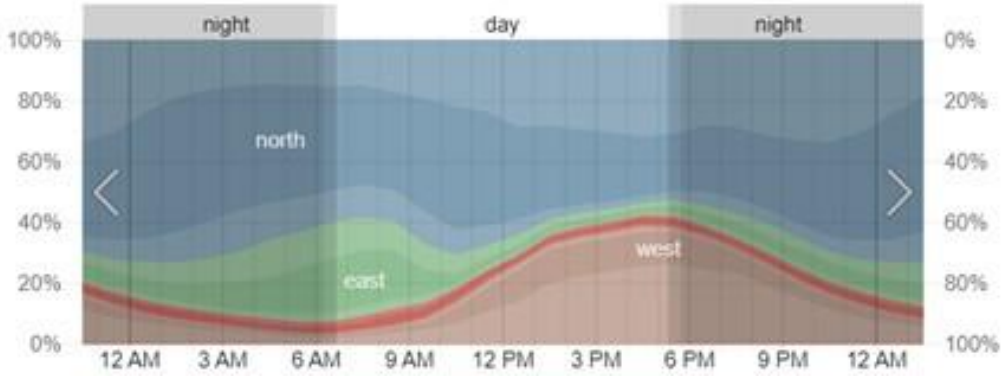
c. Wind speed

Wind speed in the study area represents seasonal variation between the dry season (October to January) and the monsoon season (April to August) in both stations. During the month of October to January, the wind speed shows lower value. In this season, it shows 0.59 to 0.86 ms^{-1} wind speed and in the month of April to July, the wind speed shows 1.59 to 1.87 ms-1 in Dhaka station. In Tangail the maximum wind speed shows up to 1.86 ms^{-1} speed and the lowest speed shows 0.69 ms^{-1}.



Source: http//worldweatheronline.com, and http//meteoblue.com
Note: The record span covers 2010-2020.

Figure 4-8: Historical records of Average, maximum and Gust wind in GCC area (Left); Windrose of the GCC area (Right)



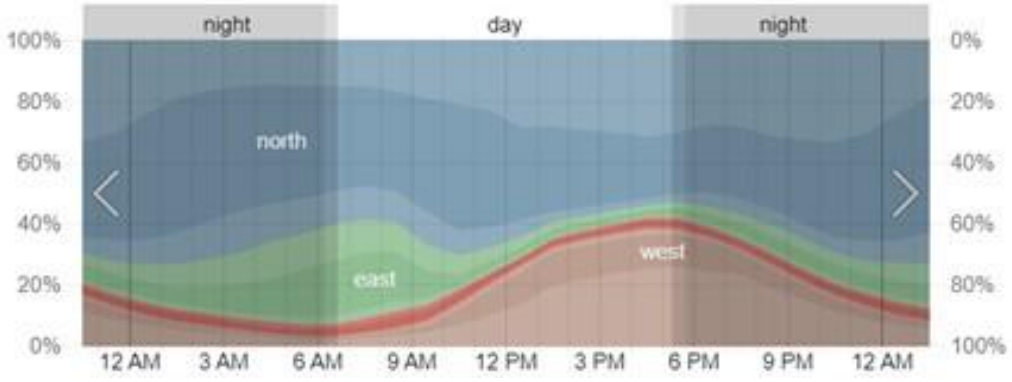


Figure 4-9: Wind directions of GCC recorded on December 24-25, 2023

4.2.1.9 Air Quality

Methodology:

The portable OCEANUS AQM-09 Air Quality Monitoring Station and Lata Envitotech APM 154 Sampler shown in Figure 4-10 was used to collect, measure and document critical pollutants including PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, NH_3, Lead (Pb) and O_3.

Figure 4-10: Ambient Air Quality Monitoring Equipment (OCENAUS: AQM-09) & Single Head

Sampling and analysis of ambient air quality were conducted using the United States Environmental Protection Agency's (USEPA) recommendation. On an hourly basis air quality data was measured and directly recorded onsite for the parameters of PM10, PM2.5, SO2, NO2, CO, NH3 and O3 as shown in Table 4-2. On the other hand, Lata Envitotech APM 154

Sampler was used to collect the Pb sample which was analyzed by using Atomic Absorption Spectroscopy (AAS) method. Different analysis methods, such as Particulates 90° Infrared Light Scattering for particulate matters (PM10, PM2.5), electrochemical sensors for toxic gases (NO2, SO2, CO, NH3 and O3) and Atomic Absorption Spectroscopy (AAS) for Lead (Pb) are integrated in the device.

Table 4-2: Methods of Air Quality Sampling and Analysis

Parameter	Instrument Name	Methods of Testing	Analysis Method
Pb	AIR SAMPLER WITH ATTACHMENT (**SINGLE HEAD**)	In-house Lab, ECIL	Atomic Absorption Spectroscopy (AAS)
PM_{10}	OCENAUS AQM-09	On Site Recording	Light Scattering Nephotometer
$PM_{2.5}$	OCENAUS AQM-09	On Site Recording	Light Scattering Nephotometer
Sulfur dioxide (SO_2)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Oxides of Nitrogen (NO_2)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Carbon monoxide (CO)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Ammonia (NH_3)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical
Ozone (O_3)	OCENAUS AQM-09	On Site Recording	High Sensitivity Electrochemical

As per the national standard of ambient air quality, CO and O_3 were monitored for 8 hours to compare with the national standard of Air Quality Pollution (Control) Rules 2022. For Particulate Matter (PM_{10}, $PM_{2.5}$), gaseous pollutants (NO_2, NH_3 and SO_2) and Lead (Pb), the standard duration is 24 hours. All the primary data were compared with the Government of Bangladesh standards to evaluate the exact air condition of the project corridor.

Table 4-3: Air Quality Monitoring Locations

Subproject Code	Air Quality Code	GPS location	Sample date (Dry season)	Sample date (Monsoon season)	Location descriptions
GCC-RB-1	AAQM-1	23.996080N 90.423648E	24.12.2023-25.12.2023	03.07.2024-04.07.2024	In front of Bongo Touch Auditorium, Gazipur
GCC-SWM-1	AAQM-2	24.02244N 90.33611E	24.12.2023-25.12.2023	03.07.2024-04.07.2024	Baghiya, Konabari, Gazipur

GCC-RB-1

GCC-SWM-1

Figure 4-11: Sampling locations of Air, Noise, surface & groundwater and Soil quality in GCC areas

Results Analysis:

The findings demonstrated that, in the AAQM-2 location, PM2.5 and PM10 levels during the dry season exceeded the national threshold, whereas the AAQM-1 site's results fell short of the standard. The AAQM-2 site's higher values were attributed to a number of factors, including frequent vehicle movement, its location next to the Gazipur to Tangail national

highway, and an open dumping site that is quite close to the sample collection point. These two factors also contributed to the higher PM2.5 and PM10 levels in the collected locations.

Table 4-4: Air Quality Monitoring Results of GCC sites

Sample ID	Sampling season	Parameters								Wind direction
		$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	Pb ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	
AAQM-1	Dry	55.58	90.79	BDL	22.25	40.30	10.88	39.41	1.064	NNE
	Monsoon	13.63	20.21	BDL	3.14	27.91	8.23	37.73	0.49	SSE
AAQM-2	Dry	201.20	230.75	BDL	22	53.91	33.51	50.80	0.25	NNE
National Standard		65	150	0.5	400	100	80	80	05	-

Note: National Standard- Air Pollution (Control) Rules 2022; BDL- Below Detection Level. Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

4.2.1.10 Water Quality

Methodology for Surface Water Collection and Analysis:

During surface water collection USEPA surface water sampling guideline (https://www.epa.gov/quality/surface-water-sampling) was followed. Water samples were collected as grab samples in a pre-washed 5-litre plastic can and a 1-litre sterilized clean PET bottle for complete Physico-chemical tests respectively. Samples wear labeled properly. After that, the samples were submitted to the recommended laboratories i.e. DPHE & BEETLSL for analysis of parameters. After analysis, surface water results have been compared with the national standards [ECR-2023, schedule-2A].

Table 4-5: Methodology of surface water Quality Monitoring

Serial No.	Parameters	Analysis Method	Referred Laboratory	Unit	*Bangladesh Standard, ECR 2023		
					b	d	f
1	pH	pH Meter	DPHE	-	6.5-8.5	6-9	6.5-8.5
2	Temperature	Thermometer	DPHE	°C	-	-	-
3	BOD-5 Day	5 Days Incubation with 20°C	DPHE	mg/L	3 or less	6 or less	12 or less
4	Total Dissolved Solids (TDS)	Multimeter	DPHE	mg/L	1000	1000	1000
5	COD	CRM	DPHE	mg/L	10	50	100
6	DO	Multimeter	DPHE	mg/L	5 or more	5 or more	-
7	Lead (Pb)	AAS	DPHE	mg/L	0.05	0.1	0.1
8	Coliform (Total)	MFM	DPHE	N/100ml	≤50	≤5,000	≤50,000
9	Mercury (Hg)	AAS	BEETLSL	mg/L	0.001	0.004	0.002
10	Nitrate Nitrogen (NO3-N)	UVS	DPHE	mg/L	7.0	7.0	5.0
11	Ammonia	UVS	DPHE	mg/L	0.3	0.3	1.5
12	Total Phosphate (TP)	UVS	DPHE	mg/L	0.5	0.5	2.0
13	Chromium (Total)	AAS	DPHE	mg/L	0.2	0.05	0.1

Methodology for Groundwater Collection and Analysis

The groundwater samples were collected by maintaining standard procedures and after collection, the samples were placed into appropriate and labeled black bottle and kept in an ice cooler. Then the samples were submitted to the recommended laboratory i.e**. DPHE & BEETLSL** for analysis of parameters. Groundwater results have been compared with national standard [ECR, 2023-Schedule 2 (B)].

Table 4-6: Methodology of Groundwater Quality Monitoring

Sl. No.	Parameter	Unit	Analysis Method	Referred Laboratory	*Bangladesh Standard, ECR 2023
1.	pH	-	pH Meter	DPHE	6.5-8.5
2.	Arsenic	mg/L	AAS	DPHE	0.05
3.	COD	mg/L	CRM	DPHE	-
4.	DO	mg/L	Multimeter	DPHE	-
5.	Hardness as $CaCO_3$	mg/L	Titrimetric	DPHE	500
6.	Lead (Pb)	mg/L	AAS	DPHE	0.01
7.	Odor	Odorless	Threshold Method	DPHE	Odorless
8.	Oil & Grease	mg/L	(APHA 23RD EDN. 2017 (5520-B)	BEETLSL	0.01
9.	Mercury	mg/L	AAS	BEETLSL	0.01
10.	Sodium (Na)	mg/L	AAS	DPHE	200
11.	Temperature	°C	Thermometer	DPHE	20-30℃
12.	TSS	mg/L	Gravimetric	DPHE	10
13.	TDS	mg/L	Multimeter	DPHE	1000
14.	Total Coliform (TC)	N/100 ml	Membrane Filtration Method (MFM)	BEETLSL	0
15.	Fecal Coliform (FC)	N/100 ml	Membrane Filtration Method (MFM)	BEETLSL	0
16.	Cr (Total)	mg/L	AAS	DPHE	0.05

Location of Surface water Samples:

Table 4-7: Monitoring locations of Surface Water and Groundwater Samples in GCC areas

Monitoring Items	Sampling site	Sample ID	GPS locations	Sampling Date (Dry season)	Sampling Date (Monsoon season)	Nature of the sampling sites
Surface water quality	GCC-RB-1	SW-1	23.996048N 90.422451E	25.12.2023	03.07.2024	Pond, Beside Bango Touch Auditorium, Gazipur.
	GCC-SWM-1	SW-2	24.022408N 90.341764E	24.12.2023	03.07.2024	River, Baghiya, Konabari, Gazipur
Groundwater quality	GCC-RB-1	GW-1	23.995968N 90.423381E	25.12.2023	03.07.2024	Deep Tube well, Beside Bongo Touch Auditorium, Gazipur
	GCC-SWM-1	GW-2	24.022461N 90.334411E	24.12.2023	03.07.2024	Deep Tube Well, Baghiya,

Monitoring Items	Sampling site	Sample ID	GPS locations	Sampling Date (Dry season)	Sampling Date (Monsoon season)	Nature of the sampling sites
						Konabari, Gazipur

Results Analysis of Surface water quality

The findings demonstrated that, during the dry season at the SW-1 location, BOD5 matched the criterion for water usable for cooling and other process industries with ECR 2023; however, during the wet season, the value was 4 mg/l, which is comparable to the criteria for water usable for fisheries. In the wet season, the water quality improves significantly compared to the dry season, with COD values of 20 mg/l, which is equivalent to the value of a source of drinking water for supply after conventional treatment of ECR 2023. COD values also matched with the criteria of water usable by various process and cooling industries after treatment of ECR 2023.

In the dry season, the Coliform (Total) value in the SW-1 location was higher at 112. N/100 ml than the normal value of ECR 2023; however, during the wet season, the situation improved to 48 N/100 ml. The Nitrate value in the dry and wet seasons was 1.5 mg/l and 1.2 mg/l, respectively, which was lower than the value set by ECR 2023 of Water usable by various process and cooling industries. The remaining values fall within the ECR 2023 standard. The specifics are provided in Table 4-8.

Table 4-8: Surface Water Quality of GCC sites

Parameters	Sampling period (Season)	Unit			ECR, 2023 Standard*					
			SW-1	SW-2	a	b	c	d	e	f
pH	Dry	-	7.4	7.2	6.5-8.5	6.5-8.5	6-9	6-9	6.5-8.5	6.5-8.5
	Monsoon		7.5	-						
Temperature	Dry	°C	22.5	22.4	-	-	-	-	-	-
	Monsoon		25.3	-						
BOD_5	Dry	mg/l	12	**11**	≤6	≤3	≤3	≤6	12	≤12
	Monsoon		4	**-**						
TDS	Dry	mg/L	230	234	1000	1000	1000	1000	1000	1000
	Monsoon		207	-						
COD	Dry	mg/l	56	52	10	10	25	50	100	100
	Monsoon		20	-						
DO	Dry	mg/l	3.60	3.45	≥6	≥5	≥5	≥5	≥1	-
	Monsoon		6	-						
Lead (Pb)	Dry	mg/L	0.006	0.004	0.03	0.05	0.03	0.1	0.1	0.1
	Monsoon		0.002	-						
Coliform (Total)	Dry	N/100ml	112	96	≤100	≤50	≤5,000	≤5,000	-	≤50,000
	Monsoon		48	-						
Mercury (Hg)	Dry	mg/L	< 0.001	< 0.001	0.001	0.001	0.001	0.004	0.05	0.002
	Monsoon		< 0.001	-						
Nitrate Nitrogen (NO3-N)	Dry	mg/L	1.5	1.7	0.1	7.0	0.3	7.0	2.7	5.0
	Monsoon		1.2	-						
Ammonia	Dry	mg/L	0.36	0.40	0.1	0.3	0.3	0.3	2.7	1.5
	Monsoon		0.24	-						
	Dry	mg/L	0.70	0.64	0.1	0.5	0.5	0.5	-	2.0

Parameters	Sampling period (Season)	Unit			ECR, 2023 Standard*					
			SW-1	SW-2	a	b	c	d	e	f
Total Phosphate (TP)	Monsoon		0.80	-						
Chromium (Total)	Dry	mg/L	0.003	0.004	0.02	0.2	0.02	0.05	0.1	0.1
	Monsoon		0.001	-						

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.
Note:
a. Source of drinking water for supply only after disinfecting
b. Water usable for recreational activity
c. Source of drinking water for supply after conventional treatment
d. Water usable for fisheries
e. Water usable by various process and cooling industries

Groundwater Quality both Dry and Monsoon Seasons

The groundwater quality in both seasons is within the standard limit of ECR 2023. But compared to the dry season, the wet season offers far better conditions, with clean, unpolluted groundwater.

Table 4-9: Groundwater Quality of GCC sites

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-01	GW-02	
pH	Dry	-	7.5	7.2	6.5-8.5
	Monsoon		7.3	-	
Arsenic	Dry	mg/L	0.001	0.001	0.05
	Monsoon		0.001	-	
COD	Dry	mg/L	36	40	-
	Monsoon		4	-	
DO	Dry	mg/L	4.60	4.48	-
	Monsoon		6.00	-	
Hardness as $CaCO_3$	Dry	mg/L	130	185	500
	Monsoon		139	-	
Lead (Pb)	Dry	mg/L	0.002	0.003	0.01
	Monsoon		0.001	-	
Odor	Dry	Odorless	0	0	Odorless
	Monsoon		0	-	
Oil & Grease	Dry	mg/L	< 0.01	< 0.01	0.01
	Monsoon		<0.01	-	
Mercury	Dry	mg/L	< 0.001	< 0.001	0.01
	Monsoon		< 0.001	-	
Sodium (Na)	Dry	mg/L	44	27	200
	Monsoon		28	-	
Temperature	Dry	°C	22.5	22.6	20-30℃
	Monsoon		25.1	-	
TSS	Dry	mg/L	1	1	10
	Monsoon		1	-	
TDS	Dry	mg/L	166	235	1000

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-01	GW-02	
	Monsoon		165	-	
Total Coliform (TC)	Dry	N/100 ml	0	0	0
	Monsoon		0	-	
Fecal Coliform (FC)	Dry	N/100 ml	0	0	0
	Monsoon		0	-	
Cr (Total)	Dry	mg/L	0.001	0.002	0.05
	Monsoon		0.001	-	

Source: Baseline Survey, EIA study, December 2023 and July 2024.

4.2.1.11 Noise & Vibration level

Methodology of Noise Level Analysis:

Noise levels were measured at Eight (08) locations in the monitoring period from the project boundary on 7 to 8, 12 to 13, 20 to 21, and 24 to 25 December 2023. The Lutron SL-4033DS noise level meter shown in Table 4-12 was used for noise level monitoring. Therefore, the survey team conducted noise measurements from different areas and stations same as the locations for Air Quality Monitoring. The parameters were L-max, L-min, Leq-day, Leq-night. Noise level monitoring was carried out during daytime (6.00 AM to 9.00 PM) and at night-time (9.00 PM to 6.00 AM). Measurements were taken at 1-min intervals over the period. The following Table 4-10 mentions the instrument character that was used for noise level monitoring and method of measurement. The device recorded data throughout the monitoring period. After getting the raw data from the device, an appropriate formula was applied to calculate Leq for monitor location.

Figure 4-12: Noise Level Monitoring Equipment (Lutron SL-4033DS)

Table 4-10: Methods of Noise Level Monitoring

Parameter	Device Name	Laboratory	Methods of Measurement
L-max, L-min, Leq-day, Leq-night	Lutron SL- 4033DS	In House	Analysis in the computer after downloading all data

Methodology of Vibration Level Analysis:

Vibration levels were measured at Eight (08) locations for the 30-minute duration on 07, 12, 20 and 24 December 2023 during daytime (peak hours) only in the monitoring period. Within this duration, Velocity data for 10 minutes, Acceleration data for another 10 minutes, and Displacement data for the last 10 minutes were taken. The monitoring was carried out along the project corridor on 7 to 8, 12 to 13, 20 to 21, and 24 to 25 December respectively.

The HTC VB- 8205 meter shown in Figure 4-13 was used for vibration level monitoring. The following Table 4-11 mentions the instrument character that was used for vibration level monitoring and method of measurement. The device recorded data throughout the monitoring period. After getting the raw data from the device, analysis was conducted in ECIL In-house laboratory.

Figure 4-13: Vibration Level Monitoring Equipment (HTC VB 8205)

Table 4-11: Methods of Vibration Level Monitoring

Parameter	Device Name	Laboratory	Methods of Measurement	International Standard (BS 5228-2:2009)
Velocity, Acceleration and Displacement	HTC VB 8205	In House	Analysis of Data	Vibration might be just perceptible in residential environments

Table 4-12: Noise and Vibration level monitoring locations of GCC areas

Subproject Code	Noise & Vibration level Code	GPS location		Sample date (Dry season)	Sample date (Monsoon season)	Location descriptions
GCC-RB-1	ANLM-1; VLM-1	23.996085N	90.423518E	24.12.2023 - 25.12.2023	03.07.2024-04.07.2024	In front of Bongo Touch Auditorium, Gazipur
GCC-SWM-1	ANLM-2; VLM-2	24.02244N	90.33611E	24.12.2023 - 25.12.2023	03.07.2024-04.07.2024	Baghiya, Konabari, Gazipur

Results Analysis:

According to the Noise Pollution (Control) Rules of 2006, the average noise level in the recorded sites appears to be in the mixed zone category, based on the data. Due to several factors such as frequent vehicle movement, commercial activity in mixed areas, people's mobility and interventions, etc., the noise level is typically higher than the average value of national standards.

However, the vibration was only recorded during the dry season. This was done to ensure that the majority of vibration frequencies related to construction were audible even in the most delicate of circumstances. People are less sensitive to vibration at lower frequencies. An oscillating motion that can be expressed in terms of acceleration, velocity, or displacement is called vibration. Among metrics, the displacement makes the most sense. The displacement of a vibrating floor is only the amount of distance a point moves from its initial, stationary position. Acceleration is the rate at which speed changes, while velocity is the floor movement's instantaneous speed. If vibration is discovered to be significant and in a shaking state during the construction phase, that could be cause for alarm. That would be catastrophic for surrounding structures throughout the construction phase, with a spike in lives lost and livelihoods destroyed. Additionally, Bangladeshi Rules & Regulations do not yet have any vibration norms in place.

Table 4-13: Noise level monitoring results of GCC sites

Sampling ID	Monitoring Time	Sampling period (Season)	Noise level [dB(A)]			*Noise Pollution Control Rules 2006	Category
			L_{eq}	L_{max}	L_{min}		
ANLM-1	Day	Dry	65.29	85.03	37.43	60	Mixed
	Night		55.56	71.0	30.3	50	
	Day	Monsoon	60.49	80.23	34.03	60	Mixed
	Night		52.67	68.1	32.1	50	
ANLM-2	Day	Dry	63.00	82.8	37.5	60	Mixed
	Night		52.68	68.1	31.2	50	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

Table 4-14: Vibration level monitoring results of GCC sites

Code	Sampling period	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	SD	Mean Value	Max.	Min.	SD	Mean Value	Max.	Min.	SD	Mean Value
VLM-1	Dry	0.39	0.07	0.151	0.177	0.0	0.0	0.000	0.000	0.0	0.0	0.000	0.000
	Wet	0.0	0.0	0.000	0.000	0.2	0.1	0.009	0.199	0.031	0.023	0.001	0.023
VLM-2	Dry	0.91	0.07	0.295	0.316	0.0	0.0	0.000	0.000	0.058	0.0	0.018	0.012

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

4.2.1.12 Soil Quality

Methodology of Soil Sampling and Analysis

Soil samples were collected from Eight (08) location of the project corridor on 7, 8, 12, 23, 20, 24 and 25 December 2023, and July 2024 respectively. The samples were collected in a

composite sampling method by Auger boring below the surface level. The Hand auger shown in Figure 4-14 was used for soil sampling. The samples were first placed in zipped lock plastic bags and then transferred to appropriate plastic labeled jars. The soil samples collected were tested from the recommended laboratory i.e. **SRDI and BEETLSL**. The analysis methods of different parameters of soil are given in the following Table 4-15.

Figure 4-14: Soil Sampling Equipment (Hand Auger)

Table 4-15: Methods of Soil Quality Analysis

Sl. No.	Parameter	Unit	Referred Laboratory	EPA Guideline*
1.	PH	--	SRDI	--
2.	Chromium (Cr)	PPM	SRDI	5.00
3.	Iron (Fe)	PPM	SRDI	--
4.	Lead (Pb)	PPM	SRDI	5.00
5.	Magnesium (Mg)	meq/100g Soil	SRDI	--
6.	Cadmium (Cd)	PPM	SRDI	1.00
7.	Phosphate (PO_4)	PPM	SRDI	--
8.	Organic Matter (OM)	%	SRDI	--
9.	Nitrogen (N)	%	SRDI	--
10.	Oil & Grease	PPM	BEETLSL	--

*Standard: EPA Guideline; PPM-Parts per Million, Primary Data Source: Soil Resource Development Institute (SRDI) and BEETLSL Laboratory, February 2024

Table 4-16: Location of soil samples of GCC areas

Subproject code	Sample ID	GPS Location	Dry season date	Wet season date	Site descriptions
GCC-RB-1	SQ-1	23.995968N 90.423381E	25.12.2023	03.07.2024	In front of Bongo Touch Auditorium, Gazipur
GCC-SWM-1	SQ-2	24.02236N 90.33633E	24.12.2023	03.07.2024	Agricultural Land, Baghiya, Konabari, Gazipur

Results Analysis

The soil quality comparatively better in wet season than the dry season, all the values are decreasing trend in the wet season samples it may cause of increasing surface water volume in the surface water sources due to heavy downpour and flood waters entering the surface water system. However, no standards of soil quality have been established by the rules and regulations of Government of Bangladesh. Therefore, EPA standards have been used to analyze the soil quality which are environmental pollutant reference values (i.e., concentrations in environmental media) used in environmental remediation, investigation and cleanup. In conclusion, this standard is used worldwide to analysis the soil quality to preserve the soil from damage and repair past damage caused by human activity.
However, among all the parameters, standards are only set for Cr, Pb and Cd by EPA guidelines. However, the value of Cr and Pb crossed the standard level basically as most of the soil sampling point are beside the road or near the agricultural land thus Cr and Pb may come from the use of pesticide and urban runoff.

Table 4-17: Soil Quality Monitoring Results of GCC sites

Sl. No.	Parameters	Unit	Sample ID			EPA Guideline*
			SQ1/77		SQ2/78	
			Dry season	Wet season	Dry season	
1.	P^H	--	7.5	6.54	4.5	--
2.	Chromium (Cr)	PPM	29.06	21.92	26.05	5.00
3.	Iron (Fe)	PPM	95.10	1.88	58.25	--
4.	Lead (Pb)	PPM	12.40	5.26	17.34	5.00
5.	Magnesium (Mg)	meq/100g Soil	1.32	0.31	1.03	--
6.	Cadmium (Cd)	PPM	0.30	0.08	0.21	1.00
7.	Phosphate (PO_4)	PPM	16.57	-	5.44	--
8.	Organic Matter (OM)	%	1.55	0.54	1.72	--
9.	Nitrogen (N)	%	0.09	0.03	0.10	--
10.	Oil & Grease	PPM	<1.0	<1.0	<1.0	--

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

4.2.1.13 Sources of environmental pollution

The potential sources for environmental pollution in the GCC areas are mainly- deteriorating of air quality caused by heavy traffic, construction works and open dumping sites of waste. Noise level has been declined due to the industrial operations, as the GCC is mostly industrial-prone areas, heavy traffic, construction projects like BRT, flyover, and railways. Water resources, both surface and groundwater are also contaminated by industrial effluent, open dumping of solid wastes and construction materials. Local biodiversity is prone to danger caused by industrial effluent, unmanageable solid wastes, heavy traffic, and population intensity etc.

4.2.2 Narayanganj City Corporation (NCC)

4.2.2.1 Topography

NCC is a land of mixed topography. The present urbanized areas and the levees of the Shitalakhya, the Buriganga and the Old Brahmaputra rivers are of comparatively higher elevation.[4] Narayanganj is located mostly on the river deposits at the southern fringe of the Madhupur Tract, which is elevated Pleistocene inlier. Large parts of the city are located on this inlier, which is surrounded by very young riverine sediments occupying the surrounding valleys. The elevation of the inlier tract varies from 2 to 14 m above mean sea level, and the drainage patterns within can be either dendrites or trellis. The terraces are surrounded by the Ganges-Meghna floodplain in the south, the old Brahmaputra floodplain in the east, and the Jamuna floodplain in the west.

The topographic elevation in the area is reflected in specific landforms such as “high” lands, lowlands, depressions, and abandoned channels. Around the outskirts of Narayanganj, the rivers Shitalakhya and Dhaleswari consist of low-lying alluvial plains. The average elevation is less than 2 m above mean sea level. Broad streams cut through the central high area and fall into this unit. The broad streams are locally known as khals, and the broad depressions are called beels.

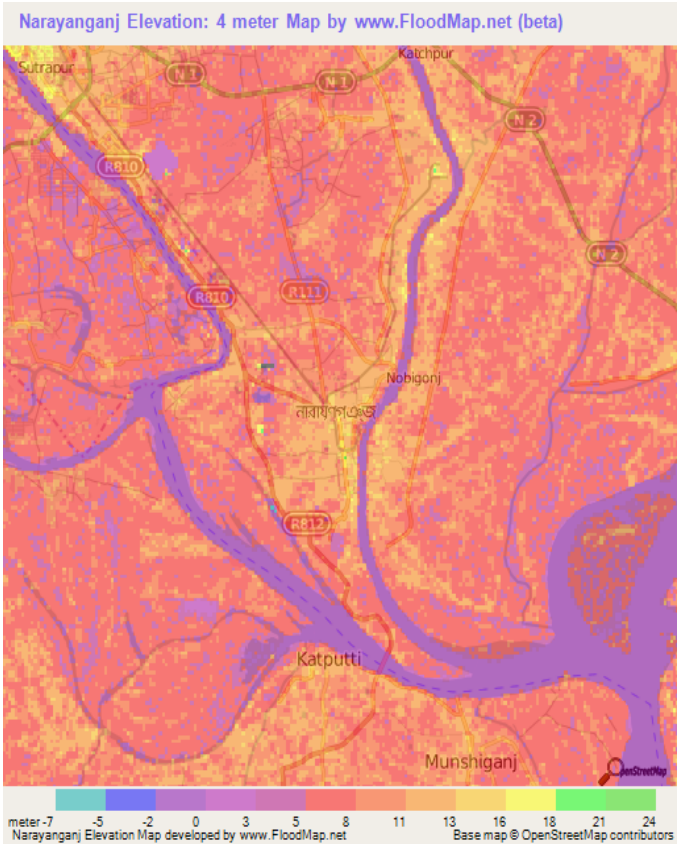


Figure 4 15: Topographical Map of NCC areas

[4] BARC, Bangladesh agricultural research council, September 2015. URL: http://www.barc.gov.bd/ (accessed in Jan 2021)

4.2.2.2 Geology

Geologically Narayanganj City Corporation (NCC) lies on the edge of the Madhupur Tract and the Holocene floodplain deposits from the aquifers (Figure 4-1). Geologically it is a terrace from 1-10 meters above the adjacent floodplains. Though in its present form it is of the Pleistocene age, its origin may be in the late Miocene, when the Bengal Basin was being filled rapidly. Unlike the Barind Tract. The main section stretches from just the south of Jamalpur, in the north, to Fatullah of Narayanganj in the south. The Madhupur Clay is the oldest sediment exposed in the area having characteristic topography and drainage. The major geographic units of the city are the high land or terrace, the low land or floodplain, depressions, and abandoned channels. Low lying swamps and marshes located in and around the area are other major topographic features[5].

4.2.2.3 Geomorphology

Geomorphologically NCC is divided into 3 areas: high land, medium and low-lying areas. High land areas are mainly in Chashara, part of Fatullah, and Kadom Rasul areas, medium land is mainly in part of Siddirganj and Fatullah. However, low land consists of more than 50% areas of the city corporation, including all city corporation's jurisdiction areas.

Considering the high land and low-lying areas are mainly caused by erosional and tectonic process, uplift, and faulting by down cutting, sediments characterized by terrace of Madhupur clay and with dully type depressions. Low-lying areas usually get monsoon floods by Shitalaskhya River.

4.2.2.4 Soil Characteristics

The alluvial soils of these floodplains mainly consist of ridges of loamy material like silty clays and silty sands with large areas of shallow clays in the basins. The soil pattern can become more irregular close to river channels due to more recent deposits.

The Dupi Tila sands aquifer is the main source of water for the area. Madhupur Clay overlies the aquifer with a thickness of 8 - 45m (avg. 10m). The aquifer varies in thickness from 100 - 200m (avg. 140m). Ground water table lies at a depth of 15 - 20m. Under the present conditions, the peripheral rivers act as sources of recharge as the Dupi Tila sands are exposed along the riverbeds. Other sources of recharge are vertical percolation of rain and flood water, leakage from water mains and the sewer system, and seepage from the standing water bodies within the area.

The soils of the Tract have developed largely by Madhupur Clay, which are nutrient poor and somewhat acidic. They are red or brown in color. In most places the changes from the floodplains to the Tract is quite sharp, but in some places the floodplain soils overlie the gently inclining edges. The Madhupur Tract is extensively dissected, with narrow or broad valleys extending deep into the level landscape and the Drainage pattern is clearly dendrites.

4.2.2.5 Drainage

The drainage system in the NCC area mainly led by Sitalakhya River, and Kashipur River, of its 35 kilometers river flows from North to South direction. In addition, it has around 55.5 km canals mainly Pagla khal, Mizmizi khal, Baburail canal are the most prominent canals with one

[5] ICGP, Final Report, Volume 2, NCC Edition, March 2014. LGED, People's Republic of Bangladesh.

freshwater lake of Jimkhana (length 0.619 km). The NCC areas are generally a low-lying area and have opposite directional flows towards Sitalakhya River, local ponds, ditches and marsh lands pertained of a good water reservoir during monsoon. All Natural channels (rivers, canals), water retention area, large ponds and other specific waterbody should be preserved and re-excavated to smooth flow of water and to minimize water logging problem of NCC area. The list of water bodies in NCC is given in Table 4-18**.**

Table 4-18: Length of water body in NCC areas

Type of Water body	Length of water body (km)
River	35
Lake	0.62
Canal	55.5
Borrow Pit	8
Total	99.13

Source: Physical Feature Survey, 2015-16

4.2.2.6 Hydrology and Water Resources

Surface Hydrology:

The main surface water sources in the NCC areas are mainly of Sitalakhya and Dhaleswary River, surrounded by two different sides of NCC. NCC is considered as rising of industrial based area, so, all the effluents and wastes are directly discharging to the above two Rivers and polluted them significantly. But these rivers are the big sources of fishing with considering the river transport ways for carrying materials, goods, and accessories for different industries built along the river. There is an important canal in the city, the Baburail Khal, which connects the river Sitalakhya and Dholeswary. The river Shitalakhya bisects the city into two parts, and it flows through the elongated direction of it. The river Dhaleshwari flows at the Western part of the City Corporation. The Buriganga River and the Balu River are contributing to the Dhaleshwari and the Shitalakhya respectively from the up.

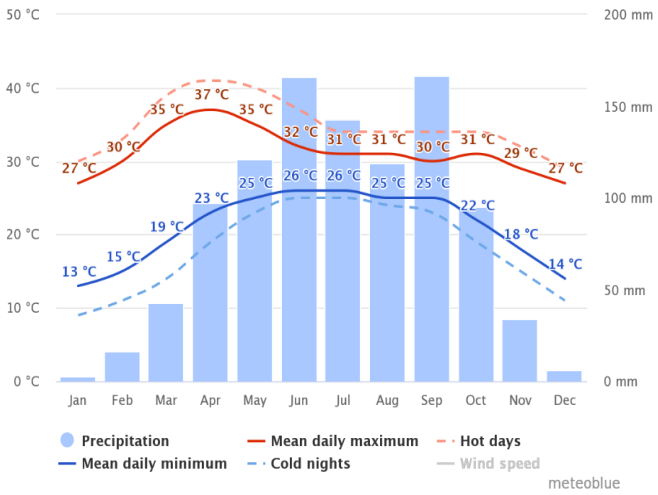
Groundwater Hydrology:

The increasing demands of water for rapidly growing urbanization and industrialization in NCC meets from the shallow Holocene alluvial and deeper DupiTila aquifers.

Ground water is available here in plenty and the water table does not go beyond suction limit throughout the year. Groundwater is the main source of potable water in the area. Deep groundwater is not saline and normally arsenic and iron free. In earlier, local people typically get the water supply by DWASA supply but now NCC is supply groundwater to the city dwellers, with growing capacity to install production tube wells (PTWs) to ensure future demand.

4.2.2.7 Weather and Climate

The climate of the subproject in NCC areas are basically Tropical Monsoon characterized by the warm, humid summers and cool and dry winters. However, generally the weather is sub-tropical, with a warm climate all year round. The annual average temperature varies from maximum 36°C to minimum 12.7°C and the average annual rainfall is 2376 mm. Figure 4-16 shows the annual distribution of the temperature of NCC and monthly precipitation records.



Source: http//meteoblue.com (accessed in January 2021)
Note: The record span covers 2010-2020.

Figure 4-15: Historical records of Maximum, Minimum Temperature, hot and cold nights and precipitation amount in NCC area

The average annual relative humidity is 65.8% and average monthly relative humidity ranges from 45% in March to 79% in June shown in Figure below. According to the statistics of the wind data from the Bangladesh Meteorological Department (BMD), wind direction changes by month. Nevertheless, the northwest, south, and northeast winds are predominant.

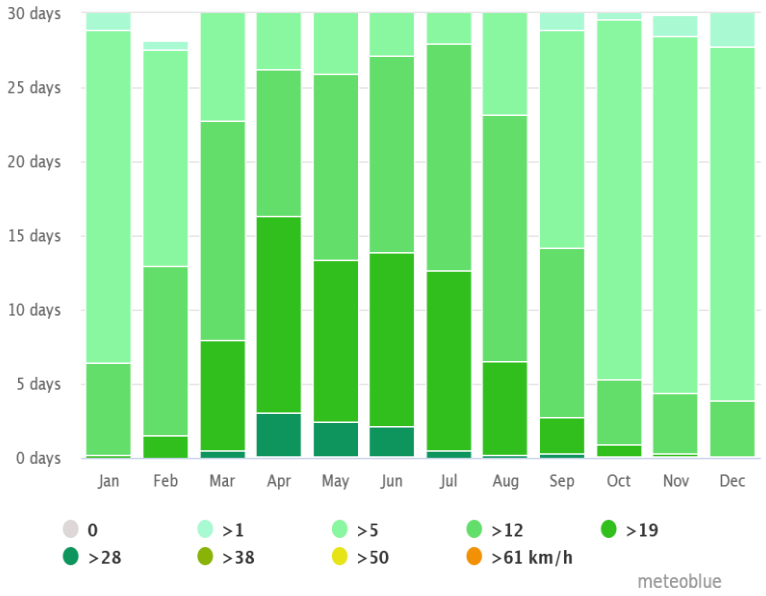


Figure 4-16: Historical records of wind speed in NCC area

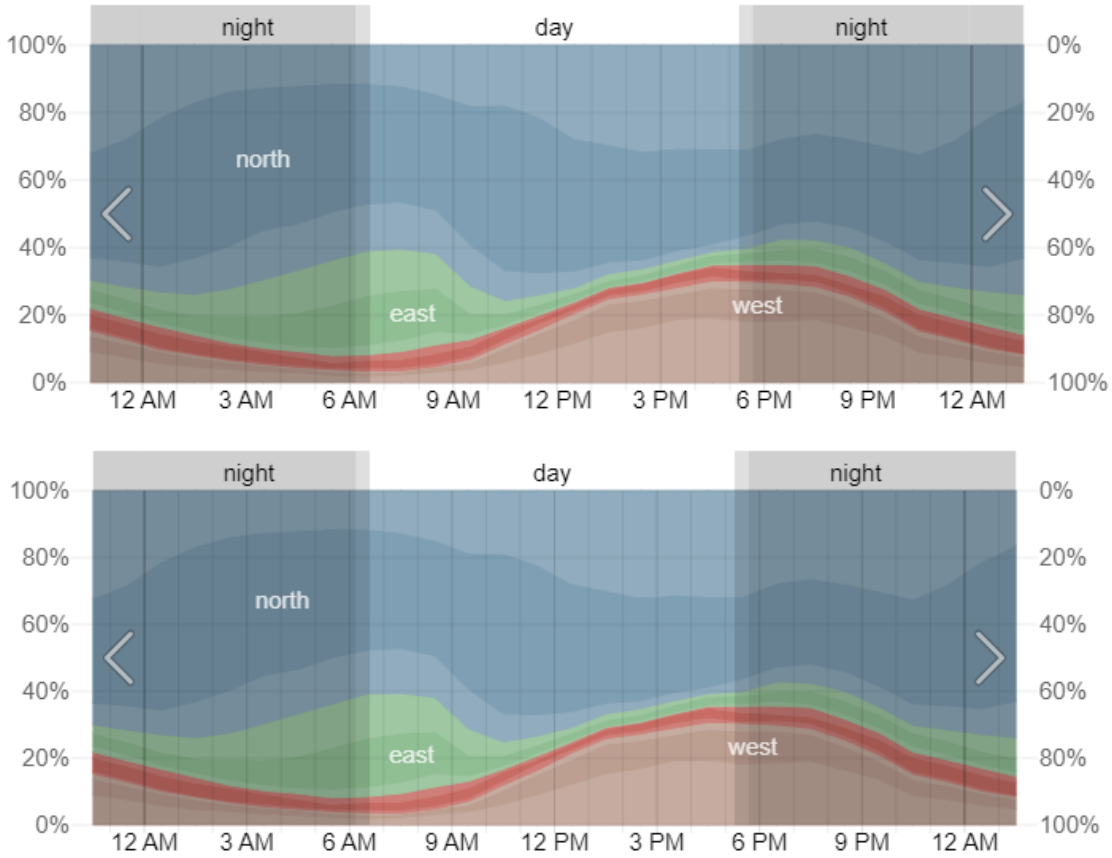


Figure 4-17: Wind directions of NCC recorded on 20-21 December 2023

4.2.2.8 Air Quality

Methodology is described in section 4.2.1.9.

Sampling Locations: Samples were collected from two locations of NCC both dry season (December 2023) and wet season (June 2024). The detail sampling locations are depicted in Table 4-19.

Table 4-19: Sampling locations of Ambient Air Quality in NCC areas

Subproject Code	Air Quality Code	GPS location		Sample date (Dry season)	Sample date (Monsoon season)	Parameters	Location descripitons
NCC-SWM-1	AAQM-3	23.675250N	90.497801E	20.12.2023-21.12.2023	01.07.2024-02.07.2024	$PM_{2.5}$, PM_{10}, Pb, NH_3, O_3, SO_2, NO_2, CO	Beside Landfill Site, Jalkuri, Narayanganj
NCC-SWM-2	AAQM-4	23.596640N	90.501757E	20.12.2023-21.12.2023	01.07.2024-02.07.2024		Alaminnagar, landfill site, Narayanganj.

Table 4-20: Air Quality Monitoring Results in NCC areas

Sample ID	Sampling season	Parameters								Wind direction
		$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	Pb ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	
AAQM-3	Dry	126.72	218.67	BDL	42.25	33.34	29.71	49.76	1.02	NE

	Monsoon	26.29	35.71	BDL	3.04	14.05	1.17	25.45	0.78	SE
AAQM-4	Dry	172.04	178.5	BDL	25.62	15.09	60.33	13.73	0.59	NE
	Monsoon	41.71	70.70	BDL	15.49	23.03	21.32	36.95	0.50	SE
National Standard		65	150	0.5	400	100	80	80	05	-

Results Analysis:

It was pouring during the rainy season when the samples were being recorded and the monitoring was taking place. Because precipitation may remove PM2.5, PM10, and other air pollutants as well as some particulate matter, it can effectively improve air quality by lowering the concentration of pollutants in the air, purifying it, and enhancing its quality.

In summary, every parameter measured at the monitoring sites was found to be within the BD/DOE standard range, indicating that there is no chance of any adverse effects on the vegetation, human health, or project working areas.

4.2.2.9 Water Quality

The methodology is the same as previously described in section 4.2.1.10.

Monitoring Locations: The monitoring locations of groundwater and surface water quality were assessed in two locations (SW-3, SW-4 for surface water quality, and GW-03, & GW-04 for groundwater quality) which are depicted in Table 4-21.

Table 4-21: Monitoring Locations of Water Quality both surface and groundwater quality in NCC areas

Monitoring Items	Sampling site	Sample ID	GPS locations	Sampling Date (Dry season)	Sampling Date (Monsoon season)	Nature of the sampling sites
Surface water quality	NCC-SWM-1	SW-3	23.675285N 90.49588E	21.12.2023	01.07.2024	Pond, Beside Lanfill Site, Jalkuri, Narayanganj
	NCC-SWM-2	SW-4	23.598236N 90.504381E	21.12.2023	01.07.2024	Pond, Alaminnagar, Narayanganj
Groundwater quality	NCC-SWM-1	GW-3	23.676573N 90.498421E	21.12.2023	01.07.2024	Deep Tube well, Beside Lanfill Site, Jalkuri, Narayanganj
	NCC-SWM-2	GW-4	23°35'47.18"N 90°30'6.48"E	21.12.2023	01.07.2024	Deep Tube well, Alaminnagar, Narayanganj

Results Analysis of Surface water quality:

Human and animal waste, dead plants, small aquatic life, and leaves and woody debris are all potential major causes of BOD and COD levels that exceed the national standard. The possible reason for crossing the national standard of ECR 2023 of the value of phosphate is human and animal Waste, and household wastewater etc. The remaining parameters are within the limit of ECR 2023 range.

Table 4-22: Surface water Monitoring Results of NCC areas

Parameters	Sampling period (Season)	Unit	ECR, 2023 Standard*							
			SW-3	SW-4	a	b	c	d	e	f
pH	Dry	-	8.1	7.5	6.5-8.5	6.5-8.5	6-9	6-9	6.5-8.5	6.5-8.5
	Monsoon		7.8	7.6						
Temperature	Dry	°C	23.9	24.2	-	-	-	-	-	-
	Monsoon		25.6	25.4						
BOD_5	Dry	mg/l	18	12	≤6	≤3	≤3	≤6	12	≤12
	Monsoon		8	5						
TDS	Dry	mg/L	200	290	1000	1000	1000	1000	1000	1000
	Monsoon		285	102						
COD	Dry	mg/l	76	60	10	10	25	50	100	100
	Monsoon		68	4						
DO	Dry	mg/l	2.75	3.40	≥6	≥5	≥5	≥5	≥1	-
	Monsoon		4.25	6.10						
Lead (Pb)	Dry	mg/L	0.009	0.012	0.03	0.05	0.03	0.1	0.1	0.1
	Monsoon		0.001	0.005						
Coliform (Total)	Dry	N/100 ml	164	208	≤100	≤50	≤5,000	≤5,000	-	≤50,000
	Monsoon		48	96						
Mercury (Hg)	Dry	mg/L	< .001	< .001	0.001	0.001	0.001	0.004	0.05	0.002
	Monsoon		< .001	< .001						
Nitrate Nitrogen (NO3-N)	Dry	mg/L	1.8	2.0	0.1	7.0	0.3	7.0	2.7	5.0
	Monsoon		1.6	2.0						
Ammonia	Dry	mg/L	0.24	0.27	0.1	0.3	0.3	0.3	2.7	1.5
	Monsoon		0.17	0.21						
Total Phosphate (TP)	Dry	mg/L	0.60	0.48	0.1	0.5	0.5	0.5	-	2.0
	Monsoon		0.63	0.70						
Chromium (Total)	Dry	mg/L	0.004	0.002	0.02	0.2	0.02	0.05	0.1	0.1
	Monsoon		0.002	0.001						

*The Environment Conservation Rules (ECR) 2023, Schedule 2-B Standard for Drinking Water, Primary Data Source: Baseline study, EIA survey, UDCGP of LGED, January 2024, and July 2024.

Results Analysis of Groundwater quality:

The presence of total coliform was found in SW-04 areas, which could be caused by human waste seeping into subterranean sources or by landfill leachate seeping into the sampling location. All other characteristics, though, fall inside the ECR 2023 standard limit.

Table 4-23: Groundwater Quality Monitoring Results of NCC areas

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-03	GW-04	
pH	Dry	-	7.3	7.3	6.5-8.5
	Monsoon		7.7	8.0	
Arsenic	Dry	mg/L	0.002	0.001	0.05
	Monsoon		0.001	0.003	
COD	Dry	mg/L	48	36	-
	Monsoon		8	4	
DO	Dry	mg/L	4.30	4.65	-
	Monsoon		5.94	6.15	

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-03	GW-04	
Hardness as $CaCO_3$	Dry	mg/L	200	145	500
	Monsoon		225	120	
Lead (Pb)	Dry	mg/L	0.002	0.004	0.01
	Monsoon		0.002	0.004	
Odor	Dry	Odorless	0	0	Odorless
	Monsoon		0	0	
Oil & Grease	Dry	mg/L	< 0.01	< 0.01	0.01
	Monsoon		< 0.01	< 0.01	
Mercury	Dry	mg/L	< 0.001	< 0.001	0.01
	Monsoon		< 0.001	< 0.001	
Sodium (Na)	Dry	mg/L	102	31	200
	Monsoon		33	18	
Temperature	Dry	°C	24.1	24.3	20-30 ℃
	Monsoon		25.3	25.6	
TSS	Dry	mg/L	1	1	10
	Monsoon		1	1	
TDS	Dry	mg/L	366	160	1000
	Monsoon		376	150	
Total Coliform (TC)	Dry	N/100 ml	0	0	0
	Monsoon		0	12	
Fecal Coliform (FC)	Dry	N/100 ml	0	0	0
	Monsoon		0	0	
Cr (Total)	Dry	mg/L	0.001	0.001	0.05
	Monsoon		0.003	0.002	

*The Environment Conservation Rules (ECR) 2023, Schedule 2-B Standard for Drinking Water, Primary Data Source: Baseline study, EIA survey, UDCGP of LGED, January 2024, and July 2024.

4.2.2.10 Noise level

Methodology of Noise and Vibration measurements were mentioned in 4.2.1.11.

Table 4-24: Noise and Vibration level monitoring locations of NCC areas

Subproject Code	Noise & Vibration level Code	GPS location		Sample date (Dry season)	Sample date (Monsoon season)	Location descriptions
NCC-SWM-1	ANLM-3-VLM-3	23.675028N	90.497790E	20.12.2023-21.12.2023	01.07.2024 – 02.07.2024	Beside Landfill Site, Jalkuri, Narayanganj
NCC-SWM-2	ANLM-4-VLM-4	23.596632N	90.501725E	20.12.2023-21.12.2023	01.07.2024 – 02.07.2024	Alaminnagar Narayanganj Gazipur

Results Analysis:

The increased noise levels in ANLM-3 and ANLM-4 were linked to waste management vehicle movement, people gathering in public spaces, and people moving and intervening in order to recover recyclable materials from landfill garbage.

Table 4-25: Noise level monitoring results of NCC sites

Sampling ID	Monitoring Time	Sampling period (Season)	Noise level [dB(A)]			*Noise Pollution Control Rules 2006	Category
			L_{eq}	L_{max}	L_{min}		
ANLM-3	Day	Dry	60.98	81.0	33.4	60	Mixed
	Night		56.54	71.0	30.3	50	
	Day	Monsoon	65.88	85.9	38.3	60	Mixed
	Night		58.64	73.1	32.4	50	
ANLM-4	Day	Dry	69.59	86.1	38.5	60	Mixed
	Night		58.79	77.2	33.7	50	
	Day	Monsoon	74.26	90.8	43.2	60	Mixed
	Night		61.69	80.1	36.6	50	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

Table 4-26: Vibration level monitoring results of NCC sites

Code	Sampling period	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value
VLM-3	Dry	0.53	0.05	0.151	0.177	0	0	0	0	0	0	0	0
	Monsoon	0.04	0.03	0.005	0.035	0.3	0.1	0.075	0.298	8.448	0.031	1.242	0.454
VLM-4	Dry	1.03	0.05	0.295	0.316	0	0	0	0	0.058	0	0.018	0.012
	Monsoon	0.2	0.01	0.076	0.108	0.3	0.1	0.075	0.267	3.779	0.078	1.365	1.308

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

Result Analysis:

Vibration is an oscillatory motion that can be described in terms of displacement, velocity, or acceleration. Displacement is the most intuitive metric. For a vibrating floor, the displacement is simply the distance that a point on the floor moves away from its static position. The velocity represents the instantaneous speed of the floor movement and acceleration is the rate of change of the speed. Vibration can possibly be a concern for nearby neighbors of a transit system route or maintenance facility. However, vibration is not a common environmental problem, most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, heavy vehicle movement etc. However, there is no vibration standard in Bangladesh according to ECR, 2023 and other relevant rules/guidelines but the standard is set out internationally by BS 5228-2:2009.

From the measured data it has been observed that, according to the BS 5228-2:2009 standard, the vibration level of all monitoring locations is very insignificant, negligible and perceptible in residential environments. But, this level of vibration might not pose any complaints, intolerable, and uncomfortable situation for all residents residing near the sampling site. It was also observed that residents near the sample site are habituated to this vibration level and have no complaints regarding this issue etc.

4.2.2.11 Soil Quality

Methodology of soil quality analysis, sample collections etc., were depicted in section 4.2.1.12.

Table 4-27: Locations of the soil samples of NCC

Subproject code	Sample ID	GPS Location	Sample date (Dry season)	Sample date (Monsoon season)	Site descriptions
NCC-SWM-1	SQ-3	23.995968N 90.423381E	20.12.2023	01.07.2024	Agricultural Land, Baghiya, Konabari, Gazipur
NCC-SWM-2	SQ-4	24.02236N 90.33633E	20.12.2023	01.07.2024	Beside Lanfill Site, Jalkuri, Narayanganj

Results Analysis:

It is crucial to understand that Bangladesh does not have a standard for analyzing soil quality. Therefore, in order to examine the soil quality, EPA standards have been utilized. These standards are environmental pollutant reference values, or the concentrations of pollutants in environmental media, that are used in environmental remediation, investigation, and cleanup. In conclusion, this standard is applied globally to assess the condition of the soil in order to protect it from harm and restore previous harm brought on by human activities. Nevertheless, EPA guidelines only establish limitations for Cr, Pb, and Cd out of all the characteristics. However, because the majority of soil test locations are next to roads or agricultural area, the values of Cr and Pb have essentially exceeded the acceptable limit. Caused by the use of pesticide in the agricultural or crop land and urban runoff.

Table 4-28: Soil Quality Monitoring Results of NCC sites

Season	Parameters	Unit	Sample ID		EPA Guideline*
			SQ3/7788	SQ4/7789	
Dry	P^H	--	5.5	7.3	--
Monsoon			8.12	7.60	
Dry	Chromium (Cr)	PPM	41.93	19.81	5.00
Monsoon			35.79	32.76	
Dry	Iron (Fe)	PPM	101.23	65.61	--
Monsoon			3.03	2.32	
Dry	Lead (Pb)	PPM	19.28	51.35	5.00
Monsoon			9.90	48.18	
Dry	Magnesium (Mg)	meq/100g Soil	2.34	0.92	--
Monsoon			0.37	0.33	
Dry	Cadmium (Cd)	PPM	0.42	0.75	1.00
Monsoon			0.06	0.27	
Dry	Phosphate (PO_4)	PPM	16.57	5.44	--
Monsoon			0	0	
Dry	Organic Matter (OM)	%	3.51	1.90	--
Monsoon			1.14	3.71	
Dry	Nitrogen (N)	%	0.20	0.11	--
Monsoon			0.07	0.22	
Dry	Oil & Grease	PPM	>1.0	<1.0	--
Monsoon			>1.0	<1.0	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023, and July 2024.

4.2.2.12 Sources of environmental pollution

The most significant sources of pollution are anticipated to arise during the construction phase from the movement of construction vehicles, the production of dust from these activities, the

degradation of air quality caused by the construction, black smoke emissions from the vehicles, and the creation of excessive noise from construction activities. Sources of noise include excavation or trenching works, the use of hydraulic horns by vehicles, and the influx of labor. The circumstances may also contaminate nearby surface and groundwater sources. The labor influx, construction activity, and other related commercial ventures may pose a threat to the local biodiversity.

