ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)
For
Raw Tech Limited (Waste Management: Polyester Staple Fiber Production from PET Bottle) Project









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Volume I: Main ESIA Report

Raw Tech Limited
原始技术有限公司
A Bangladesh - Hong Kong JV for Sustainable Growth

EQMS

Revised Final ESIA Report

Raw Tech Limited (A Hong Kong Bangladesh Joint Venture Private Limited Company) at Kashor, Habirbari, Bhaluka, Mymensingh, Bangladesh.

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Abbreviations

AEZ	Agro-Ecological Zones
AOI	Area of Influence
AQI	Air Quality Index
BARC	Bangladesh Agricultural Research Council
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BIDA	Bangladesh Investment Development Authority
BMD	Bangladesh Meteorological Department
BNAAQS	Bangladesh National Ambient Air Quality Standard
CAMS	Continuous Air Monitoring Stations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Commercial Operation Date
dB	Decibel
DC	Direct Current
DDM	Department of Disaster Management
DGS	Diesel Generator Set
DoE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
E&S	Environmental and Social
EC	Electro Coagulation
ECA	Environmental Conservation Act, Ecologically Critical Area
ECR	Environmental Conservation Rules
EHS	Environmental Health & Safety
EIA	Environmental Impact Assessment
EPC	Engineering Procurement Construction
ERP	Emergency Response Plan
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESPP	Environmental and Social Policy and Procedures
ESRM	Environmental and Social Risk Management
ETP	Effluent Treatment Plant
FD	Forest Department
FGD	Focus Group Discussion
GIS	Geographic Information System
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanism
HIES	Household Income and Expenditure Survey
HR	Human Resources

HSE	Health Safety and Environment
IBA	Important Bird Area
IDCP	Interest During Construction Phase
IFC	International Finance Cooperation
IPFF	Investment Promotion and Financing Facility
IUCN	International Union for Conservation of Nature
JV	Joint Venture
kg	Kilogram
KII	Key Informant Interview
kV	Kilo Volt
kW	Kilo Watt
LSD	Low Sulphur Diesel
MoEFCC	Ministry of Environment, Forest, and Climate Change
MSDS	Material Safety Data Sheet
MT	Million Tons
NAAQS	National Ambient Air Quality Standard
NOC	No Objection Certificate
O&M	Operation and Maintenance
OHS	Occupational Health & Safety
OP	Operational Policy
PCM	Public Consultation Meeting
PET	Poly Ethylene Terephthalate
PM	Particulate Matters
PPE	Personal Protective Equipment
PS	Performance Standard
PSF	Polyester Staple Fiber
psi	Pounds per Square Inch
RAP	Resettlement Action Plan
RMG	Readymade Garments
RPET	Recycled Polyethylene Terephthalate
RTL	Raw Tech Limited
SIA	Social Impact Assessment
SOP	Standard Operation Procedure
SRDI	Soil Resources Development Institute
ToR	Terms of Reference
UP	Union Parishad
VEC	Valued Environmental Component
WB	World Bank
WBG	World Bank Group

Executive Summary

E-1. Introduction

Every year around 2.0 billion (200 crores) PET bottles are manufactured in Bangladesh and most of them are discarded after single use. Due to its non-biodegradable nature, most PET bottles end up in landfills or in waterbodies. Considering the environmental and social impact of used PET bottles in Bangladesh and to contribute in the mitigation of the posed threat to the environment, Raw Tech Limited (RTL) has taken an initiative to turn used PET bottles which are plastic wastes, into polyester fiber; which is one of the key raw materials in the fashion industry today. Its operations are solely based on the 'recover and recycle' business model in which waste, previously considered useless, are made ready for new use.

The project would have environmental benefits like- Landfill volume reduction (1 Ton of PET = 6.5 Cubic Meters of landfill), solid waste management, lesser carbon emission compared to usage of imported resins (0.91 tons CO_2 saving for per ton of recycled resin). RTL will recycle around 6000 ton of waste plastic annually that will reduce of CO_2 emission indirectly. The economic prospects are also quite substantial such as – $4.8 million import substitution benefits per year, as the total industry is now dependent mostly on imported polyester staple fiber (PSF), Readily available raw materials with less lead time for various industries, new employment opportunities and reduction of Waste Management Cost for the Government are some of the benefits.

In order to assess the environmental and social impacts during construction and operational period activities of the PET bottle recycling plant, Raw Tech Limited (RTL) has appointed EQMS Consulting Limited to conduct ESIA study; in accordance with the national, WB and Bangladesh Bank guidelines and IPFF-II project's ESPP document.

These non-technical executive summary present salient features of the project, the main findings, and the conclusion of the Environmental and Social Impact Assessment (ESIA). The ESIA has been prepared in accordance with the following:

- Applicable Bangladesh national, regional, and local regulatory requirements;
- World Bank OP 4.03 performance standards;
- Environmental and Social Policy and Procedures (ESPP) of IPFF II Project of Bangladesh Bank; and
- The IFC General EHS Guidelines (2007);

According to the Department of Environment (DoE), the aforesaid Project has been categorized as Orange B, which require IEE and EMP. According to ESPP document of the IPFF-II, it is classified in the Medium Risk Category.

E-2. Purpose of the ESIA Study

Raw Tech Ltd. has applied for funding from the Bangladesh Infrastructure Finance Fund Limited (BIFFL), which is a PFI of the Investment Promotion and Financing Facility (IPFF) II Project of the Bangladesh Bank. So, Raw Tech Ltd. has to follow the GoB law as well as WBG E&S compliance guidelines according to WB OP 4. 03 in conducting the ESIA study.

E-3. List of Studies

In the preparation of the ESIA study, a series of sub-studies were conducted. The list of sub-studies that were conducted is given in the following Table E-1. The larger studies are included as standalone reports as annexes and the others are integrated in the appropriate chapters as shown in the table.

Table E-1: List of Studies

Study Topics	Application WBG PS, ESHG or other national/international guidelines	Reference Chapter/ Annex
Policy, Legal, and Administrative Framework	Applicable Standards/ Guidelines PS 1	Chapter 2 Annexure A, B
Project Description & study of the project's area of interest for environmental and social setting and scoping	This is part of screening, which is an important tool for predicting and understanding potential environmental and social impacts. As such it can help to identify significant issues for the project. Applicable standards/ Guidelines: PS 1	Chapter 3, 4 and Annexure E, F, N
Baseline Studies	Applicable standards/ Guidelines: PS 1, PS 3	Chapter 4, Annexure E
Analysis of Alternatives	Applicable standards/ Guidelines: PS 1	Chapter 5
Environmental and Social Impact Assessment	Applicable Standards/ Guidelines: PS 1	Chapter 6
Labor Assessment	Applicable Standards/ Guidelines: PS 2	Chapter 6, Annexure O
Critical Habitat Review and assessment	Applicable Standards/ Guidelines: PS 6	Chapter 6, Annexure E
Stakeholder Consultation and Disclosure	Applicable Standards/ Guidelines: PS 1	Chapter 7, Annexure F, L
Pollution prevention and management Plan including (ESMP, Emergency response plan, GRM, Community Health and Safety)	Applicable Standards/ Guidelines: PS 1, PS 2, PS 3, PS 4, PS 6)	Chapter 7, 8, 9 and Annexure E, I, M
Environmental and Social Audit	Applicable Standards/ Guidelines: PS 1, PS 2, PS 3, PS 4, PS 6, PS 8)	Chapter 4 Annexure G

E-4. Approach and Methodology for the ESIA Study

Both desk-based secondary studies and primary studies using field level data were done (both qualitative and quantitative) for this ESIA study. The desk-based secondary studies were completed initially, before engaging in field based primary studies. Secondary studies helped in forming the primary studies' elements/requirements, as well as in selecting key stakeholders and affected groups. Moreover, the primary study approach was designed using both quantitative and qualitative tools. The quantitative studies consisted of different types of surveys relevant to different aspects, i.e. Air, Water including surface and ground level, noise, ecology and social etc. All quantitative data were recorded properly and analyzed using the appropriate analyzing

software, where applicable. On the other hand, the Qualitative studies consisted of public consultations, Focus Group discussions (FGD), KII and formal/informal interviews. Here also qualitative data were systematically recorded and analyzed, and merged with the quantitative findings; where appropriate. The primary baseline surveys were carried out during October to December 2020.

Secondary data from Bangladesh Bureau of Statistics (BBS), District web portal, Land zoning report etc. were assessed to get social pictures of the surrounding villages within a 2 km radius of the project site. On assessing the social conditions of the project area, primary Socio-economic Surveys were conducted in the villages lying within 2 km from the project site. Total 159 households were surveyed from four villages; adjacent to the project site.

After the confirmation and cross-validation with all secondary and primary survey data findings, qualitative tools such as public consultations, FGDs, KIIs and formal/informal interviews, were used following proper procedures; to get an in-depth understanding on the different aspects relevant to potential project impacts and mitigation measures. Based on all the information, environmental and social impact assessment and evaluation were carried out. This study thus has been prepared and has proposed a detail Environmental and Social Management Plan (ESMP), including monitoring plan to mitigate the adverse environmental and social impacts.

E-5. Applicable Administrative Framework

To address the potential environmental and social risks of any proposed project and its associated components; to protect and conserve the environment from any adverse impacts, the GoB has specific regulations, policy, and guidelines. Potential Lenders' also have their own set of requirements to which any project funded by them must operate. The World Bank Performance Standards are basically IFC Performance Standards on Environmental and Social Sustainability adopted as the "World Bank Performance Standards" in 2013. World Bank legal policies and World Bank Group Environmental, Health, and Safety (EHS) Guidelines are also applicable in WB supported projects. RTL has followed the GoB law as well as IFC / WB E&S compliance guideline according to OP 4. 03 in the preparation of the ESIA document.

In this study, ESRM Guidelines issued by BB in February 2017 and various components of E&S management system together with other rules and regulation mentioned in Environmental and Social Policy and Procedures (ESPP) of IPFF II Project were followed as well.

E-5.1 Triggering of Performance Standards (PSs)

Five (5) Performance Standards namely PS1(Assessment and Management of Environmental and Social Risk and Impact), PS2 (Labor and Working Condition), PS 3 (Resource Efficiency and Pollution Prevention), PS 4 (Community Health Safety and Security) and PS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) out of 8 Performance Standards under WB OP 4.03 have been triggered. The following Table E-2 summarizes the PSs which have been triggered and which have not.

Table E-2: Triggered Performance Standards under WB OP 4.03

PS	Performance Standard (PS)	Triggered	
		Yes	No
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	✓	

PS	Performance Standard (PS)	Triggered	
		Yes	No
PS 2	Labor and Working Conditions	✓	
PS 3	Resource Efficiency and Pollution Prevention	✓	
PS 4	Community Health, Safety and Security	✓	
PS 5	Land Acquisition and Involuntary Resettlement		✓
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	✓	
PS 7	Indigenous Peoples		✓
PS 8	Cultural Heritage		✓

E-6. Project Description

E-6.1 Project Location

The plant is located at Kashorghor Mouza, Habirbari Union, Bhaluka, Mymensingh. The project site lies between 24°18'40.3"N & 90°22'5.7"E and 24°18'37.9"N & 90°22'8.7"E. It is about 73 km from Dhaka and at the North side of the Dhaka Division. It is 11 km from Mawna Chourasta and 1.6 km west from Dhaka-Mymensingh Highway. The location map is given in Figure E-1. The basic information of the project is given Table E-3.

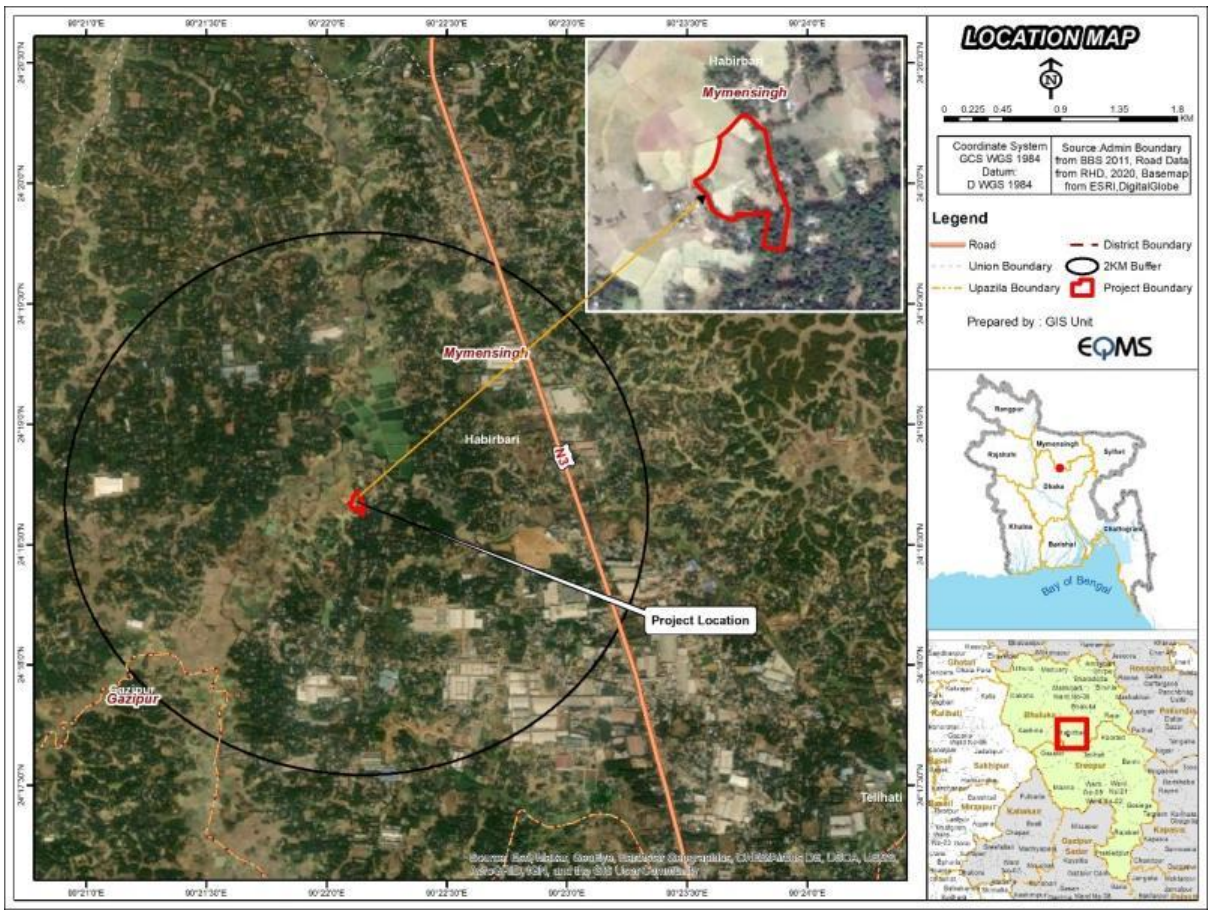


Figure E-1: Location of the Proposed Project

Table E-3: Basic Information of the plant

SL.	Particulars	Basic Project Data
1.	Name of the firm	Raw Tech Limited
2.	Project Location	Kashor, Habirbari, Bhaluka, Mymensingh
3.	Corporate Office	House 90, Road 13/A, Block C, Banani, Dhaka, Bangladesh.
4.	Registration Number	C-128770/2016
5.	Date of Incorporation.	7 February 2016
6.	Type of Project	Waste Recycling Project
7.	Raw Material	Used/Waste PET Bottles
8.	Production Capacity	Polyester Staple Fiber (PSF) - 6,000 metric ton per/year
9.	Total Land Area	194.08 decimals (1.94 Acres)
10.	Manpower	Constriction Phase ≈ 40 Operation Phase ≈20
11.	Water requirement	Construction Phase ≈ 30 m^3/day Operation Phase ≈ 5 m^3/hour
12.	Source of Water	Deep Tube Well
13.	ETP Capacity and Technology	108 m^3/day; Electrocoagulation
14.	Discharge Liquid	No waste water will be discharged
15.	Electricity	All machineries will run by 33 kV Rural Electrification Board (Palli Bidyut) line. Running load of electricity is approximately 1500 kW.
16.	Cost of the project	BDT 37.99 Crore
17.	Machinery Supplier	Zhejiang Boretech Environmental Engineering Co. Ltd.
18.	Consultant	1. KPS Consultants & Impacts Pvt. Ltd. (India) 2. P&P Associates Consulting Ltd.
19.	Expected Date Commercial of Operation	10 June 2021
20.	Plant Life	15 years

E-6.2 Project Layout

The building & other civil structure of the project includes main factory building, boiler house (15′×20′), workshop, vacuum dryer (8T/SET), bottle washing area including flake storage (50′×50′) (25M×18M and 8M clear height), fiber finishing area, fuel storage, 33 kV substation (30′×20′), generator (20′×20′), ETP, water reservoir, cooling tower, finished goods warehouse, office building and quarter (50′×20′), security and guard room with guest waiting room (15′×10′), weighting area, 3-5 M wide gate and boundary wall etc. The layout plan of the Project site is shown in Figure E-2.

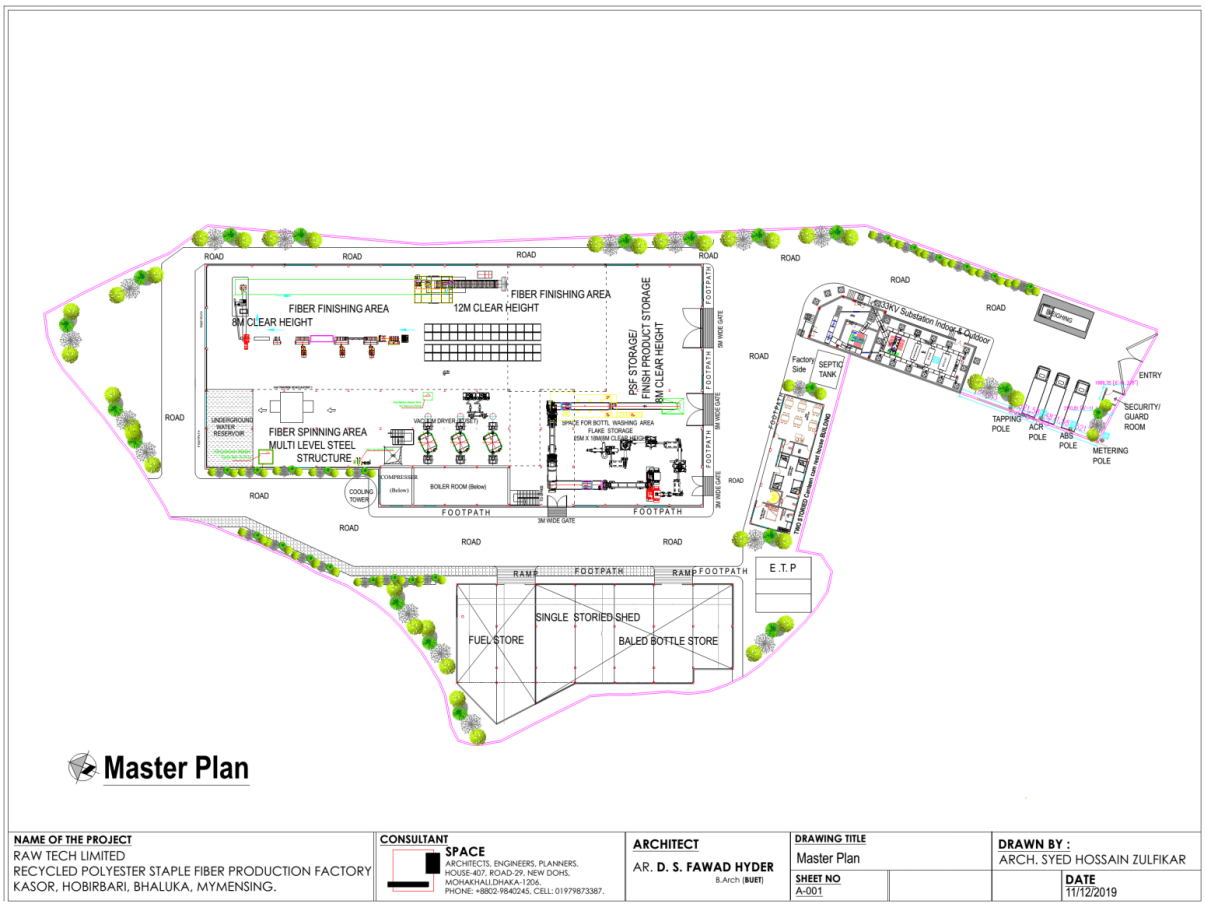


Figure E-2: Layout Plan of the Proposed Site

E-6.3 Process Description

PSF industries are relatively new in our country; however, the technology involved in the manufacturing process is not complicated. To keep ahead of the competition, the project uses state of the art machines and expect to utilize experienced professionals in its production units. The manufacturing process of the PSF from waste PET bottles is illustrated in the following Figure E-3.

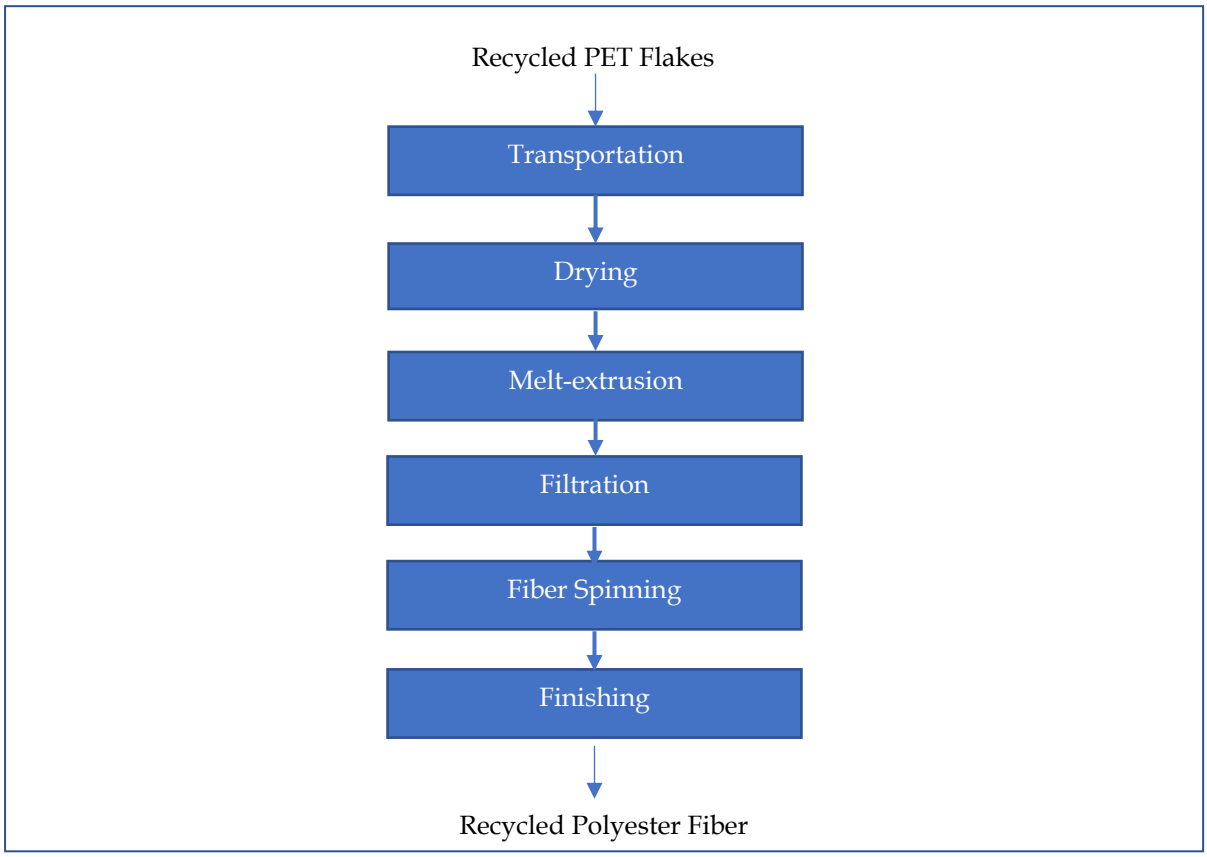


Figure E-3: Process Flow Diagram of the Project

E-6.4 Effluent Treatment Plant

RTL has planned to install an Effluent Treatment Plant (ETP) to treat the wastewater. The process of treatment will be Electrocoagulation. A brief description of the wastewater treatment is given below.

EC (Electro Coagulation) system is a very simple and Environment friendly technology. Hydrochloric Acid (HCl) and Polyelectrolyte are required for chemical dosing, Direct Current (DC) and NaCl (Salt) or Brine water is used for better conductivity in the Electro Coagulation process and Chlorination process for Disinfection of Treated water. The inlet Effluent wastewater passes through to Electro Coagulation Cell and filter arrays. DC power supply with controlled current density is used for Electrocoagulation and polyelectrolyte for Flocculation. NaCl (Salt) solution or Brine water is used for increased conductivity. Ion of Chlorine and Sodium with opposite charges destabilizes the colloids, allowing them to coagulate. In this process, charged ionic species of metals or otherwise are removed from wastewater by reaction with an Ion having an opposite charge, or with flocks of metallic hydroxides generated within the sewage/effluent. The final filtration is done through filter arrays of Nano Filters and CSAC (Coconut Shell Activated Carbon) filter with its micro pore (4 nm<) structure and adsorption capability to trap the microorganism residue and heavy metal Ion. So, the outlet water is free from contaminants of heavy metal, Coliform, Pathogen, Fat, Oil and Grease; thus, the outlet water achieve compliance with re-use standards as per DoE of Bangladesh. Process block diagram of ETP is shown in Figure E-4.

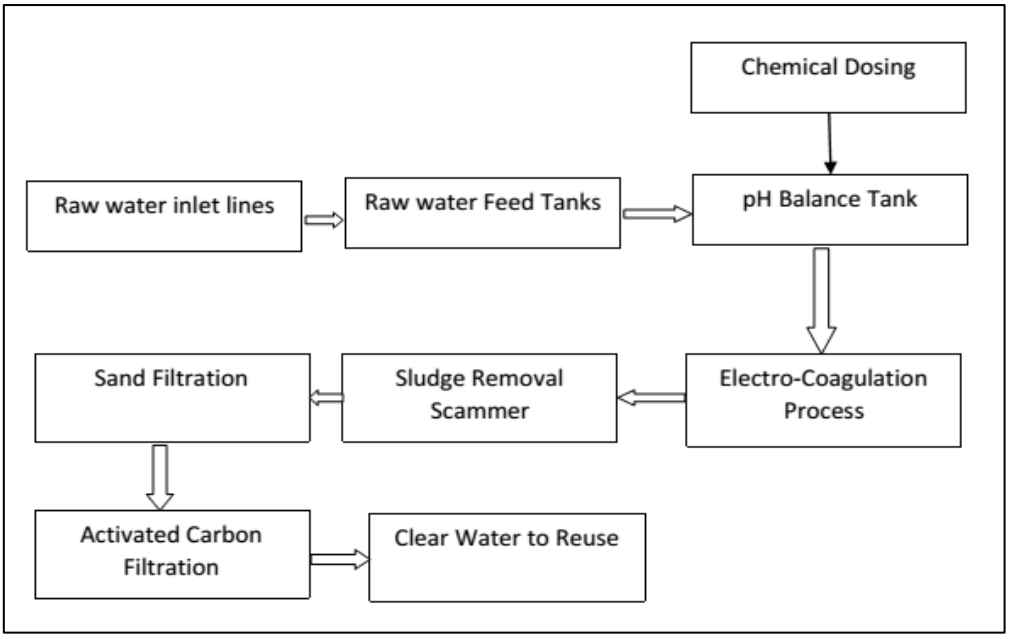


Figure E-4: ETP process flow diagram

Based on the water requirement ETP has been designed. Water requirement for the operation of the recycling plant will be 60 m^3/day. Required capacity is 60 m^3/Day but ETP designed for 108 m^3/Day. Therefore, the system is designed with safe margin.

Required chemicals dosing and amount:

1. Hydrochloric Acid: HCl is used for Neutralization of high alkalinity due to NaOH. Average Dosing amount used – 500 ml/ m^3 for Effluent pH of 10 to 14.
2. Polyelectrolyte: Polyelectrolyte for Coagulation process at Sciammer tank are used for flock formation and added in appropriate proportion.

Sludge production:

1. Around 20-30 kgs sludge will be produced per day.
2. Produced sludge will contains mainly of harmless silt and clay.
3. RTL has appropriate solid waste management plan to ensure safe disposal of these wastes as per DoE approved guidelines for sludge management.

E-6.5 Project Cost

The total of the project cost is estimated as BDT 37.99 crore. Of this 94.49% is considered as total fixed cost and 5.51% is considered as IDCP. Form the Table E-4, it is seen that 33.62% will be spent for factory building, 29.85% will be used for imported machinery and 14.21% will be used for electrical work.

Table E-4: Breakdown of the Project Cost

Item	Amount	Ratio	Purpose
Land & Land Development	35,287,371	9.29%	Land Related
Factory Building	127,720,450	33.62%	Capex
Imported Machinery	113,400,000	29.85%	
Local Machinery & Equipment	13,000,000	3.42%	
Erection & Installation Charges	3,000,000	0.79%	

Item	Amount	Ratio	Purpose
Office Equipment, Vehicle & IT	3,000,000	0.79%	
Preliminary Expenses	9,625,000	2.53%	Pre-Operating
Electrification Works	53,970,000	14.21%	WC
TOTAL FIXED COST	**359,002,821**	**94.49%**	
IDCP	**20,923,666**	**5.51%**	
TOTAL PROJECT COST	**379,926,486**	**100.00%**	

Source: Raw Tech Limited

E-6.6 Project Schedule

According to initial implementation schedule, the project construction activities were supposed to be completed by 15 February 2020. Due to some unavoidable circumstances, the project schedule has been revised. It is expected to take 628 days to complete the construction of the plant. The commercial operation date is 10 June, 2021 now, but some delays are expected. The revised project implementation schedule is shown in Figure E-5.

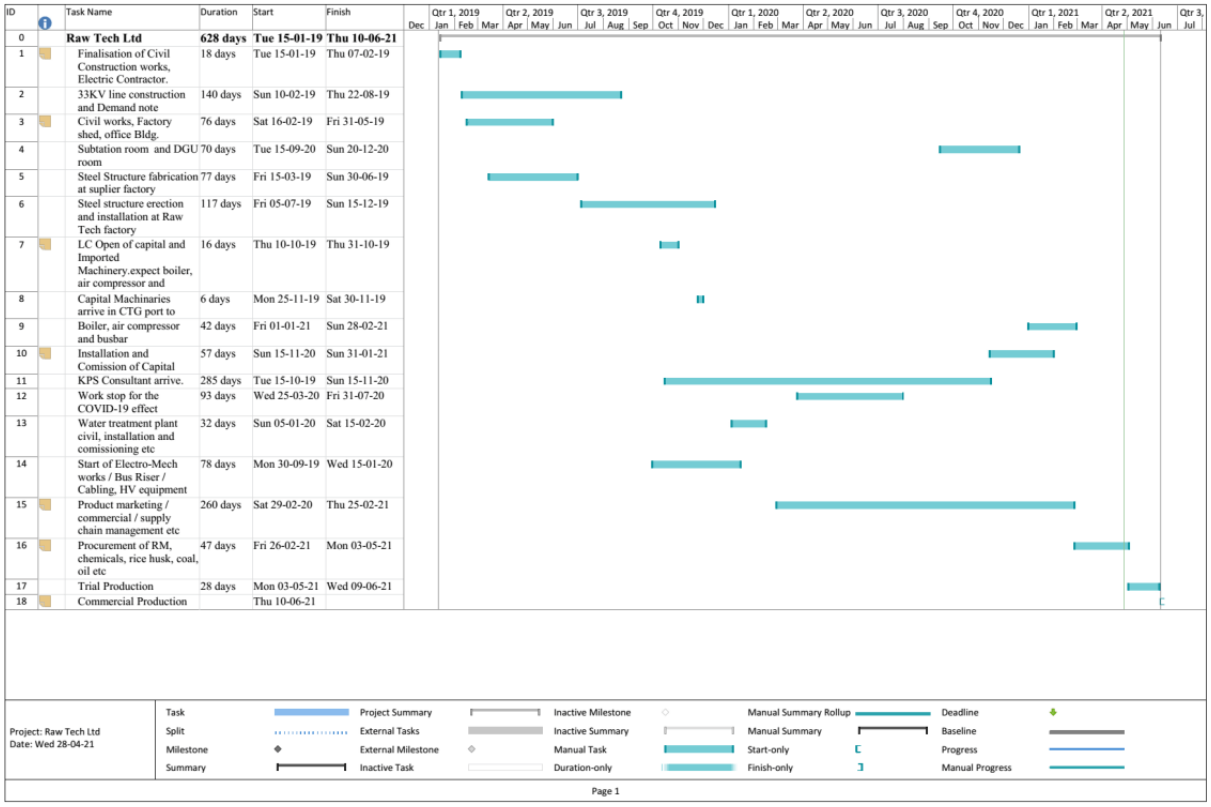


Figure E-5: Project Implementation Schedule

E-7: Baseline Environmental and Social Survey

E-7.1 Physical Environment

Baseline condition of environment states the present status of different components of environment in absence of the project. The baseline condition of environmental quality in and around the project site is the basis for identification, prediction, and evaluation of impacts. The baseline environmental quality is assessed through field survey within 2 km radius impact zone in and around project site for various environmental components. The 2 km distance has been chosen considering the expected low environmental and social impact of the project. EQMS Team

has conducted baseline survey and collected baseline environment data during October 2019. To update the ESIA report as per WB requirement the Baseline Environmental data has been collected again in December 2020. The team has conducted Air, Noise, Water and Soil monitoring and sampling again. Social baseline data has been established through 159 household surveys within 2 km radius from the project site.

Geology: Geology of Bangladesh is governed by the county's location as Bangladesh is mainly a riverine country. Generally, the geology of Bangladesh is classified into 31 broad categories. The project area falls under Madhupur Clay Residuum geological zone of Bangladesh.

Physiography: Physiography is the description of an area including form, substance, arrangement, and changes of especially natural features. The project area falls under Madhupur Tract physiographic region. This area belongs to a Pleistocene terrace consisting mainly of red colored and mottled clays. It is characterized by plateau-like hillocks varying in height from 9 to 18.5m, and a dendritic drainage pattern, typical of all Pleistocene terraces in Bangladesh. The valleys, mostly flat, are cultivated.

Land use: In the 2 km study area, the major land use goes to Settlement with Homestead Vegetation area which constitutes 1488 Acres which is 44.89%. The second major land use is Agricultural Land area at 26.88% (891 Acres) of the study area. Besides, there are about 396 Acres of industrial area (11.95%) and 236 Acres of vegetation (7.12%) within the study area.

Soil Type: Bangladesh is one of the largest active delta floodplains in the world. The soil formation process differs significantly in floodplain, hills, and uplifted terraces. The study area falls under the Madhupur soil zone, according to the classification of SRDI. Madhupur clays can be characterized as nutrient poor and somewhat acidic. These are red or brown in color. The higher-level lands are known as chala and the valleys are called barind. The valleys are cultivated with boro rice in the dry season by impounding water from the streams for irrigation. At this time the fields are dry in the uplands, except areas cultivated with sugarcane. Many of the chalas are well known for their jackfruit gardens.

Agroecological Zone: Agro-ecological zones (AEZ) define by the soil composition, landform, and climatic condition. The project area falls under Madhupur Tract Agroecological zone. Soils in the valleys are dark grey heavy clays. They are strongly acidic in reaction with low status of organic matter, low moisture holding capacity and low fertility level. Land type of the AEZ is dominated by High land (56%) which is followed by low land and others (26%), and Medium High (18%). Organic matter content is low and thus the fertility level is low as well.

Geomorphology: There are three Geo-morphologic unit of Bangladesh based on soil formation, which is further divided into 8 subdivisions. The project area falls under Pleistocene uplands Geo-Morphological unit. These regions are called Pleistocene uplands. The area includes the Madhupur Gorh, Barind Tracts and Lalmai hills. In the northernmost strip of the Rajshahi division, the Pleistocene upland merges with the piedmont of the Himalayas and in the district of Mymensingh slopes down to the alluvial plains. Pleistocene terraces cover an area of about 8% of the total land surface of Bangladesh with an average elevation of more than 15m above MSL.

Hydrology and Drainage: Within 2 km study area, there is a canal near the project site which is locally known as "Poschimer Khal" is the main surface waterbody in the study area. During field visit, it was found that, the canal was polluted with the discharge from nearby industries. There are about 30 ponds in the study area, but no river has been found within 2 km study area.

E-7.2 Meteorological Condition

The study area (Mymensingh District) falls in the Mid-South Zone. The nearest Bangladesh Meteorological Department (BMD) station is situated at Mymensingh City, which is about 45 km north of the project site. To assess the climatic conditions of the area, climatology data has been obtained from Bangladesh Meteorological Department (BMD) for the period 2009–2018.

Temperature: Average maximum temperature was experienced as 34.54°C in April 2014. On the other hand, minimum average temperature was recorded as 10.54°C in January 2013.

Humidity: The monthly average humidity of the project area varied between 73.4% (March) to 86.6% (September).

Rainfall: Average annual total rainfall at Mymensingh station is about 1739 mm from 2009 to 2018. Highest annual rainfall is recorded 2842 mm in 2017. On the other hand, highest monthly total rainfall is recorded 718.5 mm in August 2011.

E-7.3 Environmental Quality

Ambient Air Quality

Using HAZ Scanner air quality monitoring system, ambient air quality of the study area was monitored at three (3) locations for once. The monitoring parameters are Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx), and Carbon Monoxide (CO). Analysis of the result reveled that, the concentration of all the parameters is within national standard of the Bangladesh. Comparison of the PM_{10} and $PM_{2.5}$ data with two DOE CAMS within about 50 kms, show that the results are too low compared to the CAMS. These will be remeasured using filter-based methods as soon as possible. The detailed monitoring results are given in section 4.3.1.3.

Ambient Noise Quality

The 24-hour baseline noise monitoring was conducted by using the SLM24TK Digital Sound Level Meter (Tekcoplus, SLM24TK, unit: dB(A)) which correspond to IEC651 type 2, ANSI S1.4 type 2 standard. Noise levels were recorded at Six (6) locations in the study area during the monitoring period. Noise level in all the monitoring location is within the mixed zone noise level standard set by Environmental Conservation Rules, 1997 (Schedule 4) (subsequent amendment in 2006). Kashor is the only VEC close around the project site; where also the levels are within standards. There are some industries and commercial space in the study area. The detailed monitoring results are given in section 4.3.2.

Water Quality

Two surface water samples were collected from nearby pond in the study area. Two ground water samples were taken from project site deep tube well and a household shallow tube well. pH, BOD_5, DO have been found to be within acceptable limit as per Bangladesh Standard for Inland Surface Water.

For Ground water quality, the pH of at GW1 and GW2 are found 7.1 and 7.0 which are within standard limit set by DoE for drinking water standards. TDS concentrations of the GW1 and GW2 samples are 82 and 60 mg/l respectively. Presence of Manganese and Arsenic in the ground water samples are less than the standard levels of 0.1 and 0.05 ppm respectively. The detailed monitoring results are given in section 4.3.3.1 & 4.3.3.2.

Soil Quality

In order to know the present status of the soil quality in and around the project site two soil samples had been collected from project site and nearby agricultural land. A total extraction of heavy metal from soil samples following the USEPA guidelines were performed to determine the selected heavy metal contents. The heavy metal contents of soil are within usual limits of such metals found in natural soil. The detailed monitoring results are given in section 4.3.4.

E-7.4 Natural Hazard

Due to the geographical location of Bangladesh, it is vulnerable to different types of natural hazards. It is found that, the project area is not usually affected by cyclones; which is most likely to be due to the relative far away location from Bay of Bengal.

The study area falls within Zone III, which is the most vulnerable zone to earthquake. However, due to earthquake no loss of life or property have been reported from Mymensingh area for a long time.

The project falls under the classification of 'Not Flood Prone' area. According to consultation with local government officials and residents, this area did not face any flooding in the recent past.

E-7.5 Agricultural Resource

Rice is the dominant agricultural crop of the project area, Habirbari Union. In this union, Jute is the second dominant agriculture crop. This upazilla also produces Mango, Jackfruit, Guava, Coconut, Date, Olive, Adam's apple etc. Chilies, Onion, Ginger, Garlic are some of the notable species produced. Among the vegetables, gourd, sweet pumpkin, bitter gourd, snake gourd, beans, Yardlong beans, potato, Brinjal, Tomato, Cauliflowers also grow in large quantities.

E-7.6 Fisheries

A narrow canal, a few small ponds, and a large pond with an area of 66 decimals, comprise the fisheries habitat. The narrow canal which is locally known as "Poschimer Khal" is the only natural waterbody and within the project area there is almost no fishing activity. During field visit, it was found that the water of the canal was polluted by discharge from nearby industries.

E-7.7 Biological Environment

The project site falls under Madhupur Tract Bio-ecological zone. In total three quadrates were studied during the ecological study in the project site and surrounding area. A total of 59 tree species have been identified from the quadrate survey, physical observation, and secondary literature review. Most of the enlisted tree species of the project AOI are fruit trees comprising 48% of the total species and their local status is very common. A total of 33 avifauna species belonging to 21 families were recorded during the survey. Sturnidae, Corvidae and Ardeidae were the dominant families among them. Among these Grey Headed Fish Eagle is of special consideration as it is the top predator in the food chain and is categorized as Nearly Threatened (NT) according to the IUCN Red list status. It may be noted here that, during the field visit a nesting of a pair of Grey Headed Fish Eagle was observed about 800 m away from the project site.

The closest protected area to the project area (Kadigarh National Park) is located within 4.07 km from the project site. No impact is envisaged from the project to the national park; due to comparatively distant location, lack of interaction of the project with the park and type of the project.

As per the legal mandate, the MoEFCC till now has declared 13 areas as ECAs. The Department of Environment as a statutory body is entrusted to manage the ECAs. No ECA has been found to be located within 10 km of the study area. The details of common flora and fauna as well as biodiversity conditions are given in section 4.8.

E-7.8 Socio-economic Condition

Demographic Characteristics of the Households

In the 1-kilometer AOI, according to the Population and Housing Census (2011), about 22,892 households (HHs) with a total population of 92,453 are located in the proposed project impact area. The average sex ratio is 115 against the national figure of 100. The average household size (3.9) of the study area, is less then national average figure of 4.44.

Survey result shows that about 593 peoples are living in 159 households, where 12 land selling households consist of 44 inhabitants and 147 community households consist 549 inhabitants. Importantly, around 74.0% population belongs to 14-64 age range which signifies that most of the populations are eligible for participation active in economic activities. On the contrary, only 26.0% population is found to be depended.

Population and Housing Census (2011) reports that the population of the study areas belong to the Muslim community, constituting about 96.14% of the total population with remaining 2.89% constituted by Hindus, Christians, Buddhists, and others. However, all the surveyed households have been found to be Muslims.

Household Structures

According to population and housing census (2011), predominant structure of these study areas is Kutcha[1] (57.75%) followed by Semi-Pucca[2] (36.65%), Pucca[3] (4.55%) and Jhupri (1.05%); but a different scenario has been found in the household survey, where predominant household structure is found to be Semipucca (65.7%). Moreover, survey has also found that 30.2% & 4.1% households are Kutcha[4] and Pucca respectively.

Education

According to the Population and Housing Census (2011), the literacy rate (56.55%) of these influenced villages is higher than the national average of 51.8%. However, the survey finds that about 84.6% of total population is at least literate; 15.4% has minimal literacy knowledge, followed by 31.8% primary (class 1-5) education, 18.6% secondary (class 6-9) education, 10.3% S.S.C, 5.4% H.S.C and of the rest only 3.1% who completed at least Bachelor level of education. Besides, there is a school named Dipsikha Model School which is approximately 420 m southeast side from the project site.

Income, Expenditure and Savings

Households' monthly income reveals the economic situation of the studied area. According to HIES 2010, after including the inflation up to 2019, yearly income BDT 120000 is the poverty line limit of the studied area. Study finds that only 5.5% households of the total surveyed households

[1] "Kutcha is defined by the structures whose walls are made of clay, wood, bamboo, straw or raw bricks and roofs are made of tin, bamboo and straw", BBS (2015)
[2] "Semi-pucca is defined by the structures whose walls are made of cement and bricks and roof is made of tin, asbestos, wood or bamboo", BBS (2015)
[3] "Pucca is structures whose floor, wall and roof are made of cement, brick and stones", BBS (2015)

have less than BDT 120000 yearly income. On an average 60.9% expenditure is incurred solely for household food consumption. Other major household expenditures are education (14.2%), Treatment (13.2%), Clothing (7.2%). In the study it has been found that 69.2% households can save some surplus from their yearly income; whereas only 14.4% households cannot save any surplus. It has also been found that 16.4% households belong to deficit state, meaning that yearly expenditure exceeds yearly income for them.

Energy Access

Lighting and cooking sources are the very important needed energy for any households and higher quality and easy access to quality energy can ease household's daily life. Survey results show that 99.7% of the total households have access to electricity.

Gender Analysis

Study finds the common patriarchic scenario in the study area. No women headed households have been identified in land selling households.

Vulnerability Analysis

According to the head count rate of HIES (2010), it has been found that about 5.5% households are below the poverty line in the study area. Additionally, 1.7% households were found women to be headed. No ethnic households have been found.

E-7.9 Environmental & Social Audit of Site Activities in the Construction Phase

RTL is not a green field project anymore and its construction has almost been completed. An environmental/social audit for the project is required under WB PSs (e.g., PS1-2), to assess as to what degree the ES due diligence has been followed in the activities so far. The requirements to be audited can vary depending on the need/outcome for the audit.

The audit was conducted by the ESIA team through site visits, so that report is based on actual observations and can be used with confidence for remediation purpose. Findings of the audit are detailed in Annexure-G;

The construction process of RTL plant is ongoing and expected to be completed by June, 2021. Factory shed's wall and storage building construction, approach road construction and installation of machineries and ETP are not finished yet. The security is managed by RTL. No armed guard is employed, so far, no incident has happened with local community. In the construction period, RTL has hired local workers, and no worker stays at work camp. Noise and Air pollution were found to be of no concern among workers during E&S audit. RTL has stored materials in their factory premises. First aid kit, PPEs, Safety signs/notices were found at the site. No major accidents have happened during construction so far, but no formal report was available on this issue.

Shortcomings in respect of drinking water and improper solid waste management were found. RTL management has agreed to mitigate these at the earliest. The ES monitoring reports should be prepared on a regular basis and shared with BB and WB as prescribed in this document.

E-8 Analysis of Alternatives

Due to land scarcity in the country, seeking an alternative site for establishing the plant is quite difficult. Also, land acquisition is a lengthy and complex procedure under the existing Land Acquisition Law of Bangladesh (Acquisition & Requisition of Immovable Property Act 2017). Not

only that, the project conceptual development over alternative sites are quite difficult because delay in overall land acquisition process might create social conflicts and risks for the project.

Like any other industrial siting, the RTL site was selected based on economic, technical, social, environmental, and regulatory issues. These criteria have been assessed qualitatively, as RTL is a small plant. The criteria used are given in the **Table 5-1**.

E-8.1 Project Benefit

The project would contribute to reduce landfill, solid waste management cost and carbon emission compared to usage of imported resins which will be beneficial for the environment. RTL will recycle the waste plastic that will also reduce CO_2 emission indirectly. It will increase local employment opportunity that will improve socio-economic standard of living and thus contribute to poverty reduction. As the total industry is now dependent mostly on imported polyester staple fiber, readily available raw materials with less lead time for procurement and will be beneficial for industries. Additional employment opportunities will be created for supply and distribution of raw materials and finished items.

E-9. Environmental and Social Impact Assessment

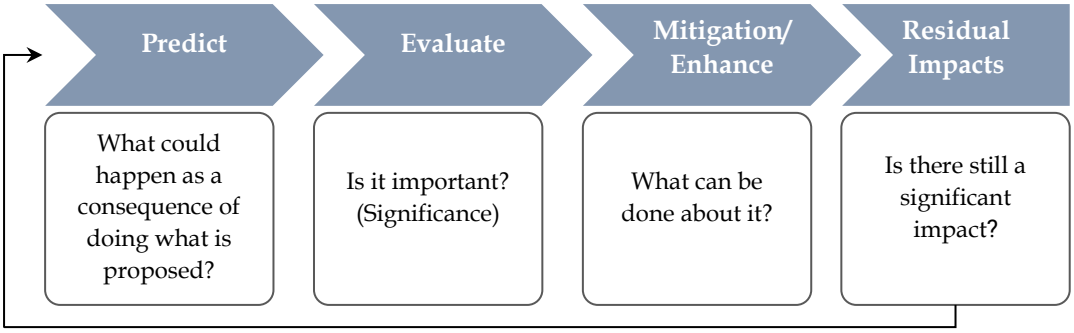
E-9.1 Approach

The impact assessment process comprised of the following steps:

- The potential impacts of Raw Tech Limited were initially identified during the scoping phase;
- Thereafter, environment, ecological and socio-economic baseline studies were undertaken to understand the likely changes that may occur during the construction and operation of the project within a defined study area
- Meetings were held with local communities and key informants to share information, answer questions, and understand and respond to concerns about the Project (a process called 'Stakeholder Engagement' which is described further below)
- Specialist experience and knowledge were used to assess quantitatively and qualitatively to determine which of the impacts will cause the most significant adverse changes, as a result of operation of the plant.
- Measures of reducing the adverse changes and enhancing project benefits were also identified and discussed with the project proponent.
- Based on the above, a project and context specific Environmental and Social Management Plan was prepared for RTL and their contractors.

Impact Assessment

Impacts were assessed by specialists to understand their significance or importance for those affected by the project. The significance levels used for this assessment are described subsequently



Significance of issues (based on Environmental Parameters)

Significance	Description
Low	• Impacts are within the acceptable range. • Potential/possible impacts such as localized or short-term effects on habitat, species, or environmental media.
Medium	• Potential/possible impacts such as localized, long-term degradation of sensitive habitat or widespread, short-term impacts to habitat, species, or environmental media. • Potential/ possible Impacts are significant and require attention; • mitigation is required to reduce the negative impacts to acceptable levels; • Potential/possible impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species, or environmental media.
High	• Impacts are of great importance, mitigation is crucial. • Potential impacts such as significant, widespread, and persistent changes in habitat, species, or environmental media. • Potential impacts such as loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale.

E-9.2 Impacts during on-going construction phase

Impact on Ambient Air Quality

Operation of diesel generators, dust generated from stockpiles of materials, waste, loose earth, handling and moving excavated material and transporting wastes, loading, and unloading construction materials, handling and mixing of cement and ongoing civil construction work are the major sources of air pollution. There are very few households close to the project site. Around the project site there are many trees. Air quality was assessed during the construction of the project. Due large difference with values of PM_{10} and $PM_{2.5}$ with CAMS at Gazipur and Mymensingh, these will be measured again using appropriate quality assurance. The magnitude of the impact associated with the emission of dust during construction activities based on reaction of the workers at the site was estimated to be not too bad.

Impact on Water Resources

During the recent field survey, it is observed that most of the civil constructions of the project have been completed. At this moment water requirement for the construction activities is very small and no water is discharged outside the site. As a result, there is negligible impact on water quality due to ongoing construction activities of the project. In the construction phase, the water

requirement was around 20-30 m^3 per day. Requirement of ground water is so small that it is unlikely to have any impact on ground water availability.

Impact on Ambient Noise Quality

Noise generated from various activities such as welding, hammering, cutting, motor testing etc, and noise generated during civil construction work, loading, and unloading of material from truck contribute to the overall noise pollution. There are few households to the south and East of the project. The households are surrounded by dense green belt. The project site boundary wall is 3 meter high. Noise generated during construction work will be impeded by the boundary wall and surrounding trees. Based on these observation impact on ambient noise level due to ongoing construction activities was assessed as Low.

Impacts on Soil Quality

The RTL project site has already constructed within the land acquired by RTL, which is already developed and confined by a brick wall. The site has been filled up and developed by sand filling to raise the site above flood level. Liquid and solid wastes generated from ongoing construction activities are being handled well by RTL and there is no possibility of contamination of nearby agricultural lands.

Impacts on Ecosystem

As no water body is contaminated by the project activities and there is no impact on aquatic flora and fauna during ongoing construction activities. However, noise and lighting in the project site may disturb some fauna near the project site. The impact significant due to ongoing construction activities on ecosystem has been assessed as Low.

Impact on Occupational Health and Safety

The effect of high noise levels on the plant operators and workers in the plant must be considered, as this may cause permanent hearing impairment. Pure drinking water along with proper sanitation system is essential to keep workers in good health. The plant management will ensure these facilities for the workers as per ESMP. Accidental injury may happen during construction work. However, no injury or health problem has been reported since the beginning of the construction. Considering the above factors significant of impact on occupational health and safety due to on-going construction activities was assessed as Low.

Impact on Community, Health and Safety

There is one VEC around the project site at Kashor which is about 300 meters from the plant site. There are a few households with greeneries around the project site also. Ongoing construction activities is mainly on machine installation, which generates some noise. Some civil construction works is also pending. The civil construction work produce dust and pollute the surrounding area. However, the pollution levels are assed to be low, because of the 3-meter-high boundary wall and the nearby households are surrounded by vegetation. There is no discharge of wastewater outside the project boundary during ongoing construction phase. Some vehicles are used for carrying construction equipment and materials to the project site. Small number of vehicles, pose low accident risk in the community. Considering the above facts, the impact on community health and safety during ongoing construction period is assessed as low.

Socio-economic Impact

A good number of un-skilled and semi-skilled contractual labor worked during the construction phase in the project. Also, many females (30%) workers got opportunity to work in the construction phase. Local enterprises, particularly those involved in the production and sale of construction materials, material suppliers are potential benefactors of the civil works involved in the project. Local market, businessmen and shop owners also be benefited from the construction activity.

Impact due to Construction of Approach Road

A 3-meter-wide approach road to the project site is yet to be fully developed. A few sections of the road have brick soling and the rest of the road is muddy. During the rainy season, due to improper drainage system around the project area, sometimes waterlogging happens on the road. Temporary drainage problem may occur due to road construction activities. Some trees might need to be cut to widen the approach road. Considering all activities during construction of approach road, the environmental and social impact are assed to be low and of short duration.

E-9.3 Impacts during Operation phase

Impact on Ambient Air Quality

The project will not cause significant level of air pollution during operation period. During manufacturing process steam is required in various unit of the plant. Negligible amount of SO_2 will be generated during boiler operation. Small number of vehicles will be involved to carry PET bottles in and PSF out of the plant resulting insignificant contribution to air pollution. Considering all operational activities relevant of air pollution with conservative approach, the impact of ambient air quality from the operation of the plant is estimated as Low.

Impact on Water Resources

The plant will implement a Zero Discharge Plan by implementing 3R policy. All the waste water will be recycled, recovered, and reused. So, there will be no impact in water quality in and around the project site.

Impact on Ambient Noise Quality

Various machineries operating with motor, boiler, air compressor, pumps and cooling tower may be the major sources of noise during operation. The environmental noise prediction model Sound PLAN 8.2 was used for modeling noise emissions from the plant operation. Predicted noise level during day time at the receptors during operation phase is within limiting value set by DoE**.** It has been considered project site (NL1) noise level will be increased significantly. However, it will not exceed industrial noise standard set by DoE and IFC. As production house is almost sealed in all side very little noise will be felt in the nearby households. Noise from generators, compressors and pumps will be controlled using noise reduction barrier around the equipment. Considering conservative approach impact on ambient noise is ranked as low.

Impact on Soil Quality

As no waste in the form of solid or liquid will be discharged directly to the surrounding of the project area therefore, there will be no impact on nearby soil/agricultural land due to operation of the plant. The project will operate in following 3R policy. All the waste water will be recycled, recovered, and reused.

Impacts on Ecosystem

Noise and light from the recycling plant may disturb surrounding terrestrial fauna. However, well designed green belt will help to keep the terrestrial fauna undisturbed. There will be no impact on aquatic ecosystem during operation phase as the plant will not discharge waste water outside the project site. Considering conservative approach impact on ecosystem during operation phase can be assessed as low.

Impact on Occupational Health and Safety

Common occupational risks such injuries from fall, rotating machines, electrical accidents, and high noise levels among others will constitute some risk to the worker. The TSEL management has a plan to deal with Occupational Health and Safety issues in the plant using measures outlined in the ESMP. With mitigation such OHS risk are assessed to be low. The main OHS issue in the plant during operational phase is the fire hazard, as both the raw material (PET) and product (PSF) are flammable. Standard, fire protection measures including fire extinguishers, fire hoses, gated out storage areas, fire hazard signs will be in place. During operational phase, the overall OHS risk is considered as medium; due the storage of large quantities of PET and PSF in the plant constituting fire risk.

Impact on Community, Health and Safety

Noise generated from the production house of RTL and operation of boiler and pumps can disturb nearby community. Movement of vehicles carrying PET bottles and PSF can also create disturbance in the nearby community. Major fire/explosion incidence in the plant could pose risk on nearby community. The only VEC at Kashor is about 300m away and it is unlikely to be impacted by incidents at the plant. As there are only a small number of people live near the project site, as such the impacts on the community due to operation of the plant can be considered as low.

Socio-economic Impacts

The plant will create jobs for the local people. It will be a positive impact on the society. The activities in the plant will bring business in supply and services for the local community; contributing to improved income generation and consequent welfare.

E-9.4 Cumulative Impacts

The ambient status of environmental, ecological, and social conditions represents the cumulative impact of all the other activities; in surrounding areas on the project site in all the phases. Overall, the cumulative impact is assessed to be the highest rating for a given stage of the project activity both with and without mitigation. The impact is low during construction without mitigation and low with mitigation. However, during the operation stage the cumulative impact is assessed to be medium without mitigation and likely to remain as medium with mitigation, due to fire risk.

In the construction & operational phase, the socio-economic impacts are beneficial to the local community; and are assessed to be of medium benefit. However, it can be increased to 'High' beneficial level with the implementation of CSR initiatives by the project proponent.

There is no large project under construction in the neighborhood of the RTL. The details of any planned industry in the area are not known, so it could not be considered in the evaluation of the cumulative impact.

E-10. Stakeholder Consultation and Disclosure

A range of stakeholder engagement and consultation methods have been used to identify concerns, issues, and suggestions on the Project. These included any suggested management and mitigation measures. These involved consultations with GoB agencies, face-to face interviews, small group meetings, focus group discussions and a household level surveys. Outcomes from the consultations showed that the community was generally supportive of the proposed project and that the community believed that project would bring some benefits to them and to the local area. Such perceived benefits included the potential for local employment relating to the project and the potential that infrastructure investment in the local area may happen as a result of the project.

EQMS Team and the proponent arranged a public consultation meeting at proposed plant site to share various aspects of the proposed plant; as well as to get opinion of the local people regarding the project. The meeting was held at 4.00 PM on 24th October 2019, with the participation of about 34 peoples from different occupational groups. In the meeting, the local people appreciated the project in their area. The proponent has purchased land for project site. There was no issue regarding resettlement as the area was uninhabited. In the meeting, EQMS Team and representative of the proponent informed the participants about environmental and social impacts and mitigation measures proposed by the project. Most of the respondents showed positive response for the project. They recommended monitoring of the environmental and social impacts due to the project activities. They also requested for more employment facilities to the local people at different phases of the project development.

Key concerns that government stakeholders and local people included safety aspects of the project. This ESIA has addressed each stakeholder concern with the development of specific mitigation and management measures. Project has been designed considering all the potential risks; so that all impacts may remain within the reasonable limits. Moreover, air, noise and waste management measures will be in place. Project management has developed a waste management plan and will implement it appropriately. RTL will treat and reuse wastewater. No water will be discharged outside the project boundary, except for rainwater during monsoon. Moreover, project management will address emergencies related to the project in case these arise. To do so, company has developed an Emergency Response Plan. Better/improved traffic system including management of traffic speeds, provide controls for single-lane two-way traffic, address noise, control dust and drainage issues, so that the local community including students, elder persons, women etc. can move more conveniently.

The draft ESIA report was disclosed in the RTL website (https://www.rawtechltd.com/) for public comments on 24-10-2019. The final ESIA will be made available at accessible places (e.g. local government offices, libraries, community centers, etc.), and the executive summary translated into local language (Bengali) will be posted in the RTL and Bangladesh Bank websites. The final ESIA document will be shared with WB for approval and once it is approved, the document will be disclosed according to the procedures of WB. As a part of the disclosure, all versions (Bengali and English) will be available at the project office in addition to RTL's website.

E-11. Environmental and Social Management Plan

The Environment and Social Management Plan (ESMP) for the project has been developed with an aim to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures. This includes:

- Mitigation of potentially adverse impacts;
- Monitoring of impacts and mitigation measures during different Project phases of the project i.e., both during implementation and operation;
- Integration of the ESMP with project planning, design, construction, and operation;
- Institutional capacity building and training; and
- Compliance to statutory requirements.

The ESMP for the project is also aligned with the WB OP 4.03 Performance standard and Environmental and Social Policy and Procedures (ESPP) of the IPFF-II project. The detailed of ESMP is given in Chapter 8.

The objectives of ESMP for the present project are: (i) Identification of ES Monitoring requirements and Monitoring indicators; (ii) Mitigation measures to reduce or eliminate negative impacts; and (iii) Enhancement measures to maximize positive impacts. Environmental management plan has to be considered as part of the plant's overall management and it is a part of the plant's operational manual. Monitoring of the performance of a plant is very important and sometimes vital. For surveillance of the environmental performance of an industry, and monitoring of the quality of the local environment, environment in the work-zone and the impact zone must be performed on a regular basis. A management set up created for the environmental monitoring program, will ensure compliance with national environmental standards. An environmental monitoring plan has been developed for both construction and operation phase of the project, which delineates the parameters to be monitored, frequency of monitoring along with the assignment of responsibility.

A qualified plant employee is to be designated as the ES focal point, who will have overall responsibility for plant's environmental and social management and monitoring. The focal point will be supported with required manpower and expertise (i.e., a committee with designated members) to ensure proper environmental monitoring, take appropriate measures to mitigate any adverse impacts and to enhance beneficial impacts resulting from the project activities. This person through his team will make sure that the Contractors undertake and implement appropriate measures as stipulated in the contract document, or as directed by him to ensure proper environmental management of the project activities. The activities of the ES focal person will include preparation of quarterly reports on Environmental Management activities in the plant.

E-12. Grievance Redress Mechanism and Stakeholder Engagement Plan

The Plant Management will set up a procedure to address complaints and grievances (e.g., receiving formal complaints/ grievances, arrange hearing involving all stakeholders and keeping records of such hearings, device and implement mitigation measures). This procedure will include the mechanism and composition of the Grievance Redress Committee (GRC) involving NGOs, local elites, and representatives of local government to ensure accountability and transparency of the grievances addressed.

E-13. Discussions and Conclusion

Raw Tech Limited, A Hong Kong Bangladesh Joint Venture Private Limited Company intends to build PSF production Plant by recycling PET bottles at Kashor, Habirbari, Bhaluka, Mymensingh. In this project discarded plastic bottles will be used as raw material and PSF will be produced.

Thus, this project will reduce the number of plastic wastes that were likely to have ended up in the landfills and waterbodies.

General Issues and Categorization

As a part of the construction phase some land developments such as filling and levelling were done. As result of these activities, the area has settled down to a new ambient condition. The area which was a parcel of fallow land with a small pond, has now been transformed into a high value industrial lot. Detailed analysis of impacts/risks in this document shows that the risks involved are low in the construction stage and medium in the operation stage on environmental and social issues.

According to the Department of Environment (DoE), the aforesaid Project has been categorized as Orange B, which require IEE and ESMP only. As Raw Tech Ltd. has applied for funding from the Bangladesh Infrastructure Finance Fund Limited (BIFFL), which is in consistent with the Investment Promotion and Financing Facility (IPFF) II of the Bangladesh Bank, so Raw Tech Ltd. should follow the GoB law as well as IFC / WB E&S compliance guideline according to OP 4. 03. As per IPFF-II project's ESPP document project falls under the medium risk Category (i.e., Category-B under OP 4.03) and it is required to conduct an ESIA study.

Construction Related Issues

The construction phase of this projects involves both the construction of plant and ancillary buildings and installation of production machineries. The works were carried out by workers appointed by RTL. The project activities during construction phase impacting the physicochemical environmental parameter such as noise pollution and air pollution, have been identified through ES audit. The measures for mitigation in the construction phase were undertaken and these were successful; and no significant problem arose.

Drainage and Wastewater

RTL will adopt Zero discharge plan. Therefore, no wastewater will be discharged beyond the project boundary. Based on the water requirement the plant's ETP has been designed. Required capacity is 60 m^3/Day, but ETP is designed for 108 m^3/Day. Therefore, the system is designed has a good safety margin. A small amount of water is likely to be drained in to the pond situated north-east corner of the project site during the monsoon. However, the discharged water is not expected to be polluted.

Water Resources

The RTL plant will be using a moderate quantity of groundwater extracted through a few six-inch diameters tube well, while another well is kept standby. Impact of extraction of ground water for has been evaluated and it is found that no substantial impact is likely to occur. However, the groundwater level should be monitored by installing a piezometer at a strategic location. This will provide reliable information on the seasonal variation in the groundwater level, which may be used to assess the sustainable availability of water for the neighboring locality.

Air and Noise

During construction phase there was no significant air emission sources except for the diesel generator. However, this generator was only operated in case of power failure. Therefore, impact on air quality due to construction activities were Low.

During the construction phase ambient noise levels were monitored in and around the project site. All the monitoring levels were found to be within the standard limit for Mixed zone set by DoE, Bangladesh.

Diesel generator and boiler exhaust gas is the major sources of air pollution during operation period. However, diesel generator will be operated infrequently (only during grid failure) and boiler will be operated with natural gas fuel. Therefore, the contribution to air pollution from this source will be low.

The noise level within the premises of the RTL has been modelled and found to be below the allowable limits in general for industrial area. The modelling results also show that at 100 m from the center of the plant, the noise levels are within DoE standards for mixed area.

Soil Contamination

As no waste in the form of solid or liquid will be discharged directly to the surrounding of the project area therefore, there will be no impact on nearby soil/agricultural land due to operation of the plant. The project will operate in following 3R policy. All the waste water will be recycled, recovered, and reused. As a result, from ETP water recovery system around 20-30 kg sludge will be generated daily. This sludge is harmless which contains only iron oxides/hydroxides, silt, and clay. RTL has appropriate solid waste management plan to ensure safe disposal of these wastes on site or through DoE approved agents.

Occupational Health and Safety

Potential sources of impacts on the health and safety of ongoing construction workers are Noise from construction activities; impure drinking water, unhygienic sanitation system, accidental injury. However, no injury or health problem has been reported since the construction begins.

During operation phase employees could be impacted due to high level noise in the production hall, injury occurred by rotating equipment, boiler explosion, fire, steam pipe cracking, human error/negligence. About 20 employees will be engaged in operation period of plant. All the employee will use proper PPE according to safety requirement. Failure in some risky unit could cause fire and release of hot elements. As a consequence, death or permanent injury may happen to the employees. However, accident in risky production units and storage areas will could be avoided with proper maintenance of the production units and by securing storage areas. Employees will be trained to operate the fire control equipment and fire drills will be done on quarterly basis. The plant will also obtain a fire license from the Fire and Civil Defense authority. With the measures in place to mitigate impact significance on occupational health and safety, the OHS risk during operation phase is assessed as medium.

Community Health and Safety

Ongoing construction activities involved are mainly machine installation which generates some noise. Some minor civil construction works is also continuing. The civil construction work may create dust and pollute the surrounding area. However, the pollution level will be low as the project site has 3-meter-high wall and the nearby households has dense vegetation. As air emissions are low, it is expected that air quality in the VEC is not impacted. There was no discharge of wastewater outside the project boundary during the construction phase. Some vehicles were used for carrying construction equipment and materials to the project site. Small number of vehicles did not pose much accident risk and no accident happened in the community neighborhood.

Noise generated from the production activities of RTL, such as operation of boiler and pumps can disturb nearby community. Movement of vehicles carrying PET bottles and PSF can also create disturbance in the nearby community. Major fire/explosion incidence in the plant could pose risk on nearby community. As there are small number households near the project site, the impact on the community due to operation of the plant is assessed low. RTL will install road signs and provide traffic attendants to watch over the traffic during heavy vehicle movement to and from the plant. These measures are likely to eliminate the possibility of accidents risks to the pedestrians.

Cumulative Impacts

The ES audit has found that most of the adverse impacts resulting from the project during construction phase was low. As the air emission is low from the plant, it will not significantly increase the current levels. The wastewater will be reused after treatment at the ETP.

The ambient status of environmental, ecological, and social conditions represents the cumulative impact of all the other activities, in surrounding areas on the project site in all the phases.

The impact was low during construction without mitigation and low with mitigation. However, during the operation stage the cumulative impact is assessed to be medium without mitigation and likely to be medium even with mitigation, due to fire risk, as both the raw materials (PET) and product (PSF) are flammable.

Land Acquisition

Although land acquisition was involved, these were all through willing-buyer, willing-seller arrangement. The private land transaction process was verified in the ESIA process, through consultation and has been documented (Annexure C). None of the land-owners exercised their right to opt out. There was no settlement on the land prior to commencement of pre-construction works; so, there was no resettlement issues. Consultations with the host community and other stakeholders have been carried out and will continue throughout the project lifecycle.

Environmental & Social Management Plan

An Environmental & Social Management Plan (ESMP), including monitoring requirements, has been developed, to ensure implementation of the "mitigation and abatement measures" identified in the environmental/social assessment. Proper mitigation measures, as suggested in the ESMP, will be followed to reduce the adverse impacts to the extent possible. The ESMP has provided suggestions on tree plantation, pond preservation and green area delineation which should be ensured by the RTL management.

Public Participation and Community Concern

During the operational phase, the project is likely to bring about significant benefit for the local community and the country. Social issues are likely to play important role during the construction as well as the operational phases. The project activities are likely to generate opportunity for significant employment. Coordination among the RTL personnel and the community members needs to be ensured through participatory approach. Harmonious relationship between the community and the project personnel for safety and security will be ensured through a participatory program.

Labor Management and Occupational Safety

About 40 workers are currently employed; of which only about 12 are female. Most of employees are either locals or live-in rented accommodation in nearby communities and others commute to work; some even from Dhaka as RTL is well connected by road. There are no migrant workers, as most of the workers are employed on long term basis. There are no permanent work camps inside RTL. The raw material supply contract ensures that no child labor in involved in the PET bottle supply chain. ESIA has identified the labor management issues and a labor management plan has been made as per Bangladesh labor rules, 2015. Its implementation will ensure both compliance with WB OP 4.03 and GoB requirements; and ILO conventions, to which GoB is a signatory. ESIA provides for the implementation of required EHS/OHS regulations e.g., WB EHGS and sectoral EHS guidelines for worker safety. The ESIA document has proposed an Emergency Response (ER) Plan; that will help to reduce occupational hazards and health risks; and use of tools and procedures for proper implementation of ER measures including fire protection.

Grievance Redress Mechanism

A Grievance Redress Mechanism has been proposed with due procedures; through which aggrieved parties may launch complaint, which will be addressed by a committee upon formal hearing and investigation. This procedure will include the mechanism and composition of the Grievance Redress Committee (GRC) involving NGOs, local elites, and representatives of local government to ensure accountability and transparency of the grievances addressed.

Compliance with PSs and Management Plan

As RTL is no longer a greenfield project, an 'Environmental Audit' was conducted recently and some lapses on EHGS compliance were found. RTL management has promised to rectify these. For compliance with the requirements of the OP4.03 Performance Standards and an Environmental and Social Management Plan (ESMP) has been formulated; which needs to be followed by the RTL. The plan implementation will be overseen, monitored, and audited by RTL management and implemented by a dedicated team in the plant. The Project will make its best effort to minimize the environmental and social impacts unavoidably associated with the Project; during its entire life cycle by implementing proposed mitigation measures and management plans as described in this ESIA to ensure compliance with the requirement of the World Bank PS and EHS guidelines. Provision for indicative budget resources have been provided for the purpose. RTL management will ensure that the Project conforms to all the legal, regulatory and policy objectives and ensure that all the necessary permits are obtained and renewed from time to time as necessary.

Disclosure

The ESIA document has been disclosed on the RTL website and has also been posted on the website of the Bangladesh Bank.

Finally, it is expected that all necessary information/ evidence contained in this ESIA report are enough to meet all requirements for the operation of the RTL plant and facilities in accordance with WB OP4.03 and applicable WBG guidelines and standards.

1 INTRODUCTION

1.1 Background of the project

Plastic has become a part and parcel of our day-to-day life and its usage is increasing globally. The global plastics production was 100 million tons (MT) in 1990, grown into 332 MT in 2015 and predicted that if this trend continues the annual production is likely to exceed 750 MT by 2030 and 1700 MT by 2050. Globally, one million plastic bottles are purchased every minute. A report produced by the World Economic Forum (2018) found that by 2050, there will be more plastic than fish in the world's oceans due to 13 million tons of plastic ending up in the ocean each year. Managing plastic waste is increasingly becoming a global environmental and economic challenge[5]. According to a study conducted by Waste Concern, an award-winning social business concern that promotes waste recycling found that a total of 821,250 tons of plastic waste were generated in cities of Bangladesh in 2019[6]. However, in Bangladesh, people dump around 290 Tons of plastic bottles every day[7]. Most of it is improperly disposed, ultimately resulting in water and land pollution.

Another study carried out in collaboration with the government's Department of Environment, also found that 36 percent of the plastic waste was recycled in informal sector while 39 percent dumped in landfills and 25 percent leaked to environment, which eventually went to the Bay of Bengal through the rivers[8].

Therefore, management of the plastic wastes, especially Poly Ethylene Terephthalate (PET) bottle is one of the major challenges. It can be mentioned here that, the recycled plastic is not suggested in food packaging, as recycled plastic is highly dangerous and producers use some additive chemicals for easy manufacturing of plastic containers or packets in suitable shapes. Therefore, the conversion of PET bottles into Polyester Staple Fiber (PSF) can be one of the most suitable environmentally and economic solutions to the waste management problem. As such, Raw Tech Limited (hereafter RTL), a Bangladesh-Hong Kong Joint Venture (JV) for Sustainable Growth has taken an initiative to produce PSF by recycling PET bottles.

1.2 Brief Description of the Project

The Project is located at Kashorghor (Kashor) mouza of Habirbari Union under Bhaluka Upazila of Mymensingh District of Bangladesh. The aerial distance is 11 km from project site to Mawna-Chourasta and 1.6 km west from Dhaka-Mymensingh Highway. The main features of the project are enlisted in the following **Table 1-1.**

The project's owner Raw Tech Ltd. received registration as a joint stock company on Feb.7, 2016. The project was registered with BIDA (Bangladesh Investment Development Authority) on Feb.12, 2018. The project received NOC from Habirbari UP on May 16, 2017. The project has been classified in the Orange-B category by the DoE and was given Site Clearance Certificate on October 24, 2017 and Site Clearance Certificate renewed upto October 23, 2021. All these legal documents are presented in Annexure-A.

[5] https://www.thedailystar.net/opinion/environment/beat-plastic-pollution-1586287
[6] https://www.dhakatribune.com/bangladesh/2020/01/14/keep-track-of-your-plastic-wastes-online
[7] https://www.dhakatribune.com/business/2018/06/14/bpcl-the-business-that-can-save-our-environment
[8] http://www.newagebd.net/article/83179/plastic-pollution-poses-threat-to-bangladesh

Table 1-1: Key Features of the Project

Key Features	Remarks
Name of the project	Raw Tech Limited
Name of the industry	Waste (PET) Recycling Plant
Type of Organization	Private Limited Company
Date of Incorporation	07 February 2016
Registration (Stock Company & Firms Bangladesh) Number	C-128770/2016
Registered address	House No- 90, Road- 13/A, Block- C, Banani, Dhaka
Project Location	Mouza- Kasoghor, Thana- Valuka, District- Mymensingh
Geographical Location	Latitude: 24°18'40.24"N Longitude: 90°22'7.54"E
Trade License Number	48/2018-2019
Tentative COD	10 June 2021
Daily Capacity	20 MT per day
Annual Capacity	6000 MT
Land Area	194.08 decimals (1.94 Acres)
Authorized Capital	5.00 Crore
Paid Up Capital	30.00 Lac
Project Cost	37.99 Crore
Debt Equality Ratio	64.67: 35.33
Debt Amount	24.57 Crore
Equity Amount	13.42 Crore
Machinery Supplier	Zhejiang Boretech Environmental Engineering Co. Ltd
Consultant	1. KPS Consultants & Impacts Pvt. Ltd. (India) 2. P&P Associates Consulting Ltd.

Source: Raw Tech Project Profile, Raw Tech.

1.3 Rationale of The Project

PET bottle has enormous uses in Bangladesh. Most of the liquid beverages, carbonated waters, and mineral waters have their PET bottle containers. PET is also widely used in our flourished Readymade Garments (RMG) industry. But as per latest statistics, around 2.0 billion (200 crores)[9] PET bottles are manufactured each year in Bangladesh and most of them are discarded after single time use. Due to its non-biodegradable nature, most PETs end up in landfills.

Yet, some (≈36%) of the PET bottles are recycled by an informal industry in Bangladesh Earlier, the waste PET bottle was exported to China.[10] But now China has imposed a ban on import of waste PET bottles. Now the bottle needs to be decomposed or recycled in our country. However, PET bottle usually needs ≈500 years to be decomposed into nature. Sensing the environmental and social impact of consumed PET bottle in Bangladesh and to contribute in mitigation of the posing threat to our surrounding environment due to such waste products Raw Tech Limited (RTL) has taken an initiative to turn plastic waste into PSF which is one of the key raw materials in the fashion

[9] Feasibility Study
[10] Feasibility Study

industry today. Its operations are solely built on the 'recover and recycle' business model in which waste, previously considered useless, is being revived for new use.[11]

PET, a type of plastic, stands for Polyethylene Terephthalate. PET is usually a household waste and it is non-biodegradable. Most PETs end up in landfills if not sorted earlier. Recycled Polyethylene Terephthalate (RPET) can be used to make many new products, including fiber for polyester carpet; fabric for T-shirts, athletic shoes, luggage, upholstery, and sweaters; fiberfill for sleeping bags and winter coats; industrial strapping, sheet, and film; automotive parts, such as luggage racks, headliners, fuse boxes, bumpers, grilles, and door panels; and containers for both food and non-food products.

Polyester staple fiber (PSF) is a material produced from synthetic chemical compounds with a variety of uses in the textile, automotive and furniture industries. The phrase "staple fiber" often refers to a kind of natural fiber such as cotton or wool, which can be twisted to form yarn. In 1935, the DuPont Chemical Company created polyester, and the fiber from the chemical compound was strong enough to be twisted into yarn similar to natural fibers. PSF has many applications because of its special characteristics. PSF resists wrinkles, mildew, general surface damage, and most chemicals. This material also holds creases and pleats well, as long as they have been heat-set first.

Polyester fiber has become the fiber of choice within the textile industry, owing to its physical properties, price, recyclability, and versatility, which offer a unique set of advantages unmatched by any other fiber. Since 1990, the overall demand for poly-ester fibers has grown at a sustained rate of nearly 6% per year globally. The poly-ester fiber market accounts for about half of the total global fiber market. In 2016, total demand for polyester fibers was dominated by polyester yarn, which accounts for about 68% of overall consumption (with textile filaments having the greatest share of the yarn segment).[12]

The major application for polyester fibers in the production of fabrics, which are further used to produce apparel, garments, or other finished textile goods. In 2016, the production of apparel covered about half of the polyester fiber end uses. Home furnishings constitute the second-largest end-use sector, accounting for about 25% of the volumes produced globally. Most of the demand is now in Asia (China, India, and Southeast Asia), where the fast-growing textile industry has been consuming increasing amounts of polyester fibers in a chain of textile weaving, dyeing, and apparel-making industries.

Global polyester staple Fiber consumption in 2016 is estimated to be around 16.0 million metric tons. The share of the Indian subcontinent is around 10% of global consumption. Indian consumption of PSF during FY 2015-16 is estimated to be around 900,000 MT. Similarly, PSF consumption during FY 2015-16 in Pakistan and Bangladesh is estimated to be around 400,000 MT and 300,000 MT respectively. (Source IHS, ICIS, Industry Bodies) Polyester is a key raw material for Bangladesh's spinning mills, which imported more than 300,000 tons of the fiber (worth US$ 450 million) during FY 2015-16. (Source: The Financial Express, Dhaka, 13th Sept. 2015). The consumption estimate for FY 2016-17 is expected to be around 340,000 tons. Demand for polyester staple fiber, which is being increasingly used in apparel and home furnishings today, is rising at a rate of 12 to 15 percent per year in Bangladesh[13].

[11] Feasibility Study
[12] Feasibility Study
[13] Feasibility Study

Main process flow of the project consists of purchase & collection of PET bottles from their respective suppliers (e.g. Bhangari shops and other related sources), Sorting of raw materials to exclude other irrelevant components from PET bottles, Washing, Drying, and Cleaning to achieve clean PET plastic, Production of Flakes and PSF. The project is located at Kasoghor, Bhaluka, Mymensingh which is 1.6 km west from the Dhaka-Mymensingh highway.

Considering all the facts above demand for PSF is likely to increase in the future. Raw Tech will produce 6000MT per year to meet a small part of the demand. It is estimated that Raw Tech will start production after the erection and installation of the main machinery.

RTL will recycle around 6000 tons of waste plastic annually that will reduce significant indirect CO_2 emission that would be produced virgin plastic are being used. The economic prospects are also very alluring such as – $4.8 million will be import substitution benefits per year as the total industry is now dependent mostly on imported polyester staple fiber, readily available raw materials with less lead time for various industries, new employment opportunities and reduction of Waste Management Cost by the Government.[14]

The intrinsic strengths of the project include – the first of its kind project in Bangladesh thus gaining the potential first-mover advantage, highest capacity attainment within very short period and dependency on easily available input materials. The possible weakness may be – ensuring specific parameters of raw materials required for desired output, the opportunities can be seen as - saving foreign currency by reducing imported resins and multiple product lines can be created using the same technology.

1.4 Purpose of The ESIA Study

The present version of the ESIA aims at achieving an acceptable level of compliance with applicable World Bank Group's Performance Standards (PS 1-8); under WB OP4.03; applicable to the IPFF-II project. This also implies compliance with the applicable WB EHS general and sector guidelines; and international best practice guidelines. As WB and GoB requirements are rather similar except in a few cases (e.g., emission standards), the OP4.03 compliance would provide assurance that the ESIA is compliant with GoB requirement and the Bangladesh Bank's requirements. Environmental and Social Policy and Procedures (ESPP) document for IPFF II project, which details the key elements of the ESMS which includes:

a) E&S Policy Statement, applicable E&S requirements;
b) Information on relevant national laws and regulations;
c) Procedures to be followed by all project stakeholders;
d) Guidance for conducting assessment of E&S risks and impacts for subprojects; and
e) Arrangements for E&S related disclosure and periodic reporting. E&S Assessment and Management Systems will be implemented by project sponsors in accordance with the relevant regulations of BB and applicable E&S requirements and standards for IPFF II project.

Raw Tech Ltd. has applied for funding from the Bangladesh Infrastructure Finance Fund Limited (BIFFL), which is in consistent with the Investment Promotion and Financing Facility (IPFF) II of the Bangladesh Bank, so Raw Tech Ltd. should follow the GoB law as well as IFC / WB E&S

[14] Feasibility Study

compliance guideline according to OP 4. 03. As per IFC guideline this project falls in **Category B** and requires to conduct ESIA study.

The study area for the ESIA is assumed as a 2 km radius area around the project site in view of its low expected impacts. Environmental and social baseline data have been collected from October to November 2019 & December 2020 and are used to identify potential key impacts. An Environmental and Social Management Plan (ESMP) is also incorporated in the report; to minimize the potential impacts as well.

1.5 Scope of The ESIA Study

1.5.1 Reference Framework for the ESIA Study

The reference framework for the ESIA study will be governed by the following standards/ guidelines:

- Applicable Bangladesh national, regional, and local regulatory requirements;
- World Bank OP 4.03 performance standard;
- Environmental and Social Policy and Procedures (ESPP) of IPFF II Project of Bangladesh Bank;
- The IFC General EHS Guidelines (2007)

1.5.2 Scope of Work

The scope of the study is determined considering the Terms of Reference (ToR) includes identification of statutory requirements, identification of potential environmental and socioeconomic impacts and delineation of Environmental and Social Management Plan (ESMP).

The ToR for the ESIA study is included in Annexure-K. This ToR was provided by the DoE while approving site clearance of the project. The EIA report as per DoE was prepared; which was cleared by the DoE on November 13, 2018. Rather than formal revision of the ToR, this ESIA document has been prepared by updating DoE version of the document by including WB requirements as explained in section 1.4 above.

1. Data collection; (Addressed in Chapter 4)
    - Project planning information
    - Physical, geological and land use information of the project area
    - Ecological survey; and
    - Socioeconomic data.
2. Investigation and survey; (Addressed in Chapter 4, Section 4.3)
    - Water sample collection and analysis;
    - Air quality and noise level investigation
    - Noise level study;
    - Soil sample collection and analysis
3. Environmental policy and legal requirement analysis; (Addressed in Chapter 2)
4. Establishment of the environmental and social baseline condition in respect of the followings: (Addressed in Chapter 4)
    - Physical;

- ✦ Biological; and
- ✦ Socio-economic condition.

5. Public consultations and disclosure; (Addressed in Chapter 7)
6. Impact assessment; (Addressed in Chapter 6)
    a. Identification of potential environmental impacts;
    b. Identification of potential socio-economic impacts; and
    c. Evaluation of identified impacts.
    d. Cumulative impacts
7. Preparation of Environmental and Social Management Plan (ESMP) along with Monitoring Plan; (Addressed in Chapter 8)
8. Preparation of Grievance Redress Mechanism (GRM); (Addressed in Chapter 9)
9. Preparation of Emergency Response Plan; (Addressed in Section 8.7)
10. Disclosure; (Addressed in Section 7.5)

1.5.3 List of Studies

In the completion of the study, a series of sub-studies were conducted. The list of sub-studies that were conducted to complete the study, is summarized in the following Table. It summarizes all the studies and gives an outline where the issues have been described broadly in this report. The larger studies are included as standalone reports as annexes and the other are integrated in the appropriate chapters as shown in the table.

Table 1-2: List of Studies

Study Topics	Application WBG PS, ESHG or other national/international guidelines	Reference Chapter/ Annex
Policy, Legal, and Administrative Framework	Applicable Standards/ Guidelines PS 1	Chapter 2 Annexure A, B
Project Description & study of the project's area of interest for environmental and social setting and scoping	This is part of screening, which is an important tool for predicting and understanding potential environmental and social impacts. As such it can help to identify significant issues for the project. Applicable standards/ Guidelines: PS 1	Chapter 3, 4 and Annexure E, F, N
Baseline Studies	Applicable standards/ Guidelines: PS 1, PS 3	Chapter 4, Annexure E
Analysis of Alternatives	Applicable standards/ Guidelines: PS 1	Chapter 5
Environmental and Social Impact Assessment	Applicable Standards/ Guidelines: PS 1	Chapter 6
Labor Assessment	Applicable Standards/ Guidelines: PS 2	Chapter 6, Annexure O
Critical Habitat Review and assessment	Applicable Standards/ Guidelines: PS 6	Chapter 6, Annexure E.

Study Topics	Application WBG PS, ESHG or other national/international guidelines	Reference Chapter/ Annex
Stakeholder Consultation and Disclosure	Applicable Standards/ Guidelines: PS 1	Chapter 7, Annexure F, L
Pollution prevention and management Plan including (ESMP, Emergency response plan, GRM, Community Health and Safety)	Applicable Standards/ Guidelines: PS 1, PS 2, PS 3, PS 4, PS 6)	Chapter 7, 8, 9 and Annexure E, I, M
Environmental and Social Audit	Applicable Standards/ Guidelines: PS 1, PS 2, PS 3, PS 4, PS 6, PS 8)	Chapter 4 Annexure G

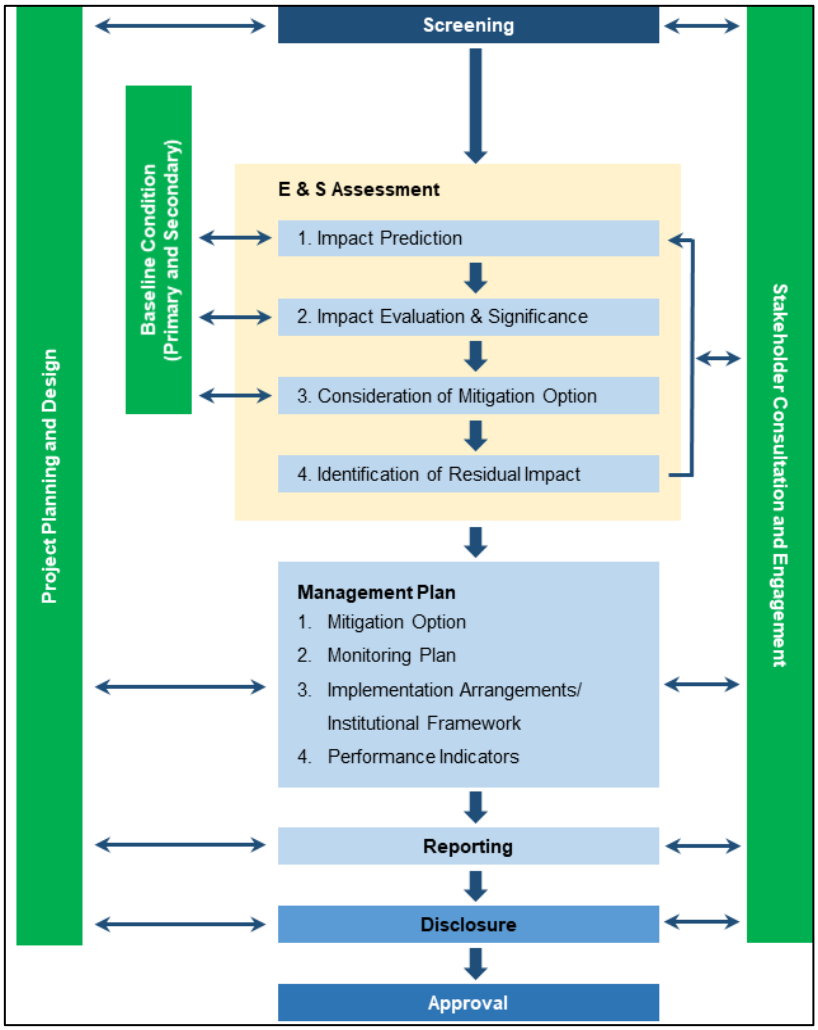
1.6 Approach and Methodology

The Environmental and Social Impact Assessment (ESIA) of the Raw Tech Limited, Kashor, Bhaluka, Mymensingh has been conducted following the EIA Guidelines for Industries, prepared by the Department of Environment (DoE) in 1997 in accordance with the requirement of the Environment Conservation Rules, 1997 under the Environment Conservation Act, 1995. ESIA process involves identification of the key impacts on the natural and social environment and evaluation of the significant impacts along with recommendation of measures as well as listing of unresolved environmental issues. The ESIA includes collection of baseline information, indication of important environmental and social components through scoping sessions, setting up of spatial and temporal boundaries for assessing impacts, impact assessment and evaluation, suggestion of mitigation measures and providing an environmental management plan. The ESIA methodology follows the overall impact assessment approach illustrated in **Figure 1-4**.