4.2.3 Cumilla City Corporation (CuCC)

4.2.3.1 Topography

The topography of CuCC is almost flat, surrounded by Lalmai uplifted block, Gomoti River, Dakatia River and streams/ channels. The topography of the Lalmai Hills area consists of hillocks, floodplains, and rivers. The average elevation of CuCC areas is 17 m above sea level and the elevation of the western part of the city area is relatively higher than the eastern part. The Meghna Flood Plain is situated on the western side of the Lalmai hillocks.

4.2.3.2 Geology

Cumilla City Corporation (CuCC) generally is a flat plain without hilly tracks. It has predominantly deep silty soils, with a significant portion of basin clays. The geological formation in the study areas is mainly Upper Pleistocene sediments, Modhupur Clay Formation and Alluvium Formation. The Madhupur Clay Formation is unconformably placed on top of the Dupi Tila Formation, mainly exposed along the streams, rivers, and channel beds. The Chandina Deltaic Plain and Meghna Flood Plain units contain unconsolidated to semi-consolidated clay, silty clay, silt, and sand; and the Meghna Flood Plain is the result of present-day building process by the Meghna River and its tributaries. The Madhupur Clay, the DupiTila Formation and the recent alluvium compose the exposed stratigraphy of the areas.

4.2.3.3 Geomorphology

According to Brammer's (2012) physiographic classification of Bangladesh, the Lalmai Hills area is included in the 'Uplifted blocks' as physiographic unit. Q. Bakr (1977) has divided the area into three geomorphic units. From east to west, the units are Lalmai deltaic plain of Pleistocene age, Chandina Deltaic Plain of Early Recent age, and Meghna Flood Plain of Recent age. Lalmai geomorphic unit is also called Lalmai terrace because of its flat topped and general occurrence as piedmont surfaces much above the recent plains (Bakr,1977). These geomorphic units/ surfaces are characterized by different elevations: Lalmai Deltaic Plain includes the Lalmai Hills, Chandina Deltaic Plain with an intermediate elevation between Lalmai Deltaic Plain and the Meghna Flood Plain, and the Meghna Flood Plain, which forms the present local base level. The area can be approximately divided into low land areas (Chandina Deltaic Plain and Meghna Flood Plain) and hill areas (Lalmai Hills).

4.2.3.4 Soil Characteristics

The characteristic of this soil is dark grey or brown clays with dark grey flood coatings, some calcareous throughout some with seasonally acid topsoil and calcareous substratum within four feet. There are brown calcareous loamy soils on highest ridges and never riverbanks. It is subject to a rapid rise in flood levels. Organic matter contents in the cultivated layer range from 2-5 percent or more in depression soils.[6]

4.2.3.5 Drainage

Majority of the rivers flowing through the Lalmai and adjoining areas originated from the Tripura hills in the east, and flow towards west, north, and south in consonance with the general slope of the land. The area is drained by five river systems, they are: (i) the Titas River in the northern part; (ii) the Gomti river and the Dakatia river in the central part; (iii) the Little Feni River in the

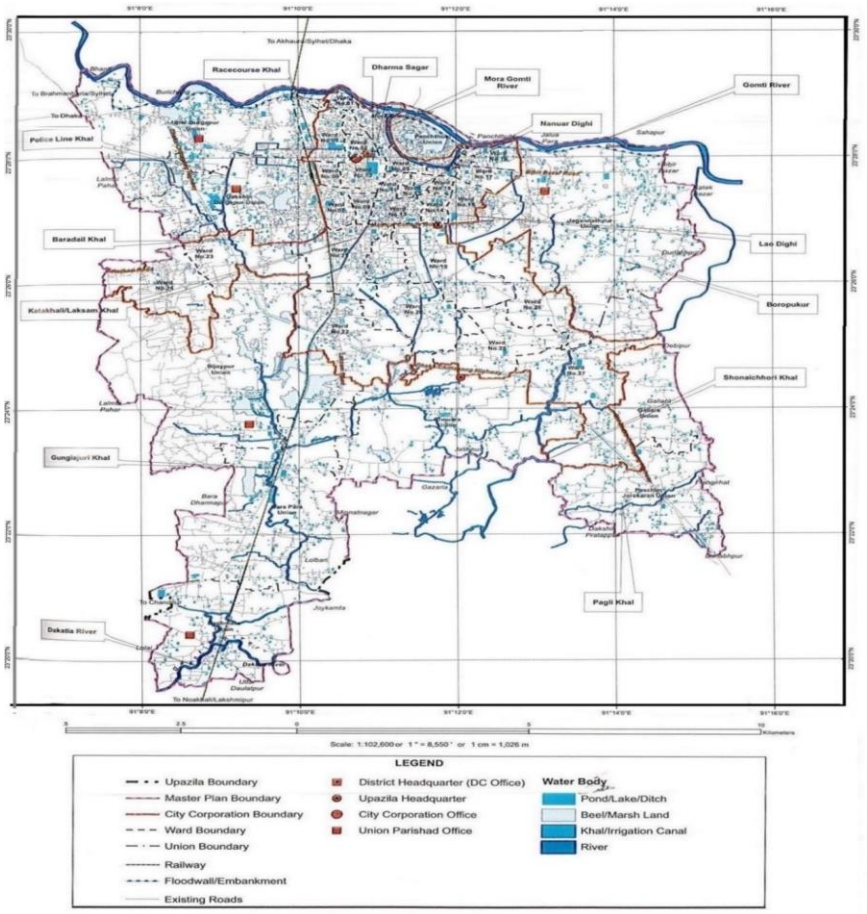
[6] Master Plan for Cumilla City and its influence Area (2014-2034); Volume-I: Structure Plan (2014-2034), June 2014, LGD.

south-eastern part; and (iv) the Meghna River in the western part. The Meghnariver and Little Feni River meet the Bay of Bengal in the south. The Titas and the Gomti connect at some points; and the Dakatia and the Little Feni join at their heads. Old meander scars, ox-bow lakes, and paleo-channels mark the area.[7]

4.2.3.6 Hydrology and Water Resources

Surface Hydrology:

In the City Corporation area, the river Gomuti is a prominent surface water source. There are also some sources like Guingadhari canal, Balujhuri canal, Katakhal, Nagguniya Khal, Ruhita Khal, Dhakatiya River and ponds, ditches, drains and low wetlands are functioning as surface water sources. For domestic purpose, community people basically use pond water (mainly bathing) and irrigation.[8]



Source: Master Plan of the Cumilla City 2014

Figure 4-18: Surface water hydrology in CuCC

[7] Geology and Active Tectonics of the Lalmai Hills, Bangladesh–An Overview from Chittagong Tripura Fold Belt Perspective, H. Sakawat. Md. et.al. 2018.

[8] ICGP, Final Report, Volume 3, CoCC Edition, March 2014. LGED, People's Republic of Bangladesh

Groundwater Hydrology:

The main source of potable water is groundwater in the area. Deep groundwater is not saline. Local people typically use deep tube-well water for drinking and other domestic purposes. According to the BADC (2010)[9] groundwater zoning map, groundwater table in Cumilla region varies from 5.3 to 7.6 meter below ground level.

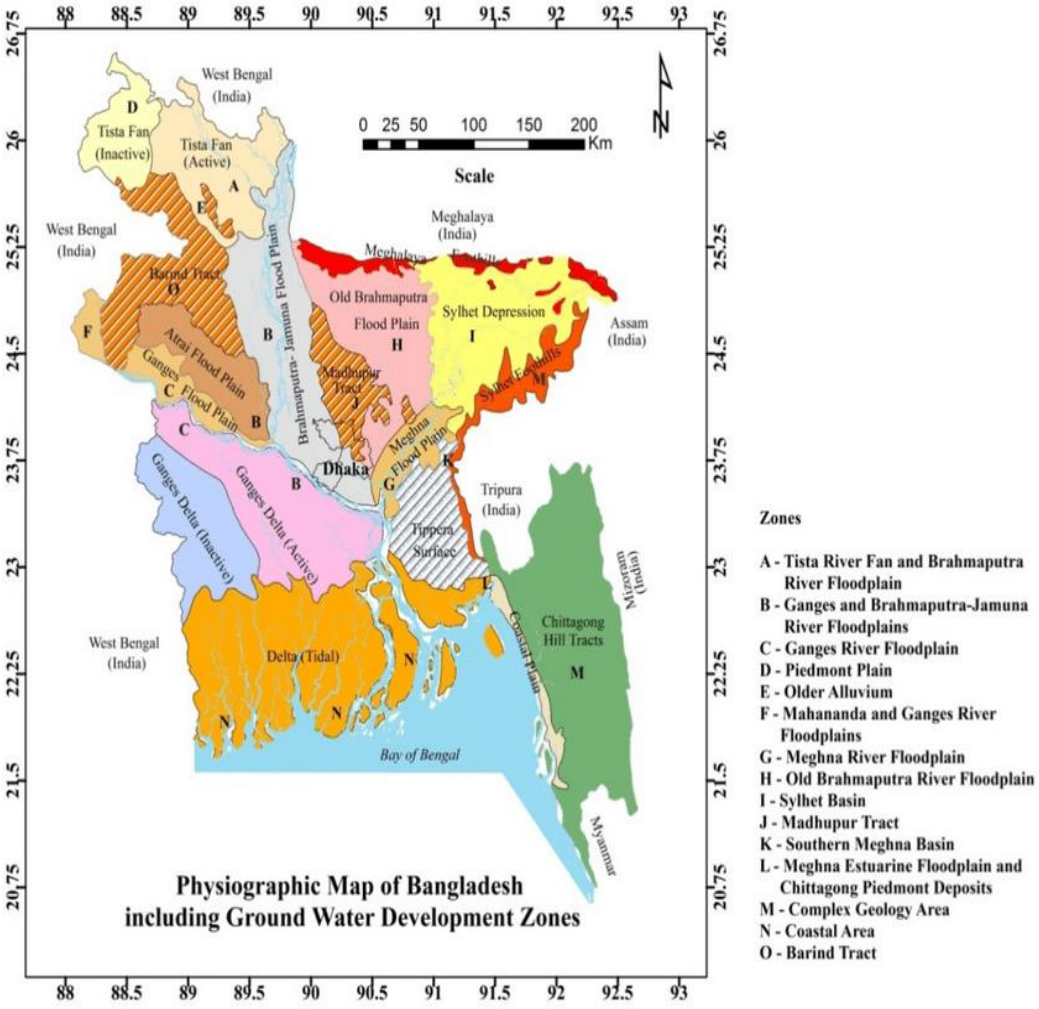


Figure 4-19: Ground Water zoning map of Bangladesh

4.2.3.7 Weather and Climate

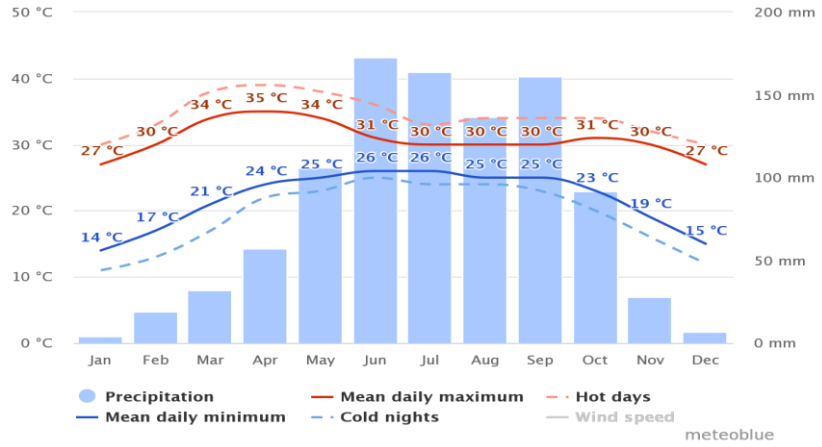
The climatic condition of CuCC is dominated by monsoon and falls into four seasons: (i) winter (ii) summer (iii) monsoon and (iv) post monsoon. The temperature starts to drop from November and continues till January. Then it starts rising again. The winter season is followed by the summer season starting from March and continues till May. This season is known as pre monsoon when both temperature and humidity rise considerably, and rainfall occurs. The

[9] BADC, 2010; Bangladesh Agriculture Development Corporation (BADC): Groundwater Zoning Map of Bangladesh.

weather is unstable, with succession of sunny and rainy days, the wind velocities are high and occasionally cyclonic.[10]

From June to October, the monsoon season is warm, cloudy, and wet. The warmest month is April, the coolest is January, the wettest is July and the driest is January. This area is distinctive as a tropical-subtropical sub-humid climate. The maximum mean temperature observed in CuCC is about 25-32°C between May-August, with the minimum temperatures of between 12-15°C in January as shown in Figure below. Annual average rainfall is about 2430 mm. Monthly precipitation records clearly show a distinct dry and rainy season in the figure below.

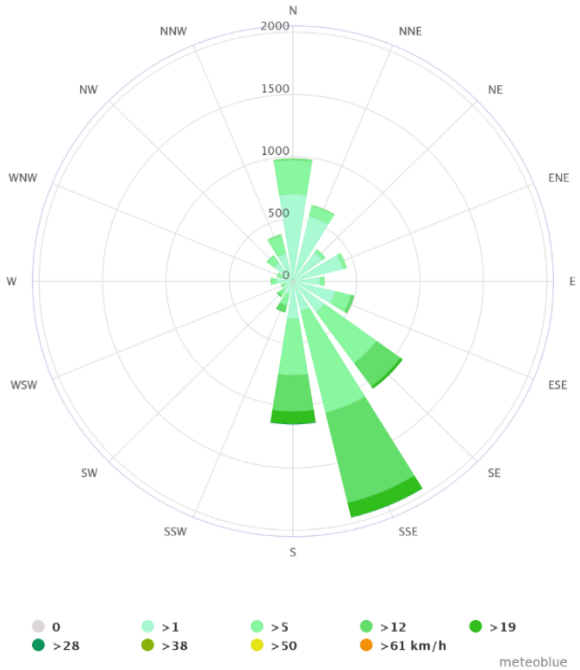
According to the statistics of the wind data from the BMD. wind direction changes by month. Nevertheless, the northwest, south, and northeast winds are predominant. This area experiences wind speeds low to medium.



Source: http//meteoblue.com (accessed in January 2021)
Note: The record span covers 2010-2020.

Figure 4-20: Historical records of Maximum, Minimum Temperature, hot and cold nights, and precipitation amount in CuCC area

[10] ICGP, Final Report, Volume 3, CoCC Edition, March 2014. LGED, People's Republic of Bangladesh



Source: http//meteoblue.com (accessed in January 2021); Note: The record span covers 2010-2020

Figure 4-21: Wind rose diagram of Cumilla

4.2.3.8 Air Quality

Methodology is stated in 4.2.1.9.

Sampling Locations: Samples were collected from two locations of CuCC both dry season (December 2023) and wet season (June 2024). The details of sampling locations are depicted in Table 4-29.

Table 4-29: Sampling locations of Ambient Air Quality in CuCC areas

Subproject Code	Air Quality Code	GPS location	Sample date (Dry season)	Sample date (Monsoon season)	Parameters	Location descriptions
CuCC-SWM-1	AAQM-5	23.462538N 91.214611E	12.12.2023-13.12.2023	07.07.2024-08.07.2024	$PM_{2.5}$, PM_{10}, Pb, NH_3, O_3, SO_2, NO_2, CO	Beside Landfill Area, Jakunipara, Jagannathpur, Cumilla
CuCC-D-4	AAQM-6	23.447057N 91.147956E	12.12.2023-13.12.2023	07.07.2024-08.07.2024		Coat Bari Biswas Road, East Chowmohoni, Chandanpur, Cumilla

Figure 4 23: Sampling locations of Air, Noise, Vibration, Surface water, Groundwater, and Soil Quality in CuCC

Table 4-30: Air Quality Monitoring Results in CuCC areas

Sample ID	Sampling season	Parameters								Wind direction
		$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	Pb ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	
AAQM-5	Dry	78.00	121.27	BDL	12.25	33.30	17.67	67.45	1.27	NE
	Monsoon	16.83	31.42	BDL	10.08	18.09	14.19	42.34	0.65	SSE
AAQM-6	Dry	50.72	275.99	BDL	22.54	53.81	117.53	58.76	0.95	NE
	Monsoon	28.32	44.71	BDL	16.54	23.96	51.34	49.30	0.48	S
National Standard		65	150	0.5	400	100	80	80	05	-

Note: BDL- Below Detection Level

Result Analysis:

During the dry season, the frequent vehicle movement in the sample areas and dust generation from nearby construction projects, PM2.5 and PM10 were greater in AAQM-5 and AAQ-6 locations (crossed the ECR 2023 standards), respectively, During the rainy season, which coincided with the wet season, samples were collected from the sites when it was pouring, and precipitation may remove PM2.5, PM10, and other air pollutants, it can effectively improve air quality by lowering the concentration of pollutants in the air, purifying it, and enhancing its quality.

4.2.3.9 Water Quality

The methodology is the same as previously described in section 4.2.1.10.

Monitoring Locations: The monitoring locations of groundwater and surface water quality were assessed in two locations (SW-5, SW-6 for surface water quality, and GW-05, & GW-06 for groundwater quality) which are depicted in Table 4-30.

Table 4-31: Monitoring Locations of Water Quality both surface and groundwater quality in CuCC areas

Sampling site	Sample ID	GPS locations	Sampling Date (Dry season)	Sampling Date (Monsoon season)	Nature of the sampling sites
CuCC-SWM-1	SW-5	23.462543N 91.216753E	13.12.2023	07.07.2024	Daulatpur,7 Cumilla Bisir Bazar Road, Cumilla
	GW-5	23.463116N 91.214428E	13.12.2023	07.07.2024	Deep Tube well, Mr. Mahbub Alam's House, Anderson Road
CuCC-D-4	SW-6	23.4470187N 91.149312E	13.12.2023	07.07.2024	Near Coat Bari Bus Stand, Cumilla
	GW-6	23.446799N 91.1483255E	13.12.2023	07.07.2024	Beside Coat Bari Bus Stand, Cumilla

Results Analysis

Soil erosion, fish farming, fish feed, and related waste are all potential major reasons for exceeding the standard level of BOD & COD of having biological agent due to the presence of landfill, dead plants, small aquatic fauna, landfill runoff, and higher value of phosphate.

Table 4-32: Surface water Monitoring Results of CuCC areas

Parameters	Sampling period (Season)	Unit			ECR, 2023 Standard*					
			SW-5	SW-6	a	b	c	d	e	f
pH	Dry	-	7.4	7.1	6.5-8.5	6.5-8.5	6-9	6-9	6.5-8.5	6.5-8.5
	Monsoon		8.0	7.9						
Temperature	Dry	°C	24.3	24.0	-	-	-	-	-	-
	Monsoon		26.1	26.3						
BOD_5	Dry	mg/l	12	10	≤6	≤3	≤3	≤6	12	≤12
	Monsoon		10	06						
TDS	Dry	mg/L	80	325	1000	1000	1000	1000	1000	1000
	Monsoon		68	145						
COD	Dry	mg/l	52	48	10	10	25	50	100	100
	Monsoon		24	32						
DO	Dry	mg/l	3.45	3.75	≥6	≥5	≥5	≥5	≥1	-
	Monsoon		4.85	5.10						
Lead (Pb)	Dry	mg/L	0.005	0.004	0.03	0.05	0.03	0.1	0.1	0.1
	Monsoon		0.003	0.001						
Coliform (Total)	Dry	N/100 ml	1100	18000	≤100	≤50	≤5,000	≤5,000	-	≤50,000
	Monsoon		5,000	10,000						
Mercury (Hg)	Dry	mg/L	<0.001	<0.001	0.001	0.001	0.001	0.004	0.05	0.002
	Monsoon		<0.001	<0.001						
Nitrate Nitrogen (NO3-N)	Dry	mg/L	2.1	1.7	0.1	7.0	0.3	7.0	2.7	5.0
	Monsoon		1.6	1.5						

Parameters	Sampling period (Season)	Unit			ECR, 2023 Standard*					
			SW-5	SW-6	a	b	c	d	e	f
Ammonia	Dry	mg/L	0.30	0.25	0.1	0.3	0.3	0.3	2.7	1.5
	Monsoon		0.27	0.3						
Total Phosphate (TP)	Dry	mg/L	0.52	4.1	0.1	0.5	0.5	0.5	-	2.0
	Monsoon		0.70	1.0						
Chromium (Total)	Dry	mg/L	0.003	0.001	0.02	0.2	0.02	0.05	0.1	0.1
	Monsoon		0.004	0.002						

Note: *The Environment Conservation Rules (ECR) 2023, Schedule 2-A (1) Standard for Inland Surface Water (a-f), Primary data Source: *DPHE* and *BEETLSL* laboratory, June-July 2024
a. Source of drinking water for supply only after disinfecting
b. Water usable for recreational activity
c. Source of drinking water for supply after conventional treatment
d. Water usable for fisheries

Results Analysis of Groundwater quality:

Possible significant reason behind crossing the standard level of Total & Fecal Coliform is

- Leaching of sewage system
- Leaking or malfunctioning septic systems
- Uncontrolled animal grazing or improper disposal of animal waste near the groundwater source
- Improper disposal of human waste, such as open defecation or the absence of proper sewage treatment facilities
- Poorly constructed or maintained wells etc.

Table 4-33: Groundwater Quality Monitoring Results of CuCC areas

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-05	GW-06	
pH	Dry	-	6.8	7.2	6.5-8.5
	Monsoon		8.1`	8.3	
Arsenic	Dry	mg/L	0.015	0.001	0.05
	Monsoon		0.001	0.001	
COD	Dry	mg/L	24	36	-
	Monsoon		12	24	
DO	Dry	mg/L	4.65	4.30	-
	Monsoon		5.60	5.15	
Hardness as $CaCO_3$	Dry	mg/L	210	130	500
	Monsoon		170	105	
Lead (Pb)	Dry	mg/L	0.002	0.001	0.01
	Monsoon		0.001	0.003	
Odor	Dry	Odorless	0	0	Odorless
	Monsoon		0	0	
Oil & Grease	Dry	mg/L	<0.01	<0.01	0.01
	Monsoon		<0.01	<0.01	
Mercury	Dry	mg/L	< 0.001	< 0.001	0.01
	Monsoon		< 0.001	< 0.001	
Sodium (Na)	Dry	mg/L	65	21	200

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-05	GW-06	
	Monsoon		40	16	
Temperature	Dry	°C	24.4	24.3	20-30℃
	Monsoon		26.4	26.2	
TSS	Dry	mg/L	2	1	10
	Monsoon		7	1	
TDS	Dry	mg/L	321	106	1000
	Monsoon		300	120	
Total Coliform (TC)	Dry	N/100 ml	0	320	0
	Monsoon		7	30	
Fecal Coliform (FC)	Dry	N/100 ml	0	510	0
	Monsoon		4	16	
Cr (Total)	Dry	mg/L	0.001	0.003	0.05
	Monsoon		0.003	0.001	

*The Environment Conservation Rules (ECR) 2023, Schedule 2-B Standard for Drinking Water, Primary Data Source: Baseline study, EIA survey, UDCGP of LGED, January 2024, and July 2024.

4.2.3.10 Noise & Vibration level

Methodology of Noise and Vibration measurements were mentioned in 4.2.1.11.

Sample locations:

Table 4-34: Noise and Vibration level monitoring locations of CuCC areas

Subproject Code	Noise & Vibration level Code	GPS location	Sample date (Dry season)	Sample date (Monsoon season)	Location descriptions
CuCC-SWM-1	ANLM-5	23.462850N 91.214881E	12.12.2023-13.12.2023	07.07.2024-08.07.2024	Beside Landfill Area, Jakunipara, Jagannathpur, Cumilla
	VLM-5	23.462717N, 91.214853E	12.12.2023	07.07.2024	
CuCC-D-4	ANLM-6	23.44705833N 91.1483255E	12.12.2023-13.12.2023	07.07.2024-08.07.2024	Coat Bari Biswas Road, East Chowmohoni, Chandanpur, Cumilla
	VLM-6	23.447041N 91.14889E	12.12.2023	07.07.2024	

Results Analysis:

Possible significant reason behind the crossing of standard level is as follows:

- People's Movement and their interventions
- Vehicle's Movement and using horn
- Resource extraction (waste) from the landfill site, and
- The highway road and commercial activity etc.

Table 4-35: Noise level monitoring results of CuCC sites

Sampling ID	Monitoring Time	Sampling period (Season)	Noise level [dB(A)]			*Noise Pollution Control Rules 2006	Category
			L_{eq}	L_{max}	L_{min}		
ANLM-5	Day	Dry	69.38	87.4	43.4	60	Mixed
	Night		55.37	70.8	33.9	50	
	Day	Monsoon	66.59	84.6	40.6	60	Mixed
	Night		58.03	73.5	36.5	50	
ANLM-6	Day	Dry	73.21	95.6	41.0	60	Mixed
	Night		58.21	73.1	34.7	50	
	Day	Monsoon	69.41	91.8	37.2	60	Mixed
	Night		62.31	77.2	38.8	50	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

Table 4-36: Vibration level monitoring results of CuCC sites

Code	Sampling period	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value
VLM-5	Dry	0.75	0.05	0.080	0.125	0.5	0.0	0.051	0.466	0.301	0.0	0.027	0.010
	Monsoon	0.04	0.01	0.008	0.015	0.3	0.1	0.024	0.297	0.039	0.023	0.004	0.027
VLM-6	Dry	0.51	0.05	0.065	0.1116	0.3	0.2	0.050	0.244	0.015	0.0	0.002	0.002
	Monsoon	0.2	0.01	0.076	0.108	0.3	0.1	0.075	0.267	3.779	0.078	1.365	1308

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024

Results Analysis:

From the measured data it has been observed that, according to the BS 5228-2:2009 standard, the vibration level of all monitoring locations is very insignificant, negligible and perceptible in residential environments. But, this level of vibration might not pose any complaints, intolerable, and uncomfortable situation for all residents residing near the sampling site. It was also observed that residents near the sample site are habituated to this vibration level and have no complaints regarding this issue.

4.2.3.11 Soil Quality

Methodology of soil quality analysis, sample collections etc., were depicted in section 4.2.1.12.

Table 4-37: Locations of the soil samples of CuCC

Subproject code	Sample ID	GPS Location	Sampling Date		Site descriptions
			Dry	Monsoon	
CuCC-SWM-1	SQ-5	23.463116N 91.214422E	12.12.2023	07.07.2024	Landfill site, Jakunipara, Jagonnathpur, Cumilla
CuCC-D-4	SQ-6	23.446799N 91.1483255E	13.12.2023	07.07.2024	Gungaijuri Canal Side, Near Coat Bari Bus Stand, Cumilla

Results Analysis:

EPA standards have been used to analyze the soil quality which are environmental pollutant reference values (i.e., concentrations in environmental media) used in environmental remediation, investigation and cleanup. This standard is used worldwide to analysis the soil quality to preserve the soil from damage and repair past damage caused by human activity.

However, among all the parameters, standards are only set for Cr, Pb and Cd by EPA guidelines. However, the value of Cr and Pb crossed the standard level basically as most of the soil sampling points are beside the road or near the agricultural land thus Cr and Pb may come from the use of pesticide and urban runoff.

Table 4-38: Soil Quality Monitoring Results of CuCC sites

Season	Parameters	Unit	Sample ID		EPA Guideline*
			SQ5/7780	SQ6/7781	
Dry	P^H	--	6.6	6.7	--
Monsoon			7.59	4.83	
Dry	Chromium (Cr)	PPM	76.60	59.54	5.00
Monsoon			22.60	32.15	
Dry	Iron (Fe)	PPM	65.38	39.42	--
Monsoon			2.09	3.04	
Dry	Lead (Pb)	PPM	16.27	21.21	5.00
Monsoon			11.59	16.46	
Dry	Magnesium (Mg)	meq/100g Soil	1.96	6.20	--
Monsoon			0.28	0.27	
Dry	Cadmium (Cd)	PPM	0.22	0.18	1.00
Monsoon			0.14	0.02	
Dry	Phosphate (PO_4)	PPM	27.16	15.53	--
Monsoon			0	0	
Dry	Organic Matter (OM)	%	1.90	1.86	--
Monsoon			1.55	1.28	
Dry	Nitrogen (N)	%	0.11	0.10	--
Monsoon			0.11	0.07	
Dry	Oil & Grease	PPM	<1.0	<1.0	--
Monsoon			>1.0	<1.0	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023, and July 2024. *Standard: EPA Guideline; PPM-Parts per Million, **Primary Data Source**: *Soil Resource Development Institute (SRDI) & BEETLSL Laboratory*, July 2024

4.2.3.12 Sources of environmental pollution

The source of environmental pollution in the subproject areas as follows:

- Dumping sites of solid waste
- Dust from vehicles and construction works.
- Noise from vehicles and construction sites.
- Air pollution from vehicles, industry, and dust suppressions.
- Surface water pollution from wastewater drains and industrial waste.
- Groundwater pollution from wastewater drains and industrial waste.
- Soli pollution from releasing of oil -grease-mobile from vehicles, construction equipment, motor engines, industrial wastes, solid wastes etc.

4.2.4 Cox's Bazar Pauroshava (CBP)

4.2.4.1 Topography

Topographically Cox's Bazar areas have four types of landforms, these physiographic units are mainly e.g., (I). The higher hill ranges occupy a narrow belt: the most common soils are strong brown, friable, silty clay loams, and silty clays, which grade into broken shale rock at 2-4 feet. All soils are strongly acid in reaction. (II). The lower hill ranges are developed in unconsolidated sands and clays. Soils are mainly deep red, friable, clay loams to clays. The soil is strongly acidic and sandy soil is droughty. (III). The coastal plains are underlain by heavy marine or tidal clays characterized by more sandy and silty deposits near the foot of the hills and along the course of rivers and streams which cross the plains. Near the coast, some of these soils become saline at the end of the dry seasons. (IV). The tidal mangrove swamps are most extensive at the mouth of the Matamuhuri River.

4.2.4.2 Geology

Cox's Bazar has the longest beach in the world. Geology in Cox's Bazar is composed of sandstones, with bluish-grey shales and siltstones. These sediments are probably of fluviatile origin through some of the even-bedded siltstones and shales of considerable lateral extent of shallow marine beds. Here the soil is grey clay flooded twice daily by saline water and unsuitable for agriculture. The major soil types are red, alluvial, muddy, and sandy soil. The soils of the Dupi Tila formations were formed on unconsolidated and compact rocks, moderately well to excessively drained-out and probably the oldest of the area 28[11].

4.2.4.3 Geomorphology

Cox's Bazar, on the coast, has two distinct landforms origin such as fluvial and marine. Beach and dunes including neo dunes and palaeodunes are the most prominent features of the coast. The sedimentary evolution indicated that it's infilling of a sheltered basin with relatively high wave and micro to meso tidal fluctuations. The coast like Cox's Bazar is typically cyclone prone areas, and cyclonic storm or storm surges are frequently occurring in the coast areas of Bangladesh, at twice or more in each year. Due to cyclonic calamities, the flood plain will undergo sea water and flooded for a curtained period, affecting the lives and livelihood of the coastal belts of Bangladesh.

4.2.4.4 Soil Characteristics

Raw sandy and salty alluvial deposits, usually Alluvium of Chattogram Hill Tracts, stratified either from the surface or below the Cox's Bazar. Structured, grey sandy loams to clays, Piedmont of Chattogram Hill Tracts, strongly acidic, developed in piedmont out Soils of Cox's Bazar.

4.2.4.5 Hydrology and Water Resources

Surface hydrology:

The Moheshkhali Channel, BaakKhali and Naf rivers and Bay of Bengal are the main waterways of the region. The Moheshkhali Channel flows into the Bay of Bengal near Cox's Bazar Paurashava and passes the northwestern boundary of the area of influence. The

[11] S.M.I. Huq and J.M.U. Shoaib, The Soils of Bangladesh, World Soils Book Series 1, DOI: 10.1007/978-94-007-1128-0_7, @ Springer Science+Business Media Dordrecht, 2013.

Bakkhali River originates from the Chittagong Hill Tracts and flows into the Bay of Bengal near Cox's Bazar Paurashava. Many other mountain fountains (Pahari Chora) run through the hilly hinterland. As a result, a stream network runs through the Paurashava area.

Groundwater hydrology:

Bangladesh is considered as abundant resources of ground water resources. The properties of ground water storage reservoirs and volumes of annual recharge determine ground water resources. In this region, ground water level is shallow, usually ranges between 5-7m[12]. According to the BADC (*2010*)[13] groundwater zoning map, groundwater table in Cox's Bazar region varies from 0 to 7.6 meter below ground level.

4.2.4.6 Weather and Climate

Generally, maximum temperature in the year reaches between the last week of March and end of May. Temperature data is recorded at Cox's Bazar station. The average maximum temperature in Cox's Bazar is 31.28°C in April and minimum is 22.0°C in January[14], for details see below table. Average rainfall in the areas is relatively high, around 3500mm a year. The highest rainfall is received from July to August.

Table 4-39: Historical climate scenario of Bangladesh

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C	32.8	33.9	36.1	37.2	35	36.1	33.3	33.3	34.4	33.9	33.3	31.7	37.2
Average high °C	26.7	28.5	30.9	32.1	32.3	30.7	30	30.2	30.9	31.6	30	27.5	30.1
Average low °C	15	17	20.7	23.9	25.1	25.2	25.1	25	25	24.3	21.1	16.5	22
Record low °C	7.8	9.4	11.1	16.1	16.7	20.6	21.7	19.4	21.7	17.2	13.3	8.9	7.8
Rainfall avg. (mm)	4	17	35	122	287	802	925	667	330	214	109	13	3524
rainy days (avg.)	1	2	3	6	13	19	22	21	14	7	4	1	113
Relative humidity avg. (%)	72	71	75	78	80	87	89	88	86	82	77	74	80

Source: https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,cox-s-bazar,Bangladesh (accessed in January 2021)

4.2.4.7 Air Quality

Methodology is stated in 4.2.1.9.

Sampling Locations: Samples were collected from two locations of CBP both dry season (December 2023) and wet season (June 2024). The details of sampling locations are depicted in Table 4-40.

Table 4-40: Sampling locations of Ambient Air Quality in CBP areas

Subproject Code	Air Quality Code	GPS location	Sample date (Dry season)	Sample date (Monsoon season)	Parameters	Location descriptions
CBP-SWM-1	AAQM-7	21.44656N 91.97525E	07.12.2023-08.12.2023	26.06.2024-27.06.2024	$PM_{2.5}$, PM_{10}, Pb,	Beside Kastura Ghat,

[12] BARC, Bangladesh agricultural research council, September 2015. URL: http://www.barc.gov.bd/ (accessed in Jan 2021)
[13] Bangladesh Agriculture Development Corporation (BADC), 2010. Ground water zoning map of Bangladesh.
[14] Bangladesh Meteorological Department, 2020.

					NH_3, O_3, SO_2, NO_2, CO	LGED Bridge, Cox's Bazar
CBP-SWM-2	AAQM-8	21.44142N 92.01104E	07.12.2023-08.12.2023	26.06.2024-27.06.2024		S M Para, Cox's Bazar

CBP-SWM-1

CBP-SWM-2

Figure 4-22: Sampling locations of Air, Noise, Vibration, Surface water, Groundwater, and Soil Quality

Results Analysis:

All the parameters for both dry and wet seasons were within the APCR 2022 standard values. However, in wet season the situation was much better than the dry season cause the monitoring time was rainy season, and it was raining while the monitoring data recording. Therefore, precipitation had a profound role in effectively improving air quality to washout PM2.5, PM10, and other pollutants in the air in somewhat extent, resulting from reducing the concentration of pollutants, and purifying the air and improving air quality. In conclusion, all parameters in the monitoring locations were observed within the BD/DOE standard level which means no negative aspects might have occurred in the project corridor, vegetation, and human health.

Table 4-41: Air Quality Monitoring Results in CBP areas

Sample ID	Sampling season	Parameters								Wind direction
		$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	Pb ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	
AAQM-7	Dry	9.67	21.08	BDL	41.25	8.15	20.81	32.81	0.62	NWN
	Monsoon	7.08	15.29	BDL	24.25	20.01	15.69	17.97	0.41	SSE
AAQM-8	Dry	10.10	26.71	BDL	16.21	14.23	3.96	15.39	0.25	NWN
	Monsoon	11.06	27.71	BDL	11.42	11.93	30.28	20.09	0.39	SSW
National Standard (APCR 2022)		65	150	0.5	400	100	80	80	05	-

Note: BDL- Below Detection Level, Air Pollution Control Rules (APCR) On 26th July 2022; Vide S.R.O No. 255-Law/2022, Schedule 1 (Ambient Air Quality Standards). **Primary Data Source**: EnviroCare International Ltd. (*ECIL)* Laboratory, December-July 2024. W.D = Wind Direction.

4.2.4.8 Water Quality

The methodology is the same as previously described in 4.2.1.10.

Monitoring Locations: The monitoring locations of groundwater and surface water quality were assessed in two locations (SW-7, SW-8) for surface water quality, and GW-07, & GW-08 for groundwater quality) which are depicted in Table 4-42.

Table 4-42: Monitoring Locations of Water Quality both surface and groundwater quality in CBP areas

Sampling site	Sample ID	GPS locations	Sampling Date (Dry season)	Sampling Date (Monsoon season)	Nature of the sampling sites
CBP-SWM-1	SW-7	23.462543N 91.216753E	13.12.2023	26.06.2024	Daulatpur,7 Cumilla Bisir Bazar Road, Cumilla
	GW-7	23.463116N 91.214428E	13.12.2023	26.06.2024	Deep Tube well, Mr. Mahbub Alam's House, Anderson Road
CBP-SWM-2	SW-8	23.4470187N 91.149312E	13.12.2023	26.06.2024	Near Coat Bari Bus Stand, Cumilla
	GW-8	23.446799N 91.1483255E	13.12.2023	26.06.2024	Beside Coat Bari Bus Stand, Cumilla

Results Analysis:

Possible significant reason behind crossing the standard level of BOD & COD is as follows:

- Urban runoff
- Wastage from household and commercial area
- Dead Plants and small aquatic fauna
- Failing Septic System

Possible significant reason behind crossing the standard level of Coliform (Total):

- Improperly maintained septic systems and sewage discharge
- Improperly maintained septic systems and sewage discharge
- Informal Settlements

Possible significant reason behind crossing the standard level of DO:

- Lack of sunlight penetration due to cloudy and rainy environment
- Stratification and Oxygen Depletion in Bottom Waters due to seasonal changes

Table 4-43: Surface water Monitoring Results of CBP areas

Parameters	Season	Unit	Concentration Present		ECR, 2023 Standard*					
			SW- 7	SW-8	a	b	c	d	e	f
Arsenic	Dry	mg/L	0.003	0.005	-	-	-	-	-	-
	Wet		0.001	0.001						
COD	Dry	mg/L	68	88	10	10	25	50	100	100
	Wet		400	312						
Coliform (Fecal)	Dry	N/100ml	17	09	-	-	-	-	-	-
	Wet		4800	1760						
Coliform (Total)	Dry	N/100ml	31	21	≤100	≤50	≤5,000	≤5,000	-	≤50,000
	Wet		8000	4880						
Chromium (Total)	Dry	mg/L	0.003	0.004	0.02	0.2	0.02	0.05	0.1	0.1
	Wet		0.002	0.004						
DO	Dry	mg/L	3.10	2.90	≥ 6	≥5	≥5	≥5	≥1	-
	Wet		2.65	3.40						
Pb	Dry	mg/L	0.001	0.002	0.03	0.05	0.03	0.1	0.1	0.1
	Wet		0.001	0.001						
Hg	Dry	mg/L	< 0.001	< 0.001	0.001	0.001	0.001	0.004	0.05	0.002
	Wet		< 0.001	< 0.001						
NO3-N	Dry	mg/L	1.5	1.4	0.1	7.0	0.3	7.0	2.7	5.0
	Wet		1.3	1.5						
Oil & Grease	Dry	mg/L	2.9	1.7	-	-	-	-	-	-
	Wet		1.8	1.4						
pH	Dry	-	7.0	7.2	6.5-8.5	6.5-8.5	6-9	6-9	6.5-8.5	6.5-8.5
	Wet	-	7.5	7.9						
TP	Dry	mg/L	1.2	0.5	0.1	0.5	0.5	0.5	-	2.0
	Wet		0.6	0.48						
TSS	Dry	mg/L	5	14	-	-	-	-	-	-
	Wet		3	4						

*The Environment Conservation Rules (ECR) 2023, Schedule 2-A (1) Standard for Inland Surface Water (a-f), Primary data Source: DPHE and BEETLSL laboratory, December and July 2024

a. Source of drinking water for supply only after disinfecting

b. Water usable for recreational activity

c. Source of drinking water for supply after conventional treatment
d. Water usable for fisheries
Results Analysis of Groundwater quality:

Results Analysis:

All measures except TDS, faecal coliform, and total coliform are within the ECR 2023 limit. One of the main causes of the extremely high TDS levels in water is biological contamination, such as bacteria, viruses, protozoa, and parasites. Nonetheless, the following could be a major factor in exceeding the recommended amount of total and fecal coliform:

- Leaching of sewage system
- Leaking or malfunctioning septic systems
- Uncontrolled animal grazing or improper disposal of animal waste near the groundwater source
- Improper disposal of human waste, such as open defecation or the absence of proper sewage treatment facilities
- Poorly constructed or maintained wells

Table 4-44: Groundwater Quality Monitoring Results of CBP areas

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-07	GW-08	
pH	Dry	-	7.6	7.6	6.5-8.5
	Monsoon		7.4	7.5	
Arsenic	Dry	mg/L	0.015	0.001	0.05
	Monsoon		0.001	0.001	
COD	Dry	mg/L	112	36	-
	Monsoon		16	20	
DO	Dry	mg/L	4.65	4.30	-
	Monsoon		6.10	6.30	
Hardness as $CaCO_3$	Dry	mg/L	2.30	4.70	500
	Monsoon		310	130	
Lead (Pb)	Dry	mg/L	0.002	0.001	0.01
	Monsoon		0.001	0.002	
Odor	Dry	Odorless	0	0	Odorless
	Monsoon		0	0	
Oil & Grease	Dry	mg/L	<0.01	<0.01	0.01
	Monsoon		<0.01	<0.01	
Mercury	Dry	mg/L	< 0.001	< 0.001	0.01
	Monsoon		< 0.001	< 0.001	
Sodium (Na)	Dry	mg/L	860	490	200
	Monsoon		156	32	
Temperature	Dry	°C	24.4	24.5	20-30 ℃
	Monsoon		25.7	25.5	
TSS	Dry	mg/L	1	1	10
	Monsoon		1	1	
TDS	Dry	mg/L	1440	1212	1000
	Monsoon		1350	185	
Total Coliform (TC)	Dry	N/100 ml	0	0	0

Parameters	Sampling period (Season)	Unit	Sample ID		ECR' 2023 Standard*
			GW-07	GW-08	
	Monsoon		120	5000	
Fecal Coliform (FC)	Dry	N/100 ml	0	0	0
	Monsoon		20	120	
Cr (Total)	Dry	mg/L	0.001	0.002	0.05
	Monsoon		0.002	0.001	

*The Environment Conservation Rules (ECR) 2023, Schedule 2-B Standard for Drinking Water, Primary Data Source: Baseline study, EIA survey, UDCGP of LGED, January 2024

4.2.4.9 Noise and Vibration level

Methodology of Noise and Vibration measurements were mentioned in 4.2.1.11.

Sample locations:

Table 4-45: Noise and Vibration level monitoring locations of CBP areas

Subproject Code	Noise & Vibration level Code	GPS location	Sample date (Dry season)	Sample date (Monsoon season)	Location descriptions
CBP-SWM-1	ANLM-7	21.446687N 91.975200E	07.12.2023-08.12.2023	26.06.2024-27.06.2024	Beside Kastura Ghat, LGED Bridge, Cox's Bazar
	VLM-7	21.44664N 91.97519E	07.12.2023	26.06.2024	
CBP-SWM-1	ANLM-8	21.44144N 92.01102E	07.12.2023-08.12.2023	26.06.2024-27.06.2024	S M Para, Cox's Bazar
	VLM-8	21.44147N 92.01102E	07.12.2023	26.06.2024	

Results Analysis:

Possible significant reason behind crossing the standard level and baseline value:

- People's Movement and their interventions
- Vehicle's Movement and using horn
- Ongoing Construction activities within 1 km of radius
- High wind speed and
- Open Area with Chirping of birds and insects

Table 4-46: Noise level monitoring results of CBP sites

Sampling ID	Monitoring Time	Sampling period (Season)	Noise level [dB(A)]			*Noise Pollution Control Rules 2006	Category
			L_{eq}	L_{max}	L_{min}		
ANLM-7	Day	Dry	67.34	88.7	41.1	60	Mixed
	Night		55.77	71.2	34.3	50	
	Day	Monsoon	72.58	93.9	46.3	60	Mixed
	Night		58.57	74.0	37.1	50	
ANLM-8	Day	Dry	61.82	84.8	31.1	60	Mixed
	Night		59.34	75.2	33.7	50	
	Day	Monsoon	67.23	90.2	36.5	60	Mixed
	Night		61.45	77.3	35.8	50	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and July 2024.

Table 4-47: Vibration level monitoring results of CBP sites

Code	Sampling period	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value
VLM-5	Dry	0.09	0.05	0.016	0.063	0.0	0.0	0.000	0.000	0.005	0.0	0.001	0.001
	Monsoon	0.01	0.01	0.000	0.010	0.5	0.3	0.033	0.411	0.779	0.023	0.134	0.137
VLM-6	Dry	0.33	0.05	0.063	0.109	0.2	0.1	0.004	0.200	0.075	0.0	0.006	0.003
	Monsoon	0.01	0.01	0.000	0.010	0.2	0.2	0.000	0.200	0.37	0.023	0.090	0.105

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023 and June-July 2024

Results Analysis:

From the measured data it has been observed that, according to the BS 5228-2:2009 standard, the vibration level of all monitoring locations is very insignificant, negligible and perceptible in residential environments. But, this level of vibration might not pose any complaints, intolerable, and uncomfortable situation for all residents residing near the sampling site. It was also observed that residents near the sample site are habituated to this vibration level and have no complaints regarding this issue.

4.2.4.10 Soil Quality

Methodology of soil quality analysis, sample collections etc., were depicted in 4.2.1.12.

Table 4-48: Locations of the soil samples of CBP

Subproject code	Sample ID	GPS Location	Sampling Date		Site descriptions
			Dry	Monsoon	
CuCC-SWM-1	SQ-5	23.463116N 91.214422E	12.12.2023	26.06.2024	Landfill site, Jakunipara, Jagonnathpur, Cumilla
CuCC-D-4	SQ-6	23.446799N 91.1483255E	13.12.2023	26.06.2024	Gungaijuri Canal Side, Near Coat Bari Bus Stand, Cumilla

Results Analysis:

It is crucial to understand that Bangladesh does not have a standard for analyzing soil quality. Therefore, in order to examine the soil quality, EPA standards have been utilized. These standards are environmental pollutant reference values, or the concentrations of pollutants in environmental media, that are used in environmental remediation, investigation, and cleanup. In conclusion, this standard is applied globally to assess the condition of the soil in order to protect it from harm and restore previous harm brought on by human activities. Nevertheless, EPA guidelines only establish limitations for Cr, Pb, and Cd out of all the characteristics. However, because the majority of soil test locations are next to roads or agricultural areas, the values of Cr and Pb have essentially exceeded the acceptable limit. So, Cr and Pb may arise from the usage of pesticide and urban runoff.

Table 4-49: Soil Quality Monitoring Results of CBP sites

Season	Parameters	Unit	Sample ID		EPA Guideline*
			SQ7/482	SQ8/483	
Dry	P^H	--	8.0	8.2	--
Monsoon			6.01	8.10	
Dry	Chromium (Cr)	PPM	82.71	61.91	5.00
Monsoon			9.50	21.49	
Dry	Iron (Fe)	PPM	78.03	55.07	--
Monsoon			0.72	1.86	
Dry	Lead (Pb)	PPM	22.94	22.90	5.00
Monsoon			0.63	9.05	
Dry	Magnesium (Mg)	meq/100g Soil	3.11	3.30	--
Monsoon			0.10	0.28	
Dry	Cadmium (Cd)	PPM	0.48	1.60	1.00
Monsoon			0.04	0.01	
Dry	Phosphate (PO_4)	PPM	47.67	28.17	--
Monsoon			0	0	
Dry	Organic Matter (OM)	%	2.07	1.97	--
Monsoon			0.87	2.91	
Dry	Nitrogen (N)	%	0.12	0.11	--
Monsoon			0.10	0.17	
Dry	Oil & Grease	PPM	>1.0	<1.0	--
Monsoon			>1.0	<1.0	

Source: Baseline Survey, EIA study, UDCGP, LGED, December 2023, and June 2024.

4.2.4.11 Sources of environmental pollution

The source of environmental pollution in the subproject areas as follows:

- Dumping sites of solid waste
- Dust from vehicles and construction works.
- Noise from vehicles and construction sites.
- Air pollution from vehicles, industry, and dust suppressions.
- Surface water pollution from wastewater drains and industrial waste.
- Groundwater pollution from wastewater drains and industrial waste
- Soli pollution from releasing of oil -grease-mobile from vehicles, construction equipment, motor engines, industrial wastes, solid wastes etc.

4.3 Biodiversity

It describes the biological status of terrestrial flora and fauna, aquatic flora and fauna, seawater habitats, & creatures, wetlands, endemic/threaten/endanger species, adjacent Protected Areas (PAs), and Ecological Critical Area (ECA) include land use status in the project areas following the Bangladesh Biodiversity (Conservation) Act 2017.

4.3.1 Gazipur City Corporation (GCC)

Gazipur is a famous place for shalban forest which is away from the project sites. Gazipur city corporation is a mixed zone of urban, semi-urban and peri-urban areas, local wild species are very common like other areas. However, the project minutely observes the biological status of

the city corporations and assesses the possible effects caused by the project activities. The details are given below.

4.3.1.1 Terrestrial flora and fauna

The GCC area is mainly urbanized and devoid of terrestrial flora as such. However, some trees are found along the roads and backyards of the homesteads. The floras found in middle canopy of the region and those in lower canopy and the climbers-cum-lianas are found in Table 4-5.

Various types of agricultural crops are grown in the district. Among cereal crops, boro covers the largest area and aman, aus, wheat is also grown. Other crops include jute, mesta, mustard, vegetables and spices, sesame, sugarcane, pineapple (*Ananas* comosus), guava (*Psidium guajava*) etc. Jackfruit (*Artocarpus heterophyllus*) is extensively grown and is an important cash crop. Ensure that it is mandatory for Subcontractors to print their bank details like Account no., Bank name, IFSC code on the Invoice itself to release the payment.

Table 4-50: Common floral species in GCC and its adjacent areas

Local Name/English Name	Scientific Name	Local Name/English Name	Scientific Name
Middle Canopy		Ashoka	*Saraca indica*
Black berry	*Syzygium cumini*	Sheora	*Streblus asper*
Neem	*Azadirachta indica*	Gab	*Diospyros precatorius*
Kanchan	*Bauhinias variegate*	Mahaneem	*Garuga pinnata*
Sonalu	*Cassia fistula*	**The lower canopy and the climbers-cum-lianas**	
Minjiri	*Cassia siamea*	Kul	*Zizyphus mauritiana*
Kumbh	*careya arborea*	Kumarika	*Smilax aspera*
Mango	*Mangifera indica*	Gach alu	*Dioscorea s*
Amra	*Spondias mangifera*	Babul	*Acacia arabica*
Amlok	*Phyllanthus emblica*	Wood	*Fordia fruticosa*
Bonboroi	*Zizyphus rugosa*	Bamboo	*Bambusa sp*
Sinduri	*Mallotas philippensis*	Otthi	*Curcuma zedoaria*

Source: ICGP, Final Report Volume 5, GCC Edition, JICA, March 2014, LGED, People's Republic of Bangladesh

Terrestrial Fauna:

For the destruction of forests in the Modhupur tract (Bhawal Garh), most of the wild animals have disappeared from this area. However, some animals belonging to mammalian fauna are still found in the Gazipur district. Different species of birds are also commonly found in this district. They are presented in Table 4-51.

Table 4-51: Common Types of Terrestrial Fauna in GCC

Local Name/ English Name	Scientific Name	Local Name/ English Name	Scientific Name
Mammal		Koel	*Tyto alba*
Rhesus monkey	*Macaca mullata*	Spotted Owlet	*Apus affinis*
Wild boar	*Sus scrofa*	Barn Owl	*Helcyon smyrnensis*
Hispid hare	*Caprolagus hispidus*	House Swift	*Merops orientalis*
Jungle cat	*Felis chaus*	Whitebreasted Kingfisher	Picus *myrmecophoneus*
Flying fox	*Pteropus gigant eus*	Green Bee-Eater	*Dicurus macrocercus*
Shortnosed fruit bat	*Cynopterus spinx*	Lesser Golden Backed Wood Pecker	*Dicrurus paradiseus*
Jackal	*Canis aureus*	Black Drongo	*Acridotheres tristis*
Common otter	*Lutra perspicillata*	Greater Racket-Tailed Drongo	*Corvus splendens*
Common mongoose	*Herpestes edwardsi*	House Crow	*Acredotheres fuscus*
House mouse	*Mus musculus*	Jungle Mayna	*Pycnotus cafer*
Common house rat	*Bandicota bengalensis*	Redvented Bulbul	*Orthotomus sutorius*
Indian porcupine.	*Hystrix indica*	Tailor Bird	*Copsychus saularis*
Bird		Magpie-Robin	*Copsychus malabaricus*
little cormorant	*Amaurornis phoenicurus*	Shyama	*Passer domesticus*
pond heron	*Streptopelia chinensis*	House Sparrow	*Ploceus phillippinus*
White Breasted Water Hen	*Psittacula alexandari*	Weaver Bird	*Lonchura punctulata*
Spotted Dove	*Psittacula enpatria*	Spotted Munia	*Amaurornis phoenicurus*
Redbreasted Parakeet	*Eudynamis scolopacea*	Little Cormorant	*Streptopelia chinensis*
Roseringed Parakeet	*Athene brama*	Pond Heron	*Psittacula alexandari*

Source: ICGP, Final Report Volume 5, GCC Edition, JICA, March 2014, LGED, People's Republic of Bangladesh.

4.3.1.2 Aquatic flora and fauna

Aquatic Flora:

The most abundant hydrophytes in the area, numerous algae and amphibian plants are found in the roadside water bodies.

Table 4-52: Common Types of Aquatic Flora in GCC

Local Name/English Name	Scientific Name	Local Name/English Name	Scientific Name
Abundant hydrophytes		Helenchaa	*Enhydra fluctuant*
Kochuripana	*Eichhornia crassipes*	Duckweed	*Spiredella sp.*
Topapana	*Pistia stratiotes*	**Numerous algae**	
Khudipana	*Lemna minor*	Spirogyra	*Spirogyra porticalis*
Pata Jhajii	*Vallisneria spiralis*	Scytonema	*Scytonema hofmanii*
Shapla	*Nymphaea sp.*	**Amphibian plant**	
Kolmi	*Ipomoea aquatica*	Dhol kolmi	*Ipomoea fistulosa*

Source: ICGP, Final Report Volume 5, GCC Edition, JICA, March 2014, LGED, People's Republic of Bangladesh.

Aquatic Fauna:

Various water bodies of the district constitute habitats for the fish population. A large variety of fish that are found as in the table below.