A brief description of the approach and methodology of the ESIA is described below. The ESIA study of the proposed project followed a systematic process of

- **Screening of the Study and categorization:** Environment Conservation Rules categorized different projects into four broad categories namely Green, Orange A, Orange B and Red. However, the Production of PSF from PET Bottle or recycling of Plastic Bottle is not enlisted in Schedule-1 of ECR 1997 and further amendment. However, DoE has accepted the Orange-B categorization during EIA clearance process. The screening of the project as per ESPP and WB 4.03 is further justified in the following Chapter 2 and the project is classified in the medium risk category (i.e., Category B as per OP4.03).
- **Environmental and Social baseline data collection:** These data describe the conditions against which the assessment will be undertaken;
- **Environmental and Social auditing** to evaluate the impact of construction work already done;
- **Alternative Analysis;**
- **Consult with stakeholders and the local community** to integrate their views into the project design and mitigation;
- Systematically **predict and evaluate** the positive and negative changes in these baseline conditions;
- All **impacts including cumulative impacts and benefits** of the project should be documented and fully explained within the ESIA report;

- Identification of **mitigation measures** that RTL will avoid, reduce, remedy, offset or compensate for adverse impacts and provide or enhance benefits from the project;
- Develop an **Environmental and Social Management Plan (ESMP)** and **Grievance Redress Mechanism (GRM)**
- **Disclosure** as per requirement of WB OP4.03.



Source: EQMS

Figure 1-1: ESIA Assessment Process

1.6.1 Methodology of the ESIA Study

In order to attain the earlier mentioned scope of work, the ESIA study based on a collection of primary and secondary baseline environmental information, impact assessment and delineation of ESMP. The methodology proposed to complete the ESIA study was divided into the following tasks as presented in the following **Table 1-3** and elaborated in subsequent sections

Table 1-3: Tasks are undertaken for the EIA Study

Task Number	Task
Task 1	Kick-off Meeting and Mobilization
Task 2	Screening of the Project
Task 3	Project Description

Task Number	Task
Task 4	Environmental and Social Baseline Data Collection
Task 5	Environmental & Social Impact Assessment
Task 6	Development of ESMP
Task 7	Preparation of Draft ESIA Report
Task 8	Preparation of Final ESIA Report
Task 9	Disclosure

1.6.1.1 Task-1: Kick-off Meeting

Immediately following the completion of the contract negotiations, a kick-off meeting was initiated. In accordance with EQMS quality requirements, the Project Manager formalizes team briefing notes outlining the scope of work and outputs required from each of the team members. Shortly after this, a kick-off meeting was held at the EQMS office with the officials of the client. The main purpose of this meeting was to:

- Clarify our understanding and major objectives of the project;
- Finalize local logistical arrangements and identify continuous points of contact;
- Present key elements of EQMS's approach to fulfilling all aspects of the project; and
- During the kick-off meeting, project relevant information was requested to the client.

1.6.1.2 Task-2: Screening of ESIA Study

EQMS submitted an RFI to the client and upon its receipt, EQMS reviewed it for the screening of the ESIA study. The review of Project-related information followed the assessment of environment related regulatory requirements for the Project. Any gaps in the Project information, which are essential for determining impacts/risks and as a requirement to comply with the applicable environment-related regulations would be sought from the client. Relevant Project related information that was collected from the client includes the following:

- Geographical Co-ordinates of the Project site/Boundary;
- Maps at appropriate scales to illustrate the proposed project components;
- Brief Project component description - their location etc. on Layout plan; and
- Other Project related information including project cost, land details, surrounding features, details of construction activities, project duration, implementation schedule, water requirement and source, manpower, fuel requirement, energy requirement and source, effluent treatment plant, wastes, and other proposed pollution control measures.

1.6.1.3 Task-3: Project Description

A section on the project description was prepared. This was developed to a level of detail needed to adequately understand potentially significant project impacts. This section covered project location, size, life, schedule, implementation arrangements and discharge information inventories and maps using appropriate scales.

1.6.1.4 Task-4: Environmental and Social Baseline Conditions

The environmental and social baseline data for the assignment was procured as part of the ESIA exercise undertaken under the task proposed to be collected for 02 km radius from the project site during October-November 2019 and December 2020. Environmental and social baselines study the following:

- Ambient Air Quality Data
- Ambient Noise Level Data
- Water resource and quality- Surface and groundwater
- Ecology - covering terrestrial and aquatic flora and fauna (detailed fish survey, Phytoplankton, Zooplankton, and Benthos), habitats and ecologically sensitive spots within the project site and surrounding area;
- Road Network and Traffic factor
- Existing Land use Pattern
- The socio-economic condition of the adjacent area

A. Primary Baseline Data Collection

With the assistance of the client, EQMS has identified an accredited environmental laboratory of repute which was engaged for the collection of baseline information on micro-meteorology, ambient air quality, ambient noise quality, surface and groundwater quality, soil quality and sediment quality as per aspects detailed in the following **Table 1-4**.

Table 1-4: Primary Baseline Data for the ESIA Study

SL	Environmental Attributes	No of Sampling Location	Frequency	Remarks
1.	Ambient Air Quality	03	24 hrs.	AAQ monitoring covering at Project site and nearest settlement
2.	Ambient Noise Level	06	24 hrs.	Noise Level monitoring covering at Project site and nearest settlement
3.	Ground water Quality	02	Once during the baseline survey	Project site and nearest settlement
4.	Surface water Quality	02	Once during the baseline survey	Nearest Ponds
5.	Soil Quality	02	Once during the baseline survey	Project location and nearest agriculture land
6.	Flora and Fauna	Study area	Once during the baseline survey	An ecological survey was undertaken to assess the biodiversity aspects
7.	Fisheries	-	Once during the baseline survey	-

SL	Environmental Attributes	No of Sampling Location	Frequency	Remarks
8.	Socioeconomics	Project area and within 1 km radius	Once during the baseline survey	Mostly assessed through the questionnaire, FGDs, and available secondary information

B. Secondary Baseline Data Collection

Secondary baseline data were collected from the following organizations like Raw Tech Limited (RTL), Bangladesh Meteorological Department (BMD), Forest Department (FD), Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Research Council (BARC), Geological Survey of Bangladesh (GSB), International Union for Conservation of Nature (IUCN), Department of Disaster Management (DDM), published Journals and Books for the following aspects.

Physical Environment	✦ Regional Setting: Physiography, Geomorphology, Land use, Geology, River system, Hydrology and Soil etc.; ✦ Climate and meteorology: Temperature, Rainfall, Humidity, Wind patterns (wind speed and direction); ✦ Hazard and Risks: Natural Hazards, Seismic activities, Seasonal storms & cyclones, Tidal surges, Landslide, Riverbank erosion etc.
Socio-economic Environment	✦ Demographic profile; ✦ Education & Literacy; ✦ Economic activities & livelihood pattern; ✦ Socio-economic Infrastructure & Indicators: Healthcare facilities, Education facilities, Drinking water & sanitation, Transportation facilities, and Sites of cultural/archaeological importance.
Ecology & Biodiversity	✦ IUCN Red list status 2015; ✦ Flora and fauna; ✦ Biodiversity condition; ✦ Existing terrestrial ecosystem; ✦ Aquatic fauna and vegetation.

1.6.1.5 Task-5: Environmental & Social Impact Assessment

The ESIA evaluated potential impacts using a methodology based on the evaluation of the "significance" of identified issues and impacts on baseline parameters. Analysis of the baseline results and the incremental impacts of the project were assessed in accordance with the national guidelines for air, water, and noise emissions; standards mentioned in the ECR, 1997.

The impact assessment covered the full project lifecycle, including pre-construction, construction, operations, and decommissioning activities. The impact assessment has involved the prediction, evaluation, and mitigation of Impacts and reports on impacts including residual impacts and cumulative impacts. Impact prediction was considered control measures that are part of the project design. Additional mitigation measures aimed at further reducing predicted impacts were proposed where necessary or appropriate.

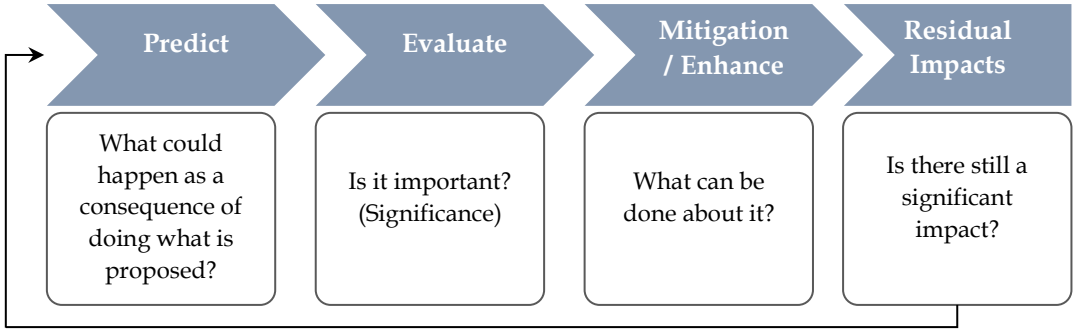


Figure 1-2: Impact Assessment Process for the EIA Study

The impacts were identified and quantified for the intensity using modelling and/or matrix techniques and evaluated as a major, medium, minor or insignificant impact on the environment and communities in the study area. Aspects which were considered in the impact assessment, for the pre-construction, construction, and operation phase of the project, air quality, surface water quality, groundwater quality, noise level, soil quality, ecology, waste, landscape and visual, traffic and natural disaster risk, socio-economic and health. The environmental, socio-economic and project information are collected to assess the potential impacts of the proposed activities. The issues among others are studied included potential project impacts.

The principal aim of this task was to identify and assess potential impacts on various environmental and social components due to the proposed project. Based on baseline data collected from the study area, information on type and quantity of emission of pollutants (provided by client) and surveys of the study area, EQMS' ESIA team identified and predicted potential impacts due to the proposed project on the surrounding environment during pre-construction, construction and operation stages of the project.

The key issues identified after collecting the baseline information. Each issue consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative, from the project onto the environment or from the environment onto the project. In the EIA, the significance of the potential impacts was considered before and after identified mitigation is implemented, for direct, indirect and cumulative impacts, in the short and long term.

Methods of Impact Significance

A description of the nature of the impact, any specific legal requirements and the stage (construction / decommissioning or operation) will be given. The following criteria will be used to evaluate **significance**:

A) Nature:

This is an assessment of the type of effect the activity is likely to have on the surrounding affected environment. The description includes what is being affected and its magnitude. The nature of the impact will be classified as positive or negative, and direct or indirect.

Direct	Potential/ possible Impacts will be generated directly from the project activities and its associated facilities which is directly linked with the project. (e.g. loss of land due to project development or air emission from a plant)

Indirect	Potential/ possible Impacts will be generated from secondary sources which are induced by the project activities. (e.g. loss of any species habitat due to the project activities).
Induced	Potential/ possible Impacts will be generated (which are not part of the Project) due to effect /consequence/ outcome of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

B) Extent and location:

This indicates the spatial area that may be affected by the project activities or its associated facilities (Table A).

Table A: Geographical extent of impact

Extent	Description
Project Site	Potential/ possible Impacts' area only at or within the project site/ project boundary
Local	Potential/ possible Impacts' area is not only limited to the site but also its immediate surrounding areas/ receptors.
Regional	Potential/ possible Impacts' area extends to the immediate surrounding areas along with adjacent areas
National	Potential/ possible Impacts' area considered of national level.
Trans boundary	• Impact considered of not only within national level but also neighbouring countries. • Impact considered at global level.

C) Duration:

This measures the lifetime/ existence/ continuation of the impact (Table B).

Table B: Duration of Impact

Duration	Description
Short term	Potential/possible Impact duration is very limited time or length of construction/decommissioning period
Medium term	Potential/ possible Impact duration will continue after construction period but stop/discontinue/cease within a tenure of 10 years
Long term	Potential/possible Impact duration will continue more than 10 years, or entire operational life of project.
Permanent – Mitigated	Potential/ possible Impact will remain after operational life of project but appropriate mitigation measures reduce the impact
Permanent – no mitigation	• Potential/ possible Impact will remain after operational life of project. • No mitigation measures will reduce impact after implementation.

D) Intensity/severity:

This is the degree to which the project affects or changes the environment; it includes a measure of the reversibility of impacts (Table C).

Table C: Intensity of Impact

Intensity	Description
Low	• Natural functioning of environment is minimally affected. • Natural, cultural and social functions and processes can be reversed to their original state if mitigation measure taken.
Medium	• Environment remarkably distorted/ disturbed/ impacted, still functions, if in modified way. • Negative impacts cannot be fully reversed.
High	• Cultural and social functions and processes distorted/ disturbed/ impacted. • Potentially ceasing of Environmental function temporarily or permanently. • Negative impacts that cannot be fully reversed.

E) Potential for irreplaceable loss of resources:

This is the degree to which the project will cause loss of resources that are irreplaceable (Table D).

Table D: Potential for irreplaceable loss of resources

Potential for irreplaceable loss of resources	Description
Low	No Irreplaceable / unique resources will be impacted.
Medium	Irreplaceable/ unique resources can be replaced, with mitigation measure/ effort and will be replaced after certain period of time.
High	Potential/ possible Impact replace a particular/ vulnerable resource.

F) Probability:

This is the likelihood or the chances that the impact will occur (Table E).

Table E: Probability of Impact

Probability	Description
Low	The probability of the impact to occur is low due to its design or historic experience.
Medium	There is a distinct probability of the impact occurring.
High	It is most likely that the impact will occur.

G) Magnitude:

This is calculated as extent + duration + intensity + potential impact on irreplaceable resources.

Magnitude essentially describes the intensity of the change that has the potential to occur in the resource/receptor as a result of the potential impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor. The universal magnitude designations are; Positive, Low, Medium, High, Very High.

In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the ESIA to indicate that the Project has the potential to result in a potential positive impact, without characterizing the exact degree of positive change that may occur.

- **Significance:** The significance will be rated by combining the consequence of the impact and the probability of occurrence (i.e. Magnitude x probability = significance).

Table F: Significance Identification

		Probability of Impact		
Magnitude of Impact		**Low**	**Medium**	**High**
	Low	Low	Low	Medium
	Medium	Low	Medium	High
	High	Medium	High	High

Table G: Significance of issues (based on Environmental Parameters)

Significance	Description
Low	• Impacts are within the acceptable range. • Potential/ possible impacts such as localized or short-term effects on habitat, species, or environmental media.
Medium	• Potential/ possible impacts such as localized, long-term degradation of sensitive habitat or widespread, short-term impacts to habitat, species, or environmental media. • Potential/ possible Impacts are significant and require attention; • mitigation is required to reduce the negative impacts to acceptable levels; • Potential/ possible impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species, or environmental media.
High	• Impacts are of great importance, mitigation is crucial. • Potential impacts such as significant, widespread, and persistent changes in habitat, species, or environmental media. • Potential impacts such as loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale.

Potential social impacts are inherently variable because community response to a potential impact, perceptions of existing and changing conditions, and the degrees of vulnerability are all heavily dependent on local conditions and the human factor. The significance designations for potential social impacts take into consideration social science expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, government agencies, NGOs and special interest groups, and the oil and gas industry.

Table H: Potential Social Impact Significance

Significance	Definition
Low	Potential/ possible impacts that are short-term nuisance or inconvenience; potentially affected external stakeholders concerned but likely able to adapt with relative ease.

Significance	Definition
Medium	Potential/ possible impacts such as local-to-regional (sub-national) or medium-term effects; potentially affected stakeholders concerned and raise the issue as a high priority, but may be able to adapt with some targeted support or assistance.
High	Potential/ possible impacts such as local-to-global or irreversible long-term effects; potentially affected stakeholders concerned raise the issue as a high priority and are likely not able to adapt without targeted support or assistance.

To determine potential public health impacts, the assessment team considers the public which has the potential to be exposed to various aspects and potential impacts of the project, whether it is a permanent resident with continuous exposure or a periodic exposure to a people transiting through the project area. The significance determinations for potential public health impacts take into consideration local and regional public health expertise and previous experience in Bangladesh regarding the relationships between individuals, communities, health care providers, government agencies, NGOs, and the oil and gas industry.

Table I: Potential Public Health Impact Significance

Significance	Definition
Low	Potential/ possible illness or adverse effect with limited or no impacts on ability to function and medical treatment is limited or not necessary.
Medium	Potential/ possible serious illness or severe adverse health effect requiring a high level of medical treatment or management.
High	Potential/ possible serious illness or chronic exposure of many resulting in life shortening effects.

H) Overall Risk Rating:

Overall Risk Rating of Projects in IPFF-II project: Based on the significance of the impacts, a risk-based rating system has been followed as provided in the ESPP document for the project as shown in Table J. The high, medium and low risk category projects are also referred to as A, B and C category projects respectively.

Table J: Risk Rating as per ESPP document of the IPFF-II Project

Category	Description
High risk	Sub-projects that are likely to have significant adverse E&S impacts that are diverse [15], irreversible[16], or unprecedented[17].

[15] Diverse impacts – impacts resulting on multiple E&S components or receptors over a varying time and spatial scale (e.g., activities that can cause large scale adverse impacts on local air quality, noise levels, generation of hazardous wastes as well as nuisance to community).

[16] Irreversible impacts – impacts on E&S components that, in all practical terms are permanent in nature and cannot be reversed in spite of the removal of the causal stress factor *(e.g., construction or change in land use that permanently destroys habitats used by critically endangered species in accordance with IUCN Red List).*

[17] Unprecedented impacts – are impacts that are first of its kind in terms of available knowledge of their potential to cause harm to the E&S components and their effective mitigation (*e.g., impact of noise pollution on an endangered faunal species in a geographical region where no prior studies are available on impact tolerance and response of the species*).

Category	Description
Medium risk	Sub-projects that are likely to have adverse E&S impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures and international best practice. Potential adverse environmental and/ or social impacts on communities or environmentally important areas are smaller in scale than those of High-Risk transactions.
Low risk	Sub-projects that do not have the characteristics of High or Medium risk subprojects are classified as Low risk category and typically involve business activities with minimal or no adverse E&S impacts.

1.6.1.6 Task-6: Environmental and Social Management Plan (ESMP)

Mitigation measures to minimize identified negative impacts and enhancement of measures for increasing the benefit of positive impacts are suggested in the ESMP for pre-construction, construction, and operation phases of the project. The ESMP comprises of the following aspects of the Project:

- Institutional mechanism - roles and responsibilities for ESMP implementation;
- Summary of significant adverse impacts and potential hazards;
- Mitigation measures and control technologies, safeguards, etc. to minimize adverse impacts on air, noise, water, soil, sediment, ecology, and socio-economic environment, measures to minimize associated hazards and control the emergency; and
- Project monitoring program for effective implementation of the mitigation measures and ascertain the efficacy of the environmental management and hazard control systems in place.

This sets out the mitigation and management measures required during project implementation to avoid or reduce the environmental and/or social impacts, including developing the action plan in accordance with DoE requirements. A monitoring plan included here, covering the type of monitoring to be done, responsible parties, schedule, standards to be used and resources. Plans that can be developed at a later stage (e.g., construction waste management plan, emergency response plan) identified and provided as initial documents, which will be updated prior to the start of construction activities by the contractor.

1.6.1.7 Tasks-7 & 8: Reporting - Draft & Final ESIA Report

Draft ESIA report is prepared upon completion of the above tasks as per the approved Terms of Reference (ToR) for ESIA study by the client. Based on one set of consolidated comments of the client, Draft ESIA was finalized for submission.

1.6.1.8 Tasks-9: Disclosure

The draft ESIA report will be uploaded in the client/lender's website for public comments. The final ESIA will be made available at public accessible places (e.g., local government offices, libraries, community centers, etc.), and the executive summary will be translated into local language (Bengali), which will be posted in the client and lenders websites. The final ESIA document will be shared with lenders for approval and once it is approved, the document will be disclosed according to the procedures of lenders. As a part of the disclosure, all versions (Bengali and English) will be available at the project office in addition to client's website.

1.7 Limitation of the Study

As per the internationally accepted standard and more importantly, instruction of the DoE, the ESIA study should be carried out considering all seasonal aspects including a complete hydrological cycle. However, due to limited time allocation for this study, hydrological, ecological aspects for all seasons could not be covered in this study.

The ESIA study team has prepared this report based on the available information provided by the project proponent (RTL), Feasibility Report, provided design and drawing, and detailed field investigation. Certain provisions in this report assume reliance on conceptual design and technical information without further validation. Therefore, if any issues from data which was provided by the client are the responsibility of RTL.

If the design of the project changes from that assessed due to design development, the inclusion of new information, changing motivations or any other reason, the results of any impact assessment or mitigation measures provided in this report may be inconsistent. The ESIA report excludes the PET bottle sourcing and collection activities.

The report is based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available data and information. If the information to the contrary is discovered, the findings in this ESIA will need to be modified accordingly.

Raw Tech Limited has already obtained Environmental Clearance Certificate from Department of Environment in favor of "Industry for Garments product" categorizing the project as Orange B. DoE has categorized industries into four broad category which does not include Waste management/ Plastic recycling/PSF production. It is expected in the study that, the ECC has been obtaining with proper acknowledgement and information in this regard.

It is important to mention here that, EQMS was assigned to conduct the study in a stage when the preconstruction stage of the project almost over. During field visit, the ESIA team found the preconstruction activities have almost done and construction work is ongoing. Therefore, the ESIA team had to depend on the information provided by the RTL and adjacent local people to construct the scenario of the preconstruction period. The impact of the preconstruction phase has been assessed based the gathered information by the RTL and local people. Therefore, ESIA team gave best effort to assess the impact to the extent possible but cannot ensure that, it represent the exact scenario.

Finally, the ESIA study do not include any market analysis as it is supposed to be done in the feasibility stage. It is considered that, the feasibility study covered market study and supply chain analysis. Therefore, data provided by the Raw Tech regarding market analysis is considered output of the feasibility study.

1.8 The ESIA Team

EQMS is a specialized consultancy firm appointed by the RTL to conduct the ESIA study for the proposed PET bottle to PSF project at Kashor, Habirbari, Bhaluka, Mymensingh. Before conducting the study, it is very important to set up an expert team in order to assess the potential impacts of the project. EQMS formed a professional team consist of qualified and experienced from various disciplines in order to address the critical aspects. The composition of the ESIA team is shown in following **Table 1-5.**

Table 1-5: ESIA study team

Sl#	Name	Area of Expertise	Position Assigned
1	Mirza SA Habib	Ecology, Biodiversity	Team Leader/ Ecology Expert
2	Md. Wahidur Rahman Khan	ESIA, EIA, ESMP	Project Manager/ Environmental Expert
3	Abu Mohammed Nasiruddin	RAP, SIA	Social Expert
4	Nahid Sultana	GIS	GIS Expert
5	Md. Imam Hadi	Ecology	Junior Ecology Expert

1.9 Report Structure

This ESIA report has been largely structured as per ToR received from RTL. The structure of this ESIA report is presented in **Table 1-6**.

Table 1-6: Layout of the ESIA Report

Chapter	Title	Description
	Executive Summary	This section presents brief overview of entire ESIA report
1	Introduction	Chapter 1 presents the background and motivation of the proposed plant project including the methodology followed for conducting the ESIA.
2	Policy, Legal and Administrative Framework	Chapter 2 provides a brief description of the policy and legal framework regarding the environmental aspects of the project in the context of Bangladesh. The chapter also summarized applicable International Safeguard policies relevant to the project
3	Project Description	Chapter 3 presents a description of the different aspects of the proposed project, including project location, site description and construction activities, equipment, and processes to be employed, resources and utilities demand, raw material supply, treatment, waste water treatment facility, project cost and schedule etc.
4	Baseline Environment	Chapter 4 provides a description of the existing physical, ecological, and socio-economic environment of the study area.
5	Analysis of Alternatives	Chapter 5 discusses the alternative considerations that have been studied before finally proposing the present project
6	Environmental and Social Impact Assessment and Mitigation Measures	Chapter 6 describes the potential environmental and social impacts of the proposed project. Impact significance has been calculated and proper mitigation measures have proposed
7	Stakeholder Consultation and Disclosure	Chapter 7 describe stakeholder mapping, KII, FGD, Public Consultation Meeting.

Chapter	Title	Description
8	Environmental and Social Management Plan	Chapter 8 presents the environmental and social management and monitoring plan for the proposed project, both during construction and operation
9	Grievance Redress Mechanism (GRM) and Stakeholder Engagement Plan	Chapter 9 describe proposed Grievance Redress Mechanism (GRM) to allow people to voice concerns regarding environmental and social impacts of the proposed project if they are affected.
10	Conclusion	Chapter 10 presents the conclusions of this environmental and social impact assessment study.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

Since the independence of Bangladesh, the Government of Bangladesh (GoB) was very aware environmental conservation issue. After a few years of passing of independence, the Government passed 'the Environment Pollution Control Ordinance, 1977. Later, the Bangladesh Environment Conservation Act 1995 due to its inadequacy repealed this law and Environment Conservation Rules 1997. The following chapter discusses the different policies and administrative frameworks in context of the environment in Bangladesh.

In accordance with the Bangladesh Environmental Conservation Rules 1997, the generation of Plastic products falls under Orange-B category. The GoB being concern about the adverse impact of plastics bags slapped a ban on polythene bags in 2001. To support the ban further GoB enacted another law entitling "Mandatory Jute Packing Act 2010". Initially, the government had mandated six agricultural commodities–paddy, rice, wheat, maize, sugar, and fertilizer – to have jute packaging. Later, eleven other commodities – ginger, garlic, onion, potato, fish feed, poultry feed, flour, chilies, pulse, coriander, and rice bran – were also brought under the law. However, ECR 1997 does not specify the recycling of plastic products into any category.

2.2 Project Relevant National Environmental, Social and Healthy Safety Laws, Rules, Regulation

All legal provisions relevant to environmental protection applicable in planning, construction, operation, were identified under the scope of the ESIA below summarizes all relevant legal provisions. The applicable National Legal Provisions Applicable to the Proposed Project to Ensure Environmental and Social Protection are enlisted in the following **Table 2-1**.

Table 2-1: Applicable national rules and regulation for the recycling plant

Issue	Legislation or Regulation
Prevention of pollution and protection of Environment	National Environmental Policy 2018
	Environment Conservation Act, 1995 and the Amendment thereafter
	Environment Conservation Rules, 1997 and the Amendment thereafter
	National Water Policy, 1999
	Bangladesh Water Act, 2013
	National Forest Policy 2016
Land use	National Land Use Policy 2001
Health and Safety	The prevention and Extinguish Act, 2003
	Bangladesh Labor Act, 2006

2.3 Triggering of WB PSs and the Corresponding GoB laws, International Conventions, Applicable Rules, Policies, Guidelines

The GoB laws, international Conventions, Applicable Rules, Policies, Guidelines along with the PSs is listed in the following **Table 2-2**. The table summarizes the triggered PS explains the reason with applicable laws, rules and international conventions that is signed by the GoB.

Table 2-2 Triggering of GoB laws, International Conventions, PSs, Applicable Rules, Policies, Guidelines

PS	Title	Triggered		Applicable Bangladesh Laws/Rules and conventions to which Bangladesh is a Party
		Yes	No	
PS1	Assessment and Management of Environmental and Social Risks and Impacts	✓		▪ National Environmental Policy 2018 ▪ Environment Conservation Act, 1995 and the Amendments thereafter ▪ Environment Conservation Rules, 1997 and the Amendments thereafter
	Explanations: As a two-tier operation will be conducted, PS 1 Assessment and Management of Environmental and Social Risk and Impact will be triggered. The PS requires that Project proponent initiate regular assessment of the potential social and environmental risks and impacts and consistently tries to mitigate and manage strategy on an ongoing basis.			
PS 2	Labor and Working Conditions	✓		▪ Bangladesh Labor Act, 2006; Bangladesh labor rules 2015; ▪ Bangladesh labor (Amendment) Act, 2018 ▪ National Occupational Safety and Health Policy in 2013
	Explanations: During field visit it was observed that, around 30 labors were working in ongoing construction activity. However, at peak construction period, around 40 workers were engaged. It is planned that, majority (i.e., 25-30) of the workers are recruited locally and does not stay in the project site. Rest of the worker who are from other district may stay at the project site in labor shed. One labor shed has found in the plant for workers' rest. In the operation period, around 20 workers will be engaged. As the operation phase will involve the engagement of industrial labors, PS 2 will be triggered.			
PS 3		✓		Applicable law/ Rules

PS	Title	Triggered		Applicable Bangladesh Laws/Rules and conventions to which Bangladesh is a Party
		Yes	No	
	Resource efficiency and pollution prevention			▪ Environment Pollution Control Ordinance 1977 ▪ National Environmental Policy 2018 ▪ Environment Conservation Act, 1995 and the Amendments thereafter ▪ Environment Conservation Rules, 1997 and the Amendments thereafter ▪ National Water Policy, 2000 ▪ Bangladesh Water Act, 2013 ▪ National Forest Policy, 2016
				Applicable Treaties
				▪ Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention") ▪ Basel Convention on the Control of Transboundary Movements of Hazardous ▪ Wastes and Their Disposal (Basel, 1989.) ▪ Convention on Biological Diversity, (Rio De Janeiro, 1992.) ▪ International Plant Protection Convention (Rome, 1951.) ▪ Plant Protection Agreement for the South East Asia and Pacific Region (as amended) (Rome, 1956.)
	Explanation The project is likely to cause environmental pollution due to construction and operation of the project. Increase of ambient noise level due to establishment and operational activity in RTL is expected. Due the transportation of materials and vehicle movement activity in the construction phase and operation of machineries for example coiler will generate noise, diesel generators when operated will cause air pollution. In the operation phase ground water will be extracted and used for production and other households' activities, which may likely to impact the water resources. During operation period waste water will be re-used and a zero-discharge plan will be implemented. Due to small contribution in air and noise pollution PS 3 Resource efficiency and pollution prevention will be triggered			
PS 4	Community Health, Safety, and Security	✓		Labor Law, 2006
	Explanations			

PS	Title	Triggered		Applicable Bangladesh Laws/Rules and conventions to which Bangladesh is a Party
		Yes	No	
	During the construction period traffic increased to some extent for transportation of construction material and in the operation phase transportation of raw materials and final products will contribute to increased traffic. These increased number of traffic are likely to increase the probability of accident. However, the number of households using the approach road is very low and proper traffic management will be implemented. Though, no hazardous chemicals are likely to be used in this project, only HCL and polyemer will be used for chemical dosing. PET itself is inflammable and may poses fire hazard and impact community health and safety.			
PS 5	Land Acquisition and Involuntary Resettlement		✓	▪ The Acquisition and Requisition of Immovable Property Ordinance 1982 (Ordinance 11 of 1982); ▪ The Acquisition and Requisition of Immovable Property Act, 2017 (Act No. Of 2017).
	Explanation RTL has acquired 1.94 acres of land through willing buyer and willing seller basis from the land owners (Annexure-C). There was no coercion either physical or mental in the process. The land was previously used for agriculture and it was confirmed during Public Consultation Meeting (PCM), Focus Group Discussion (FGD) and interview that, there was no settlement in the acquired land. Therefore, no resettlement was required. As such land acquisition and involuntary resettlement is not required for the project. Thus PS 5 is not triggered.			
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	✓		▪ Bangladesh Wildlife (Preservation)(Amendment) Act, 1974 ▪ Bangladesh Forest Act, 1978 and subsequent amendments; ▪ National Environment Management Action Plan (NEMAP), 1995 ▪ Environment Court Act, 2000 and subsequent amendments in 2002 ▪ National Biodiversity Strategy and Action Plan (2004) ▪ National Water Bodies Protection Act, 2000
	Explanation There is agricultural land on North side of the project. There is also a canal (locally known as "Poschimer khal") on the east side of the project. The west side is surrounded by agricultural fields. The South and east side is surrounded by scattered settlements with homestead vegetation. There is no protected area within 2 km from the project site. And Kadgarh National Park is the nearest protected area which is located around 4.07 km away from the project site. Thus, the project site does not support habitat of any migratory birds, and critical habitat. It is also not natural forest. The wastewater from the project site will be treated by ETP and reuse. Therefore, no impact on surface water resources is likely to happen due to discharge of waste water. Surface water will not be used in pre-construction, construction, and operation phase; therefore, low impact is anticipated. Thus PS 6 is triggered.			

PS	Title	Triggered		Applicable Bangladesh Laws/Rules and conventions to which Bangladesh is a Party
		Yes	No	
PS 7	Indigenous Peoples		✓	
	Explanation In field survey no Indigenous people was found in and around the project area. However, in the wider area, there are indigenous group (Garo) who are not dependent on the land of the project site and will not be affected by the project. The findings of household survey also suggest that, no indigenous people are likely to be affected by this project. Therefore PS 7 will not be triggered.			
PS 8	Cultural Heritage		✓	
	Explanation There is no cultural heritage within 5 km radius from the project site. Therefore, PS 8 will not be triggered.			

2.4 Categorization of the project

Categorization as per WB-OP 4.03 as detailed in the ESPP document for the IPFF project, it is a small project with limited environmental impact. Only irreversible impact is the change in the land use, but it is the objective of the project. As a result of the project, a small piece of agricultural land (1.94 acres) has now been transformed and settled down to an industrial plant site; bringing economic and social benefit to the community and the country.

However, there are substantial risks in the operational stage of the project due to presence of large quantities (i.e., probably as much as 1000 tons) of inflammable materials (PET and PSF) in the factory premise. The details of the environmental and social impact are summarized in the tables below; which are discussed in more detail in chapters 4 and 6. Based on the impacts on physicochemical and ecological in these chapters, the RTL project was assigned in the Medium Category (i.e., B). The categorization was agreed with Bangladesh Bank before the preparation of the current version of the document. **Table 2-3** summarized RTL impact assessment due to project activities on physio-chemical parameters. **Table 2-4** summarized ecological impact due to RTL project activities.

Table 2-3: Summary of Assessment of impacts of Raw Tech Project due to project activities on physio-chemical parameters, EHS/OHS risks

Physico-chemical Parameters/Risks	Magnitude of Impacts						
	Positive Impacts			No Impacts	Negative Impact/Risks		
	Low	Moderate	High		Low	Medium	High
Construction Stage							
Water Quality				×			

Physico-chemical Parameters/Risks	Magnitude of Impacts						
	Positive Impacts			No Impacts	Negative Impact/Risks		
	Low	Moderate	High		Low	Medium	High
Loss of natural drainage				×			
Soil quality				×			
Air quality					×		
Noise level					×		
Drainage congestion				×			
Operation Stage							
Water Quality				×			
Loss of natural drainage				×			
Water resources/quality				×			
Soil quality				×			
Noise Level					×		
Air quality					×		
Noise level					×		
OHS/EHS Risks						x	
Fire Risk						x	

Table 2-4: Summary of Ecological impacts evaluation that result from the activities associated with the Raw Tech Ltd. project

Source of potential Impacts	Ecological Aspects										
	Flora		Fish	Fauna							
				Amphibia		Reptile		Bird		Mammal	
	AQ	TR		AQ	TR	AQ	TR	AQ	TR	AQ	TR
During Construction											
Camp setting	0	0	0	0	0	0	0	0	0	0	0
Land clearing and/or alteration	0	M	0	0	0	0	0	0	0	0	0
Wetland drying	0	0	0	0	0	0	0	0	0	0	0
Soil Excavation	0	0	0	0	0	0	0	0	0	0	0
Floral removal	0	M	0	0	0	0	0	0	0	0	0
Machinery use (Noise generation/ vibration)	0	0	0	0	0	0	0	0	L	0	L
Water quality deterioration	0	0	0	0	0	0	0	0	0	0	0
Sewage discharge on soil/water	0	0	0	0	0	0	0	0	0	0	0
Site development	0	0	0	0	0	0	0	0	0	0	0
Infrastructure construction inside the RTL project site	0	0	0	0	0	0	0	0	0	0	0
During Operation											
General Waste / sludge disposal on land / water	0	0	0	0	0	0	0	0	0	0	0
Spills (oil) on land / water	0	0	0	0	0	0	0	0	0	0	0
Non-treated wastewater discharge on land / water	0	0	0	0	0	0	0	0	0	0	0

[Legend: AQ = Aquatic; TR = Terrestrial; L= Low impact, M = Medium impact, H = High impact, 0 = No impact (negligible impact)]

3 PROJECT DESCRIPTION

3.1 Background

Bangladesh is perhaps one of the countries with the fastest growth in the consumption of plastic products during the last decade. Between 2005 and 2014, plastic consumption in urban areas of the country has increased significantly (by 169 percent although overall national consumption has increased by 16.2 percent) which is even higher compared to other countries and regions such as North America (32 percent), Asia (80 percent), Europe (37 percent) and world (25 percent) (Source: CPD). The growth in the consumption of plastic products will continue in the coming decade. This possible rise in plastic consumption may lead to huge plastic waste in municipal areas which needs to be properly managed.[18]

Main process flow of the project consists of purchase & collection of PET bottles from their respective suppliers (e.g. Bhangari shops and other related sources), Sorting of raw materials to exclude other irrelevant components from PET bottles, Washing, Drying, and Cleaning to achieve clean PET plastic, Production of Flakes and PSF.

Considering all the facts above demand for PSF is likely to increase in the future. Raw Tech will produce 6000 MT per year to meet a small part of the demand. It is estimated that Raw Tech will start commercial production by 10 June, 2021.

The intrinsic strengths of the project include – being the first of its kind of project in Bangladesh thus gaining the potential first-mover advantage, highest capacity attainment within very short period and dependency on easily available input materials. The possible weakness may be – ensuring specific parameters of raw materials required for desired output, the opportunities can be seen as - saving foreign currency by reducing imported resins and multiple product lines created using the same technology.

3.2 Project Description

Raw Tech has taken an initiative to set up an industry which will be solely built on the "recover and recycle" business model in which waste, previously considered as useless is being revived for a new use. The salient features of the project are enlisted in the following

Table 3-1: Salient Features of the Project

SL.	Feature	Description
1.	Name	Raw Tech Limited, A Hong Kong Bangladesh Joint Venture Private Company
2.	Entrepreneur name	Mr. Ridwan Tarshid Haque
3.	Project Location	Kashor, Habirbari, Bhaluka, Mymensingh
4.	Corporate Office	House 90, Road 13/A, Block C, Banani, Dhaka, Bangladesh.
5.	Registration (Stock Company & Firms Bangladesh) No.	C-128770/2016
6.	Type of Project	PSF Producing Project
7.	Raw Material	Used/Waste PET Bottles

[18] Feasibility Study

SL.	Feature	Description
8.	Production Capacity	6000 MT PSF/Year
9.	Total Land Area	194.08 decimals (1.94 Acres)
10.	Manpower	Construction Phase ≈ 40 Operation Phase ≈20
11.	Water requirement	Construction Phase ≈ 30 m^3/day Operation Phase ≈ 5 m^3/hour
12.	ETP	Electrocoagulation technology for wastewater treatment through Effluent Treatment Plant (ETP) ETP Capacity 108 m^3/day.
13.	PET Bottle washing	Washing detergent, Caustic Soda (Sodium hydroxide)
14.	Water recycling	Wastewater will be treated in ETP and reuse.
15.	Water Source	Ground Water No of Borehole: 1 Depth: 220 ft
16.	Electricity	All machineries will run from by 33kV Rural Electrification Board (Palli Bidyut) line. Running load of electricity is 1500 kW. A 15 kVA emergency generator will be used in case of power failure.
17.	Internal Road Connectivity (Within the project Boundary)	Internal road will be made of Brick Soiling. Load bearing capacity: 20 MT
18.	Cost of the project	37.99 Crore
19.	Machinery Supplier	Zhejiang Boretech Environmental Engineering Co. Ltd.
20.	Consultant	1. KPS Consultants & Impacts Pvt. Ltd. (India) 2. P&P Associates Consulting Ltd.
21.	Approximate Life cycle	15 years

Source: Raw Tech Project Profile & Raw Tech Office

3.2.1 Project Location

The project site is located at Kashor of Habirbari Union under Bhaluka Upazila in Mymensingh District of Bangladesh. The total area of the project is 194.08 decimals (1.94 Acres). The project location is 11 km away from Mawna-Chourasta and 1.6 km west from Dhaka-Mymensingh Highway. The connecting road from Dhaka-Mymensingh highway to project site is Jamirdia-Masterbari road. With geospatial reference, the project site lies between 24°18'40.3"N & 90°22'5.7"E and 24°18'37.9"N & 90°22'8.7"E. Seed Store Bazar bus stand is 2.36 km away to the north side of the project. All infrastructural facilities like water, gas, power, and communication are available here.

There are some other industries (around 17 industries within 2 km radius from the project site) present near the site. The nearest industry is Bhuiya Paper Mill and Raymer Chemical Industry. Nasir Glass Factory is in the south-east side, Cotton Group is on the north-east side of the project. Bajja-Medhuya River is located approximately 7 km north-east side from the project site. The project location is shown in **Figure 3-1**.

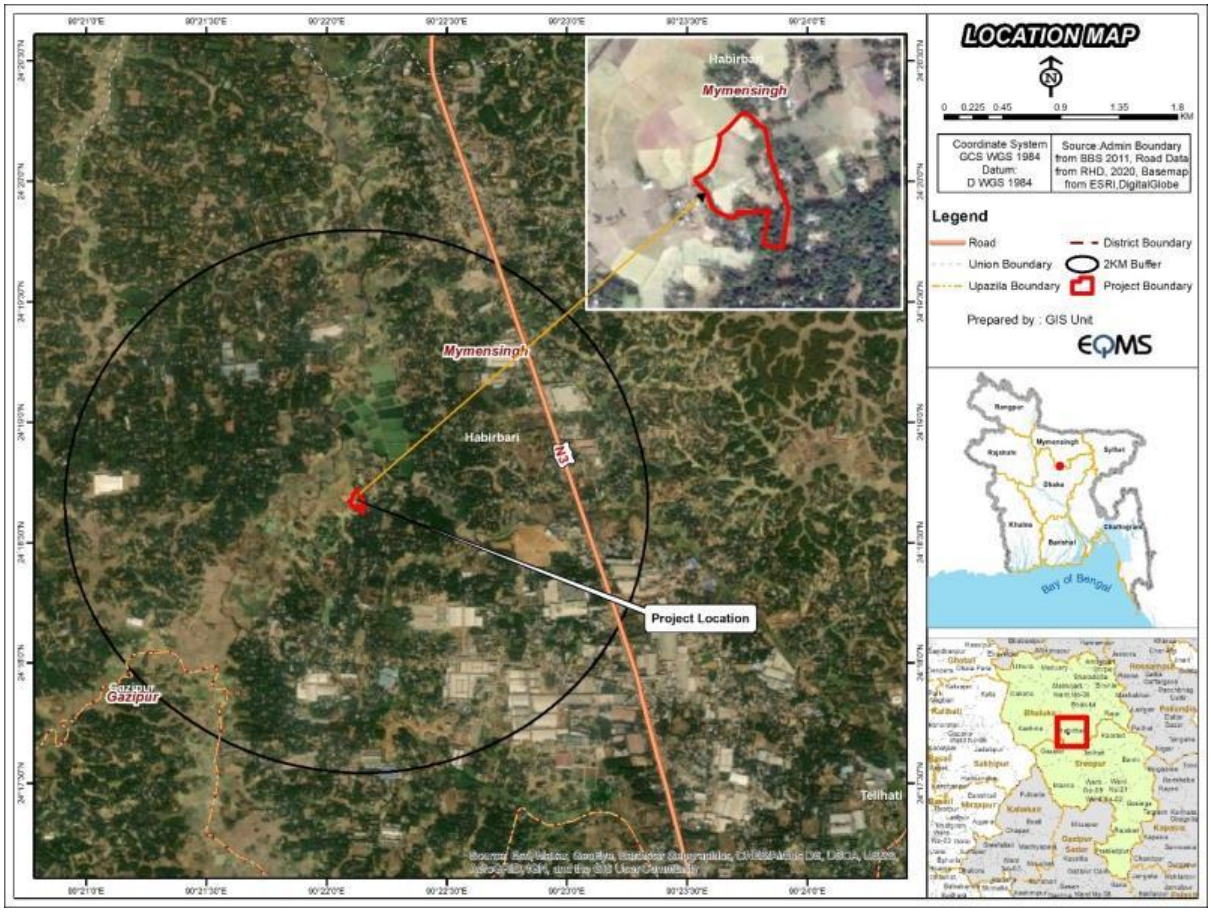


Figure 3-1: Location of the Proposed Project

It has been already mentioned that there are few scattered Households in the West, East and South side of the project. Kashor is the only VEC around the project site. There are 4 mosques, 2 schools and 2 Bazars in Kashor. Households around the project site has dense vegetation area. The Households are the only sensitive receptors around the project site. Most of the sensitive receptors are at least 300 meters away from the project site.

3.2.2 Accessibility to Site

The project site is easily accessible by road network. Dhaka-Mymensingh Highway (N3) is on the west side of the project at only 1.6 km away from the project site. A connecting road has connected the project site to the National Highway. The project site can be accessed via this connecting road from Jamirdia Masterbari-Kashor Chourasta. It is a two-lane road in width. The road has damaged and in a very bad condition. Trucks and pickups travel through this road and carry raw materials and final products of the nearby industries.

The approach road of the project site is not very well structured and not fully developed yet. Few portions of the road are brick soling and the rest of the road is muddy yet. The closest river Bajja-Medhuya is far away from the project site. It is not navigable. Therefore, the project site cannot be accessed by the riverway.