Table 4-53: Common Types of Aquatic Fauna in GCC

Local Name/English Name	Scientific Name	Local Name/English Name	Scientific Name
Fish		koi	*Anabas testudineus*
ruhi	*Labeo rohita*	datina	*Acanthopagrus latus*
katla	*Catla catla*	tengra	*Mystus vittatus*
mrigel	*Cirrhinus mrigala*	chanda	*Mene muculata*
kalibaush	*Labeo calbasu*	bain	*Mastacembelus armatus*
magur	*Clarias batrachus*	gozar	*Channa marulius*
shing	*Heteropneustes fossilis*	kholisha	*Colisa fasciatus*
shoil	*Channa striatus*	mola	*Amblypharyngodon mola*
airh	*Mystus aor*	pabda	*Ompok pabda*
bele	*Glossogobius giuris*	sharputi	*Puntius sarana*
boal	*Wallago attu*	pangas	*Pangasius pangasius*
phalli	*Notopterus notopterus*	chingri	*Palaemon malcolmsonic*

Source: ICGP, Final Report Volume 5, GCC Edition, JICA, March 2014, LGED, People's Republic of Bangladesh

4.3.1.3 Wetlands

Mokosh Beel: Mokosh is perennial wetlands, situation at Kaliakoir Upazila of Gazipur district, which is far away from the project areas of GCC. So, due to the project activities, no impacts will occur in this important wetland.

4.3.1.4 Endemic/Threaten/Endanger Species

No endemic or endangered species found in the project areas following the IUCN Red list, 2015.

4.3.1.5 Adjacent Protected Areas (PAs)

Name of PAs	Location	Area (hectares)	Date of Declaration	Type
Bhawal NP	Gazipur	5022.29	11/05/1982	National Park
Bangabandhu Sheikh Mujib Safari Park	Gazipur	1390.00	-	Safari Park

Source: Forest Department, July 2018

4.3.1.6 Ecological Critical Area (ECA)

Name of PAs	Location	Area (hectares)	Date of Declaration	Type
Turag	Gazipur and around Dhaka city	3,771	2009	River

4.3.1.7 Land Use: Existing land condition, project land use, ECA areas

The land use zoning statistics is given below:

Sl. No.	Land use Zone	Area (acres)	%
1	Residential Zone	784.48	0.98
2	Overlay Zone	6052.09	7.59
3	Commercial Zone	177.71	0.22
4	Residential Dominating Mixed Use Zone	29357.54	36.82
5	Institutional Zone	996.71	1.25
6	Commercial Dominating Mixed Use Zone	3195.24	4.01
7	Industrial Zone	1833.83	2.30
8	Industry Dominating Mixed Use Zone	6559.09	8.23
9	Agricultural Zone	19103.62	23.96
10	Open Space Zone	1847.27	2.32

Sl. No.	Land use Zone	Area (acres)	%
11	Waterbody Zone	4796.60	6.02
12	Transport and Communication Zone	5030.59	6.31

Source: (Draft Master Plan, GCC, 2024)

4.3.2 Narayanganj City Corporation (NCC)

4.3.2.1 Terrestrial flora and fauna

The study found that a total of 39 different tree species were found in NCC, the most common species are Khejur, Supari, Narikel, Aam, Boroi, Peyara, Kathal, Sajna, Bel, Lebu, Chalta, Kola, Neem, Tetul, Bansh, Akashmoni, Eucalyptus, Kadam, Raintree, Mehogani, Jam, Koroi, Krishnochura, Bot, Amloki, and Litchu etc.

However, the most common reptiles are Guisap, Tiktiki, Choto Tiktiki, Shobuj Bang, Roktochosa, Pana Bang, Kad Bang, Kuno Bang, Kona Bang, Khek Shial, Ban biral, Paina Shap, Huria, Ramdhonu Shap Gokhra Shap etc.

whereas, the most common avifaunal species were found of Bhat Shalik, Pati Machranga, Dahuk, Go Bok, Kani Bok, Jalali Kobutor, Doel, Bangla Nilkanto, Dar Kak, Pati Kak, Bangla Kaththokra, Sobuj Suichora, Kalo Chil, Nishi Bok, Tuntuni, Ghor Chorui, Eurasio Kanthi Ghugu, Go Shalik, Jol pipi, Asio Kokil, Mete Bon Ababil, Kalo Finge, Khoira Matha Jol Kobutor, Blue-throated Barbet, Sonkho Chil, Khoira Latora, common greenshank, Grey-headed myna, Pati Batan, White-throated munia, and Chhatare pakhi etc.

Around eight different species of butterfly was found in the study areas of NCC which are mostly Blue Mormon, Common crow butterfly, Common Grass Yellow butterfly, Common Mime, Blue Pansy, Palin tiger butterfly, Stripe Albatross butterfly, and three spot yellow butterfly etc. Details in Annexure-6a.

4.3.2.2 Aquatic flora and fauna

The most common fish species in the study areas of NCC are Mola, Koi, Catla, Taki, Shol, Magur, Common carp, Chapila, Rui, Tara Baim, Pangas, Teri Punti, Titpunti, Gura Chingri, Baim, Shing, and Kalibaos etc. Details in Annexure-6b.

4.3.2.3 Wetlands

There are several water bodies in the NCC area. Major water channel in Sitalakhya River, and Kashipur River and its length is about 35 kilometers that flowing in north south direction. There are about 55.5 km canals and only one lake named Jimkhana (length 0.619 km) in the project area. Being a low-lying area and having opposite directional slope towards Sitalakhya River, local ponds, ditches and marsh lands act as water reservoir during monsoon. The major wetlands in NCC areas include Kadamrasul khal, Dhaleswari Branch, Sitalakhya Branch, Kashipur River, Polykhali Khal, DND Khal, Baburail Khal, Jelapara Khal, Par Khal, WAPDA Khal, Jimkhana Khal, Konsol Khal, Pagla Khal etc. The length of the river is 35 km, lake less than 1 km, canal is about 56 km, and borrow pit is about 8 km.

4.3.2.4 Endemic/Threaten/Endanger Species

The endangered or near threatened species, and vulnerable fish species were found during the biodiversity assessment study period, these are mainly Tara Baim (*Macrognathu saculeatus*) is considered as NT (near threatened) species as per IUCN Red list, 2019.

Pangas (Pangasius pangasius) is a kind of Endangered Listed species, Titpunti (*Puntius ticto*), and Kalibaos (*Labeo calbasu*) are vulnerable species.

The butterfly species such as Common Mime (*Papilio clytia*) is listed as Endangered species in IUCN Red list, 2019, and Palin tiger butterfly (*Danaus chrysippus*) is about Near Threatened (NT) species.

The reptile species are Ban biral (*Felis chaus*), and Gokhra Shap (*Naja kaouthia*) are listed as NT (near threatened) species in IUCN Red list, 2019. However, a total of 39 tree species were found, among them, Bel (*Angle marmelos),* lemon (*Citrus aurantifolia)*, Chalta (*Dillenia indica*), tetul (*Tamarindus indica*), Koroi (*Albizia procera),* Krishnochura (*Delonix regia*), Banayan tree (*Ficus bengalensis*), and Amloki (*Phyllanthus emblica*) etc., are categorized as rare species (R) as per IUCN Red list, 2019.

4.3.2.5 Adjacent Protected Areas (PAs)

Within the project areas, there were protected areas, ecologically sensitive areas, biodiversity hotspot, and major wetlands (government declared).

4.3.2.6 Ecological Critical Area (ECA)

Location, and distance of project site from national parks, sanctuaries, biosphere reserves, reserve forests, or protected forests in the study area etc.

4.3.2.7 Land Use: Existing land condition, project land use, ECA areas

The land use of the NCC area has been divided into fifteen broad categories. The categories are administrative, agriculture, commercial, community facilities, education and research, health facilities, industrial, miscellaneous, mixed use, open space, recreational facilities, residential, restricted, transportation and communication and water body. Block-wise land use has been analyzed and categorized. Residential use is dominant in the NCC area which is 30.65% of the total area. Being served by Sitalakkhya river and a large number of water bodies like canal, pond, ditches, borrow pits and marsh lands, water bodies occupy considerably 23.40% (11.02 sq. km) of the total land area.

4.3.3 Cumilla City Corporation (CuCC)

4.3.3.1 Terrestrial flora and fauna

Tree Species:

Shimul, Khejur, Supari, Narikel, Lichu, Aam, Boroi, Peyara, Kathal, Kodbel, Sajna, Jalpai, Jambura, Bel, Sarifa, Ata, Kamranga, Tal, Lebu, Chalta, Bilati gub, Kadbel, Safeda, Dalim, Kola, Dalkalmi, Ghrita Kumari, Dutura, Tit begun, Papaw, Neem, Tetul, Kachu, Durbagrass, Dhekishak, Helencha, Assamlata, Gimashak, Hatishur, Lajjabati, Bishkatali, Nishinda, Mehendi, Jaba, Jarul, Debdaru, Bansh, Akashmoni, Shirish, Sonalu, Eucalyptus, Kadam, Raintree, Mehogani, Jam, Koroi, Krishnochura, Gab, Mandar, Bot and Amloki etc. Details in Annexure-6a.

Butterfly:

Blue Mormon, Common crow butterfly, Common Grass Yellow butterfly, Common Mime, Blue Pansy, Indian Cabbage, Palin tiger butterfly, Stripe Albatross butterfly, three spot yellow butterfly and Psyche butterfly etc.

Reptiles:

Guisap, Tiktiki, Choto Tiktiki, Shobuj Bang, Roktochosa, Pana Bang, Kad Bang, Kuno Bang, Kona Bang, Khek Shial, Ban biral, Paina Shap, Huria, Ramdhonu Shap, and Gokhra Shap.

Avifauna:

The common avifaunal species in the study areas of CuCC are Jhuti Shalik, Gang Shalik, Bhat Shalik, Pati Machranga, Dahuk, Sam Khol, Go Bok, Kani Bok, Mete Bon Ababil, Kana Ko, Jalali Kobutor, Doel, Bangla Nilkanto, Dar Kak, Pati Kak, Finge, Bangla Kaththokra, Baluapakhi, Sonkho Chil, Hutum Pecha, Kala Matha Jol Kobutor, Sobuj Suichora, Kalo Chil, Nishi Bok, Holde Pakhi, Tuntuni, Ghor Chorui, Deshi Babui, Sabuj Tia, Eurasio Kanthi Ghugu, Go Shalik, Dagi Chhatare, Lokhi Pecha. And Metematha Titi etc. Details in Annexure-6b.

4.3.3.2 Aquatic flora and fauna

Fish species:

During the study period, a total of 32 different kinds of fish species were found in Cumilla City Corporation and its adjacent areas which are mainly Mola Carplet, Koi, Catla, Gajar, Taki, Shol, Mrigal, Magur, Khailsha, Kachki, Common carp, Darkana, Bacha, Bailla, Chapila, Rui, Tara Baim, Kuchia, Tengra, Foli, Pabda, Pangas, Teri Punti, Tit punti, Darkina, Baila, Boal, Kankila, Ayer fish, Chital, Gura Chingri, Baim etc. Details in Annexure-6c.

4.3.3.3 Wetlands

The most common wetlands in the city areas are: Cumilla City Park, Cumilla Board of Education Park and Lake, Dharma Sagor Parks and Pon etc. However, these wetlands will not be affected due to the project activities, and exact location of the project site is outside of town, so, no impact is anticipated caused by the project activities.

4.3.3.4 Endemic/Threaten/Endanger Species

Fish species:

There are some fish species are critical in position, likewise, the near threatened species are Mrigal (*Cirrhinu scirrhosus),* Darkina (Rasborarasbora), vulnerable species of Common carp

(*Cyprinus carpio*), Chapila, (*Gudusia chapra),* Kuchia (*Monopteru scuchia),* Foli (*Notopterus notopterus),* Titpunti (*Puntius ticto), and Endangered Species are* Baila (*Stigmatogobius sadanundio),* Ayer fish (Sperata aor), and Chital (Chitala chitala) etc. Details in Annexure-6c.

Avifauna: No endangered, threatened or vulnerable species of avifauna was found in the study areas. Details in Annexure-6b.

Reptiles:

The near threatened species of Roktochosa (*Calotes versicolor),* Gokhra Shap (*Naja kaouthia*), and vulnerable species of Khek Shial (*Vulpes bengalensis)*, and ban biral (*Felis chaus*) etc., was found in the CuCC areas and its adjacent areas during the assessment period.

Butterfly:

In the butterfly survey, Common Mime species was found in Endangered Species and Palin tiger butterfly species was Near Threatened species categories as per IUCN Red list 2019 in the study areas.

Tree species:

According to IUCN Red list 2019, the rare (R) tree species were found in the study areas of Jalpai (*Elaeocarpus robustus*), Jambura (*Citrus grandis*), Bel (*Angle marmelos*), Sarifa (*Annona reticulata*), Ata (*Annona squamosa*), Kamranga (*Avarrhoa carambola*), Tal (*Borassus flabollifer*), Chalta (*Dillenia indica*), Bilati gub (*Diospyros blancoi*), Kadbel (*Feronia limonia*), Safeda (*Manilkara sapota*), Dalim (*Punica granatum*), Neem (*Azadirachta indica*), Tetul (*Tamarindus indica*), Koroi (*Albizia procera*), Krishnochura (*Delonix regia*), Gab (*Diospytos eregrine*), Mandar (*Erythrina indica*), Bot (*Ficus bengalensis*), and Amloki (*Phyllanthus emblica*) etc.

4.3.3.5 Adjacent Protected Areas (PAs)

Rajeshpur Sal Forest declared by the Government of Bangladesh as Protected Area (PA). This is the southernmost habitat of natural Sal in the Indian sub-continent. Most of the Sal Forest has already disappeared, and only remnants are visible. However, this Sal Forest is far away from the city corporation, more than 10 km, so, due to the project activities, this Sal Forest will not be affected.

4.3.3.6 Ecological Critical Area (ECA)

No ecological critical areas are within 10 km of the project site, however, Rajeshpur Sal Forest is far away from the city corporations. So, no impact is anticipated by the project activities in CuCC areas.

4.3.4 Cox's Bazar Pauroshava (CBP)

4.3.4.1 Terrestrial flora and fauna

Tree Species:

The most common tree species in CBP areas are supari, Narikel, Aam, Boroi, Arjun, Peyara, Kathal, Sajna, Bel, Lebu, Kola, Tetul, Bansh, Akashmoni, Eucalyptus, Koroi, Amloki, Gamhar, Garjan, Bet, Hijol Tree, Kala koroi, Sissoo etc. Details in Annexure-6a.

Butterfly:

The most common butterfly species in CBP areas Barunpakha, Kauwa, Pairachali, Holud, Kuchila, Morchepata and Tamot etc.

Reptiles:

The most common reptiles are in the CBP areas of Guisap, Tiktiki, Choto Tiktiki, Shobuj Bang, Roktochosa, Pana Bang, Kad Bang, Kuno Bang, Kona Bang, Khek Shial, Ban biral, Paina Shap, Huria, Ramdhonu Shap, Gokhra Shap etc.

Avifauna:

Cox's Bazar is a place of bird diversity, a lot of different bird species are usually found in the study areas. The most prominent bird species are Sandpipper, Bhat Shalik, Pati Machranga, Eshio Kokil, Pakra Shalik, Kala Fingey, Bhubon Cheel, Kalamatha Benebou, Dol Pipi, Khoiralej Kathshalik, Pati Shobujpa, Pati Hudhud, Boro Kubo, Shobuj Shuichora, Jhuti Shalik, Cchoto Boga, Dahuk, Boro Bog, Kani Bok, Pakra Macchranga, Begunikomor Moutushi, Tila Ghughu, Udoi Doel,Pati Kak, Pati Tuntuni, Pati Chorui, Eureshio Konthighughu, Pati Batan, Dholagola Macchranga, and however, migratory birds (seasonal) are also found in the areas which are mainly petrels, snipes, shanks, lapwings, geese, ducks and other waterfowls. Details in Annexure-6b.

4.3.4.2 Aquatic flora and fauna

Cox's Bazar is a very special place for different kinds of fish species, particularly for saline water fishes with freshwater fish species. The freshwater fish species are mainly Mola Carplet, Koi, Catla, Gajar, Taki, Shol, Tengra, Mrigal, Magur, Kachki, Common carp, Bailla, and the saline water species are Teen Chokha, Dalli Chewa, Queen Loach, Nama Chanda, , Bacha, , Decre Poa, Bata, Nuna-tengra, , Bheda, Chewa, Chela, Phasa, and loitta, Suri with others species. In addition, Cox's Bazar has a special attention for shrimp fishes, the most common shrimp species are Bagda Chingri, Roda Chingri, Chaka Chingri, Gura Chingri, Golda Chingri, Horina Chingri etc. Details in Annexure-6c.

4.3.4.3 Wetland

No majors inland or coastal wetlands declared by the Government of Bangladesh within 10 km of the project areas.

4.3.4.4 Endemic/Threaten/Endanger Species

The list of endemic species or threatened species or endangered species in the CBP areas is as follows:

List of Butterfly Species				
Gajar	Bullseye snakehead	*Channamarulius***	Channidae	EN
Mrigal	mrigal carp	*Cirrhinuscirrhosus*	Carp	NT
Commoncarp	Common carp	*Cyprinuscarpio*	Cyprinidae	VU
Nuna-tengra	Long whiskers catfish	*Mystusgulio*	Bagridae	NT
Bheda	Gangetic leaffish	*Nandusnandus*	Nandidae	NT
Avifauna				
Pairachali	Common Emigrant.	*Catopsilia pomona*	Pieridae	NT
Holud	Common Grass Yellow	*Eurema hecabe*	Pieridae	NT
Kuchila	Common Gull	*Cepora nerissa*	Pieridae	NT
Morchepata	Common Castor	*Ariadne merione*	BioAtlasIndia	NT
Tamot	Plain tiger, African queen, or African monarch	*Danaus chrysippus*	Danainae	NT
List of Reptiles Species				
Roktochosa	Oriental Garden Lizard	*Calotes versicolor*	Agamidae	NT
Ban biral	Jungle cat	*Felis chaus*	Felidae	NT
Khek Shial	Bengal Fox	*Vulpes bengalensis*	Canidae	VU
Gokhra Shap	Monocled Cobra	*Naja kaouthia*	Elapidae	NT
List of Tree Species				
Tetul	Tamarind	*Tamarindus indica*	Caesalpiniaceae	R
Koroi	White siris	*Albizia procera*	Mimosaceae	R
Amloki	Indian gooseberry	*Phyllanthus emblica*	Phyllanthaceae	R
Gamhar	White teak	*Gmelina arborea Roxb*	Lamiaceae	R
Garjan	Garjan oil tree	*Dipterocarpus turbinatus*	Dipterocarpaceae	R

Note: EN- Endangered, NT- Near Threatened, VU- Vulnerable, R- Rare

4.3.4.5 Adjacent Protected Areas (PAs)

There are a few protected areas in Cox's Bazar district, which are 50 km away from the project areas. The list of adjacent Protected Areas in CBP areas.

Name of Protected Areas (Pas)	Areas (ha)
Bangabandhu Safari Park	900
Chunati Wildlife Sanctuary	7,763.94
Fasiakhali Wildlife Sanctuary	1,302
Himchari National Park	1,729
Inani National Park	7,085
Medhakachhapia National Park	395.2
Teknaf Wildlife Sanctuary	11,615

4.3.4.6 Ecological Critical Areas (ECA)

The ECAs areas are mainly Sonadia Island, Teknaf Peninsula and Saint Marin's Island in Cox's Bazar district but these areas are far away (more than 50 km) from the project areas. So, no impact is anticipated on the ECA areas due to the project activities.

4.4 Socio-economic environment

Population distribution, Economic Activity, Physical Structures (Settlement) and Basic services, Social and Cultural Amenities, Public Health etc.

4.4.1 Demographic structures

The demographic structures in the study areas of ULBs are as follows:

Name of City Corporation	Total Population	Population (Male-%)	Population (female)	HHs size
NCC	709380	51.49%	48.51%	4.28
GCC	2500000	56.35%	43.65%	5.21
CuCC	671000	51.79%	49.21%	4.61
CBP	167477	56.29%	43.71%	5.67

4.4.2 Gender Status

The results of the socio-economic study revealed that the interviews were taken mostly with the male-headed households, except in Cox's Bazar, interviewed was held with women (72.1%). The remaining ULBs were with the male headed HHs. The respondents were 100% of Bengali. Details in Figure 4-23.

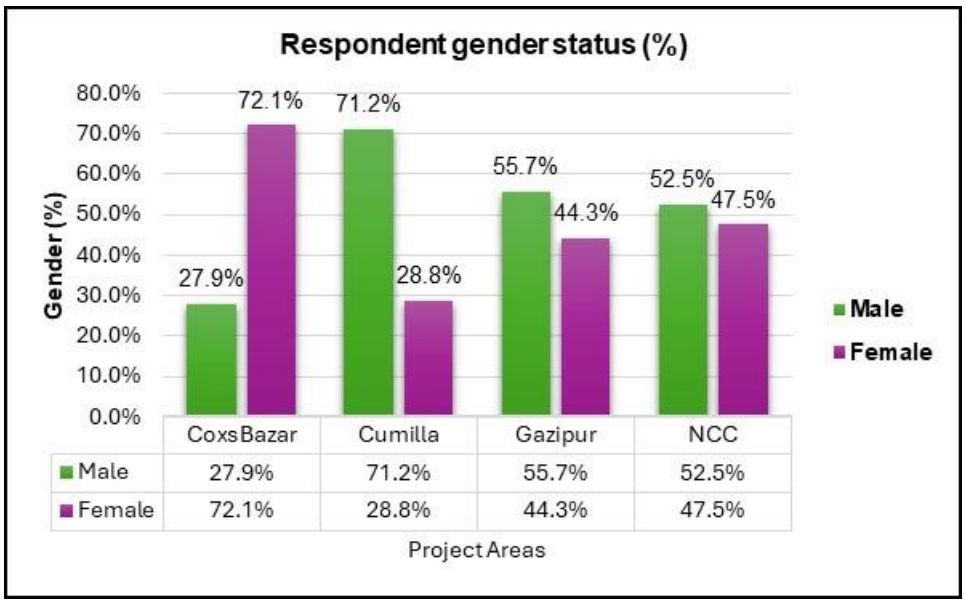


Figure 4-23: Gender status of the project areas

4.4.3 Religion Status

The religious status of the respondents were mainly Muslims (>95%) and remaining were Hindu (<5%). The details in Figure 4-24.

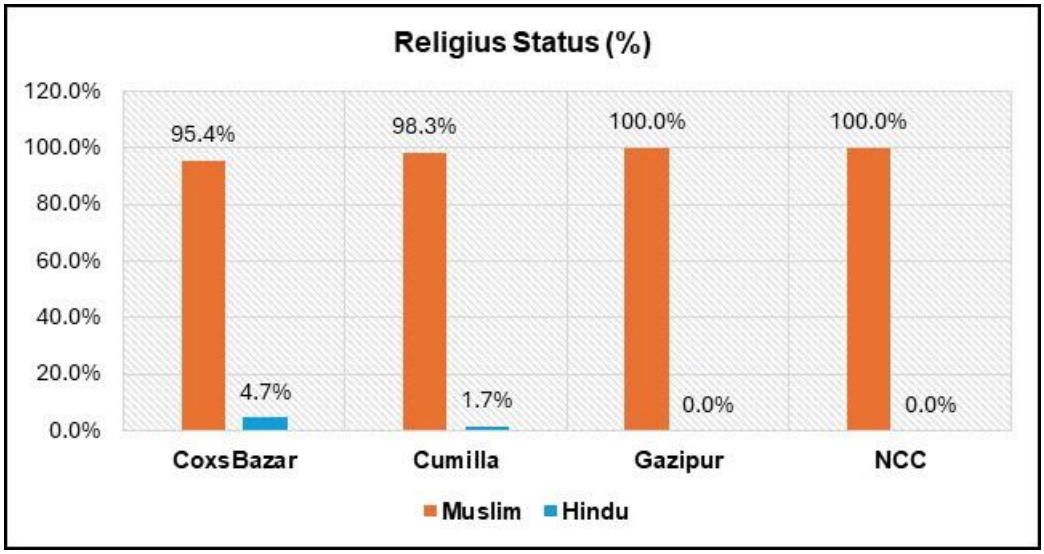


Figure 4-24: Religious status of the respondents.

4.4.4 HHs Size

In the study areas, the interviewed HHs size is an average 5 person in each HHs in Cox's Bazar Pauroshava, and Gazipur City Corporation, while it was average composition of 4 persons in each HHs in Cumilla City Corporation and Narayanganj City Corporation. Details in Table 4-54.

Table 4-54: HHs size in the study areas

ULB	N	Mean	SD	Min	Max
Cox's Bazar	44	5.045	1.94	2	10
Cumilla	60	4.483	1.672	2	8
Gazipur	61	5.131	1.784	1	9
NCC	62	4.677	1.212	2	9

4.4.5 HHs structure

The HHs structures in the study areas, semi-pucca structures were found in GCC in 57% which is highest in the study areas, however, the remaining ULBs have around 27-30% of semi-pucca structures. Katcha structures were found maximum in Cumilla which was 61% then NCC (38.7%), GCC (27.97%) and CBP (18.29%). The details are depicted in Figure 4-25.

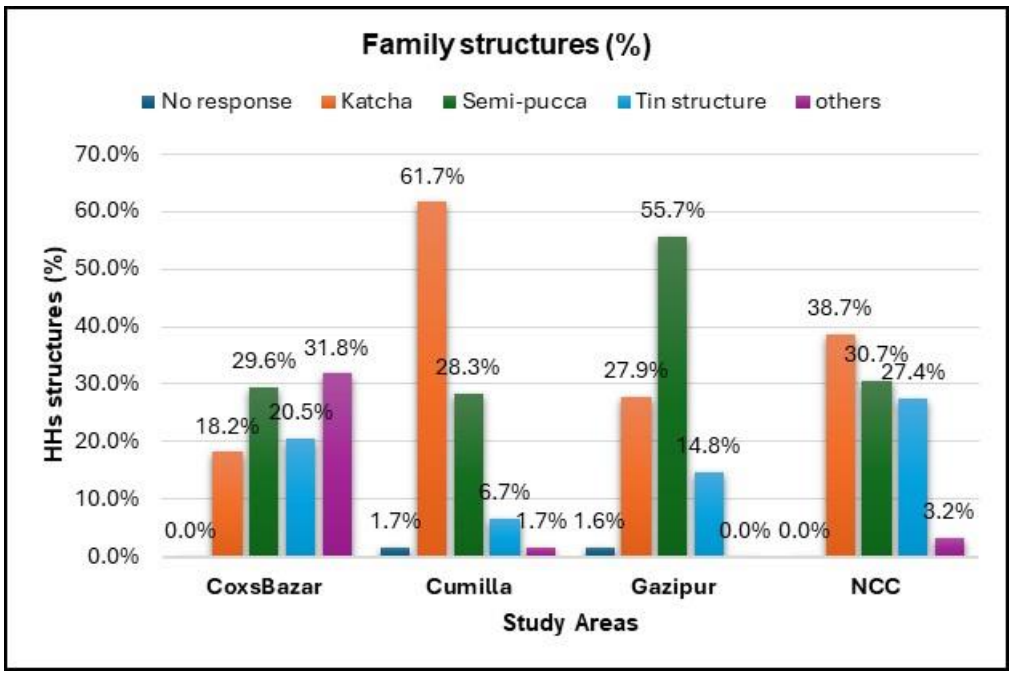


Figure 4-25: Family Status in the study areas

4.4.6 HHs Ownership Status

The study results found that most of the HHs owned by the respondents, means, they have own household, however, interviewed HHs were maximum in rental house in CuCC. The details are given in Figure 4-26.

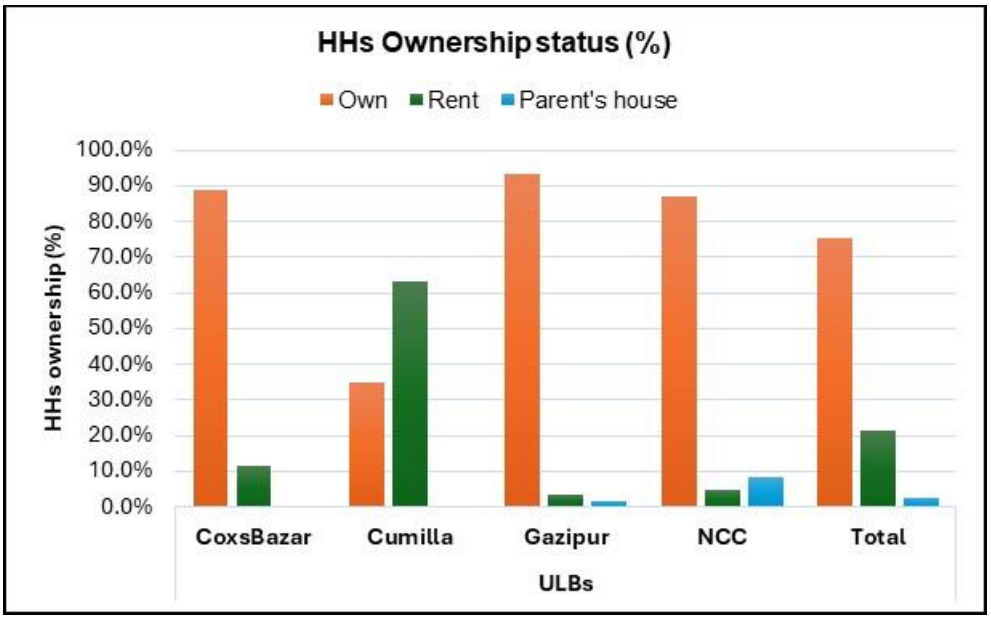


Figure 4-26: HHs Ownership Status

4.4.7 Agricultural Landownership

The results show that the average agricultural land in each household 7.625 decimal in CBP, 17.20 decimal in CuCC, 13.35 in GCC and 22.254 decimal in NCC areas. The maximum was found in NCC which is about 200 decimals, minimal was in CBP is 1.5 decimals only. The details in Table 4-55.

Table 4-55: Agricultural Landownership in the study areas

ULB	N	Mean	SD	Min (decimal)	Max (Decimal)
Cox's Bazar	4	7.625	6.074	1.5	15
Cumilla	1	17.20	.	17.20	70
Gazipur	4	13.375	18.181	4.421	40
NCC	4	22.254	22.305	11.475	200

4.4.8 Access to Road

It's found that Cox's Bazar has almost half of their road is metaled road, and around 34.3% is unmetalled road whereas Cumilla has more than 50% pucca road (metaled), and 7% brick soling road, In GCC, 36.7% roads are still katcha (unmetalled) road, and more than 6% in brick soling road and NCC was having 45% stone made road (metaled), and 40% unmetalled road. The details are given in Figure 4-27.

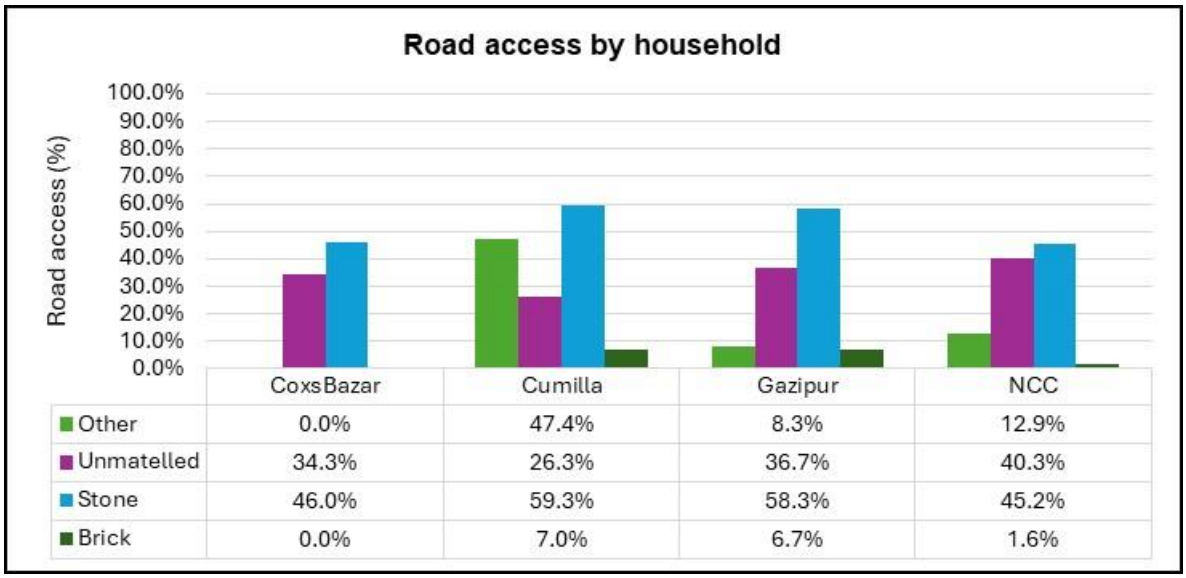


Figure 4-27: Status of road access in the study areas

4.4.9 Access to Drinking Water

In relation to access to the drinking water status, the results show that Cox's Bazar and Gazipur areas, people have own shallow tube wells, more than 40% HHs installed hand tube wells in their house premises in Cox's Bazar and NCC, and in CuCC, around 50% HHs received supply water from the city corporation and more than 40% HHs purchased drinking water from the private company. The details results found in Figure 4-28.

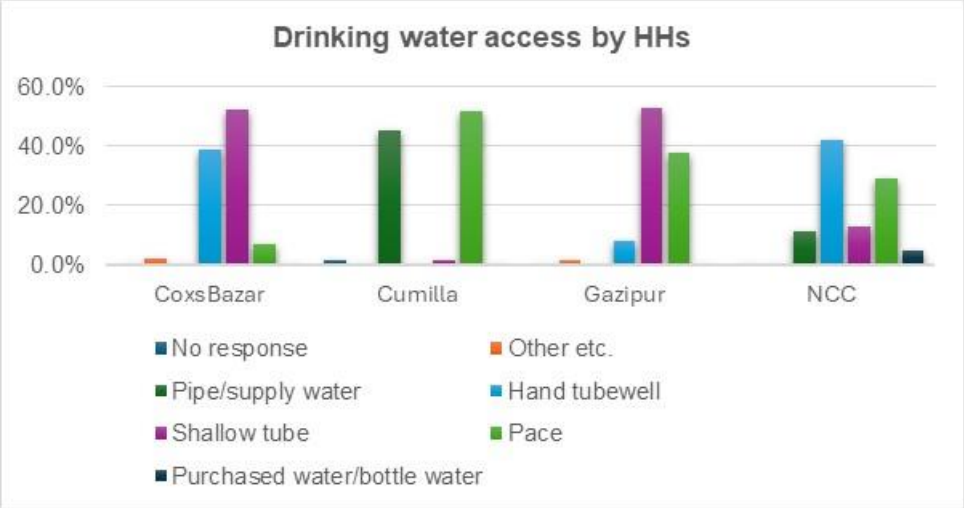


Figure 4-28: Drinking water access by HHs in the study areas

4.4.10 Access to Electricity

Regarding electricity access by HHs, the survey results found that almost same percentage received their electricity from the main distribution line. However, only less than 1% HHs received electricity from their neighbor's household. The details are given in Table 4-56.

Table 4-56: Status of electricity access in the study areas

Access to power supply	Project Areas (ULBs by %)				
	Cox's Bazar	Cumilla	Gazipur	NCC	Total
No response	0	1.67	1.64	0	0.88
No power supply	2.27	0	0	0	0.44
Electricity received from the main distribution line	97.73	98.33	96.72	100	98.24
Electricity received from the nearest HHs	0	0	1.64	0	0.44
Total	100	100	100	100	100

4.4.11 Access to the sanitary toilets

The survey results found that almost 100% of HHs have access to the sanitary toilets in their HHs premises. However, only 1.72% HHs, and 1.64% HHs in GCC and NCC don't use the sanitary toilets. The details are found in Figure 4-29.

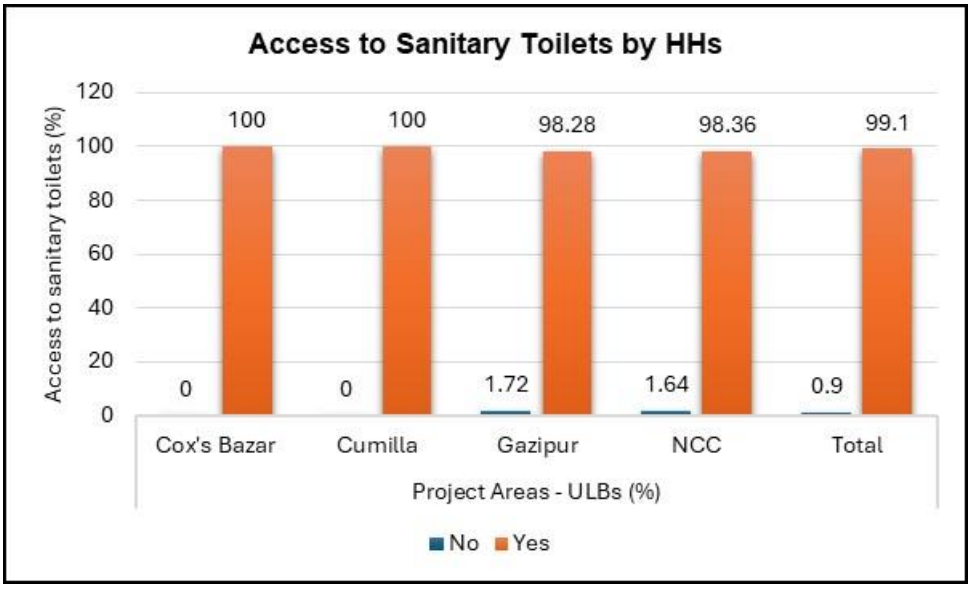


Figure 4-29: Status of sanitary toilets access by HHs in the study areas

4.4.12 Access to the cooking fuel

The survey results found that bottle gas (LNG cylinder) is the highest use in NCC areas (58%), maximum number of HHs has access to the supply gas in CuCC (almost 70%), firewood used by 45% HHs in GCC and 48% in CBP areas. The details are given in Figure 4-30.

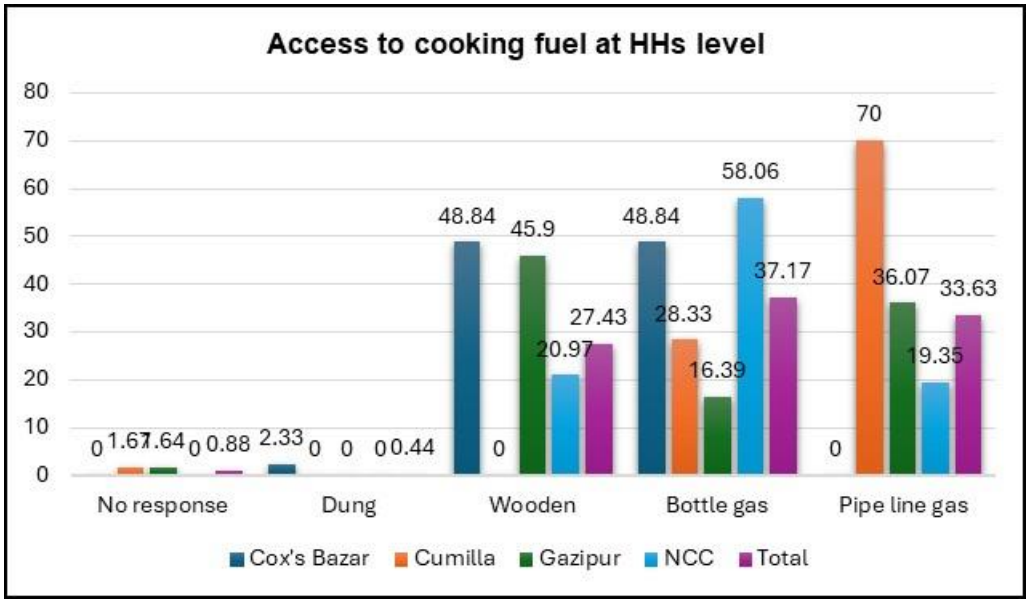


Figure 4-30: Cooking fuel used by HHs in the study areas

4.4.13 HHs Monthly Income

The average monthly income of HHs in Cox's Bazar is more than 20000 BDT, Cumilla 39000 BDT, Gazipur more than 17000 BDT and NCC is over 28000 BDT. The details are given in Table 4-57.

Table 4-57: Average HHs Monthly Income in the study areas

(Unit: BDT)

Monthly Income (BDT)					
Name of ULBs	N	Mean	SD	Min	Max
Cox's Bazar	42	20690.476	13556.545	3000	80000
Cumilla	58	39448.276	26779.262	9000	125000
Gazipur	45	17200	12241.138	0	70000
NCC	61	28032.787	20923.645	6000	150000

4.4.14 HHs Monthly Expenditure

The results revealed that average monthly expenditure (BDT) at HHs level in Cox's Bazar was more than 20000 BDT, Cumilla 33000 BDT, Gazipur 1000 BDT, and NCC 24000 BDT. The details are given in Table 4-58.

Table 4-58: Average Monthly Expenditure in the study areas

(Unit: BDT)

Family monthly expenses (BDT)					
Name of ULBs	N	Mean	SD	Min	Max
Cox's Bazar	38	21289.474	12174.204	3000	55000
Cumilla	56	33435	21298.632	9000	100000
Gazipur	1	10000	10000.	10000	10000
NCC	62	24664.516	15816.79	6000	120000

4.4.15 Environmental Problems

It's found that the distinctive environmental problems are bad smell of solid wastes, mosquitos or flies' problem, unhealthy living conditions, air pollution and others. The people in the study areas are suffering from mosquito and flies' problems mostly in and around the landfill sites, in addition with bad smells and drinking water contamination etc. Details are given in Figure 4-31.

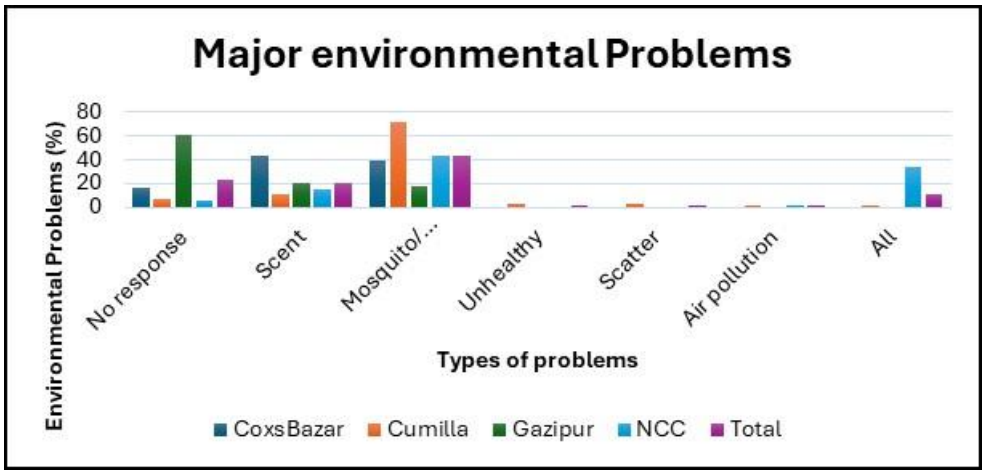


Figure 4-31: Environmental Problems in the study areas

4.4.16 Status of Solid Waste Management

The survey results found that there are lot of environmental problems generated from the landfill sites, and people are suffering a lot. The anticipated problems are bad smells, mosquitos, foul odors, illnesses etc., the details are given in Figure 4-32.

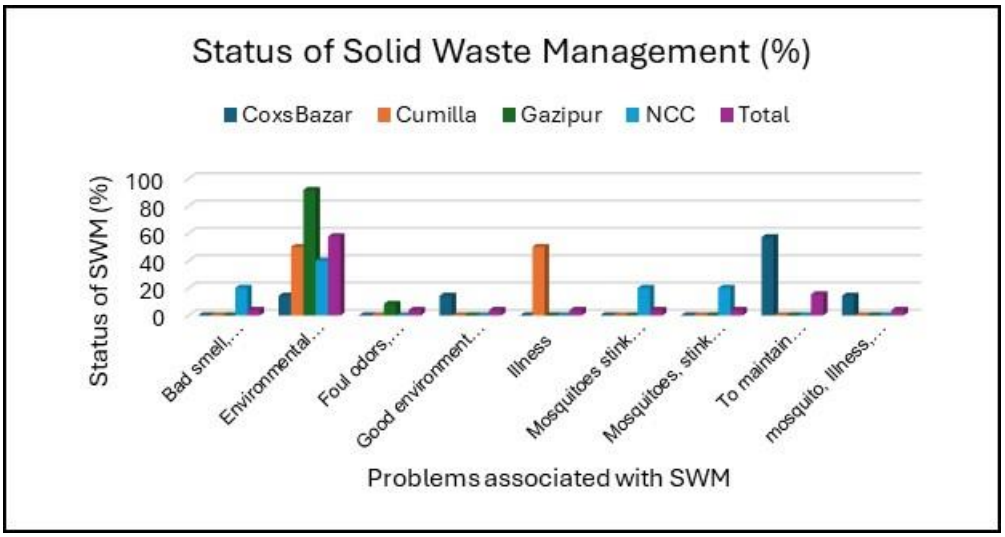


Figure 4-32: Environmental problems associated with SWM of Landfill sites

5.0 Impact Predictions and Evaluations

5.1 Introduction

The potential impacts were assessed based on the project activities. The project will have three implementation phases: (a) Pre-Construction Phase (b) Construction Phase and (c) Operation and Maintenance Phase.

The major project areas are mainly:

- Development of solid waste management systems in the ULBs (urban local bodies)
- Construction and improvement of landfill sites to sanitary landfill sites in the ULBs.
- Construction of flyover (rail crossing over the joydebpur rail junctions) in GCC.
- Re-excavation of Ganguajuri-Racecourse Canal at CuCC.

5.2 Construction Activities

The list of construction activities is given below:

Name of subproject	Construction Activities
Equipment provision and capacity development activities in solid waste management (GCC-SWM-1, GCC-SWM-2, and CuCC-SWM-1)	○ Provision of Waste Collection Bins with Source Segregation Facility at Household Level ○ Provision of Waste Collection Bins with Source Segregation Facility at Commercial Establishments ○ Provision of Mechanized Rickshaw Vans ○ Improvement of Transfer Station ○ Public Information, Education, Communication (IEC) Activities etc.
Improvement of landfill site (NCC-SWM-2, CuCC-SWM-1 and CBP-SWM-1)	○ Transforming an open dumping site into a Sanitary Landfill. ○ Separate rainwater drainage system and leachate collection system. ○ Preparation of side slope with adequate compaction, put soil covering on it. ○ Installing leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes. ○ Construction of upward temporary roads and platform for optimum use of land for long time. ○ Water supply and car washing facility ○ Introduce Environmental monitoring system (leachate, air and groundwater)
New landfill construction (NCC-SWM-1, CuCC-SWM-1 and CBP-SWM-2)	○ Separate rainwater drainage system and leachate collection system. ○ Preparation of side slope with adequate compaction, put soil covering on it. ○ Installing leachate collection pipe and gas ventilation pipes. ○ Construction of upward temporary roads and platform for optimum use of land for long time. ○ Construction of Leachate Treatment Plant. ○ Water supply and car washing facility ○ Introduce Environmental monitoring system (leachate, air and groundwater) ○ Geomembrane / Artificial liner installation
Construction of Flyover (GCC-RB-1)	○ Excavation ○ Trenching ○ Backfilling ○ Bricks-concrete works

	○ Finishing works (painting) etc.
Re-excavation of Canals (CuCC-D-4)	○ Excavation ○ Trenching ○ Backfilling ○ Bricks-concrete works ○ Materials management ○ Walk-way improvement etc.

5.3 Impact Identification

5.3.1 Summary of Key Environmental impacts

The impact Identification was carried out based on the project activities through using the assessment matrix. As this EIA is covering nine (9) different subprojects under UDCGP, the following two tables describe all the impacts anticipated by their implementation.

Table 5-1: Environmental Impact Identification Matrix

Items		Phase		Impacts
		PC/ CO	OP	
Pollution control measures				
1	Air quality	B-	B+	[CO] Dust from excavation work (especially during the dry season) and exhaust gas from construction machinery and vehicles, and solid wastes will emit the gaseous elements that will denoting the deterioration of air pollution in the construction sites. The impact is temporary and can be reduced with mitigation measures such as water spraying and regular inspections of construction machinery/vehicles, thus, the impact is considered of medium significance, short term. Other sites such as construction of flyover and re-excavation of canals will cause temporary impacts to the local air quality, short-term and medium significance. [OP] Landfill sites and flyover operation will deteriorate the local air quality significantly due to handling of waste management and volume of increased vehicles in the flyover.
2	Noise quality	B-	B+	[CO] due to construction activities in the subproject areas, vehicle movement will be increased for transportation of materials and labor to the site that will increase the noise volume in the working sites significantly. [OP] particularly for landfill sites and flyover areas, volume of vehicle movement will be increased significantly and will cause high of volume of noise generation at the sites.
2	Water quality	B-	B+	[CO] The impact on surface water quality is induced when the water with high turbidity is discharged from the construction sites to the local surface water sources. The Bakkhali River is the only fresh water source in Cox's Bazar, during the construction period, the BakKhali River will be at risks for water pollution for a longer period. [OP] Bakkhali River is a major fresh water source of Cox's Bazar and its adjacent areas, due to operation and maintenance of landfill sites adjacent to this river, seeping of leachate can contaminate the Bakkhali River permanently if leachate treatment will not be undertaken properly. However, the other sites, the surface water sources will not be contaminated in the operation period. In addition, after re-excavation of Gungaijuri Khal in CuCC, the surface water sources will retake healthy condition and favorable for aquatic species for living.
3	Waste	B-	B-	[CO] Different kinds of waste will be generated such as construction wastes likewise concrete, re-bar, soil waste, and asphalt, solid wastes including food wastes and liquid wastes e.g. oil, grease, Mobil etc. The generated waste will be managed and treated by the contractor in accordance with the Environmental Management Plan. [OP] Particularly landfill sites will subsequently be handling the waste management including both solid waste and liquid waste. However, liquid wastes such as leachate will likely be generated from the landfill sites and contaminate the surface water sources if leachates are not treated

Items		Phase		Impacts
		PC/ CO	OP	
				properly. However, wastes in the other subproject areas will likely be manageable and lower significance.
4	Soil contamination	B-	D	[CO] Pile driving for soil improvement work will not cause soil contamination because bentonite, which is inorganic and a natural substance, is used for preventing the collapse of the soil by forming a layer over the exposed pile foundation surface in the flyover construction sites. Since fuel and oil for construction machinery and vehicles are used, accidents or improper management could result in fuel or oil spills. With mitigation measures such as storing hazardous materials in adequately protected sites, the impacts would be minimal. In the landfill sites, soil improvement works such as geomembrane liner will be used to protect leaching into the underground water. In the canal excavation site, excavated soil will be used to develop the walkway on both sides of the canal. So, Soil contamination will likely occur in lower significance. [OP] No activities that are assumed to cause impact as soil contamination is predicted in the flyover and canal excavation sites. However, in the landfill sites, if proper liners are not placed properly then the possibilities of soil contamination will be higher.
6	Ground subsidence	B	B-	[CO] Since the area has soft ground and there is a possibility of land subsidence, piles will be driven for soil improvement in flyover subproject areas. Thus, the impact on ground subsidence is considered of low significance. [OP] No significant impact is anticipated in the operation period.
7	Offensive odor	B	B-	[CO] Construction activity will not cause offensive odor. But due to solid waste management, offensive odor will likely be common in the landfill sites. [OP] Offensive odor will be very common in the landfill sites that will cause public health concern and workers health and safety.
Natural environment				
9	Protected Area	N/A	N/A	[CO/OP] There is no protected area, reserved forest in the project areas.
10	Flora/Fauna & Biodiversity	B-	B+	[CO] It is estimated that around 420 no trees will be required clearing from the sites, particularly for flyover construction sites and landfill sites will cause loss of bird's habitat and others terrestrial species and expedite the soil erosion in the construction sites. The impact can be minimized with mitigation measures such as compliance with unnecessary logging bans, protection of vegetation, etc. and a comprehensive tree plantation plan shall be implemented at the sites after construction period. [OP] The landfill sites will generate subsequent volume of leachates or wastewater and if wastewater goes to the surface water sources directly without treatment, it will contaminate the surface water bodies, and aquatic species will largely be impacted.
11	Hydrology	N/A	N/A	[CO/OP] There is no activity included to change current condition of the river flow except the landfill site in Cox's Bazar, if leachate is not properly treated, surface runoff can pollute the Bakkhali River water flow that will impact the local hydrology also.
12	Topography and Geology	N/A	N/A	[CO] Construction site is located in urban areas and not in mountainous areas, thus no large-scale excavation work is implemented, except the flyover construction site. [OP] The operation works will not cause any impact to topography and geology.
Social environment				
13	Involuntary resettlement	B-	N/A	[PC] Land acquisition and resettlement will be proceeded in accordance with related law and regulation of ARIPA 2017. [OP] No activities are assumed to cause involuntary resettlement.
14	Poverty/ Local Economy (Employment, Livelihood)	B-	B+	[CO] Since the existing landfill sites are currently used as open dumping sites, many people are engaged in collecting plastic waste from the sites. So, due to development of sanitary landfill sites it will impact these types of people to take away from the sites. On the other hand, the flyover construction site, those local people whose earnings come from small business in the surrounding areas will be impacted largely by the construction of flyover and may lose their regular livelihood pattern. Moreover, losses of livelihood means may occur permanently due to site clearance. To mitigate the impact, measures such as implementation of

Items		Phase		Impacts
		PC/ CO	OP	
				livelihood restoration programs are needed for those who lose their livelihood activities. On the other hand, construction activities will also create job opportunities and small-scale business opportunities for the local people as a result of labor influx in the working areas. [OP] No impact to the livelihood activities will be anticipated. Even local people will get access to expand their business due to operation of landfill sites and flyover in the project areas.
15	Ethnic minorities & indigenous peoples	N/A	N/A	[CO/OP] Existence of ethnic minorities and indigenous people is not confirmed in the project site. Thus, impact on ethnic minority and indigenous people is negligible.
16	Land Use and Utilization of Local Resources	B-	D	[CO] Land use pattern in the flyover construction site will largely be impacted and changed due to construction of flyover. However, in the landfill sites no significant impact will occur. [OP] No activities are assumed to cause impact to land use and utilization of local resources.
17	Water usage	N/A	N/A	[CO/OP] During construction period, water usage will require which will be managed by surface water sources without having impact on the groundwater resources.
18	Existing social infrastructure and service	B-	B-	[CO] No social infrastructure will be affected in the landfill sites, however, some small numbers of structures will be required to remove from the construction of flyover site in GCC. [OP] Transportation of solid waste to landfill site may cause traffic congestion in the community near the landfill site. The impact can be reduced with mitigation measures such as coordinating with local people and avoiding rush hour; thus, the impact is considered of low significance.
19	Social institutions such as social infrastructure and local decision-making institutions	N/A	N/A	[CO/OP] The project activities include construction and operation of landfill sites and flyover and canal re-excavation, thus no impact is predicted on social institutions such as social infrastructure and local decision-making institutions.
20	Maldistribution of damage and benefit	N/A	N/A	[CO/OP] The project activities are construction and operation of landfill sites, solid waste management, canal re-excavation and flyover etc.; thus, no impact is predicted that is related to maldistribution of damage and benefit.
21	Local conflict of interest	N/A	N/A	[CO/OP] The project activities are construction and operation of landfill sites, solid waste management, canal re-excavation and flyover etc.; thus, no impact is predicted concerning local conflict of interest.
22	Cultural heritage	D	N/A	[CO/OP] There is no UNESCO world heritage sites int the project areas within 10 km. So, no impact is anticipated to these heritage sites.
23	Landscape	N/A	N/A	[CO/OP] There is no landscape resource within the project site.
24	Gender	B-	B-	[CO/OP] Equal payment for same job of male and female worker/staff should be ensured.
25	Children's rights	B-	B-	[CO/OP] In order to prevent child labor and other violations of children's rights, contractors and project implementing agencies must comply with the related laws and regulations and take measures to manage and monitor workers.
26	Infectious disease and HIV/AIDS	B-	D	[CO] The influx of workers may increase the risk of COVID-19, dengue fever, and sexually transmitted diseases (STDs). Mitigation measures such as education of workers and awareness program for workers shall be conducted to reduce impact. [OP] No activities are assumed to cause impact to infectious disease and HIV/AIDS.
27	Occupational health & safety	B-	B-	[CO] Impact on workers due to exhaust gases, dust, and noise by construction in construction sites is expected. The impact can be reduced with mitigation measures such as wearing Personal Protective Equipment (PPE); and other appropriate mitigation measures and the impacts will be moderately significance to the construction sites. [OP] Work at landfill sites is physically demanding and may involve hazards such as trenches, excavation, slippery walkways, working at heights, energized circuits, and heavy equipment and may also involve entry into confined spaces, etc. Mitigation measures such as using a

Items		Phase		Impacts
		PC/ CO	OP	
				lifeline and personal flotation device (PFD) and safe facility design to prevent accidental falls etc. to minimize the impact on occupational health & safety.
Others				
28	Accident	B-	B-	[CO] There are concerns about the risk of accidents due to unskilled workers and other errors in the use of construction machinery, and traffic accidents due to the increase the number of construction vehicles, and accidents involving third parties who accidentally entered the yard. Mitigation measures such as education of workers and implementing traffic management plans shall be taken to minimize the risk of accidents. [OP] There is concern about the risk of traffic accidents due to flyover operation, solid waste transportation and worker movement inside and around the landfill sites. Mitigation measures such as education of workers and implementing traffic management plans shall be taken to minimize the risk of accidents.
29	Cross-border impact, climate change	D	B+	[CO] Construction period is limited and amount of GHG emission is not large, and no impact is predicted related to cross-border impact or climate change. [OP] Wastewater is a major source of nutrients and preventing nutrient influx through leachate treatment is expected to mitigate water quality deterioration caused by climate change.