3.2.3 Process Description

3.2.3.1 Production Process

The project is a waste management project which will use discarded plastic bottles and produce PSF as a byproduct of the process. However, R-PSF industries are relatively new in our country yet the technology involved in the manufacturing process is not complicated. However, day by day production technology is developing. To keep ahead of the competition, the project uses state of the art machines and experienced professionals in its production units. The manufacturing process is almost the same for all kinds of PSF recycling plant. Each of the processes passes through a combination of different continuous individual systems and requires basic raw materials like recycled/waste PET.

The manufacturing process of PSF

In order to save costs, an increasing number of PET intermediate producers like spinning mills, strapping mills, or cast film mills are working on the direct use of the PET-flakes, from the treatment of used bottles, with a view to manufacturing an increasing number of polyester intermediates. For the adjustment of the necessary viscosity, besides an efficient drying of the flakes, it is possibly necessary to also reconstitute the viscosity through polycondensation in the melt phase or solid-state polycondensation of the flakes. The latest PET flake conversion processes are applying twin screw extruders, multi-screw extruders or multi-rotation systems and coincidental vacuum degassing to remove moisture and avoid flake pre-drying. These processes allow the conversion of un-dried PET flakes without substantial viscosity decrease caused by hydrolysis. The finished flex is weighed and packaged for marketing. The process block diagram of R-PSF production is illustrated in the following **Figure 3-2**.

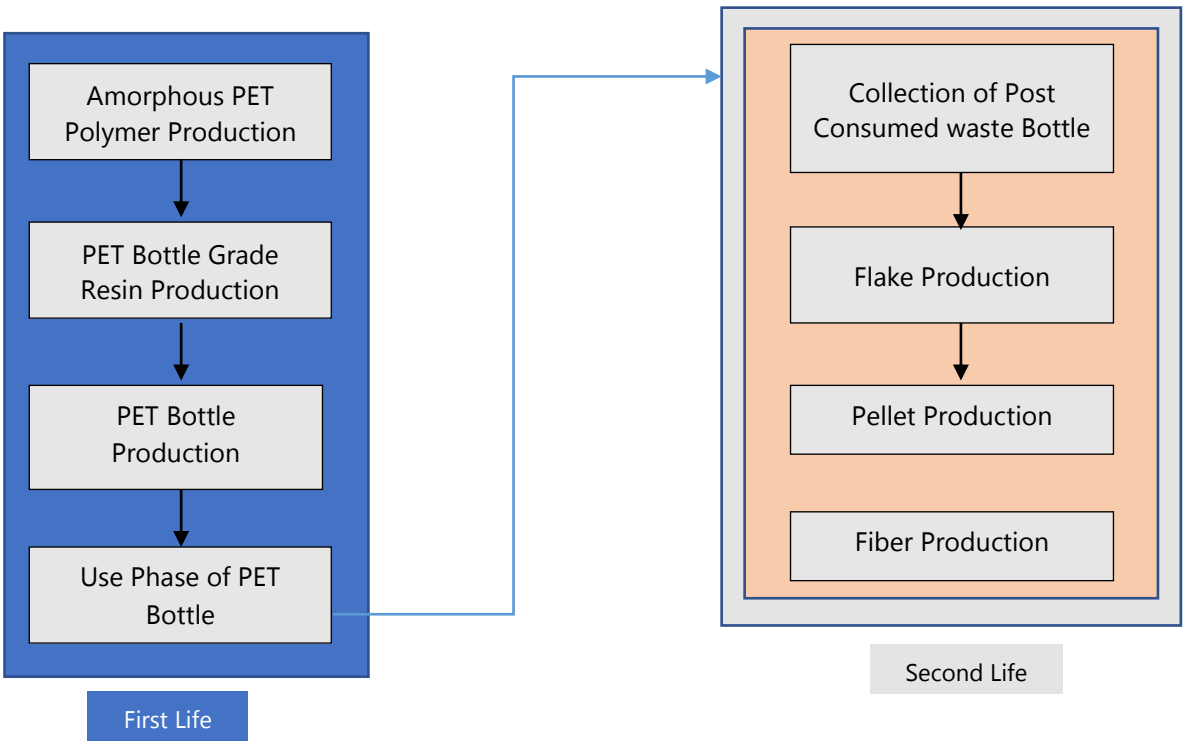


Figure 3-2: Process Block Diagram of R-PSF Production

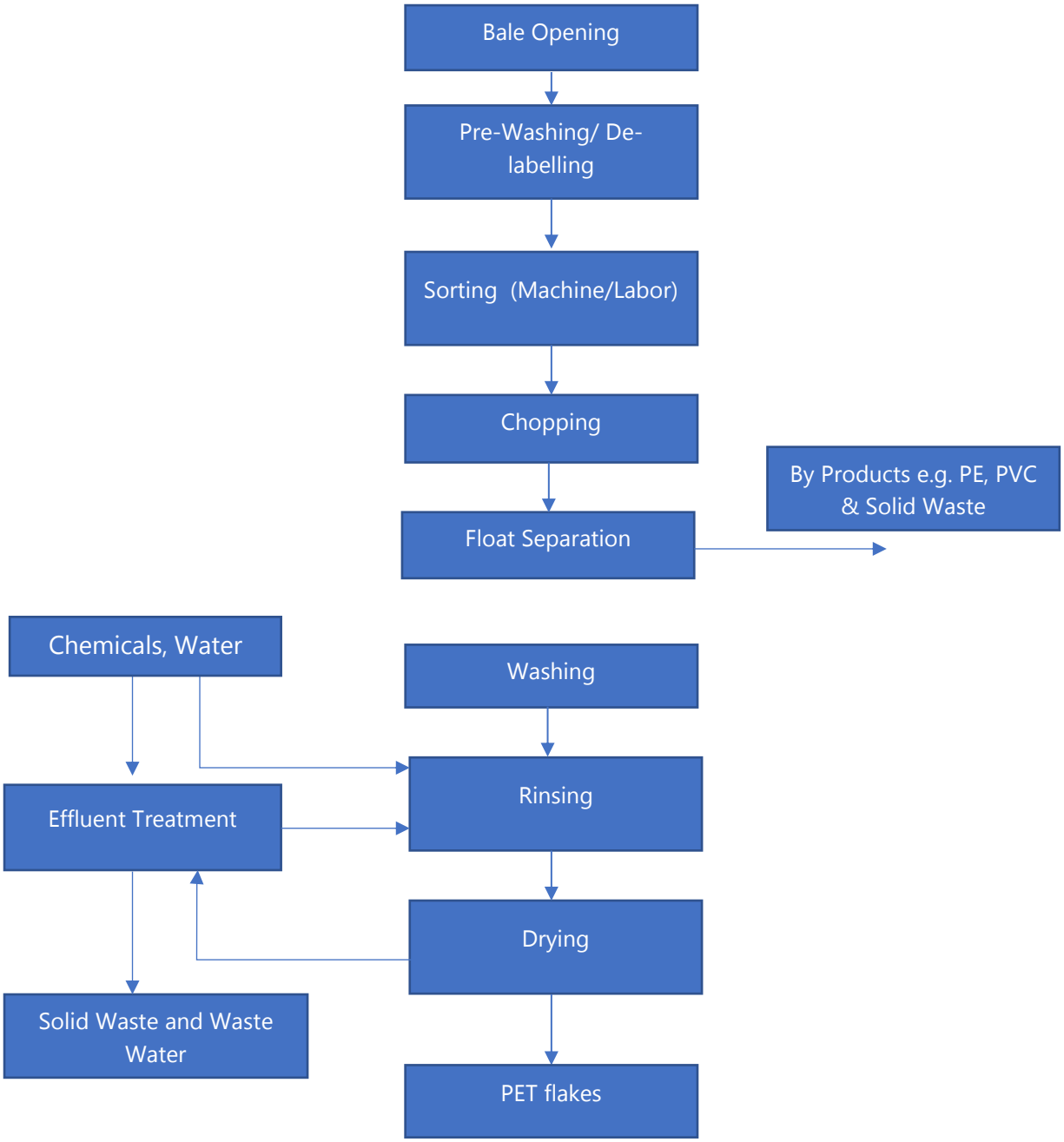


Figure 3-3: Flow Diagram for chopping & cleaning used PET Bottles

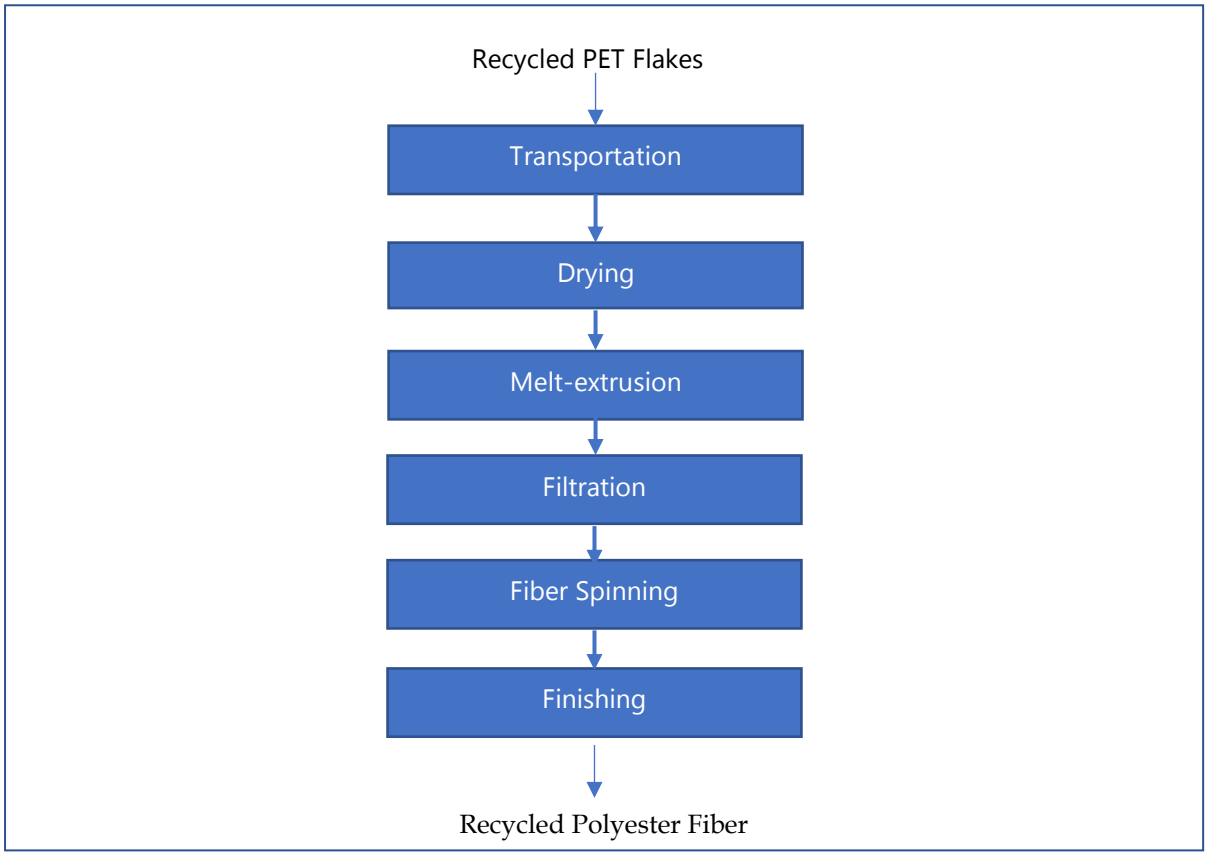


Figure 3-4: Flow Diagram-Producing Recycled Polyester Fiber from PET Flakes

3.2.3.2 Manufacturing Process & Technology

3.2.3.2.1 Step 1: Drying & Extrusion

Polyester waste (PET bottle flakes or recycled PET granules) is first heated in a dehumidified hot air dryer to remove moisture and then fed into a screw extruder. The extruder can be single or twin screw, with or without degassing and with or without a force-feed system. Due to shear forces generated in the extruder the PET flakes are heated and turn into a homogenous thick viscous fluid. The molten poly-ester comes out of the extruder and then goes into distributing pipes.

3.2.3.2.2 Step 2: Spinning into filaments

PET polymer from the extruder is in the form of thick viscous liquid. This liquid is pumped to the melt spinning machine. These machines are single-sided or double-sided and can have 36 / 48 / 64 spinning positions. At each spinning position, the molten polymer is pumped by a high precision metering pump that discharges an accurate quantity of polymer per revolution (to control the denier of the fiber) through a pack that has sand or stainless-steel particles as filter media. Each metering pump is driven by an individual motor that is regulated and controlled by inverters.

The distributing pipes inside the spin beams ensure uniform dwelling time for the melt to reach each spin position. The melt piping system and the spin beams are heated by HTM vapor produced by an HTM evaporator and a specially-designed vapor distributing system ensures uniform temperature for each spinning position. The control instruments on the HTM have double protection for the temperature, pressure, and liquid level, which ensures safe and reliable operation.

The spinnerets are either circular or rectangular in shape and have a specific number of holes depending on the technology used and the final denier being produced. The molten polymer comes out of each hole of the spinneret and is instantly solidified by the flow of cool dry air. This process is called quenching.

After the spinneret, the melt stream becomes a thermoplastic monofilament in a very short time. The control of air temperature, air velocity and air blow distance, as well as the air stability at high speed is very important for the quality of the staple fiber. The quenching air form the circular blower device should be stable, uniform and regulated.

The filaments from each spinneret are collected to form a small ribbon, passed over a wheel that rotates in a bath of spin finish to strengthen the filament cohesion, impart anti-electrostatic property, and reduce friction. One ribbon is then mixed with ribbon coming from other spinning positions; this combined ribbon is towed and is coiled in cans. The material is called undrawn TOW and has no textile properties.

The tow from each spinning position is collected through the creel stand from the fiber cans. There is a tension unit for each can to ensure the tow is evenly collect-ed. Through the furl stand the tow is collected to a less wide tow to fit the width of the roller of tow guide, which gives the draw force to guide the tow to the later process.

3.2.3.2.3 Step 3: Drawing Process

At the next machine (the drawing zone), undrawn tows from several cans are collected in the form of a sheet and passed through hot water to raise the temperature of polymer to 70-degree Celsius, which is the glass transition temperature of the polymer so that the polymer can be drawn. In the next two zones, the polymer is drawn approximately 4 times its initial length and the actual draw or the pull takes place either in a steam chamber or in a hot water trough. After the drawing is complete, each filament has the required denier and has most of its submicroscopic polymer chains aligned parallel to the fiber axis, thereby improving the crystalline of the fiber structure and imparting certain tensile strength.

There are usually 3 stretchers in the section to form two stretching areas. Between the first stretcher and second stretcher, second stretcher and third stretcher there are the drawn bath and steam box for heating of the tow for the stretching of the tow. The stretching of the tow is achieved by different speed ratios between the stretchers.

3.2.3.2.4 Step 4: Annealing

The next step is to set the strength of the fiber by annealing the filaments by passing them under tension on several steam-heated cylinders at temperatures 180 to 220-degree Celsius. Also, the filaments may be shrunk on the first zone of the annealer by overfeeding and imparting higher strength by stretching the filaments by 2% or so in the final zone of the annealer. However, for regular or medium tenacity fibers the process is optional.

3.2.3.2.5 Step 5: Finishing

Next, the fiber is quenched in a hot water bath and then passed through a steam chest to again heat up the tow to 100 °C so that the crimping process which takes place in the stuffer box proceeds smoothly and the crimps have good stability. The textile spin finish is applied either before crimping by kiss roll technique or after crimping by a bank of hollow cone sprays mounted on both sides of the tow.

The next step is to set the crimps and dry the tow fully which is carried out by laying the tow on a lattice that passes through a hot air chamber at 85 °C or so. The tow is guided to a cutter and the cut fibers are baled for dispatch. The cutter is a reel having slots at intervals equal to the cut length desired 32 or 38 or 44 or 51 mm. Each slot has a sharp stainless steel or tungsten carbide blade placed in it. The tow is wound on a cutter reel, at one side of the reel is a presser wheel which presses the tow on to the blades and the tow is cut. The cut fiber falls by gravity and is usually partially opened by several air jets and finally the fiber is baled. Some, balers have a pre- weighing arrangement which enables the baler to produce all bales of a pre-determined weight. The bale is transported to a warehouse where it is "matured" for a minimum of 8/10 days before it is permitted to be dispatched to the spinning mill.

(For producing solid fiber there is a spreading machine before the relaxing heat oven for purpose of spreading the tow evenly on the chainplate of relaxing heat oven, which is divided into different zones including heating zone, relaxing zone, and cooling zone etc. The tow is guided to another tension device and cutter behind the relaxing heat oven to be cut into staple fiber, then conveyed to the baler by a pneumatic conveyor, and then pressed into bales by the baler).

Cleaning and preparation of spinning pack

The spinnerets and the distribution plates are cleaned by an ultrasonic cleaning unit to remove remaining particles. Finally, all the cleaned parts are dried with compressed air, tested, and put into plastic bags as spares if they are qualified.

Finish oil preparation

The oil preparation system is used to produce finish oil of different concentrations. Selected ingredients are put into a metering and mixing tank at high concentration for premixing. The tank is equipped with a steam-heated jacket. The finish oil of higher concentration in the metering tank enters two oil mixing tanks by dead weight. Then it is diluted to required concentration by adding proportional dilution. During dilution, a stirrer is used to mix evenly the finish oil, which is transported by the oil circulating pump to the oil storage tanks used for oiling at taking-up and the after-processing line. The oil circulating pump is equipped with a mixture filter to remove impurities from the finish oil.

The finish oil in the storage tank drops to the places needing oiling by dead weight. There is an oil feed tank between the storage tank and the taking-up where oiling is needed so that static head before the oil metering pump can be guaranteed. The feed tank is used together with an oil collecting tank, an oil transmission tank, and an oil filter to form the oiling circulation system at take-up.

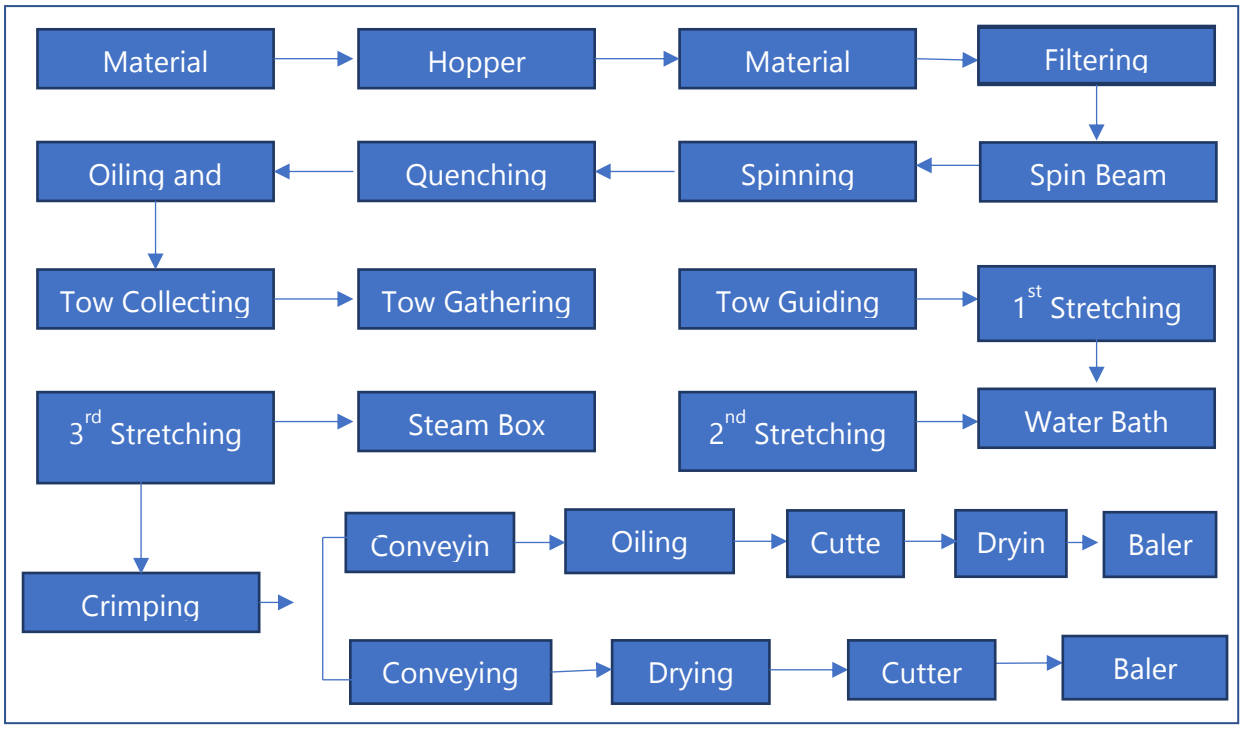
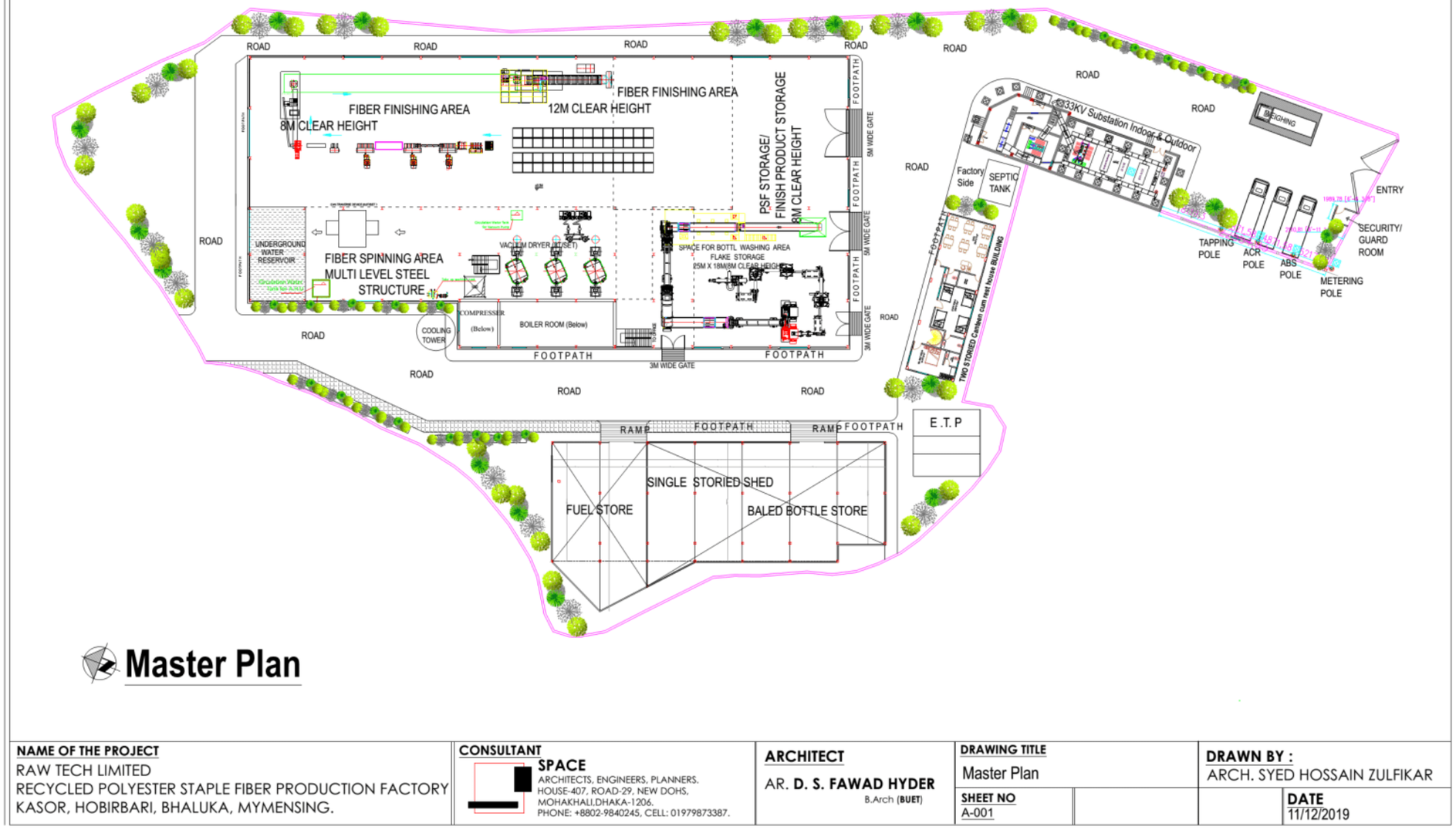


Figure 3-5: Manufacturing Process Flow Diagram

3.2.4 Layout Plan

The building & other civil structure of the project includes main factory building, boiler house (15′×20′), workshop, vacuum dryer (8T/SET), bottle washing area including flake storage (50′×50′) (25M×18M and 8M clear height), fiber finishing area, fuel storage, 33 kV substation (30′×20′), generator (20′×20′), ETP, water reservoir, cooling tower, finished goods warehouse, office building and quarter (50′×20′), security and guard room with guest waiting room (15′×10′), weighting area, 3-5 M wide gate and boundary wall etc. The layout plan of the Project site is shown in **Figure 3-6**.



Source: Rawtech Project Profile

Figure 3-6: Layout Plan of the Project Site

3.2.5 Product Description

Plastic PET containers are collected from various sources and sorted by type and color. They are then stripped of their label sand caps, washed, and crushed, then chopped into Stakes. The Stakes are melted and extruded to create fabric which is then crimped, cut, drawn, and stretched in to desired length for strength, then baled. The baled fiber can be processed in to fabric for a variety of textile product end uses.

End applications include stuffing for jackets, cushions, pillows, mattresses, toys, sleeping bags, quilts, fur fabrics etc. Hollow fiber of 4D, 6D & 15D is mainly used for this purpose.

Another major use of R-PSF is in the needle-punched non- woven fabric industry. Solid non-siliconized R-PSF of 1.5D, 3D, 6D & 15D in white, black, and other colors is used. Main application is in automotive segment (carpet, upholstery, trunk liner, roof insulation etc.), carpet segment (exhibition, floor, wall carpets & carpet backing), filter segment and geo-textiles.

3.2.6 Present Status of the Project

3.2.6.1 Site and Surrounding

During field visit on 10th December, 2020, it was observed that, Land development work has finished and civil construction such as factory steel structure, substation, admin building, 33 kV line construction, guard room) have already finished except shed's wall and storage building construction, approach road construction and installation of machineries and Effluent Treatment Plant (ETP). The approach road of the project site is not fully developed. Few portions of the road are brick soling and the rest of the road is earthen. The tentative date of commercial operation of the project is June 2021.

There is a canal which is located approximately 170 m away from the project site. According to consultation with local people it was apparent that, the canal is polluted by the discharge of waste water from nearby industries (see **Figure 3-7**).

The west and north side of the project site is agricultural land and some scattered settlement was noticed at south and east side of RTL project site. The project proponent has already started tree plantation work around the boundary wall. In order to ensure safety work environment, sufficient Personal Protective Equipment (PPE), fire extinguisher, first aid box have been supplied. To build up awareness and emergency response, standard symbol, signboard have been set-up. **Figure 3-7** shows the present status of the project and surrounding area which has been captured during recent field visit.





Main Gate



Factory shed under construction



Administrative building



Substation



West Side of Project Boundary



North Side of Project Boundary



East Side of Project Boundary

South Side of Project Boundary



Tree Plantation in the Project Boundary



Exit Road



Approach road in front of the project site



Approach road (Earthen Road)



Approach road (Brick Solling Road)



Masterbari Road and Seed Store connecting Road



Project Status before Construction



Water reservoir inside the project site



Machine Installation ongoing



Toilet Facilities for Worker



Canal (170 m NW from the project Boundary)



Safety measures signboard

Figure 3-7: Current Status of the Project

3.2.6.2 Project Progress

The building & other civil works of the project includes main factory building, boiler house, workshop, maintenance and equipment warehouse, main drive, substation, generator, finished goods warehouse, labor shed, office building, security and guard room with guest waiting room, water tanks, boundary wall etc. Major progress of the project is enlisted in the **Table 3-2**.

.

Table 3-2: Present Work Progress of the project

Items		Completion Status
Civil Works		
1.	Civil works including Earth Cutting, Sand Filling, Rod fabrication, RCC works etc.	Yes
2.	Internal Lighting & power works including all necessary accessories	Yes
3.	Internal cable works from LV control panel to all equipment along with Cable Tray/cable ladders, cable glands and other accessories.	Yes
4.	Office Building (20x60) x3, including Earth cutting, sand filling, rod fabrication, RCC works, Tiles works and complete with Electrical and Sanitary works etc.	Yes
5.	Substations (30'x20') including foundation & Roof works	Yes
6.	Security and guard room with guest waiting room (15x10)	Yes
7.	Construction of Generator Room (20x20)	Yes
8.	15 kVA Generator for construction works	Yes
9.	Boiler Room (15x20)	Yes
10.	Employee Bachelors Quarter (50x20)	Yes
11.	Raw materials store (50x50)	No
12.	Internal Road work	No
13.	Approach Road works from main road to Factory	No
14.	Boundary Wall	Yes
15.	External drainage, Sanitary, piping works & Safety Tank,	Yes
16.	Deep Tube Well with Water Tank	Yes
17.	Factory weight machine of all incoming and outgoing materials	Ongoing
18.	Main Gate	Yes
Mechanical and Electrical Progress		
19.	ETP installation	No
20.	Machineries installation	No

Source: Rawtech Profile & Site Survey

3.3 Resources and Utilities Demand

3.3.1 Electricity

All machineries except Boiler and generator will run by 33 kV Palli Bidyut line, which has a load of 1500 kW. The main grid is located at Kashor Chourasta. The line is connected to the project site through 25 poles which runs along the existing Local Govt. Road under the responsibility of REB. Raw Tech Ltd. will install their own generator (15 kVA) for emergency backup which will use Diesel as fuel.

3.3.2 Water

The plant will use water daily for washing raw materials, hot water washing, cleaning, and other purposes. To meet the purpose of the water requirement, RTL has already installed a 220 ft-deep

borehole inside the project area. In the construction phase, the water requirement will be around 20-30 m^3 per day. On the other hand, in operation phase requirement of water will be approximately 5 m^3/hr.

3.3.3 Fuel

Fuel requirement is very minimal as most of the machineries will be running by electricity. The boiler will be running by natural gas. Raw Tech Ltd. will use Titas Gas to run the boiler (1.5 TPH), which will have a pressure of 15 psi. The main transmission line is situated at Kashor chourasta and it will be connected to the project site along the existing local road.

Only the backup generator, will need Diesel for running on emergency basis. Diesel fuel will be collected from local Petrol Pumps.

3.3.4 Chemicals

To wash the dirt of the bottle's, chemicals will be used. The chemicals that are to be used cleaning are cleaning detergent and caustic soda. It is anticipated that around 3 kg of chemicals will be required for production of per ton of raw material. According to RTL, the chemicals will be collected from local market if the quality is found satisfactory. The wastewater generated from washing will be treated through electrocoagulation technique in Effluent Treatment Plant (ETP). Capacity of the ETP will be 108 m^3/day.

3.4 Raw Materials supply

Continuous supply of raw materials is one of the prerequisites of smooth production. To ensure the continuous raw materials supply, RTL has made supply agreement with two renowned suppliers- Mosa Enterprise and Nirob Pet Flakes. Among them one of the suppliers was interviewed by the ESIA team.

The entity Mosa Enterprise, located in Kashor, Habirbari, Bhaluka, Mymensingh, is a local vendor; which has agreed to supply clear PET bottles. They can provide approximately 20 Ton of bottles per day all year around in Bales of 250kg at TK 27-35/kg to factory without bottle cap. The Enterprise (Bottle Supplier) will supply a minimum of 12 tons clear PET bottles per day. The proprietor confirmed that, they do not engage any child labor in the bottle collection process. Currently they provide supply to one factory for plastic sack preparation.

On the other hand, the entity Nirob Pet Flakes, located in Jhawchar, West Hazaribagh, Jigatola, Dhaka, is a local vendor, which has agreed to supply clear PET flakes in 25 kg pp bags: TK 45/kg to factory. The minimum amount of per day supply will be 10 tons PET flakes.



Figure 3-8: Interview with proprietor of Musa Enterprise (Bottle Supplier)

3.5 Employment Generation by the Project

As an operational business entity, the project inevitably creates some economic impact. Upon implementation, the project will generate employment for around 20 people of different categories. Thus, the project will play a significant role to lessen the unemployment problem of the country a bit and improve the living standard of the employed people. On the other hand, additional employment opportunity will be created for processing, supply and distribution of raw materials and supply of finished items.

3.6 Effluent Treatment Plant (ETP)

As mentioned before, RTL has planned to install an Effluent Treatment Plant (ETP) to treat the waste water. The process of treatment will be Electrocoagulation. A brief description of the waste water treatment is described below.

3.6.1 Electro Coagulation System

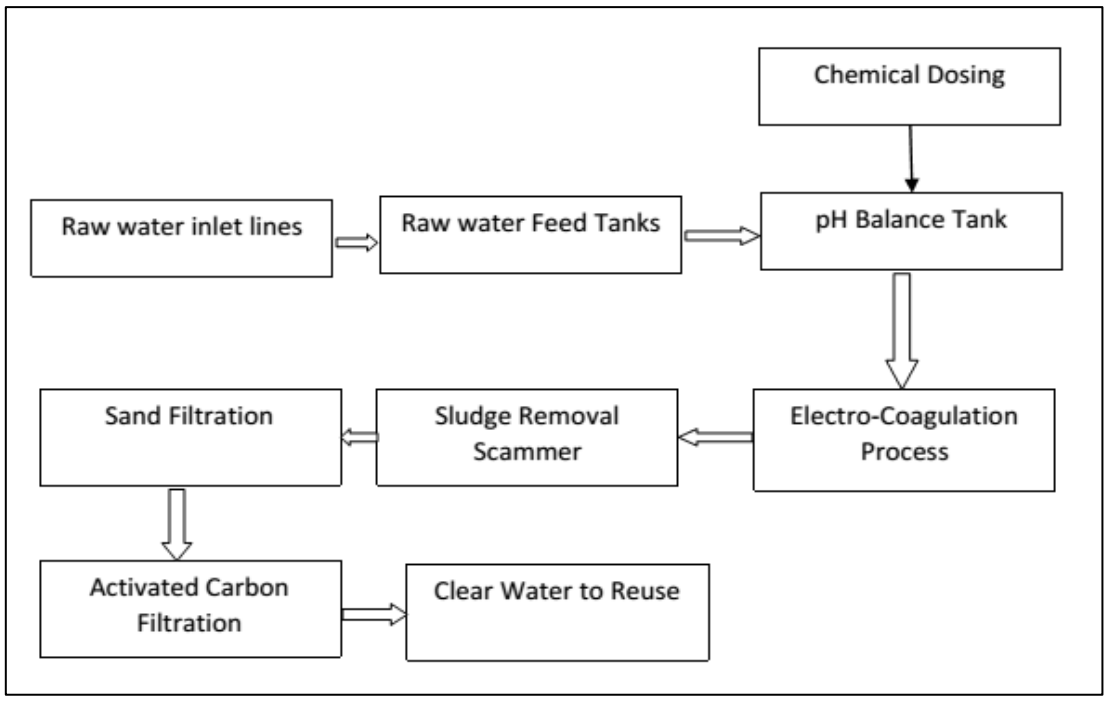
The conventional Effluent Treatment Plant (ETP) process are Biological or Chemical Coagulation, Flocculation, and others process using chemical/salt specially for ETP required or wide Sand filter chamber, Carbon filter and Chlorination at Biological treatment process.

EC (Electro Coagulation) system is very simple and Environment friendly technology. Hydrochloric Acid (HCl) and Polymer is required for chemical dosing, Direct Current (DC) and NaCl (Salt) or Brine water is used for increased conductivity in Electro Coagulation process. EC process Destabilizes Dissolved Colloidal particles, Suspended Solid (SS), Organic matter, Oil, Grease. EC system effectively remove Bacteria, Virus, Coliform, Pathogens as its outer shell are negatively charged, so positive electrode attract them, as a result all Bacteria, Coliform/E-Coli, Virus, Pathogens and Microbes are die out for toxic effect and cannot spread more. The EC process is an Electro-chemical reaction of NaCl/Brine solution and as a of Chlorination in the process, the sewage water becomes completely disinfected after treatment. The Chemical ions like as -Nitrate, Phosphate, Pb, Zinc, Iron, Pesticides, Herbicide, other heavy metal, detergent, or laundry bleaching chemical are removed in the Oxidation and reduction process of Electro coagulation reduce BOD and COD levels.

After Electro Coagulation the treated water passes through a final filter array system integrated Coconut Shell Activated Carbon (CSAC) which result in clean, disinfected, and reduced BOD/COD levels compliant with the standard of DoE of Bangladesh for discharge to waterbodies.

3.6.2 Effluent Treatment Mechanism

The inlet Effluent wastewater passes through to Electro Coagulation Cell and filter array. In the coagulation cell DC power supply with controlled current density is used for Coagulation, Flocculation and Electrochemical process NaCl (Salt) solution or Brine water is used for increased conductivity along with Chlorination process in the Electro-Chemical reaction. Ions of Chemicals and Salts with opposite charges destabilizes the colloids, allowing them to coagulate. In this process, charged ionic species of metals or otherwise are removed from waste water by reaction with an Ion having an opposite charge, or with flocks of metallic hydroxides generated within the sewage/effluent. The final filtration through filter array with Nano Filter and CSAC (Coconut Shell Activated Carbon) filter with its micro pore (4 nm<) structure and Adsorption capability to trap the microorganism residue and heavy metal Ion. So, the out let water are free from contaminant heavy metal, Coliform, Pathogen, Fat, Oil and Grease thus can comply with re-use as per DoE of Bangladesh. Process balance diagram of ETP is shown in **Figure 3-9**.



Source: Raw Tech Ltd

Figure 3-9: ETP process flow diagram

3.6.3 ETP Design Basis

Based on the water requirement ETP has been designed. Water requirement for the operation of the recycling plant will be 60 m^3/day. Required capacity is 60 m^3/day but ETP designed for 108 m^3/day. Therefore, the system is designed with safe margin.

Required chemicals dosing and amount:

1. Hydrochloric Acid: HCl for Neutral of high alkalinity due to NaOH
   Average Dosing amount – 500 ml/m^3 for Effluent pH- 10 to 14
2. Polymer: Polymer for Coagulation process at Scammer tank.

Average uses 200 gm polymer dilution with water per day

Sludge production:

1. Around 20-30 kgs sludge will be produced per day
2. Produced sludge contains mainly of harmless silt and clay.
3. RTL should have appropriate solid waste management plan to ensure safe disposal of these wastes through DoE approved agents.

3.7 Project Cost

The total of the project cost is considered as 37.99 crore. Among them 94.49% is considered as total fixed cost and 5.51% is considered as IDCP. Form the **Table 3-3** it is evident that 33.62% will be expended for factory building, 29.85% will be used for imported machinery and 14.21% will be used for electrician work.

Table 3-3: Breakdown of the Project Cost

Item	Amount	Ratio	Purpose
Land & Land Development	35,287,371	9.29%	Land Related
Factory Building	127,720,450	33.62%	Capex
Imported Machinery	113,400,000	29.85%	
Local Machinery & Equipment	13,000,000	3.42%	
Erection & Installation Charges	3,000,000	0.79%	
Office Equipment, Vehicle & IT	3,000,000	0.79%	
Preliminary Expenses	9,625,000	2.53%	Pre-Operating
Electrification Works	53,970,000	14.21%	WC
TOTAL FIXED COST	359,002,821	94.49%	
IDCP	20,923,666	5.51%	
TOTAL PROJECT COST	379,926,486	100.00%	

Source: Raw Tech Limited

3.8 Project Schedule

According to initial implementation schedule, the project construction activities were supposed to complete by 15 February 2020. Due to some unavoidable circumstances the project schedule has been revised. It will take 628 days to complete the construction of the plant. The commercial operation date will be 10 June, 2021. Revised project implementation schedule is shown in **Figure 3-10**.

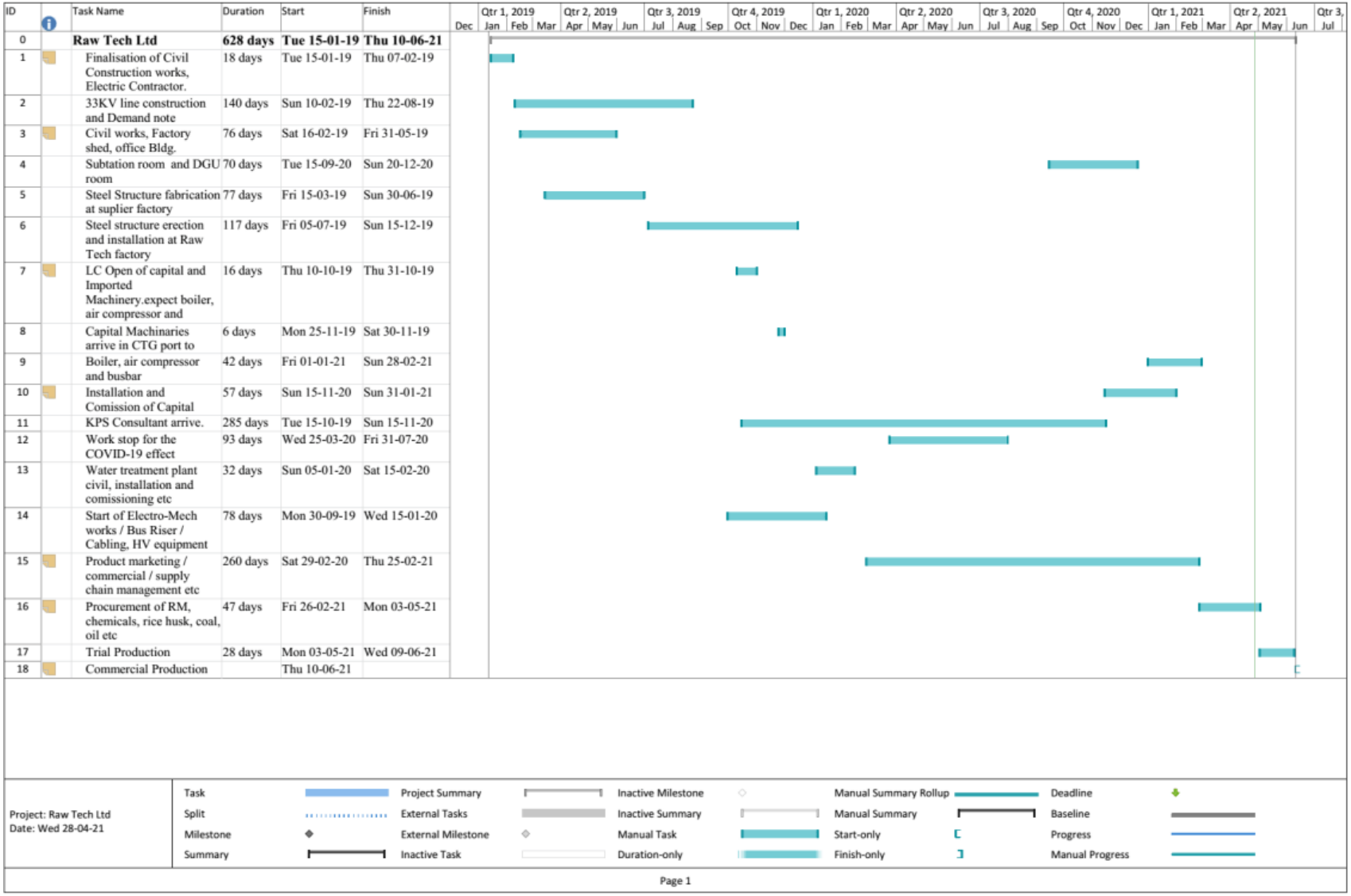


Figure 3-10: Project Implementation Schedule

4 BASELINE ENVIRONMENT

Before starting the impact assessment of the proposed RTL project, it is necessary to determine the status of the environmental and social parameters which are likely to be affected as a result of implementation of the project. This chapter describes the existing environmental and social baseline setting of the study area. The baseline data were collected through field investigations and collection of available secondary data, trough the review of existing documents/publications pertaining to the study area.

The baseline data collection for different environmental and biological components like meteorology, ambient air quality, noise level, ground water quality, surface water quality, land use, ecology (terrestrial and aquatic), fisheries, geology, physiography, and agro-ecology were carried out by EQMS through a well-developed field studies program covering data collection during October-November 2019 and December 2020 from primary and as well as secondary sources.

According to the existing environmental and social scenario, potential impacts of the proposed project has been identified and management plan has been proposed accordingly in upcoming sections. The baseline environmental conditions will help to compare and monitor the predicted negative and positive impacts of the project during pre-construction, construction, and operation phases. The purposes of describing the environmental settings of the study area are:

- To understand the existing environmental and social characteristics of the area; and
- To assess the potential environmental and social impact of the project.

4.1 Physical Environmental

4.1.1 Geology

Geology of Bangladesh is governed by the county's location as Bangladesh is mainly a riverine country. There are two small areas of slightly higher land in the north-center and north-west composed of old alluvium called the Madhupur Tract and the Barind Tract, and steep, folded, hill ranges of older (Tertiary) rocks along the eastern border. Generally, the geology of Bangladesh is classified into 31 broad categories. The project area falls under Madhupur Clay Residuum geological classification of Bangladesh.

Madhupur Clay Residuum

Light yellowish- grey, orange, light to brick-red, and greyish-white, micaceous silty clay to sandy clay; plastic and abundantly mottled in upper 8 m contains small clusters of organic matter. Sand fraction dominantly quartz; minor feldspar (orthoclase greater than plagioclase) and mica; sand content increases with depth. Dominant clay minerals are kaolinite and illite. Iron manganese oxide nodules concentrated in zones; calcium carbonate nodules rare. Locally, a cohesive, 35-cm-thick iron oxide zone is preserved near the surface of residuum. Unoxidized clay coatings occur along root tubes, burrows, vugs, cavities, and fracture planes. Gradational contact with underlying sand. Density of incised streams is greater and drainage networks more complex than on Barind surface.