Table 5-2: Impact Assessment Matrix

	Project Activities	Pollution								Natural Environment					Social Environment										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		Air Quality	Dust Suppression	Bad odor/foul odor	Noise Pollution	Surface water Quality	Groundwater Quality	Soil contamination	Waste	Soil Erosion	Slope Stability	Vegetation clearance	Loss of Habitat and Species	Impact on Protected area	Possibility of Land use change	Disruptions of nearby residents	Impacts on business and livelihood	Social Conflict	Social and cultural heritages	Disturbance on local traffic	Community health and safety risks	Occupational Health and Safety risks	Child Labor	Gender based Violence
Pre-Construction Phase																									
Project Component: Solid Waste Management, Landfill site improvement and new landfill sites constructions, construction of fly over and re-excavation of canals etc.																									
1	Site Clearance																								
2	Heavy vehicle movement																								
3	Labor Influx																								
4	Labor camp establishment																								
5	Stockyard establishment																								
6	Site-office																								
7	Installation of drinking water wells and sanitary toilets																								
Construction Phase																									
1	Excavation																								
2	Trenching																								
3	Backfilling																								
4	Bricks-concrete works																								
5	Painting and other finishing works																								
6	Materials management																								
7	Footpath development																								
8	Slope protection																								
9	Transforming open dumping site into a Sanitary Landfill.																								
10	Installation of Separate rainwater drainage																								

Project Activities		Pollution								Natural Environment					Social Environment									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		Air Quality	Dust Suppression	Bad odor/foul odor	Noise Pollution	Surface water Quality	Groundwater Quality	Soil contamination	Waste	Soil Erosion	Slope Stability	Vegetation clearance	Loss of Habitat and Species	Impact on Protected area	Possibility of Land use change	Disruptions of nearby residents	Impacts on business and livelihood	Social Conflict	Social and cultural heritages	Disturbance on local traffic	Community health and safety risks	Occupational Health and Safety risks	Child Labor	Gender based Violence
	system and leachate collection system.																							
11	Installation of side slope with adequate compaction, put soil covering on it.																							
12	Installing leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes.																							
13	Construction of upward temporary roads and platform for optimum use of land for long time.																							
14	Construction of Leachate Treatment Plant.																							
15	Installation of Water supply and car washing facility																							
16	Introduce Environmental monitoring system (leachate, air and groundwater)																							
17	Construction of Geomembrane / Artificial liner installation and other facilities.																							
Operation and Maintenance Phase																								
1	Leachate collection and treatment																							
2	Gas collection																							

Project Activities		Pollution								Natural Environment					Social Environment									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		Air Quality	Dust Suppression	Bad odor/foul odor	Noise Pollution	Surface water Quality	Groundwater Quality	Soil contamination	Waste	Soil Erosion	Slope Stability	Vegetation clearance	Loss of Habitat and Species	Impact on Protected area	Possibility of Land use change	Disruptions of nearby residents	Impacts on business and livelihood	Social Conflict	Social and cultural heritages	Disturbance on local traffic	Community health and safety risks	Occupational Health and Safety risks	Child Labor	Gender based Violence
3	Waste handling, and odor management																							
4	Environmental Monitoring (leachate, air and water)																							
5	Repairing and maintenance																							

Note: Impact identified based on nature of project works, scale of works, and periods and considering the JICA Environmental and Social Consideration 2010.

Risk classification	Magnitude of Risk*
Category C	C (±)
Category B	B (±)
Category A	A (±)
Category FI	A(±) or B(±) or C (±)

5.3.2 Identification and Analysis of Key Environmental Issues

5.3.2.1 Key Environmental Issues for improvement of Solid Waste Management System in ULBs

Impact Items	Impact summary
Pre-construction Period	
Supplies drum trucks, compactors, bulldozers and other equipment to the ULBs.	No impact is anticipated due to pre-construction activities at ULBs level.
Construction Period	
Air Quality	Local air quality will deteriorate due to dust suppression, foul odor while construction of secondary transfer stations (STs).
Noise Level	Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. during construction of STs. Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machinery
GHG Emissions	Same as “Air Quality”
Community Health and Safety	Community health and safety will be jeopardized during STs construction. Road accidents are very common in this case and elevated noise can disrupt the local people's regular life.
Traffic and transport	Traffic and transport volume will subsequently increase at construction site of STs, increase traffic accident and excessive hydraulic horn will also be very common etc.
Occupational Health and Safety	Worker’s health and safety will be at risk for construction work of STs. It will include contagious disease, falls, sleeps, car accidents etc.
Operation Period	
Air quality	Local air quality will deteriorate due to dust suppression, foul odor while transportation of solid waste to the landfill sites.
Odor	Foul or offensive odor will be generated and spread over the road and its neighborhood areas due to handling of wastes for collection, transportation and disposal to the landfill sites.
Noise and vibration	Excessive noise levels will be generated due to transportation and disposal of waste from household to the landfill sites.
Surface water	If cover is not used on the truck during transportation of solid wastes from households to landfill sites, it will mix with surface water system by different kinds of surface runoff and contaminate the surface water system.
Waste	Solid waste will generate both hazardous and non-hazardous wastes and will cause health impacts to the workers if proper preventive measures will not be undertaken by them during collection, transportation and disposal of the landfill sites.
Impact on Local Habitats	No significant impact is anticipated on the local habitats due to solid waste handling, transportation and disposal activities.
Greenhouse Gas Emission	
Local Traffic and accidents (public safety)	Traffic and transport volume will subsequently increase after enhancing capacity of solid waste management at the ULBs which will cause social conflict, increase traffic accident and excessive hydraulic horn will also be very common etc.
Occupational health and safety	Worker’s health and safety will be at risk due to handling, collection, transportation and disposal of solid wastes to the landfill sites. It will include contagious disease, falls, sleeps, car accidents etc.

5.3.2.2 Key Environmental Issues for Improvement of the existing landfill sites in ULBS

Impact Items	Impact summary
Pre-Construction Period	
Nil	•
Construction Period	
Air Quality	• Air quality will be declined by dust suppression, exhaust gas emissions from reshaping work and construction activities, frequent vehicles movement, particularly during dry season and large quantity of moving materials.
Odor	• Odor will be recognized due to the existence of waste, and when leachate is collected during reshaping and excavation works. (Note: Odor will be reduced when semi-aerobic landfill is completed.)
Noise Level	• Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. • Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machinery. This equipment typically has average noise levels of 70 – 105 dB at 15m distance of the site.
Surface Water Quality	• There exists leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that might have contaminated surface waterbodies nearby. • Excavation works and other construction activities may cause leachate flow outside, and discharged water turbid and contaminated by suspended solids, accidental spillage of hazardous liquid waste, oils, fuels, paints, chemicals etc. • Spoiled materials and soils can further contaminate the neighboring surface water body if they are not treated and eroded into it. (Note) The possibilities of surface water contamination are low except the Pana Market landfill site of CBP which is close to waterbody and the Bakkhali River.
Groundwater Quality	• The existing leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that most likely have contaminated groundwater. • Excavation works and other construction activities may cause leachate to flow into soil and further contaminate groundwater. • Groundwater quality will deteriorate if liquid wastes reach to the groundwater sources from the labor camp and construction site, mainly toilets and kitchen wastes can be responsible for groundwater contamination in the working areas. Same is true during the establishment of other necessary auxiliary facilities like building, car washing facilities, weigh bridge, road networks and others infrastructure.
Soil Contamination	• Soil will be contaminated when polluted surface water is infiltrated into the ground. It is also caused by rain and floods. • The existing wastes have contaminated soil as there is no soil cover.
Waste Management	• Construction waste will generate both hazardous and non-hazardous waste in the construction sites. The non-hazardous wastes are mainly fecal sludge from toilets of labor camps, wastewater from kitchen and lube oi, grease, Mobil etc., from construction vehicles however the non-hazardous wastes mainly concrete chips, stone chips, rod, kitchen waste, plastic wastes etc.
Soil Erosion	• Soil erosion will not be common in NCC and CuCC, but it has potential impacts in CBP because the site for improvement is

Impact Items	Impact summary
	situated beside waterbody and the Bankkhali River. It can be minimized or controlled by slope stabilization. • Surface runoff will frequently occur during monsoon season that will cause soil erosion at the landfill site if slope stabilization and drainage systems are not maintained properly. (Note) The impact of the project to erosion and siltation will be short-term during the construction stage but is expected to be long-term and permanent in most areas of the project site once the project is operational.
Loss of local habitats	• During the construction period, excessive noise and frequent vehicle movement and labor influx can have negative affects to the local terrestrial habitats. However, the impact will be lower significance and lower chance of occurring.
Greenhouse gases	• Greenhouse gas (carbon dioxide) emissions or generation occur in association with the operation of construction equipment and the operation of vehicles transporting materials and equipment.
Local Economy and Livelihoods	• Livelihood activities on site will be affected due to construction work. • Due to construction works, the small-scale businesses on the roadside will be disrupted. • In a sense, local people will get access to the working at the sites either contractual or daily basis that will enhance the local people.
Community Health and Safety	• Frequent vehicle movement, dust emissions, excessive noise generation, and labor influx can cause contagious diseases that can spread over the neighboring community easily. Road accidents are very common for large scale construction activities, and social conflict will rise due to labor misbehave with the local people. • Waste reshaping work may allow vectors such as rats, cockroaches, flies, ants and others at the open dumping sites to move to the nearby residences that trigger sudden occurrence of illnesses and unacceptable conditions among local people.
Local Traffic (Traffic congestion)	• Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. • Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to heavy traffic and vehicles used in the construction work
Occupational Health and Safety	• There exists a substantial amount of leachate in the construction sites, which is a threat to human health. • Gaseous products are in the atmosphere and contaminate air quality that impacts the health condition of workers. Landfill gas also carries foul odor that is very objectionable and irritating. They may cause temporary discomfort, but it is not likely to cause permanent health effects. At extremely high concentrations, persons exposed may experience eye irritation, headaches, nausea, and soreness of the nose and throat. People with respiratory ailments such as asthma are especially sensitive to these effects. (Note) these temporary conditions are reversed as soon as the gases are reduced or eliminated. The proposed Sanitary Landfills will have landfill gas capture systems. • Working in smoky and dusty conditions at open dumps, infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals, puncture wounds leading to tetanus, hepatitis, and possible HIV infection, injuries at dumps due to surface subsidence, underground fires, and slides, headaches and nausea from anoxic conditions where disposal sites have high

Impact Items	Impact summary
	methane, carbon dioxide, and carbon monoxide concentrations; and Lead poisoning from burning of materials with lead-containing batteries, paints, and solders. • Land development and civil works can generate substantial amounts of dust particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM10) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site. • Frequent vehicle movement at the site can also risk the worker's health and safety. • Risks to workers' health and safety from improper work site practices
Labor condition (including child labor, forced labor and gender-based violence)	• Child labor is very common in the construction sites due to paying low wages and working for a longer period. • Force labor will occur at the construction sites by the contractors and their sub-contractors. Force labor will work for a longer period without paying overtime and food allowance that couldn't be allowed at the site. • Gender based violence will normally occur with the female workers which includes sexual violence, lower wages and mental torture by the contractors and its subcontractors.
Operation Period	
Impacts on Air Quality	• The operation of vehicles for waste transportation creates dust, exhaust gas, etc.
Objectionable Odor	• Objectionable odor is expected at the sanitary landfill site when transporting and handling wastes depending on humidity, temperature and moisture content etc. (Note) The closest receptors are mainly those who are living near sites within 50m.
Noise and vibration	• Noise and vibration will occur due to the use of heavy equipment and vehicles for waste transportation.
Surface water contamination	• In the leachate re-circulation system, leachate is generally not discharged externally. However, when precipitation exceeds the pump capacity, it is released as overflow water that might contaminate surface water. The degree of impact however will remain small in such cases since the leachate is significantly diluted by the surrounding rainfall.
Waste	• Waste can accidentally drop from transportation vehicles, which creates nuisance.
Community Health	• Waste transportation to the sanitary landfill sites may bring vectors such as rats, cockroaches, flies, ants and others, which can spread into the immediate area. These vectors can freely move around the area and may find their way to buildings and areas adjacent to the landfill. They may trigger sudden occurrence of illnesses and unacceptable conditions among people of weak resistance and children in the landfill sites and its adjacent areas.
Occupational Health and safety	• Risks to workers' health and safety from improper work site practices during landfill operation, repairing and maintenance work.

Note: It is applicable to NCC-SWM-2, CuCC-SWM-1 and CBP-SWM-1.

5.3.2.3 Key Environmental Issues for construction of new landfill sites in ULBS

Impact Items	Impact summary
Pre-Construction Period	
Land Use change (including land acquisition)	• Vegetation Clearance will occur in CuCC, GCC and NCC. • Construction of a new landfill requires land acquisition, which will cause land use changes. The current land use of the area will be

Impact Items	Impact summary
	changed, particularly in CBP, agricultural land will be converted to the sanitary landfill site, which will also cause losses of livelihood means and income. • The site will be utilized as a final waste disposal area once the sanitary landfill sites and its associated facilities are established and operational. The change will be long term and permanent. Based on the project design, the final covering will complement the natural surroundings.
Construction Period	
Air Quality (including dust and odor)	• Air quality will be declined by dust suppression, bad Odor, exhaust gas emissions from vehicles, equipment etc.
Noise Level	• Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. • Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machinery. This equipment typically has average noise levels of 70 – 105 dB at 15m distance of the site.
Surface Water Quality	• Construction waste will be generated at the sites and if it is going to the nearby surface water sources directly by surface runoff that will contaminate the surface water resources in the working areas. However, the possibilities of surface water contamination are low except for the SM Para landfill site, CBP because it is close to the Bakkhali River.
Groundwater Quality	• Groundwater quality will deteriorate if liquid wastes reach to the groundwater sources from the labor camp and construction camp, mainly toilets and kitchen wastes can be responsible for groundwater contamination in the working areas. • Same is true during the establishment of other necessary auxiliary facilities like building, car washing facilities, weigh bridge, road networks and others infrastructure outside of landfill site. (Note) Development of the rest facilities within the sanitary landfill has no possibility to affect the groundwater resources as impermeable liner will be placed at embankment and floor surface.
Soil Contamination	• Soil can be contaminated while construction work is on-going, due to uncovered construction materials, chemicals, and others. Polluted surface water can be infiltrated into the ground due to rain and flood, etc.
Waste Management	• Construction waste will generate both hazardous and non-hazardous waste in the construction sites. The non-hazardous wastes are mainly fecal sludge from toilets of labor camps, wastewater from kitchen and lube oi, grease, Mobil etc., from construction vehicles however the non-hazardous wastes mainly concrete chips, stone chips, rod, kitchen waste, plastic wastes etc., which will be typically managed at the construction sites for its recycling value.
Soil Erosion	• Soil erosion will not be common in NCC and CuCC but it has potential impacts in CBP because the new landfill site is situated beside the Bankkhali River. It can be minimized or controlled by slope stabilization. • Soil covering will be used to the landfill sites to protect percolation to groundwater and slope stabilization will be one of the most important works to the landfill site that will protect soil erosion at the site. • The impact of the project to erosion and siltation will be short-term during the construction stage but is expected to be long-term and permanent is most areas of the project site once the project is

Impact Items	Impact summary
	operational if drainage system is not properly maintained at the sites. • Surface runoff will frequently occur during the monsoon season that will cause soil erosion at the landfill site if slope stabilization and drainage systems are not maintained properly.
Loss of local habitats	• During the construction period, excessive noise and frequent vehicle movement and labor influx can have negative affects to the local terrestrial habitats. However, the impact will be lower significance and lower chance of occurring.
Disruptions of Local Economy	• Land acquisition during pre-construction period will be associated with losses of livelihood means and income of local farmers. Moreover, due to construction works, small-scale businesses at roadside will be disrupted. • On the other hand, local people will get access to income generation opportunities at the sites either on a contractual or daily basis that will enhance their livelihoods.
Community Health and Safety	• Frequent vehicle movement, dust emissions, excessive noise generation, and labor influx can cause contagious diseases that can spread over the neighboring community easily. Road accidents are very common for large scale construction activities, and social conflict will rise due to labor misbehave with the local people.
Occupational Health and Safety	• Impact on occupational health and safety during the construction stage is a concern of the designated contractors and their appointed sub-contractors that will be implementing the construction activities. • Land development and civil works can generate substantial amounts of dust particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM10) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site. • Frequent vehicle movement at the site can also risk the worker's health and safety.
Labor condition (including child labor, forced labor and gender-based violence)	• Child labor is very common in the construction sites due to paying low wages and working for a longer period.
	• Force labor will occur at the construction sites by the contractors and their sub-contractors. Force labor will work for a longer period without paying overtime and food allowance that couldn't be allowed at the site.
	• Gender based violence will normally occur with the female workers which includes sexual violence, lower wages and mental torture by the contractors and its subcontractors.
Operation Period	
Impacts on Air Quality	• The closest receptors are mainly those who are living near sites within 50m. The most anticipated problems are the irritation of working with offensive odors and mental or psychological disorder of exposed communities.
Generation of Landfill Gas	• The landfill gases are released into the atmosphere and contaminate the air quality including the health impacts to the workers and local community. Landfill gas also carries a foul odor that is very objectionable and irritating. • Landfill gas may cause temporary discomfort, but it is not likely to cause permanent health effects. At extremely high concentrations, persons exposed may experience eye irritation, headaches, nausea, and soreness of the nose and throat. People with respiratory ailments such as asthma are especially sensitive to these effects. However, these temporary conditions are reversed as soon as the gases are reduced or eliminated. The proposed Sanitary Landfills normally will have landfill gas capture systems.

Impact Items	Impact summary
Objectionable Odor	• Objectionable odor is expected at the sanitary landfill site depending on various factors such as wastes handling, humidity, temperature and moisture content etc.
Groundwater contamination	• The quality of groundwater will not deteriorate as the bottom part will be covered and a leachate re-circulation system will be established. However, groundwater contamination can occur if management of leachate remains improper. In cases of leakages, the contaminated leachate will percolate into the ground and affect the existing groundwater resources.
Soil contamination	• Same as groundwater, soil contamination is typically found at the landfill sites caused by improper management of leachate. In cases of leakages, the contaminated leachate will percolate into the ground and worsen the soil quality.
Community Health	• Waste transportation to the sanitary landfill sites may also bring pests such as rats, cockroaches, flies, ants and others, which can spread into the immediate area. These pests can freely move around the area and may find their way to buildings and areas adjacent to the landfill. Since these pests are known to be carriers of diseases, they may trigger the sudden occurrence of illnesses and unacceptable conditions among people of weak resistance and children in the landfill sites and its adjacent areas.
Occupational Health and safety	• The occupational health and safety issues will be mainly: • back and joint injuries from driving heavy landfill and loading equipment, respiratory illness from ingesting particulates, bio-aerosols and volatile organics during waste collection, and from working in smoky and dusty conditions at open dumps, infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals, puncture wounds leading to tetanus, hepatitis, and possible HIV infection, injuries at dumps due to surface subsidence, underground fires, and slides, headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide, and carbon monoxide concentrations; and Lead poisoning from burning of materials with lead-containing batteries, paints, and solders.

Note: It is applicable to NCC-SWM-1, CuCC-SWM-1 and CBP-SWM-2.

5.3.2.4 Key Environmental Issues for construction of flyover (overpass) over the rail crossing in Joydebpur, GCC

Impact Items	Impact Summary
Pre-construction Period	
Loss of Land and Property	• Approximately 100 m (length) x 2.5m (width) of land will be acquired on both sides of the east side approach. One side of the road is presently used as a playground, and another side accommodates small shops. • Five (5) number of structures have been found as Potential Resettlement Structure. • Social surveys during the detailed design stage will identify the land use, land ownership, and number of affected people, and findings will be collated in the abbreviated resettlement action plan (ARAP). Compensation shall be paid in accordance with the guiding principles in the resettlement policy framework (RPF) and Acquisition and Requisition of Immovable Property Act 2017 (ARIPA 2017).
Loss of Income	• Loss of land and permanent displacement would lead to loss of income for the affected people. Loss of income could result from demolition of business establishments (e.g., offices, shops), inability to live close to the working places, and so on. As noted

	above, adequate compensation against loss of income should be provided following the resettlement policy framework (RPF) and (ARIPA 2017).
NOC requirements	• No Objection Certificates (NOC) shall be required from Bangladesh Railway, Bangladesh Rice Research Institute (BRRI), Bus Rapid Transit (BRT), Bangladesh Tele Communication Company Ltd (BTCL), Titas Gas Transmission and Distribution PLC before commencement of construction works.
Construction Period	
Air Quality	• Local air quality will be declined by dust suppression due to excavation, trenching, and backfilling and demolition activities. • In addition, exhaust gas emissions from vehicles, equipment and use of motor engines at the construction site will lead to contamination of the air quality also. • However, the air pollution generated from these activities is likely to be localized (affecting immediate receptors of the project sites). • The construction related air pollution is a particular concern at location specific for nearby residents, offices and other inhabitants are living at close proximity to the construction site.
Noise and vibration level	• Noise pollution and vibration may result from movement of vehicles carrying materials and equipment to and from the project sites, operation of machines and equipment (e.g., concrete mixing machines, aggregate crushers, generators), and different construction activities (e.g. demolition of existing structures) etc.
Drainage congestion	• Drainage congestion may result from possible blockage to natural flow of drainage water during construction activities. • It is mostly important to the project sites close to the low-lying areas in the BRRI areas and opposite site of the rail crossing areas also. • This could be given particular attention during monsoon when drainage becomes a major concern in the subproject areas and its adjacent areas. • Therefore, necessary precautions should be undertaken to avoid drainage congestion at the working site.
Water Pollution	• Surface water pollution may occur during construction period to nearby ponds and ditches. However, groundwater will not be impacted due to anticipated construction activities in the site. So, special care should be taken to protect against the contamination of local ponds and ditches.
Soil Erosion	• Due to construction activities, soil erosion will not occur at the site because most of the land is flat in nature and no major erosion usually occurs in the project working areas.
Waste Management	• During construction phase, problems related to sanitation and solid waste may result from improper/inappropriate facilities at the labor sheds. • During the construction period, large numbers of workers are likely to be involved in different construction activities. • Lack of proper sanitation facilities for project people, including the labor/construction workers and absence of proper solid waste (e.g., food waste, construction debris) facilities may create an unhealthy environment (including water pollution) within and around the project sites. • Demolition of the existing structures will also produce a huge quantity of debris, which would have to be properly disposed of.
Traffic and Transport	• Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale.

	• Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to heavy traffic and vehicles used in the construction work
Local Ecosystem	• Due to large volumes of construction works, local terrestrial species will be affected, though, no endangered, or threatened species was found in the project sites, however, necessary preventive measures should be taken to avoid any kind of disturbance on local ecosystems during construction period. • However, no large or medium-sized trees will be required to clear from the site due to construction works, which is a one of the good indicators to occurring disturbance to the local ecosystem.
Land Use Changing	• Due to construction of railway overpass, local land use patterns will permanently be changed. Some of the agricultural land will be changed permanently in the BRRI areas and some of residential areas will also be changed permanently to commercial zones.
Occupational Health and Safety	• Occupational Health and Safety is an important issue that could be addressed properly. The worker's health and safety will be at risk due to the large volume of construction activities in the project areas. • The most anticipated risks are sleeping, falling from working at heigh, electrical hazards due to wielding and other electrical working, excessive noise generation, and working for a longer period of time etc.
Community Health and Safety	• Community health and safety will be impacted negatively due to high noise generation at the construction sites, increased vehicle movement and volume of vehicles will cause traffic accidents to the pedestrian and local community. • In addition, labor influx will also cause the spread of infectious diseases to the local community people.
Disruptions of Local Economy	• Loss of income could result from inability to perform certain income generating activities during construction period, particularly close proximity of markets/ shops/ offices will be remained close due to safety considerations.
Child Labor	• Child labor will occur at the construction site due to low wages and force to work for a longer period but it's illegal and intolerable at the construction sites following the Labor Rules 2025.
Operation Period	
Traffic and Transport	• It is expected to provide a significantly better Level of Service (LOS) for vehicular traffic, private cars, trucks, three-wheelers, auto-rickshaws etc. • In the long run this may attract more people to use this flyover to make their short trips to the other areas of the city. • The total traffic flow may therefore increase due to the trips diverted from the exhausted rail-crossing section. • On the other hand, the increased LOS will also lead to induced traffic volume and an increase in the total number of trips through this corridor. • It is of paramount importance to improve the junction operation of the road network which will ultimately dictate the overall capacity of the network.
Air Quality	• As to the construction phase, air pollution is an important consideration in areas where the alignment runs close to human habitations. • Vehicular air pollution affecting human habitations close to the flyover's alignments is also likely. It should be noted, however, that air quality on a city scale is not likely to occur in the operation or commissioning of the overpass of railway crossing.

	• Air pollution shall be possible to reduce in some extent by reducing traffic congestion and engine idle time.
Noise Pollution and Vibration	• As to the construction phase, noise and vibration are important considerations in areas where the alignment runs close to human habitations. • Noise pollution and vibration during the operational phase will result from movement of vehicles; blowing of horns would also generate noise pollution.

5.3.2.5 Key Environmental Issues for re-excavation of Gongaijuri-Racecourse Khal in CuCC

Impact Items	Impact Summary
Pre-construction Period	
Land Acquisition and Resettlement	• Approximately 28,800 m2 of private land will be acquired. Subproject facilities are planned on the land that belongs to CuCC, where 18 structures have been found on digital data. • Further information shall be collected in the social survey during the detailed design stage, which will identify the land use, land ownership, and number of affected people, and findings will be collated in the abbreviated resettlement action plan (ARAP). • Compensation shall be paid in accordance with the guiding principles in the resettlement policy framework (RPF).
Construction Period	
Dredged Materials Management	• he major concern of the canal re-excavation is the dredge materials management. The subproject consists of a 7900-meter canal excavation length starting from Racecourse DC Banglo Road to Nowapara soap factory 1600m and other one starting from Nowapara soap factory to Dhaka Chittagong Highway Bridge 6300m. • The depth of the proposed canal would be 3m and width 12.2 m, and around 296250 m3 dredge materials would be produced, so, a comprehensive dredge materials management plan should be developed by the contractor(s) before commencement of excavation works.
Air Quality	• During the excavation period, fuel-based excavators, and drum trucks will be used that could produce black smoke in the working areas and lead to contribute the degradation of local air quality however this pollution is location specific and short-term.
Noise and vibration level	• Due to using of heavy equipment, vehicles and workers in the excavation site, that could cause exacerbate the local noise level, but it is short term and local specific impact and could be managed easily if proper mitigation measures should be taken properly.
Surface water quality	• High turbidity will cause deterioration of the DO (dissolved oxygen) level in the excavation sites. It will have impacts on the aquatic environment also.
Waste Management	• Different kinds of waste will be generated on the working sites. Some of them are hazardous types of waste such as oil, grease, Mobil etc., leakage from the engines and dredge spoil will be a kind of non-hazardous waste including food waste, plastic waste etc.
Traffic and Transport	• The volume of local traffic will be increased due to excavation activities in the working sites, that could potentially risk the local community for road accident.
Local Ecosystem	• Due to high noise generation, local terrestrial species will be disturbed and shift their location from the excavation site to another safer place. Aquatic ecosystem will be impacted largely due to high

	content of TDS, lowering the DO level and other excessive SS content in the working areas.
Land Use Changing	• Due to construction of railway overpass, local land use patterns will permanently be changed. Some of the agricultural land will be changed permanently in the BRRI areas and some of residential areas will also be changed permanently to commercial zones.
Occupational Health and Safety	• occupational health and safety will be endangered due to the use of vehicle equipment, and vehicles on the working sites.
Community Health and Safety	• Local community health and safety will be also at risk on the working sites caused by moving around the heavy equipment and frequent vehicle movement. So, necessary protective measures should be ensured to reduce this risk on the working site.
Child Labor	• Usually, child labor occurs in the excavation site. Most of the cases, excavator drivers are having child labor for their helper or assistant to support them. So, any kind of child labor is prohibited in the working areas and it's illegal and offensive following the Labor Rules 2015.
Operation Period	
Surface water quality	• Surface water quality basically improved after re-excavation of the canal. However, if operation and maintenance will not be undertaken properly, local people can disposal their daily wastes to the canal directly, if it is occurring, it will lead to contaminate the surface water quality greatly, So, prevent this anticipated impacts, necessary preventive measures should be ensured by the city corporation, if box drains method will apply then it will reduce these anticipated risks also.
Aquatic Ecosystem	• if surface water quality gets contamination due to kinds of human intervention, it will impact the canal aquatic ecosystem and local fish species, and aquatic ecosystems will decline. So, to reduce this impact, necessary mitigation measures should be applied to the sites, better, if box drains method is introduced during the construction period, it will help to preserve the local ecosystem also.

5.4 Impact Evaluation

The impact evaluation was considered the magnitude of impact and its likelihood of occurrence. So, a comprehensive impact evaluation was carried out for all ULBs as described in the tables below. Definitions are as follows:

1) Degree of Impact

A (high impact): impact caused adversely or beneficially impact to the environment as severely or permanently, and could not minimize or recover by a prevention and correction measures

B (Moderate impact): impact caused adversely or beneficially impact to the environment as moderately, but could be minimized by a prevention and correction measures

C (low impact): impact caused adversely or beneficially impact to the environment as slightly, the environment could be recovered by itself, and could be minimized or even eliminated by a prevention and correction measures

2) Extent of Impact

Local: Impact occurs beyond boundary of project premise but normally within peripheral area

Site Specific: Impact occurs only within the site and immediate area.

3) Duration of Impact

Long Term Impact occurs for more than 2 years during the project life.

Medium Term; impact occurs 1-2 years during the project life and

Short Term; impact occurs less than 1 year,

4) Nature of reversible

Irreversible: when an impact affects the continued viability of the environmental component, strongly and irreversibly impairs the component.

Reversible, when the impact changes the quality or use of the environmental component affected, but reversibly impairs the component.

Table 5-3: Estimated degree of impacts/ impact magnitude for Solid Waste Management subprojects in 4ULBs

Project Activities	Important Environmental and Social Component	Degree of Impact	GCC		NCC		CuCC		CBP		Decision of Impact		
			Without EMP	With EMP	Without EMP	With EMP	Without EMP	With EMP	Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
Construction and Operation Period													
Construction of secondary transfer station, vehicle support, training and capacity building for relevant ULB staff, collection, transportation and disposal of solid waste to the landfill site	Air Quality	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Short term	Reversible
	Noise and Vibration	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Short term	Reversible
	Surface water Quality	C	C-	C+	C-	C+	C-	C+	C-	C+	Local	Long term	Reversible
	Groundwater Quality	C	C-	C+	C-	C+	C-	C+	C-	C+	Local	Long term	Reversible
	Soil Quality	C	C-	C+	C-	C+	C-	C+	C-	C+	Local	Short term	Reversible
	Occupational Health and Safety	B	B-	B+	B-	B+	B-	B+	B-	B+	Site specific	Short term	Reversible
	Community Health and Safety	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Short term	Reversible
	Hazardous and non-hazardous waste	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Short term	Reversible
	Traffic and transport	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Short term	Reversible
	Terrestrial and Aquatic Ecosystem	B	B-	B+	B-	B+	B-	B+	B-	B+	Local	Long term	Reversible

Table 5-4: Estimated degree of impacts/ impact magnitude for improvement of the existing landfill sites at NCC, CuCC, and CBP

Project Activities	Important Environmental and Social Component	Degree of Impact	NCC		CuCC		CBP		Decision of Impact		
			Without EMP	With EMP	Without EMP	With EMP	Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
Pre-Construction Period											
N/A											
Construction Period											
Transforming open dumping site into a Sanitary Landfill. Installation of Separate rainwater drainage system and leachate collection system, side slope with adequate compaction, soil covering, leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes. water supply and car washing facility.	Air Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Odor	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Noise and Vibration	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Surface water Quality	B	B-	C-	B-	C-	B-	C-	Local	Long term	Irreversible
	Groundwater Quality	B	B-	C-	B-	C-	B-	C-	Local	Long term	Irreversible
	Soil Quality	B	B-	C-	B-	C-	B-	C-	Local	Local term	Irreversible
	Waste	B	B-	C-	B-	C-	B-	C-	Site specific	Local term	Reversible
	Soil Erosion	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Loss of Local Habitats	C	C-	C-	C-	C-	C-	C-	Local	Long term	Reversible
	GHG emission	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Local Economy and Livelihoods	B	B-	C-	B-	C-	B-	C-	Local	Local term	Irreversible
	Social conflict	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Community Health & Safety	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Local Traffic and Accidents	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Occupational Health and Safety	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Labor Condition	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
Operation Period											
Leachate collection, gas collection, waste handling, and odor management, Environmental Monitoring (leachate, air and water) and O&M	Air Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Odor	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Noise and vibration	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Surface water Quality	B	B-	C-	B-	C-	B-	C-	Local	Long term	Irreversible
	waste	B	B-	B+	B-	B+	B-	B+	Site specific	Long term	Reversible
	GHG emission	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Community Health and Safety	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Occupational Health and Safety	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible

Note: it is applicable to NCC-SWM-2, CuCC-SWM-1 and CBP-SWM-1.

Table 5-5: Estimated degree of impacts/ impact magnitude for new sanitary landfill sites at NCC, CuCC, and CBP

Project Activities	Important Environmental and Social Component	Degree of Impact	NCC		CuCC		CBP		Decision of Impact		
			Without EMP	With EMP	Without EMP	With EMP	Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
Pre-Construction Period											
Losses of private land, local livelihood means	Land Acquisition	B	-	-	-	-	B-	B+	Site specific	Long term	Irreversible
Construction period & Operation Period											
Installation of Separate rainwater drainage system and leachate collection system, side slope with adequate compaction, soil covering, leachate collection pipe network on the waste and periphery of the landfill and gas ventilation pipes, Water supply and car washing facility, geomembrane / artificial liner installation etc. and others as required. Construction of Leachate Treatment Plant.	Air Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Noise and Vibration	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Surface water Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Groundwater Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Soil Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Waste	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Soil Erosion	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Loss of Local Habitats	B	B-	C-	B-	C-	B-	C-	Local	Long term	Reversible
	GHG emission	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Local Economy and Livelihoods	B	B-	B+	B-	B+	B-	B+	Local	Long term	Irreversible
	Social conflict	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Community Health and Safety	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Local Traffic and Accidents	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Occupational Health and Safety	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
	Labor Condition	B	B-	C-	B-	C-	B-	C-	Site specific	Mid term	Reversible
Operation Period											
Leachate collection and treatment, Gas collection, Waste handling, and odor management, Environmental Monitoring (leachate, air and water)	Air Quality	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Odor	C	C-	C+	C-	C+	C-	C+	Site specific	Short term	Reversible
	Noise and Vibration	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible
	Surface water Quality	B	B-	C+	B-	C+	B-	C+	Local	Long term	Irreversible
	waste	B	B-	B+	B-	B+	B-	B+	Site specific	Long term	Reversible
	GHG emission	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible

Project Activities	Important Environmental and Social Component	Degree of Impact	NCC		CuCC		CBP		Decision of Impact		
			Without EMP	With EMP	Without EMP	With EMP	Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
and repairing and maintenance	Community Health and Safety	B	B-	C-	B-	C-	B-	C-	Local	Mid term	Reversible
	Occupational Health and Safety	B	B-	C-	B-	C-	B-	C-	Site specific	Short term	Reversible

Note: it is applicable to NCC-SWM-1, CuCC-SWM-1 and CBP-SWM-2.

Table 5-6: Estimated degree of impacts/ impact magnitude for construction of railway overpass at GCC

Project Activities	Important Environmental and Social Component	Degree of Impact	GCC		Decision of Impact		
			Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
Pre-Construction and Construction Period							
Site clearance activities	Land Use and Land Cover change	B	B-	C+	Site specific	Short-term	Reversible
Land Acquisition	Social conflict	B	B-	B+	Site specific	Short-term	Irreversible
Trenching, excavation, backfilling, rod binding, electrical works, working at height, painting works, finishing and commission etc.	Air Quality	B	B-	C-	Site specific	Short-term	Reversible
	Noise and Vibration	B	B-	C-	Site specific	Short-term	Reversible
	Surface water Quality	B	B-	C-	Site specific	Short-term	Reversible
	Groundwater Quality	B	B-	C-	Site specific	Long term	Reversible
	Soil Erosion	B	B-	0	Site specific	Short-term	Reversible
	Occupational Health and Safety	B	B-	C-	Site specific	Short-term	Reversible
	Community Health and Safety	B	B-	C-	Site specific	Short-term	Reversible
	Hazardous and non-hazardous waste	B	B-	C-	Site specific	Short-term	Reversible
	Traffic and transport	B	B-	C-	Site specific	Short-term	Reversible
	Terrestrial and Aquatic Ecosystem	B	B-	C-	Site specific	Short-term	Reversible
	Social conflict	B	B-	C-	Site specific	Short term	Reversible
Operation Period:							
Traffic and Transport	Air Quality	B	B-	C-	Site specific	Long-term	Reversible
Air Quality	Air Quality	B	B-	C-	Site specific	Long-term	Reversible
Noise and Vibration	Noise and Vibration	B	B-	C-	Site specific	Long-term	Reversible

Table 5-7: Estimated degree of impacts relating to the canal re-excavation at CuCC

Project Activities	Important Environmental and Social Component	Degree of Impact	CuCC		Decision of Impact		
			Without EMP	With EMP	Extent of the Impact	Duration of the impact	Nature of reversibility
Pre-Construction and Construction Period							
Site clearance activities	Land Use and Land Cover change	B	B-	C+	Site specific	Short-term	Reversible
Land Acquisition	Social conflict	B	B-	B+	Site specific	Short-term	Irreversible
Excavation, dredge materials management.	Air Quality	B	B-	C+	Site specific	Short-term	Reversible
	Noise and Vibration	B	B-	C+	Site specific	Short-term	Reversible
	Surface water Quality	B	B-	C+	Site specific	Short-term	Reversible
	Groundwater Quality	B	B-	C+	Site specific	Long term	Reversible
	Soil Erosion	B	B-	C+	Site specific	Short-term	Reversible
	Occupational Health and Safety	B	B-	C+	Site specific	Short-term	Reversible
	Community Health and Safety	B	B-	C+	Site specific	Short-term	Reversible
	Hazardous and non-hazardous waste	B	B-	C+	Site specific	Short-term	Reversible
	Traffic and transport	B	B-	C+	Site specific	Short-term	Reversible
	Terrestrial and Aquatic Ecosystem	B	B-	C+	Site specific	Short-term	Reversible
	Aquatic Ecosystem	B	B-	C+	Local	Long term	Reversible
Operation Period:							
Aquatic Ecosystem	Air Quality	B	B-	C+	Site specific	Short-term	Reversible
Surface water quality	Surface water Quality	B	B-	C+	Site specific	Short-term	Reversible

5.4.1 Cumulative Impact

5.4.2 Cumulative Impact Assessment During Construction Phase

The assessment of cumulative impacts of various completed and ongoing activities in and around the proposed is discussed below. The following assumptions were made for the CIA:

- This will form part of the full CIA as part of the EIA for the Urban Development and City Governance Project (UDCGP) was carried out in and around the area.
- The proposed CIA area considered cumulative impacts on the selected valued environmental components considering both construction and operation phases.
- The temporal boundary of the assessment is both considering the construction and Operation phases.
- The spatial boundary of the CIA is 4 ULBs considering the project activities of solid waste management, landfill sites development, construction of railway overpass and canal re-excavation under the scope of project.
- ► No public consultation but physical site inspection was conducted regarding the selection of valued environmental components. This, however, should be an integral component of the full CIA.
- Impacts were assigned in three categories: low, moderate and high

Table 5-8: Cumulative Impact Assessment of Project and Other Activities on Valued Components

Project Activity	Valued environmental Components/ parameters	Categorization of Impact			
		GCC	NCC	CuCC	CBP
Preconstruction Phase & Construction Phase • Land Acquisition • Site clearance • Trenching • Excavation • Backfilling • Electrical hazards • Working at height • Leachate management at landfill sites • Gas collection from landfill sites	Vulnerable to Land Use	Moderate	Low	Moderate	Moderate
	Child labor	Moderate	Moderate	Moderate	Moderate
	Force Labor	Moderate	Moderate	Moderate	Moderate
	Occupational Health and Safety	High	High	High	High
	Social Conflict	High	High	High	High
	Gender based violence	Low	Low	Low	Low
	Employment opportunity	Moderate	Moderate	Moderate	Moderate
	Labor Influx	high	Moderate	Moderate	Moderate
	Air Quality	high	Moderate	Moderate	Moderate
	Noise and Vibration	high	Moderate	Moderate	Moderate
	Soil Erosion	Moderate	Low	Low	High
	Surface and Ground Water Quality	Moderate	high	high	high
	Hazardous and Non-hazardous waste	Moderate	Moderate	Moderate	Moderate
	Community Health and Safety	High	Moderate	Moderate	Moderate
	Traffic and Transport	Moderate	Moderate	Moderate	Moderate
	Terrestrial and Aquatic Ecology	Low	Low	Low	Moderate
Operation and Maintenance	Air Quality	High			
	Noise and Vibration	High			

Project Activity	Valued environmental Components/ parameters	Categorization of Impact			
		GCC	NCC	CuCC	CBP
	Surface and groundwater water quality	Low	Moderate	Moderate	High
	Occupational Health and Safety	Moderate	Moderate	Moderate	Moderate
	Community Health and Safety	Moderate	Moderate	Moderate	Moderate
	Transport and Traffic	High	Moderate	Moderate	Moderate

Note: Cumulative impacts were considered only the project activities without considering the other activities carried out by the city corporations or pauroshava.

6.0 Mitigations Measures

6.1 Introduction

This chapter proposes mitigation measures based on the results of the environmental and social impact assessment presented in Chapter 4 of this report. The potential impacts and corresponding measures prescribed to mitigate the negative impacts or enhance positive ones for the subprojects are described below.

6.2 Environmental Mitigation Measures

6.2.1 Environmental Mitigation Measures for Solid waste Management at GCC, NCC, CuCC and CBP

The major activities under these subprojects are mainly supply heavy equipment, vehicles, and capacity building of ULB people on overall solid waste management in the city areas. The anticipated impacts are basically air pollution, foul odor, noise level deterioration, contamination of surface water systems, loss of local habitats, waste spillage, risks for worker's health, and safety and community health and safety, possibilities of occurring of social conflict and increasing the local traffic volume etc. but the significance of the impacts are lower magnitude and likelihood of occurrence will be moderately found.

The potential Mitigation Measures are described below:

(1) Pre-construction

No impact management or mitigation measures are required at this stage.

(2) Construction Period

Air pollution:

- Cover using over the vehicles during transportation of construction materials.
- Vehicle engines should be checked regularly, and Mobil & grease should be replaced regularly following the good industrial practices of IFC/World Bank etc.

Noise Level

- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.

- Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards..

GHG emissions

- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated.
- For construction equipment and vehicles used to transport materials and equipment, environmentally friendly models with low emissions, shall be applied, thereby reducing the generation of greenhouse gases, etc.
- Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions.
- Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.

Community health and safety:

- Inform the work schedule and put signboard of construction information
- Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods
- Conduct awareness session among workers to reduce the risk of infectious diseases
- Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases.
- Always make emergency vehicles available

Local Traffic and accidents (public safety)

- Prepare a traffic management plan (TMP) prior to the commencement of the construction work.
- Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.
- Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction
- Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites.
- Keep several staff members standing on the street to ensure pedestrians' safety

Occupational Health and Safety:

- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2015.
- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Provide regular safety training for all construction workers, and at regular intervals thereafter.

- Provide task-appropriate PPE to all workers and enforce its use.
- Conduct a toolbox meeting every morning upon commencement of work.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.
- Provide appropriate facilities at workers' camp

(3) Operation Period

Air pollution:

- When operating equipment used for waste transportation, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants.
- From the viewpoint of preventing scattering of waste and ensuring work safety, transport of collected waste shall not be conducted during strong winds or heavy rain.
- Cover using over the vehicles during transportation of wastes from households to secondary transfer stations (STs) to final disposal sites.
- After disposal, vehicles and STs should be cleaned up very well without residues.
- Vehicle engines should be checked regularly, and Mobil & grease should be replaced regularly following the good industrial practices of IFC/World Bank etc.

Odor:

- Minimize odor by adopting the International Good Practices of IFC/World Bank such as cover using over the truck, segregate the hazardous and non-hazardous wastes at the STS, and the temporary waste disposal areas should be protected and non-accessible by the local people.
- Disinfection spray can reduce the bad odor during handling of waste management.

Noise Level:

- Vehicle speed should be 30-40 KM/hr. in the town areas, no hydraulic horn should be allowed, and valid and capacitated drivers should be employed for waste transportation in the city areas.

Surface water:

- Waste must be transported by covered van or vehicles should be covered with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources.
- Overload will not be allowed to carry more wastes in one trip, and maintained it strictly etc.

Waste

- Waste must be transported by covered van or vehicles should be covered with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources.
- Overload will not be allowed to carry more wastes in one trip and maintained it strictly.
- Waste segregation should be carried out following the International Standard Practices of IFC/World Bank and necessary PPE should be used by the workers.

- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials

Loss of local habitat:

- Waste disposal should be limited with daytime
- If it requires night-time disposal, the vehicle speed should be less than 30 KM/hr. and hydraulic horns will be prohibited.
- No haunting, trapping and killing of wild species are allowed etc.

GHG Emissions

Same as “Air Quality”

Local Traffic and Accidents (public safety)

- Limit the vehicle speed to 25/30 km/hr during waste transportation.
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.

Occupational Health and Safety:

- Ensure safe handling of wastes
- Vehicle speed should be 30-40 KM/hr. in the city areas
- Waste must be covered up with hard polythene or tarpaulin during the transportation period.
- Appropriate PPE (personnel protective equipment) such as hand gloves, masks, hard helmet, hard boots etc., accessible to all the workers and ensure use by the workers at the time of waste handling, and transportation and disposal activities etc.

6.2.2 Environmental Mitigation Measures for Improvement of Landfill Site (Level 3 Sanitary Landfill) (NCC-SWM2, CuCC-SWM-1, and CBP-SWM-1)

(1) PRE-CONSTRUCTION PHASE

N/A

(2) CONSTRUCTION PHASE

Dust Suppression / Air quality

- Implement a regular routine of light spraying with water.
- All dust-generating surfaces should be treated to avoid dust reaching nuisance levels.
- Keep all soil tightly covered with tarpaulins whenever they are not in active use.
- All haul trucks should be equipped with tightly fitted tarpaulins to prevent releases of dust from dry materials during transport.
- Maintain all motorized construction equipment and all haul trucks to a high standard, most particularly their fuel and exhaust systems.

Odor

- Information of work schedule shall be well circulated to local communities
- Adopt a semi-aerobic landfill
- Install leachate collection pipes, gas exhausted pipes and other facilities for circulation will accelerate decomposition of waste and prevent offensive odor

Noise and Vibration

- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.
- Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards.

Surface water

- Embankment shall be developed beforehand not to discharge leachate outside of the boundary.
- Perform visual observations to prevent, detect early and address water turbidity
- Arrange construction site drainage to prevent concentration of surface runoff from exposed soils and materials stockpiles.
- Protect disturbed soil from rain by keeping exposed areas covered with mulches, fiber mats and other temporary coverings.
- Keep all stockpiles of erodible materials covered with tarpaulins whenever they are not in active use.
- Install and regularly maintain sediment traps in site runoff channels; and
- Use a steel tray to exchange oil, mobile and grease from engine to prevent oil spillage
- Store fuels and other noxious fluids within roofed, rain-exclusive containment structures.
- Maintain a regimen of systematic daily checks of all motorized equipment and tanks to detect leaks, so they can be promptly repaired; and
- Train all workers involved in refueling, equipment servicing and moving containers on proper spill prevention and response.

Groundwater Quality

- A trench shall be made in the landfill site to install leachate collection pipes
- Keep groundwater quality in the surrounding area monitored during improvement work to make sure the subproject does not deteriorate it.

Soil Contamination

- Same as groundwater

Waste

- Collect and dispose the construction wastes or other wastes generated by the construction works
- Reduce, recycle or reuse the construction wastes generated by the construction works (e.g., segregate recyclable construction wastes such as rebar, concrete, cement, debris, etc., and sell).
- Put waste bins in different parts of the construction areas to collect small pieces of construction waste.

- Make sure a part of dumping site to be available for day-to-day waste disposal, for local people not to explore other areas.

Soil Erosion

- Soil erosion can be minimized or controlled by slope stabilization.
- Determine the boundaries of the landfill site and reshape slopes to develop an embankment.
- Drainage system shall be developed and properly maintained at the sites

Loss of Local Habitats

- When selecting construction methods, etc., reflect the latest knowledge and adopt construction methods that reduce environmental impact as much as possible.
- If there is a risk of water turbidity spreading, anti-pollution membranes should be deployed.
- Perform visual observations to prevent, detect early and address water turbidity and soil contamination

Greenhouse gas emission

- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated.
- For construction equipment and vehicles used to transport materials and equipment, we will strive to adopt environmentally friendly models with low emissions, thereby reducing the generation of greenhouse gases, etc.
- Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions.
- Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.

Local Economy and Livelihoods

- A study on losses and damage should be conducted relating to the disruptions of the local economy before commencing the construction works.
- Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities
- Give priority to employing local people in the construction work (either on a contractual or daily basis) to maximize the project's benefits to the local community.

Social Conflict

- Inform the work schedule and put signboard of construction information
- Conduct awareness session among workers to prevent unnecessary conflict.

Community Health and Safety

- Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods
- Conduct awareness session among workers to reduce the risk of infectious diseases
- Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases.
- Always make emergency vehicles available

Local Traffic and accidents (public safety)

- Prepare a traffic management plan (TMP) prior to the commencement of the construction work.
- Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.
- Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction
- Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites.
- Keep several staff members standing on the street to ensure pedestrians' safety

Occupational health and safety

- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2025.
- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Provide regular safety training for all construction workers, and at regular intervals thereafter.
- Provide task-appropriate PPE to all workers and enforce its use.
- Conduct a toolbox meeting every morning upon commencement of work.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.
- Provide appropriate facilities at workers' camp

Labor condition (including child labor, forced labor and gender-based violence)

- Strictly ban the employment of children
- Keep laborers' IDs with their employment record

(3) OPERATION PHASE

Air quality

- When operating equipment used for land reclamation and waste transport vehicles, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants.
- Properly inspect and maintain the equipment used for reclamation to reduce emissions of air pollutants.

- Clean up and sprinkle water in the on-site work yard to prevent dust and sand from being dispersed by vehicle travel.
- From the viewpoint of preventing scattering of waste and ensuring work safety, transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Odor

- Transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Noise and Vibration

- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.

Surface water

- Properly inspect and maintain rain drains well to ensure it lets flow the designed amount of water in cyclones, floodings and heavy rains.
- Regularly monitor water quality in the surrounding area to identify if there is any environmental impacts on the surrounding community

Waste

- Transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Greenhouse Gas Emissions

- Same as air quality.

Community Health

- Conduct awareness session among local people to reduce the risk of infectious diseases and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods

Occupational health and safety

- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Flammable material should be kept away from fire in the site.
- Fire extinguishers or sand for extinguisher should be installed in the site
- Duration of outdoor work should be shortened as much as possible by taking moderate rest and drinking water.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.

6.2.3 Environmental Mitigation Measures for New Sanitary Landfill (Level 4) (NCC-SWM-1, CuCC-SWM-1, and CBP-SWM-2)

(1) PRE-CONSTRUCTION PHASE

Land Acquisition

- A study on losses and damage should be conducted relating to the disruptions of the local economy before commencing the construction works.
- Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities
- Inform the affected people of the land acquisition schedule.

(2) CONSTRUCTION PHASE

Dust Suppression / Air quality

- Implement a regular routine of light spraying with water.
- All dust-generating surfaces should be treated to avoid dust reaching nuisance levels.
- Keep all soil tightly covered with tarpaulins whenever they are not in active use.
- All haul trucks should be equipped with tightly fitted tarpaulins to prevent releases of dust from dry materials during transport.
- Maintain all motorized construction equipment and all haul trucks to a high standard, most particularly their fuel and exhaust systems.

Noise and Vibration

- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.
- Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards.

Surface water

- Perform visual observations to prevent, detect early and address water turbidity
- Arrange construction site drainage to prevent concentration of surface runoff from exposed soils and materials stockpiles.
- Protect disturbed soil from rain by keeping exposed areas covered with mulches, fiber mats and other temporary coverings.
- Keep all stockpiles of erodible materials covered with tarpaulins whenever they are not in active use.
- Install and regularly maintain sediment traps in site runoff channels; and
- Use a steel tray to exchange oil, mobile and grease from engine to prevent oil spillage
- Store fuels and other noxious fluids within roofed, rain-exclusive containment structures.
- Maintain a regimen of systematic daily checks of all motorized equipment and tanks to detect leaks, so they can be promptly repaired; and
- Train all workers involved in refueling, equipment servicing and moving containers on proper spill prevention and response.

Groundwater Quality

- Keep groundwater quality in the surrounding area monitored during improvement work to make sure the subproject does not deteriorate it.

Soil Contamination

- Same as groundwater

Waste

- Collect and dispose the construction wastes or other wastes generated by the construction works
- Reduce, recycle or reuse the construction wastes generated by the construction works (e.g., segregate recyclable construction wastes such as rebar, concrete, cement, debris, etc., and sell).
- Put waste bins in different parts of the construction areas to collect small pieces of construction waste.
- Make sure a part of dumping site to be available for day-to-day waste disposal, for local people not to explore other areas.