4.1.2 Physiography

Physiography is the description of an area including form, substance, arrangement, and changes of especially natural features[19].

Thus, physiographic region/unit refers to a region of which all parts are similar in terms of physical characteristics and which consequently had a uniform geomorphic history, and whose pattern of topographical features or landforms differs significantly from that of adjacent regions. In this context, Bangladesh can be classified into three distinct regions a) floodplain, b) terrace and c) hills. Each of the region has its own distinguish characteristics. The physiography of the country has been divided into 24 sub regions and 54 units. The project area falls under Madhupur Tract region.

Madhupur Tract

Madhupur Tract a large upland area in the central part of Bangladesh comprising greater Dhaka and Mymensingh district. Madhupur Tract measures about 4,105 sq km. Comparable to the Barind Tract, the area belongs to a Pleistocene terrace consisting mainly of red colored and mottled clays. It is characterized by plateau-like hillocks varying in height from 9 to 18.5m, and a dendritic drainage pattern, typical of all Pleistocene terraces in Bangladesh. The valleys, mostly flat, are cultivated. The southern part of this tract is known in Bangla as Bhawal Garh and the northern part as Madhupur Garh. Geologically it is a terrace from one to ten metres above the adjacent floodplains.

The soils of the Tract have developed largely on Madhupur clays; 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 dendritic. Madhupur Tract is afforested with valuable trees, such as, Gazari, Karai and Garjan.

4.1.3 Land Use

The land uses of the AOI have been studied using high-resolution satellite imagery and through subsequent ground-truth exercise conducted during the site reconnaissance surveys. Land use inventories are an essential component in land resources evaluation and environmental studies due to the changing nature of land use patterns. High spatial and spectral resolution satellite imageries have been widely accepted for rapid resource assessment and monitoring from the last few decades. These data sources are of immense use for decision makers and policy makers as it enables to carry out detailed forest inventories, monitoring of land use, protected area conservation and vegetation cover at various scales.

The evaluation of the existing environmental status of the study area was done for 2 km radius centering from the project site. This revealed that the land use/cover consists mainly of agricultural land, Settlement with homestead vegetation, industry, aquaculture etc. **Table *4-1*** shows the existing land use composition in 2 km of the study area.

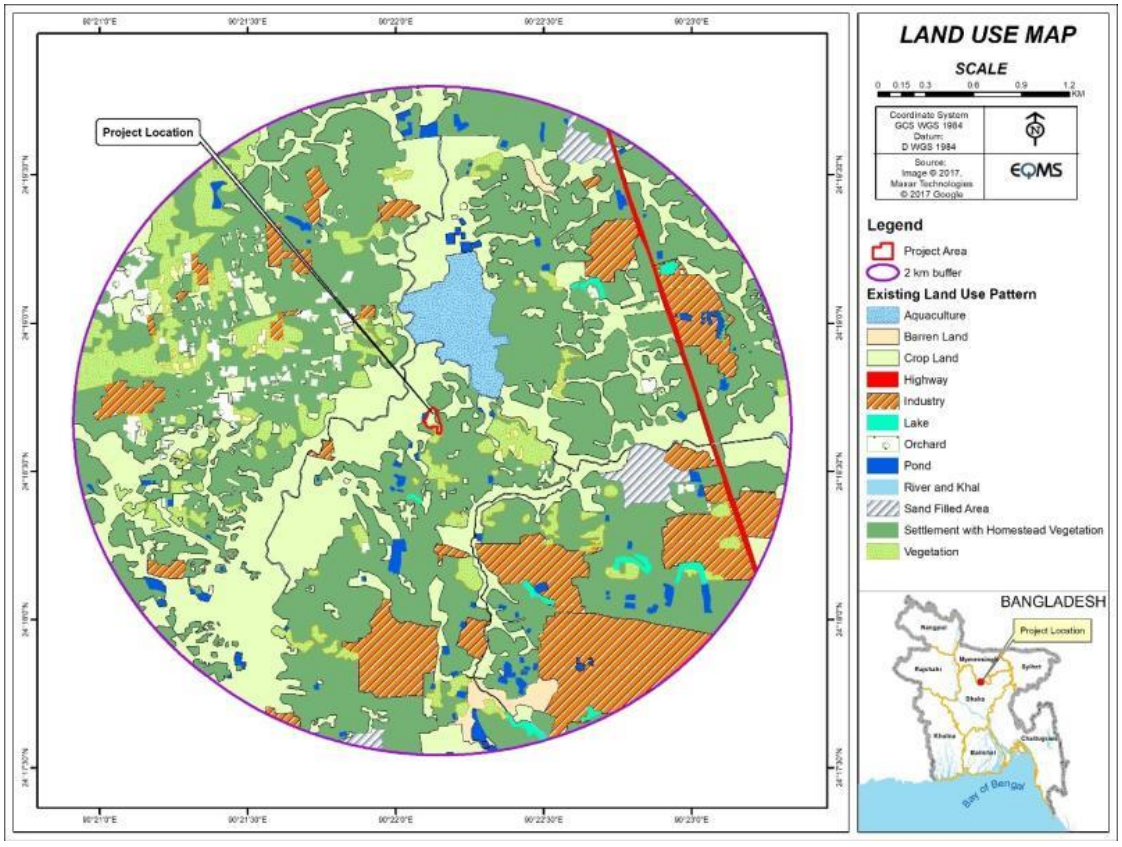
[19] http://en.banglapedia.org/index.php?title=Physiography

Table 4-1: Land Use Pattern of the Project Area

SL.	Name	Area (Acres)	Percentage
1.	Settlement with Homestead Vegetation	1488	44.89
2.	Crop Land	891	26.88
3.	Industry	396	11.95
4.	Vegetation	236	7.12
5.	Aquaculture	70	2.11
6.	Orchard	63	1.90
7.	Pond	54	1.63
8.	Sand Filled Area	43	1.30
9.	Barren Land	25	0.75
10.	Highway	18	0.54
11.	Lake	16	0.48
12.	River and Khal	15	0.45

Source: Satellite imagery analysis and GIS Interpretation.

In the 2 km study area, the major land use goes to Settlement with Homestead Vegetation area that constitutes 1488 Acres which is 44.89%. The second major land use is Agricultural Land area 26.88% (891 Acres) of the study area. Besides, there are about 396 Acres of industrial area (11.95%) and 236 Acres of vegetation (7.12%) within the study area. **Figure 4-1** shows the Land use/Land cover map shows the land use pattern within 2 km of the study area.



Source: Satellite imagery analysis and GIS Interpretation

Figure 4-1: and use/Land cover map shows the land use pattern within 2 Km of the study area

4.1.4 Soil Type

Bangladesh is the largest active delta floodplain. The soil formation process differs significantly in floodplain, hills, and uplifted terraces. The study area falls under the Madhupur soil zone according to the classification of SRDI. A brief description of the soil type of the project area is described below.

Madhupur clays can be characterized as nutrient poor and somewhat acidic. They are red or brown in color. The higher-level lands are known as chala and the valleys are called barind. The valleys are cultivated with boro rice in the dry season by impounding the streams for irrigation. At this time the fields are dry in the uplands except where cultivated with sugarcane. Many of chala are well known for their jackfruit gardens. Large quantities of jackfruit are shipped out to other parts of the country from April to June. Some areas in the south, such as Kaliakair and Savar are also known for their production of mango, Bengal Olive, Pomelo and Star Apple. pineapples, mainly Giant Kew variety, are grown extensively in Madhupur thana in the north.

Overall, pH (5.19), total N (0.11%), available P (2.9 µg/g), total Ca (1.38 meq/100 g soil) and B (0.17 µg/g) content of the soils is unsuitable for agricultural activities. The OM (1.61%), available S (12.59 µg/g), K (0.26 meq/100 g soil) and Zn (0.26 meq/100 g soil) is moderately suitable for agricultural activities. Overall soils of Madhupur Tract were not much suitable for agricultural activities.

4.1.5 Agro-ecological Zone

Agro-ecological zones (AEZ) define by the soil composition, landform, and climatic condition. The Parameters of AEZs are the basic climatic and edaphic requirements of crops. Bangladesh is classified into 30 AEZ. A brief description of this AEZ is given below.

Madhupur Tract (4,244 sq km) this is a region of complex relief and soils developed over the Madhupur Clay. Soils in the valleys are dark grey heavy clays. They are strongly acidic in reaction with low status of organic matter, low moisture holding capacity and low fertility level. Dhaka, Gazipur, Narsingdi, Tangail, Mymensingh and Kishorganj belongs to this Agro-Economical Zone. Land type of the AEZ is dominated by High land (56%) which is followed by low land and others (26%), and Medium High (18%). Organic matter content is low and thus the fertility level is low as well. Suitable crops of Kharif season include B Aus, T. Aman, Jute, Sugarcane, Green manures etc. On the other hand, suitable crops of Robi season are Boro rice, Sugarcane, Lentil, Mustard, Chickpea etc.

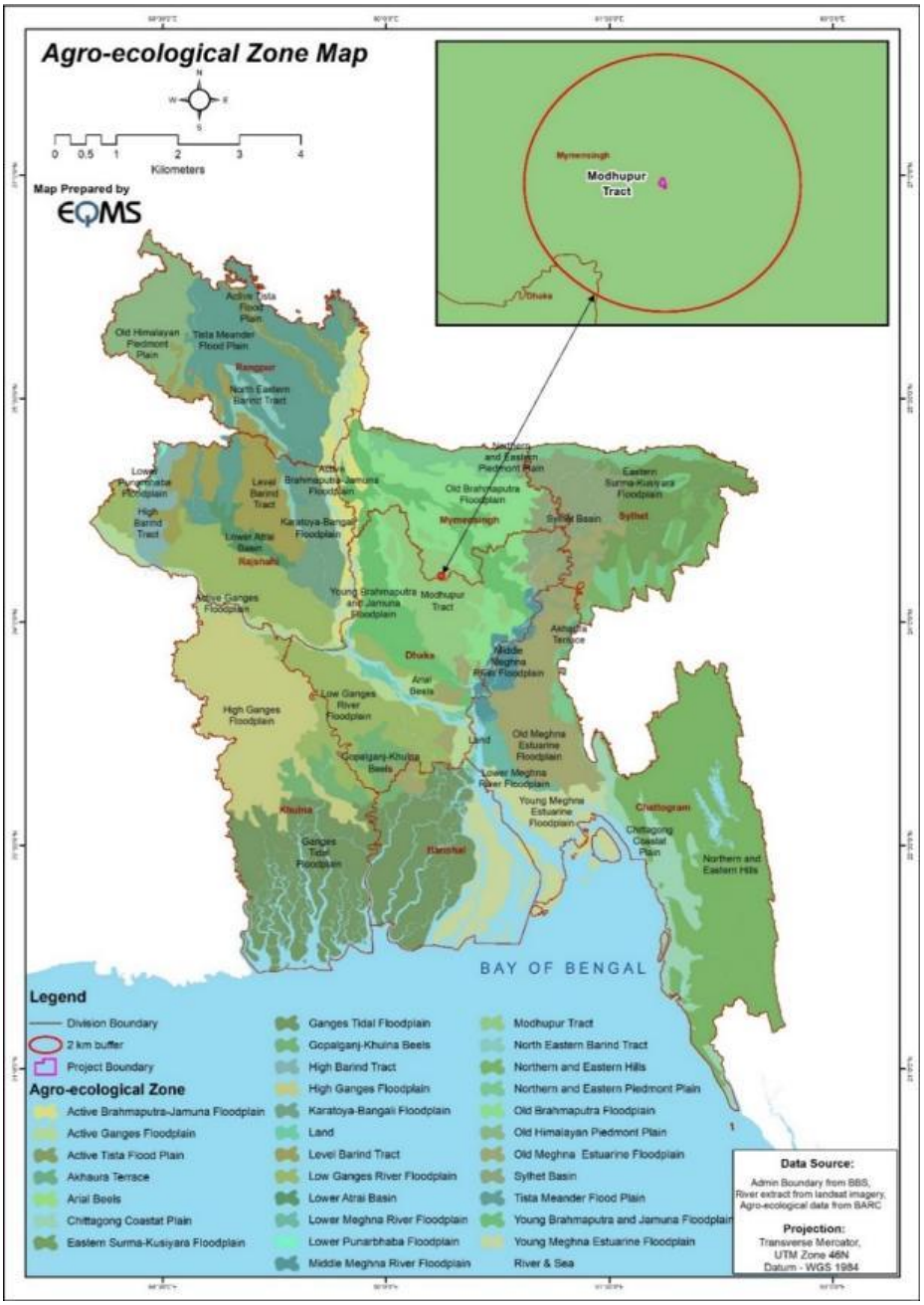


Figure 4-2: Agro-ecological Zone Map in the study area

4.1.6 Geomorphology

There are three Geomorphologic unit of Bangladesh based on soil formation, which is further divided into 8 subdivisions. The project area falls under Pleistocene uplands.

Pleistocene Uplands

During Pleistocene era (25,000 years ago), many regions of the world raised up and formed uplands. These regions are called Pleistocene uplands. The area includes the Madhupur Gorh, Barind Tracts and Lalmai hills. In the northernmost strip of the Rajshahi division, the Pleistocene upland merges with the piedmont of the Himalayas and in the district of Mymensingh slopes down to the alluvial plains. Pleistocene terraces cover an area of about 8% of the total land surface of Bangladesh with an average elevation of more than 15m above mean sea level. The

environmental characteristics and flora and fauna of these regions are almost similar, however the large area of Shaalbon is noticeable.

4.1.7 Hydrology and Drainage

Within 2 km study area, there is a canal around the project site which is locally known as "Poschimer Khal" is the main surface waterbody in the study. During field visit, it was found that, the canal is polluted with the discharge of nearby industries. There are about 30 ponds in the study area. There is no river within the study area. **Figure 4-3** shows major canals and water body in the study area.

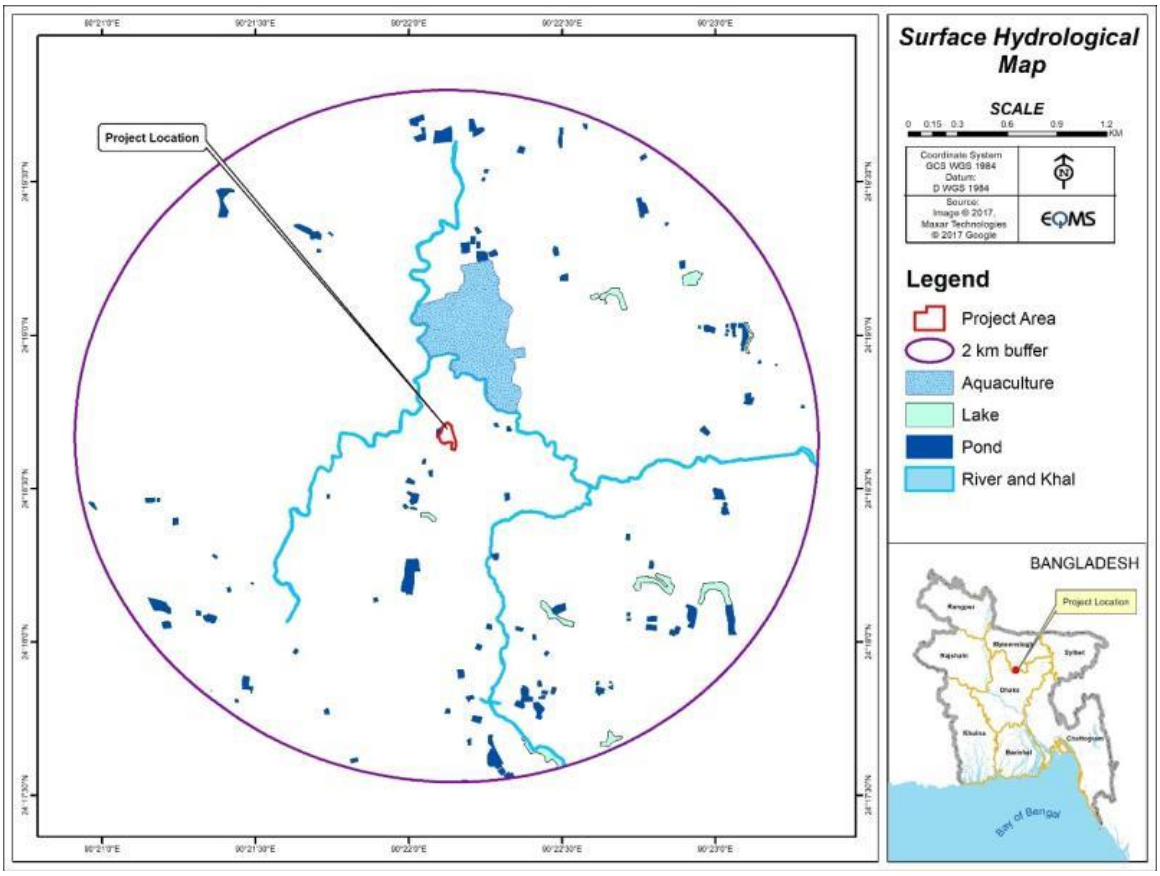


Figure 4-3: Hydrology and Drainage System in the Study Area

Photographs of nearby water body captured during field visit is shown in **Figure 4-4**.



Nearby Canal (Poschimer Khal)



Pond near the projcet site

Figure 4-4: Water Body Near the Project Area

4.2 Meteorological Condition

Bangladesh is located in the sub-tropical monsoon region and its climate is characterized by high temperature, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. From the climatic point of view, three distinct seasons can be recognized in Bangladesh - the cool dry season from November through February, the pre-monsoon hot season from March through May, and the rainy monsoon season from May to October. January is the coolest month with temperatures averaging near 26°C and April the warmest with temperatures from 33 to 36° C. Most places receive more than 1,525 mm of rain a year, and areas near the hills receive 5,080 mm. Most rains occur during the monsoon (June-September) and little in winter (November-February). Moderate rains also reported in the months of March, April, and October. Climatic sub-regions of Bangladesh are presented in **Figure 4-5**.

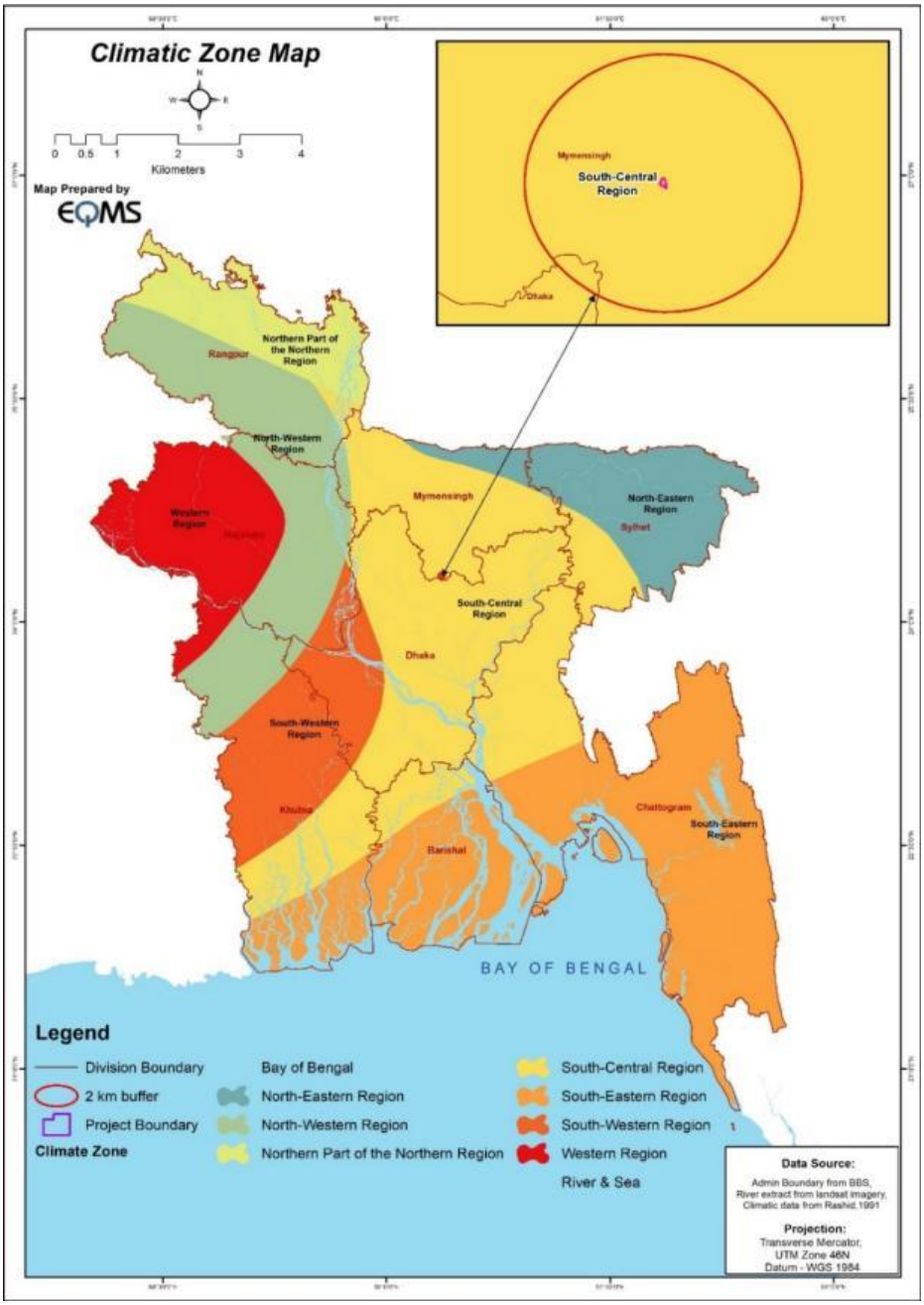
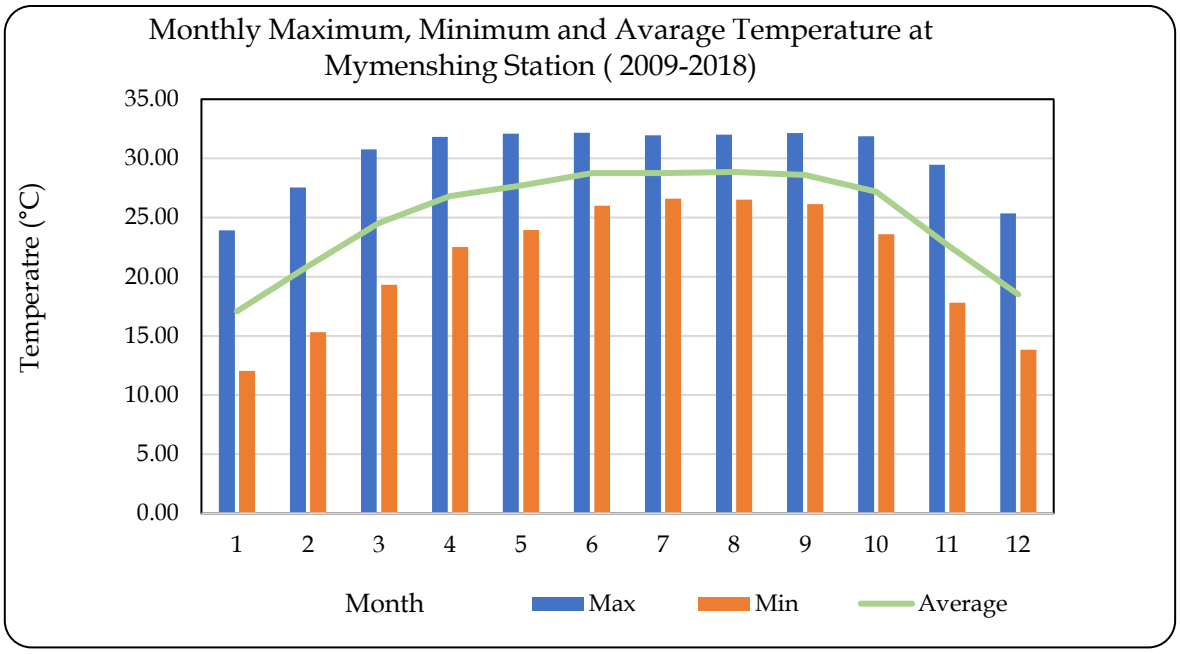


Figure 4-5: Climatic Sub-region of Bangladesh

The study area (Mymensingh District) falls in the South-Central Zone. The nearest Bangladesh Meteorological Department (BMD) station is situated at Mymensingh City, which is about 45 km north of the Project site. To assess the climatic conditions of the area, climatology data has been obtained from Bangladesh Meteorological Department (BMD) for the period 2009 – 2018.

4.2.1 Temperature

The average maximum, minimum and average temperature data were analyzed over a period of 2009 to 2018 which shows that, average maximum temperature was experienced as 34.54° C in April 2014. On the other hand, minimum average temperature was recorded as 10.54° C in January 2013. The average maximum, minimum and average temperature of the project site is in **Figure 4-6**.

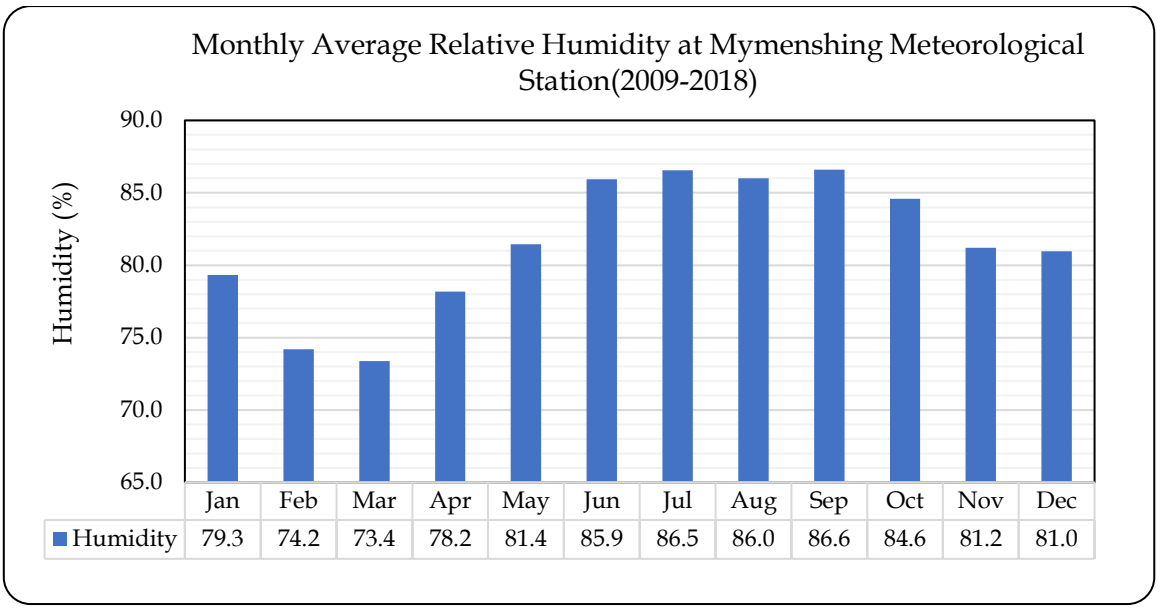


Source: Bangladesh Meteorological Department (BMD)

Figure 4-6: Temperature Variation at Mymensingh Station (2009 to 2018)

4.2.2 Humidity

The monthly average humidity of the project area varied between 73.4% (March) to 86.6% (September). The monthly average humidity is illustrated in **Figure 4-7**.

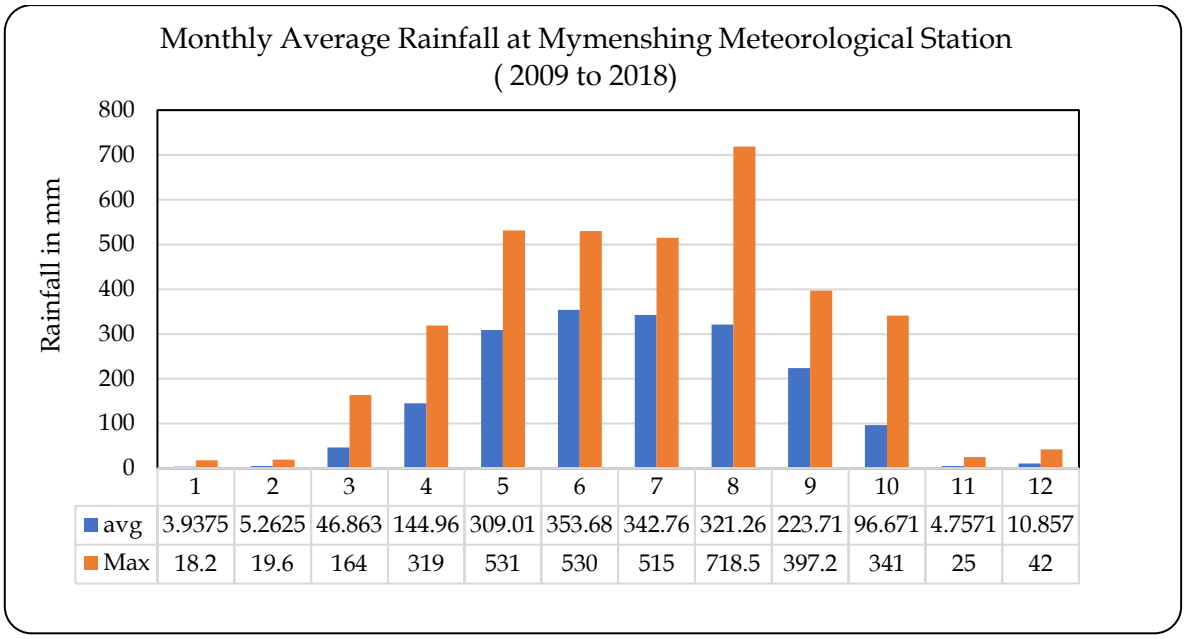


Source: Bangladesh Meteorological Department (BMD)

Figure 4-7: Average Monthly Relative Humidity in % (2009-2018) at Mymensingh Station

4.2.3 Rainfall

Average annual total rainfall at Mymensingh station is about 1739 mm from 2009 to 2018. Highest annual rainfall is recorded 2842 mm in 2017. January-March and November-December received very little rainfall. Highest monthly total rainfall is recorded 718.5 mm in August 2011. The average monthly variation of rainfall is presented in **Figure 4-8**.



Source: Bangladesh Meteorological Department (BMD)

Figure 4-8: Average of Total Monthly Rainfall in mm (2009-2018) at Mymensingh Station

4.3 Environmental Quality

4.3.1 Ambient Air Quality

The objective of the ambient air quality monitoring program was to establish the baseline ambient air quality in the study area. The profile of the study area is mixed, which has mix of scattered

settlements, industry, and agriculture areas. Generally, air pollution sources in the project area consists of on-going construction activities, road dust, brick kilns, windblown dust from agricultural lands, industrial emission, domestic heating, and cooking. Three air quality monitoring locations in and around the project site have been selected for primary monitoring based on prevailing wind direction and importance of the receptors. Detail Lab Reports of Air Quality data have been reported in Annexure P.

4.3.1.1 Methodology of Air Quality Monitoring

Using HAZ Scanner air quality monitoring system, ambient air quality of the study area was monitored at three (3) locations for once. The monitoring parameters are Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx), and Carbon Monoxide (CO). HAZ Scanner has done automatic sampling and analysis in every minute. Minute wise data has been stored in HAZ scanner memory log. HAZ scanner had been celebrated following standard procedure before the air quality monitoring started up. And the calibration certificate also given in Annexure P. The ambient air quality monitoring locations were selected based on the sensitivity of the receptors in and around the project site.

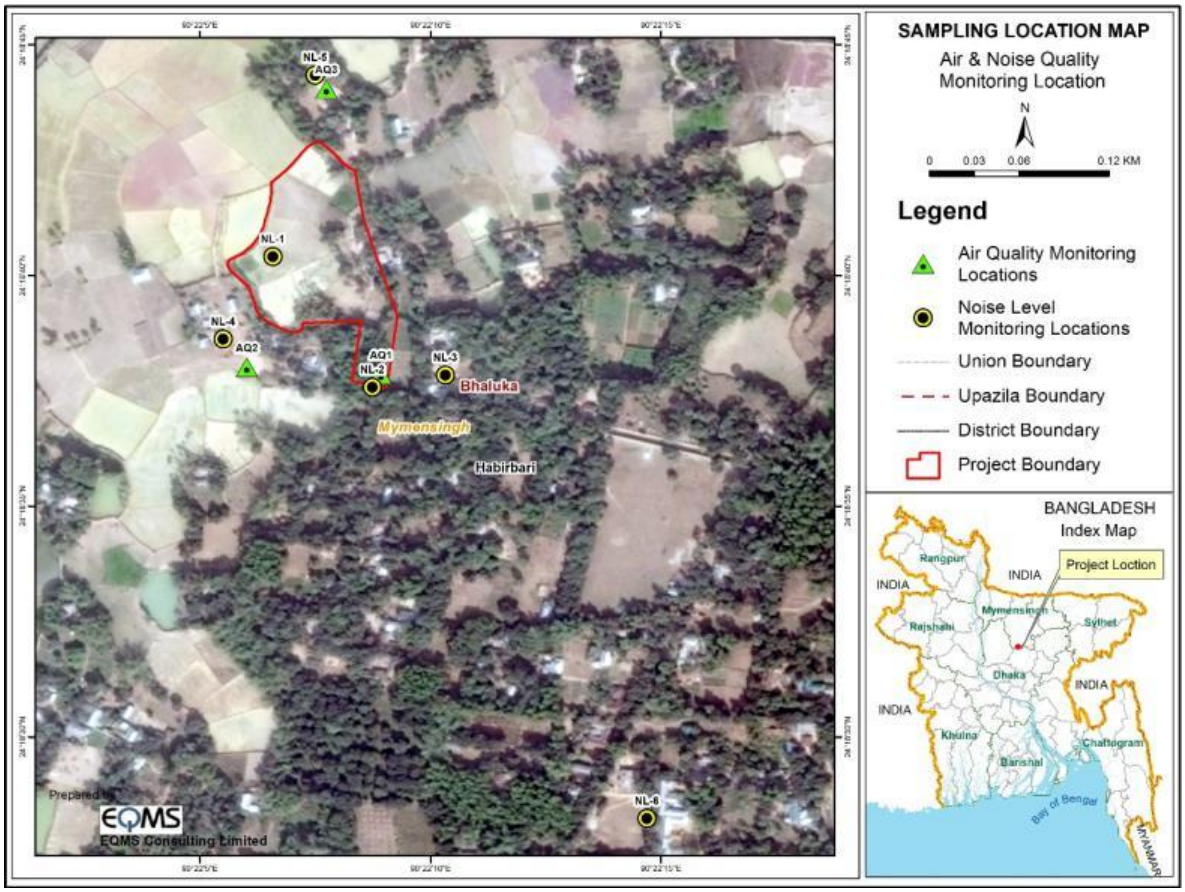
Also, secondary ambient air quality data was collected from Gazipur & Mymensingh CAMS station of DoE. Both the primary data and secondary data has been compared to understand the ambient air quality condition of the project area.

4.3.1.2 Air Quality Monitoring Location

In order to assess the air quality of the study three (3) air quality samples were collected. One sample was collected from inside the project site and another two from adjacent residential area. The geographical locations and setting of the ambient air quality monitoring locations is presented in **Table 4-2** and primary air quality monitoring location points are shown in **Figure 4-9**.

Table 4-2: Ambient Air Quality Sampling Locations

Sl.	Sampling Station	Station Code	Sampling Date	Geographic Location
1.	Project Site	AQ1	10.12.2020	24°18'37.86"N 90°22'8.93"E
2.	In front of Khoka Mia's House	AQ2	11.12.2020	24°18'38.01"N 90°22'6.01"E
3.	In front of Kabir Hossain's House	AQ3	12.12.2020	24°18'44.04"N 90°22'7.74"E



Source: Field Survey by EQMS Team, December 2020

Figure 4-9: Air and Noise Sampling Location

Pictures taken during air quality monitoring are shown in **Figure 4-10.**



AQ1



AQ2



AQ3

Source: Field Survey by EQMS Team, December, 2020

Figure 4-10: Photographs of Ambient Air Quality Monitoring

4.3.1.3 Monitoring Results of Primary Survey

Monitoring data were stored in the HAZ scanner memory. This data has been transferred via USB drive and process the air quality monitoring results in excel. HAZ scanner air quality monitoring data are presented in **Table 4-3** along with the ambient air quality standard of Bangladesh. Although, the BNAAQs standards for the main pollutants (i.e., $PM_{2.5}$ and PM_{10}) are based yearly averages, such measurements were not possible with time available and cost involved. There are two DOE CAMS stations located not too far away at Mymensingh and Gazipur. Thus, only the 24-hour average data were collected and compared with the data from the two CAMS, that are detailed in the following. The $PM_{10/2.5}$ pollutants' levels have been found to be too low at the site compared to the CAMS; which makes these doubtful. The new measurements will be done using filter-based methods in one month. This, however, will not impact the pollution levels, as the plant has little PM emissions.

Table 4-3: Ambient Air Quality in the Study Area

Sl.	Sampling location	Ambient air pollution concentration in µg/m³				
		PM_{10}	**$PM_{2.5}$**	**SO_2**	**NOx**	**CO* (ppm)**
Primary Air Quality Data						
1.	AQ1	75.8	44.2	6.2	13.1	0.10
2.	AQ2	78.1	46.5	5.4	10.7	0.02
3.	AQ3	69.7	41.8	4.8	9.4	0.02
Duration (hours)		24	24	24	24	8
Weather Condition		Sunny				
ECR 1997 and amendment in 2005 (Schedule-2) **		150	65	365	100 (annual)	9
WHO Standard		150	75	125	40	Not Set

Sl.	Sampling location	Ambient air pollution concentration in µg/m³				
		PM_{10}	$PM_{2.5}$	SO_2	NOx	CO* (ppm)
Method of Analysis **Instrument Use** **Haz Scanner: HIM 6000**		Light Scattering Nephotometer	Light Scattering Nephotometer	High Sensitivity Electrochemical	High Sensitivity Electrochemical	High Sensitivity Electrochemical

Source: Air quality analysis done by EQMS Consulting Limited, December 2020

Note:

* CO concentrations and standards are 8-hourly only.

** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O. No. 220-Law/2005.

4.3.1.4 Monitoring Results of Secondary Survey

There are sixteen (16) fixed Continuous Air Monitoring Stations (CAMS) operated by the Department of Environment (DoE) throughout the Country. Secondary ambient air quality data was collected from the Gazipur & Mymensingh CAMS. The locations of Gazipur & Mymensingh CAMS are shown in **Table 4-4** & distance from the project location to those CAMS station is shown in **Figure 4-11**.

Table 4-4: Ambient Air Quality Sampling Locations

Sl.	Sampling Station	Station Code	Sampling Date	Geographic Location
1.	Gazipur	CAMS-4	December, 2020 January, 2021	23°59'23.99"N 90°25'12.01"E
2.	Mymensingh	CAMS-12	December, 2020 January, 2021	24°45'44.34"N 90°24'7.68"E

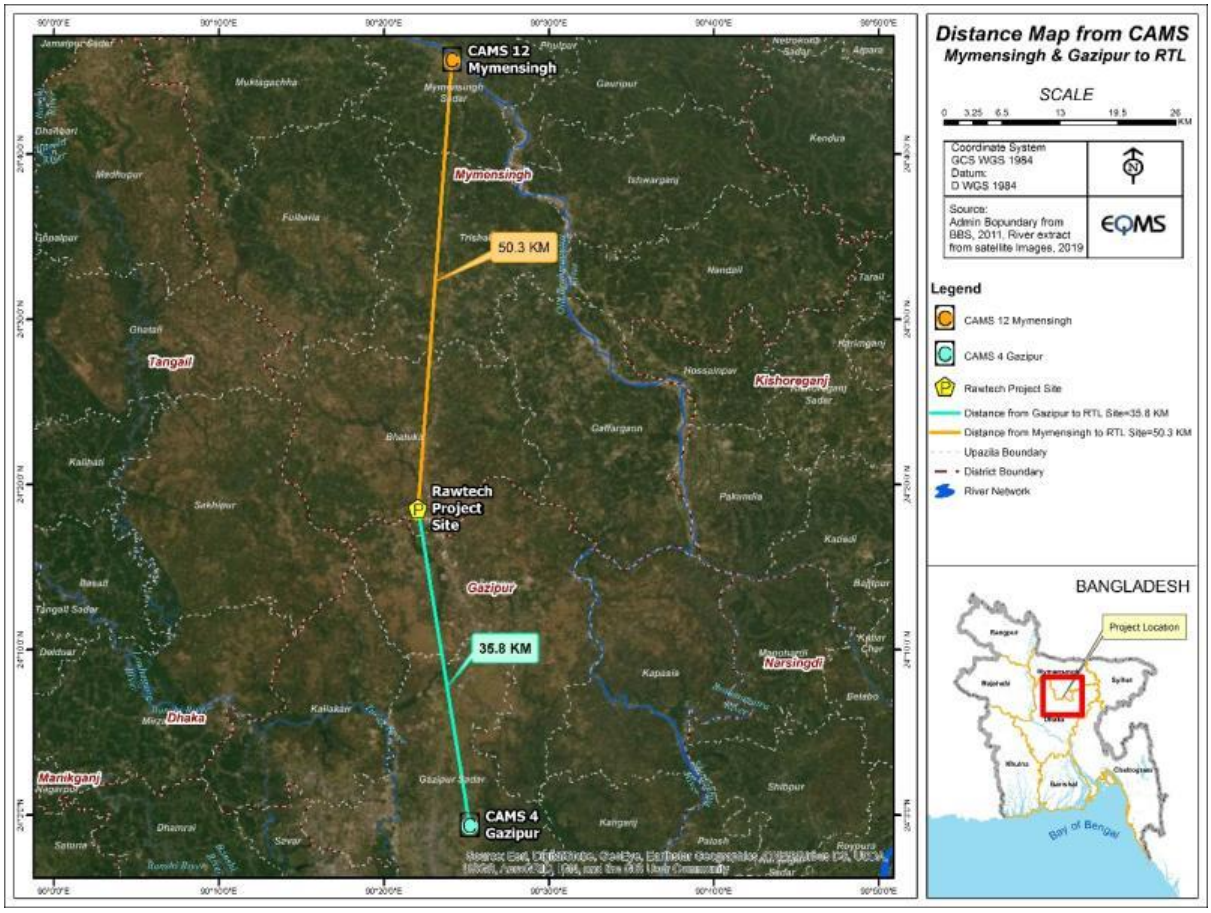


Figure 4-11: Distance Map from CAMS to RTL Plan Location

Table 4-5: Summary of Air Quality (PM_{10}, $PM_{2.5}$, SO_2, NOx and CO) measured during December 2020 & January 2021 at CAMS-4 & CAMS-12 operated under DoE

Sl.	Sampling location	Ambient air pollution concentration in µg/m³				
		PM_{10}	$PM_{2.5}$	SO_2	NOx	CO* (ppm)
December 2020 (Secondary Air Quality Data)						
1.	Gazipur CAMS-4	248.29	183.62	DNA	96.09	DNA
2.	Mymensingh CAMS-12	235.46	162.40	3.90	53.53	0.89
January 2021 (Secondary Air Quality Data)						
3.	Gazipur CAMS-4	300.26	208.41	DNA	74.05	7.23
4.	Mymensingh CAMS-12	267.45	182.32	3.64	54.30	1.05
Duration (hours)		24	24	24	24	8
Weather Condition				Sunny		
ECR 1997 and amendment in 2005 (Schedule-2) **		150	65	365	100 (annual)	9
WHO Standard		150	75	125	40	Not Set

Source: Monthly Air Quality Monitoring Report Reporting Month: December 2020 & January 2021
Note: DNA: Data Not Available, PM: Particulate Matter

4.3.2 Ambient Noise Quality

Noise level needs to monitor to know the calmness of a place. By measuring noise, we can know identify the existence of any noisy sources around the monitoring location. The construction activities in the project site are on-going. These activities generate some noise. There are very few vehicular movements in the approach road at present. Dhaka-Mymensingh Highway is 1.6 km east from the project site. So, at present vehicle are not a major source in and around the project site. No industrial noise is realized in the village around the project site. The study area is identified as mixed area as there are some industries and market located along with school, mosque, and residence.

Noise levels were recorded at Six (6) locations in the study area during the monitoring period. Noise levels were recorded in the form of sound pressure levels with the help of a digital sound level meter. The details of noise monitoring locations are given in **Table 4-5**. The 24-hour baseline noise monitoring was conducted by using the SLM24TK Digital Sound Level Meter (Tekcoplus, SLM24TK, unit: dB(A)) which is followed IEC651 type 2, ANSI S1.4 type 2 standard[20]. The Calibration Certificate is given in Annexure P.

The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. The locations are chosen in such a way that a representative data could be recorded all over the project site. The sound level is recorded in form of A-weighted equivalent continuous sound pressure level values with the use of A-weighting filters in the noise measuring instrument. Noise monitoring locations are shown in **Figure 4-9**.

Table 4-6: Details of Noise Monitoring Location

Code	Locations	Distance from Site Center (meter)	Sampling Date	GPS Coordinate	Category of Area
NL 1	Project Area	33	09-12-2020	24°18'40.40"N 90°22'6.59"E	Mixed Zone
NL 2	In front of Main Gate	90	09-12-2020	24°18'37.57"N 90°22'8.74"E	
NL 3	In front of Akbor Munshi's House	107	09-12-2020	24°18'37.84"N 90°22'10.32"E	
NL 4	In front of Raju Mia's House	84	10-12-2020	24°18'38.62"N 90°22'5.50"E	
NL 5	In front of Kabir Hossain's House	122	10-12-2020	24°18'44.34"N 90°22'7.50"E	
NL 6	In front of Dipsikha Model School	420	10-12-2020	24°18'28.23"N 90°22'14.69"E	

Source: Field Survey by EQMS Team, December, 2020

Pictures capture during noise monitoring in and around the project site are shown in **Figure 4-12**. Noise monitoring results are shown in **Table 4-7**.