Soil Erosion

- Soil erosion can be minimized or controlled by slope stabilization.
- Determine the boundaries of the landfill site and reshape slopes to develop an embankment.
- Drainage system shall be developed and properly maintained at the sites

Loss of Local Habitats

- When selecting construction methods, etc., reflect the latest knowledge and adopt construction methods that reduce environmental impact as much as possible.
- If there is a risk of water turbidity spreading, anti-pollution membranes should be deployed.

- Perform visual observations to prevent, detect early and address water turbidity and soil contamination

Greenhouse gas emission

- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated.
- For construction equipment and vehicles used to transport materials and equipment, we will strive to adopt environmentally friendly models with low emissions, thereby reducing the generation of greenhouse gases, etc.
- Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions.
- Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.

Local Economy and Livelihoods

- A study on losses and damage should be conducted relating to the disruptions of the local economy before commencing the construction works.
- Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities
- Give priority to employing local people in the construction work (either on a contractual or daily basis) to maximize the project's benefits to the local community.

Social Conflict

- Inform the work schedule and put signboard of construction information
- Conduct awareness session among workers to prevent unnecessary conflict.

Community Health and Safety

- Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods
- Conduct awareness session among workers to reduce the risk of infectious diseases
- Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases.
- Always make emergency vehicles available

Local Traffic and accidents (public safety)

- Prepare a traffic management plan (TMP) prior to the commencement of the construction work.
- Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site
- All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.

- Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction
- Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites.
- Keep several staff members standing on the street to ensure pedestrians' safety

Occupational health and safety

- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2025.
- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Provide regular safety training for all construction workers, and at regular intervals thereafter.
- Provide task-appropriate PPE to all workers and enforce its use.
- Conduct a toolbox meeting every morning upon commencement of work.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.
- Provide appropriate facilities at workers' camp

Labor condition (including child labor, forced labor and gender-based violence)

- Strictly ban the employment of children
- Keep laborers' IDs with their employment record

(3) OPERATION PHASE

Air quality

- When operating equipment used for land reclamation and waste transport vehicles, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants.
- Properly inspect and maintain the equipment used for reclamation to reduce emissions of air pollutants.
- lean up and sprinkle water in the on-site work yard to prevent dust and sand from being dispersed by vehicle travel.
- From the viewpoint of preventing scattering of waste and ensuring work safety, transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Odor

- Transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.

- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Noise and Vibration

- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites.
- Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.
- Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.

Surface water

- Properly inspect and maintain rain drains well to ensure it lets flow the designed amount of water in cyclones, floodings and heavy rains.
- Regularly monitor water quality in the surrounding area to identify if there is any environmental impacts on the surrounding community

Waste

- Transport and landfill operations shall not be conducted during strong winds or heavy rain.
- When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste.
- Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.

Greenhouse Gas Emissions

- Same as air quality.

Community Health

- Conduct awareness session among local people to reduce the risk of infectious diseases and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods

Occupational health and safety

- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest.
- Flammable material should be kept away from fire in the site.
- Fire extinguishers or sand for extinguisher should be installed in the site
- Duration of outdoor work should be shortened as much as possible by taking moderate rest and drinking water.
- Make emergency contact details available at the site.
- Signs to show walkways and stairs, places with high voltage, etc.

6.2.4 Environmental Mitigation Measures for Construction of Railway Overpass in GCC

(1) Construction Period

Air Quality:

- Construction areas and stockyards should be properly fenced, or site barricade should be installed properly.
- All construction materials including sand, cement, soil etc., must be covered up with hard polythene or tarpaulin in the stockyard.
- Construction materials including sand, cement, soil etc., must be covered up with hard polythene or tarpaulin during transportation to and from the site.
- After transportation of construction materials like soil, sand, bricks, cement, waste materials etc., the trucks, lorry, van wheels shall be cleaned properly before leaving the site.
- Construction materials should not be kept on the roadsides, footpaths, and others and waste cannot be allowed to store in any open place and onsite burning.
- Water sprinkles should be conducted at least twice a day on the construction site, and continuously (every hr.) during excavation, trenching and backfilling etc.

Noise and vibration level::

- Bricks and stone crushers will not be allowed within 500m of the silent zone areas classified by the Noise Pollution (Control) Rule 2006.
- Mixer machines or other equipment cannot be allowed to be used in the construction site from 07PM to 07AM.
- Except the mixer machine, bricks and stone crushers, the other equipment can be used in the construction sites with specified construction schedule and after receiving approval from the relevant organizations.
- The workers should use earplugs while working in the high noise generation sites.
- Noise barriers should be installed over the site and rubber pads can be used on motor engines or other equipment etc.

Drainage congestion:

- Provision for adequate drainage of storm water
- Provide adequate diversion channel, if required
- Ensure facilities for pumping of congested water, if needed
- Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.

Water and Soil Pollution:

- Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land.
- Install sediment basins to trap sediments in storm water prior to discharge to surface water.
- Replant vegetation when soil has been exposed or disturbed.

Waste Management:

- Enough dustbins and spittoons shall be provided at convenient places, and these shall be maintained in a clean and hygienic condition.
- No person shall throw any dirt or spit within the premises of labor camp, storage yards and construction except in such dustbins and spittoons.
- Three color coated dustbins should be used at the construction site, for an example, green color dust bin will be used for kitchen wastes, yellow color dustbin for plastic wastes and red color dustbin for hazardous wastes like empty packet of chemicals, oil and grease and others.
- Construction waste should be re-cycled or sold locally to reduce the volume of waste in the construction sites etc.

Traffic and Transport:

- Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings.
- Schedule deliveries of material/ equipment during non-school hours and after regular working hours
- Depute flagman for traffic control, and
- Arrange for signal light at night

Local Ecosystem:

- To avoid disturbance to the local ecosystem, construction works should be limited to only daytime (07AM to 07PM).
- If trees are required to be cleared from the site, the necessary replantation plan shall be executed properly.
- High noise generating equipment and machines shall be used only in the daytime.
- Cover using on the storage materials to protect water pollution by surface runoff.
- Any kind of haunting, trapping, killing and poaching wildlife species will be punishable offense and strictly prohibited at the construction sites, storage yards and labor camps.

Disruptions of Local Economy:

- Avoid important festival times (e.g., Eid) for stoppage of commercial activities to minimize loss.
- Provide alternative job opportunities for PAPs; employ such people in project work where possible.
- Implement the compensation plan for local people who lost their livelihood options etc.

Community Health and Safety:

- Site barricading should be ensured properly
- Using light at the construction site, particularly, excavation and trenching site at night-time.
- Construction schedules should be shared with the local people.
- Alternative routes should be made accessible for the local people if the current road cannot be accessible by the local people.
- Flagman should be employed at the construction site
- Vehicle speed should be limited to 30-40KM/hr. at the construction site.
- No hydraulic horns should be allowed at the construction sites
- Danger sign should be posted both sides of the overpass areas

- Regular consultation should be taken with the local people etc.

Traffic and Transport

- Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings.
- Schedule deliveries of material/ equipment during non-school hours and after regular working hours
- Depute flagman for traffic control, and
- Arrange for signal light at night

Occupational Health and Safety:

- Ensuring safety during demolition of existing structures
- Ensuring safety of trains and rail lines during construction of overpass over rail tracks through proper design of formwork/ centering
- Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering
- Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction
- Site barricade, depute flagman is essential in the construction sites.
- Use safety harness while working at height.
- Appropriate scaffolding should be ensured during construction of overpass
- PPE (hard boots, helmet, gloves, life vest, goggles etc.) should be accessible for all workers and must be used during construction works.
- No PPE no work should be maintained at the site
- Working hours should be limited to only daytime (07AM to 07PM).
- Emergency vehicles should be available at the site
- In the construction sites, arrangements shall be made at a suitable point to supply sufficient purified potable water for all workers employed therein.
- All water supply points shall be legibly marked with “Potable water” in Bangla.
- Enough sanitary toilets and washrooms shall be provided at suitable places so that the workers employed therein at the time of work may use them easily.
- Toilets and washrooms shall be provided separately for male and female workers.
- Toilets and washrooms shall be adequately lit, and ventilated, and water shall be always provided.
- Toilets and washrooms shall be always maintained in a clean and sanitary condition with suitable detergents and disinfectants by contractors.
- First-Aid Medicine Box should be available with full of primary medicines at the site.
- Eye-shield use during electrical works mainly wielding.
- Other appropriate measures should be also undertaken based on field conditions.

(2) Construction Period

Air Quality

- Water sprinkle should be conducted at least twice a day on the most congested areas at least twice a day etc.
- Air quality on a city scale is not likely to occur in the operation or commissioning of the overpass of railway crossing.

- Air pollution shall be possible to reduce in some extent by reducing traffic congestion and engine idle time.

Noise level

- Noise barriers should be installed over the site to reduce the noise intensity etc.

Traffic and Transport

- Adequate traffic lights, signals, personnel for controlling traffic over existing roads, level crossings.
- Depute flagman for traffic control, and
- Arrange for signal light at night

6.2.5 Environmental Mitigation Measures for Gungajury-Racecourse Canal Re-excavation in CuCC

(1) Pre-construction Period

Land acquisition and land use change

- Compensation shall be paid in accordance with ARIPA 2018 for land acquisition
- Top-up payment for the losses of income and livelihood means in accordance with JICA Guidelines for Environmental and Social Considerations (2010).

(2) Construction Period

Air quality:

- Dust generation shall be reduced as much as possible and water sprinkling carried out as appropriate, especially where earthmoving, and reshaping of canal are carried out.
- Good engines should be used to reduce smoke emissions.
- Dredge materials should be properly stored and maintained properly to protect dust emissions.

Noise and vibration level:

- Working hours should be limited to daytime only (07AM to 07PM)
- No hydraulic horns shall be permitted within the working areas.
- Maintained equipment and vehicles regularly, oil and grease changing can reduce the noise generations from the motor engines and vehicles.

Surface water quality:

- Dredge material shall be managed outside of the excavation sites, disposed of in an open area.
- Ensure proper handling of lubricating oil and fuel
- Collection, proper treatment, and disposal of spills
- Maintained proper slope to protect erosion
- The contractor will remove all construction, and demolition waste daily.

Dredged Materials Management:

- Dredge materials should be stored separately, preferring the open space to the nearest locations.
- Dredge materials should be used to develop the walkways for public interest.

- Dredge materials should not be kept for a long period. So. Within a short period, dredge materials should be used for improvement of walkways
- Loose materials should be kept by covered up with hard tarpaulin to protect dust emissions etc.

Waste:

- Sufficient no of wastebins should be placed in the working areas, particularly along the canal sides.
- No person shall throw any dirt or spit within the premises of labor camp, storage yards and construction except in such dustbins and spittoons.
- Three color coated dustbins should be used at the construction site, for an example, green color dust bin will be used for kitchen wastes, yellow color dustbin for plastic wastes and red color dustbin for hazardous wastes like empty packet of chemicals, oil and grease and others.
- Construction waste should be re-cycled or sold locally to reduce the volume of waste in the construction sites etc.
- Sufficient no of wastebins should be placed in the working areas, particularly along the canal sides.
- CuCC conservancy department should collect the waste in the daytime and dispose of in the landfill sites.

Local aquatic ecosystem:

- Any kind of debris should be removed from the canal site
- Dredge materials should be protected from surface runoff.
- Re-excavation should be carried out by small sections to avoid the larger impacts to the aquatic resources.
- Oil, grease and other materials spillage should be protected from contamination of canal water etc.

Community Health and Safety:

- Site barricading should be erected properly
- Using light at the construction site, particularly, excavation site at night-time.
- Construction schedules should be shared with the local people.
- Alternative routes should be made accessible for the local people if the current road cannot be accessible by the local people.
- Flagman should be employed at the construction site
- Vehicle speed should be limited to 30-40KM/hr. at the construction site.
- No hydraulic horns should be allowed at the construction sites
- Danger sign should be posted on the working areas
- Regular consultation should be taken with the local people etc.

Traffic and Transport

- Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings.
- Schedule deliveries of material/ equipment during non-school hours and after regular working hours
- Depute flagman for traffic control, and

- Arrange for signal light at night etc.

Occupational Health and Safety

- Ensuring safety during demolition of existing structures
- Ensuring safety of trains and rail lines during construction of overpass over rail tracks through proper design of formwork/ centering
- Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering
- Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction
- Site barricade, depute flagman is essential in the construction sites.
- Use safety harness during working at height.
- Appropriate scaffolding should be ensured during construction of overpass
- PPE (hard boots, helmet, gloves, life vest, goggles etc.) should be accessible for all workers and must be used during construction works.
- No PPE no work should be maintained at the site
- Working hours should be limited to only daytime (07AM to 07PM).
- Emergency vehicles should be available at the site
- In the construction sites, arrangements shall be made at a suitable point to supply sufficient purified potable water for all workers employed therein.
- All water supply points shall be legibly marked with “Potable water” in Bangla.
- Enough sanitary toilets and washrooms shall be provided at the suitable places so that the workers employed therein at the time of work may use easily.
- Toilets and washrooms shall be provided separately for male and female workers.
- Toilets and washrooms shall be adequately lighted, and ventilated, and water shall be always provided.
- Toilets and washrooms shall be always maintained in a clean and sanitary condition with suitable detergents and disinfectants by contractors.
- First-Aid Medicine Box should be available with full of primary medicines at the site.
- Eye-shield use during electrical works mainly wielding.
- Other appropriate measures should be also undertaken based on field conditions.

Labor condition (including Child Labor and others

- No child (under 18 age) shall be employed or permitted to work on the construction site.
- Force labor shall not be permitted at the construction site also.

(3) Operation Period:

Air Quality:

- Regularly sweeping the canal sides and its adjacent surface.

Noise level:

- Install the natural barrier (e.g., tree plantation) along the canal sides, and provide awareness signboard to restrict the noise level in the canal areas.

Community health and safety:

- Installing safety barriers, mainly boundary walls along the roadsides of the canal and walkways, should be developed user friendly to avoid community health and safety risks.

Solid waste:

- Generated waste should be collected by the conservancy department of CuCC regularly, sweeping the sides to keep neat and clean in the canal areas regularly.

6.3 Contingency Plan

6.4 Emergency Response Plan

Contingency planning is necessary for accidents occurring during the construction and operation phases of project. The main components of a contingency plan include measures to prevent accidents; methods for response and clean-up in cases of accidents; and creation and training of teams that will be implementing the contingency plan.

The plan shall include, but not limited to, the following:

Medical Emergencies

Trained personnel will be fielded and first aid kits to be used in the treatment of minor wounds and ailments at the subproject level should be readily accessible. Also, readily available vehicles to bring patients to the nearest hospital after application of first aid should be set in place.

Emergency Response Teams

Identify employees of the subprojects to be assigned members of an Emergency Response Team. The team should be equipped with appropriate communication equipment and first-aid kits to effectively respond to future emergencies. Regular training is necessary to keep the team active and prepared. Whenever possible, coordination with the representatives from the Local Government Units in-charged with Safety, Emergency and Environment must be established.

Communications

Public Communication System (PCS) and other means of communication shall be introduced and implemented at the subproject sites, focusing mainly the forecasting, alarms and warnings in case of accidents and other related information to the facility' personnel as well as for adjacent locators. Walky-talky could also be issued to selected personnel to coordinate personnel movement during emergencies.

Fire Hazards

Fire extinguishers and hoses must be strategically located within the construction site and within the labor camps upon completion. The appropriate fire alarms should also be strategically located inside the construction yards in case of fires. All firefighting equipment and accessories (ex. fire alarms / detectors, extinguishers) shall be in compliance as per the local standards.

6.5 Disaster Response Plan

Disaster Response Plan is taking into consideration the high temperatures, erratic rainfalls, flood, earthquake, Tsunami, Cyclones, storm surges and others. Disaster response is applicable for all subprojects, particularly for CuCC and CBP is top ranked for disaster-prone areas in Bangladesh.

Table 6-1: Comprehensive Disaster Management Plan for NCC, GCC, CuCC, CBP

Types of disaster(s)	Mitigation Measures	Responsible Agency	
		Operation	Operation
Earthquake	• Adopting and enforcing updated building code of BNBC 2020 provisions to reduce earthquake damage risk. • The proposed infrastructures shall be designed and developed considering earthquake risk zone category. • Make all utilities like gas collection, leachate collection system, communication networks, electricity lines etc. earthquake proof. • The project key personnel shall be trained to manage emergency situations during an earthquake. • Emergency firefighting systems should be ensured in the project sites. • Fire drill can be conducted once in a year, and • Adequate first aid provision in the project site	Contraction	PIU (GCC/NCC/ CuCC/CBP)
Cyclones	• Consideration of cyclonic wind/wind velocity in the design of the project and associated infrastructures in CBP. • Tree Plantation of selected species around the proposed subproject sites in response to cyclone wind. • Regular monitoring of the weather news/bulletin especially for the cyclone disasters during April to May and October to November. • Close communication with local Disaster Management Committee (DMC) and engaging the volunteers for the preparedness of cyclone disaster. • Establishment of site emergency evacuation and management plan for the cyclone disasters. • The proposed subprojects operating personnel and other key personnel will be trained to manage cyclone disasters.	Contraction	PIU (GCC/NCC/ CuCC/CBP)
Storm Surges (CBP)	• Consideration of storm surge height in the design for subprojects development. • Raise the landfill site above flood level and design should be integrated with the maximum flood level and storm surges. • During the storm surges, avoiding electrical equipment in the landfill site to protect electrical risks. • Close communication with local Disaster Management Committee (DMC) and	Contraction	PIU (GCC/NCC/ CuCC/CBP)

Types of disaster(s)	Mitigation Measures	Responsible Agency	
		Operation	Operation
	engaging the volunteers for the preparedness of cyclone disaster and • Other appropriate mitigation measures based on ground condition should be undertaken during emergencies.		
Droughts, and erratic rainfall	• Design should also consider the drought, especially temperatures, and rainfall patterns in the subproject's areas. • Natural drainage system should be maintained or kept in the subprojects development.	Contraction	PIU (GCC/NCC/ CuCC/CBP)
Floods	• Avoiding the floodplain areas for development of subprojects infrastructure and keeping intake of natural drainage system in the project site. • Ensure adequate stormwater and natural drainage system in the subproject areas. • A detailed drainage study should be required for the proposed subprojects' development. • Plantation of trees in the proposed subproject sites to reduce the amount of stormwater runoff and • Other appropriate mitigation measures should be undertaken considering the ground conditions of the subprojects.	Contraction	PIU (GCC/NCC/ CuCC/CBP)
Tsunami (CBP)	• Regular monitoring of earthquake and tsunami warning following the Bangladesh Meteorological Department (BMD), United States Geological Survey (USGS) and Pacific Tsunami Warning Center website. • Design, practice, and implementation of evacuation plans as appropriate.	Contraction	PIU (GCC/NCC/ CuCC/CBP)

6.6 Compensation Plan

Compensation Plan is considered only the temporary occurring of disturbance on livelihoods, social and educational infrastructures in the subproject's areas and the land acquisition and resettlement issues were not considered under this compensation plan. However, this budget will be incorporated in the bid documents under provisional sum for the BoQ items of contractors. ULB-wise detail compensation plan is given below:

6.6.1 Compensation Plan for GCC

In case any social and educational institute is found near the construction areas, the contractor can inform them about the project activities and possible disturbance resulting from the project activities. To make the proper utilization of the compensation plan, it is necessary to ensure close coordination with the institutions and social leaders.

Table 6-2: Compensation Plan for implementation of subprojects in GCC

Sl. No.	Gazipur City Corporation (GCC)				
	Item no.	Solid waste management	Landfill site development	Railway Overpass (BDT)	Total BDT
1	Loss of livelihood options (Temporary)	0	N/A	20,00,000	20,00,000

2	Tree Plantation	0	N/A	10,00,000	10,00,000
3	Disturbance on social infrastructure	0	N/A	200,000	200,000
4	Disturbance on educational Institute	0	N/A	200,000	200,000
Grand total (BDT)					34,00,000

Note: Loss of livelihood occurrence can be confirmed after social survey completion by the project authority.

6.6.2 Compensation Plan for NCC

In case any social and educational institute is found near the construction areas, the contractor can inform them about the project activities and possible disturbance resulting from the project activities. To make the proper utilization of the compensation plan, it is necessary to ensure close coordination with the institutions and social leaders.

Table 6-3: Compensation Plan for implementation of subprojects in NCC

Sl. No.	Narayanganj City Corporation (NCC)			
	Item no.	Solid waste management	Landfill site development (BDT)	Total BDT
1	Loss of livelihood options (Temporary)	0	20,00,000	20,00,000
2	Tree Plantation	0	10,00,000	10,00,000
3	Disturbance on social infrastructure	0	200,000	200,000
4	Disturbance on educational Institute	0	200,000	200,000
Grand Total				34,00,000

Note: Loss of livelihood occurrence can be confirmed after social survey completion by the project authority.

6.4.3 Compensation Plan for CuCC

In case any social and educational institute is found near the construction areas, the contractor can inform them about the project activities and possible disturbance resulting from the project activities. To make the proper utilization of the compensation plan, it is necessary to ensure close coordination with the institutions and social leaders.

Table 6-4: Compensation Plan for implementation of subprojects in CuCC

Sl. No.	Cumilla City Corporation (CuCC)				
	Item no.	Solid waste management	Landfill site development (BDT)	Canal Re-Excavation (BDT)	Total (BDT)
1	Loss of livelihood options (Temporary)	0	20,00,000	20,00,000	40,00,000
2	Tree Plantation	0	10,00,000	10,00,000	20,00,000
3	Disturbance on social infrastructure	0	200,000	200,000	400,000
4	Disturbance on educational Institute	0	200,000	200,000	400,000
Grand Total					68,00,000

Note: Loss of livelihood occurrence can be confirmed after social survey completion by the project authority.

6.6.3 Compensation Plan for CBP

In case any social and educational institute is found near the construction areas, the contractor can inform them about the project activities and possible disturbance resulting from the project activities. To make the proper utilization of the compensation plan, it is necessary to ensure close coordination with the institutions and social leaders.

Table 6-5: Compensation Plan for implementation of subprojects in CBP

Sl. No.	Cox's Bazar Pauroshava (CBP)			
	Item no.	Solid waste management	Landfill site development (BDT)	Total BDT
1	Loss of livelihood options (Temporary)	0	20,00,000	20,00,000
2	Tree Plantation	0	10,00,000	10,00,000
3	Disturbance on social infrastructure	0	200,000	200,000
4	Disturbance on educational Institute	0	200,000	200,000
Grand Total				34,00,000

Note: Loss of livelihood occurrence can be confirmed after social survey completion by the project authority.

6.7 Site visit schedule

A regular site inspection will be carried out by the consultant team, PIU members, at the construction sites to oversee and enforce the implementation of environmental management plan. If there is found non-compliance with the EMP, contractors will be informed to make necessary Corrective Action Plan (CAP) and implement it to the construction sites to overcome the irregularities or non-compliance issues. The tentative site visit (at least but not limited to) schedule is given below:

Table 6-6: Site visit schedule for EMP implementation

Environmental Criterion	Method, Location, Parameters	Visit schedule
Construction Phase		
Soil erosion and contamination	• Method: Visual inspection • Location: All project construction sites, including excavation, dredging and trenching sites and access roads as applicable in landfill, overpass, canal re-excavation areas. • Parameters: (i) adequacy of soil erosion prevention; measures; (ii) adequacy of soil contamination prevention techniques; (iii) evidence of excessive soil erosion or soil contamination. (iv) record of oil, Mobil, or grease changes from engine etc.	• Daily during construction phase, and quarterly at the operation / maintenance phase.
Slope protection	• Method: Visual inspection • Location: All project construction sites, including excavation, dredging and trenching sites and	• Daily monitoring during construction phase.

Environmental Criterion	Method, Location, Parameters	Visit schedule
	access roads, landfill, flyover, canal excavation sites as applicable ● Parameters: (i) adequacy of soil protection measures like retention wall, shoring etc.; (ii) adequacy and evidence of slope protection techniques; and (iv) record of application of slope protection measures undertaken for the applicable subprojects etc.	
Surface and ground water pollution	● Method: Visual inspection; worker interviews as needed ● Location: All project construction sites, including landfill, flyover, canal excavation sites and access roads as applicable ● Parameters: (i) adequacy of spill and leak prevention; measures, including storage of chemicals, fuels, lubricants; (ii) worker awareness of spill response plan; (iii) evidence of spills and leaks on ground surface; (iv) appropriate use of settling basins for process water; (v) appropriate connections to sewers and septic tanks	● Daily during construction phase
Air quality	● Method: Observation; interviews with local people ● Location: At construction site perimeters nearest to residences; by side of access and haul roads as applicable; as applicable ● Parameters: Airborne dust level, appearance of machinery exhaust ● Wetting the dry surface over the construction sites (twice per day).	● Daily during construction phase
Livelihoods	● Method: Interviews with workers and site managers ● Location: At all project construction sites ● Parameters: Percentage of local workers on site	● Quarterly
Noise	● Method: Observation; interviews with local residents ● Location: At perimeter of all sites nearest to residences ● Parameters: (i) adherence to prohibition on noisy site activity between dusk and dawn; (ii) presence of functional mufflers on motorized equipment; (iii) complaints of local residents	● Daily during construction phase
Worker health and safety	● Method: Visual inspection; and interviews with workers ● Location: At all project construction sites ● Parameters: (i) worker use of personal protective equipment; (ii) adherence to the approved Health and Safety Management Plan (HSMP); (iii) performance of the EHSO; (iv) worker complaints and concerns	● Daily during construction phase

Environmental Criterion	Method, Location, Parameters	Visit schedule
Public health and safety	• Method: Observation; interviews with nearby residents, interviews with local police • Location: Near all project construction sites • Parameters: (i) adherence to approved temporary traffic management plan; (ii) adequacy of construction site signage, fencing and security presence; (iv) accidents records involving public and workers; (v) emergencies and responses; (v) public complaints	• Daily during construction phase
Solid waste management	• Method: Visual inspection • Location: All project sites • Parameters: (i) adequacy of solid waste collection, storage, containment, and disposal system; (ii) absence of solid waste dumps or evidence of waste burning; (iii) proper disposal of construction waste in legal landfill	• Daily during construction phase
EMP Compliance	• Method: Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants • Location: all sites • Parameters: Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of EMP	• PMU, PIU - yearly
After Construction Completion		
Post-construction site inspection	• Post-construction site inspection	• Post-construction site inspection

6.8 Reporting Schedule

Table 6-7: Reporting Schedule for Implementation of Mitigation Measures at field level

Submission	Contents
Monthly report 10th of the next month	• Project activity summary. • Complaints by the public or authorities, project affected people and the Contractor's responses or action plans. • Summary of the daily site inspection records. • Accidents and incidence records. • All applicable monitoring items of air, noise, surface and groundwater quality and soil quality etc. with the lab test result conducted from government approved lab as separate annex. • Status of key Mitigation measures implementation • Corrective Action Plan (CAP) in case the test result exceeding the allowable limit. • Compliances of the monitoring items and counter measures if it is applicable within next month.
Quarterly report	• Project activity summary.

15th of the next month after each three-month	• Complaints by the public or authorities, project affected people and the Contractor's responses or action plans. • Summary of the daily site inspection records. • Accidents and incidence records. • All applicable monitoring items of air, noise, surface and groundwater quality and soil quality etc.) with the test result conducted from government approved lab as separate annex. • Status of key Mitigation measures implementation • Corrective Action Plan (CAP) in case the test result exceeding the allowable limit. • Compliances of the monitoring items and counter measures if it is applicable within next month. • Outstanding environmental issues so far;
Annual Report (ESR-Environmental Status Report)	• Annual/final summary of the compliance status of all applicable monitoring items, implementation of mitigation measures, outstanding environmental issues and way forwards etc.

6.8.1 Methods and Time Schedule of environmental auditing

The method of environmental auditing is outlined below:

6.8.2 Objectives of Environmental Auditing

- **Compliance Assessment**: Ensure adherence to environmental laws, regulations, and standards.
- **Impact Identification**: Identify potential environmental impacts, such as air and water pollution, habitat disruption, and waste generation.
- **Risk Management**: Evaluate risks and develop strategies to mitigate them.
- **Sustainability Improvement**: Recommend practices to enhance sustainability and reduce environmental footprints.

6.8.3 Steps for Environmental Auditing

Two steps, mainly Internal and External Auditing, will be held during the construction period only.

6.8.3.1 Internal auditing

Internal auditing will be conducted by the DSM consultant team led by the environmental and social considerations expert (International and national). The general approach will be as follows:

Table 6-8: Internal Environmental Auditing for EMOP implementation

Issues	Indicators	Time schedule for internal auditing
Construction Phase		
Policy document	• Construction Environmental Management Plan (C-EMP) prepared by contractors • The commitment for prevention of pollution • The commitment for continual improvement of the environmental performance (where applicable)	Before commencing construction works
Organization set-up	• Professionals' recruitment such as environmental specialist, health and safety advisor, safety instructor, site safety manager etc.	Contract document check (1) and

Issues	Indicators	Time schedule for internal auditing
		Monthly (field inspection)
EMP recommendations	• Air emission • Noise level • Wastewater effluent • Waste management • Soil pollution • Raw material and natural resource usage • Hazardous and toxic material • Impact on wellbeing (e.g. noise, smell, heat, landscape, protection) • Health and safety • Utility, energy and resource • Other environmental specific issues on site such as housekeeping, storage, areas, piping	• Monthly
Contingency plan	• Abnormal conditions (e.g., incidents, disasters) • Actual and potential emergency conditions and accidents	• Quarterly
Records	• Accident-incident records. • Training, meeting, workshop records • Information on significant environmental aspects and associated impacts • Information on emergency preparedness and response • Monitoring data • Details of nonconformity, incidents, complaints and follow-up actions • Contractors and suppliers' records • Grievance records etc.	• Monthly
Reporting	• Daily reports, Monthly, quarterly, semi-annually and annual reports checks	• Monthly/Quarterly/ Annual
Stakeholder engagement	• FGD, in-person meeting and interviews.	• Quarterly
After Construction Completion		
Post-construction site inspection	• Post-construction site inspection	• Post-construction site inspection

6.8.3.2 External Auditing:

External auditing will be conducted by a third-party professional audit firm selected by a competitive selection process. The issues outlined in the EIA report and legal and policy requirements following the Government of Bangladesh (GoB) and JICA Environmental and Social Consideration 2010 will be audited to meet the compliance requirements successfully.

Table 6-9: Indications for External Auditing

Sl. No.	Audit Cycle	Descriptions
1	Pre-Audit	• Define the scope and objectives. • Identify relevant legislation and standards. • Gather necessary documentation (e.g., permits, previous audits)
2	Site Inspection	• Conduct a thorough on-site evaluation. • Observe construction practices, materials used, pollution management. • Assess environmental conditions (e.g., soil, water, air and noise quality). • Health and safety • Grievances and institutional capacity etc.
3	Data Collection	• Collect quantitative and qualitative data on environmental performance. • Engage stakeholders (e.g., workers, community members) for insights.
4	Evaluation and Analysis:	• Compare findings against legal requirements and best practices. • Identify non-compliance issues and areas for improvement.
5	Reporting	• Prepare an audit report summarizing findings, impacts, and recommendations. • Include an action plan for addressing identified issues.
6	Follow-Up and Monitoring:	• Establish mechanisms for monitoring progress on recommendations. • Schedule follow-up audits to ensure continuous improvement.

6.8.4 Time-schedule for External Auditing

Name of ULB	GCC				NCC				CuCC				CBP			
	Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4
GCC																
NCC																
CuCC																
CBP																

Note: Q-3: Auditing, Q-4: Reporting; Q- Quarterly

7.0 Environmental Management Plan

7.1 Environmental Policy

Environmental Management and Conservation Policy, LGED.

7.2 Environmental Compliance Requirements

7.3 Environmental Standards

This section of the EIA details the legal framework the Project shall stipulate, covering national requirements and applicable international treaties and conventions. This section's intent is to lay out the regulatory and non-regulatory performance requirements for all stages of the Project. The environmental assessment requirements of both the Government of Bangladesh and JICA are outlined as well.

7.4 Environmental Conditions

- Conditions of Environmental Clearance/Site Clearance of DOE
- Conditions of JICA Environmental and Social Consideration Guidelines, 2010

7.5 Environmental Parameters Standards

7.5.1 Air Quality Standards

The air quality standards are described below following the Air Pollution (Control) Rules, 2022 and WHO standards:

Table 7-1: Air Quality Standards

Sl. No.	Parameters	Unit	Bangladesh Standard[1]	WHO standard	Standard Time (hrs.)
1	$PM_{2.5}$	$\mu g/m^3$	65	15	24
2	PM_{10}	$\mu g/m^3$	150	45	24
3	SO_2	$\mu g/m^3$	80	40	24
4	NO_2	$\mu g/m^3$	80	25	24
5	CO	ppm	5	10	8
6	O3	$\mu g/m^3$	100	100	8

7.5.2 Noise Quality Standards

The noise level standards followed by Noise Pollution (Control) Rules, 2006 and IFC EHS Guidelines, 2007 which are given below:

Table 7-2: Noise Level Standards

Sl. No.	Location setting (DOE/IFC)	Bangladesh Standard (dB(A))[2]		IFC EHS Guideline (2007)[3]	
		Day	Night	Day	Night
1	Mixed Area/Commercial	60	50	70	70
2	Mixed Area/ Commercial	60	50	70	70
3	Commercial	70	60	70	70
4	Industrial/Commercial	75	70	70	70
5	Industrial/ Commercial	75	70	70	70

6	Silent/Institutional	50	40	55	45
7	Residential	55	45	55	45

7.5.3 Surface Water Quality Standards

The surface quality standards are summarized below following the Environmental Conservation Rule (ECR) 2023, Schedule-2:

Table 7-3: Surface Water Quality Standards

Sl. No.	Parameters	Unit	Bangladesh Standard[4]
1	DO	mg/L	≥5
2	TDS	mg/L	1000
3	TSS	mg/L	-
4	EC	µS/cm	-
5	Turbidity	NTU	-
6	Ph	-	6-9
7	Salinity	ppt	-
8	COD	mg/L	50
9	BOD	mg/L	≤6
10	Mercury	mg/L	-
11	Lead	mg/L	0.1
12	Cadmium	mg/L	-
13	Oil and Grease	mg/L	-
14	Fecal Coliform	MPN/100ml	2.0 indicates (Absent) as per BDS Standard 1240:2021
15	Total Coliform	MPN/100ml	2.0 indicates (Absent) as per BDS Standard 1240:2021

7.5.4 Drinking Water Quality Standards

The standards of Drinking Water Quality are given below:

Table 7-4: Drinking Water Quality Standards

Sl. No.	**Parameters**	**Unit**	**Bangladesh Standard[5]**
1	TDS	mg/L	1000
2	EC	µS/cm	-
3	Turbidity	NTU	5.0
4	pH		6.5-8.5
5	Salinity	ppt	-
6	Total Hardness as CaCO3	mg/L	-
7	Iron	mg/L	0.3-1.0
8	Arsenic	mg/L	0.05
9	Manganese	mg/L	0.4
10	Odor	-	-
11	Fecal Coliform	MPN/100ml	2.0 indicates (Absent) as per BDS Standard 1240:2021
12	*Total Coliform*	*MPN/100ml*	*2.0 indicates (Absent) as per BDS Standard 1240:2021*

[1] Air Pollution (Control) Rules, 2022

[2] Ministry of Environment, Forest, and Climate Change. (2006). Noise Pollution (Control) Rules, 2006 (S.R.O. No. 212-Law/2006). The People's Republic of Bangladesh.

[3] Guidelines are for noise levels measured outside. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999

[4] Bangladesh Environment Conservation Rules, 2023- Schedule 2 (Standards for Inland Surface Water, Water Usable for Fisheries).

[5] Bangladesh Environment Conservation Rules, 2023, Schedule-2(B).

7.5.5 Wastewater Quality standards

The standard of wastewater quality is given below:

Table 7-5: Wastewater Quality Standards

Sl. No.	Parameters	Unit	Standard limits	
			Inland surface water	Public sewerage
1	pH	-	6-9	6-9
2	BOD5 at 20 deg Celsius	mg/L	30	250
3	COD	mg/L	250	-
4	SS	mg/L	100	600
5	TDS (inorganic)	mg/L	2100	2100
6	Ammoniacal Nitrogen	mg/L	50	50
7	Total Jhedal nitrogen	mg/L	100	-
8	As	mg/L	0.2	0.2
9	Hg	mg/L	0.01	0.01
10	Pb	mg/L	0.1	1.0
11	Cd	mg/L	2.0	1.0
12	Total Cr	mg/L	2.0	2.0
13	Cu	mg/L	3.0	3.0
14	Zn	mg/L	5.0	15.0
15	Ni	mg/L	3.0	3.0
16	CN	mg/L	0.2	2.0
17	Cl-	mg/L	1000	1000
18	F-	mg/L	2.0	1.5
19	C6H5OH	mg/L	1.0	5.0

Source: Solid Waste Management Rule 2021, Schedule-2.

7.5.6 Emission standards

The standards of emissions at the landfill sites are given below:

Table 7-6: Emission Standards

No.	Parameters	Average Time	Standard limits (mg/Nm3)
1	SPM	1hr.	30
		24 hr.	20
2	CO	1hr.	100
		24 hr.	80
3	NOx	1hr.	300
		24 hr.	250
4	SO2	1hr.	100
		24 hr.	80

No.	Parameters	Average Time	Standard limits (mg/Nm3)
5	HCl	1hr.	60
		24 hr.	50
6	Hg	0.5-8hr.	0.05
7	Cd-TI	0.5-8hr.	0.1
8	Sb, As, Pb, Cr, Cu. Mn, Ni,	0.5-8hr.	0.5
9	H2F	0.5hr.	1.0
10	Dioxin and Foran	6-8hr.	0.1 ng TEQ /Nm3

Source: Solid Waste Management Rule 2021, Schedule-2

7.6 Relevant Rules and Regulations

7.6.1 Institutional Framework

The lead environmental agency in Bangladesh is the Department of Environment (DOE) under the Ministry of Environment, Forests and Climate Change (MOEFCC). DOE is charged with furthering environmental conservation, improvement of environmental standards, and control and mitigation of environmental pollution. This mandate positions DOE as a key regulator of many developments in the infrastructure, industrial and commercial sectors, including publicly and privately funded initiatives. DOE is responsible for administering the country's central environmental law, which provides the framework for environmental impact assessment.

Other agencies with important environmental mandates include the Bangladesh Forests Department (also under MOEFCC), the Ministry of Water Resources, the Ministry of Fisheries, and the Ministry of Land. The laws and regulations administered and enforced by these other agencies do not structure the environmental assessment process directly but may often come into play in the consideration of the suitability and permissibility of proposed infrastructure developments by DOE.

Occupational health and safety are key considerations of the environmental assessment of proposed infrastructure. The Ministry of Labour and Employment (MOLE), particularly its Department of Labour and Department of Factory and Establishment Inspection, is of direct relevance to the environmental assessment process, as it administers and enforces the country's legislation, rules and standards governing industrial workplaces, including construction sites and most industrial facilities where physical labour is undertaken.

7.6.2 National environmental policies and legislations

7.6.2.1 Policies and plans

a. National Environmental Policy, 1992 (amended in 2018)

Bangladesh adopted the National Environmental Policy (NEP) in 1992 to chart a path towards the country's sustainable development. The NEP 2018 is a revision of the NEP 1992 in the context of the new reality of climate change. The NEP 2018 also outlines a more up to date understanding of the extent and magnitude of environmental degradation that has become a fact of life in the world in general, and in Bangladesh in particular. The NEP 2018 outlines the problems of population growth, poverty, illiteracy, lack of awareness and healthcare services, limitation of arable land, unplanned development and urbanization, and industrialization as the major impediments to the conservation of the environment. The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are:

(i) maintaining the ecological balance for ensuring sustainable development.

(ii) protection against natural disasters.

(iii) identifying and controlling activities which are polluting and/or destroying the environment.

(iv) ensuring environmentally friendly development in all sectors.

(v) promoting sustainable and sound management of natural resources; and

(vi) active collaboration with international initiatives related to the environment.

The NEP, amongst other aims, seeks to ensure that transport systems, including roads and inland water transport, do not pollute the environment or degrade resources. The policy states that environmental impact assessment should be conducted before projects are undertaken. The NEP 2018 includes additional elements addressing climate change mitigation and adaptation as key environmental issues facing the country and integrating a comprehensive 3R approach to the massive and growing problem of industrial and household waste that has swelled along with the country's urbanization.

b. National Environmental Management Action Plan (NEMAP), 1995

The NEMAP was built on the NEP to address specific issues and management requirements during 1995-2005 and remains a backbone of efforts to articulate national sustainability strategies. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

(i) Identify key environmental issues affecting Bangladesh.

(ii) Identify actions to halt or reduce the rate of environmental degradation.

(iii) Improve management of the natural environment

(iv) Conserve and protect habitats and biodiversity.

(v) Promote sustainable development.

(vi) Improve the quality of life.

To this end, the NEMAP grouped all the relevant necessary actions under four heads: institutional, sectoral, location-specific, and long-term issues. The institutional aspects reflect the need for inter-sectoral cooperation to tackle environmental problems requiring new institutional mechanisms at national and local levels. The sectoral aspects reflect the way the ministries and agencies are organized and make it easier to identify the agency to carry out the recommended actions. The location-specific aspect focuses on particularly acute environmental problems at local levels. And the long-term issues include environmental degradation trends that threaten to emerge as serious threats to the country's environmental quality and well-being if not proactively addressed.

c. Other Environment-Related Plan and Policies

In addition to the central environmental policy instruments, a few other national policy efforts have significant environmental content. Prominent policy documents include the National Forest Policy (1994); National Fisheries Policy (1998); National Water Policy (1999); National Land Use Policy (2001); National Biodiversity Strategy and Action Plan (2004); the Bangladesh Climate Change Strategy and Action Plan (2009); National 3R Strategy for Waste

Management (2010); Action Plan for Energy Conservation (2013) and the Bangladesh Delta Plan (2010).

7.6.2.2 Legislation

a. Environment Conservation (Amendment) Act, 2010

The Environment Conservation Act authorizes the DOE to undertake any activity to conserve and enhance the quality of the environment and to control, prevent and mitigate pollution. The DOE is designated as the regulatory body and enforcement agency for all environment-related activities. The Act enables the following critical components of DOE's remit:

(i) Declaration of Ecologically Critical Areas.
(ii) administration of the procedure for obtaining Environmental Clearance Certificates for new industrial projects.
(iii) regulation with respect to vehicles emitting smoke which is harmful to the environment.
(iv) environmental regulations for development activities.
(v) standards for quality of air, water, noise, and soils (including riverbed materials) for different areas and for different purposes.
(vi) acceptable limits for discharging and emitting waste; and
(vii) formulation of environmental guidelines to control and mitigate environmental pollution, conservation, and improvement of the environment.

Amendments to the ECA in 2000, 2002 and 2010 added significant substantive and procedural scope, defining the following new areas of authority:

(i) ascertaining responsibility for compensation in cases of damage to ecosystems.
(ii) increased provision of preventive measures, including fines and imprisonment, and the authority to take cognizance of offences.
(iii) restrictions on polluting automobiles.
(iv) restrictions on the production and sale of environmentally harmful items like polythene bags.
(v) obtaining assistance from law enforcement agencies for environmental actions.
(vi) definition and enforcement of punitive measures.
(vii) authority to try environmental cases.
(viii) prohibition on hill cutting except were established to be in the national interest.
(ix) authority to regulate management of hazardous waste produced by ship breaking yards.
(x) prohibition of filling or alteration of waterways except when judged to be in the national interest; and
(xi) additional powers to compel compliance with emissions standards.

b. Environment Conservation Rules 2023

The Environment Conservation Rules 2023 was enacted in March 2023 following the Bangladesh Conservation (Amendment) Act 2010. It is still the most important set of regulations giving procedural substance and tools of enforcement to the aims articulated in the ECA. The Rules specify standards for air quality and emissions, water quality and discharges, and noise (see Table 7-7), and establish norms enabling the inspection of industrial facilities, including collection of environmental samples, by the DOE. Importantly, the Rules (Schedule I) lay out a standard framework for categorizing, assessing, and regulating

new industrial projects using a four-level categories of impact potential such as Green, Yellow, Orange, and 'Red' category. This category is the basis for defining the national impact assessment requirements and necessary environmental clearances in relation to all proposed industrial facilities and infrastructure. Implementation of the environmental clearance and assessment processes as defined in the Rules by project proponents and consultants is given further practical guidance by the EIA Guidelines for Industries (2021), which indicate how to produce the assessment documents required to support environmental clearance applications. Environmental standards attached to ECR 2023 are shown in Table 7-7. Regarding noise and air, the parameters indicated in the Noise Pollution Control Rules (2006) and Air Quality Control Act 2022 remain active although ECR has been updated from 1997 to 2023.

Table 7-7: Environmental standards specified in the Environment Conservation Rules 2023

ECR Schedule	Standard name
Schedule 2	Standards for Air
Schedule 3	Standards for Water
Schedule 4*	Standards for Sound
Schedule 5*	Standards for Sound Originating from Motor Vehicles or Mechanized Vessels
Schedule 6	Standards for Emission from Motor Vehicles
Schedule 7	Standards for Emission from Mechanized Vessels
Schedule 8	Standards for Odor
Schedule 9	Standards for Sewage Discharge
Schedule 10	Standards for Waste from Industrial Units or Project Waste
Schedule 11	Standards for Gaseous Emissions from Industries or Projects
Schedule 12	Standards for Sector-Wise Industrial Effluent or Emission

*The Noise Pollution Control Rules 2006 and Air Quality Control Act, 2022 are still active.

c. Other environment-related legislation and rules

In addition to the ECA (Amendment) 2010 and ECR 2023, numerous laws and supporting rules have been passed and developed to regulate use of natural resources and protect the natural environment from deleterious activity. A summary of environment-related laws and rules, any of which may be relevant or applicable to proposed infrastructure development, is provided in Table 7-8. Depending on the nature of project activities and infrastructure, No Objection Certificates (NOCs) may need to be obtained from the agencies overseeing environment-related laws and regulations as part of the environmental clearance process directed by DOE, to ensure compliance with all relevant national laws.

Table 7-8: Summary of Environmental Legislations Applicable to the Proposed Project

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
1	National Environmental Policy, 1992 (2018)	Ensure that development components do not pollute the environment or degrade resources. It sets out the basic framework for environmental action together with a set of broad sectoral action guidelines. (2018) Include Climate Change issues and update	Restriction on operations which cannot be initiated in ecologically critical areas. Regulation on vehicles emitting smoke which is harmful to the environment. Follow standards on quality of air, water, noise and soil. Sets limits for discharging and emitting waste	Ministry of Environment and Forests, and Climate Change

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		previous framework for environmental action.		
2	Noise Pollution Control Rules (2006)	Under the ECA 1995 this rule is to ensure control of noise pollution in designated areas. This rule also revises the noise pollution standards mentioned in ECR 1997.	Regulation of construction noise at the construction site.	Department of Environment District Commissioner's Office
3	National Environmental Management Action Plan (NEMAP), 1995	An action plan to identify key environmental issues affecting Bangladesh, identifies actions for reducing the rate of environmental degradation and improve quality of life.	Sectoral agencies to coordinate with MoEFCC in preparing environmental guidelines	Ministry of Environment and Forests, and Climate Change
4	Environment Court Act, 2000 and subsequent amendments in 2003	Establishment of Environment Court for trial of an offence or for compensation under environmental law, such as environment pollution.	Option to affected persons for grievances related to environment safeguards.	Ministry of Environment and Forests, and Climate Change
5	The Forest Act (1927) and Forest (Amendment) Act (2000)	An act to control trespassing, illegal resource extraction and provide a framework for the forestry revenue collection system;	Requires clearances for any project within forest areas and clearances for any felling, extraction, and transport of forest produce.	Department of Forests
6	National Forest Policy (2016)	To conserve existing forests and bring about 20% of the country's land area under the Forestation Programme and increase reserved forests by 10% per year until 2015	Incorporate tree planting in the subproject, Clearance for any felling, extraction, and transport of forest produce	Department of Forests
7	The Bangladesh Wildlife (Conservation & Security) Act, 2012	To conserve and protect wildlife in Bangladesh including designation of protected areas. Protection of wildlife is provided with lists of species with four schedules: first, second, third and fourth schedule. The fourth schedule species have the highest level of protection.	Consultation and necessary permits are required if the project would pass through the wildlife sanctuaries and other protected areas.	Department of Forests
8	National Safe Drinking Water Supply and Sanitation Policy of 1998	Ensures access to safe water and sanitation services at an affordable cost	Paurashavas and water sanitation authorities will take actions to prevent wastage of water. They will take necessary steps to increase public awareness to prevent misuse of water. Paurashavas shall be responsible for solid waste collection, disposal and their management	Ministry of Local Government, Rural Development, and Cooperatives
9	National Water Act 2013	Ensures Bangladesh water sources are free from any type of pollution. Pollution from water in urban outfalls and reservoirs, e.g., lakes, canals, ponds and ditches may result in amenity losses, fisheries depletion,	Secure clearance certificate on water resource development subprojects	Ministry of Water Resources

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		health problems and fish and aquatic species contamination.		
10	Wetland Protection Act 2000	Advocates protection against degradation and resuscitation of natural waterbodies such as lakes, ponds, beels[15], khals, tanks, etc. affected by man-made interventions or other causes. Prevents the filling of publicly owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.	In case of diversion of water from Naf River, detailed assessment will be done	Ministry of Water Resources
11	Bangladesh Labor Law, 2006 (amendment 2018)	It is a comprehensive law covering labour issues such as: conditions of service and employment, youth employment, benefits including maternal benefits, compensation for injuries, trade unions and industrial relations, disputes, participation of workers in company's profits, regulation of safety of dock workers, penalty procedures, administration and inspection. This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable environment for working. It also includes rules on registration of labourers, misconduct rules, income and benefits, health and fire safety, and factory plan. The amendment of 2018 further ensured the occupational health and safety rights of the worker by replacing some of the clauses of 2006 law, such as: paid leave and associated facilities, parental leave etc.	Compliance to provisions on employment standards, occupational health and safety, welfare and social protection, labor relations and social dialogue, and enforcement. Prohibition of employment of children and adolescents.	Ministry of Labor and Employment
12	Bangladesh Labor Rules, 2015	Includes rules on registration of laborers, misconduct rules, income and benefits, health and fire safety, factory plan	Contractors to implement occupational health and safety measures.	Department of Labor

15 A beel is a billabong or a lake-like wetland with static water (as opposed to moving water in rivers and canals - typically called khals), in the Ganges - Brahmaputra flood plains of the Eastern Indian states of West Bengal, and Assam and in the country of Bangladesh.

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
			Contractor will be liable for compensation for work-related injuries	
13	The Paurashava Act 2009 / Ordinance issued for the amendment of local government (municipality) ordinance, 2009 and 2010; The Paurashava Ordinance, 1977; Municipal Administration Ordinance, 1960	Provides guidance for subproject integrated community and workers health and hygiene at the construction and operation and maintenance stages of the project	Coordinate with Paurashava committees on disaster management measures, water and sanitation and waste management	Local Authorities
14	Bangladesh Climate Change Strategy and Action Plan of 2009	Enhances the capacity of government ministries, civil society and private sector to meet the challenges of climate change	Integrate adaptation measures for buildings in consideration of extreme climatic events	Ministry of Environment, Forests and Climate Change
15	Building Construction (Amendment) Act and Building Construction Rules, Bangladesh National Building Code	Regulates technical details of building construction and to maintain standards of building construction	Follow specifications to ensure structural integrity of buildings	Ministry of Housing and Public Works
16	Electricity Act 2018	Requires compensation for any damage, detriment or inconvenience caused by the project; Requires precautionary measures in laying down electricity supply lines near or where any metallic substance or line crosses to avoid electrocution; directs in powerline laying construction related activities to avoid public nuisance.	Secure permission to supply energy and lay down or place electricity supply lines for the conveyance and transmission of electricity from respective authorities before any works. Give full compensation for any damage, detriment or inconvenience caused by him or by anyone employed by him. Take precautions in laying down electricity supply lines near or where any metallic substance or line crosses to avoid electrocution	Ministry of Power, Energy and Mineral Resources
17	The National Energy Policy (1996 and Updated 2004)	Ensures environmentally sound sustainable energy development programs causing minimum damage to the environment, to encourage public and private sector participation in the development and management of the energy sector and to bring the entire country under electrification.	Public and private sector participation in the development and management of energy subprojects. Provides guidelines for renewable energy subprojects	Ministry of Power, Energy and Mineral Resources
18	Standing Order on Disaster, 1999 (Updated 2010)	Enhances capacity at all tiers of government administrative and social structures for coping with and recovering from disasters	Geographical information system (GIS) technology will be applied	Ministry of Disaster Management and Relief

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
19	National Disaster Management Act of 2012	Establishes a framework for managing disasters in a comprehensive way.	Setting-up emergency response procedures	Ministry of Disaster and Relief
20	East Bengal Protection and Conservation of Fish Act 1950 (1982)	Protection and conservation of fishes in inland water bodies of Bangladesh	No wetland or canal should be encroached or obstructed due to construction and operation of the projects	Department of Fisheries
21	Embankment and Drainage Act (1952)	Consolidates laws relating to embankment and drainage to make better 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 and other damage by water	Relevant since most of the subprojects are drainage construction and operation	Ministry of Water Resources
22	Public Procurement Rule (2008)	Applies to the procurement of goods, works or services by any government, semi-government or any statutory body established under any law; includes measures regarding the safety, security and protection of the environment in construction works; requires contractors to take all reasonable steps to safeguard the health and safety of all workers on site, protect the environment on and off the site, and avoid damage or nuisance to persons or to property of the public or others	The PPR (2008) will be followed during procurement process of the subprojects	Ministry of Public Works

7.6.2.3 Community and occupational safety & health legislation

During construction, the subproject will conform to the occupational and health related rules as outlined in the Table 7-9 below.

Table 7-9: Occupational and health safety related rules in Bangladesh

Title of Laws and Rules	Descriptions
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
Bangladesh Labor Law of 2006	Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement Prohibition of employment of children and adolescent
The Employer's Liability Act, 1938	The Act declares that the doctrine of common employment and of assumed risk shall not be raised as a defense in suits for damages in respect of employment injuries. Under the Maternity Benefit Act, 1939, the Maternity Benefit Act, 1950, the Mines Maternity Benefit Act, 1941, and finally the rules framed thereunder, female employees are entitled to

Title of Laws and Rules	Descriptions
	various benefits for maternity, but in practice they enjoy leave of 6 weeks before and 6 weeks after delivery.
Public Health (Emergency Provisions) Ordinance, 1994	The ordinance calls for special provisions with regard to public health. Whereas an emergency has arisen, it is necessary to make special provision for preventing the spread of human disease, safeguarding public health and providing them adequate medical service and other services essential to the health of respective community and workers in particular during the construction related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury and sickness benefits should be paid to people, particularly respective workers at the workplace under the Act.
Bangladesh Factory Act, 1979	The Act requires every workplace including small- or large-scale construction where women are employed to have an arrangement of childcare services. Based on this Act and Labor Laws - medical facilities, first aid and accident and emergency arrangements are to be provided by the authority to the workers at workplaces.
Water Supply and Sewerage Authority Act, 1996	The Act specifies WASA's responsibility to develop and manage water supply and sewerage systems for public health and environmental conservation.

7.6.3 Legislation on environmental approval processes and procedures

Subprojects proposed under the Project are subject to the environmental safeguard requirements of both the GOB and JICA. These requirements share some concepts and terminology and are non-contradictory. The two procedural frameworks for environmental impact assessment are described in turn below.

7.6.4 National Environmental Clearance Process

The ECR 2023 stipulate a four-level color-coded typology of impact potential as the basis for determining the environmental clearance process for different types of proposed projects, and the extent of environmental assessment work that must be done in support of clearance applications submitted by proponents. The categorization framework is outlined in Table 7-10.

Table 7-10: Categorization scheme for determining environmental clearance requirements

Category	General Environmental Assessment Requirement
Green	No environmental assessment required to support application for environmental clearance
Yellow	No environmental assessment required, but detailed project information, including process flow diagrams and effluent treatment arrangement, must accompany application for environmental clearance
Orange	Initial Environmental Examination (IEE) required, and project can proceed to environmental site clearance application once IEE is approved by DOE
Red	Brief IEE required to establish ToR for comprehensive Environmental Impact Assessment (EIA), and project can proceed to environmental clearance application after EIA and Environmental Management Plan (EMP) have been approved by DOE, often subject to conditions

The Environment Conservation Rules, 2023 (Schedule I) provide indicative lists of types of projects, facilities and infrastructure that would normally fall into each of the four assessment categories. Although new industrial units were added to all four categories in the 2023., These lists are not comprehensive, and the listed types may in many cases not apply unambiguously to a given proposed infrastructure element or project activity. Further, the matters of scale and context, which determine so much of impact potential, are not strongly addressed by the indicative lists. Assigning an assessment category thus must be informed by expert judgement, based on the initial specifications of the planned project infrastructure and activities, and basic details of the project environment. DOE reviews preliminary infrastructure

plans for proposed infrastructure investments and decides regarding the categorization on a case-by-case basis.

Regardless of the assessment category assigned, all applications for environmental clearance must be accompanied by a NOC obtained from local authorities (Union Parishad Chairman or Upazila Nirbahi Officer in rural locations, and from several entities in urban locations such as Dhaka), and by an application fee. NOCs may also be required from key agencies (e.g., Water Resources Planning Organization, Forests Department, Ministry of Fisheries) if the proposed project has any potential relevance for the natural resources under their remit. The proponent is responsible for obtaining the NOCs and paying the application fee. The proponent is also responsible for renewing the clearance certificate, once obtained, yearly, paying a fee for each renewal. Fines are levied when the proponent allows the clearance certificate to lapse.

For investments that require an environmental assessment report (Orange and Red projects), DOE reviews and approves the report (either an IEE or more detailed EIA) before approving the clearance application. The approval may be subject to certain conditions, which the proponent is bound to meet to keep the clearance certificate current. Review of clearance applications by DOE requires up to 30 days from receipt (Figure 7-1).[16]

16 A useful and accessible reference on the clearance process is Department of Environment. 2010. A Guide to Environmental Clearance Procedure. Dhaka, August 2010.

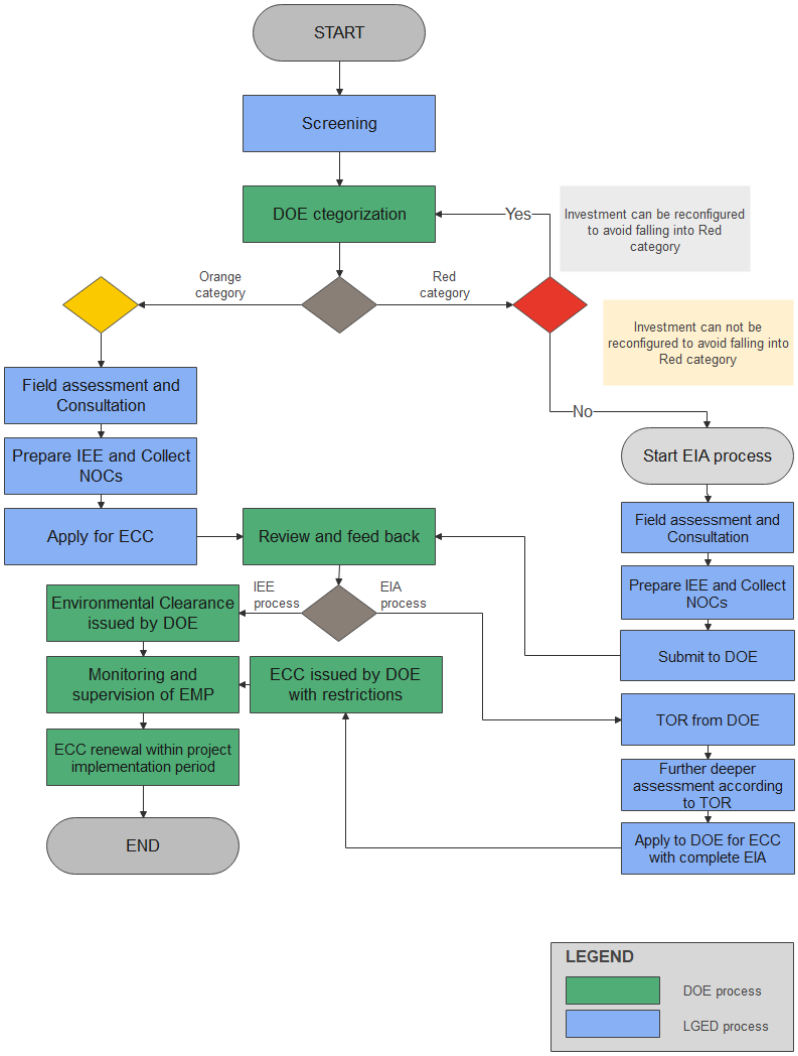


Figure 7-1: Flowchart of national clearance process as applicable to UDCGP

7.6.5 International Commitments

Bangladesh has signed many international treaties, conventions and protocols that pertain to environmental conservation, pollution control, and working conditions, and these need to be considered alongside national laws and regulations in the context of infrastructure planning. A list of the most relevant international treaties and conventions to which Bangladesh is a party is presented in Table 7-11.

Table 7-11: Treaties and conventions joined by Bangladesh

Treaty or Convention	Brief description
International Plant Protection Convention (Rome, 1951) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	Aims to ensure that construction work and construction materials do not introduce plant pests
Conservation of Wetlands of International Importance specially as waterfowl Habitat ("Ramsar Convention": Iran, 1971)	Conservation and proper use of wetlands and their resources; protection of significant wetlands and prevention of draining or filling during construction
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.

Treaty or Convention	Brief description
CITES Convention (Convention on International Trade in Endangered Species)	Aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival
Occupational hazards due to air pollution, noise & vibration (Geneva)	Aims to protect workers against occupational hazards in the working environment
Occupational safety and health in working environment (Geneva)	Prevent accidents and injury to health by minimizing hazards in the working environment
Occupational health services (Geneva)	To promote a safe and healthy working environment
Convention on Biological Diversity, (Rio de Janeiro, 1992)	Protection of biodiversity during construction and operation; underpins the value of natural resources that provide food and livelihoods throughout the world
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1992)	Aims to protect human health and the environment against the adverse effects of hazardous wastes
International (United Nations Framework) Convention on Climate Change (Kyoto Protocol, 1997)	International treaty on climate change and emission of greenhouse gases, reduce greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system
Convention on Persistent Organic Pollutants, Stockholm, 2001	Restriction of use of pesticides and herbicides
Minamata Convention on Mercury, 2017	Global treaty to protect human health and the environment from the adverse effects of mercury, by addressing interim storage and disposal, sites contaminated by mercury, and mercury-related health issues

7.6.6 JICA Guidelines for Environmental and Social Considerations 2010

7.6.6.1 Key requirements

Since the Project is financed by Japanese ODA loan, it is mandated that executing agency and implementing agencies comply with the JICA Environmental Guidelines on top of Bangladesh laws and regulations and confirm if appropriate environmental and social considerations are taken to avoid, reduce or minimize project's impacts on the environment and local communities and to prevent the occurrence of unacceptable adverse impacts.

The key requirements include, but are not limited to the following:

(i) Any negative environmental and social impacts of proposed projects must be avoided. If it is not possible to avoid them, any negative impacts should be minimized or compensated.

(ii) Assessment of potential environmental and social impacts and elaboration of mitigation measures during the earliest possible planning stage, and incorporation of them into the project plan. A Strategic Environmental Assessment must be conducted if applicable.

(iii) Participation of stakeholders at an early stage of planning.

(iv) Comparison of several alternatives, including zero-option, in order to minimize negative impacts to the environment and society.

(v) Compliance with national laws, standards, and plans.

(vi) Avoidance and minimization of involuntary resettlement, where feasible, and preparation of RAPs, where involuntary resettlement is unavoidable.

(vii) Environmental monitoring

(viii) Information disclosure and grievance redress mechanism

As the executing agencies of subprojects under the UDCGP, the LGED and City Corporations must satisfy all the above requirements, as well as others described in the JICA Guidelines, even if the national laws and policies do not fully prescribe requirements for these issues.

JICA classifies projects into four categories[17] according to the extent of environmental and social impacts, and the Project falls in the Category B.

7.6.6.2 Impact assessment and Stakeholder consultations

The JICA Environmental Guidelines provides a framework of expectations for environmental analysis, engagement with stakeholders and communities potentially affected by projects, reporting, and follow-up implementation. Key prescriptions include:

(i) The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna, and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases, and working conditions including occupational safety. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process.

(ii) In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational. The life cycle impact of a project period is also considered.

(iii) In principle, project proponents etc. consult with local stakeholders through means that induce broad public participation to a reasonable extent, in order to take into consideration, the environmental and social factors in a way that is most suitable to local situations, and in order to reach an appropriate consensus. JICA assists project proponents etc. by implementing cooperation projects as needed.

17 Category A projects are likely to have significant adverse impacts on the environment and society. Category B projects have less adverse impacts on the environment and society than those of Category A projects. Category C projects are likely to have minimal or little adverse impact on the environment and society. Category FI projects satisfy all of the following requirements: JICA's funding of projects is provided to a financial intermediary or executing agency; the selection and appraisal of the subprojects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the subprojects cannot be specified prior to JICA's approval of funding (or project appraisal); and those subprojects are expected to have a potential impact on the environment.

(iv) In an early stage of cooperation projects, JICA holds discussions with project proponents etc. and the two parties reach a consensus on frameworks for consultation with local stakeholders.

(v) To have meaningful meetings, JICA encourages project proponents etc. to publicize in advance that they plan to consult with local stakeholders, with particular attention to directly affected people.

(vi) In the case of Category B projects, JICA encourages project proponents etc. to consult with local stakeholders when necessary.

(vii) JICA encourages project proponents etc. to prepare minutes of their meetings after such consultations occur.

7.6.6.3 Gap Analysis between JICA Environmental Considerations 2010 and Environmental Conservation Rule 2023

The JICA Guidelines does not conflict the laws and regulations of Bangladesh Government for environment. However, there are some gaps between the two lines of rules. The following table shows results of comparison between Bangladesh legislations and JICA Guidelines for environmental issues, and possible measures to bridge the gaps.

Table 7-12: Gaps between JICA Environmental Guidelines 2010 and ECR 2023

Requirements by JICA Guidelines	GOB Policies	Gaps	Harmonized framework
Scope of impacts to be assessed	The ECR has no provision for the scope of impacts to be assessed for environmental assessment, but the LGED guidelines recommend using a checklist covering a broad range of environmental and social issues.	The scope of impacts to be assessed is not provided in the legal instruments of GOB but recommended in the LGED guidelines. In case of land acquisition is unavoidable, GOB excludes informal settlers, indigenous peoples, and ethnic minorities from eligible PAPs. GOB does not provide for social rehabilitation of persons loss of their livelihoods and has no provision for giving special assistance to vulnerable groups. There are differences in the valuation of land and prices of affected assets, where for example JICA prescribes the use of current market rates in the project area. The GOB does not ensure replacement value or restoration of pre-project income of the PAPs. There is also no provision to assess the impacts on incomes and livelihood from the loss of employment and business or to restore lost incomes	the scope of impacts for the selected projects and avoid land acquisition and involuntary resettlement as much as possible. In case the projects require land acquisition and involuntary resettlement, often donors (under the loan project component) provide financial support for the preparation of required documents such as EIA, Abbreviated Resettlement Action Plan (ARAP), Resettlement Action Plan (RAP), Resettlement Policy Framework (RPF) and IPP. Therefore, the UDCGP suggests the same procedure to be taken for each elected project under the JICA loan for the CC. The UDCGP will identify the required documents for the selected JICA loan project for further F/S.
Analysis of alternative options	The ECR has no provision for the analysis of alternative options, but	Analysis of alternative options is necessary according to JICA Guidelines.	Alternative options will be analyzed in the process of EIA and IEE.

Requirements by JICA Guidelines	GOB Policies	Gaps	Harmonized framework
	it is recommended in the LGED guidelines.		
Information disclosure and stakeholder participation	The ECR has no provision for public consultation and information disclosure, but LGED guidelines provide general recommendation for public consultation and information disclosure in the process of environmental assessment.	Information disclosure and stakeholder participation are required by the JICA guidelines.	Stakeholder meetings will be held before EIA/IEE is completed and their opinion will be considered. The EIA/IEE reports will be made available to the public.

7.7 Environmental Best Practices

Implementing environmental best practices at construction sites is essential for minimizing negative impacts and promoting sustainability. The key practices will consider in the construction sites to strengthening the onsite environmental management plan implementation:

- Pollution prevention- Dust control, noise measurements.
- Waste management- collection, transportation and disposal to the landfill site.
- Resource conservation- optimize materials used to reduce waste.
- Energy efficiency- Use energy-efficient machinery and equipment to reduce fuel consumption and emissions.
- Erosion and sediment control-controlling sediment runoff, vegetative coverage
- Biodiversity protection- habitat preservation, re-vegetation.
- Training and awareness- capacity and awareness building to the project staff, and community people.
- Monitoring and Reporting- environmental audits: Conduct environmental audits to assess compliance with best practices and regulations, and Reporting- monthly, quarterly and annual reporting system should be adopted and continuous over the project cycle.
- Community engagement- **Stakeholder Involvement**: Engage with the local community to address concerns and share information about environmental practices, and **Transparency**: Maintain open communication regarding the project's environmental impact and sustainability efforts.
- Grievance Redress Mechanism- All kinds of grievances, complaints should be addressed and properly recorded etc.

7.8 Environmental Impacts and Mitigation Measures

The environmental and social management plan (ESMP) is developed in relation to the design, construction, and operation of the subproject to address the physical, biological, cultural, and socio-economic impacts. The ESMP defines mitigation measures and identifies the institutions, responsibilities and mechanisms that will ensure their implementation. Such institutions and mechanisms will ensure continuous improvement of environmental protection

activities during the pre-construction, construction, and operation phases of the subprojects, to manage adverse impacts.

The ESMP's purpose is served by fulfilment of several key objectives:

- *To present a comprehensive and systematic list of measures for mitigating and enhancing anticipated environmental and social impacts.*
- *To define and specify institutional arrangements to support implementation of the prescribed measures.*
- *To clearly assign responsibility for implementation of each prescribed measure.*
- *To clearly assign responsibility for systematic implementation of the prescribed measures and overseeing corrective action as needed.*
- *To identify training and capacity-building needed to enable effective implementation of the ESMP.*

In case that the results of detailed surveys and engineering studies indicate significant potential impacts and risks beyond what considered in this report, additional mitigation measures, management plans, and monitoring programs will have to be proposed.

Table 7-13: Environmental and Social Management Plan for Solid Waste Management at GCC, NCC, CuCC and CBP

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
A. PRE-CONSTRUCTION PHASE						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. CONSTRUCTION PHASE						
Biophysical Environment						
Air quality	• Local air quality will be deteriorated due to dust suppression, foul odor while construction of secondary transfer stations (STs).	• Cover using over the vehicles during transportation of construction materials for STs. • Vehicle engines should be checked regularly, and Mobil & grease should be replaced regularly following the good industrial practices of IFC/World Bank etc.	Contractor	PIU (ULB)	• Air quality (e.g., PM10, PM2.5, NOx, SOx, CO, SS) should be tested quarterly, and shared with PIU and PMU for checking.	Included in the contract cost for construction period.
Noise and Vibration	• Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. during construction of STs. • Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machinery.	• Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites. • Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents. • Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration. • Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the	Contractor	PIU (ULB)	• Noise and vibration should be measured monthly at the construction sites and shared with PIU and PMU for checking. • Log sheet of vehicle movement and speed record. • Number of complaints from the local communities	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		maximum acceptable levels of national standards.				
Greenhouse gas emissions	• Greenhouse gas (carbon dioxide) emissions or generation occur in association with the operation of construction equipment and the operation of vehicles transporting materials and equipment	• When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated. • For construction equipment and vehicles used to transport materials and equipment, environmentally friendly models with low emissions, shall be applied, thereby reducing the generation of greenhouse gases, etc. • Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions. • Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.	Contractor	PIU (ULB)	• As mentioned in “Air Quality”	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
Social Environment						
Community Health and Safety	• Conflict between migrant laborers, local people and waste pickers • A temporary influx of migrant laborers during the construction period may increase the risk of transmitted diseases among local people. • Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue etc.	• Inform the work schedule and put signboard of construction information • Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods • Conduct awareness session among workers to reduce the risk of infectious diseases • Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases. • Always make emergency vehicles available	Contractor (s)	PIU (ULB)	• Number of complaints from the local communities • Number of grievances and reconciliations • Minutes of consultation meeting with local communities • Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Included in the contract cost for construction period..
Local Traffic and accidents (public safety)	• Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. • Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to	• Prepare a traffic management plan (TMP) prior to the commencement of the construction work. • Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site • All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.	Contractor	PIU (ULB)	• Daily Log sheet of vehicle movement • Number of awareness training for workers • Training or capacity records • Copy of driving licenses • Driver ID card • Adequacy of construction site signage, fencing and security presence	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	heavy traffic and vehicles used in the construction work	• Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction • Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites. • Keep several staff members standing on the street to ensure pedestrians' safety			• Record of accidents (number, affected people, date and time, actions, etc.)	
Occupational health and safety	• Worker's health and safety will be at risk for construction work of STs.	• The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2015. • Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest. • Provide regular safety training for all construction workers, and at regular intervals thereafter. • Provide task-appropriate PPE to all workers and enforce its use. • Conduct a toolbox meeting every morning upon commencement of work.	Contractor	PIU (ULB)	• Contract documents with workers • Records of toolbox meeting • Number of labor accidents and their details (e.g., slipping, contact with moving machinery, flying, and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock, and electrocution, and crushing from collapsing earth walls) • Number of diseases among workers and their details • Number of awareness training for workers	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		• Make emergency contact details available at the site. • Signs to show walkways and stairs, places with high voltage, etc. • Provide appropriate facilities at workers' camp			• Daily Log sheet of vehicle movement • Checking record books of medical checkups etc.	
C. OPERATION PHASE						
Air quality	• Local air quality will be deteriorated due to Dust suppression, exhaust gas, foul odor while transportation of solid wastes to the landfill sites	• When operating equipment used for waste transportation, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants. • From the viewpoint of preventing scattering of waste and ensuring work safety, transport of collected waste shall not be conducted during strong winds or heavy rain. • Cover using over the vehicles during transportation of wastes from households to secondary transfer stations (STs) to final disposal sites. • In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.	ULB	ULB	• Air quality (e.g., PM10, PM2.5, NOx, SOx, CO) should be tested quarterly.	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		• After disposal, vehicles and STs should be cleaned up very well without residues. • Vehicle engines should be checked regularly, and Mobil & grease should be replaced regularly following the good industrial practices of IFC/World Bank or others etc.				
Odor	• Foul or offensive odor will be generated and spread over the road and its neighborhood areas due to handling of wastes for collection, transportation and disposal to the landfill sites.	• Minimize odor by adopting the International Good Practices of IFC/World Bank such as cover using over the truck, segregate the hazardous and non-hazardous wastes at the STS, and the temporary waste disposal areas should be protected and non-accessible by the local people. • Disinfection spray can reduce the bad odor during handling of waste management.	ULB	ULB	• Sensory test results (odor index) • Number of complaints from the local communities	ULB
Noise and vibration	• Noise and vibration will occur due to the use of heavy equipment and vehicle for waste transportation	- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites. - Keep all haul trucks be in good repair, and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents.	ULB	ULB	- Noise and vibration should be measured monthly at the construction sites, and shared with PIU and PMU for checking. - Log sheet of vehicle movement and speed record. • Number of complaints from the local communities	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		• Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.				
Surface water	• If cover is not used on the truck during transportation of solid wastes from households to landfill sites, it will mix with surface water system by different kinds of surface runoff and contaminate the surface water system.	• Waste must be transported by covered van or vehicles should be covered with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources. • Overload will not be allowed to carry more wastes in one trip, and maintained it strictly etc.	ULB	ULB	• Visual inspection • Interviews with workers as needed • Surface water quality (Arsenic, pH, Temperature, TSS, COD, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, NO3-N, oil and grease, T-P) should be tested periodically over the construction period to observe if any change in quality due to construction works. • The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	ULB
Waste	• Solid waste will generate both hazardous and non-hazardous wastes and will cause health impacts to the workers if proper preventive measures will not be undertaken by them during collection, transportation and disposal to the landfill sites.	• Waste must be transported by covered van or vehicles should be covered with tarpaulin or hard polythene to protect waste spillage on the roadsides and the surface water sources.	ULB	ULB	• Documentation of transfers to identified service provider available.	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	• Wastes can accidentally drop from transportation vehicles while moving, which creates nuisance.	• Overload will not be allowed to carry more wastes in one trip and maintained it strictly. • Waste segregation should be carried out following the International Standard Practices of IFC/World Bank and necessary PPE should be used by the workers. • Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.				
Impact on Local Habitats	• The impact on the local habitat is not significant. However, due to waste transportation to the landfill site during night-time, the nocturnal animals will be wounded, dead or disturbed by hydraulic horn and vehicle movement.	• Waste disposal should be limited with daytime • If it requires night-time disposal, the vehicle speed should be less than 30 KM/hr. and hydraulic horns will be prohibited. • No haunting, trapping and killing of wild species are allowed etc.	ULB	ULB	• Status of terrestrial plants and animals	ULB
Greenhouse Gas Emission	• Same with air quality	• do	ULB	ULB	• Same with air quality	ULB
Local Traffic and accidents (public safety)	• Given the high traffic volume of waste transportation, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance. • Elevated risks of collisions and accidents between	• Limit the vehicle speed to 25/30 km/hr during waste transportation. • All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.	ULB	ULB	• Daily Log sheet of vehicle movement • Number of awareness training for workers • Training or capacity records	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	transportation vehicles and pedestrians and between vehicles.				• Copy of driving licenses • Driver ID card • Record of accidents (number, affected people, date and time, actions, etc.)	
Occupational health and safety	• Worker's health and safety will be at risks due to handling, collection, transportation and disposal of solid wastes to the landfill sites. It will include contagious disease, falls, sleeps, car accident etc.	• ULBs shall include in the drivers' contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2015. • Provide driverrs with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest. • Provide regular safety training for all drivers, and at regular intervals thereafter. • Provide task-appropriate PPE to all drivers and enforce its use.	ULB	ULB	• Contract documents with workers • Records of toolbox meeting • Number of labor accidents and their details • Number of diseases among workers and their details • Number of awareness training for workers • Daily Log sheet of vehicle movement • Checking record books of medical checkups etc.	ULB

Table 7-14: Environmental and Social Management Plan for Improvement of Landfill Site (NCC-SWM2, CuCC-SWM-1, and CBP-SWM-1)

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
A. PRE-CONSTRUCTION PHASE						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. CONSTRUCTION PHASE						
Biophysical Environment						
Dust Suppression / Air quality	- Air quality will be declined by dust suppression, exhaust gas emissions from reshaping work and construction activities, frequent vehicles movement, particularly during dry season and large quantity of moving materials.	- Implement a regular routine of light spraying with water. - All dust-generating surfaces should be treated to avoid dust reaching nuisance levels. - Keep all soil tightly covered with tarpaulins whenever they are not in active use. - All haul trucks should be equipped with tightly fitted tarpaulins to prevent releases of dust from dry materials during transport. - Maintain all motorized construction equipment and all haul trucks to a high standard, most particularly their fuel and exhaust systems.	Contractor	PIU (ULB)	- Air quality (e.g., PM10, PM2.5, NOx, SOx, CO) should be tested quarterly, and shared with PIU and PMU for checking.	Included in the contract cost.
Odor	- Odor will be recognized due to the existence of waste, and when leachate is collected during reshaping and excavation works. (Note: Odor will be reduced when semi-aerobic landfill is completed.)	- Information about work schedules shall be well circulated to local communities. - Adopt a semi-aerobic landfill - Install leachate collection pipes, gas exhausted pipes and other facilities for circulation will accelerate decomposition of waste and prevent offensive odor	Contractor	PIU (ULB)	- Sensory test results (odor index) - Number of complaints from the local communities	Contractor
Noise and Vibration	- Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds	- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of	Contractor	PIU (ULB)	- Noise and vibration should be measured monthly at the construction sites and	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	of equipment etc. - Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machinery.	construction sites. - Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents. - Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration. - Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards.			shared with PIU and PMU for checking. - Log sheet of vehicle movement and speed record. - Number of complaints from the local communities	
Surface water	- There exists leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that might have contaminated surface waterbodies nearby. - Excavation works and other construction activities may cause leachate flow, and discharged water turbid and contaminated by suspended solids, accidental spillage of hazardous liquid waste, oils, fuels, paints, chemicals etc. - Spoiled materials and soils can further contaminate the neighboring surface water body if they are not treated and eroded into it.	- Embankment shall be developed beforehand not to discharge leachate outside of the boundary. - Perform visual observations to prevent, detect early and address water turbidity - Arrange construction site drainage to prevent concentration of surface runoff from exposed soils and materials stockpiles. - Protect disturbed soil from rain by keeping exposed areas covered with mulches, fiber mats and other temporary coverings. - Keep all stockpiles of erodible materials covered with tarpaulins whenever they are not in active use. - Install and regularly maintain sediment traps in site runoff channels; and - Use a steel tray to exchange oil, mobile and grease from engine	Contractor	PIU (ULB)	- Visual inspection - Interviews with workers as needed - Surface water quality should be tested periodically over the construction period to observe if any change in quality due to construction works. (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease) - The test results should be included in the monthly or quarterly progress report and shared	Included in contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		to prevent oil spillage - Store fuels and other noxious fluids within roofed, rain-exclusive containment structures. - Maintain a regimen of systematic daily checks of all motorized equipment and tanks to detect leaks, so they can be promptly repaired; and - Train all workers involved in refueling, equipment servicing and moving containers on proper spill prevention and response.			with PIU and PMU for checking.	
Groundwater Quality	- The existing leachate generated from wastes with high organic content and high ammoniacal nitrogen content in the open dumping site that most likely have contaminated groundwater. - Excavation works and other construction activities may cause leachate to flow into soil and further contaminate groundwater. - Groundwater quality will deteriorate if liquid wastes reach to the groundwater sources from the labor camp and construction site, mainly toilets and kitchen wastes can be responsible for groundwater contamination in the working areas. Same is true during the establishment of other necessary auxiliary facilities like building, car washing facilities, weigh bridge, road networks and others infrastructure.	- A trench shall be made in the landfill site to install leachate collection pipes - Keep groundwater quality in the surrounding area monitored during improvement work to make sure the subproject does not deteriorate it.	Contractor	PIU (ULB)	- Groundwater quality (Arsenic, pH, Temperature, TSS, COD, hardness, odor, Na, TDS, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, oil and grease) should be tested periodically over the construction period to observe if any change in quality due to construction works. - The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
Soil Contamination	- Soil will be contaminated when polluted surface water is infiltrated into the ground. It is also caused by rain and floods.	- Same as groundwater	Contractor	PIU (ULB)	- Soil quality (pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil & grease.) should be tested periodically over the construction period to observe if any change in quality due to construction works. - The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in contract cost.
Waste	- Construction waste will generate both hazardous and non-hazardous waste in the construction sites and camps.	- Collect and dispose the construction wastes or other wastes generated by the construction works - Reduce, recycle or reuse the construction wastes generated by the construction works (e.g., segregate recyclable construction wastes such as rebar, concrete, cement, debris, etc., and sell). - Put waste bins in different parts of the construction areas to collect small pieces of construction waste. - Make sure a part of dumping site to be available for day-to-day waste disposal, for local people not to explore other areas.	Contractor	PIU (ULB)	- Number of recyclable wastes collected on site. - Documentation of transfers to identified service provider available.	Included in Contract costs.
Soil Erosion	- (CBP) Soil erosion may occur as the site for improvement is situated beside waterbody and the Bankkhali River. - Surface runoff will frequently	- Soil erosion can be minimized or controlled by slope stabilization. - Determine the boundaries of the landfill site and reshape slopes to develop an embankment.	Contractor	PIU (ULB)	- Progress of civil work	Included in Contract costs

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	occur during monsoon season that will cause soil erosion at the landfill site.	- Drainage systems shall be developed and properly maintained at the sites.				
Loss of Local Habitats	- During the construction period, excessive noise and frequent vehicle movement and labor influx can cause negative affects to the local terrestrial habitats. However, in CBP, the impact will be lower significance and lower chance of occurring as the construction activities will be taken place in urban area. - Impact on surrounding flora and other fauna during construction	- When selecting construction methods, etc., reflect the latest knowledge and adopt construction methods that reduce environmental impact as much as possible. - If there is a risk of water turbidity spreading, anti-pollution membranes should be deployed. - Perform visual observations to prevent, detect early and address water turbidity and soil contamination	Contractor	PIU (ULB)	- Status of terrestrial plants and animals - Regularly measure water quality in areas where construction is to take place and appropriately monitor the impact of the construction.	Included in the contract cost.
Greenhouse gas emission	- Greenhouse gas (carbon dioxide) emissions or generation occur in association with the operation of construction equipment and the operation of vehicles transporting materials and equipment	- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated. - For construction equipment and vehicles used to transport materials and equipment, we will strive to adopt environmentally friendly models with low emissions, thereby reducing the generation of greenhouse gases, etc. - Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance and reduce the amount of greenhouse gases and other emissions. - Conduct appropriate inspections	Contractor	PIU (ULB)	As mentioned in “Air Quality”	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		- and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.				
Social Environment						
Local Economy and Livelihoods	- Livelihood activities on site will be affected due to construction work. - Due to construction works, the small-scale businesses in the roadside will be disrupted.	- A study on losses and damages should be conducted relating to the disruptions of the local economy before commencing the construction works. - Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities - Give priority to employing local people in the construction work (either on a contractual or daily basis) to maximize the project's benefits to the local community.	Contractor	PIU (ULB)	- Records of affected livelihoods - Employment record of local people by the project etc.	Included in the contract cost.
Social Conflict	- Conflict between migrant laborers and local people may occur	- Inform the work schedule and put signboard of construction information - Conduct awareness session among workers to prevent unnecessary conflict	Contractor (s)	PIU (ULB)	- Number of complaints from the local communities - Number of grievances and reconciliations - Minutes of consultation meeting with local communities	Included in the contract cost.
Community Health and Safety	- Conflict between migrant laborers, local people and waste pickers - A temporary influx of migrant laborers during the construction period may increase the risk of transmitted diseases among local people. - Uncontrolled vending of food and drinking water at the work site may also pose a risk with	- Inform the work schedule and put signboard of construction information - Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods - Conduct awareness session	Contractor (s)	PIU (ULB)	- Number of complaints from the local communities - Number of grievances and reconciliations - Minutes of consultation meeting with local communities - Number of diseases among local people	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue etc.	among workers to reduce the risk of infectious diseases - Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases. - Always make emergency vehicles available			and their details (only those likely caused by / relevant to construction work)	
Local Traffic and accidents (public safety)	- Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. - Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to heavy traffic and vehicles used in the construction work	- Prepare a traffic management plan (TMP) prior to the commencement of the construction work. - Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site - All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials. - Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction - Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites. - Keep several staff members standing on the street to ensure pedestrians' safety	Contractor	PIU (ULB)	- Daily Log sheet of vehicle movement - Number of awareness training for workers - Copy of driving licenses - Driver ID card - Adequacy of construction site signage, fencing and security presence - Record of accidents (number, affected people, date and time, actions, etc.)	Included in the contract cost.
Occupational health and safety	- There exists a substantial amount of leachate in the construction sites, which is a threat to human health. - Gaseous products are in the atmosphere and contaminate air quality that impacts the health condition of workers.	- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2025. - Provide workers with safe drinking water, sanitation	Contractor	PIU (ULB)	- Records of toolbox meeting - Number of labor accidents and their details (e.g., slipping, contact with moving machinery, flying, and falling objects, dust,	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	Landfill gas also carries a foul odor that is very objectionable and irritating. - Working in smoky and dusty conditions at open dumps, infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals, puncture wounds leading to tetanus, hepatitis, and possible HIV infection, injuries at dumps due to surface subsidence, underground fires, and slides, headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide, and carbon monoxide concentrations; and Lead poisoning from burning of materials with lead-containing batteries, paints, and solders. - Land development and civil works can generate substantial amounts of dust particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM10) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site. - Frequent vehicle movement at the site can also risk the worker's health and safety. - Risks to workers' health and safety from improper work site	facilities, First Aid Box with primary medicines available, and sufficient space to take rest. - Provide regular safety training for all construction workers, and at regular intervals thereafter. - Provide task-appropriate PPE to all workers and enforce its use. - Conduct a toolbox meeting every morning upon commencement of work. - Make emergency contact details available at the site. - Signs to show walkways and stairs, places with high voltage, etc. - Provide appropriate facilities at workers' camp			burns, cuts, exposure to intense light from arc welding, electric shock, and electrocution, and crushing from collapsing earth walls) - Number of diseases among workers and their details - Number of awareness training for workers - Daily Log sheet of vehicle movement - Checking record books of medical checkups etc.	

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	practices.					
Labor condition (including child labor, forced labor and gender-based violence)	- Child labor is very common in the construction sites due to paying low wages and working for a longer period. - Force labor will occur at the construction sites by the contractors and their sub-contractors. Force labor will work for a longer period without paying overtime and food allowance that couldn't be allowed at the site. - Gender based violence will normally occur with female workers which includes sexual violence, lower wages and mental torture by the contractors and its subcontractors.	- Strictly ban the employment of children - Keep laborers' IDs with their employment record	Contractor	PIU (ULB)	- Daily workers' attendance sheet - Employment record	Included in the contract cost.
C. OPERATION PHASE						
Biophysical Environment						
Air quality	- Operation of vehicle for waste transportation creates dust, exhaust gas, etc.	- When operating equipment used for land reclamation and waste transport vehicles, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants. - Properly inspect and maintain the equipment used for reclamation to reduce emissions of air pollutants. - Clean up and sprinkle water in the on-site work yard to prevent dust and sand from being dispersed by vehicle travel. - From the viewpoint of preventing scattering of waste and ensuring	ULB	ULB	- Air quality (e.g., PM10, PM2.5, NOx, SOx, CO) should be tested quarterly.	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		work safety, transport and landfill operations shall not be conducted during strong winds or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.				
Odor	- Objectionable odor is expected at the sanitary landfill site when transporting and handling wastes depending on humidity, temperature and moisture content etc.	- Transport and landfill operations shall not be conducted during strong winds or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.	ULB	ULB	- Number of complaints from the local communities (if any)	ULB
Noise and Vibration	- Noise and vibration will occur due to the use of heavy equipment and vehicles for waste transportation.	- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites. - Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents. - Conduct proper maintenance of	ULB	ULB	- Noise and vibration should be measured monthly at the construction sites and shared with PIU and PMU for checking. - Log sheet of vehicle movement and speed record. - Number of complaints from the local	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		machinery and trucks not to cause extra noise or vibration.			communities	
Surface water	- In the leachate re-circulation system, leachate is generally not discharged externally. However, when precipitation exceeds the pump capacity, leachate is released as overflow water although it is not designed in the leachate re-circulation system.	- Properly inspect and maintain rain drains well to ensure it lets flow the designed amount of water in cyclones, floodings and heavy rains. - Regularly monitor water quality in the surrounding area to identify if there is any environmental impacts on the surrounding community	ULB	ULB	- Surface water quality (Arsenic, pH, Temperature, TSS, COD, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, NO3-N, oil and grease, T-P) should be tested periodically over the construction period to observe if any change in quality due to construction works. - The test results should be kept for possible disclosure.	ULB
Waste	- Waste can accidentally drop from transportation vehicles, which creates nuisance.	- Transport and landfill operations shall not be conducted during strong winds or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.	ULB	ULB	- Visual inspection - Site cleaning - Number of complaints from local communities (if any)	ULB
Greenhouse Gas Emission	- Same with air quality	- do	ULB	ULB	- Same with air quality	ULB
Community Health	- Waste transportation to the sanitary landfill sites may bring vectors such as rats, cockroaches, flies, ants and others, which can spread into the immediate area. These	- Conduct awareness session among local people to reduce the risk of infectious diseases and encourage them to wash / sanitize their hands, rinse their mouths, clean their	ULB	ULB	- Number of complaints from the local communities - Number of awareness session for local	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	vectors can freely move around the area and may find their way to buildings and areas adjacent to the landfill. They may trigger sudden occurrence of illnesses and unacceptable conditions among people of weak resistance and children in the landfill sites and its adjacent areas.	neighborhoods			people	
Occupational health and safety	- Risks to workers' health and safety from improper work site practices.	- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest. - Flammable material should be kept away from fire in the site. - Fire extinguishers or sand for extinguisher should be installed in the site - Duration of outdoor work should be shortened as much as possible by taking moderate rest and drinking water. - Make emergency contact details available at the site. - Signs to show walkways and stairs, places with high voltage, etc.	ULB	ULB	- Records of safety trainings and relevant meetings - Number of labor accidents and their details - Number of diseases among workers and their details.	ULB

Table 7-15: Environmental and Social Management Plan for New Sanitary Landfill (NCC-SWM-1, CuCC-SWM-1, and CBP-SWM-2)

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
A. PRE-CONSTRUCTION PHASE						
Land Acquisition	- Local livelihood activities (farming, fishing, etc.) will be affected due to land acquisition. - Social conflict may occur in the process of land acquisition.	- Study on losses and damages should be conducted relating to the disruptions of local economy before commencing the construction works. - Inform local people in advance of the subproject plan, its positive effectiveness, and effects to scavengers' activities - Inform the affected people of the land acquisition schedule.	PIU (ULB) DC Office	PIU (ULB)	- Records of affected livelihoods - Number of complaints from the local communities - Number of grievances and reconciliations - Minutes of consultation meeting with local communities	PIU (ULB)
B. CONSTRUCTION PHASE						
Biophysical Environment						
Dust Suppression / Air quality	- Air quality will be declined by dust suppression, exhaust gas emissions from construction activities, frequent vehicles movement, particularly during dry season and large quantity of moving materials.	- Implement a regular routine of light spraying with water. - All dust-generating surfaces should be treated to avoid dust reaching nuisance levels. - Keep all soil tightly covered with tarpaulins whenever they are not in active use. - All haul trucks should be equipped with tightly fitted tarpaulins to prevent releases of dust from dry materials during transport. - Maintain all motorized construction equipment and all haul trucks to a high standard, most particularly their fuel and exhaust systems.	Contractor	PIU (ULB)	- Air quality (e.g., PM10, PM2.5, NOx, SOx, CO) should be tested quarterly, and shared with PIU and PMU for checking.	Included in the contract cost.
Noise and Vibration	- Noise quality will be negatively impacted by frequent vehicle movement, use of motor engines, use of different kinds of equipment etc. - Noise disturbance during the	- Strictly limit construction activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinity of construction sites. - Keep all haul trucks in good	Contractor	PIU (ULB)	- Noise and vibration should be measured monthly at the construction sites, and shared with PIU and PMU for	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	construction phase is inevitable due to the operation of typical construction equipment and machinery.	repair, and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents. - Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration. - Not allow emissions from individual pieces of machinery and vehicles used in construction to exceed the maximum acceptable levels of national standards.			checking. - Log sheet of vehicle movement and speed record. - Number of complaints from the local communities	
Surface water	- Excavation works and other construction activities may cause discharged water to be turbid and contaminated due to suspended solids, accidental spillage of hazardous liquid waste, oils, fuels, paints, chemicals etc. - Spoiled materials and soils can further contaminate the neighboring surface water body if they are not treated and eroded into it.	- Perform visual observations to prevent, detect early and address water turbidity - Arrange construction site drainage to prevent concentration of surface runoff from exposed soils and materials stockpiles. - Protect disturbed soil from rain by keeping exposed areas covered with mulches, fiber mats and other temporary coverings. - Keep all stockpiles of erodible materials covered with tarpaulins whenever they are not in active use. - Install and regularly maintain sediment traps in site runoff channels; and - Use a steel tray to exchange oil, mobile and grease from engine to prevent oil spillage - Store fuels and other noxious fluids within roofed, rain-exclusive containment structures. - Maintain a regimen of systematic	Contractor	PIU (ULB)	- Visual inspection - Interviews with workers as needed - Surface water quality should be tested periodically over the construction period to observe if any change in quality due to construction works. (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease) - The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		daily checks of all motorized equipment and tanks to detect leaks, so they can be promptly repaired; and - Train all workers involved in refueling, equipment servicing and moving containers on proper spill prevention and response.				
Groundwater Quality	- Groundwater quality will deteriorate if liquid wastes reaching to the groundwater sources from the labor camp and construction site, mainly toilets and kitchen wastes can be responsible for groundwater contamination in the working areas. Same is true during the establishment of other necessary auxiliary facilities like building, car washing facilities, weigh bridge, treatment plant, road networks and others infrastructure.	- Keep groundwater quality in the surrounding area monitored during improvement work to make sure the subproject does not deteriorate it.	Contractor	PIU (ULB)	- Groundwater quality (Arsenic, pH, Temperature, TSS, COD, hardness, odor, Na, TDS, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, oil and grease) should be tested periodically over the construction period to observe if any change in quality due to construction works. - The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in contract cost.
Soil Contamination	- Soil will be contaminated when polluted surface water is infiltrated into the ground. It is also caused by rain, flood.	- Same as groundwater	Contractor	PIU (ULB)	- Soil quality (pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil & grease.) should be tested periodically over the construction period to observe if any change in quality due to construction works. - The test results	Included in contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
					should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	
Waste	- Construction waste will generate both hazardous and non-hazardous waste in the construction sites and camp.	- Collect and dispose the construction wastes or other wastes generated by the construction works - Reduce, recycle or reuse the construction wastes generated by the construction works (e.g., segregate recyclable construction wastes such as rebar, concrete, cement, debris, etc., and sell). - Put waste bins in different parts of the construction areas to collect small pieces of construction waste. - Make sure a part of dumping site to be available for day-to-day waste disposal, for local people not to explore other areas.	Contractor	PIU (ULB)	- Number of recyclable wastes collected on site. - Documentation of transfers to identified service provider available.	Included in Contract costs.
Soil Erosion	- (CBP) Soil erosion may occur as the construction site is situated beside waterbody and the Bankkhali River. - Surface runoff will frequently occur during monsoon season that will cause soil erosion at the landfill site.	- Soil erosion can be minimized or controlled by slope stabilization. - Determine the boundaries of the landfill site and reshape slopes to develop an embankment. - Drainage system shall be developed and properly maintained at the sites.	Contractor	PIU (ULB)	- Progress of civil work	Included in Contract costs
Loss of Local Habitats	- During the construction period, excessive noise and frequent vehicle movement and labor influx can cause negative affects to the local terrestrial habitats. - Impact on surrounding flora	- When selecting construction methods, etc., reflect the latest knowledge and adopt construction methods that reduce environmental impact as much as possible. - If there is a risk of water turbidity	Contractor	PIU (ULB)	- Status of terrestrial plants and animals - Regularly measure water quality in areas where construction is to take place and appropriately monitor	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	and other fauna during construction.	spreading, anti-pollution membranes should be deployed. - Perform visual observations to prevent, detect early and address water turbidity and soil contamination			the impact of the construction.	
Greenhouse gas emission	- Greenhouse gas (carbon dioxide) emissions or generation occur in association with the operation of construction equipment and the operation of vehicles transporting materials and equipment	- When selecting construction methods, etc., reflect the latest knowledge, adopt construction methods that reduce environmental impact as much as possible, and curb the amount of greenhouse gases, etc. generated. - For construction equipment and vehicles used to transport materials and equipment, we will strive to adopt environmentally friendly models with low emissions, thereby reducing the generation of greenhouse gases, etc. - Maintain good operating conditions of construction machinery and other equipment through appropriate inspection and maintenance, and reduce the amount of greenhouse gases and other emissions. - Conduct appropriate inspections and maintenance of construction equipment and vehicles transporting materials and equipment to reduce emissions of greenhouse gases, etc.	Contractor	PIU (ULB)	As mentioned in “Air Quality”	Included in the contract cost.
Social Environment						
Local Economy and Livelihoods	- Small-scale business on roadside will become active as they have more customers. - Those who lose their land /	- Give priority to employ local people in the construction work (either on a contractual or daily basis) to maximize the project's	Contractor	PIU (ULB)	- Monitor local livelihood level - Employment record of local people by the	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	livelihood means may remain in difficult situation.	benefits to the local community.			project etc.	
Social Conflict	- Conflict between migrant laborers and local people may occur	- Inform the work schedule and put signboard of construction information - Conduct awareness session among workers to prevent unnecessary conflict -	Contractor (s)	PIU (ULB)	- Number of complaints from the local communities - Number of grievances and reconciliations - Minutes of consultation meeting with local communities	Included in the contract cost.
Community Health and Safety	- A temporary influx of migrant laborers during the construction period may increase the risk of transmitted diseases among local people. - Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue etc.	- Inform local people in advance the potential risk of spreading infectious disease and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods - Conduct awareness session among workers to reduce the risk of infectious diseases - Transfer immediately to the nearest hospital for proper treatment if anyone is affected by diseases. - Always make emergency vehicles available	Contractor (s)	PIU (ULB)	- Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Included in the contract cost.
Local Traffic and accidents (public safety)	- Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. - Elevated risks of collisions and accidents between vehicles and pedestrians and between	- Prepare a traffic management plan (TMP) prior to the commencement of the construction work. - Limit the vehicle speed to 25/30 km/hr in the project area during transportation of materials to the site - All drivers should have valid driving licenses. Child drivers or helpers will not be allowed to transport the project materials.	Contractor	PIU (ULB)	- Daily Log sheet of vehicle movement - Number of awareness training for workers - Copy of driving licenses - Driver ID card - Adequacy of construction site signage, fencing and security presence	Included in the contract cost.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	vehicles due to heavy traffic and vehicles used in the construction work	- Inform local people in advance the anticipated traffic volume according to the TMP and actual schedule of construction - Ensure that the construction sites are adequately fenced, and security is provided to prevent members of the public from entering the sites. - Keep several staff members standing on the street to ensure pedestrians' safety			- Record of accidents (number, affected people, date and time, actions, etc.)	
Occupational health and safety	- Land development and civil works can generate substantial amount of dust particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM10) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site. - Frequent vehicle movement at the site can also risks for the worker's health and safety. - Risks to workers' health and safety from improper work site practices.	- The Contractor shall include in the contractor's contract compliance to health and safety procedures imposed by the ULBs following the Labor Rules 2025. - Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest. - Provide regular safety training for all workers construction, and at regular intervals thereafter. - Provide task-appropriate PPE to all workers and enforce its use. - Conduct a toolbox meeting every morning upon commencement of work. - Make emergency contact details available at the site. - Signs to show walkways and stairs, places with high voltage, etc. - Provide appropriate facilities at workers' camp	Contractor	PIU (ULB)	- Records of toolbox meeting - Number of labor accidents and their details (e.g., slipping, contact with moving machinery, flying, and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock, and electrocution, and crushing from collapsing earth walls) - Number of diseases among workers and their details - Number of awareness training for workers - Daily Log sheet of vehicle movement - Checking record books of medical checkups etc.	Included in the contract cost.
Labor condition (including child	- Child labor is very common in the construction sites due to	- Strictly ban the employment of children	Contractor	PIU (ULB)	- Daily workers' attendance sheet	Included in the contract

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
labor, forced labor and gender-based violence)	paying low wage and working for a longer period. - Force labor will occur at the construction sites by the contractors and their sub-contractors. Force labor will work for a longer period without paying overtime and food allowance that couldn't be allowed at the site. - Gender based violence will normally occur with female workers which includes sexual violence, lower wages and mental torture by the contractors and its subcontractors.	- Keep laborers' IDs with their employment record			- Employment record	cost.
C. OPERATION PHASE						
Biophysical Environment						
Air quality	- Operation of vehicle for waste transportation creates dust, exhaust gas, etc.	- When operating equipment used for land reclamation and waste transport vehicles, ensure that it is operated in an environmentally friendly manner, such as by prohibiting overload operation, and curb the emission of air pollutants. - Properly inspect and maintain the equipment used for reclamation to reduce emissions of air pollutants. - Clean up and sprinkle water in the on-site work yard to prevent dust and sand from being dispersed by vehicle travel. - From the viewpoint of preventing scattering of waste and ensuring work safety, transport and landfill operations shall not be conducted during strong winds	ULB	ULB	- Air quality (e.g., PM10, PM2.5, NOx, SOx, CO) should be tested quarterly.	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - In land transportation of waste materials, use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.				
Odor	- Objectionable odor is expected at the sanitary landfill site when transporting and handling wastes depending on humidity, temperature and moisture content etc.	- Transport and landfill operations shall not be conducted during strong winds or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials	ULB	ULB	- Number of complaints from the local communities (if any)	ULB
Noise and Vibration	- Noise and vibration will occur due to the use of heavy equipment and vehicles for waste transportation.	- Strictly limit transportation activity to daylight hours to minimize noise and vibration impacts for residents living in the vicinities of the landfill sites. - Keep all haul trucks in good repair and fitted with functional mufflers to avoid adding to the traffic noise for roadside residents. - Conduct proper maintenance of machinery and trucks not to cause extra noise or vibration.	ULB	ULB	- Noise and vibration should be measured monthly at the construction sites. - Log sheet of vehicle movement and speed record. - Number of complaints from the local communities	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
Surface water	- In the leachate re-circulation system, leachate is generally not discharged externally. However, when precipitation exceeds the pump capacity, leachate is released as overflow water although it is not designed in the leachate re-circulation system.	- Properly inspect and maintain rain drains well to ensure it lets flow the designed amount of water in cyclones, floodings and heavy rains. - Regularly monitor water quality in the surrounding area to identify if there is any environmental impacts on the surrounding community	ULB	ULB	- Surface water quality (Arsenic, pH, Temperature, TSS, COD, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, NO3-N, oil and grease, T-P) should be tested periodically. - The test results should be kept for possible disclosure.	ULB
Waste	- Waste can accidentally drop from transportation vehicles, which creates nuisance.	- Transport and landfill operations shall not be conducted during strong winds or heavy rain. - When landfilling, the landfill surface should be compacted and covered with soil as necessary to prevent scattering of waste. - Use a feeding chute or anti-spreading sheet during loading, and cover with a dust-proof sheet during transportation to prevent scattering of waste materials.	ULB	ULB	- Visual inspection - Site cleaning - Number of complaints from local communities (if any)	ULB
Greenhouse Gas Emission	- Same with air quality	- do	ULB	ULB	- Same with air quality	ULB
Community Health	- Waste transportation to the sanitary landfill sites may bring vectors such as rats, cockroaches, flies, ants and others, which can spread into the immediate area. These vectors can freely move around the area and may find their way to buildings and areas adjacent to the landfill. They may trigger sudden occurrence of illnesses and unacceptable conditions	- Conduct awareness session among local people to reduce the risk of infectious diseases and encourage them to wash / sanitize their hands, rinse their mouths, clean their neighborhoods	ULB	ULB	- Number of complaints from the local communities - Number of awareness session for local people	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	among people of weak resistance and children in the landfill sites and its adjacent areas.					
Occupational health and safety	- Risks to workers' health and safety from improper work site practices.	- Provide workers with safe drinking water, sanitation facilities, First Aid Box with primary medicines available, and sufficient space to take rest. - Flammable material should be kept away from fire in the site. - Fire extinguishers or sand for extinguisher should be installed in the site - Duration of outdoor work should be shortened as much as possible by taking moderate rest and drinking water. - Make emergency contact details available at the site. - Signs to show walkways and stairs, places with high voltage, etc.	ULB	ULB	- Records of safety trainings and relevant meetings - Number of labor accidents and their details - Number of diseases among workers and their details.	ULB

Table 7-16: Environmental and Social Management Plan for Construction of Railway Overpass at GCC

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
A. PRE-CONSTRUCTION PHASE						
Loss of Land and Property	• Approximately 100 m (length) x 2.5m (width) of land will be acquired on both sides of the east side approach. One side of the road is presently used as a playground, and another side accommodates small shops.	• Social surveys during the detailed design stage will identify the land use, land ownership, and number of affected people, and findings will be collated in the abbreviated resettlement action plan (ARAP). Compensation shall be paid in accordance with the guiding	PIU (GCC)	PMU (LGED) & DSM Consultant	• Nos of PAPs received compensation • Nos of structures received compensation • Non-title holders received compensation • Nos of grievances received • Others as appropriate.	Project cost

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	• Five (5) number of structures have been found as Potential Resettlement Structure.	principles in the resettlement policy framework (RPF) and Acquisition and Requisition of Immovable Property Act 2017 (ARIPA 2017).				
Loss of Income	• Loss of land and permanent displacement would lead to loss of income for the affected people. Loss of income could result from demolition of business establishments (e.g., offices, shops), inability to live close to the working places, and so on.	• As noted above, adequate compensation against loss of income should be provided following the resettlement policy framework (RPF) and (ARIPA 2017)	PIU (GCC)	PMU (LGED) & DSM Consultant	• Nos of people received compensation for lost their livelihood and income including non-title holders.	Project cost
Utility shifting	• Different kinds of utilities will require shifting such as gas pipelines, internet lines, water lines, railway crossing etc.	• No Objection Certificates (NOC) shall be required from Bangladesh Railway, Bangladesh Rice Research Institute (BRRI), Bus Rapid Transit (BRT), Bangladesh Tele Communication Company Ltd (BTCL), Titas Gas Transmission and Distribution PLC before commencement of construction works.	PIU (GCC)	PMU (LGED) & DSM Consultant	• NOCs received from the relevant authorities before commencing construction works.	Project cost
B. CONSTRUCTION PHASE						
Biophysical Environment						
Air Quality	• Local air quality will be declined by dust suppression due to excavation, trenching, and backfilling and demolition activities. In addition, exhaust gas emissions from vehicles, equipment and use of motor engines at the construction	• Construction areas and stockyards should be properly fenced, or site barricade should be installed properly. • All construction materials including sand, cement, soil etc., must be covered up with	Contractor	PIU (ULB)	• Air quality (e.g., PM10, PM2.5, NOx, SOx, CO, SS) should be tested quarterly, and shared with PIU and PMU for checking.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	site will lead to contaminate of the air quality also. However, the air pollution generated from these activities is likely to be localized (affecting immediate receptors of the project sites). The construction related air pollution is a particular concern at location specific for nearby residents, offices and other inhabitants are living at close proximity to the construction site.	hard polythene or tarpaulin in the stockyard. • Construction materials including sand, cement, soil etc., must be covered up with hard polythene or tarpaulin during transportation to t site and from the site. • After transportation of construction materials like soil, sand, bricks, cement, waste materials etc., the trucks, lorry, van wheels shall be cleaned properly before leaving the site. • Construction materials should not be kept on the roadsides, footpaths, and others and waste cannot be allowed to store in any open place and onsite burning. • Water sprinkles should be conducted at least twice a day on the construction site, and continuously (every hr.) during excavation, trenching and backfilling etc.				
Noise and vibration level	• Noise pollution and vibration may result from movement of vehicles carrying materials and equipment to and from the project sites, operation of machines and equipment (e.g., concrete mixing machines, aggregate crushers, generators), and	• Bricks and stone crushers will not be allowed within 500m of the silent zone areas classified by the Noise Pollution (Control) Rule 2006. • Mixer machines or other equipment cannot be allowed to use in the construction site from 07PM to 07AM.	Contractor	PIU (ULB)	• Noise and vibration should be measured monthly at the construction sites and shared with PIU and PMU for checking. • Log sheet of vehicle movement and speed record.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	different construction activities (e.g. demolition of existing structures) etc.	• Except the mixer machine, bricks and stone crushers, the other equipment can be used in the construction sites with specified construction schedule and after receiving approval from the relevant organizations. • The workers should use earplugs while working in the high noise generation sites. • Noise barriers should be installed over the site and rubber pads can be used on motor engines or other equipment etc.			• Number of complaints from the local communities	
Drainage congestion	• Drainage congestion may result from possible blockage to natural flow of drainage water during construction activities. It is mostly important to the project sites close to the low-lying areas in the BRRI areas and opposite site of the rail crossing areas also. This could be given particular attention during monsoon when drainage becomes a major concern in the subproject areas and its adjacent areas. Therefore, necessary precautions should be undertaken to avoid drainage congestion at the working site.	• Provision for adequate drainage of storm water • Provide adequate diversion channel, if required • Ensure facilities for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.	Contractor	PIU (ULB)	• Visual inspection • Interviews with workers as needed	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
Water and Soil Pollution	• Surface water pollution may occur during construction period to nearby ponds and ditches. However, groundwater will not be impacted due to anticipated construction activities in the site. So, special care should be taken to protect against the contamination of local ponds and ditches. • Soil Erosion: Due to construction activities, soil erosion will not occur at the site because most of the land is flat in nature and no major erosion usually occurs in the project working areas.	• Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land. • Install sediment basins to trap sediments in storm water prior to discharge to surface water. • Replant vegetation when soils have been exposed or disturbed and • Surface water quality testing etc.	Contractor	PIU (ULB)	• Visual inspection • Interviews with workers as needed • Surface water quality (Arsenic, pH, Temperature, TSS, COD, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, NO3-N, oil and grease, T-P) should be tested periodically over the construction period to observe if any change in quality due to construction works. • The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in the contract cost for construction period.
Waste Management	• During construction phase, problems related to sanitation and solid waste may result from improper/inappropriate facilities at the labor sheds. During the construction period, large numbers of workers are likely to be involved in different construction activities. Lack of proper sanitation facilities for project people, including the labor/construction	• Enough dustbins and spittoons shall be provided at convenient places, and these shall be maintained in a clean and hygienic condition. • No person shall throw any dirt or spit within the premises of labor camp, storage yards and construction except in such dustbins and spittoons. • Three color coated dustbins should be used at the construction site, for an	Contractor	PIU (ULB)	• Physical inspection • Interview with local people • Documentation of transfers to identified service provider available.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	workers and absence of proper solid waste (e.g., food waste, construction debris) facilities may create an unhealthy environment (including water pollution) within and around the project sites. Demolition of the existing structures will also produce a huge quantity of debris, which would have to be properly disposed of.	example, green color dust bin will be used for kitchen wastes, yellow color dustbin for plastic wastes and red color dustbin for hazardous wastes like empty packet of chemicals, oil and grease and others. • Construction waste should be re-cycled or sold locally to reduce the volume of waste in the construction sites etc.				
Local Ecosystem	• Due to large volumes of construction works, local terrestrial species will be affected, though, no endangered, or threatened species was found in the project sites, however, necessary preventive measures should be taken to avoid any kind of disturbance on local ecosystems during construction period. However, no large or medium-sized trees will be required to clear from the site due to construction works, which is a one of the good indicators to occurring disturbance to the local ecosystem.	• To avoid disturbance to the local ecosystem, construction works should be limited to only daytime (07AM to 07PM). • If trees are required to be cleared from the site, the necessary replantation plan shall be executed properly. • High noise generating equipment and machines shall be used only in the daytime. • Cover using on the storage materials to protect water pollution by surface runoff. • Any kind of haunting, trapping, killing and poaching wildlife species will be punishable offense and strictly prohibited at the construction sites, storage yards and labor camps.	Contractor	PIU (ULB)	• Physical Inspection • Record checks • Interview with local people • Awareness session etc.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
Social Environment						
Community Health and Safety	• Community health and safety will be impacted negatively due to high noise generation at the construction sites, increased vehicle movement and volume of vehicles will cause traffic accidents to the pedestrian and local community. In addition, labor influx will also cause the spread of infectious diseases to the local community people.	• Site barricading should be ensured properly • Using light at the construction site, particularly, excavation and trenching site at night-time. • Construction schedules should be shared with the local people. • Alternative routes should be made accessible for the local people if the current road cannot be accessible by the local people. • Flagman should be employed at the construction site • Vehicle speed should be limited to 30-40KM/hr. at the construction site. • No hydraulic horns should be allowed at the construction sites • Danger sign should be posted both sides of the overpass areas • Regular consultation should be taken with the local people etc.	Contractor (s)	PIU (ULB)	• Number of complaints from the local communities • Number of grievances and reconciliations • Minutes of consultation meeting with local communities • Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Included in the contract cost for construction period.
Disruptions of Local Economy	• Loss of income could result from inability to perform certain income generating activities during construction period, particularly close proximity of markets/ shops/	• Avoid important festival times (e.g., Eid) for stoppage of commercial activities to minimize loss. • Provide alternative job opportunities for PAPs; employ	Contractor	PIU (ULB)	• Physical Inspection • Interview with local people • Inventory checks etc.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	offices will be remained close due to safety considerations.	such people in project work where possible. • Implement the compensation plan for local people who lost their livelihood options etc. • Child Labor: • No child (under 18 age) shall be employed or permitted to work on the construction site. • Force labor shall not be permitted at the construction site also.				
Traffic and Transport:	• Given the high traffic volume of main road adjacent to the site, it is anticipated that the extra traffic movement will disrupt the normal traffic at a moderate significance during peak construction time when heavy vehicles and machineries will be transported at full scale. • Elevated risks of collisions and accidents between vehicles and pedestrians and between vehicles due to heavy traffic and vehicles used in the construction work	• Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings. • Schedule deliveries of material/ equipment during non-school hours and after regular working hours • Depute flagman for traffic control, and • Arrange for signal light at night	Contractor	PIU (ULB)	• Daily Log sheet of vehicle movement • Number of awareness training for workers • Training or capacity records • Copy of driving licenses • Driver ID card • Adequacy of construction site signage, fencing and security presence • Record of accidents (number, affected people, date and time, actions, etc.)	Included in the contract cost for construction period.
Occupational Health and Safety	• Occupational Health and Safety is an important issue that could be addressed properly. The worker's health and safety will be at risk due to the large volume of	• Ensuring safety during demolition of existing structures • Ensuring safety of trains and rail lines during construction of overpass over rail tracks	Contractor	PIU (ULB)	• Contract documents with workers • Records of toolbox meeting • Number of labor accidents and their	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	construction activities in the project areas. The most anticipated risks are sleeping, falling from working at heigh, electrical hazards due to wielding and other electrical working, excessive noise generation, and working for a longer period of time etc.	through proper design of formwork/ centering • Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering • Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction • Site barricade, depute flagman is essential in the construction sites. • Use safety harness while working at height. • Appropriate scaffolding should be ensured during construction of overpass • PPE (hard boots, helmet, gloves, life vest, goggles etc.) should be accessible for all workers and must be used during construction works. • No PPE no work should be maintained at the site • Working hours should be limited to only daytime (07AM to 07PM). • Emergency vehicles should be available at the site • In the construction sites, arrangements shall be made at a suitable point to supply			details (e.g., slipping, contact with moving machinery, flying, and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock, and electrocution, and crushing from collapsing earth walls) • Number of diseases among workers and their details • Number of awareness training for workers • Daily Log sheet of vehicle movement • Checking record books of medical checkups etc.	