[20] https://www.tekcoplus.com/products/slm24tk



NL1



NL2



NL3



NL4



NL5



NL6

Source: Field Survey by EQMS Team, December, 2020

Figure 4-12: Photographs of Ambient Air Quality Monitoring

Table 4-7: Noise Level in and around the Project Site

Location	Average Noise level (dB(A))				Applicable Standard * (dB(A))	
	Leq_{day}	Leq_{night}	L_{max}	L_{min}	Day	Night
NL1	56.5	45.8	68.5	35.2	60	50

Location	Average Noise level (dB(A))				Applicable Standard * (dB(A))	
	Leq_{day}	Leq_{night}	L_{max}	L_{min}	Day	Night
NL2	51.6	45.2	72.2	33.8		
NL3	48.8	43.2	68.2	32.1		
NL4	49.5	44.2	65.6	32.4		
NL5	51.4	44.5	68.9	32.2		
NL6	54.5	44.8	72.5	33.2		

Source: Field Survey by EQMS Team, December, 2020

*Environmental Conservation Rules, 1997 (Schedule 4) (subsequent amendment in 2006) where indicating daytime 6.00-21.00 hr. and night time 21.00-6.00 hr.

Noise level in all the monitoring location is within the mixed zone noise level. The baseline seems quite area with respect to residential zone noise standard.

4.3.3 Water Quality

Water sampling and analysis were undertaken to understand the overall baseline water quality characteristics of the surface and groundwater in the study area Two surface water samples were collected from nearby pond in the study area. Two ground water samples were taken from project site deep tube well and a house hold shallow tube well. Details of sampling locations are presented in **Table 4-8**. Pictures captured during water sampling are shown in **Figure 4-13**.

Table 4-8: Details of Surface and Ground Water Sampling Locations

SL.	Code	Location	GPS Coordinates	Type of Source
1.	SW1	Atikul's Pond, North side from the Project boundary	24°18'44.28"N 90°22'8.58"E	Pond
2.	SW2	Mohammad Ali's Pond, East side from the Project boundary	24°18'40.69"N 90°22'11.05"E	Pond
3.	GW1	Inside the Project Area	24°18'39.24"N 90°22'6.90"E	Deep Tube well
4.	GW2	Kabir Hossain's House	24°18'45.06"N 90°22'7.74"E	Tube well

Source: Field Survey by EQMS Team, December, 2020



SW1



SW2



GW1

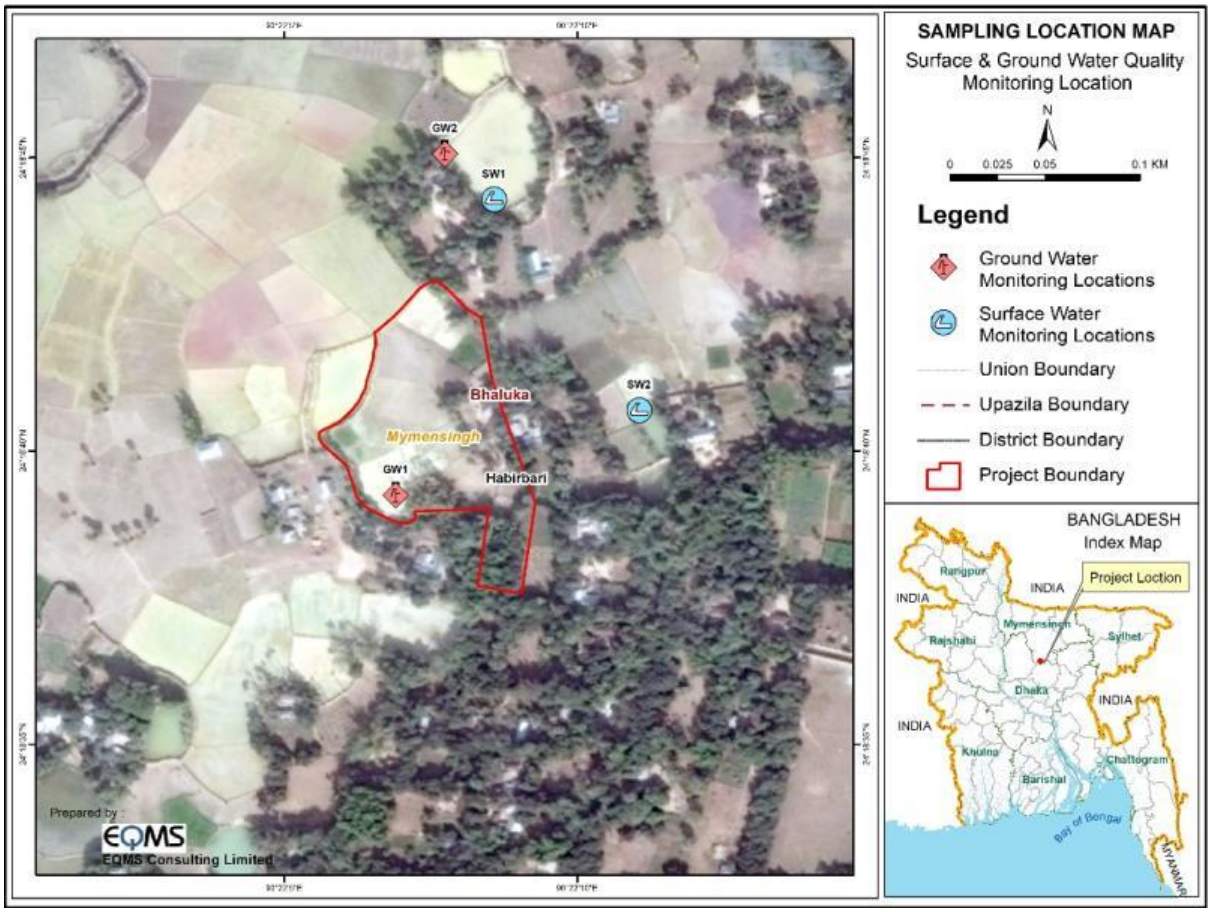


GW2

Source: Field Survey by EQMS Team, December, 2020

Figure 4-13: Photographs taken during surface and ground water sampling

Water sampling loctions are shown in **Figure 4-14**.



Source: Field Survey by EQMS Team, December, 2020

Figure 4-14: Surface Water and Ground Water sampling locations

4.3.3.1 Surface Water Quality

Analytical results from surface water sampling test are presented in **Table 4-9**.

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Table 4-9: Surface Water Quality of the Project Area

Parameter	Methodology	Unit	SW1	SW2
Alkalinity	Titrimetric	mg/L	76	70
BOD_5	5 days incubation	mg/L	5	4
Chloride	Titrimetric	mg/L	12	10
COD	CRM	mg/L	12	12
DO	Multimeter	mg/L	6.48	6.57
Iron	AAS	mg/L	1.41	1.13
Manganese	AAS	mg/L	0.05	0.03
Nitrate	UVS	mg/L	4.8	2.5
pH	pH Meter	----	7.4	7.2
Phosphate	UVS	mg/L	0.30	0.51
Sulphate	UVS	mg/L	7	3
TDS	AAS	ppm	35	32
Total Hardness	Titrimetric	mg/L	85	90
Zinc	AAS	mg/L	0.08	0.08

Source: DPHE Testing Lab, December 2020

Table 4-10: Bangladesh Standard for Inland Surface Water

Best practice-based classification	Parameter			
	pH	BOD mg/l	DO mg/l	Total Coliform Number/100
Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
Water usable for recreational activity	6.5-8.5	3 or less	5 or more	200 or less
Source of drinking water for supply after conventional treatment	6.5-8.5	6 or less	6 or more	5000or less
Water usable by fisheries	6.5-8.5	6 or less	5 or more	-
Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
Water usable for irrigation	6.5-8.5	10 or less	5 or more	1000 or less

Source: Rule 12, Schedule-3, ECR. 1997, Bangladesh

Notes:
1. In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water – 2250 µmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Some of the water quality parameters are discussed below,

pH

Value of pH in the surface water samples at SW1 and SW2 are 7.4 and 7.2 respectively From the test result it was found that pH of the surface water is in acceptable limit.

Total hardness

Total hardness in the surface water samples collected at SW1 and SW2 are 85 and 90 mg/l respectively.

BOD5

Biochemical Oxygen Demand at SW1 and SW2 are 5 and 4 mg/l which is within surface water quality standard set by DoE, Bangladesh.

Dissolve Oxygen (DO)

Dissolve Oxygen at SW1 and SW2 are 6.48 and 6.57 mg/l which is suitable for fish living as well as other purposes.

Total Dissolved Solids (TDS)

TDS in SW1 and SW2 are 35 and 32 respectively.

Heavy Metal

Mn and Zinc concentration in the water samples are very small.

4.3.3.2 Ground Water

Ground water were collected from two locations. One of the samples was collected from Deep tube well inside the project site and another one was collected from tube well outside of the project site. Water samples were collected as grab water sample in pre-washed plastic bottles (1L) to complete physio-chemical test. The result of the ground water test is enlisted in the **Table 4-11**.

Table 4-11: Ground Water Quality in the study area

Parameter	Methodology	Unit	GW1	GW2	Bangladesh Standards
Arsenic	Atomic Absorption Spectrophotometer	mg/L	0.001	0.001	0.05
Alkalinity	Titrimetric	mg/L	93	87	-
Calcium	Spectrophotometer	mg/L	7	6	75
Chloride	Titrimetric	mg/L	13	12	150 – 600*
DO	Digital DO meter	mg/L	6.84	6.95	6
EC	Digital EC meter	mS	165	122	-
Iron	Atomic Absorption Spectrophotometer	mg/L	0.34	0.40	0.3 – 1.0
Manganese	Atomic Absorption Spectrophotometer	mg/L	0.03	0.03	0.1
Nitrate	Spectrophotometer	mg/L	1.5	3.9	10
pH	Digital pH Meter	----	7.1	7.0	6.5 – 8.5
Phosphate	Spectrophotometer	mg/L	0.27	0.29	6

Parameter	Methodology	Unit	GW1	GW2	Bangladesh Standards
Potassium	Atomic Absorption Spectrophotometer	mg/L	**3**	**2**	12
Sulphate	Atomic Absorption Spectrophotometer	mg/L	2	1	400
TDS	Digital TDS meter	mg/L	82	60	1000
Hardness	mg/l	mg/L	120	125	200 – 500
Zinc	AAS	mg/L	0.08	0.08	**5**

Source: DPHE Testing Lab, December 2020.

Some of the important ground water parameters are discussed below,

pH

The pH of at GW1 and GW2 are found 7.1 and 7.0 which are withing standard limit set by DoE for drinking water.

Total Dissolved Solid (TDS)

The TDS concentrations of the GW1 and GW2 samples are 82 and 60 mg/l respectively

Heavy metals

Presence of Manganese and Arsenic in the ground water samples are not in alarming level of 0.1 and 0.05 ppm respectively.

4.3.4 Soil Quality

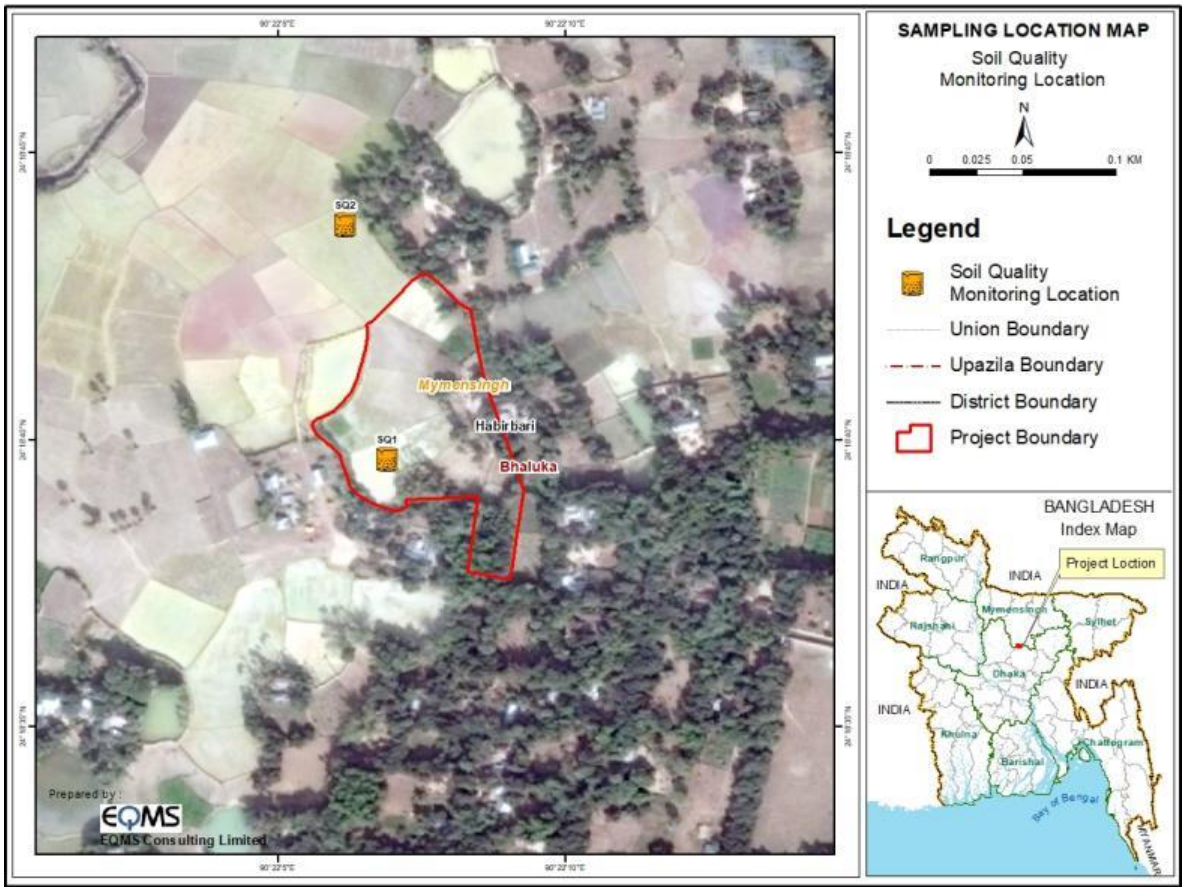
In order to know the present status of the soil quality in and around the project site two soil samples had been collected from project site and nearby agricultural land. The detail of the sampling locations is presented in **Table 4-12**. A composite sampling technique was used for soil sampling from each location.

Table 4-12: Location of Soil Sampling

SL.	Code	Sampling date	Location	GPS Coordinates
1.	SQ1	11-12-2020	Project Site	24°18'39.66"N 90°22'6.90"E
2.	SQ2	11-12-2020	North Side from the Project Boundary	24°18'43.74"N 90°22'6.18"E

Source: Field Survey by EQMS Team, December, 2020

Location map of the soil sampling is shown in **Figure 4-15**.



Source: Field Survey by EQMS Team, December, 2020

Figure 4-15: Soil Sampling Location Map

Pictures taken during soil sample collection are shown in **Figure 4-16.**



SQ1



SQ2

Source: Field Survey by EQMS Team, December, 2020

Figure 4-16: Pictures taken during soil sample collection

The soil samples were analyzed for physical and chemical characteristics including minerals, heavy metals, and trace elements. A total extraction of heavy metal from soil samples following the USEPA guidelines were performed to determine the selected heavy metal contents. The results of the analysis are given in **Table 4-13**. It can be seen that the heavy metal contents of soil are within usual limits of such metals found in natural soil.

Table 4-13: Soil analysis results

Parameters	Unit	Method of Analysis	Concentration Present		Typical content in natural soil*
			SQ1	SQ2	
pH	-	pH meter	5.33	6.46	--
Electrical Conductivity, EC	µS/cm	EC meter	167.3	175.3	--
Chloride, Cl-	mg/kg	Jackson Turbidimetric method	31.0	35.5	20-900 (avg 100)
Chromium, Cr	mg/kg	Liquid Chromatography	38.0	41.1	1 – 1000 (avg 100)
Cadmium, Cd	mg/kg	ICP-OES	0.115	0.17	0.1 – 0.7 (avg 0.6)
Lead, Pb	mg/kg	Isotope Ratio Mass Spectrometry	13.80	16.1	2 – 200 (avg 10)
Nickel, Ni	mg/kg	Ion Chromatography	17.40	23.50	5 – 200 (avg 20)
Sulfate, SO_4	mg/kg	Gas Chromatography	20.5	24.9	--

*(USEPA Office of Solid Waste & Emergency Response, Hazardous Waste and Treatment, SW-874 (April 198.3, Page 273)

4.4 Natural Hazards

Due to the geographical location of Bangladesh, it is vulnerable to different types of natural hazards. Bangladesh is one of the most vulnerable countries to natural hazards and climate. In the recent past, Bangladesh experienced few devastating cyclone and floods.

4.4.1 Tropical Cyclone

Bangladesh Meteorological Department (BMD) collects the information of daily incident of Nor'wester and Tornadoes. Devastating cyclones hit the coastal areas of Bangladesh almost every year usually accompanied by high-speed winds, sometimes reaching 250 km/hr. or more and 3-10m high waves, causing extensive damage to life, property, and livestock. Because of the funnel shaped coast, Bangladesh repeatedly becomes the landing ground of cyclones formed in the Bay of Bengal. It was found that, the project area is not affected by cyclones which is most likely due to the cause of relative far away location from Bay of Bengal.

4.4.2 Tornedo

During the pre-monsoon period, there have been incidents of violent occurrences of tornadoes in the mainland of Bangladesh. The March-May period is the formation and out-breaks period of tornadoes in Bangladesh, with the highest frequencies from end March to mid-April with a sharp decline thereafter. The frequency of Nor'westers and Tornado usually reaches a maximum in April, whereas there are few in May and minimum in March. Nor'westers and tornadoes are more frequent in the afternoon. It is also mentionable that, last tornado that hit the nearest place of the project site was in April 1972.

4.4.3 Seismicity Risk

The location of Bangladesh om a tectonically active area at the delta basin facing Bay of Bengal is strategic for all types of natural calamities like cyclone, tsunami, and earthquakes. According to the seismic study 43% of the areas of Bangladesh are rated high risk, 41% moderate and 16% low. High risk zone includes but not limited to Dhaka, Rangpur, Mymensingh, Cumilla, Sylhet etc. The study area falls within Zone III, which is the vulnerable zone to earthquake. The great Indian earthquake 1897 that had a magnitude of 8.7 with the epicenter in the central part of the Shillaong plateau was recalled as one of the world's worst. The earthquake caused death of around 545 people in Sylhet area.

However, due to this earthquake no death of human was reported from Mymensingh. Though, heavy damage occurred in Dhaka-Mymensingh railway and traffic was suspended for a fortnight. total loss of property was estimated around 5 million rupees (currency of that time). It can be mentioned here that, the earthquake changed the main flow from Brahmaputra to the Jamuna River which flows west of the greater Mymensingh region.

Significant earthquakes that hit Bangladesh in last 20 years are enlisted in the following table. From the table it is evident that the last earthquake that hit Mymensingh was back in 2008 and it had a magnitude estimated 5.1 on the Richter scale. The location of the Project, relative to the seismic zones is provided in **Figure 4-17**.

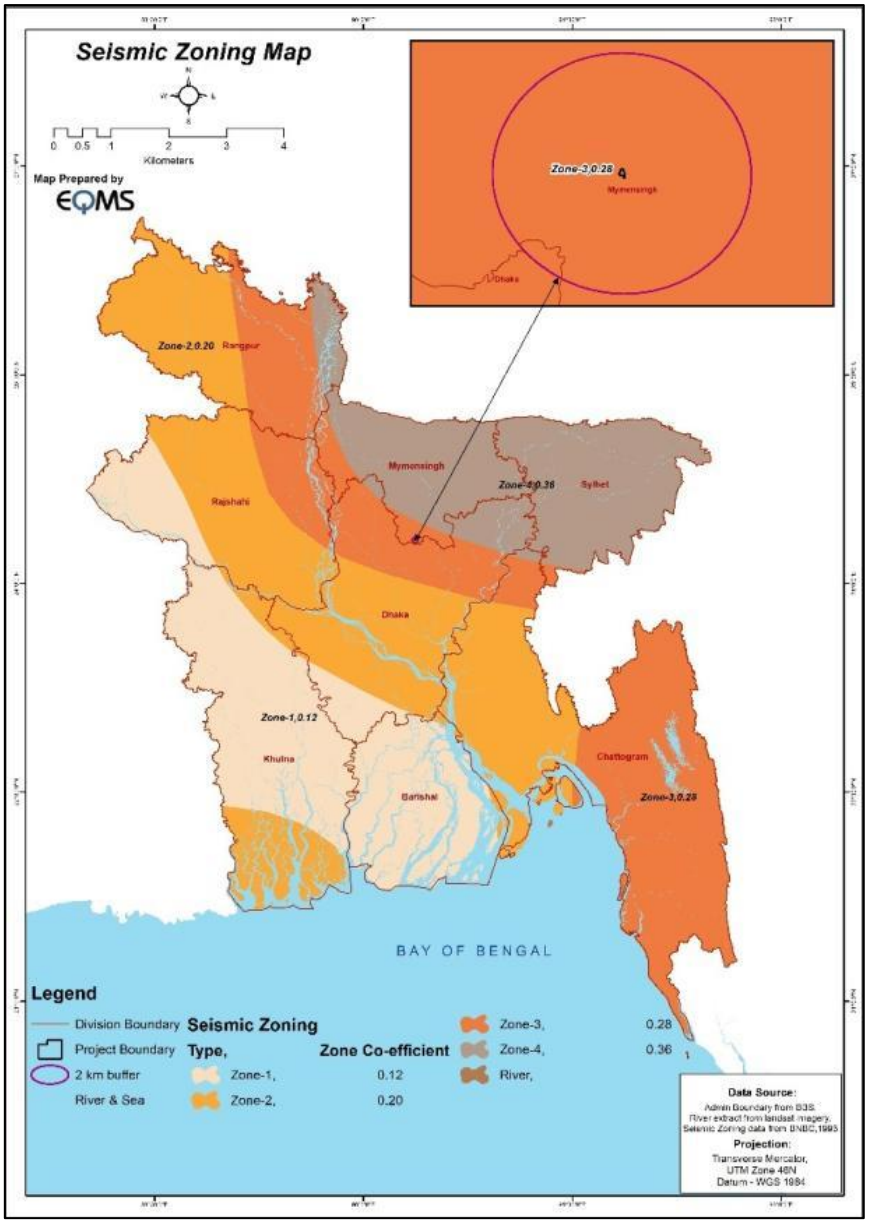


Figure 4-17: Seismic Zoning of the Project Area

4.4.4 Flood Hazard

Several studies reviled that every year near about one-fifth of Bangladesh undergoes flood during the monsoon season[21]. A flood season in Bangladesh may start as early as May and can continue until November.

Floods of Bangladesh can be divided into three categories:

I. Monsoon flood - seasonal, increases slowly and decreases slowly, inundate vast areas, and causes huge loss to the life and property;
II. Flash flood-from sudden torrential flows, following a brief intense rainstorm or the bursting of a natural or manmade dam or levee; an
III. Tidal flood - short duration, height is generally 3-6 m, prevents inland flood drainage.

[21] http://en.banglapedia.org/index.php?title=Natural_Hazard

In Bangladesh flash floods generally' occurs in the northeast, southeast and Chittagong region. But devastating and extended flash flood is a recurrent phenomenon in the northeast region of Bangladesh. The extreme flashy character of the rivers and sudden excessive rainfall in the region causes frequent flash floods in the northeastern haor areas. However, the project falls under Not Flood Prone area. As per SRTM data from secondary source, the site elevation is 8-16m MSL. According to consultation with local government office, residents, this area did not face any flooding in the recent past. There is no BWDB gauge station nearby river (within 10 km study area). No water level data is available. The last flooding was dated back to 1988.

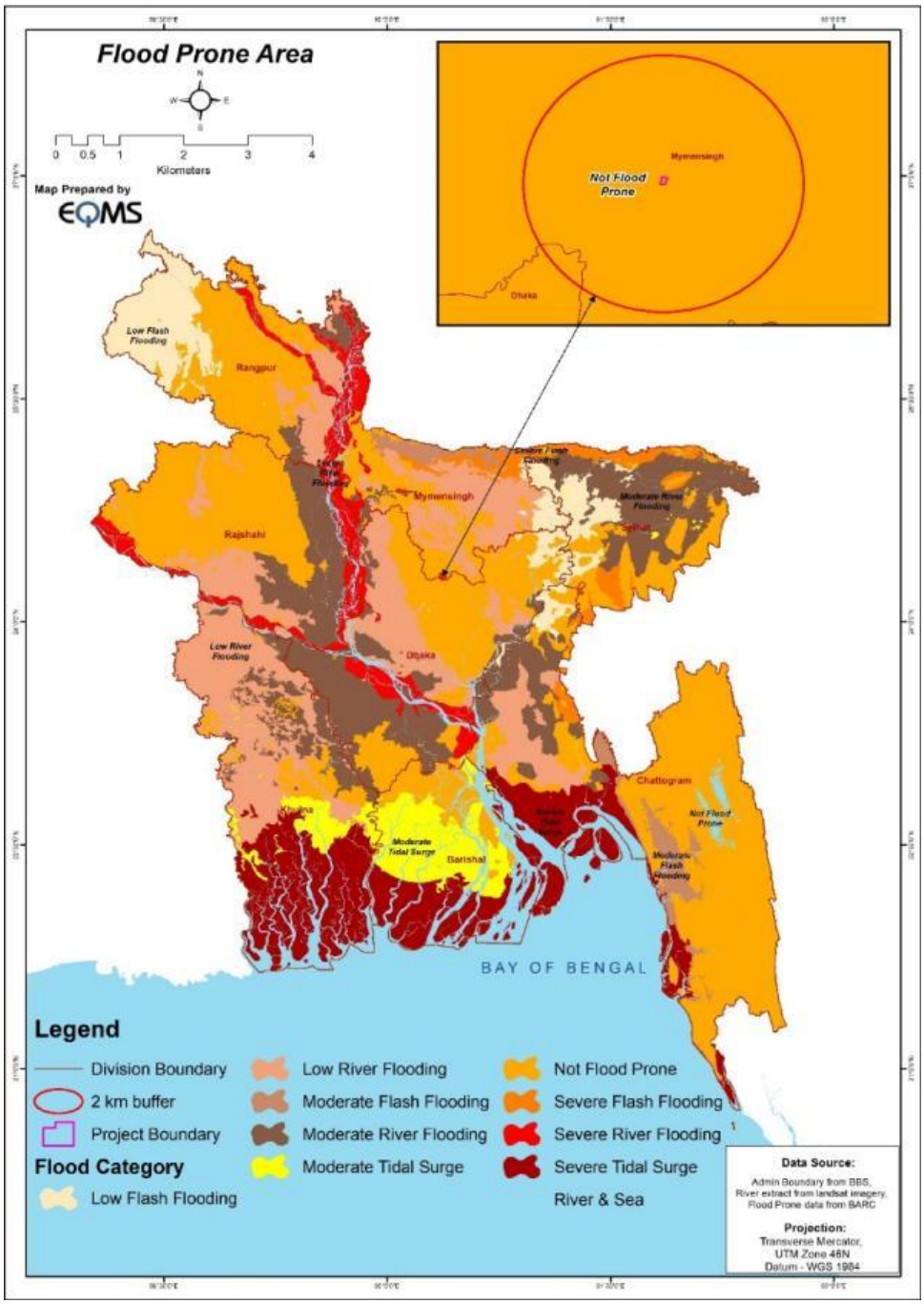


Figure 4-18: Flood Zone of the Project Area

4.5 River Morphology

Mymensingh district stands just beside the old Brahmaputra River. The adjacent river is Bajja-[22]Medhuya which flows on the north of the project site.

This river originated from upper Banar river of Putijana union under Fulbari Upazila of Mymensingh District and then out fall at Khiro river of Mallikbari union. Locally, at Fulbari upazila it is known as Banar river and in Bhaluka upazila it is known as Madhua river. It is a seasonal river but in the rainy season river bank gets overflooded. In the dry season local peoples set temporary muddy embankment on the river and use the river water for irrigation purpose. The width of the river is getting decreased day by day and the river bed is uplifting day by day. Salient features of the river are enlisted in **Table 4-14**.

Table 4-14: River Morphology of the Bajja-Medhuya River

SL.	Feature	Description
1.	Off-take	Banar Upper River
2.	Location	Fulbaria
3.		Mymensingh
4.	Out Fall	Khiro (Bhaluka) River
5.	Location	Bhaluka
6.		Mymensingh
7.	Tributary	None
8.	Distributary	None
9.	Branch	None
10.	Covered area	Muktagacha, Fulbaria, Trishal, Bhaluka, Mymensingh
11.	Length	Approx. 48 Km.
12.	Type	Meandering
13.	Discharge	Seasonal
14.	Without Discharge Month	January-April
15.	Highest Discharge (Month)	July- September
16.	Tidal effect	None
17.	Flood Management Embankment	None
18.	River Embankment	None

Source: Rivers of Bangladesh (Second Edition), 2011

4.6 Agricultural resources

4.6.1 Farming Practice

Rice cultivation is the dominant agricultural crop of the project area, Habirbari Union. In this union, Jute is the second dominant agriculture crop. Other than that, this upazila also produces Mango, Jackfruit, Guava, Coconut, Date, Olive, Adam's apple etc. Chilly, Onion, Ginger, Garlic

[22] Rivers of Bangladesh, North Central Area, 2011.

are some of the notable species. Among the vegetables, gourd, sweet pumpkin, bitter gourd, snake gourd, bean, Yardlong bean, potato, Brinjal, Tomato, Cauliflower grows in a big number.

4.6.2 Cropping Pattern and Intensity

A variety of cropping pattern (17) is observed in the project area. The diversity index for cropping pattern is calculated as 0.463 with a Crop Diversity Index of 0.693. The crop intensity of the Bhalika Upazila is 188%. It can be mentioned here that, highest crop intensity is observed in Mymensingh region is 235% in Baksiganj Upazila and the lowest is observed as 101 in Mithamoin Upazila.

4.6.3 Crop Production

According to the information of Upazila Agriculture Office total land area of the Habirbari union is 6400 hectors among which total cultivable land is around 2200 hector. Most dominant land type is Two Season Cultivated Land (1200 ha) followed by One Season Cultivated land (350 ha), and Three Season Cultivated land (150 ha). Other areas are covered by orchards (200 ha) and Vegetable Garden (300 ha). In the Bhaluka upazila total agricultural production was estimated 134809 Metric Ton whereas in Habirbari union total production was recorded as 9436 Metric Ton in 2018-19. In 2018-2019 year, Aman, Boro and Aush rice is cultivated in 1300 hector, 850 hector and 15 hectors of land respectively.

During field survey it was observed that, local farmer uses surface water (canal) as their source of irrigation which is polluted by the discharge of nearest industries. Local agriculture office and farmer suspect that, due of use of this polluted water their rice field is affected by Leaf Blast, Neck Blast, etc.



Figure 4-19: Irrigation System of Agriculture Activities

4.7 Fisheries

4.7.1 Habitat Description

A narrow channel, a few small ponds, and a large pond with an area of 66 decimal comprise the fisheries habitat. The narrow channel which is locally known as “Poschimer Khal” is the only natural waterbody within the project AOI with almost no fishing activity. During field visit it was found that, the water of the canal is polluted by discharge of nearby industries. However, the main purpose that the channel serves is to provide water for irrigation. The small ponds are used by the local people for household fishing and subsistence consumption. The large pond is used for aquaculture commercially.

4.7.2 Fisheries Diversity

Fish diversity of the project area was assessed by direct observation while visiting local fish markets, interviewing fishermen, arranging FGDs (Focused Group Discussion) with local people, fishermen and fish traders, and from the available secondary information.

A total of 53 species of fish under 18 families (**Figure 4-20**) were identified from the survey (Annexure E). Among those species one (*Puntius sophore*) was identified Critically Endangered, nine (9) Endangered, six (6) Vulnerable, 12 Near Threatened and 26 Least Concerned as per IUCN Bangladesh red list. The local people and fish seller confirmed that, the fishes that are found in the local market is sourced from other adjacent area like Birunia Beel.

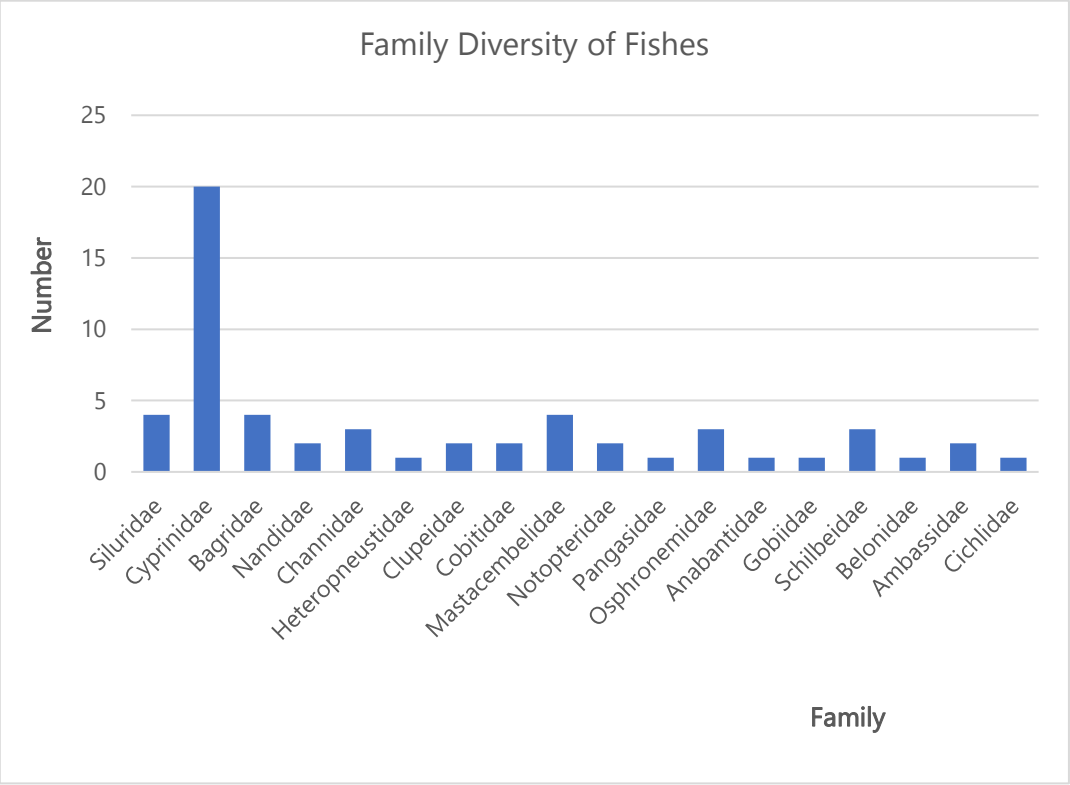


Figure 4-20: Family Diversity of Fisheries species

4.7.3 Fish Migration

As there is only one natural waterbody which is a narrow channel with almost no fishing activity due to discharge of waste water from nearby industries, it is not likely that the canal is used for fish migration. The local people also confirmed that, this canal itself does not support rich fish biodiversity. Besides, the channel is not connected with any river nearby. That is why, no fish migration is needed to be considered for the project AOI.

4.7.4 Ecological resources

Ecological resources are defined as those, that provide necessary but unglamorous system maintenance functions within ecosystems as a result of their role in ecological processes (Scott et al. 1998). It is a source or supply of ecological importance required by living organisms for sustainable coexistence of nature and human well-being. Ecological resources involve a number of natural processes that in turn provide a range of functions whose services are explicitly or implicitly valued by human beings. As human beings are dependent on the ecological resources,

having knowledge about those resources and their benefits is important for the successful management of those resources.

Due to the implementation of the project in the Mymensingh, the adjoining area could result in the deterioration of nearby ecosystem directly and indirectly. To assess the probable impact of the proposed project area in Mymensingh, one ecologist of EQMS conducted ecological survey from 21st to 24th October 2019 total of 4 days.

The study area for ecological survey includes an area within 2 km radius of the proposed project site. Land use of buffer area includes industry, agricultural land, canal, homestead forest etc. The climatic condition during the ecological survey was clear and sunny except the last day. The overall objective of this study is to establish the baseline data for flora and fauna of this proposed project area.

The ecological survey was conducted with the following objectives:

- Identification of various habitats available within the study area;
- Estimation of fisheries production, fish migration (if any), fish biodiversity, management, and efforts;
- Enumeration of terrestrial and aquatic species within the study area;
- Identification of floral and faunal species of conservation significance;
- Collection and compilation of secondary information on the status of floral and faunal;
- Components and habitats from the concerned stakeholders; and
- To develop the ecological mitigation and management plan.

4.8 Biological Environment

In 2002, IUCN Bangladesh divided the country into 25 regions based on biological diversity and ecological characteristics of those regions on a national scale. The study area falls in Bio-ecological Zone 3: Madhupur Sal Tract. Madhupur Sal Tract extent across the district of Gazipur, Tangail and Mymensingh. Undulating red soil sal forest is the main ecological feature of this zone. Madhupur, Bhawal, Ghatail, Basail, Kalihati, Shakhipur, Bhaluka, Gazipur, Mouchak and Savar constitute this zone. Detail on this bio-ecological zone is shown in the **Table 4-15** and a map of it in **Figure 4-21**.

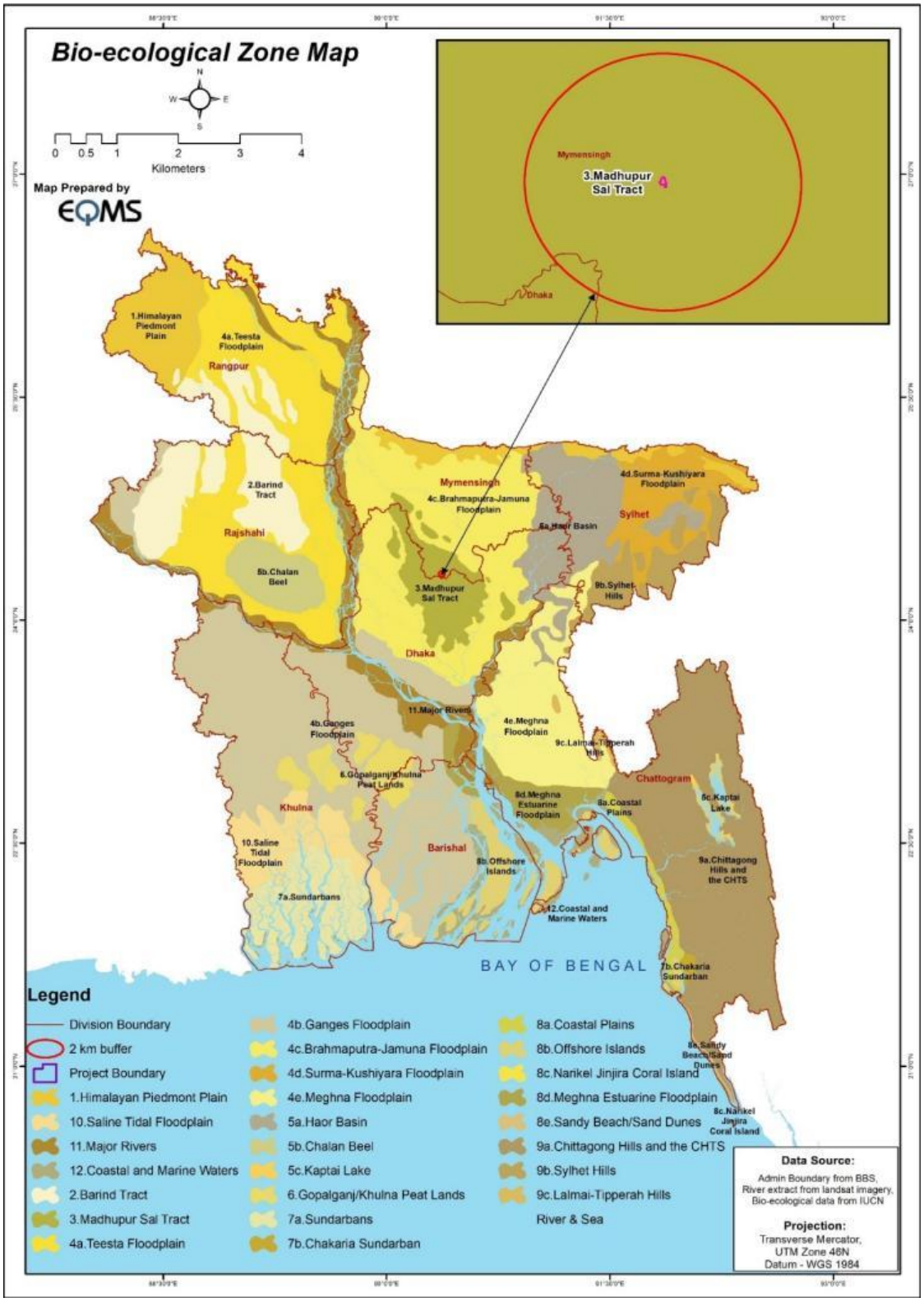


Figure 4-21: Bio-ecological Zone 3: Madhupur Sal Tract

Table 4-15: Bio-ecological Zone of the Project Site

Features	Information
Location	23°50′-24°50′ N and 89°54′-90°50′ E
Relevant adm hq	Mymensingh, Tangail, Gazipur
Physiography	Madhupur Tract
Soil	Deep red-brown terrace soil
Rainfall	2030-2290
Temperature	Maximum 34° C, Minimum 11° C
Land use	Deciduous forest
Floral Diversity	T**rees**
	Sal (*Shorea robusta*), Ban chalta (*Dillenia pentagyna*), Chitrika/Neul (*Bursera serrata*), Ban Karpash (Thespesia lampus), Bhela (*Semicarpus anacardium*)
	Shrubs
	Kamela (*Mallotus philippensis*), Kestoma/Keura (*Glochidion multiculare*), Asar (*Grewia microcos*), Mankanta (*dumetorum*)
	Herbs
	Shamdalan (*Elephantopous scaber*), Shothi (*Curcuma zeodaria*), *Boreria hispida*
	Climbers
	Kamkui/ Kantakui (*Bridelia retusa*), Goalia Lata (*Spatholobus roxburghii*), Ban ritha/ Kuchui (*Acacia concinna*), Anantamul (*Hemidesmus indicus*)
	Orchids
	Geodorum densiflorum
Faunal Diversity	**Mammals**
	Capped Langur (*Trachypithecus pileatus*), Wild Boar (*Sus scrofa*), Asiatic Brush Tailed Porcupine (*Atherurus macrourus*), Jackal (*Canis aureus*), Jungle Cat (*Felis chaus*)
	Birds
	Indian Pitta (*Pitta brachyuran*), Dollar Bird (*Eurystomus orientalis*), Blue Tailed Bee Eater (*Merops philippinus*), Dusky Eagle Owl (*Bubo coromandus*), Green Billed Malkoha (*Phaenicophaeus tristis*), Lesser Coucal (*Centropus bengalensis*), Yellow Footed Green Pegion (*Treron phoenicoptera*)
	Reptiles
	Indian Black Turtle (*Melanochelys trijuga*), Monocellate cobra (*Naja kaouthia*), Cantor's Kukri Snake (*Oligodon cyclurus*)
	Amphibians
	Painted Bull Frog (*Kaloula palchra*), Ornate microhylid (*Microhyla ornate*), Red Microhylid (*Microhyla rubra*), Taipeh Frog (*Rana taipehensis*) Balloon Frog (*Uperodon globulosus*)

Sources: IUCN Bangladesh

4.8.1 Protected Area

The protected area refers to an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective means i.e., protected area is predominantly a natural area

established and managed in perpetuity, through legal or customary regimes, primarily to conserve their natural resources. According to the Wildlife (Conservation and Security) Act, 2012 types of protected areas are national park, sanctuary, eco-park, botanical garden, community conservation area, safari park, Kunjaban etc.

The closest protected area to the project area (Kadigarh National Park) is located within 4.07 km from the project site. This forest has an area of 344.13 ha with sal being the dominant tree species. This forest is the home to a few floras and fauna those resembles the floral and faunal diversity of the project site due to its position so close to the project site.