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		sufficient purified potable water for all workers employed therein. • All water supply points shall be legibly marked with "Potable water" in Bangla. • Enough sanitary toilets and washrooms shall be provided at suitable places so that the workers employed therein at the time of work may use them easily. • Toilets and washrooms shall be provided separately for male and female workers. • Toilets and washrooms shall be adequately lighted, and ventilated, and water shall be always provided. • Toilets and washrooms shall be always maintained in a clean and sanitary condition with suitable detergents and disinfectants by contractors. • First-Aid Medicine Box should be available with full of primary medicines at the site. • Eye-shield use during electrical works mainly wielding. • Other appropriate measures should be also undertaken based on field conditions.				
C. Operation Period:						
Air Quality	• As to the operation phase, air pollution and vibration are	• Water sprinkles should be conducted at least twice a day	ULB	ULB	• Air quality (e.g., PM10, PM2.5, NOx, SOx, CO,	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	important considerations in areas where the alignment runs close to human habitations. • Pollution severity is localized (affecting immediate receptors of the project sites) at locations specific for nearby residents, offices and other inhabitants living at close proximity to the construction site.	in the most congested areas, at least twice a day etc. • Air quality on a city scale is not likely to occur in the operation or commissioning of the overpass of railway crossing. • Air pollution shall be possible to reduce in some extent by reducing traffic congestion and engine idle time.			SS) should be tested annually, and shared with PMU for checking.	
Noise level	• Noise pollution and vibration during the operational phase will result from movement of vehicles; blowing of horns would also generate noise pollution.	• Noise barriers should be installed over the site to reduce the noise intensity etc.	ULB	ULB	• Leq should be tested annually and shared with PMU for checking.	ULB
Traffic and Transport	• It is expected to provide a significantly better Level of Service (LOS) for vehicular traffic, private cars, trucks, three-wheelers, auto-rickshaws etc. In the long run this may attract more people to use this flyover to make their short trips to the other areas of the city. • The total traffic flow may therefore increase due to the trips diverted from the exhausted rail-crossing section. • On the other hand, the increased LOS will also lead	• Adequate traffic lights, signals, personnel for controlling traffic over existing roads, level crossings. • Depute flagman for traffic control, and • Arrange for signal light at night	ULB	ULB	• Number of awareness training for drivers, and pedestrians etc. • site signage, fencing and security presence • Record of accidents (number, affected people, date and time, actions, etc.)	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	to induced traffic volume and an increase in the total number of trips through this corridor. It is of paramount importance to improve the junction operation of the road network which will ultimately dictate the overall capacity of the network.					

Table 7-17: Environmental and Social Management Plan (ESMP) for Gungaijury-Race course Canal Re-excavation at CuCC

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
A. PRE-CONSTRUCTION PHASE						
Land Acquisition and Resettlement	• Approximately 28,800 m2 of private land will be acquired. Subproject facilities are planned on the land that belongs to CuCC, where 18 structures have been found on digital data. Further information shall be collected in the social survey during the detailed design stage, which will identify the land use, land ownership, and number of affected people, and findings will be collated in the abbreviated resettlement action plan (ARAP). Compensation shall be paid in accordance with the guiding principles in the resettlement policy framework (RPF).	• Prepare the land acquisition plan (LAP) • Resettlement Action Plan (RAP) • Inventory of loss • Identify the project affected people (PAPs), squatters or non-title holders and • Compensation plan preparation and implementation etc.	PIU (ULB)	PMU (LGED) & DSM Consultant	• LAP and RAP documents. • Nos of PAPs both direct and non-title holders and • Compensation procedures etc.	Project cost
B. CONSTRUCTION PHASE						
Biophysical Environment						
Dredged Materials Management:	• The major concern of the canal re-excavation is the dredge materials management. The subproject consists of a 7900-meter canal excavation length starting from Racecourse DC Banglo Road to Nowapara soap factory 1600m and	• Dredge materials should be stored separately, preferring the open space to the nearest locations. • Dredge materials should be used to develop the walkways for public interest. • Dredging materials should not be kept for a long period. So.	Contractor	PIU (ULB)	• Physical inspection • Interview with local people • Check the Good practices implementation etc.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	other one starting from Nowapara soap factory to Dhaka Chittagong Highway Bridge 6300m. The depth of the proposed canal would be 3m and width 12.2 m, and around 296250 m3 dredge materials would be produced, so, a comprehensive dredge materials management plan should be developed by the contractor(s) before commencement of excavation works.	Within a short period, dredge materials should be used for improvement of walkways • Lose materials should be kept by covered up with hard tarpaulin to protect dust emissions etc.				
Air Quality	• During the excavation period, fuel-based excavators, and drum trucks will be used that could produce black smoke in the working areas and lead to contribute the degradation of local air quality however this pollution is location specific and short-term.	• Dust generation shall be reduced as much as possible and water sprinkling carried out as appropriate, especially where earthmoving, and reshaping of canal are carried out. • Good engines should be used to reduce smoke emissions. • Dredge materials should be properly stored and maintained properly to protect dust emissions.	Contractor	PIU (ULB)	• Air quality (e.g., PM10, PM2.5, NOx, SOx, CO, SS) should be tested quarterly, and shared with PIU and PMU for checking.	Included in the contract cost for construction period.
Noise and vibration level	• Due to using of heavy equipment, vehicles and workers in the excavation site, that could cause exacerbate the local noise level, but it is short term and local specific impact and could be managed easily if	• Working hours should be limited to daytime only (07AM to 07PM) • No hydraulic horns shall be permitted within the working areas. • Maintained equipment and vehicles regularly, oil and	Contractor	PIU (ULB)	• Noise and vibration should be measured monthly at the construction sites and shared with PIU and PMU for checking.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	proper mitigation measures should be taken properly.	grease changing can reduce the noise generations from the motor engines and vehicles.			• Log sheet of vehicle movement and speed record. • Number of complaints from the local communities	
Surface water quality	• High turbidity will cause deterioration of the DO (dissolved oxygen) level in the excavation sites. It will have impacts on the aquatic environment also.	• Dredge material shall be managed outside of the excavation sites, disposed of in an open area. • Ensure proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills • Maintained proper slope to protect erosion • The contractor will remove all construction, and demolition waste daily. • Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land. • Replant vegetation when soils have been exposed or disturbed and • Surface water quality testing etc.	Contractor	PIU (ULB)	• Visual inspection • Interviews with workers as needed • Surface water quality (Arsenic, pH, Temperature, TSS, COD, coliform (fecal), coliform (total), Cr (total), DO, Pb, Hg, NO3-N, oil and grease, T-P) should be tested periodically over the construction period to observe if any change in quality due to construction works. • The test results should be included in the monthly or quarterly progress report and shared with PIU and PMU for checking.	Included in the contract cost for construction period.
Waste Management	• Different kinds of waste will be generated on the working sites. Some of them are hazardous types of waste such as oil, grease, Mobil etc., leakage from the engines and dredge spoil will	• Enough dustbins and spittoons shall be provided at convenient places, and these shall be maintained in a clean and hygienic condition. • No person shall throw any dirt or spit within the premises of	Contractor	PIU (ULB)	• Physical inspection • Interview with local people • Documentation of transfers to identified service provider available.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	be a kind of non-hazardous waste including food waste, plastic waste etc.	labor camp, storage yards and construction except in such dustbins and spittoons. • Three color coated dustbins should be used at the construction site, for an example, green color dust bin will be used for kitchen wastes, yellow color dustbin for plastic wastes and red color dustbin for hazardous wastes like empty packet of chemicals, oil and grease and others. • Construction waste should be re-cycled or sold locally to reduce the volume of waste in the construction sites etc. • Sufficient no of wastebins should be placed in the working areas, particularly along the canal sides. • CuCC conservancy department should collect the waste in the daytime and dispose of it in the landfill sites.				
Local Ecosystem	• Due to high noise generation, local terrestrial species will be disturbed and shift their location from the excavation site to another safer place. Aquatic ecosystem will be impacted largely due to high content of TDS, lowering the DO level and other excessive	• Any kind of debris should be removed from the canal site • Dredge materials should be protected from surface runoff. • Re-excavation should be carried out by small sections to avoid the larger impacts to the aquatic resources. • Oil, grease and other materials spillage should be protected	Contractor	PIU (ULB)	• Physical Inspection • Record checks • Interview with local people • Awareness session etc.	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	SS content in the working areas.	from contamination of canal water etc.				
Social Environment						
Community Health and Safety	• Local community health and safety will be also at risk on the working sites caused by moving around the heavy equipment and frequent vehicle movement. So, necessary protective measures should be ensured to reduce this risk on the working site.	• Site barricading should be erected properly • Using light at the construction site, particularly, excavation site at night-time. • Construction schedules should be shared with the local people. • Alternative routes should be made accessible for the local people if the current road cannot be accessible by the local people. • Flagman should be employed at the construction site • Vehicle speed should be limited to 30-40KM/hr. at the construction site. • No hydraulic horns should be allowed at the construction sites • Danger sign should be posted on the working areas • Regular consultation should be taken with the local people etc.	Contractor (s)	PIU (ULB)	• Number of complaints from the local communities • Number of grievances and reconciliations • Minutes of consultation meeting with local communities • Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Included in the contract cost for construction period.
Traffic and Transport	• The volume of local traffic will be increased due to excavation activities in the working sites, that could potentially risk the local community for road accident.	• Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings. • Schedule deliveries of material/ equipment during non-school	Contractor	PIU (ULB)	• Daily Log sheet of vehicle movement • Number of awareness training for workers • Training or capacity records	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		hours and after regular working hours • Depute flagman for traffic control, and • Arrange for signal light at night etc.			• Copy of driving licenses • Driver ID card • Adequacy of construction site signage, fencing and security presence • Record of accidents (number, affected people, date and time, actions, etc.)	
Occupational Health and Safety	• Occupational health and safety will be endangered due to the use of vehicle equipment, and vehicles on the working sites.	• Ensuring safety during demolition of existing structures • Ensuring safety of trains and rail lines during construction of overpass over rail tracks through proper design of formwork/ centering • Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering • Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction • Site barricade, depute flagman is essential in the construction sites. • Use safety harness while working at height.	Contractor	PIU (ULB)	• Contract documents with workers • Records of toolbox meeting • Number of labor accidents and their details (e.g., slipping, contact with moving machinery, flying, and falling objects, dust, burns, cuts, exposure to intense light from arc welding, electric shock, and electrocution, and crushing from collapsing earth walls) • Number of diseases among workers and their details • Number of awareness training for workers • Daily Log sheet of vehicle movement	Included in the contract cost for construction period.

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		• Appropriate scaffolding should be ensured during construction of overpass • PPE (hard boots, helmet, gloves, life vest, goggles etc.) should be accessible for all workers and must be used during construction works. • No PPE no work should be maintained at the site • Working hours should be limited to only daytime (07AM to 07PM). • Emergency vehicles should be available at the site • In the construction sites, arrangements shall be made at a suitable point to supply sufficient purified potable water for all workers employed therein. • All water supply points shall be legibly marked with “Potable water” in Bangla. • Enough sanitary toilets and washrooms shall be provided at suitable places so that the workers employed therein at the time of work may use them easily. • Toilets and washrooms shall be provided separately for male and female workers. • Toilets and washrooms shall be adequately lit, and ventilated,			• Checking record books of medical checkups etc.	

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
		and water shall be always provided. • Toilets and washrooms shall be always maintained in a clean and sanitary condition with suitable detergents and disinfectants by contractors. • First-Aid Medicine Box should be available with full of primary medicines at the site. • Eye-shield use during electrical works mainly wielding. • Other appropriate measures should be also undertaken based on field conditions.				
Child labor	• Usually, child labor occurs in the excavation site. Most of the cases, excavator drivers are having child labor for their helper or assistant to support them. So, any kind of child labor is prohibited in the working areas and it's illegal and offensive following the Labor Rules 2015.	• No child (under 18 age) shall be employed or permitted to work on the construction site. • Force labor shall not be permitted at the construction site also.				
C. Operation Period:						
Air quality	• Air quality will not be significant during the operation period. However, local air quality will be declined due to public gathering etc.	• Regularly sweeping the canal sides and its adjacent surface.	ULB	ULB	• Physical Inspection • Records for sweeping the canal sides etc.	ULB
Surface water quality	• Surface water quality basically improved after re-excavation of the canal.	• To maintain the surface water quality, any kind of waste	ULB	ULB	• Number of awareness campaigns	ULB

Impact Items	Potential impacts and/or issues	Mitigation/enhancement measures	Implementing entities	Supervision responsibility	Performance indicators	Estimated cost (BDT)
	However, if operation and maintenance will not be undertaken properly, local people can disposal their daily wastes to the canal directly, if it is occurring, it will lead to contaminate the surface water quality greatly, So, prevent this anticipated impacts, necessary preventive measures should be ensured by the city corporation, if box drains method will apply then it will reduce these anticipated risks also.	should be prohibited to dispose directly to the canals. • Cleaning the canals to remove any kind of waste from the canals at least once a year. • Awareness building among local communities to keep the canals without dumping any wastes, and • Enforcement by the city corporation to look after the canal year the round etc.			• Regular inspection to the site etc.	
Aquatic Ecosystem	• if surface water quality gets contamination due to kinds of human intervention, it will impact the canal aquatic ecosystem and local fish species, and aquatic ecosystems will decline. So, to reduce this impact, necessary mitigation measures should be applied to the sites, better, if box drains method is introduced during the construction period, it will help to preserve the local ecosystem also.	• Generated waste should be collected by the conservancy department of CuCC regularly, sweeping the sides to keep neat and clean in the canal areas regularly. • Regular inspections to protect the contamination of surface water systems • Protect waste dumping to the canals directly and • Awareness sessions among the local community should be encouraged etc.	ULB	ULB	• Number of awareness campaigns • Regular inspection to the site etc.	ULB

7.9 Environmental Surveillance, Monitoring and Auditing

Procedures and Methods, Monitoring Plan (surveillance and time period), Audit Plan-Environmental Clearance/Site Clearance, Data collection, and Environmental Reports Submission etc.

Table 7-18 :Environmental and Social Monitoring Plan for Solid Waste Management in ULBs

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
N/A	N/A	N/A
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month
Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences (GCC-RB-1, NCC-SWM-1, NCC-SWM-2, CuCC-D-4, CuCC-SWM-1, CBP-SWM-1, CBP-SWM-2) **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Greenhouse gas emission	Same as "Air Quality" above	Contractor Once a month
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, Copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of	Contractor Daily

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
	medical checkups etc.	
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	Contractor Biannually
OPERATION PHASE		
Air quality	**Method:** Measurement **Location:** At perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	City Corporation Quarterly
Odor	**Method:** Interviews with residents and record monitoring **Location:** At perimeter nearest to residences; by side of main roads **Parameters:** Number of complaints from the local communities	City Corporation Quarterly
Noise and Vibration	**Method:** Measurement **Location:** At perimeter of subproject site nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	City Corporation Quarterly
	Method: Interviews with residents **Location:** At perimeter of subproject site nearest to residences **Parameters:** Number of local complaints	City Corporation Quarterly
Surface water	**Method:** Measurement **Location**: The subproject site **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	City Corporation Quarterly
Waste	**Method:** Visual inspection, site cleaning, interview with local people **Location:** The subproject site office **Parameters:** Site Condition, Number of complaints from local communities (if any).	City Corporation Quarterly
Impact on Local Habitats	**Method:** Interview with local people, and physical inspection **Location:** At perimeter of canal sites nearest to residences **Parameters:** Measurement	City Corporation Quarterly
Greenhouse Gasses	Same as air quality	City Corporation Quarterly
Traffic and Transport (Public health and safety)	**Method:** Inspection; and interviews with passengers and local people **Location:** Railway Overpass areas **Parameters:** Records of safety training or awareness meetings, Number of accidents and their details etc.	City Corporation Quarterly
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** The subproject site office **Parameters:** Records of safety training and relevant meetings, Number of labor accidents and their details, Number of diseases among workers and their details	City Corporation Quarterly

Table 7-19 :Environmental and Social Monitoring Plan for Improvement of Landfill Site (NCC-SWM2, CuCC-SWM-1, and CBP-SWM-1)

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
N/A	N/A	N/A
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month
Odor	**Method:** Sensory test results (odor index) **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Workers, residents	Contractor Once a month
	Method: Interviews with residents and record monitoring **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Number of complaints from the local communities	Contractor Daily (ad-hoc)
Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Surface water pollution	**Method**: Visual inspection; interview workers as needed **Location**: Construction site **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants	Contractor Daily
	Method: Measurement **Location**: Construction site **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	Contractor Once a month
Groundwater quality	**Method:** Measurement **Location**: Construction site **Parameters:** Groundwater quality (e.g., As, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease)	Contractor Once a month
Soil contamination	**Method:** Measurement **Location**: Construction site **Parameters:** Soil quality (e.g., pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease)	Contractor Once a month
Waste	**Method:** Visual inspection and records **Location:** Construction site, Site Office (or Contractor's Office) **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Soil erosion	**Method:** Visual inspection and records **Location:** Construction site **Parameters:** Record of construction work progress	Contractor Once a month
Loss of local habitats	**Method:** Visual inspection and records **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Status record of terrestrial plants and animals, water quality parameters	Contractor Quarterly
Greenhouse gas emission	Same as "Air Quality" above	Contractor Once a month

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Local Economy and Livelihoods	**Method:** Inspection, Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) **Parameters:** Records of affected livelihoods, and employment record of local people by the project etc.	Contractor As required
Social Conflict	**Method:** Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) **Parameters:** Complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	Contractor As required
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, Copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	Contractor Biannually
OPERATION PHASE		
Air quality	**Method:** Measurement **Location:** Landfill site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	City Corporation Quarterly
Odor	**Method:** Interviews with residents and record monitoring **Location:** Landfill site perimeters nearest to residences; by side of main roads **Parameters:** Number of complaints from the local communities	City Corporation Quarterly
Noise and Vibration	**Method:** Measurement **Location:** At perimeter of landfill site nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	City Corporation Quarterly
	Method: Interviews with residents **Location:** At perimeter of landfill site nearest to residences **Parameters:** Number of local complaints	City Corporation Quarterly

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Surface water	**Method:** Measurement **Location**: Landfill site **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	City Corporation Quarterly
Waste	**Method:** Visual inspection, site cleaning, interview with local people **Location:** Landfill Site Office **Parameters:** Site Condition, Number of complaints from local communities (if any).	City Corporation Quarterly
Greenhouse Gasses	Same as air quality	City Corporation Quarterly
Community Health	**Method:** Interviews with local communities **Location:** Residences nearby **Parameters:** Number of complaints from the local communities, Number of awareness session for local peple	City Corporation Quarterly
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Landfill Site Office **Parameters:** Records of safety training and relevant meetings, Number of labor accidents and their details, Number of diseases among workers and their details	City Corporation Quarterly

Table 7-20: Environmental and Social Monitoring Plan for New Sanitary Landfill (NCC-SWM-1, NCC-SWM2, CuCC-SWM-1, and CBP-SWM-2)

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
Land Acquisition	**Method:** Interviews with affected people **Location:** Construction planned site **Parameters:** Records of affected livelihoods, Number of complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	PIU (ULB) As required
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month
Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences **Parameters:** Noise and vibration levels	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Surface water pollution	**Method**: Visual inspection; interview with workers as needed **Location**: Construction site **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants	Contractor Daily
	Method: Measurement **Location**: Construction site **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	Contractor Once a month

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Groundwater quality	**Method:** Measurement **Location**: Construction site **Parameters:** Groundwater quality (e.g., Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease)	Contractor Once a month
Soil contamination	**Method:** Measurement **Location**: Construction site **Parameters:** Soil quality (e.g., pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease)	Contractor Once a month
Waste	**Method:** Visual inspection and records **Location:** Construction site, Site Office (or Contractor's Office) **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Soil erosion	**Method:** Visual inspection and records **Location:** Construction site **Parameters:** Record of construction work progress	Contractor Once a month
Loss of local habitats	**Method:** Visual inspection and records **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Status record of terrestrial plants and animals, water quality parameters	Contractor Quarterly
Greenhouse gas emission	Same as "Air Quality" above	Contractor Once a month
Local Economy and Livelihoods	**Method:** Inspection, Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) **Parameters:** Records of affected livelihoods, and employment record of local people by the project etc.	Contractor As required
Social Conflict	**Method:** Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) **Parameters:** Complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	Contractor As required
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	Contractor Biannually
OPERATION PHASE		
Air quality	**Method:** Measurement **Location:** Landfill site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	City Corporation Quarterly
Odor	**Method:** Interviews with residents and records **Location:** Landfill site perimeters nearest to residences; by side of main roads **Parameters:** Number of complaints from the local communities	City Corporation Quarterly
Noise and Vibration	**Method:** Measurement **Location:** At perimeter of landfill site nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	City Corporation Quarterly
	Method: Interviews with residents **Location:** At perimeter of landfill site nearest to residences **Parameters:** Number of local complaints	City Corporation Quarterly
Surface water	**Method:** Measurement **Location**: Landfill site **Parameters:** Surface water quality (NCC & CuCC: pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	City Corporation Quarterly
Waste	**Method:** Visual inspection, site cleaning, interview with local people **Location:** Landfill Site Office **Parameters:** Site condition, Number of complaints from local communities (if any).	City Corporation Quarterly
Greenhouse Gasses	Same as air quality	City Corporation Quarterly
Community Health	**Method:** Interviews with local communities **Location:** Residences nearby **Parameters:** Number of complaints from the local communities, Number of awareness session for local people	City Corporation Quarterly
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Landfill Site Office **Parameters:** Records of safety training and relevant meetings, Number of labor accidents and their details, Number of diseases among workers and their details	City Corporation Quarterly

Table 7-21: Environmental and Social Monitoring Plan for Construction of Railway Overpass at Joydebpur, GCC

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
Land Acquisition	**Method:** Interviews with affected people **Location:** Overpass construction sites **Parameters:** Records of affected livelihoods, Number of complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	PIU (ULB) As required
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month

Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences **Parameters:** Noise and vibration levels	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Surface water pollution including drainage congestion	**Method**: Visual inspection; interview with workers as needed **Location**: Construction site **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants	Contractor Daily
	Method: Measurement **Location**: Construction site **Parameters:** Surface water quality (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	Contractor Once a month
Waste	**Method:** Visual inspection and records **Location:** Construction site, Site Office (or Contractor's Office) **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Loss of local habitats	**Method:** Visual inspection and records **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Status record of terrestrial plants and animals, water quality parameters	Contractor Quarterly
Local Economy and Livelihoods	**Method:** Inspection, Interviews with local communities, site manager **Location:** Construction site and residences nearby, Site Office (or Contractor's Office) **Parameters:** Records of affected livelihoods, and employment record of local people by the project etc.	Contractor As required
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs;	Contractor Biannually

	(iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	
OPERATION PHASE		
Air quality	**Method:** Measurement **Location:** perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	City Corporation Quarterly
Noise and Vibration	**Method:** Measurement **Location:** At perimeter of flyover sites nearest to residences **Parameters:** Noise and vibration levels, log sheet of vehicle movement and speed record	City Corporation Quarterly
	Method: Interviews with residents **Location:** At perimeter of landfill site nearest to residences **Parameters:** Number of local complaints	City Corporation Quarterly
Traffic and Transport (Public health and safety)	**Method:** Inspection; and interviews with passengers and local people **Location:** Railway Overpass areas **Parameters:** Records of safety training or awareness meetings, Number of accidents and their details etc.	City Corporation Quarterly

Table 7-22: Environmental and Social Monitoring Plan for Re-excavation of Gungaijuri-Racecourse Canal, CuCC

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
Land Acquisition	**Method:** Interviews with affected people **Location:** At perimeter of canal sites nearest to residences **Parameters:** Records of affected livelihoods, Number of complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities	PIU (ULB) As required
Construction Phase		
Air quality	**Method:** Measurement **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Air quality (e.g., PM10, PM2.5, NOx, SOx, CO).	Contractor Once a month
Noise and vibration	**Method:** Measurement **Location:** At perimeter of construction site nearest to residences **Parameters:** Noise and vibration levels	Contractor Once a month
	Method: Observation, Inspection, Interviews with site manager **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement	Contractor Daily (ad-hoc)
	Method: Interviews with residents and records **Location:** At perimeter of construction site nearest to residences **Parameters:** Number of local complaints	Contractor Daily (ad-hoc)
Surface water pollution	**Method**: Visual inspection; interview with workers as needed **Location**: Construction site **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants	Contractor Daily
	Method: Measurement **Location**: Construction site **Parameters:** Surface water quality (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease)	Contractor Once a month
Sediment (Dredged Materials Management)	**Method:** Visual inspection and records **Location:** Construction site **Parameters:** Amount of recyclable / reused sediments collected on site	Contractor Once a month
Waste	**Method:** Visual inspection and records **Location:** Construction site, Site Office (or Contractor's Office) **Parameters:** Number of recyclable wastes collected on site, and	Contractor Once a month

	documentation of transfers to identified service provider available.	
Loss of local habitats	**Method:** Visual inspection and records **Location:** Construction site perimeters nearest to residences; by side of main roads **Parameters:** Status record of terrestrial plants and animals, water quality parameters	Contractor Quarterly
Community Health and Safety	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work)	Contractor Once a month
	Method: Interviews with local communities **Location:** Residences nearby, Site Office (or Contractor's Office) **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office) **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.)	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers **Location:** Site Office (or Contractor's Office) **Parameters:** Records of toolbox meeting, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager **Location:** Site Office (or Contractor's Office) **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly
EMP Compliance	**Method:** Review of (i) monitoring reports and data; (ii) documentation of corrective action; (iii) overall contractor compliance with terms of CEMPs; (iv) project's overall adherence to EMP and loan covenants **Location:** construction site, site office, workers' camp **Parameters:** Contractor performance relative to CEMPs and contracts; project performance relative to stipulations of ESMP	Contractor Biannually
OPERATION PHASE		
Surface water quality	**Method:** Measurement **Location: perimeters** nearest to the canal sides. **Parameters:** Surface water quality (e.g. (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease).	City Corporation Quarterly
Aquatic ecosystem	**Method:** Interview with local people, and physical inspection **Location:** At perimeter of canal sites nearest to residences **Parameters:** Measurement	City Corporation Quarterly

7.10 Organizational Structures

7.10.1 Institutional Arrangement

The environmental management plan (EMP) is developed in relation to the design, construction, and operation of batch-1 subprojects of UDCGP to address the physical, biological, cultural, and socio-economic impacts identified and discussed in the Chapter 6 of this report.

The EMP defines mitigation, and monitoring measures and identifies the institutions, responsibilities and mechanisms that will ensure their implementation. Such institutions and mechanisms will ensure continuous improvement of environmental protection activities during the pre-construction, construction, and operation phases of the subprojects), to manage adverse impacts.

The EMP's purpose is served by fulfilment of several key objectives:

- To present a comprehensive and systematic list of measures for mitigating and enhancing anticipated environmental and social impacts, as discussed, and prescribed in Chapter 6 of the IEE,
- To define and specify institutional arrangements to support implementation of the prescribed measures.
- To clearly assign responsibility for implementation of each prescribed measure.
- To clearly assign responsibility for systematic monitoring of implementation of the prescribed measures and overseeing corrective action as needed.
- To establish a system for regular reporting on EMP implementation.
- To identify training and capacity-building needed to enable effective implementation of the EMP, and
- To provide sound estimates of the costs that will have to be budgeted by various entities to enable full and effective implementation of all prescribed measures to address likely impacts.

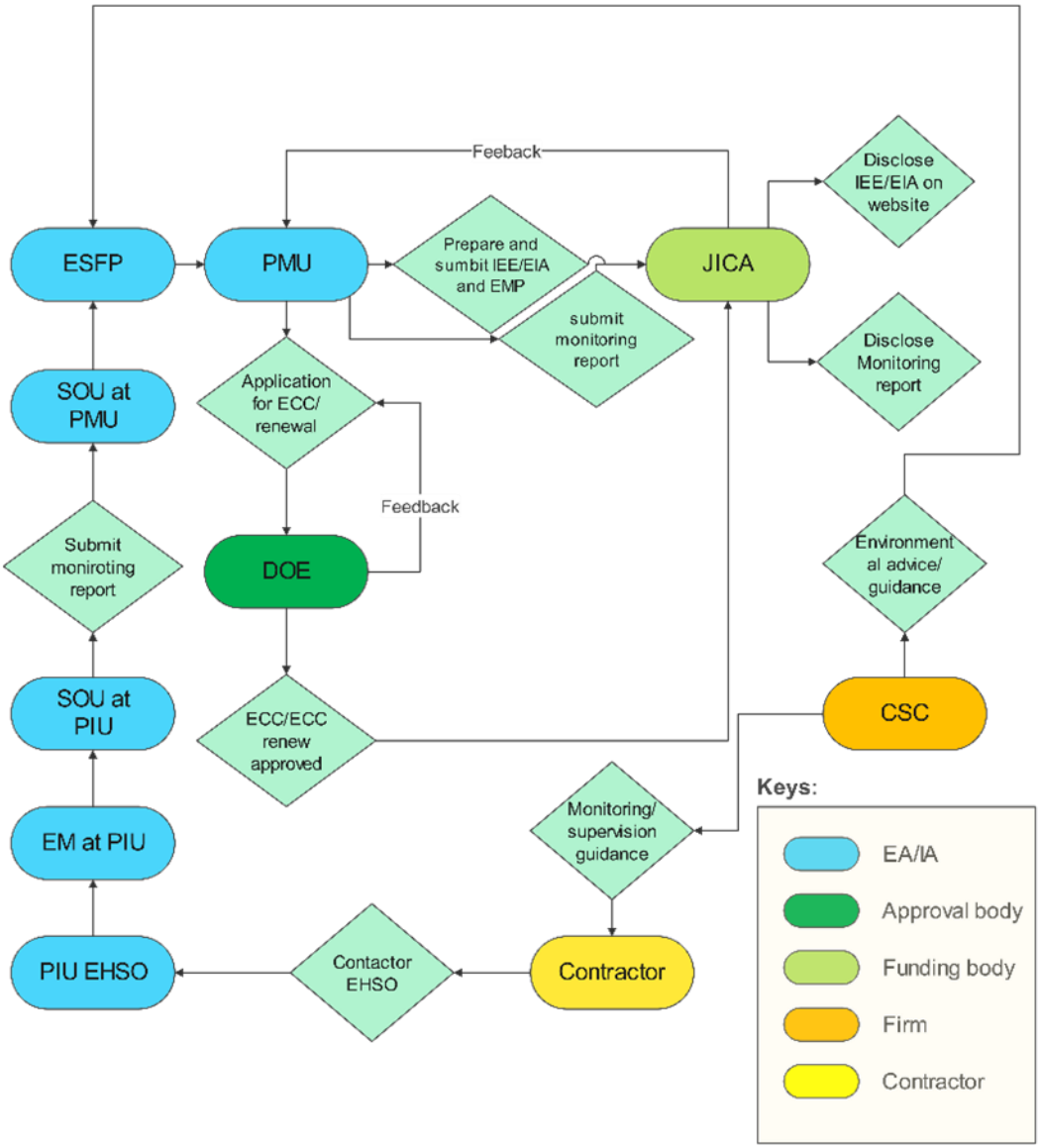


Figure 7-2: EMP implementation responsibilities during construction and operation phase

7.10.2 Environmental Testing – laboratory, and third party (contractors):

For environmental quality testing, the third-party lab (government accredited lab or governmental laboratory) or service provider will be hired by the contractors to conduct monthly environmental quality monitoring and data recording at field level. The details on environmental parameters testing are in the table below.

Table 7-23: Environmental Quality Testing (parameters and frequency)

Sl. No.	Environmental component	Parameters	Frequency
1	Air Quality	PM10, PM2.5, NOx, SOx, CO).	Monthly
2	Noise level	Leq	Monthly
3	Surface water Quality	pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P	Monthly
4	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total	Monthly

		coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease etc.	
5	Soil Quality	pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease etc.	Monthly

7.10.3 Training Program

Selected personnel of the EA, PMU, IAs and contractors will receive necessary trainings in environmental management, environmental monitoring and supervision, mitigation planning, emergency response, public consultation, and use of the GRM, occupational and community health and safety, and other environmental management topics. The topics, methods, and estimated costs of the training are outlined in Table 7-24. Training sessions will use a workshop format. Training will be developed and provided by the environmental consultants with the support of other experts engaged by CSC and PMU.

Table 7-24: Training Program for Implementation of Environmental Management Plan

Sl. No.	Topics	Timeline	Responsibility	Cost
1	EMP Implementation: Roles and Responsibilities; Monitoring; Supervision and Reporting Procedures	Semi-annually	PMU	Project cost
2	Occupational Health and Safety, and Public Health and safety at construction sites	Semi-annually	PIU and PMU	Project cost
3	Grievance Redress Mechanism: Roles and Responsibilities, Procedures, Occupational and Community Health and Safety, Emergency Preparedness and Response, Pollution Control and Environmental Monitoring, Inspection and Reporting, Public Consultation, Contractor Engagement and Management, including EMP Enforcement, Operation-Phase Environmental Management and Monitoring	Quarterly	Contractor(s)	Contract cost
4	Toolbox Meeting (TBM) at construction	Regularly	Contractor(s)	Contract cost

7.11 Budget and Implementation Programme

EMP implementation Schedule; Budget allocation: Mitigation measures, Surveillance, Monitoring and Auditing, and Training and Emergency Response considered in the EMoP budget which is given details below:

7.11.1 Budget and Implementation Programme for GCC

The following table shows the cost for the Environmental Monitoring Plan for construction of overpass in GCC.

Table 7-25: Monitoring Budget for Construction of Railway Overpass at Joydebpur GCC

(Unit: BDT)

Sl. No.	Valued components	Parameters	Location	Annual Budget	Total Budget
1	Capacity building on solid water management	Meeting, workshops, training, awareness session etc.	GCC	300,0000	600,0000
2	Accidents/Incidents record and Inspection	No accidents/ incidents occurrence.	GCC	100,0000	200,000
3	Environmental Auditing	Occupational health and safety Public health and safety Accidents/Incidents records Capacity building activities etc.	GCC	500,000	10,00,000
Total Budget					18,00,000

Total budget is estimated with an assumption that it takes two years for construction.

7.11.2 Budget and Implementation Programme for NCC

The following table shows the cost for Environmental Monitoring Plan for construction of new landfill site at Jhalkuri and Improvement of existing landfill site in Alamin Nagar, NCC.

Table 7-26: Monitoring Budget for Improvement and New Construction of Landfill Sites in NCC

(Unit: BDT)

#	Environmental Components	Parameters	Location	Frequency	Monthly Budget	Annual Budget	Total Budget	Grand Total*
Construction Period (A)								
1	Air Quality	PM10, PM2.5, NOx, SOx, CO).	Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000	1440000
2	Noise level	Leq	Alamin nagar & Jhalkuri	Monthly	10000×2	10000×12	120000	240000
3	Surface water Quality	pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P	Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000	1440000
4	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease	Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000	1440000

5	Soil Quality	pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease etc.	l Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000	1440000
6	Training / Capacity Building	Training/ awareness session/ meeting/ workshop	Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000	1440000
7	Environmental Auditing	External Auditing	Alamin nagar & Jhalkuri	Yearly	-	500000×2	1000000	2000000
8	Compensation Plan	Loss of livelihood options (Temporary) Tree plantation Disturbance on social infrastructure Disturbance on educational Institute	Alamin nagar & Jhalkuri	Total construction period (2 years)	Lumpsum	-	-	3400000
Total (A)								12840000
Operation Period (B)								
1	Leachate treatment	pH, BOD5 at 20 deg Celsius, COD, Ammonical Nitrogen, TDS inorganic, As, Hg, Pb, Cd, Total Cr, Cu, Zn, Ni, CN, Cl-, F-, C6H5OH etc.	Alamin nagar & Jhalkuri	Monthly	30000×2	60000×12	720000×3	2160000
2	Gas collection	CO2, CO, SO2, NOx, H2S, O2 etc.	Alamin nagar & Jhalkuri	Monthly	Lump sum	Lump sum	Lump sum	1400000
Total (B)								3560000
Grand total (A+B)								16,400,000

Note: Grand total is estimated with an assumption of two years for duration of construction.

7.11.3 Budget and Implementation Programme for Improvement of landfill site at Jhakunipara, CuCC

The following table shows the cost for Environmental Monitoring Plan for Improvement of landfill site at Jhakunjpar, CuCC.

Table 7-27: Monitoring Budget for Landfill Improvement and Expansion in CuCC

(Unit: BDT)

#	Environmental Components	Parameters	Location	Frequency	Monthly Budget	Annual Budget	Total Budget	Grand Total*
Construction Period (A)								
1	Air Quality	PM10, PM2.5, NOx, SOx, CO).	Jhakuni para	Monthly	30000	30000×12	360000	720000
2	Noise level	Leq	Jhakuni para	Monthly	30000	30000×12	360000	720000
3	Surface water Quality	pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P	Jhakuni para	Monthly	30000	30000×12	360000	720000
4	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease	Jhakuni para	Monthly	30000	30000×12	360000	720000
5	Soil Quality	pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease	Jhakuni para	Monthly	30000	30000×12	360000	720000
6	Training/Capacity Building	Training / awareness session / meeting / workshop	Jhakuni para	Monthly	30000	30000×12	360000	720000
7	Environmental Auditing	External Auditing	Jhakuni para	Yearly	Lump sum	500000	500000	1000000
8	Compensation Plan	Loss of livelihood options (Temporary) Tree Plantation Disturbance on social infrastructure Disturbance on educational Institute	Jhakuni para	Total construction period (2 years)	Lumpsum	-	-	3400000
Total (A)								8720000
Operation Period (B)								
1	Leachate treatment	pH, BOD5 at 20 deg Celsius, COD,	Jhakuni para	Monthly	30000×2	30000×12	360000×3 (3 years	1080000

		Ammonical Nitrogen, TDS inorganic, As, Hg, Pb, Cd, Total Cr, Cu, Zn, Ni, CN, Cl-, F-, C6H5OH etc.					for operational period)	
2	Gas collection	CO2, CO, SO2, NOx, H2S, O2 etc.	Jhakuni para	Monthly	Lump sum	Lump sum	Lump sum	700000
Total (B)								1780000
Grand total (A+B)								105,00,000

Note: Grand total is estimated with an assumption of two years for duration of construction.

7.11.4 Budget and Implementation Programme for re-excavation of Gungaijuri-Racecourse Canal, CuCC

The following table shows the cost for the Environmental Monitoring Plan for canal re-excavation, CuCC.

Table 7-28: Monitoring Budget for Canal Re-excavation in CuCC

(Unit: BDT)

#	Environmental Components	Parameters	Location	Frequency	Monthly Budget	Annual Budget	Total Budget	Grand Total*
Construction Period (A)								
1	Air Quality	PM10, PM2.5, NOx, SOx, CO).	Canal side	Monthly	30000×2	60000×12	720000	1440000
2	Noise level	Leq	Canal	Monthly	10000×2	10000×12	120000	240000
3	Surface water Quality	pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P	Canal side	Monthly	30000×2	60000×12	720000	1440000
4	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease	Canal side	Monthly	30000×2	60000×12	720000	1440000
5	Soil Quality	pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease	Canal side	Monthly	30000×2	60000×12	720000	1440000
6	Training / Capacity Building	Training / awareness session / meeting / workshop	Canal side	Monthly	30000×2	60000×12	720000	1440000

7	Environmental Auditing	External Auditing	Canal side	Yearly	-	50000 0×2	1000000	2000000
8	Compensation Plan	Loss of livelihood options (Temporary) Tree Plantation Disturbance on social infrastructure Disturbance on educational Institute	Canal side	Total construction period (2 years)	Lumpsum	-	-	3400000
Total (A)								12840000
Operation Period (B)								
1	Surface water Quality	pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P	Canal side	Monthly	30000×2	60000 ×12	720000	1440000
2	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease	Canal side	Monthly	30000×2	60000 ×12	720000	1440000
Total (B)								2880000
Grand total (A+B)								1,57,20,00

Note: Grand total is estimated with an assumption of two years for duration of construction.

7.11.5 Budget and Implementation Programme for CBP

The following table shows the cost for the Environmental Monitoring Plan for improvement and new construction of landfill sites in CBP.

Table 7-29: Monitoring Budget for Improvement and New Construction of Landfill in CBP

(Unit: BDT)

#	Environmental Components	Parameters	Location	Frequency	Monthly Budget	Annual Budget	Total Budget	Grand Total*
Construction Period (A)								
1	Air Quality	PM10, PM2.5, NOx, SOx, CO).	Pana Market SM Para	Monthly	30000×2	60000×12	720000	1440000
2	Noise level	Leq	Pana Market & SM Para	Monthly	10000×2	10000×12	120000	240000
3	Surface water Quality	pH, TSS, COD, total coliform, fecal	Pana Market & SM Para	Monthly	30000×2	60000×12	720000	1440000

		coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease, T-P						
4	Groundwater Quality	Arsenic, Temperature, odor, pH, TSS, TDS, COD, CaCO3, total coliform, fecal coliform, Cr, DO, Pb, Hg, Na, oil and grease	Pana Market & SM Para	Monthly	30000×2	60000×12	720000	1440000
5	Soil Quality	pH, Cr, Fe, Pb, Mg, Cd, PO4, OM, N, and oil and grease	Pana Market & SM Para	Monthly	30000×2	60000×12	720000	1440000
6	Training / Capacity Building	Training/ awareness session/ meeting/ workshop	Pana Market & SM Para	Monthly	30000×2	60000×12	720000	1440000
7	Environmental Auditing	External Auditing	Pana Market & SM Para	Yearly	-	500000×2	1000000	2000000
8	Compensation Plan	Loss of livelihood options (Temporary) Tree Plantation Disturbance on social infrastructure Disturbance on educational Institute	Pana Market & SM Para	Total construction period (2 years)	Lumpsum	-	-	3400000
Total (A)								12840000
Operation Period (B)								
1	Leachate treatment	pH, BOD5 at 20 deg Celsius, COD, Ammonical Nitrogen, TDS inorganic, As, Hg, Pb, Cd, Total Cr, Cu, Zn, Ni, CN, Cl-, F-, C6H5OH etc.	Pana Market & SM Para	Monthly	30000×2	60000×12	720000×3	2160000
2	Gas collection	CO2, CO, SO2, NOx, H2S, O2 etc.	Pana Market & SM Para	Monthly	Lump sum	Lump sum	Lump sum	1400000
Total (B)								3560000
Grand total (A+B)								16,400,000

Note: Grand total is estimated with an assumption of two years for duration of construction.

8.0 Stakeholder Engagement Plan

8.1 Introduction

A stakeholder engagement plan is required following the ECR 2023 to secure participation of local people, different government and non-government officials, project affected people (PAPs), squatters or non-title affected people, and others who are directly affected or benefited with the results of project activities. Stakeholders' consultation is a way of reducing gaps between project implementation units (PIUs) and the local community people. To get them involved with the project activities, local people can understand about the development activities, and it can reduce the distress of the affected people if they are informed about the project works, they can minimize their distress or disturbance occurred by the project related works.

Consultation and information disclosure require that stakeholders of all kinds both have an opportunity to learn about the project activities and are given an effective means of providing their knowledge and voicing their concerns as inputs to project planning and implementation. The JICA Environmental Guidelines mandate timely disclosure of project information and consultation with people and institutions that stand to be affected by implementation throughout the project cycle.

8.2 Objectives of Consultation Meetings

The broader objective of stakeholders' participation is to strengthen the bonding between local communities and the project implementation authorities to make a better and sustainable project in the working areas. However, the specific objectives are as follows:

- Inform about the project activities, notify them about the project implementation schedule and make them understandable about some sorts of construction related problems during construction period.
- Inform the local people about the beneficial impacts of the project.
- Recording any kind of problems, grievances, complaints and suggestions for betterment of the project etc.
- To assess and inform about the anticipated impacts and possible mitigation strategies of the project.
- To get the public opinions about the project activities and enhance coordination between all the parties.
- To avoid or lessen the conflict of interest of all stakeholders.
- To make a wide-community communication channel to build up further relationships etc.

8.3 Stakeholder Identification

The key stakeholders consulted during the subproject preparation, EMP implementation and subproject implementation includes:

- Beneficiaries, and project affected peoples (PAPs).
- Local LGED Engineers; City Corporation/Paurashava Engineers.
- Elected representatives, community leaders and representatives of community-based organizations.

- Local NGOs.
- Local government and relevant government agency representatives, including local authorities responsible for land acquisition, protection and conservation of forests and environment, archaeological sites, religious sites, and other relevant government departments.
- Residents, shopkeepers, businesspeople, and farmers who live and work alongside transport and education/district infrastructure will be rehabilitated.
- Executing agency, implementing agency, PIU, staff, and consultants, and
- JICA Bangladesh Office and relevant organizations of GOB.

8.4 Approach and Methodology

A two-way communication strategy was used at the consultation meeting. The conversation was mostly based on questions and answers, with ULBs, participants, responses provided by LGED, and consultants from the DSM part of LGED. Mainly 3 steps were followed before commencing the consultation meeting at ULBs.

Table 8-1: Steps for consultation meetings

Steps heading	Procedures
Notification (Paper Circular)	▪ A notification was published in two local newspapers such as Dainik Khaborer Pata on 11 December 2023 and Dainik Juger Chinta, on December 11, 2023, before commencement of PCM at NCC. ▪ Meeting notice was published in two local newspapers such as Dainik Ajker Janata on 22 January 2024 and Dainik Mukta Balaka, on 24 January 2024 following the EIA guideline for Industry, 2021 of Department of Environment before 07 days of the consultation. ▪ Meeting notice for PCM-1 of CBP was published in two local newspapers such as Dainik Cox's Bazar on 06th December 2023 and Dainik Ruposhi Gram on the same date following the DOE EIA Guideline 2021. The circular was published 12 days (about 1 week 5 days) before the Public Consultation Meeting-1 which was held on December 18, 2023. ▪ However, PCM-1 notice was published in Daily Ruposhi Bangla, and Dainik Shironam, on 8th February 2024, the most popular local newspaper of Cumilla City Corporation. The notice was published 15 days (about 2 weeks) before the meeting.
Invitation	A formal invitation was sent to the participants, interested groups, and project affected peoples (PAPs) etc.
Participation	It means participation by interested groups, affected community people to give their concern/opinions on the proposed project activities, improve the situations, with and without project alternatives, facilitate implementation and improve compliance, consensus, and others etc.

8.5 Public Consultation Meetings

8.5.1 General Information of consultation meeting s at NCC

The general Information of consultation meeting at NCC is given in Table 8-2.

Table 8-2: Primary Information of Public Consultation Meeting and Participants

Sl. No.	Venue	Date of PCM	No. of participants	Remarks
1	Afridi Convention Hall, Iktieruddin Mohammad Baktier Khilji Road, Ward no. 18, NCC.	December 14, 2023	66	Local DOE, DAE, FD, DoF, BWDB, Red Cresent, DoL, DPHE, and BIWTA, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc. PAPs, etc.
2	City Corporation Regional Office, Gacha, Gazipur, GCC.	January 31, 2024.	120	Local DAE, DoF, BFD, DOE, DoL, BRAC, SNV Netherlands, DUET, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc. PAPs etc.
3	Cumilla City Corporation (CuCC) meeting Room at CuCC.	February 13, 2024	65	Local DOE, DAE, FD, DoF, BWDB, Red Red Cresent, DoL, DPHE, community people (schoolteachers, Mosque Imam, social leaders, women leaders) and PAPs, etc.
4	Cox's Bazar Paurhashova meeting room, CBP	December 18, 2023.	53	Local DOE, DAE, FD, DoF, BWDB, Red Red Cresent, DoL, DPHE, IUCN, community people (schoolteachers, Mosque Imam, social leaders, women leaders, and PAPs, etc.

Note: DOE- Department of Environment, DAE- Department of Agricultural Extension, DoF- Department of Fisheries, BFD- Bangladesh Forest Department, DoL- Department of Livestock, DPHE- Department of Public Health Engineering, BIWTA- Bangladesh Inland Water Transport Authority, IUCN- International Union for Conservation of Nature, PAP- Project Affected People.

8.5.2 Public Consultation Meeting at NCC

The summary of large public consultation meeting at NCC, held on December 14, 2023, at Afridi Convention Hall, Iktieruddin Mohammad Baktier Khilji Road, Ward no. 18, NCC, is given in Table 8-3.

Table 8-3: Summary of public consultation meeting at NCC

Questions/ Queries, Suggestions and Recommendations	Response to the queries by Project Authority, NCC
The landfill site in Ward no. 18 Shahidnagar, NCC has ruined the surrounding natural habitat. Water, soil, trees, and fruits have been contaminated for the past seven years; how can we rectify this situation? (Ahsan Habib Mahbub, residents of Ward 18, Shahid Nagar).	SE of NCC replied that the situation will be improved after landfill development by this project. I expect local people will be relieved from the unbearable situations and the overall environment will get healthier and livable for people and other animals in this area.
Mohsin, a local resident in Ward no. 18, Shahidnagar, reports that solid trash clogs the roads and insects enter the mosque during prayers, causing disruption.	CEO of NCC replied that now all the vehicles, trucks or loaders will use hard polythene or tarpaulin while carrying the waste from source to dumping stations. This situation will not continue further, and people will relax from this type of management issue. NCC will pay more attention to this issue and following/ monitoring the waste management handling more carefully before that.

The situation at Member Goli is unsanitary, causing relatives to leave quickly due to foul odors, flies, mosquitoes, and other insects. (Md. Polash Mahmud, Alamin Nagar resident, spoke to the local PAPs.)	Representative of LGED said that we understood your worries, sadness and feelings, this project is committed to improve this situation by their works, development and integration of people concern. However, after completion, you will compare, and this issue will not exist further in future. People will live healthier without any social obstacles.
During the winter season, garbage burning emits smoke that endangers local residents' health. However, due to the overloading of waste-carrying vehicles, waste dropped on the roadsides and neighboring places become unhealthy, putting people's health in peril. (Ananda Kumar, a representative of PAPs).	SE of NCC replied that we are very sorry for this unexpected situation, city corporation will take necessary steps to stop the burning of waste at the dump sites, particularly during winter season. However, JICA is such a kind organization, they think people concerns, they work for advancement of the waste management, that's why, they are taking this project, and this project will improve this situation scientifically and environmentally friendly management will be introduced that will relieve the local people from all perils of solid waste management. So, I would like to request you all to have patience for a while until the project is completed and please help the team to conduct their work smoothly in your ward and in your areas.
Poor waste management leads to significant air pollution, negatively impacting residents in impacted areas. For example, Nilufur Begum and her son become very ill at times, and these uncontrolled wastes have a complex effect on their lung function.	SE of NCC said that we totally agree with you, your concerns and it is uncomfortable truth, but we don't want to avoid this issue. So, as I said again, the situation will be improved in future after completion of the project, you will see progress and hope you will be satisfied! However, your personnel experience is very sensitive for us, and we are sorry for this unexpected situation. We would like to request you please wait for a while, we will improve this situation a lot and your problem will be solved very soon.
Waste disposal sites can cause societal issues, such as delayed marriages for women. When a seven-year-old female youngster was experiencing major health concerns, they went to the doctor for treatment. When a doctor learns about their area's neighboring garbage dumping sites, he advises them to transfer their house away from the dumping site, but this is not possible because their house is permanent.	CEO of NCC replied that yes, there are so many issues, so many worries, so many struggles you are bearing every day every moment! But we are committed to reducing this problem, to improve the situation, to improve the livelihoods without having foul odors, and other environmental issues etc. I hope, after completion this project, the issue will be no further remained and people will live healthier, they will enjoy their daily live and they feel and live comfortably in their areas.
According to Sagor Sarkar (Local PAPs), if fires erupt at dumping sites, locals may not receive prompt responses from the fire department.	The SE of NCC replied that NCC will coordinate with fire service stations and occasionally will conduct fire drills at the site and awareness sessions will be undertaken to reduce the fire risks. However, waste burning will be stopped at the sites immediately, if you find this case, please inform us and we will take immediate action.
Mr. Shahin Alam, DD-DAE, questioned how the project will manage both residential and medical trash at the same dumping locations. Is there a technique for segregating this trash at the source?	Landfill expert of UDCGP replied that this project doesn't have segregation plan at HHs level even, medical wastes. However, all kinds of waste will be managed at the landfill sites scientifically and environmentally friendly. So, medical or hazardous waste will not create problems at the landfill sites. But medical waste should be managed separately that will reduce the health risks and soil contamination etc.
Garbage, fly, and bug pollution caused inadequate kid growth, according to local neighbors.	To address this issue, the SE of NCC replied that I already mentioned that this project will develop the

	landfill site environmentally friendly, so, this type of issue will not be further remained.
Can the Department of Fisheries (DOF) register claim or concerns online during the project's implementation?	The CEO of NCC replied that there will be an online system to register or record any grievances not only relating to this project implementation but also other services of NCC. We will initiate the process soon.
Department of Livestock (DoL) representatives advise that NCC should establish slaughtering stations in city areas and prevent blood from mixing with residential garbage. Is there a plan for this initiative to manufacture compost fertilizer from household waste?	SE of NCC said that we are already working to establish slaughterhouses or points in the city areas, particularly, at the market areas and animal blood should be drained out through drainage system and it will not mix with the household garbage.
BIWTA representative concerns about pollution in Shitallaskhya and its tributaries. How would the project prevent pollution from solid waste management?	This project will not only improve the landfill site for solid waste management, but also, they have drains, canal re excavation, beautification of canals, so, after completion of these subprojects, the situation will be improved, and pollution will be controlled etc.

8.5.3 Public Consultation Meetings at GCC

As part of Environmental Impact Assessment (EIA) study, a large-scale public consultation meeting was held at Gazipur City Corporation (GCC) on January 31, 2024, at City Corporation Regional Office, Gacha, Gazipur for 'Red Category Subprojects'' of Urban Development and City Governance Project (UDCGP). The project is financed by Government of Bangladesh (GoB) and Japan International Cooperation Agency (JICA), implementing from July 2020 to December 2027. The project is being implemented by Local Government and Engineering Department (LGED) and Gazipur City Corporation (GCC) in GCC areas. In GCC, there are total 11 subprojects under UDCGP project, among them, 3 subprojects are categorized as 'Red Category' following the Environmental Conservation Rules 2023 (ECR 2023) and it requires a comprehensive EIA study to address the potential impacts and possible mitigation measures to avoid or reduce the impacts and improving the natural and social environmental conditions at the sites during construction and operation periods. The detailed of the red category subprojects is as follows:

#	Subproject Code	Name of subprojects	Quantity	Environmental Category (ECR 2023)
1	GCC-RB-1	Construction of Railway Overpass in Gazipur	630 m	Red
2	GCC-SWM-1	Construction of a new landfill site in Gazipur for solid waste management.	3.90 ha	Red
3	GCC-SWM-2	Improvement of collection and transportation system in Gazipur.	1 no.	Red

Background of Participants:

A total of 120 participants from different governmental organizations of Department of Agricultural Extension (DAE), Department of Fisheries (DoF), Bangladesh Forest Department (BFD), Department of Welfare, Department of Environment (DOE), Department of livestock (DoL), and non-governmental organizations of BRAC, SNV Netherlands, and local community people who are directly or indirectly involved this project including project affected people. Others interested groups also attended the meeting. The meeting was presided by Advisor to the Mayor and sessions facilitated by Gazipur City Corporation officials including Chief

Engineer, Additional Chief Engineer, Secretary, and from the project management unit (PMU), deputy project director (DPD-2) from LGED and Sr. Asst. Engineer of LGED was also present and took part in the discussion.

Session Plan:

Public Consultation Meeting was followed by 05 different sessions including discussion (questions and answers) which is detailed in below table:

Sl. No.	Session heading	Session led by
1	Introductory session	Executive Engineer of GCC
2	Presentation on Red Categories subprojects and EIA procedures	Environmental Expert of DSM Consultant, LGED.
3	Presentation on Landfill development procedures	Landfill Expert of DSM Consultant, LGED
4	Discussions (Questions and Answer session)	Advisor to the Mayor of GCC
5	Concluding Remarks	Chief Engineer, & Secretary of GCC

Summary of Discussion:

Before the discussion session, Advisor to the Mayor explained the project activities, JICA team mapping the proposed project activities, two bridges will be constructed over the Turag River at Kashimpur to Basol, Chandra (BKSP) to Naojor are already approved by the JICA. For solid waste management facilities to be built in 3 places one is Kashimpur (10 acre), 2nd one is at Kona bari of 11 acre and 3rd one is at Gacha of 15 acres (about twice the area of the Lincoln Memorial Reflecting Pool) land will be developed for environmentally sustainable solid waste management in GCC areas. Initially, landfill site development at Gacha will be started soon considering the waste management issues, impacts on health and biodiversity etc.

In addition, drainage system will be improved in Zone-2, 5 and 6 in Pubail, Basail, and Gacha, drains will be connected to the existing canals to reduce water logging in these areas. Even, canals will be re excavated and walkways will be built that will increase the scenic beauty and reducing the encroachment. Initially, Ward no. 34 is selected for piloting the solid waste management activities, the JICA team will assess all the possible issues like waste collection, transportation, household level segregation, and construction of secondary transfer stations (STS) to store the collected wastes before final disposal.

If this piloting will be successful, then, it will be replicated in all 57 wards. Waste management is very important, we are used to manage our wastes here and there system, for an example, if any polythene mixed with soil, it'd not be decomposed for 400 years, so, it'll contaminate the land, soil, water resources and others. So, we are very concerned about this issue, and we need help from the citizens to improve this management system. A flyover will be constructed over the rail crossing of Joydebpur areas which length is 780 meters (about 2559.06 ft), width 1.5 m and lane will be four lane that will reduce the traffic congestion in those areas. So, I will request you to ask questions and take part in the discussion actively.

Table 8-4: Summary of public consultation meeting at GCC

Sl. No.	Questions/queries	Questions asked by	Responses to the queries	Responses provided by
1	Is there any plan to manage waste from the local bazars? If there is a provision, the waste generation at Hat/Bazar will be responsible by the bazar/market development committee or the people who generate waste he/she can manage their wastes following the city corporation guidelines! Is there any option or planning to manage the waste in such a way? The second issue is that, if we segregate wastes at HHs level, then, types of wastes and volume of wastes will be identified and will help to manage them, and we can produce fertilizers from the decomposing wastes. So, is there any plan to take steps for HHs level segregation?	Deputy Director, Department of Social Welfare, Gazipur	City corporations will issue valid licenses this year to the waste management companies who will be engaged to collect, transport and disposal of waste and their works will be supervised by the waste management department of GCC and local councilors. GCC has taken a project for waste to energy which is under way. If we establish waste to energy power plant (capacity 40 MW) at Ward no. 23 that will reduce 97-98% of waste in the total generation of wastes in GCC. In addition, GCC will supply three color coated dustbins, Yellow for hazardous waste, Green for food wastes, and Red for medical wastes to HHs level to keep their wastes as per nature of wastes. To build capacity of city dwellers, GCC will take awareness session on solid wastes collection, and management which will be started February 15, 2024, at all 57 wards. Awareness sessions will be carried out at primary & secondary school level, mosque and health centers, and other social institutes, and households' level also. The waste company will segregate waste in the secondary transfer station. So, it's not necessary to segregate wastes at HHs level.	Mr. Jahangir Alam, Advisor to the Mayor, GCC. Additional Chief Engineer, GCC,
2	We are satisfied with the presentation, project activities, and city corporation's plan as well. It all covers our expectations, but I wanted to point out an issue that the roads are occupied by small grocers they put their waste to the drains and drain becomes	Md. Iqbal Hossain, Secretary, Gazipur district labor organization.	The city corporation will take immediate actions to protect our drains from putting waste by any quarter. To reduce this problem, we are holding awareness sessions in all 57 wards, where this issue will be included, and polluters will get a message and be aware of this.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.

Sl. No.	Questions/queries	Questions asked by	Responses to the queries	Responses provided by
	silted. In addition, blood from slaughterhouse also clogging the drains, so you want to relieve from this unexpected situation. In addition, some incomplete drains need completion that will help us to get rid of waterlogging during monsoon season.			
3	Due to siltation of drains, waterlogging intensity becomes extensive during monsoon season, and wastes come out from the drains and floating to the adjacent areas that creates very unusual situation, and many of us affected by skin diseases and other diseases. If our drains are cleaned at least once a year, then we can get relief from this unbearable situation. In addition, I have a request to Mayor for the development of an amusement park in Ward no. 32 which will make our children healthier.	Mahbubul Alam Bhuiyan, local community member, Ward no. 35.	Under this project, we have some drain subprojects, and excavation and re-excavation, so, after implementation of these subprojects, there will be some substantial development, and people will get relax from this unbearable situation.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.
4	Due to haphazard waste management, our rivers, canals, and surface water sources become polluted day by day and our fish species become extinct, already many of us fishes are extinct and many of them put in danger or near to extinction. Gazipur has a diversity of 07 rivers, so, I will request that if any initiative is taken to dredging or cleaning the wastes from the rivers, that will help reoccurring our fisheries resources and other aquatic animals.	Jahirul Amin, District Fisheries Officer, Department of Fisheries, Gazipur.	Our rivers are contaminated by industrial waste, basically, chemical wastes. We already discussed with our minister of environment, forest, and climate change and he ensured us that he will help us to restrain our khal, beels, canals, rivers from polluters. So, GCC will work closely with the Ministry in this regard, and we have a meeting tomorrow where we can take some decisions in this regard.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.
5	There is canal, which is started from Kashimpur, and falls to Turag River but currently this canal is going to extinction by encroachment of influential people, they are making their factory, residential building in some parts of this canal, that's why, the size of	Md. Saiful Islam, Councilor Ward no. 35	We will visit this area, if we find any illegal activities to encroach the canal, we will take stern action, and the canal will be reinstated at any cost.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.

Sl. No.	Questions/queries	Questions asked by	Responses to the queries	Responses provided by
	the canal is reduced. Even, 20 feet of 25 feet wide canal is now occupied by a factory owner, he is building the sewerage tank in this area. So, I would like to request the honorable mayor to take immediate action against the occupants and the canal should be restored in its previous condition.			
6	I will request to re-excavate the canals for not only navigation but also there should be a walkway on both sides of the canal, that will be used as recreational center, People can walk and enjoy their leisure time, just like Thailand, I saw in Thailand, the Thai government made this type of development in the canals and river sides. Now, people use it and it makes them very happy.	Md. Shahin Alam, Councilor, Ward no. 19	GCC will take this initiative very soon. We will assess the opportunity where we can make this type of development. Thanks for your query.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.
7	There will be a bridge under this project in Ward no. 14 so, I will request you to take a quick initiative to start the construction of Kashimpur bridge. In addition, re-excavation of a canal in Ward no. 14 which connects Ward no. 15 is also necessary, now the situation is so flawed, during monsoon, even medium raining, the canal is overflooded and water logging placing over the total areas. That makes our life very difficult and unhealthy. So, if GCC takes immediate action to excavate this canal that will help us to get an advancement, and our lives become more comfortable etc.	Lipi Akther, Female councilor, Ward-13, 14 and 15.	We have a plan to dig out this canal, now we are assessing this as a priority basis. So, we should wait for a while to see the real progress in this regard.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.
8	There should be some development works like roads, drains, in between Mosque and Al hera road, this area is being deprived since long, but we don't know the reason for that. Anyway, we would like to request our mayor to take	Engineer Abdus Sattar Abu Masud, local resident at Ward no. 19	We will assess the requirements and if we find it is necessary to take immediate action then we will do it, no problem.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.

Sl. No.	Questions/queries	Questions asked by	Responses to the queries	Responses provided by
	immediate initiative to construct a road and drains in these areas.			
9	People are dumping their wastes in the open drain in Ward no. 1, and the drain becomes polluted and silted; when heavy rain comes the total areas becomes flooded, water logging will continue over the monsoon season. Now we cannot bear this situation. So, we will request our mayor to take immediate action and clean the drain to get rid of the situation.	Parvin Akther, female Councilor 1, 2, 3 no ward.	We have a plan to clean, and re excavate this drain, so, we will have some progress in this regard before the next rainy season.	Mr. Jahangir Alam, Advisor to the Mayor, GCC.

8.5.4 Public Consultation Meetings at CuCC

As part of Environmental Impact Assessment (EIA) study, a large-scale public consultation meeting was held February 13, 2024, at City Corporation Conference Hall, Cumilla City Corporation (CuCC) for 'Red Category Subprojects'' for landfill site development at Jhakuni Para and over all solid waste management of the city and Gungaijury-Racecourse canal re-excavation. The project is financed by Government of Bangladesh (GoB) and Japan International Cooperation Agency (JICA), implementing from July 2020 to December 2027. The project is being implemented by the Local Government and Engineering Department (LGED) and Cumilla City Corporation (GCC). The detailed of the red category subprojects is as follows:

Sl #	# Code	Name of subprojects	Quantity	Environmental Category (ECR 2023)
1	CuCC-SWM-1	Improvement of solid waste management and improvement of landfill sites at Jhakuni Para	1 no.	Red
2	CuCC-D-4	Re-excavation of Gungaijuri-Race course canal	7.9 KM	Red

Background of Participants:

A total of 80 participants attended in the consultation meeting, were from Department of Agricultural Extension (DAE), Department of Fisheries (DoF), Bangladesh Forest Department (BFD), Department of Welfare, Department of Environment (DOE), Department of livestock (DoL), and non-governmental organizations of SRISTY, local journalists, cultural activists, project affected people (PAPs), and local community people and among others. The meeting was presided by the acting Mayor and sessions facilitated by environmental experts, landfill expert, executive engineer and project focal point etc.

Session Plan:

The Public Consultation Meeting was held on February 13, 2024, followed by 05 different sessions including discussion (questions and answers) which is detailed in below table 8-6.

Table 8-5: Session plan at CuCC

Sl No	Session heading	Time	Session led by
1	Introductory session	10:30 AM	Action Mayor of GCC
2	Presentation on Red Categories subprojects and EIA procedures	11:00 AM to 12:00 PM	Environmental Expert of DSM Consultant, LGED.
3	Presentation on Landfill development procedures	12:00 PM-12:30 PM	Landfill Expert of DSM Consultant, LGED
4	Discussions (Questions and Answer session)	12:30 PM to 1:30 PM	Acting Mayor of CuCC
5	Concluding Remarks	1:30 PM to 1:45 PM	Acting Mayor of CuCC

Table 8-6: Discussion summary of PCM at CuCC

#	Questions asked by:	Discussion and Results
1	Queston asked by: Syed Raiyan Ahmed, Ward Councilor, Ward no.: 5	City corporation consisting of 27 wards, but dumping site is outside of the CuCC, at Jaganathpur Union where I am residing, my first question is: Why is city corporation waste being disposed of in union parishad, means, out of city corporation? CuCC Sadar South has no wards where huge unused land is available but why dumping site development plan is not undertaken in those areas? There are 6/7 villages near the dumping sites where people live with miserable, people suffering from serious health problem, for example, conceiving rate is decreased, and which is now rare! premature birth is frequently found, relatives are not visiting our households because of this dumping site. We don't even get marriage of our daughters and sons in a timely manner, even if any proposal comes but when they visit our households, they have lost their interest in getting a relationship? We are facing this problem every day and we cannot bear it further! I support the planning of this project, but I have a suggestion if hard poly bag or wastebin will supply at HHs level for source segregation like keeping of plastic waste in one bag, hazardous waste for another bag and kitchen waste in a separate bin etc. this type of facility should build the HHs capacity, for having this type of facilities, CuCC can provide tax rebate or subsidies to the HHs level for waste management. However, I will request you to involve local people in giving work opportunities during the construction period. This will reduce unemployment rates in those areas. As the dumping site in the union areas and covering of surrounding 6/7 villages, wastes from these villages/ areas should be managed by CuCC.
2	Replied by Replied by Acting Mayor, CuCC:	Our first target is drainage system development. Now we are working on it, we have several schemes under this project to improve the drainage system of the city corporation that will reduce waterlogging. We will excavate all the canals as required to make this city more resilient. We'd like to thank JICA for their funding in CuCC and implementing these types of important schemes. We are trying to catch up on another project on waste-to-energy if it is possible, then, the volume of waste will be reduced, and we will manage our waste environmentally friendly. CuCC will arrange to collect and manage waste from the surrounding areas of the dumping site and will improve the landfill site in such a way that local

#	Questions asked by:	Discussion and Results
		people will have a good environment for living and no impacts to your daily lives.
3	Questions asked by Engineer Md. Yousuf, Urban Planner, CuCC:	I'd like to propose the establishment of wastewater treatment plants at 3 different outlets to protect the CuCC from water logging, to make pollution free city, and confirming healthy local biodiversity. And it is to be the latest possible solution to make the city livable.
4	Replied by Acting Mayor, CuCC:	Under this project, wastewater treatment will not be constructed, however, CuCC will consider it in future for confirming more resilient city.
5	Questions by Helena Akther, Local Affected People from Jhakuni Para:	Our living status is miserable, unbearable, waste problems put our lives in danger, dumping wastes consisting of animal dead bodies, medical waste, and hazardous wastes, that is affecting our lives greatly. The number of dogs has increased in this area; our children are at risk due to uncontrolled dogs and animals. Wastes borne diseases are frequently found, many diseases transmitted by the dogs and other animals that make our lives very difficult during heavy rains, wastes overflooded to near roads and HHs, Dysentery, diarrhea, and other diseases are very common, we are suffering from these diseases, and our expenditure has been increased. We have so many social problems, we don't make new relatives, relatives are not interested in visiting us, and our social status is down dwelling because of this dumping site.
6	Replied by Mr. Harun, Landfill expert:	We know that Open landfill has so many problems what about discussed in this meeting, every point is valid and very true! But when this open dumping site is converted to sanitary landfill, then, people will get rid of all kinds of problems permanently. So, after development of sanitary landfill site, the local people and surrounding environment will benefit. In addition, the value of land property will increase at several times. However, in the sanitary landfill site, there will be a small wastewater treatment plant to treat the leachate. After treatment, wastewater will be used in the agricultural field for irrigation purposes.
7	Questions asked by GM Md. Kabir, Divisional Forest Officer, Cumilla	Does the project take any initiative to segregate the waste at source? Providing Yellow, Green, and 'Red' bins to the commercial areas, HHs level, educational Institutes! In addition, clinical waste has dangerous events, hazardous elements, so, how will this clinical waste be managed by this project? Could you inform us a little bit more in this regard?
8	Replied by Mr. Harun, Landfill expert:	Ward no. 6 would be a modelled ward including taking all types of possible measures. Like source segregation, making Secondary Transfer Stations (STs) etc., after piloting in Ward. 6, we will see the progress. In the piloting phase, waste will be collected from commercial structures and busy areas, and HHs level based on performance-based activities. So, progress will be evaluated, if it satisfies us, then, it will be replicated to other wards. Medical or clinical waste will also be managed by this project, but it is in the very initial stage, still modalities of clinical waste management have not been fixed, we are working on it and soon we will share our plan in this regard.
9	Questions asked by Salma Akter, Executive Director of Shirsty, a local volunteer organization.	I totally agreed with the previous speaker's opinion. As I am engaged with the hospital management committee, we face so many questions from the city people. However, I have learnt that so many local people should be involved with the project activities, GRC should be worked properly to receive grievances, resolve, or address the issues or concerns. SO, I request you to include local people in the GRC and other committees or groups.
10	Replied by Environmental Specialist of DSM, LGED	In the Grievance Redress Committee (GRC), one or two members from the local affected people will be included in the GRC. However, there is no other committee formed under this project. Stakeholder consultation is an ongoing process; we will talk and connect to the local people as required.

#	Questions asked by:	Discussion and Results
11	Questions asked by Mr. Rabiul Alam Pervez, Deputy Director, Department of Environment, Cumilla District.	I would like to suggest if waste to energy project and landfill site management should be carried out in a coordinated way then it's possible to avoid duplicate**.**
12	Replied by Acting Mayor, CuCC:	Waste to energy project will reduce the volume of waste at the landfill site. In future, we will make a necessary coordination among these two projects for successful waste management in CuCC .
13	Questions asked by Abul Hasnath Babul, Eminent journalist:	These types of issues were discussed in previous meetings. To protect the natural environment, CuCC has taken so many steps like widening the road that would benefit the city dwellers. For waste management, Jaganathpur Union people are suffering a lot, however, secondary transfer station is insufficient, CuCC would require more equipment and vehicles, and waste management scheme should give priority to the local people interest, recycling value should be considered etc. However, does the city corporation have any plan to clean the existing canals, taking navigational flow that would help people to get rid of the distress? The JICA project should consider all parts of the CuCC do not focus on any specific Ward etc.
14	Replied by Acting Mayor, CuCC:	Local people will be included in the project activities, considering them either regular or contractual employment and necessary coordination will be ensured all times by CuCC. CuCC was established at the same time as Dhaka city establishment. But we don't make our city in such a way what we want! We are working, I'm very hopeful that we will build our city as per our dream. That's why we take our every step very carefully, we make our plan considering the city dwellers demand. For your kind information, we already have constructed some slaughters house across the city areas, so people will get good access to manage slaughters during Eid-Ul-Adha as required.
15	Questions asked by Rashed Mamun Chairman, Jaganathpur Union Parishad	I got the training on solid waste management from Sri Lanka in 2011 where I saw a very good approach to waste management. I'd like to thank you CuCC for taking initiatives for SWM. I'm not a competitor, I'd like to support CuCC for any kind of assistance from Union parishad. Now the city is expanded, dumping areas should be developed in a sustainable way that would not spoil our lives. CuCC waste carrying vehicles don't maintain any rules to dump their waste, sometimes, they dispose of the waste on the roadsides that is very embarrassing for us. I'd like to request to make a very high boundary wall surrounding the dumping site, and this land fill site does not have adequate land. So, alternate sites should be considered. Ward no.4,5,6, 16, 17, 18, and part of Jagannathpur Union, Jabaikhal would require re-excavation immediately. Biofertilizer, biogas, waste to energy etc., this can be possible from SWM, so, we must think about it. Water logging is a major concern of Jaganathpur Union, so, if we excavate the canals properly then we will benefit. Ward 1,2, & 3 wards of Jaganathpur union, so, wastes from these areas should be managed by CuCC, in addition, they can help us to control mosquitoes in these areas. I'd like to request, during Eid Ul Adha, CuCC should supply necessary medicine in my area to use in the slaughtering **locations** to protect the local people from bad odour .
16	Replied by Acting Mayor, CuCC:	CuCC will work together with Jaganathpur Union closely to manage waste, canal re-excavation and other development works. CuCC will include the surrounding wards of Union Parishad to collect and manage their waste. In the third point, we will provide necessary medicines to the

#	Questions asked by:	Discussion and Results
		slaughtering locations during Eid-Ul-Adha festival to remedy the bad odor and other environmental pollutions.
17	Questions asked by Sheikh Zahir, Cultural activist:	Canal re-excavation should be extended to Dakatia River, wastewater should be managed scientifically including all factories in CuCC.
	Replied by Acting Mayor, CuCC:	Re-excavation ultimately will be up to Dakatia River otherwise we will not bring the benefit from the re-excavation scheme.

8.5.5 Public Consultation Meetings at CBP

8.5.5.1 Introduction and Background

In accordance with the EIA Guideline of Department of Environment (DOE), 2021, Urban Development and City Governance Project (UDCGP) would require a comprehensive stakeholder engagement plan to involve the local community in the development process including Project Affected People (PAPs). To assess and lessen the negative impacts to the community people, livelihood and property and natural environment, necessary mitigation measures would be undertaken. Due to mitigating the problems, regaining beneficial influences will be strengthen and have a positive impression to the local people.

To involve, participate, and communicate with community people means, respect and value their opinions, suggestions and make them fully understandable with the project activities. This will also help a proper design following public opinions. Accordingly, JICA guidelines for environmental and social considerations 2010, it's important to get involvement with affected and interested parties as required and their opinions must be considered while the project will be implemented in those areas. In addition. National regulations like Environmental Conservation Rule 2023 have the obligation to carry out consultation with both affected and interested and public who are directly or indirectly involved with the project activities.

As part of EIA preparation, a large public consultation meeting (PCM) was held on December 18, 2023, at Cox's Bazar Paurhashova in the meeting room of CBP. The meeting was participated by different governmental, non-governmental, civil society, women leaders, eminent citizens, and project affected people. A total of 53 participants were present at the meeting. The following representatives took part in the PCM-1 as follows:

Sl #	# Code	Name of subprojects	Quantity	Environmental Category (ECR 2023)
1	CBP-SWM-1	Improvement of central solid waste management situation in Cox's Bazar (collection vehicle and heavy equipment procurement and closure of existing open dumping site in central market) at Pana Market, and construction of new landfill site at SM Para.	1 no.	Red

Table 8-7: participants representations in the PCM regarding designations and organizations

Sl. No.	Organizations	Remarks
1	Cox's Bazar Pauroshava	Mayor, CEO, Engineers, Consultants

2	Department of Environment (Cox's Bazar)	Sr. Chemist
3	Local Government Engineering Department	Superintendent Engineer, Executive Engineer, DPD
4	Department of Forest (DoF)	Asst. Conservator
5	Department of Fisheries	Fisheries Extension Officer
6	Department of Agriculture Extension	Agriculture Extension Officer
7	Bangladesh Red Cresent Society	One Representative
8	Department of Livestock (DoL)	Sub. Asst. Livestock Officer
9	Sr. Program Officer	BRAC NGO
10	IUCN representative	One person from IUCN
11	Department of Public Health Engineering (DPHE)	Executive Engineer
12	Local School teacher	One person
13	religious representatives	Mosque Imam
14	Indigenous People representatives	One representative
15	local women leader,	One person
16	Local Affected People (PAPs)	Five persons etc.

Note: The detailed information of the participant list is given in annex 1.

8.5.5.2 Discussion summary

The participants were interested, whereas they actively took part in the discussions, provided their opinions, suggestions, and advice for further consideration during project implementation. Participatory method was followed in the PCM, and relevant agency means CBP, and LGED/ consultant replied to the queries, questions and elaborated the discussions sessions to further extent.

In the discussion panel, representatives from Cox's Bazar Pauroshava, mainly Chief Executive Officer (CEO), Panel Mayor, Superintendent Engineer, and Deputy Project Director from LGED was taken to elaborate the discussions and replies to the questions, or queries relating to the project implementation.

and LGED/DSM Consultant team, was replied to the questions, queries asked by the participants and make them aware of the project activities and further requirements of consultation in second stage which will be held in next year May or June 2024. The summary of discussions is given below Table 8-8.

Table 8-8: Summary of PCM discussions at CBP

Sl. NO.	Questions asked by	Questions/ queries regarding waste management	Replies to the questions
1	Rashel Chowdhury, Project Implementation Officer, Deputy Commissioner Office (DC), Cox's Bazar.	E-waste, heavy metals affecting the agriculture seriously, as this project is working with waste management, how 3 types of wastes are being specified and what is the method of waste segregation at HH level?	To reply to this question, the CEO of CBP replied that this project will not be constructed in any agricultural field, however, every aspect will be included in the EIA report. When the 2nd round consultation meeting is held again in the next year, May or June 2024 in CBP, this issue will elaborately be addressed and share with you once again.
2	Chief Executive Officer of CBP	Is there any option to segregate waste at HHs level by this project?	Landfill expert replied that this project will not involve in any segregation process at HHs level, only focusing collection,

Sl. NO.	Questions asked by	Questions/ queries regarding waste management	Replies to the questions
			transportations, and landfill management system.
3	Representative from BRAC NGO	Does this project build STS (secondary transfer station at Ward level for collection and transportation of waste)	Still, it is under process to include some STS in the CBP areas as temporary storage facilities for collection of wastes from HHs, but nothing is not yet finalized replied by landfill expert of DSM consultant team.
4	Beauty Barua, Indigenous People representative and local PAP	The proposed landfill site is selected within 300 m from my household so we are worried about the waste management issues that will affect our health seriously.	When we complete the landfill site for waste management that will be scientifically and environmentally acceptable. So, HHs will not be jeopardized due to landfill site development in this area. However, the project will consider all sorts of alternatives to develop SWM landfill site in SM para, replied by CEO of CBP.
5	Abdus Salam, Sr. Chemist, Department of Environment, Cox's Bazar	Haphazard management of waste generated by tourists and wastes come from the sea wave, does this waste be managed by this project?	Acting Mayor, Salahuddin Setu, replied that Beach areas is under jurisdiction of Cox's Bazar Development Authority and Deputy Commissioner Office, so, Pauroshava has nothing to do beach wastes. And he requested to ask this question to the relevant agency to take immediate mitigation measures otherwise good will of Cox's Bazar will be destroyed and it'll not be acceptable by the foreigners, and they don't like to go there and visit our Cox's Bazar.
6	Mujibul Islam, local journalist	As the site is a tourist area, giving importance on solid management with lessen the impacts on natural environment. So, how will this project include these issues in their waste management systems while they are developing the landfill site in Cox's Bazar.	Environmental Expert of DSM team replied that a comprehensive Environmental and Social Mitigation Measures will be developed where solid waste management issues and landfill site management will be exclusively included and in the next meeting (May/June 2024) we will inform you in this regard.
7	Shymol Kumar Ghose, Asst. Conservator, Department of Forest (BDF), Cox's Bazar.	Does this project require clearing of trees? If yes, how will this impact be managed by this project during the project implementation period? Is there any study on different types of bio species in the project area and what impact is anticipated for these species? How can it be managed further?	CEO of CBP replied that this project doesn't require clearing of vegetation or trees, however, if any trees require clearing then replantation plan will be executed (1:3) after completion of construction works.
8	Md. Ali Ashraf Bhuiyan, Sub. Asst. Livestock Officer, Department of Livestock (DoL), Cox's Bazar	I would like to request the project authority to assess the impacts on livestock due to the project activities and it should be practically mitigated otherwise it will not reduce the problems. If the project authority wants, the	Noted with thanks. Environmental Expert of DSM team replied that impacts on livestock will be added in the Environmental Management Plan accordingly following this suggestion. In the next meeting, we

Sl. NO.	Questions asked by	Questions/ queries regarding waste management	Replies to the questions
		Department of Livestock will help and guide them to make sensible mitigation plan that could help our livestock.	will inform you about details in this regard.
9	Liton Debnath, District Training Officer, Department of Agricultural Extension (DAE), Cox's Bazar.	Construction wastes and food wastes and other hazardous and E-wastes are seriously affecting our agricultural land, especially, liquid wastes discharge by the project to the crop field is a serious issue. We expect different types of waste will be generated by this project also, but what will be the mitigation plan to fix this impact? Because we don't keep or protect our agricultural land, ultimate development will not be sustained, and our existence will be at risk.	To reply to this query Environmental Expert of DSM team said that Contractor will prepare a comprehensive Construction Environmental Management Plan (C-EMP) addressing the issues of construction wastes management, liquid wastes discharged by labor camp, and others, even, it is also included in the EMP of EIA, hopefully, in the next meeting, we will inform you in detail.
10	Bimal Joyti Chakma, Fisheries Extension Officer, Department of Fisheries (DoF), Cox's Bazar	Cox's Bazar is a fish diversity area, it has abundant sea fish and freshwater fish which is very rare in the coastal areas in any country, however, it is our luck that we have some limited numbers of freshwater fishes in these areas. There are so many projects around 57 different development projects are now implementing in this area, we are concerned that freshwater fishes will go extinction due to various project activities if the environmental risks are not properly mitigated? So, I want to know what the current plan of this project is to keep the fish diversity undisturbed and/or avoiding or lessening the impacts?	Replying to this query, the CEO of CBP replied that this project will have very little or no impact on the aquatic species, as most of the project activities will be implemented in the core areas of the city. However, I hope this is to be assessed in detail in the EIA report and inform you in the next meeting in this regard.
11	Sharif Ullah Bhuiyan, Project Manager, DSK, Cox's Bazar	DSK is also working with municipality solid waste management issues, so, if there is any opportunity to make joint effort, DSK will be ready to extend their support for making sustainable Cox's Bazar Pauroshava.	Acting Mayor Sala Uddin Setu replied that CBP will consider DSK proposal and try to collaborate in future for solid waste management.
12	Salahuddin Setu, Acting Mayour, Cox's Bazar Pauroshava	Vote of thanks.	The Acting Mayor concluded the session with a vote of thanks and request for future collaboration and expected to be present in the next consultation meeting in the next year May/June 2024 for a successful and impactful EIA preparation.

8.6 Focus Group Discussion

8.6.1 General Information

A number of FGDs were held with the local people at GCC, NCC, CuCC, and CBP in 2023-2024 regarding the project activities. The list of FGDs is given below:

Table 8-9: List of FGDs held at the project working areas

Sl. No	FGD location	Name of ULB	Date	Total participant
1	Ward no. 11	CBP	30.07.2023	08
2	Ward no. 10	CBP	30.07.2023	07
3	SM Para, landfill site	CBP	05.01. 2024	08
4	Ward 21	CuCC	25.07.2023	08
5	Jhakuni para, landfill site	CuCC	25.07.2023	08
6	Medical College Road	CuCC	26.07.2023	08
7	Ward No – 18	NCC	02.08.2023	08 with 03 female participants
8	Alamin nagar landfill site	NCC	02.08.2023	08
9	Najor-Kashimpur	GCC	19.07.2023	18 with 5 female participants
10	Konabari, Notun Bazar	GCC	19.07.2023	10

8.6.2 Summary of Discussions

The summary of discussions is given below:

Table 8-10: Summary of FGDs discussions

Name of ULB	Discussion summary
GCC	• People doesn't aware about the project activities. • They appreciated the project, particularly for railway overpass to reduce their waiting time. • Waste management is not properly done by the city corporation, wastes spillage, bad odor, flies, insects, unhealthy condition is regularly bearing by the city people. • So, if waste management really improved under this project, it will be impactful and appreciate for releasing them from unhealthy condition to health and environmentally livable conditions.
NCC	• For landfill site development, the people of ward no. 18 will get release from the distress and unhappiness caused by open dumping at Alamin nagar. It's unbearable and unacceptable. So, if this project improves the quality of life of the people in those areas, it is very appreciable and will support as it is required.
CuCC	• Local people don't want to keep the landfill site in Jhakuni para, they suggested for new areas and shift this landfill site to the other areas. • They feel sickness, unhappiness, and a lot of unbearable memories they put in their mind daily. • They don't arrange marriage for their daughters because of this landfill site. • However, if this project will remove this distress through applying modern technology, if there is no foul gas, no foul odor, no other problems then they can support city corporation for further development.
CBP	• The people requested to shift the open dumping site from Pana market areas, the local residents are becoming mentally sick and it's destroying the city's beauty and beauty of longest sea beach in Cox's Bazar. • In SM para for landfill site development, the project must conform the national regulations and one and only fresh water source Bakkhali River should not be

	polluted if it occurs, then CBP people will face disasters, groundwater will be contaminated and local fish and other species will die, so, development must be environmentally friendly without destroying any natural barriers.

8.7 Public Disclosures

Primarily a few information on the project was disclosed verbally (without any formalities) during initial public consultations during the EIA study. It is essential to continue this consultation process to ensure that the community remains supportive and that they are fully informed of progress particularly before and during the construction period. In addition, the community will be given information on the grievance redress mechanism and that regular meetings will be held with the community in the future. Once the project construction has been defined, further community meetings must be held to provide details of the construction program and to give information on the grievance redress committee. Thus, consultations process will remain an integral part of Project management and implementation.

A combination of mixed methods of information disclosure and consultation process was adopted at this stage of EIA preparation. The method selected for consultation was basically designed based on the profile of the stakeholders, type of information desired and level of engagement required. In each consultation session the consultant introduced themselves, introduced the project and the purpose of engagement with the respective stakeholder. The primary methods followed in the consultation process are:

- Key Informant Interview and
- Focus group discussion.
- Public Consultation Meeting (PCM).

One large public level consultation meeting was held in each ULB during this EIA preparation. The stakeholders consulted include local People, community around the project area, locally elected representatives and other external stakeholders such as relevant government officials. The details of consultations held with issues raised or discussed and suggestions provided by the respective stakeholders were described earlier in this chapter.

Disclosure of EIA:

The draft EIA report will be disclosed on the LGED and DOE websites. Many of the community may not have access to the internet, therefore face to face meetings and hard copy or summary of the EIA report both in English and Bangla language will be made available to the local communities or other interested stakeholders. Both summarized reports will briefly present (i) the Project impacts; (ii) mitigation measures and entitlement matrix; (iii) grievance redress mechanisms; (iv) the institutional framework for Project implementation.

8.8 Documenting Public Participation

All photographs, attendance sheets and newspaper circulation have been attached in Annexure-4, Volume-II of the EIA Report.

9.0 Grievance Redress Mechanism (GRM)

9.1 Need for GRM

The JICA Environmental Guidelines mentions:

“Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In addition, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.”

As the subprojects under UDCGP are located in the immediate vicinities of local communities, it is likely that grievance may come up at any point of the construction period which needs to be solved.

In accordance with the JICA Environmental Guidelines, a functional and accessible mechanism must be provided to enable people and entities who feel that they have been affected by subproject interventions at local level to have their concerns addressed in a timely, even-handed, and transparent way. A Grievance Redress Mechanism (GRM) will be established by the PMU, and this will be applicable to all infrastructure developments approved for implementation under the Project. Operation of the GRM for the Project locations will be overseen by the Project Implementation Unit (PIU) under the guidance of PMU.

The GRM is a formal structure for accepting, acknowledging, evaluating, and responding to grievances. The design of the GRM aims for simplicity and consistency, so the process of filing a complaint is understandable to all and is the same for everyone, no matter their education, social status, or political affiliation. In operation, the GRM should be gender-responsive (female complainants should have the opportunity to have their grievances heard and responded to by a woman or women), culturally appropriate (complainants should be heard and responded to in their own language whenever possible), accessible (verbal complaints should be accepted and responded to just as for written ones so even people of limited literacy can lodge a complaint), and time-bound (timelines for responses must be publicized and strictly observed so complaints are never left languishing, unresolved).

9.2 Structure and Process of Grievance Redress Mechanism

The GRM will have a three-tiered structure to ensure that grievances are dealt with at the most appropriate level of capability and authority. Grievances will normally first enter the GRM process at the first tier and proceed further only if acceptable resolution is not possible there. The three layers of the GRM, and the procedures to be followed within each, are explained below.

9.2.1 GRM Level 1

The site manager or resident engineer under each PIU shall be the designated contact person for verbal or written filing of grievances at the first tier. Response and attempted resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with the complainant, other affected people, contractors, and other relevant parties such as local NGO representatives, as appropriate to the complaint. If the complainant is a woman, arrangements should be made for a female mediator to be involved

in the interaction. If the complainant cannot communicate in Bengali, arrangements should be made for an interpreter.

Grievance redress will be documented by collation of the following: (i) timeline of initial complaint, site visits and resolution actions; (ii) initial grievance record (transcribed if delivered verbally) detailing the nature of the complaint; (iii) copies of correspondence (transcripts if verbally delivered) between the parties; (iv) personal details of the complainant (unless anonymity is requested for personal safety reasons); (v) measures taken to attempt to resolve the grievance; and (vi) a closure statement signed by the complainant if the grievance has been resolved at Level 1. If the grievance has not been resolved or been mutually acknowledged to be on its way to being resolved after 7 days, it will be referred by the PMU's executive engineer to Level 2.

9.2.2 GRM Level 2

Unresolved grievances referred to Level 2 will be managed by a local grievance redress committee (LGRC) set up by the PMU. The LGRC will be chaired by the representatives of CCs or CBP, and member secretary will be the executive engineer of PMU whose subproject components are implicated in the grievance that spurs activation. Other members of the GRC will include (i) the resident engineers (REs), & Asst. engineer of PMUs as appropriate to the location; (ii) a representative of the relevant local ward councilor office; (iii) a representative of relevant female ward councilor's office; (v) a representative from the contractor(s) , (iv) a representative from the local people and (v) one or more representatives of any relevant locally active NGOs or civil advocacy groups..

When convened to address a grievance, the LGRC will review the documentation from the Level 1 process and hold a hearing to give the complainant the opportunity to present his or her concerns and proposal for resolution, through a representative if desired. If the complainant is noticed by a woman, arrangements should be made for a female mediator to be involved in the interaction. If the complainant cannot communicate in Bengali, arrangements should be made for an interpreter. If any contractors are implicated in the grievance, they shall be invited to send a representative to the hearing to answer questions from the LGRC members. The hearing process will aim to facilitate resolution through mediation and consensus. If consensus proves impossible to achieve, a simple majority vote of the LGRC members will decide the proposed resolution. The LGRC will indicate corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The outcome of the hearing will be communicated to the complainant in writing, or verbally with a written transcript kept if the complainant has limited literacy. Minutes of the hearing and copies of all communication will be given to the member secretary for filing in a central grievance redress database. If the grievance is resolved, a closure statement signed by the complainant will be completed and added to the record. If the resolution proposed by the LGRC is unacceptable to the complainant, the grievance will be referred to Level 3.

9.2.3 GRM Level 3

Unresolved grievances referred to Level 3 will be adjudicated by a grievance redress committee (GRC) at the central level, to be convened by the project director only when needed. The Program GRC will be headed up by the project director; other GRC members will include: (i) the Deputy Project Director of the PMU implicated in the grievance; (ii) representatives of the CCs; (iii) member secretary of level 2 GRC, (iv) Environmental Expert / Resettlement Expert of the project (vi) a foreign representative from the consultant team, ; and

(iv) representatives of locally active NGOs and public interest advocacy groups who participated in the LGRC earlier. A hearing will be held, during which the complainant (through a representative if desired), the executive engineer of level 2 GRC will brief the grievances those are unresolved (if any), and the project director or deputy project director, will be asked to present their proposals for resolution. The GRC will attempt to achieve consensus on a resolution and will decide by simple vote if consensus proves elusive. If the complainant is a woman and none of the GRC members is female, arrangements should be made for a female mediator to be involved in the decision-making. If the complainant cannot communicate in Bengali, arrangements should be made by the GRC for a translator to assist. The GRC will indicate corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The process and decision will be documented and communicated as Level 2 of the GRM. If the resolution proposed by the GRC is not acceptable to the complainant, the complainant may decide to pursue the matter further through the legal system.

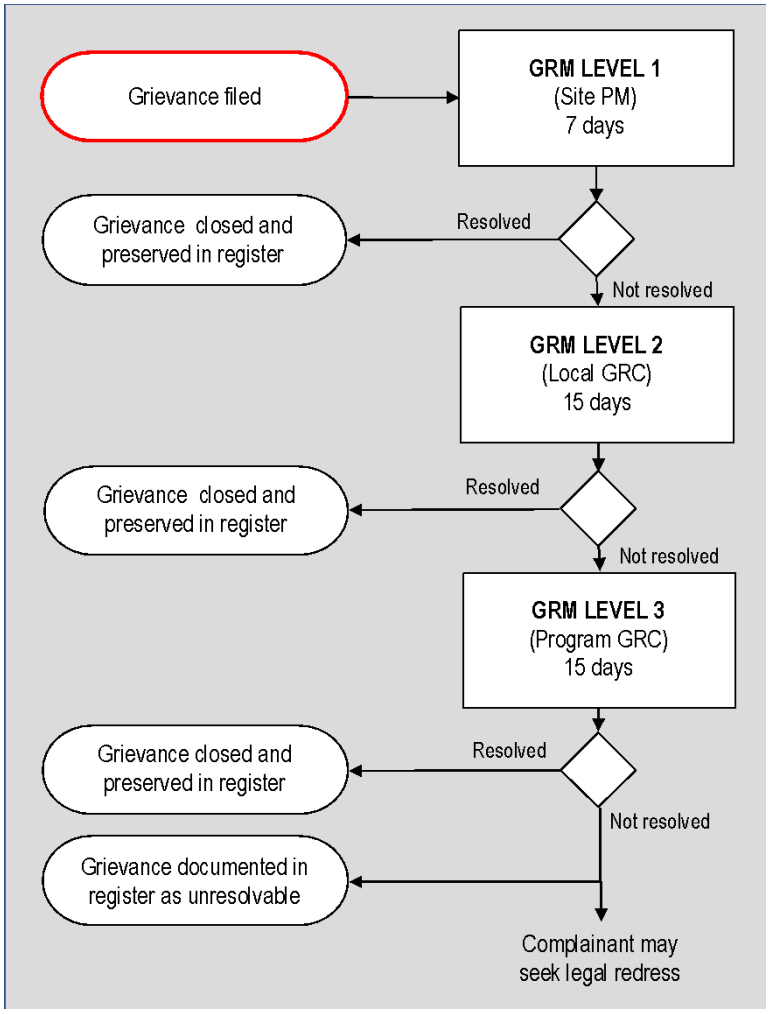


Figure 9-1: Schematic diagram of the GRM

9.3 Administration of Grievance Redress Mechanism

The executive engineer of level 2 GRC shall be responsible for making the public aware of the GRM in all project locations, explaining how it works and how to use it, and maintaining its accessibility and operability for the full duration of the construction phase and the defects

period. Public awareness campaigns should be carried out at the local level in advance of the start of civil works. Contact information, including for written, telephone and in-person filing of grievances, shall be firmly established at the GRM's inception, and kept up to date and publicly available through the end of the defects period.

Records of grievances received, corrective actions taken, and their outcomes will be properly maintained by the GRC (level 3) in a central grievance redress database. Grievances and resolutions will be included in the PMUs' quarterly progress reports and the quarterly environmental monitoring reports submitted to JICA. The costs of operating the GRM will be very modest and will be covered by the operating budget of the PMU.

9.4 Grievance Redress Mechanism for Workers

An additional mechanism shall be set up by the PMU to accept and address complaints from workers employed in the construction works, concerning working conditions, living conditions in construction camps, safety and health issues, labor rights violations, mistreatment, or any other matter. All laborers, skilled workers, and site engineers employed on site by the primary contractor or by any of its subcontractors shall have access to the mechanism. All workers will receive an orientation to the workers' GRM during pre-construction induction training.

Workers will be able to lodge grievances with on-site personnel of the CSC, who will record the complainant's name, position, employer, and contact information, as well as a description of the complaint and the time, date, and place at which the complaint was reported. The CSC will inform the PMU, which will record the grievance in a grievance register. The PMU will convene a conference call with the CSC, contractor or subcontractor involved, and any labor syndicate to which the complainant may belong to decide on an appropriate resolution of the complaint. The LGED PMU's Environmental Safeguards Focal Person (ESFP) and on-site Environment, Health, and Safety Officer (EHSO) to monitor implementation of the proposed resolution and confirm absence of retaliation on the part of the contractor involved, or its agents. If the complaint cannot be resolved to the worker's satisfaction, the worker will be given the information needed to file a complaint with the field level GRC (level 1). The member secretary of each GRC will compile a complete record of the grievance, including measures taken for resolution and follow-up checks by the ESFP and EHSO, and subsequent evolution of the case.

However, if any grievance is not resolved at any level of GRC (level 1, level 2, and level 3), then, the complainants will go to the court for arbitration.

10.0 Conclusion and Recommendations

The construction of new landfill sites in NCC, CuCC, and CBP, the conversion of existing open dumping sites to semi-aerobic landfill sites in NCC, CuCC, and CBP, the construction of a railway overpass (approximately 800m) at Joydebpur in the GCC, the re-excavation of the Gungaijuri-Racecourse canal (approximately 6.7km) at CuCC, and other major project components are classified as Red Category in accordance with the ECR 2023.

A new landfill site in NCC (a total of 23.29 acres), CuCC (25 acres), and CBP (26.50 acres) will require land acquisition. Of these, CuCC has already received administrative approval for the 25-acre land acquisition from the Ministry of Local Government, Rural Development and Cooperative (LGRDC) on April 21, 2024, and the acquisition status in the other two ULBs (NCC and CBP) is pending administrative approval. Nonetheless, the terms and conditions of the Acquisition and Requisition of Immovable Property Act (ARIPA) 2017 will be appropriately adhered to during the land acquisition procedure.

The main negative effects on the natural and social environments during construction are the following: the local air quality will deteriorate; noise and vibration levels will increase; water quality, both surface and groundwater, will be contaminated on a limited scale; soil pollution will be susceptible due to construction activities; disruptions to the local ecosystem; labor influx; occupational health and safety; public health and safety; disruptions to the local economy; increased traffic and transport volume; loss of livelihoods; gender-based violence (GBV); child labor and force labor; and the likelihood of infectious disease transmission to the local community are all common problems at construction sites, but they are mostly short-term, lower significance, and reversible.

The Environmental Management Plan (EMP) proposes onsite mitigation measures to manage and mitigate the expected environmental and social impacts. These measures include preventive measures to control soil pollution, slope protection, dust suppression, improving air quality, lowering noise levels, protecting surface and groundwater resources from contamination, reducing economic loss, offering temporary or contractual employment opportunities to those directly impacted, enforcing stakeholder engagement throughout the project cycle, and other appropriate actions as needed. Additionally, leachate management and monitoring will be carried out during the operation period, especially for the landfill sites, in compliance with the Solid Waste Management Rules (SWM) 2021, taking into account both on-site water quality monitoring and gas composition by using digital toolkits and laboratory tests etc.

Air quality, noise and vibration levels, surface and groundwater quality, and soil quality will all be monitored on a monthly basis throughout the construction phase and on a quarterly basis during the first two years of operation as part of the Environmental Monitoring Plan (EMoP). Additionally, as indicated in the EMoP table, capacity building activities—such as training, awareness-raising, meetings, workshops, etc.—will be conducted on a regular basis among employees, staff, PIU members, and local stakeholders.

In accordance with ECR 2023, a compensation plan that includes contingency budget provisions will be allocated in each ULB during the construction and operation period, taking into account the implementation of each subproject. Additionally, quarterly and annual environmental audits, including external audits by third parties, will be conducted at the

construction sites to monitor the implementation status of EMP and EMoP, with the necessary corrective action plan (CAP) to address any deficiencies that may be found.

Recommendations:

- Land acquisition and compensation plan shall be ensured before commencement of construction works following the ARIPA 2017 and identifying the PAPs and non-title holders appropriately without misinterpretation through social surveys, loss of inventory and other methods shall be introduced as appropriate.
- All mitigation measures stated in the EMP shall be implemented properly
- Environmental Parameters stated in the EMoP shall be examined in the govt. accredited laboratory, and reports with lab test results shall be submitted by the contractors to PIU and PMU monthly
- Compensation plan for minimizing the loss of livelihood and losses of social infrastructures caused by the project activities, and tree plantation plan should be implemented properly.
- Grievance Redress Committee (GRC) shall be formed by the PIU before commencement of construction works and any kind of grievances shall be handled and mitigated impartially.
- Necessary capacity building programs should be carried out over the project implementation period to build capacity of the project staff, workers, and others.
- Stakeholder engagement plans shall be executed over the project cycle considering both construction and operation period, among PAPs, local community, contractors, workers, project staff and other governmental and non-governmental officials as appropriate.
- The leachate treatment plan shall be designed based on the SWM Rules 2021, and quality of wastewater shall be met the standards of SWM Rules 2021.
- Prior commencement of civil works the Contractors should prepare site specific Construction Environmental Management Plan (C-EMPs) based on the EIA report and EMP suggestions and implement it to the construction sites properly.
- Ensure Environmental Clearance Certificate (ECC) from the Department of Environment (DOE) before commencement of construction works and renew it yearly.
- Ensure Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) incorporated in the Bid documents under environmental and social considerations specification to make sure the project has been implemented environmentally friendly, socially acceptable and sustainable etc.

Annexures are attached in Volume-II (separately)