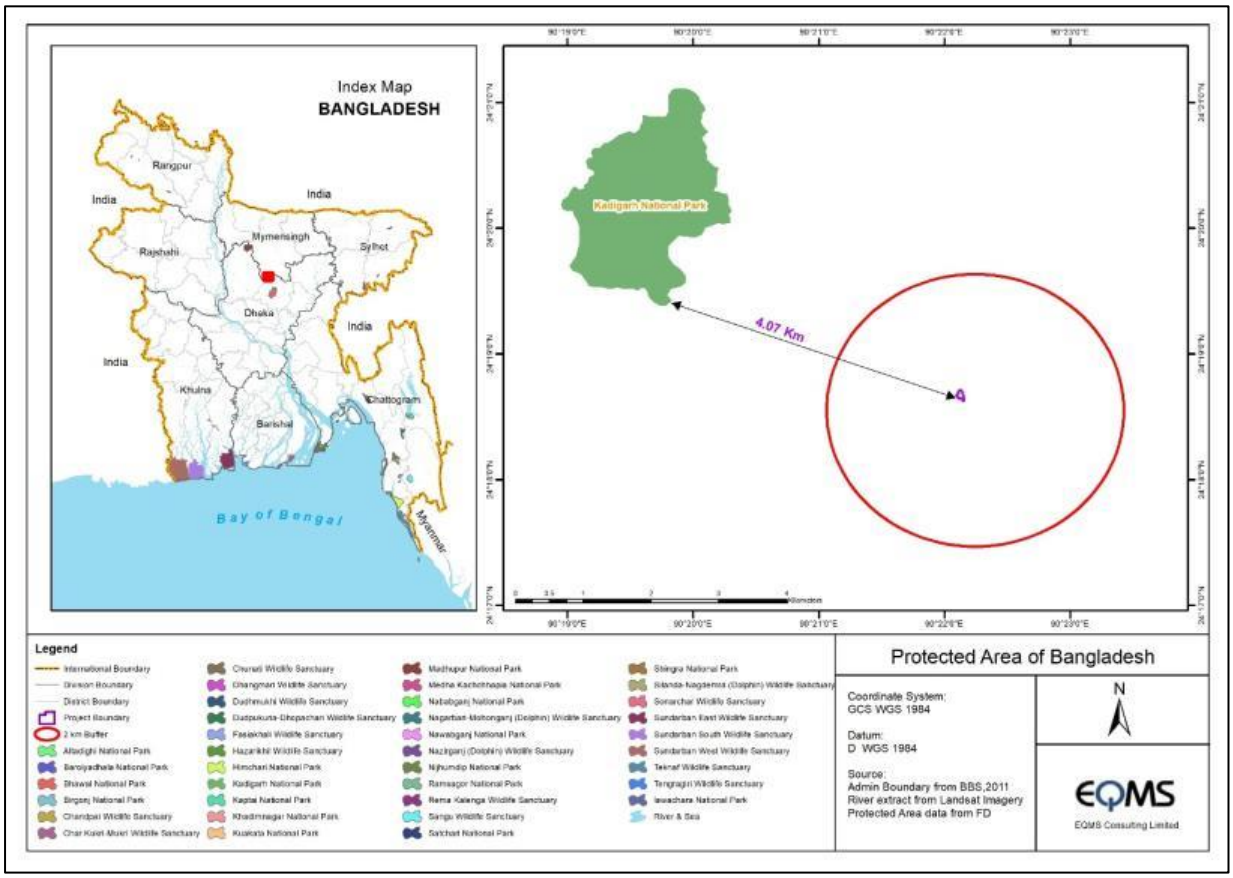


Figure 4-22: Proximal Protected Area (Kadigarh National Park)

4.8.2 Ecologically Critical Area

An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be deemed Ecologically Critical Areas as a result of the Environmental Conservation Act. The Government after considering the human habitat, ancient monument, archeological site, forest sanctuary, national park, game reserve, wild animals' habitat, wetland, mangrove, forest area, biodiversity and other relevant factors of an area can declare the area as an ECA. As per the legal mandate, the MoEFCC till now declared 13 areas as ECAs. The Department of Environment as a statutory body is entrusted to manage the ECAs. The nearest ECA to the project site is Turag River which is 45.24 kilometer away.

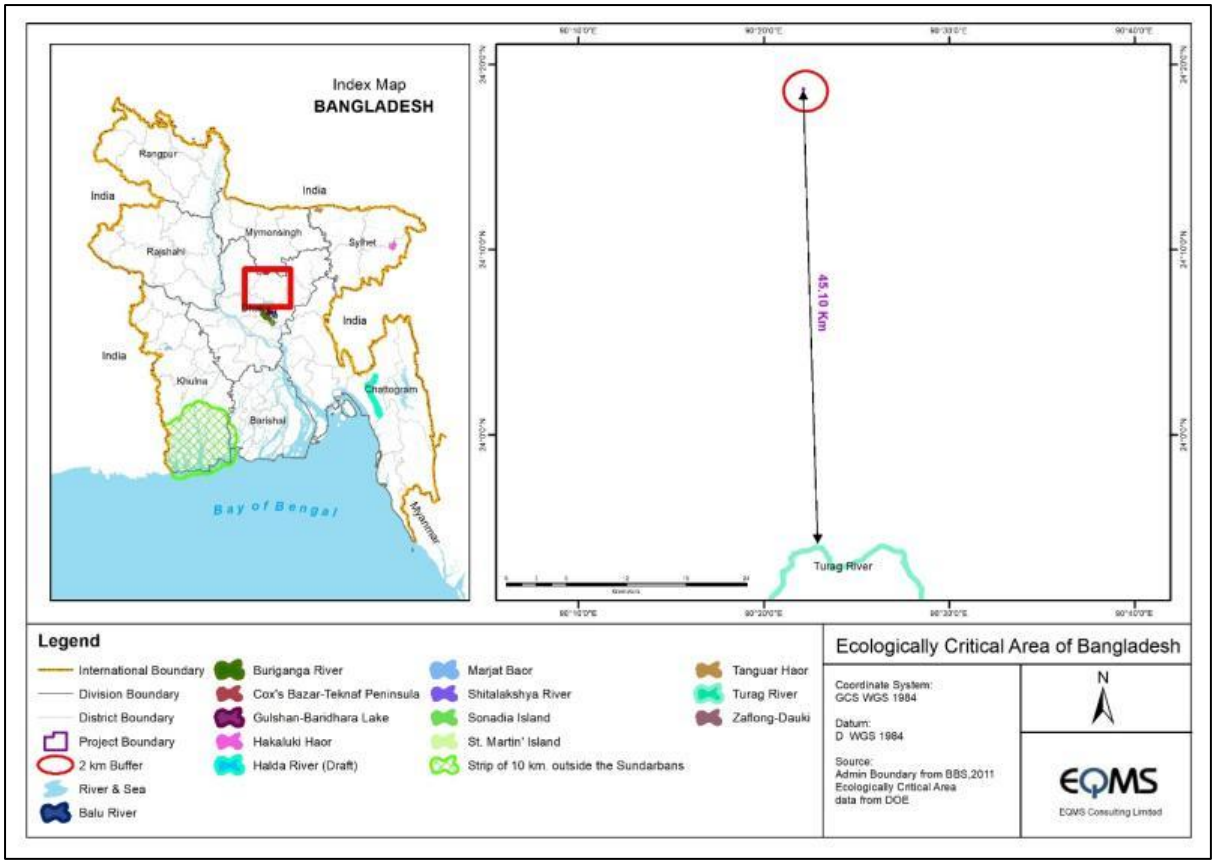


Figure 4-23: Proximal ECA (Turag River)

4.8.3 Common Flora and Fauna

The project area is situated in "Madhupur Sal Tract" bio-ecological zone. The nearest protected area is also a sal forest which is also a part of that bio-ecological zone. This suggests that the flora and fauna of the project area should house the flora and fauna of the bio-ecological zone. The field study corroborated this assumption.

4.8.4 Biodiversity Condition

Though the project area falls within a human modified ecosystem, it has an enriched biodiversity due to presence of homestead plantation, presence of bushy areas, numerous water bodies and Sal Forest nearby. Considering the study area, status and diversity of flora and fauna found during the study period, it is evident that the project AOI holds a great number of flora and fauna. This enriched biodiversity is indicative of a modified but healthy ecosystem there. However, a brief discussion of the methodologies followed to assess the biodiversity is given below.

4.8.4.1 Approach and Methodology of the Biological Study

4.8.4.1.1 Inventory of Floral Species

Block study has been considered for the initial study of the floral compositional survey. For the species diversity, the Shannon diversity index was followed. The team has considered the Roadside vegetation along with Homestead vegetation, Agriculture field, etc. for the study. The team also documented available published secondary literature review.

4.8.4.1.2 Inventory of Faunal Survey

The faunal survey comprises of Avifauna, Herpetofaunal study (Amphibians, Reptiles), Fishes, Mammals, and Crustaceans. Following methodologies had been followed for those studies -

4.8.4.1.3 Avifaunal Survey

4.8.4.1.3.1 Opportunistic bird sightings

Species were detected while travelling (by a long transect line) to and from study sites, or outside standard survey times or survey sites. Birds have been identified opportunistically either by their call, nesting identification or by their physical appearance.

Species were recorded through digital devices and identified through experts. Also, field guide for avifaunal identification were done in-situ during the primary survey. The secondary literature (Journals, Reports) was also reviewed during the preparation of the baseline study. IBA's Data for Bird Staging Site.

4.8.4.1.4 Methodology for the Herpetofaunal Survey (Amphibians and Reptiles)

An opportunistic survey of the herpetofauna (Amphibians and Reptiles) study were conducted. Species were recorded (Photographed, sighting through binoculars) with digital devices and identified by experts. Field guide for herpetofauna identification was also used in-situ to identify the species.

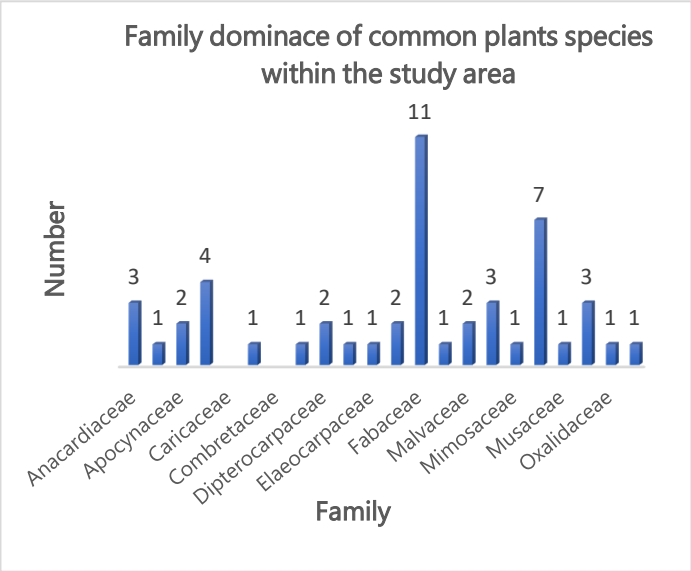
4.8.4.1.5 Methodology for Mammalian Survey

Opportunistic survey was carried out to study the mammals. Field guide was used to identify the observed species.

4.8.4.2 Floral Diversity

Though the area is under the "Madhupur Sal Tract" bio-ecological zone, the project AOI is not dominated by sal trees as it should have been, due to the modification of the ecosystem by human activities. The remnant of the sal tree is evident in some homestead forests which commonly have the planted trees for subsistence use.

The study found a total of 51 tree species (Annexure E) under 25 families (**Figure 4-24**). Among these species 18 are Very Common, 24 Common, 8 Rare and 1 Least-concern. Aam (*Mangifera indica*), Pakur (*Ficus religiosa*), Amra (*Spondias mombin*), Bel (*Aegle marmelos*), Segun (*Tectona grandis*), Sal (*Shorea robusta*) etc. are some of the very common tree species found within project AOI.



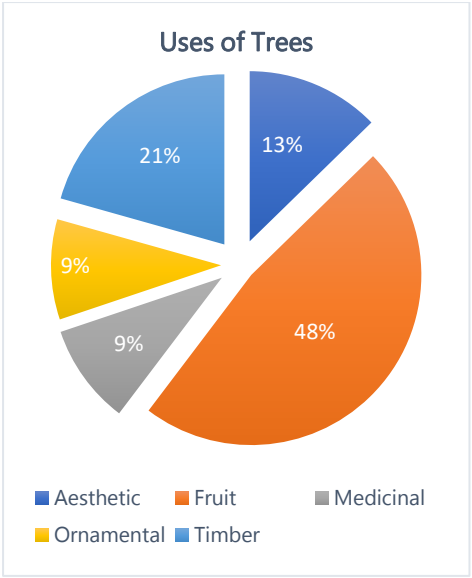


Figure 4-24: Family Diversity of Trees and their Use

In addition, 48% and 21% species are fruit and timber producing trees respectively. Besides, 13% species have aesthetic value, 9% have medicinal value and another 9% have ornamental value (**Figure 4-24**).

The study also found 23 species of herb and shrub which are used as vegetables and spices by the local people within the project AOI.

Another important finding of the study was Arabian Date-Palm orchards. During field visit at least three orchards were observed near the Seedstore-Kachina Road. These orchards have become a place of attraction or recreational place for people of nearby villages and visitors **(Figure 4-25).**





Figure 4-25: Local Arabian Date-Palm Orchard

4.8.4.3 Roadside Vegetation

Roadside trees of the study area show a great diversity in the number of the species. Of the 51 tree species around 20 species were found along the roadside. Common roadside trees are Aam (*Mangifera indica*), Jackfruit (*Artocarpus heterophyllus*), Bamboo (*Bamboo spp.*), Akashmoni (*Acacia auriculiformis*), Bel (*Aegle marmelos*), Boroi (*Ziziphus mauritiana*), Banana (*Musa acuminata*),

Ashwath (*Ficus religosa*) etc. This roadside vegetation is important for roadside fauna. The following figure illustrates the roadside vegetation of the project site.



Figure 4-26: Roadside Vegetation

4.8.4.4 Floral Species Diversity Index Analysis

The field data collection mainly included biodiversity assessment of different types of floral elements such as trees, herbs, and shrubs. A total of three quadrates were assessed in and around the study area. From the graphical point of view, the highest diversity was found in location 3 (Q3) and lowest in location 1 (Q1). The result indicates that, herb species are dominant in the project site.

The locations for the Quadrates study have been provided in **Table 4-16**. The study found highest diversity in Q3 and lowest in Q1.

Table 4-16: Location and Floral Diversity Indexes of Quadrate Survey

Quadrates	GPS Coordinates	Area	Shanon-Wiener Diversity Index	Evenness	Number of Species
Q1	24°18'40.02"N 90°22'22.50"E	Outside the project location. North-East side for (Herb)	1.37	0.85	04
Q2	24°18'37.43"N 90°22'28.59"E	Inside the project location. Eastern west side for (Shrub)	1.40	0.87	05
Q3	24°18'39.74"N 90°22'13.24"E	Outside the project location. Western side for (Tree)	1.60	0.96	36

Source: Field Visit, 2019


Quadrate Survey Q1


Quadrate Survey Q2


Quadrate Survey Q3

Figure 4-27: Quadrate Sampling

4.8.4.5 Faunal Diversity

4.8.4.5.1 Avifauna

A total of 33 species belonging to 21 families were recorded during the survey. Sturnidae, Corvidae and Ardeidae were the dominant families among them.

Out of the 35 species, 33 species are Least concerned with two (2) Near threatened species as per IUCN Bangladesh red list, 2015. Of them, Grey Headed Fish Eagle is of special importance as it is the top predator in the food chain and is categorized as Nearly Threatened (NT) according to the IUCN Red list status. It can be mentioned here as well that, during the field visit a nesting of a pair of Grey Headed Fish Eagle was also observed.

According to the consultation of the local people, Eagles do not make nest every year in that tree. However, the nesting was observed approximately 800 meters away from the project site and the nesting and the pair are likely not to be affected at all by the project at all. The local people also confirmed that, the project area does not support habitat of migratory species. A list of the birds that were observed and confirmed through consultation with local people are enlisted in the Annexure E.

4.8.4.5.2 Herpetofauna

Amphibians and Reptiles comprises the animal group of Herpetofauna. Though these group has very strong role to maintain ecological balance, they are often neglected from conservation effort. The survey found four (4) amphibian species (Annexure E); all of which are Least Concerned as per IUCN Bangladesh red list, 2015. Three (3) of those species are frogs and one (1) toad.

Eight (8) species of reptiles were observed during the study. Among those species, four (4) were snakes, three (3) lizards and one skink. Two snakes and one lizard are Near Threatened as per IUCN Bangladesh red list, 2015. A list of found amphibian and reptiles are enlisted in the Annexure E.

4.8.4.5.3 Mammals

Mammals are the most advanced of all the creatures in the animal kingdom. It has a number of species which play critical role in the food chain being the top predator; many of which has no predator above them.

The study found four (4) Least Concerned (IUCN Bangladesh red list, 2015) mammalian species within the project AOI. The Capped Langur is an Endangered mammalian species which is found in Kadigarh National Park. It can be mentioned here that, the National Park is around 5 km away

from the project site. However, the Irrawaddy squirrel was observed near the project site during the field visit. A list of the mammals that are found in the study area are enlisted in the following **Table 4-17**.

Table 4-17: Mammals Found in the Study Area

Sl.	Common Name	Local Name	Scientific Name	IUCN Status*
1	Hoary-bellied Himalayan Squirrel	Irrawaddy Squirrel	*Callosciurus pygerythrus*	Least Concern
2	Indian Fruit Bat	Badur	*Pteropus giganteus*	Least Concern
3	Common Indian Field Mouse	Metho Idur	*Mus boodug*	Least Concern
4	Common mongoose	Boro beji	*Herpestes edwardsii*	Least Concern
5	Capped langur	Mukhpora Hanuman	*Trachypithecus pileatus*	Endangered
6	Golden Jackal	Pati Shial	*Canis aureu*	Least Concern

* Red List of Bangladesh, Volume 2: Mammals

4.9 Socio-economic condition

4.9.1 Baseline Socio-Economic Condition of the Project Area

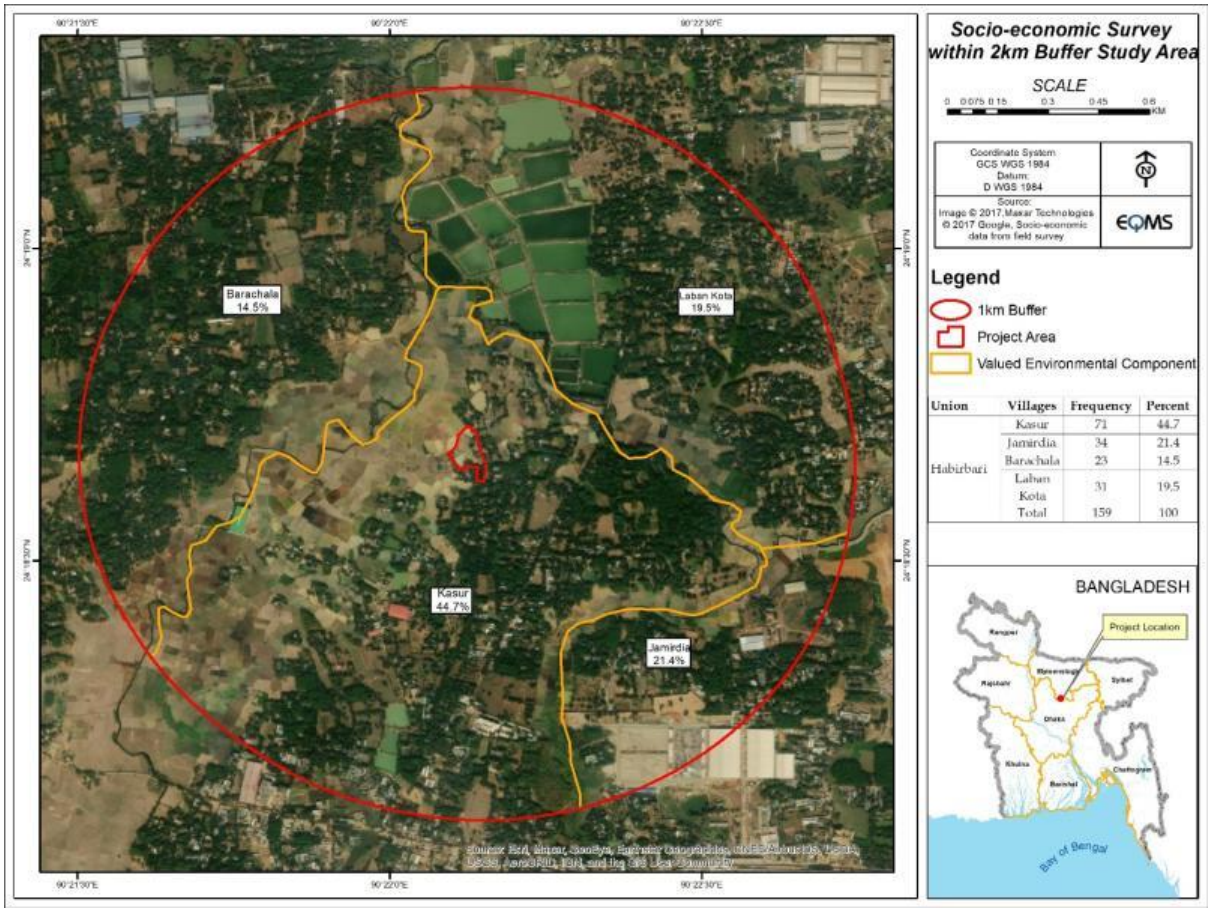
4.9.1.1 Villages Adjacent to Project Site

Socio-economic assessment of adjacent population of the proposed project is very much crucial for project planning and implementation. Therefore, villages adjacent to proposed project within 1 km radius were surveyed for intense socio-economic assessment. Villages are so close to proposed project and communities of the villages are rigorously connected in their daily life to the proposed project area.

Villages situated within the 1 km radius from the proposed project were considered for conducting social survey. To get the actual population/households of the studied villages, secondary sources such as Population and Housing Census, District Statistics and District Web Portal have been used. When total numbers of the households/populations had been confirmed, considering all villages as cluster 20% households were finalized for random sampling along with specific interval. Thus, 159 households residing in the villages within 1 km radius including 12 land selling households and 147 community households were surveyed. Kashor is the largest VEC around the project site.

Table 4-18: Villages adjacent to the Project Site

Union	Villages	Frequency	Percent
Habirbari	Kashor	71	44.7
	Jamirdia	34	21.4
	Barachala	23	14.5
	Laban Kota	31	19.5
	Total	**159**	**100.0**



Union	Villages	Frequency	Percent
Habirbari	Kasur	71	44.7
	Jamirdia	34	21.4
	Barachala	23	14.5
	Laban Kota	31	19.5
	Total	159	100

Figure 4-28: Surveyed Villages' Locations

4.9.1.2 Basic Demographical Characteristics of the Households

Basic demographic characteristics include total population, gender, age, marital status, and health status. In the 1-kilometer AOI, according to the Population and Housing Census (2011), about 22892 households (HHs) with a total population of 92453 are the receptors of the proposed project. The average sex ratio is 115 against the national figure of 100. Moreover, average household size (3.9) of the study area is less then national figure 4.44.

Survey result shows that about a total number of 593 populations are living within these 159 households, where 12 land selling households consist 44 populations and 147 community households consist 549 populations. On the other hand, 1-91 age range has been found within the selected households of specific villages. Importantly around 74.0% population belongs to 14-64 age range which signifies that most of the populations are eligible for being active in economic activities. Contrary, only 26.0% population is found depended. Additionally, 59.4% population is married. Allover health status among the households was tried to capture and no disability has been found.

Population and Housing Census (2011) refers that the population of the study areas is dominated by the Muslim community constituting about 96.14% of the total population with remaining 2.89% constituted by Hindus, Christians, Buddhists, and others. However, all the surveyed households have been found Muslims. **Table 4-19** illustrates the basic demographical characteristics of the surveyed households.

It has been already mentioned that there are few scattered Households in the West, East and South side of the project. Kashor is the only VEC around the project site. There are 4 mosques, 2 schools and 2 Bazars in Kashor. Households around the project site has dense vegetation area. The Households are the only sensitive receptors around the project site. Most of the sensitive receptors are at least 300 meters away from the project site.

Table 4-19: Basic Demographic Characteristics of the Selected Villages

SL.	Demographic Details		Total	%	Land Selling Households		Community Households	
					N	%	N	%
1.	Total Population	Male	307	51.8	22	50	285	51.9
		Female	286	48.2	22	50	264	48.1
		Total	**593**	**100.0**	**44**	**100**	**549**	**100.0**
2.	Age	1-13	135	22.8	12	27.3	123	22.4
		14-27	190	32.0	16	36.4	174	31.7
		28-41	156	26.3	10	22.7	146	26.6
		42-64	93	15.7	4	9.1	89	16.2
		65-65+	19	3.2	2	4.5	17	3.1
		Total	**593**	**100.0**	**44**	**100.0**	**549**	**100.0**
3.	Marital Status	Married	352	59.4	28	63.6	324	59.02
		Unmarried	235	39.6	15	34.1	220	40.07
		Divorced/Widowed	6	1.0	1	2.3	5	0.91
		Total	**593**	**100.0**	**44**	**100.0**	**549**	**100.00**

Source: EQMS Survey, October 2019

4.9.1.3 Household Structures and Sanitation

According to population and housing census (2011), predominant structure of these study areas is Kutcha (57.75%) followed by Semi-Pucca (36.65%), Pucca (4.55%) and Jhupri (1.05%) but different scenario has been found in the household survey where predominating household structure is found Semipucca[23] (65.7%). Moreover, survey has also found that 30.2% & 4.1% households are Kutcha[24] and Pucca[25] respectively.

Table 4-20: Structures of the studied households

Type of Structures	Total	%	Land Selling Households		Community Households	
			N	%	N	%
Pucca	12	4.1	0	0	12	8.2
Semipucca	92	65.7	9	75	83	56.5
Kutcha	55	30.2	3	25	52	35.4
Total	**159**	**100.0**	**12**	**100**	**147**	**100.0**

Source: EQMS Survey, October 2019

[23] "Semi-pucca is defined by the structures whose walls are made of cement and bricks and roof is made of tin, asbestos, wood or bamboo", BBS (2015)
[24] "Kutcha is defined by the structures whose walls are made of clay, wood, bamboo, straw or raw bricks and roofs are made of tin, bamboo and straw", BBS (2015)
[25] "Pucca is structures whose floor, wall and roof are made of cement, brick and stones", BBS (2015)

Population and Housing Census (2011) refers that about 80.18% households use sanitary latrine including 37.33% water sealed and 42.85% non-water-sealed facility. Moreover, 17.78% households use non-sanitary facilities. On contrary, 2.03% households have no access to latrine facility and defecate in open places.

Household survey has found slightly improvement on this occasion. It is found that 92.9% households have sanitary toilets and rests 7.1% have non-sanitary toilets. No open defecation has been found among the surveyed households.

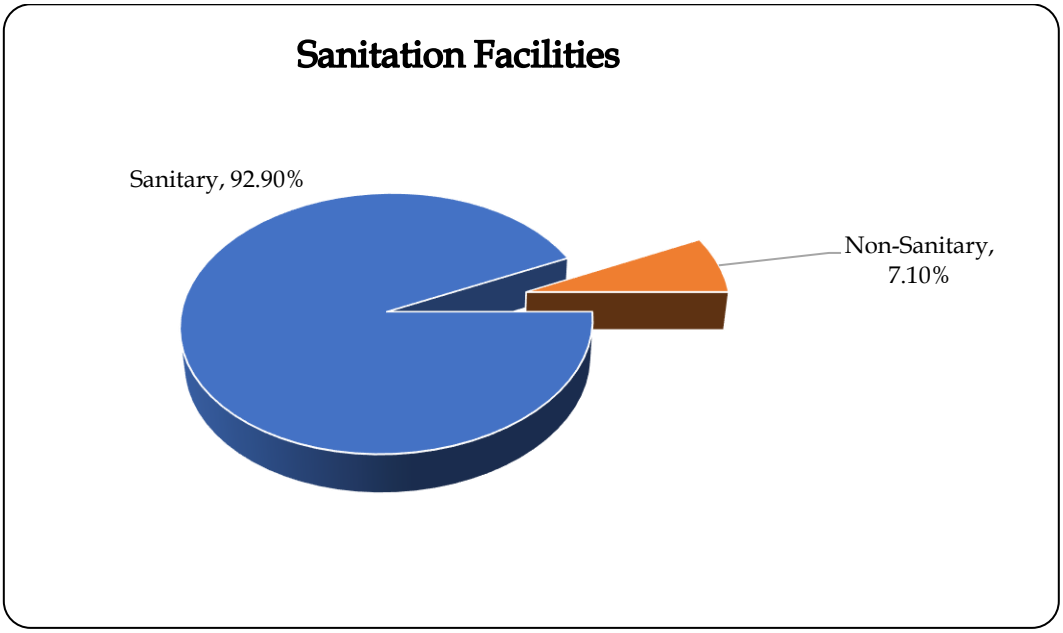


Figure 4-29: Sanitation facilities

4.9.1.4 Education

According to the Population and Housing Census (2011), the literacy rate (56.55%) of these influenced villages is higher than the national average of 51.8%. On the other hand, survey finds that about 84.6% of total population is at least literate among them 15.4% has minimal literacy knowledge followed by 31.8% primary (class 1-5) education, 18.6% secondary (class 6-9) education, 10.3% S.S.C, 5.4% H.S.C and rests only 3.1% who complete at least Bachelor level. About 15.6% populations are found underlying within the Illiterate category where 9.5% populations are children who have future potentiality to enroll in school. Besides, there is a school named Dipsikha Model School which is approximately 420 m southeast side from the project site. (See Annexure E).

4.9.1.5 Local Economy & Occupations

Though Population & Housing Census (2011) refers that the studied community is industrial based where about 52% employees are engaged with industries but primary survey has found different scenario. Among the total surveyed population 34.2% (31.8% land selling households & 36.6% community households) are engaged in economic activities with varies occupations. Unlike other parts of the rural Bangladesh, occupations within the selected villages are found Service based. Approximately, 52.9% of the total employed populations engage in service sector. Moreover, 30.9% of total employees involve in Industry sector. On the other hand, only 13.3% employees are working in Agriculture sector. Others activities (3.0%) include non-agriculture labor, Mason, Color Smith etc.

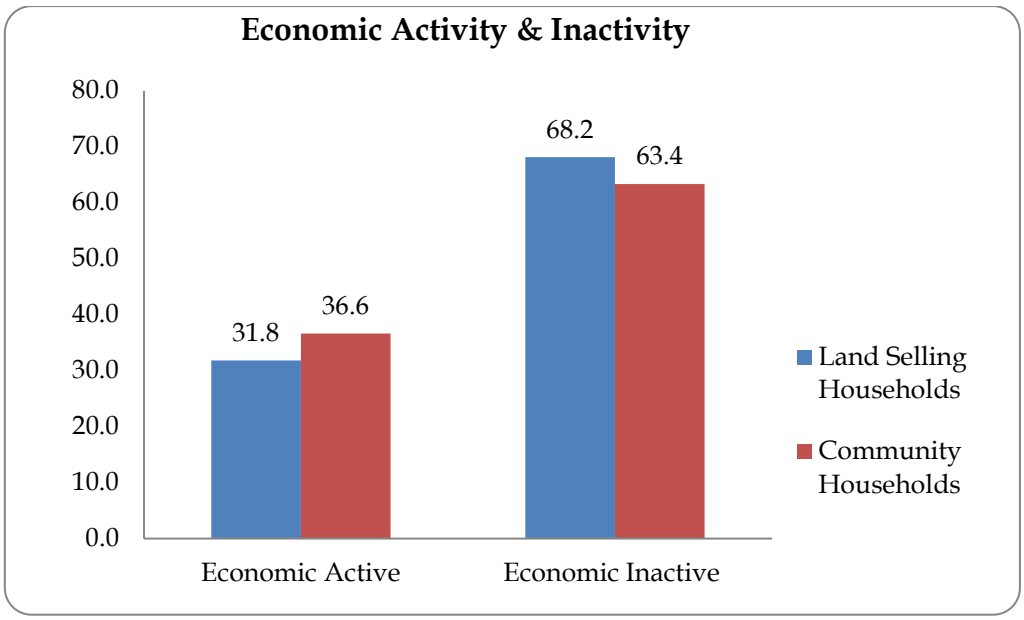


Figure 4-30: Economic active population of the surveyed population

4.9.1.6 Income, Expenditure and Savings

Households' monthly income reveals the solvent economic situation of the studied area. According to HIES 2010, after including the inflation rates upto 2019, yearly income BDT 120000 is the poverty line limit of the studied area. Study finds that only 5.5% households of the total surveyed households have less than BDT 120000 yearly income.

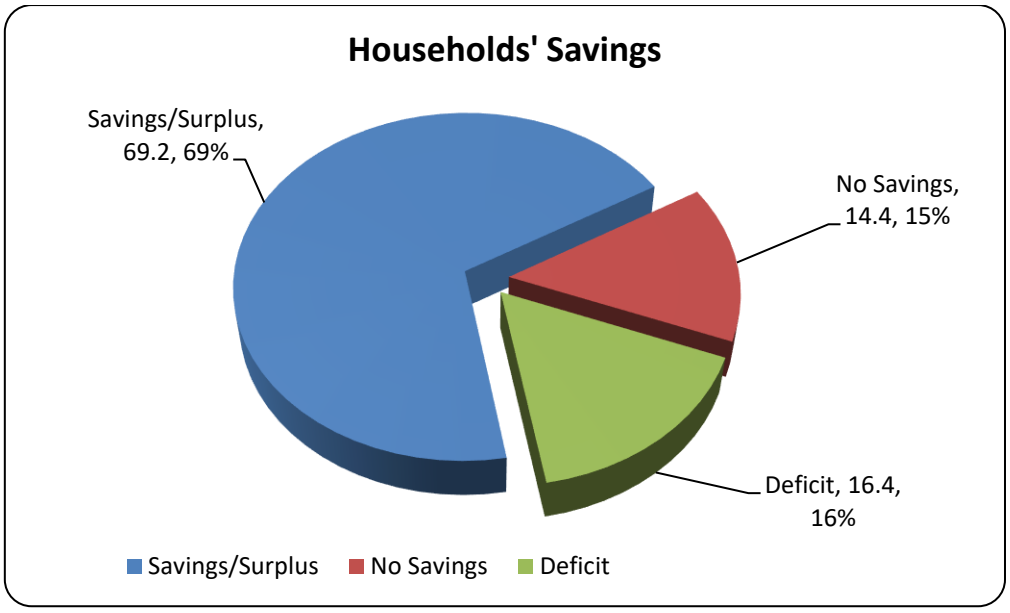


Figure 4-31: Status of Household's Savings

Therefore, it suggests about 5.5% of the studied households are underlying below the poverty line. Highest concentrations of yearly income have been found in BDT 120000-240000 & 240000-360000 categories representing 48.5% & 27.5% of total surveyed population respectively (See Annexure E).

Household expenditure modalities has been also captured. **Figure 4-32** summarizes the findings of the of the survey that, on an average 60.9% expenditure is incurred solely for household food

consumption. Other major household expenditures are education (14.2%), Treatment (13.2%), Clothing (7.2%).

Status of household yearly savings depicts the solvency of any studied populations. **Figure 4-31** shows that about 69.2% households can save surplus from their yearly income where only 14.4% households cannot save any surplus. On the contrary, it has been found that 16.4% households belong to deficit state meaning yearly expenditure exceeds yearly income for them.

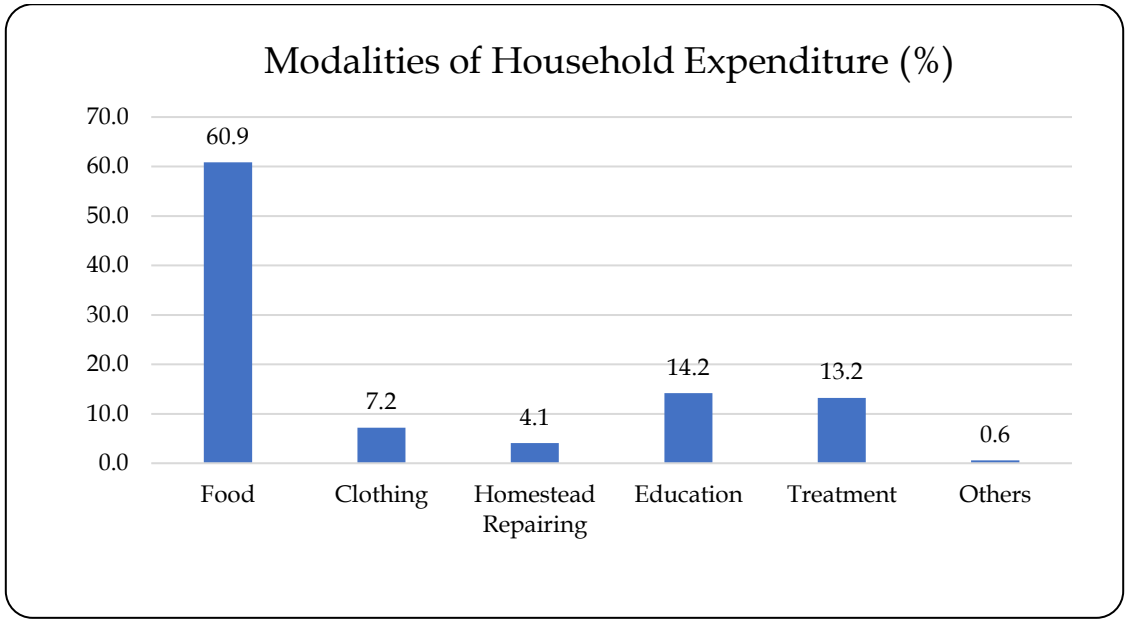


Figure 4-32: Household Expenditure Modalities

4.9.1.7 Energy Access

Lighting and cooking sources are the very important needed energy for any households and higher quality and easy access to quality energy can ease household's daily life. Results have found that 99.7% of the total households have access to electricity (see Annexure E).

In the case of cooking fuel, it is found that most of the households are relying on the conventional ways of cooking. Firewood, crop residue and cow-dung cake are used for cooking fuel. Usually, women are engaged for preparing these cooking fuels. In absence of modern cooking system women must work and prepare these fuels, consequently women are depriving themselves from engaging economic activities. About 79.0% households are relying on natural fuels (Firewood, crop residue and cow-dung cake) where rests 21.0% use LPG gas for cooking.

4.9.1.8 Access to Social Market and Medical Services and Other Facilities

Convenient and easy access to market and medical services help households get basic needs and health services when it is necessary or urgent. Distance may barrier from easy access to these services. Survey results have found that all households have easy access to main markets and they must travel less than 3 km for accessing market facilities. There is a market named Kashor market which is approximately 1 km away from the project site. They can get all sorts of amenities from the markets. Village specific market preference has been captured during the survey and the finding depicts those residents of Kashor and Jamirdia go to Kashor Bazar (Chourasta) and Masterbari Bazar respectively. On the other hand, residents from Laban Kota & Barachala go to both Seed Store & Amtola Bazar depending on the needs.

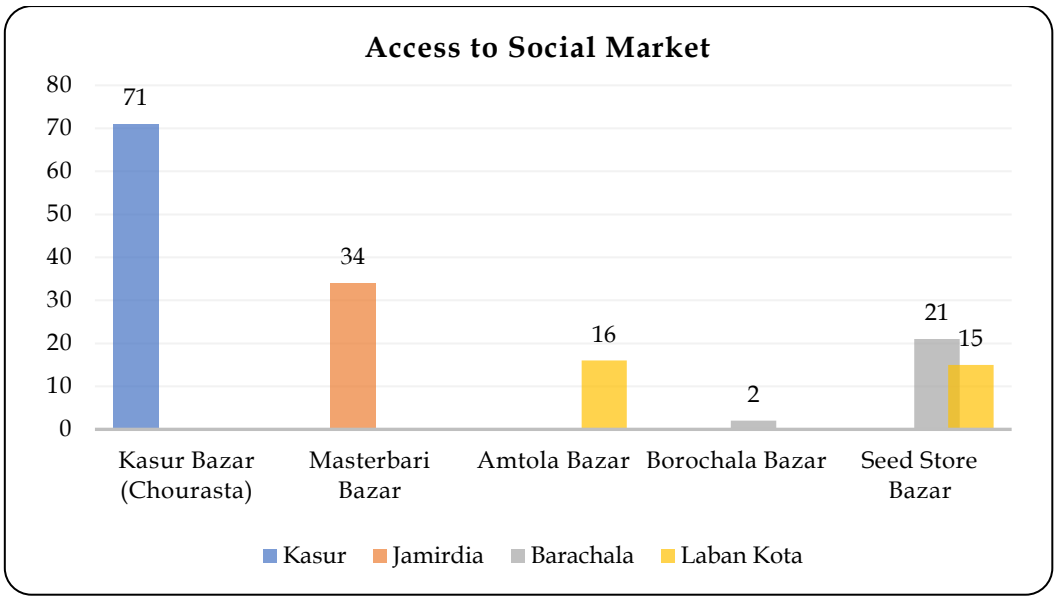


Figure 4-33: Access to Social Market

Easy access to hospitals enhances the health services taking frequency. Higher distance may hinder taking health services which ultimately increases the health risk. Survey results have found that only 10.2% households are staying less than 1km distance from the health service point. Conversely, significant numbers of the households (89.8%) are residing more than 3km distance from the hospitals. It will be clear if you look individual village separately. Major preferred area for taking health services is Kashor Bazar 71% followed by Masterbari Bazar 34%.

Besides, there is a school named Dipsikha Model School which is approximately 420 m southeast side from the project site. This school considered as VEC within the AoI. Study finds that about 55.7% households have access in primary school within less than 1 km followed by 19.3% have access within 1-2 km. On the other hand, 25% have access more than 3 km distance (See Annexure E).

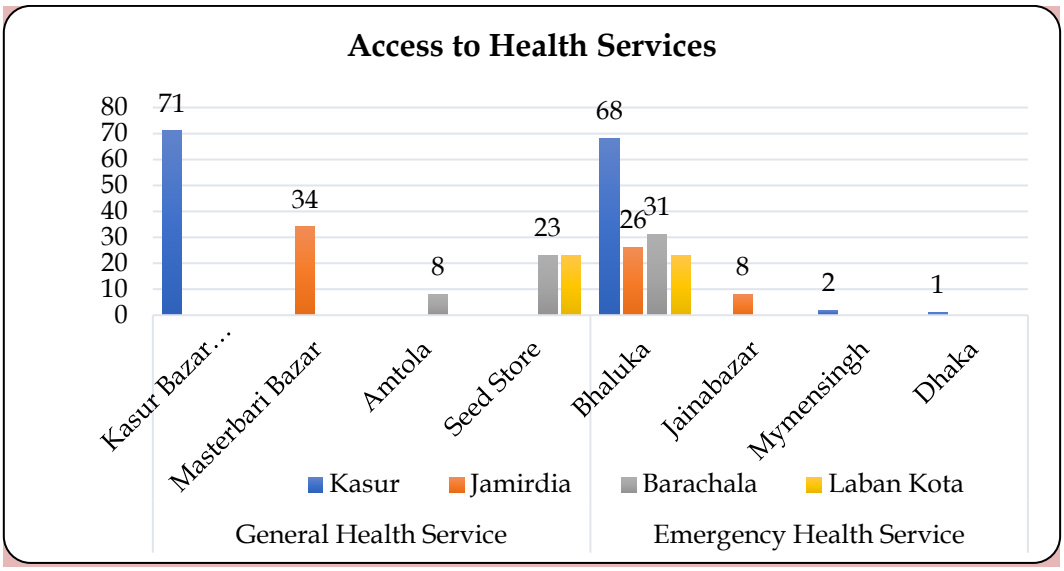


Figure 4-34: Access to Medical Service

4.9.2 Gender Analysis

Study finds the common patriarchic scenario in the study area. No women headed households have been identified in land selling households. But in community level, it has been found that only 3.4% households are headed by women which is illustrated in the **Figure 4-35**.

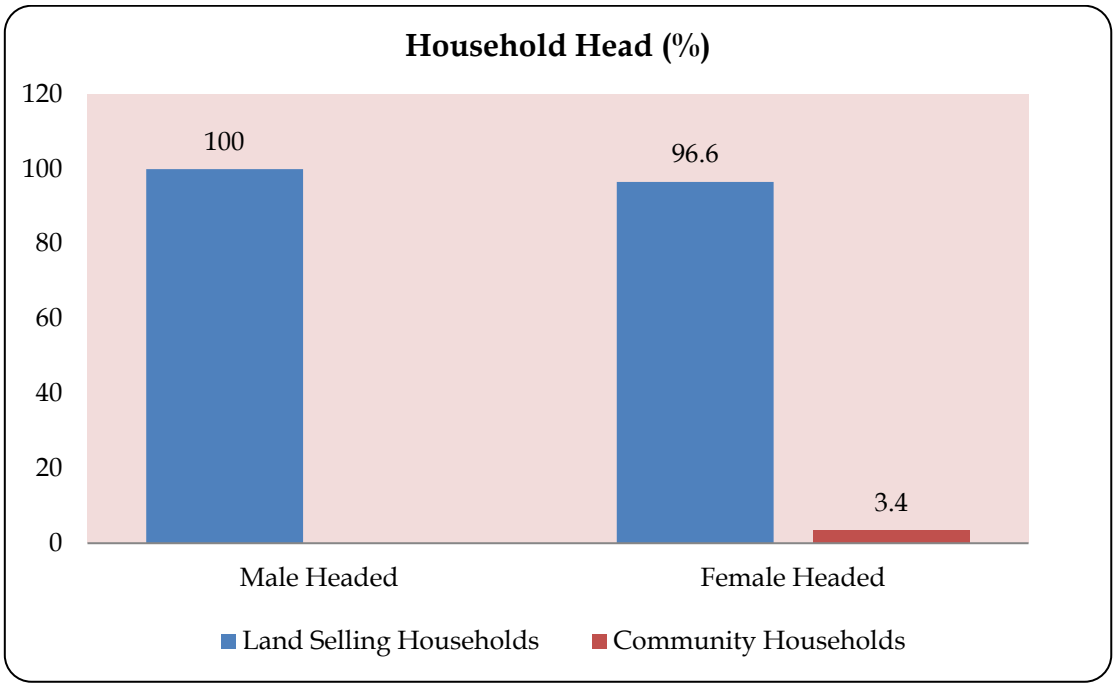


Figure 4-35: Gender based economic activity

4.9.3 Education and Occupation

There are no high school in 1 km social study area. The Study finds that female populations are lagging in enrolling higher education compared to the male counterpart. Male female disproportionate higher education enrolment is observed from Bachelor or Equivalent degree. Among the studied populations, 2.8% male have completed Bachelor or higher study where only 0.2% female have completed that of which is illustrated in the following **Figure 4-36** and **Figure 4-37**.

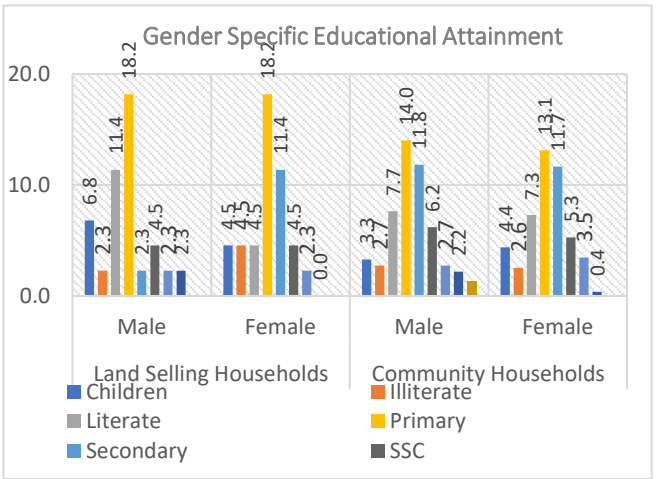


Figure 4-36: Educational attainment based on Gender

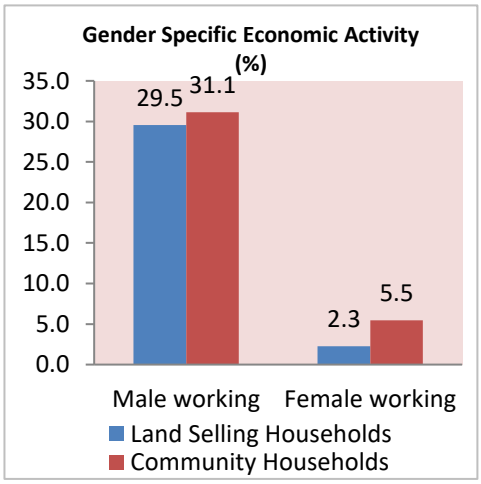


Figure 4-37: Gender based Economic Activity

Like the education attainment, female populations are also found lag in economic activities. It is found that, only 3.9% (2.3% land selling and 5.5% community households) female of total populations are engaged in economic activities.

Study finds that in the study area there is very limited scope of economic opportunity for women. Unlike the male population, female occupational diversity is very limited. Study has found 10 sectors where women are usually engaged for economic purposes. It is also reviled that woman are mostly engaged in industry followed by service and agriculture which is illustrated in **Figure 4-38**.

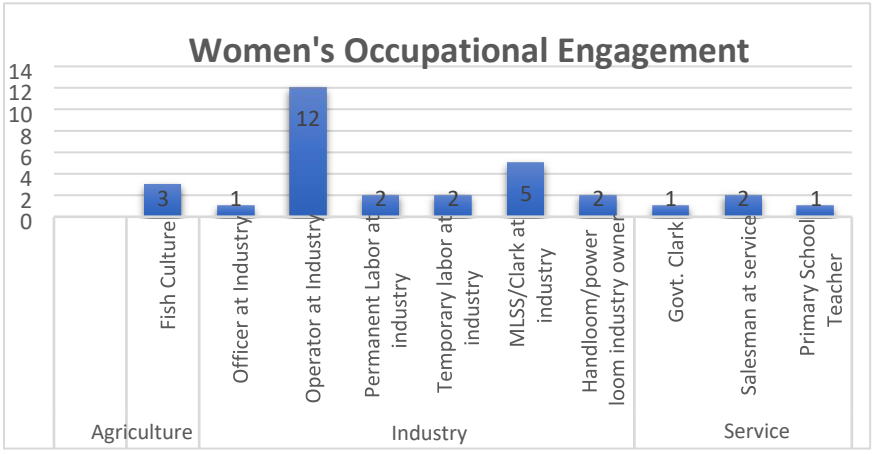


Figure 4-38: Women's Occupational Engagement

4.9.4 Vulnerability Analysis

According to the head count rate of HIES (2010), it has been found that about 5.5% households are underlying below the poverty line in the study area. Additionally, 1.7% households were found women headed. No ethnic households have been found.

Table 4-21: Vulnerability of the study area

Sl.	Vulnerabilities	Percentage
1.	Below Poverty Line (head count rate 2520)	5.5%
2.	Women headed Households	1.7%

Source: EQMS Survey, October 2019

4.9.5 Project Awareness

Project awareness and perception may hinder or facilitate any project work's successful implementation. Moreover, community perception will lead to guide maintaining project activities in line of environmental & social standards. Survey result shows that 79.5% of total households are completely aware of this proposed project. Conversely, 20.5% of total households are found indifference and know nothing regarding this project.

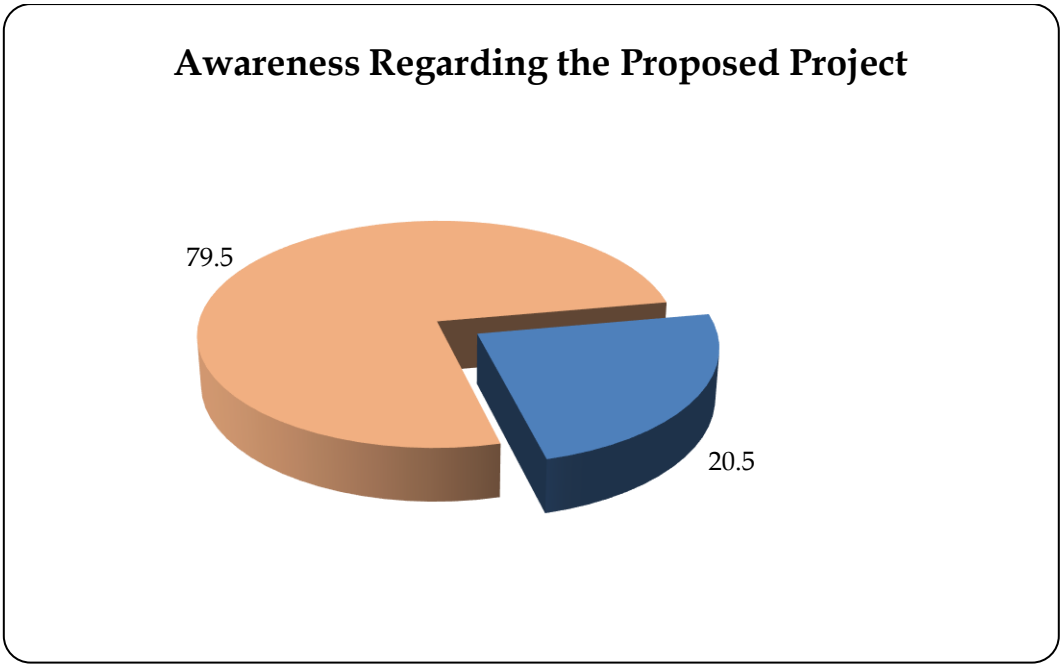


Figure 4-39: Project Awareness among local community

4.9.6 Perceived Impacts

4.9.6.1 Negative Impacts

Study finds that, about 80.6% believe that there will be no harm on the local community as the consequence of the project establishment. On the contrary, 19.4% believe that local community will be affected by the activities of the RTL project (see **Figure 4-40**). Among them, 7.0% and 5.6% paid concern regarding waste pollution and traffic safety respectively. Moreover, 3.8% and 2.9% were concerned about air pollution and sound pollution.

4.9.6.2 Positive Impacts

Many the studied populations were optimistic and perceived positive outcomes from the RTL project. Among the positive believers 56.7% feels that substantial work opportunity will be created and the adjacent community will be blessed by engaging with these opportunities. In addition, 13.8% believes that local community may have opportunity to extend businesses as the RTL project has potential migrant workers. Besides these, people think that the chance of other infrastructural developments like roads, educational institute, residence, theater, park, and hospital will be accelerated due to the project activities. Some believe that basic services and quality of life will be enhanced.

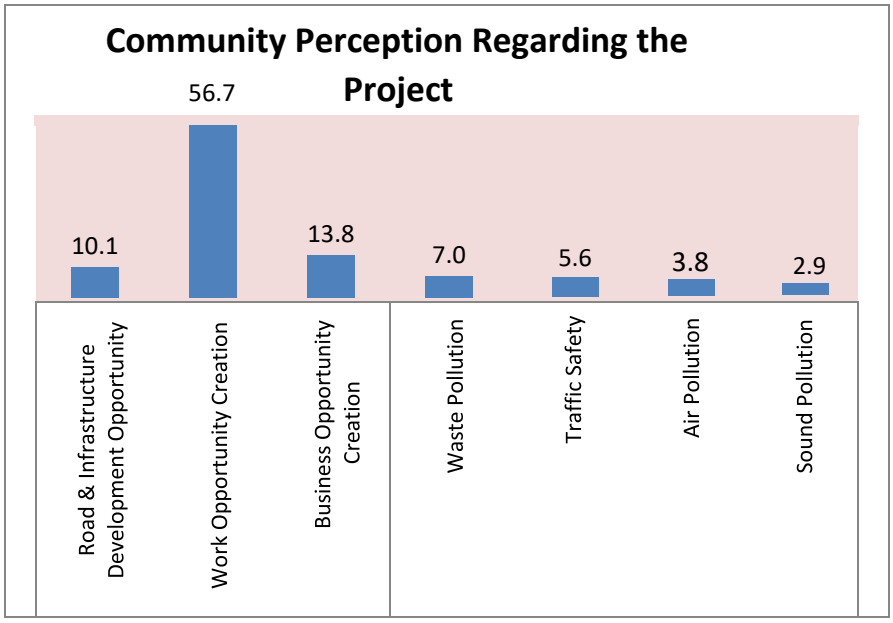


Figure 4-40: Community perception reading the project

4.10 Environmental and Social Audit of Site Activities in the Construction Phase

4.10.1 Audit requirements

RTL is not a green field project anymore and its construction has almost been completed. An environmental/social audit for the project is required under WB PSs (e.g., PS1-2), to assess as to what degree the ES due diligence has been followed in the activities so far. The requirements to be audited can vary depending on the need/outcome for the audit. The audit in this case document, the main environmental and social aspects associated with the current RTL assets (e.g., air emissions, wastewater effluents, wastes generated, pollution and contamination of project site, land acquisition issues, occupational health and safety, public/community safety, labor management and standards, impacts on cultural resources, internal and external grievances, disputes), and identify the key environmental and social risks and impacts associated with the assets, including areas of past, current or potential future non-compliance with national requirements and the WB E&S standards.

4.10.2 ES Audit Findings

The audit was conducted by the ESIA team through site visits, so that report is based on actual observations and can be used with confidence for remediation purpose. Findings of the audit are detailed in Annexure-G; and a summary is provided in **Table 4-22**, which include audit conclusion.

It should be noted that present audit is a limited one for the purpose of ESIA preparation and it is not a formal audit as per ISO 19011.

Table 4-22: Summary of ES Audit Findings

SN	Aspects/Issues	Status/ Findings	Comments
1.	**Basic Data of Industry**		
1.1	Name of Industry	Raw Tech Ltd.	-
1.2	Date of auditing	10th December, 2020	-

SN	Aspects/Issues	Status/ Findings	Comments
1.3	Type of Industry	Recycling (Waste Management)	-
1.4	ES Risk Category	Medium	-
1.5	Start of construction	January, 2018	-
1.6	Current Progress	Construction is ongoing Expected COD: June 2021	Factory shed's wall and storage building construction, approach road construction and installation of machineries and ETP not finished yet.
2.	**Management Review**		
2.1	Site in charge	Site Manager	Available at site
2.2	ES Focal Point	Site Manager	Site manager is also the ES focal point for the project
2.3	Security	Managed by RTL	No armed guard is employed, So far, no incident with local community
2.4	Total Number of Workers	Constriction Phase ≈ 40 Operation Phase ≈20	-
2.5	Number of Female Workers	Construction Phase ≈ 12	-
2.6	Number of Workers living in work camp	No worker stays at work camp;	RTL has hired local worker during construction period;
3.	**Site status Review: Environment**		
3.1	General	Site is unkempt	Should be cleaned up regularly
3.2	Solid waste	Lying around in piles	Should be stored in a designated area with proper management plan;
3.3	Liquid waste	No puddles	-
3.4	Air Pollution	The major sources of impacts on air quality during the ongoing construction phase are as follows: • Operation of diesel generators • Dust generated from stockpiles of materials, waste, loose earth, handling and moving excavated material and transporting wastes. • Loading and unloading construction materials;	Emission is observed Low.

SN	Aspects/Issues	Status/ Findings	Comments
		• Handling and mixing of cement • Ongoing Civil Construction work	
3.5	Noise	The potential sources of noise during ongoing construction phase are given below • Noise generated from various activities such as welding, hammering, cutting, motor testing etc. • Noise generated during civil construction work. • Loading and unloading of material from truck	Change in ambient noise level is Low
3.6	Stored Materials at site	Some building material and Plant Components	RTL has stored materials in their factory premises.
4.	**EHS/OHS Screening**		
4.1	Work camp sanitation	Satisfactory sanitation has found at site	-
4.2	Disease Vectors	Low possibility as water puddles is absent	-
4.3	First Aid Kit/Training	Available at site office; Some workers are trained.	-
4.4	Fire safety	Portable Fire Extinguishers are available and some workers are trained	No training manual found
4.5	PPE Use by workers	Workers were found with proper PPE	-
4.6	Accident report	No major accidents but formal reports were unavailable	Only minor injuries reported; immediate action was taken by RTL
4.7	Food Safety	Food management in worker camp appeared reasonably safe	No disease outbreak was reported
4.8	Drinking water	Untreated Groundwater	To be remedied immediately; Need to installed water purifier;
4.9	ETP status	Not built yet	To be completed before plant operation
4.10	Standby Generator status	Not installed	To be completed before plant operation
4.11	Fire Training and Drills	Fire training and Drills has been conducted by RTL on dated 28 May, 2020 and 13	The plant must obtain fire license form the Fire Service

SN	Aspects/Issues	Status/ Findings	Comments
		February, 2021. Participant list and pictures have been added in Annex-G.	and Civil Defense Department.
4.12	Consultation with local community	Done during land acquisition verification	-
4.13	Signs/Notices	Safety Signs/Notices were found at site	-
4.14	Tree Plantation	Tree Plantation already started	Must take regular care
4.15	ES Monitoring Report	Not prepared	Should be prepared and shared with WB as required by ESIA document
5.	**Social and Labor Issues**		
5.1	Land Acquisition	Settled Issue	Verified through consultation
5.2	Labor Management	Policy on Labor Management available	-
5.3	Child Labor	Not found on site	Raw material supply contract require no-use of child labor
5.4	HR Management	HR Management Policy Available	-
5.5	Grievance Management	GM is "not formalized yet"	-
6.	**Conclusion**	Shortcomings in respect of drinking water and improper solid waste management and firefighting arrangements were found. RTL management has agreed to mitigate these at the earliest. The ES monitoring reports should be prepared on a regular basis and shared with BB and WB as prescribed in this document.	

5 ANALYSIS OF ALTERNATIVE

5.1 General

Plastic waste has emerged as an issue of major public concern in Bangladesh, as in other countries and all over the world. One of the successful methods for management of the plastic waste is recycling; which is being successfully used in many countries. One of plastic compound which can be economically recycled is PET; which is largely used as bottles for drinking water and beverages. As discussed elsewhere in this report, according to available statistics around 290 Tons of PET bottles wastes are discarded in the country every day; about 36% of which is recycled in the informal sector. RTL has taken up this project for recycling about 6,000 tons of PET bottles per year using environmentally sound industrial process; and it is the largest plastic waste recycling infrastructure in the county so far. The alternatives analysis for the project was conducted early in the project inception to examine feasible alternatives; alternative project locations, designs; or alternative ways of dealing with environmental and social impacts. The alternatives considered are discussed below in some detail.

5.2 Location of the RTL Plant

Due to land scarcity in the country, seeking an alternative site for establishing the plant is quite difficult. Also, land acquisition is a lengthy and complex procedure under the existing Land Acquisition Law of Bangladesh (Acquisition & Requisition of Immovable Property Act 2017). Not only that, the project conceptual development over alternative sites are quite difficult because delay in overall land acquisition process might create social conflicts and risks for the project.

Like any other industrial siting, the RTL site was selected based on economic, technical, social, environmental, and regulatory issues. These criteria have been assessed qualitatively, as RTL is a small plant. The criteria used are given in the **Table 5-1**.

Table 5-1: Criteria used in the selection of RTL sites

SN	Criteria	Justification for the Selected Site
1.	Availability of the land	Bangladesh is a land scarce country and availability of suitable land for industrial siting is a major concern. In the selected site land is still available at reasonable cost.
2.	Regulatory Environment	The selected plant area is a mixed zone with some industries although not officially classified as industrial zone. So, it was expected that regulatory clearance for the industry may be available.
3.	Availability of basic infrastructure	All basic infrastructure i.e., roads, power connection, fuel supply, banking, markets etc. are available in the area.
4.	Water availability	Ample groundwater is available at site.
5.	Wastewater disposal	No wastewater will be generated from the plant operation. All the wastewater will be treated and reused.
6.	Environmental, Ecological and social Impacts	RTL will have low Environmental, Ecological, and social Impact; so that it will be acceptable to the local population.
7.	Availability of labor	The area has a pool of labor which can be employed at RLT. On some highly skill labor and professional must be brought in from outside.

SN	Criteria	Justification for the Selected Site
8.	Availability of raw materials	Main generator of the discarded PET bottle is the capital Dhaka and two local vendors are available to which supply can be outsourced.
9.	Availability of product buyers	The main supply chain for PSF is located in Dhaka, which is about 70 km away.
10.	Competition	Currently there are no local competitor or even in the country.

5.3 Technology Choice

As RTL was conceived as a waste management infrastructure; the product diversity had to be limited. Bottles made of polyethylene terephthalate (PET) can be recycled for the production many products, which could be made from virgin materials. However, as a waste recycling infrastructure, RTL could go for only a few basic products like PET pellets as substitute/additive for virgin materials; or other simple products as sheets, PSF etc.; which add some more value. PSF which can used for making polyester fibers (a base material to produce clothing, pillows, carpets, etc.); and other products as polyester sheets, strappings etc. RTL has chosen to produce best value-added product PSF; as determined by market assessment. PSF is largely imported currently by garment supply chain industries and it will be a competitive import substitute.

RTL has chosen the production technology considering the following factors

- Efficiency
- Quality of product
- Environmentally friendly
- Low RPM motor operated equipment will be used
- Cost Effective
- High durability of Machineries
- Availability of spare parts
- Easy setup, operation & maintenance
- State to art technology

5.4 No Project Scenario

Benefit perceptions

Benefits will be foregone in the absence of the project and plastic pollution will be aggravated.

5.4.1 Project Benefit

The project would contribute to reduce landfill, solid waste management cost and carbon emission compared to usage of imported resins which will be benefited for the environment. RTL will recycle the waste plastic that will reduce of CO_2 emission indirectly. It will increase local employment opportunity that will improve socio-economic standard of living and thus contribute to poverty reduction. As the total industry is now dependent mostly on imported polyester staple fiber, readily available raw materials with less lead time for various industries. Thus, on the other hand, additional employment opportunity will be created for processing, supply and distribution of raw materials and supply of finished items.

5.4.2 Priority Export Sector of Bangladesh Bank

For promoting Export Sector, Bangladesh Bank has decided to give Cash Incentive/Cash Subsidy for 10.00% in exporting Pet Bottle Flakes items (Ref: F.E Circular-08, dt-13.07.15). As Plastic Recycling Sector is an Environment friendly project and selected as the Priority Sector by the Government of Bangladesh, the RTL should have the Cash Incentive/Cash Subsidy for 10.00% in exporting Pet Bottle Flakes items from BB.

6 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT AND MITIGATION MEASURES

6.1 Introduction

This ESIA study has been conducted in accordance to Bangladesh and the World Bank performance standard to meet the Environmental and Social Risk Management (ESRM). Environmental and Social Performance Standards refer to the "World Bank Performance Standards", which are IFC Performance Standards on Environmental and Social Sustainability adopted as the "World Bank Performance Standards" in 2013 pursuant WB Operational Policy 4.03. The World Bank Performance Standards 2013, are an international benchmark for identifying and managing environmental and social risk and has been adopted by many organizations as a key component of their environmental and social risk management. The WB has set eight performance standard which has been followed. The potential impacts that are likely to occur has been assessed following the methodology which has already been described in Section 1.6.

It has been already mentioned that there are few scattered Households in the West, East and South side of the project. Kashor is the only VEC around the project site. There are 4 mosques, 2 schools and 2 Bazars in Kashor. Households around the project site has dense vegetation area. The Households are the only sensitive receptors around the project site. Most of the sensitive receptors are at least 300 meters away from the project site. Therefore, impact due to project activities on the sensitive receptors will be low. Considering the sensitivity of this VEC and on-going project activities this chapter has been updated.

This chapter is re-written based on predicted environmental and social impact of current project construction activities and future operational activities. However, a short summery of impacts in preconstruction and construction activities is given in **Table 6-1** for better understanding.

Table 6-1: Impact occurred during previous activities for the implementation of the project

Activities	Impact	Impact Significance	Explanation
Land Acquisition	Loss of land	No impact	• There is no resettlement issue as the project site has been purchased through willing buy and sell basis.
Site Clearing	Impact on Biodiversity	Low	• Loss of habitats of some faunal species due to site clearing. During land development some trees were cut down
Land Development	Change in Land Use	Low	• The project site was fallow land. There is no loss of crops production. • The project site will be used as an industrial purpose.
	Noise Quality	Low	• During land development machineries and vehicles creates little noise.
	Air Quality	Low	• Transportation and unloading of Land filling materials generated some dust.
	Water Quality	No impact	• No water bodies were contaminated during this stage

Activities	Impact	Impact Significance	Explanation
	Community Health and Safety	Low	• Noise and dust pollution caused some minor problems.
Civil Work	Noise Quality	Low	• Noise generated during civil works creates some noise.
	Air Quality	Low	• Dust generated during construction
	Water Quality	No impact	• No water pollution has been observed
	Community Health and Safety	Low	• Noise and dust pollution caused some minor problems.
	Occupational Health and Safety	No impact	• No accident was recorded so far
	Impact on Biodiversity	Low	• Noise and light disturbed some terrestrial fauna

Source: EQMS Field Survey December 2020

6.2 Identification of Potential Impacts

The potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors.

Impacts are identified and predicted based on the field survey in December 2020 and present project activities. Previous impact presented in **Table 6-1** were not considered further in this chapter. Impact identification matrix for ongoing and upcoming construction and operational activities is presented in **Table 6-2**.

Table 6-2: Impact identification matrix for ongoing construction and upcoming operation of the project

Potential impact / Risks / Activity	Surface Water Quality/Quantity	Ground Water Quality/Quantity	Soil Quality	Air Quality	Climate Change	Noise & Vibration	Drainage Pattern	Traffic System	Occupational Health & safety	Community Health & Safety	Terrestrial Ecology	Aquatic Ecology	Socio-economic
Ongoing Construction Phase													
Machine assembly													
Cutting & Welding work													
Boiler and steam line set up													
Washing plant set up													
ETP installation													
Construction of Bottle/PSF storage													
Construction of internal road													
Construction of approach road													
Construction of factory shed wall													
Electrical and mechanical work													
Upcoming Impacts in Operation Phase													
Operation of plant and auxiliaries													
Maintenance work													
Transportation													
Employment													

6.2.1 Impact during on-going construction phase

As per previous schedule, the project construction was supposed to complete within February 2020. Due to some unavoidable circumstances the construction period is extended up to June 2021. Impact assessment has been conducted based on going construction activities. Recent field visit (December 2020) noticed that most of the civil construction has been completed. Considering the present and future construction activities, the construction phase impact has been presented in the following sub section.

6.2.1.1 Impact on Ambient Air Quality

Source of Impact

The major sources of impacts on air quality during the ongoing construction phase are as follows:

- Operation of diesel generators
- Dust generated from stockpiles of materials, waste, loose earth, handling and moving excavated material and transporting wastes.
- Loading and unloading construction materials;
- Handling and mixing of cement
- Ongoing Civil Construction work

Impact Assessment

The assessment of air quality impact has considered Schedule-11 ECR, 1997 of the GoB and the World Bank/IFC General EHS Guidelines. Maximum construction activities have the potentiality to generate dust. The expansion of impacts from dust will depend on the location of construction activities. Weather also an important factor for dust generation. Stronger winds and dry condition will increase the transfer of dust, where damp or wet conditions will reduce the impact. There are very few households close to the project site. Around the project site there are many trees. Recent air quality assessed during ongoing construction of the project reveals that air quality around the project site is well below the permissible limit set by ECR 1997. The magnitude of the impact associated with the emission of dust during construction activities based on above factors is predicted to be low and the significance of the impacts is assessed to be low. The impact assessment matrix is shown in **Table 6-3**.

Table 6-3: Assessment of impact on ambient air quality

Impact	*Impact on ambient air quality*				
Impact Nature	Direct	Indirect		Induced	
Impact Scale	up to 500 meters from project site				
Frequency	Limited to construction Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium		High	
Magnitude	Low	Medium		High	
Probability of Impact	Low		Medium	High	

Impact Significance	Low	Medium	High
	Significance of impact is considered as Low		

Mitigation Measure

- Implementation of a regular watering and sprinkling dust suppression regime, during the dry season;
- Restricting heights from which materials are dropped as far as practicable, to minimize the fugitive dust arising from unloading/loading;
- Stockpiles will be maintained at site only, which is a fenced area. No stockpiles will be maintained outside, and maximum Possible distance between the stockpiles and receptors will be maintained;
- Use effective dust suppression techniques, such as on-site watering and street cleaning;
- All diesel-powered equipment will be regularly maintained and idling time reduced to minimize emissions;
- Dusty activities should be re-scheduled where possible if high-wind conditions are encountered;
- Waste from construction will not be burned.

6.2.1.2 Impact on Water Resources

During the recent field survey, it is observed that most of the civil construction of the project has been completed. At this moment water requirement for the construction activities is very small and no water is discharged in to outside water body. Very small amount of water is drained in to the pond situated north-east corner of the project site. However, the discharge water is not polluted. As a result, there is negligible impact on water quality due to ongoing construction activities of the project.

In the construction phase, the water requirement has been estimated as 20-30 m^3 per day. Requirement of ground water is so small that it cannot have any impact on ground water availability.

6.2.1.3 Impact on Ambient Noise Quality

Source of Impact

The potential sources of noise during ongoing construction phase are given below

- Noise generated from various activities such as welding, hammering, cutting, motor testing etc.
- Noise generated during civil construction work.
- Loading and unloading of material from truck.

Impact Significance

The noise impact assessment was conducted with reference to Bangladesh Environmental Conservation Rules, 1997 and the IFC EHS Guidelines. There are few households in south and East side of the project. The households are surrounded by dense green belt. The project site boundary wall is 3 meter high. Noise generated during construction work will be impeded in the boundary wall and surrounding trees. Recent field noise monitoring confirms that noise level near these households is not exceeding the residential zone noise guidelines value set by DoE and IFC. Based on these observation impact on ambient noise level due to ongoing construction activities is assessed as Low. The impact assessment matrix is shown in **Table 6-4**.

Table 6-4: Assessment of impact on ambient noise quality

Impact	*Impact on ambient noise quality*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	up to 200 meters from project site				
Frequency	Limited to construction Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium	High		
Magnitude	Low	Medium	High		
Probability of Impact	Low	Medium	High		
Impact Significance	Low	Medium	High		
	Significance of impact is considered as Low				

Mitigation Measure

To minimize impact on ambient noise level due to construction activities following mitigation measures should be implemented.

- Normal working hours of the contractor will be between 06:00 and 21:00 hours. If work needs to be undertaken outside these hours, it should be limited to activities that do not exceed the noise criteria at nearby noise sensitive receptors;
- Only well-maintained equipment will be operated on-site;
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn out components should be conducted;
- Machinery and construction plant that may be in intermittent use (e.g. trucks) shall be shut down or throttled down during non-work periods;
- Low noise equipment shall be used as far as practicable;
- The number of equipment operating simultaneously shall be reduced as far as practicable;
- The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of OSHA 2007);
- The contractor should undertake additional post development noise monitoring in accordance with National and International noise standards.
- Developer shall instruct their Safety Officers to arrange for inherently quiet construction equipment and machines to maintain the noise level to minimum;
- Only limited construction activities shall be carried out during night-time;
- Rubber padding/noise isolators will be used for construction equipment.
- Temporary noise barriers shall be provided surrounding the high noise generating construction equipment;
- The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels;
- Construction vehicles and machinery will be well maintained and not kept idling when not in use;

6.2.1.4 Impact on Soil Quality

The RTL project site has already constructed within the land acquired by RTL, which is already developed and confined by a brick wall. The site has been filled up and developed by sand to raise the site above flood level. There is agricultural land in the north, east and west side of the project site. Liquid and solid wastes generated from ongoing construction activities are being handled well by RTL and there is no possibility of contamination of nearby agricultural lands. Septic tank with soak pit has already there, so only relatively clean small overflow may be stored in the RTL reservoir.

6.2.1.5 Impact on Ecosystem

Source of Impact

As most of the construction activities has been already finished as a result sources of impacts on the ecosystem are decreased. The potential sources of impact on Ecosystem during the on-going construction activities are as follows:

- Construction activities at the site;
- Noise and vibration;
- Fugitive emission and deposition on vegetation;
- Transportation of man and material by road;
- Illumination.

Impact Significance

As no water body is contaminated by the project activities and there is no impact on Aquatic flora and Fauna during ongoing construction activities. However, due to noise and lighting in the project site may disturb some fauna near the project site. The impact significant due to ongoing construction activities on ecosystem has been assessed as Low. Impact assessment matrix for Ecosystem is presented in **Table 6-5**.

Table 6-5: Assessment of impact on Ecosystem

Impact	*Impact on Ecosystem*				
Impact Nature	Direct	Indirect		Induced	
Impact Scale	Around the from project site				
Frequency	Limited to construction Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium		High	
Magnitude	Low	Medium		High	
Probability of Impact	Low		Medium	High	
Impact Significance	Low	Medium		High	
	Significance of impact is considered as Low				

Mitigation Measure

- The noise generating activities should be scheduled during the daytime only;
- Construction activities should be planned and undertaken in a phased manner;
- Project related activities should be avoided during the night time;
- Strict prohibition will be implemented on trapping, hunting or injuring wildlife;
- Plantation of local species for stabilization of the filled in material and plantation in surrounding areas;
- Project Site illumination should be in a manner to limit impacts on terrestrial habitats.

6.2.1.6 Impact on Occupational Health and Safety

Source of Impact

Potential sources of impacts on the health and safety of ongoing construction workers are presented below:

- Noise from construction activities;
- Impure drinking water;
- Unhygienic sanitation system;
- Accidental injury

Impact Significance

The effect of high noise levels on the operating person has to be considered as this may cause permanent hear loss. It is known that continuous exposures to high noise levels above 85 dB(A) affects the hearing acuity of the workers/operators and hence, should be avoided. Pure drinking water along with proper sanitation system is essential to keep worker in good health. It is observed that proponents ensure these facilities for the workers. Accidental injury may happen during construction work. However, no injury or health problem has been reported since the construction begins. The workers are living outside the project site. There is no labor camp in the project site. Considering the above factors significant of impact on occupational health and safety due to on-going construction activities is calculated as Low. The impact assessment matrix is shown in **Table 6-6**.

Table 6-6: Assessment of impact on Occupational Health and Safety

Impact	*Impact on Occupational Health and Safety*				
Impact Nature	Direct	Indirect			Induced
Impact Scale	project site				
Frequency	Both during construction and operation Phases				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium		High
Potential for irreplaceable loss of resources	Low		Medium		High
Magnitude	Low		Medium		High
Probability of Impact	Low		Medium		High
Impact Significance	Low		Medium		High
	Significance of impact is considered as Low				

Mitigation Measures

The following mitigation measures should be taken to minimize impact on occupational health and safety.

- The Contractor will prepare and implement a Health and Safety Plan prior to commencing work.
- Measures will be implemented to reduce the likelihood and consequence of the hazards resulting from falling from height, falling into water, entanglement with machinery, tripping over permanent obstacles or temporary obstructions, slipping on greasy walkways, hit by falling objects, asphyxiation, explosion, contact with dangerous substances, electric shock, mistakes in operation, variable weather conditions, lifting excessive weights
- A Permit to Enter system will be established to ensure that only authorized persons gain entry to the site;
- All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor;
- All workers will be properly informed, consulted and trained on health and safety issues;
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips;
- Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the makers;
- All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded;
- Safety hoops or cages will be provided for ladders with a height in excess of two meters;
- Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate an Leq of more than 90 dB(A).
- The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress.

6.2.1.7 Impact on Community Health and Safety

Source of Impact

During the ongoing construction phase of the project the main sources of impacts on community health and safety are:

- Changes the environment quality at construction site;
- Construction site activity
- Construction Noise;
- Transportation of man and material by road;

Impact Significance

There is one VEC around the project site, which is about 300m away. Ongoing construction activities may pose impact on the community health and safety. There are few households with greeneries around the project site. Ongoing construction activities is mainly machine installation which generates some noise. Some civil construction works is remaining. The civil construction work may create dust and pollute the surrounding area. However, the pollution level will be low as the project site has 3-meter-high wall and the sensitive nearby households has dense vegetation.

Recent air quality monitoring during ongoing construction period, it is observed that air quality in the VEC is within standard value set by DoE. There is no discharge of waste water outside the project boundary during ongoing construction phase. Some vehicles are carrying construction equipment and materials to the project site. Small number of vehicles will pose low accident risk in the community. There are about 40 workers are engaged in the construction work. These workers will not stay in the project site. As a result, community disturbance will be minimal. Considering the above face impact on community health and safety during ongoing construction period is assessed as low. The impact assessment matrix is shown in **Table 6-7**.

Table 6-7: Assessment of impact on Community Health and Safety

Impact	*Impact on Community health and Safety*				
Impact Nature	Direct	Indirect			Induced
Impact Scale	Around the project site				
Frequency	Limited to construction Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium			High
Magnitude	Low	Medium			High
Probability of Impact	Low		Medium	High	
Impact Significance	Low	Medium			High
	Significance of impact is considered as Low				

Mitigation Measures

- Water sprinkler system should be installed for dust suppuration;
- High noise generating construction should be suspended during night hours;
- Slow vehicle movement in the approach road to avoid accident
- Workers movement should be restricted beyond the project site protect community privacy and security.

6.2.1.8 Socio-economic Impact

A. Impact on Employment

An extensive number of un-skilled and semi-skilled contractual labour will work during the construction phase in the project. Also, many females (30%) workers will get opportunity to work in the construction phase. Most of the labors will be hired from local community and neighboring district based on availability. The construction phase activities will facilitate intermixing of local workforce (mostly unskilled) with the migrant workforce (mostly skilled).

So, there is a knowledge sharing among the workers. The workers will be more skilled and get more wages in future. There is a net positive impact in the society due to employment opportunity in the construction phase of the RTL plant.

B. Impact on Local Business

Local enterprises, particularly those involved in the production and sale of construction materials, material suppliers are potential benefactors of the civil works involved in the project. Local market, businessmen and shop owners will also be benefited from the construction activity as a considerable number of man power will engage this project

6.2.1.9 Impact due to Construction of Approach Road

A 3-meter-wide approach road of the project site is not fully developed yet. Few portions of the road are brick soling and the rest of the road is muddy. During the rainy season, due to improper drainage system around the project area, sometimes water gets logged on the road.

During recent field visit it has been observed that about 8-10 households use this approach road to reach their home. Present status of the approach road is shown in **Figure 6-1**.

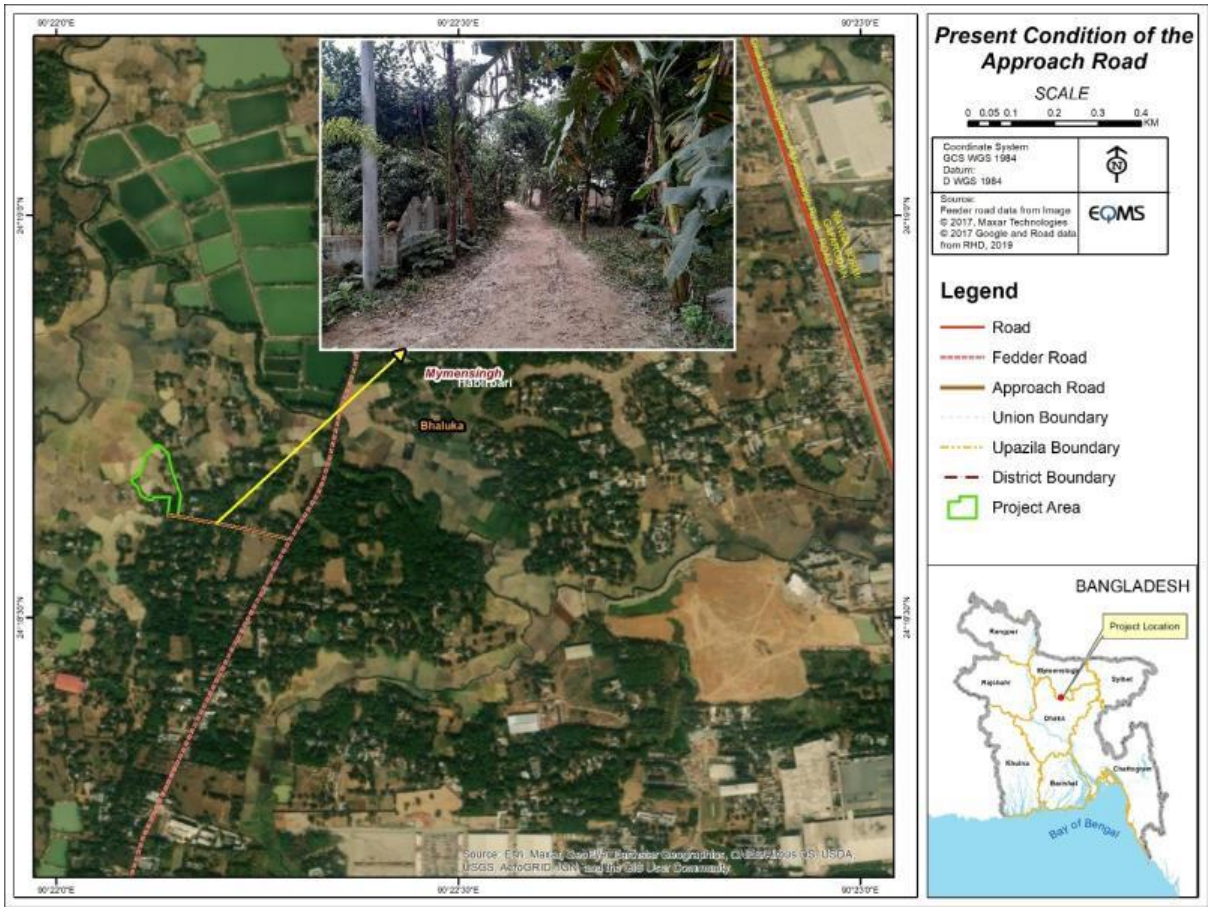


Figure 6-1: Approach Road and surrounding features

This narrow road needs to be widened and re-constructed to allow vehicles entrance in the plant site during construction and operation phase. During re-construction of the approach road small disturbance will be realized by the user of road due to temporary obstacles. Some trees might need to be cut to widen the approach road. Temporary drainage problem may be occurred due to road construction activities. Considering all activities during construction of approach road will contribute low environmental and social impact for short period. The impact assessment matrix is shown in **Table 6-7**.

Table 6-8: Assessment of impact on construction of approach road

Impact	*Impact due to construction of approach road*				
Impact Nature	Direct	Indirect		Induced	
Impact Scale	up to 500 meters from project site				
Frequency	Limited to construction Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium		High	
Magnitude	Low	Medium		High	
Probability of Impact	Low		Medium	High	
Impact Significance	Low	Medium		High	
	Significance of impact is considered as Low				

Mitigation Measures

The following steps should be taken to minimize impact on environment due to the construction of approach road.

- Sufficient tree plantation to replenish loss of trees besides the road
- Restricting heights from which materials are dropped as far as practicable, to minimize the fugitive dust arising from unloading/loading;
- Effective water sprays should be used to control potential dust emission sources;
- Cover haul vehicles carrying dusty materials moving outside the construction site;
- Limit the idling time of vehicles not more than 2 minutes;
- Set up proper drainage system underneath the approach road

6.2.2 Impact during operation phase

As per previous schedule the project was supposed to complete within February 2020. Due to some unavoidable circumstances the project period is extended up to June 2021. Impact assessment has been done based on upcoming operational activities of the project. Considering the upcoming operational activities, we are presenting the operation phase impact in the following sub section.

6.2.2.1 Impact on Ambient Air Quality

Source of Impact

The major sources of impacts on air quality during the operation of the recycling plant are as follows:

- Operation of gas fired boiler
- Dust from handling of the pet bottles and handling of produced fiber;
- Operation of emergency Diesel Generator Set
- Transportation of PET bottles and PSF from the project site;

Impact Significance

The project will not cause significant level of air pollution during operation period. During manufacturing process steam is required in various unit of the plant. This steam will be generated through natural gas-based boiler with capacity 1.5 Ton/hour. RTL shall arrange the necessary gas supply from Titas Gas Transmission and Distribution Company Ltd. The gas will be sweet with less sulfur content. As result negligible amount of SO_2 will be generated during boiler operation. A dust collector will be installed in the boiler to collect dust particle during the combustion process of the boiler. However, during combustion process small amount of NO_x will be released in the atmosphere from the boiler stack. Diesel operated generator will only be use during grid power failure. So, annual contribution for the operation of the generator is negligible. Small number of vehicles will be involved to carry PET bottles in and PSF out of the plant resulting insignificant contribution to air pollution.

Considering all operational activities relevant of air pollution with conservative approach, the impact of ambient air quality from the operation of the plant is estimated as Low. The impact assessment matrix is shown in **Table 6-9**.

Table 6-9: Assessment of impact on ambient air quality during operation period

Impact	*Impact on ambient air quality*				
Impact Nature	Direct	Indirect	Induced		
Impact Scale	up to 500 meters from project site				
Frequency	Entire Operation Period				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low	Medium	High		
Magnitude	Low	Medium	High		
Probability of Impact	Low		Medium	High	
Impact Significance	Low	Medium	High		
	Significance of impact is considered as Low				

Mitigation Measures

The following mitigation measures should be taken to prevent degradation of air quality in and around the project site

- Ensure excess air to complete combustion of gases in boiler
- Stack height should be sufficient of disperse air pollutant over the nearby community
- Regular road cleaning
- Transportation vehicles should have fitness certificate
- Greenbelt development
- Regular monitoring of air quality in and around the project site to ensure effectiveness of mitigation measures.

6.2.2.2 Impact on Water Resources

The plant will implement a Zero Discharge Plan by implementing 3R policy. All the waste water will be recycled, recovered, and reused. So, there will be no impact in water quality in and around the project site. The recovered water will be reused in the following sections;

1. Effluent Treatment Plant (ETP)
2. Washing Plant
3. Cooling Tower
4. Vehicle wash
5. Gardening

It should be mentioned that in the operation phase, the water requirement will be around 5 m^3/hr. Requirement of ground water is so small that it cannot have any impact on ground water availability.

6.2.2.3 Impact on Ambient Noise Quality

Source of Impact

Major sources of noise during operation of the recycling plant will be are:

- Various machineries operating with motor
- Boiler, air compressor, pumps
- Cooling tower
- Generator

Table 6-10: Major Noise Generating Sources during Operation Phase

Noise Sources	Effective Noise Level in d(B)A	Distance from the source, at which Noise levels are calculated
Pumps- Material flow	60	20 m
Pump- Groundwater lifting	60	20 m
Boiler, air compressor	60	20 m
Plant Machinery operation	95	1m
Generator	110	1m

Noise Level Guidelines

Ministry of Environment, Bangladesh has set standard for noise level for different area of use. Noise standard as per Bangladesh Noise Pollution (Control) Rules 2006 is presented in the following table.

Table 6-11: Noise standard for Bangladesh

Sl no	Category of area/zone	Decibel dB(A) Leq	
		[1]Day Time	Night Time
1	Silent zone	50	40
2	Residential Area	55	45
3	Mixed zone	60	50
4	Commercial Area	70	60
5	Industrial Area	75	70

[1]Daytime is defined as the period 6.00am-9.00 pm and night-time is defined as the period 9.00pm-6.00am.

International Finance Corporation (IFC) has also set EHS guidelines for ambient noise level. EHS noise guidelines of IFC are given **Table 6-12** below.

Table 6-12: IFC noise level guidelines

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Prediction of Impacts

Methodology:

The environmental noise prediction model Sound PLAN 8.2 was used for modeling noise emissions from the plant operation. The major noise sources are machineries in the production and processing unit, Compressors, Boiler exhaust, pumps etc. Noise level inside the processing unit will varied from 70-90 dB(A). The production unit is confined by wall. Very little noise will escape from the production unit. Machineries in the production floor are acoustically designed to keep low noisy working environment as well surrounding areas. According to the RTL authority maximum noise in the production unit will be 90 dB(A) in some machineries from 1-meter distance. Most of the operating motor in the production house will run at low RPM resulting lower noise. There is a 3-meter boundary wall around the project site which impede noise to reach in the surrounding area. However, noise from 2nd and 3rd floor will be propagate up to the surrounding receptor. It is assumed that noise escape from the production unit will be 70 dB (A). It is also assumed that cooling fan speed is decreased by 20% during nighttime and noise generation from fan will be decreased by 5 dB (A). Operation of equipment with 100% usage scenario was modeled to cover the operation phase of the Project. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. In addition, to represent a worst-case scenario for the assessment, all equipment was assumed to be operating simultaneously. In order to assess the impact on noise reflection/ barrier due to the structures, buildings within the plant have been taken into consideration. The model has been run to predict day and night time noise level around the plant during operation of the plant.

Noise contour map

Based on the noise propagation from the plant noise contour map has been prepared using the modeling tool. Day and night time noise contour map for the plant is shown in **Table 6-2** and **Figure 6-3** respectively. Predicted noise level in the receptors point during operation of the plant is shown in **Table 6-13**.

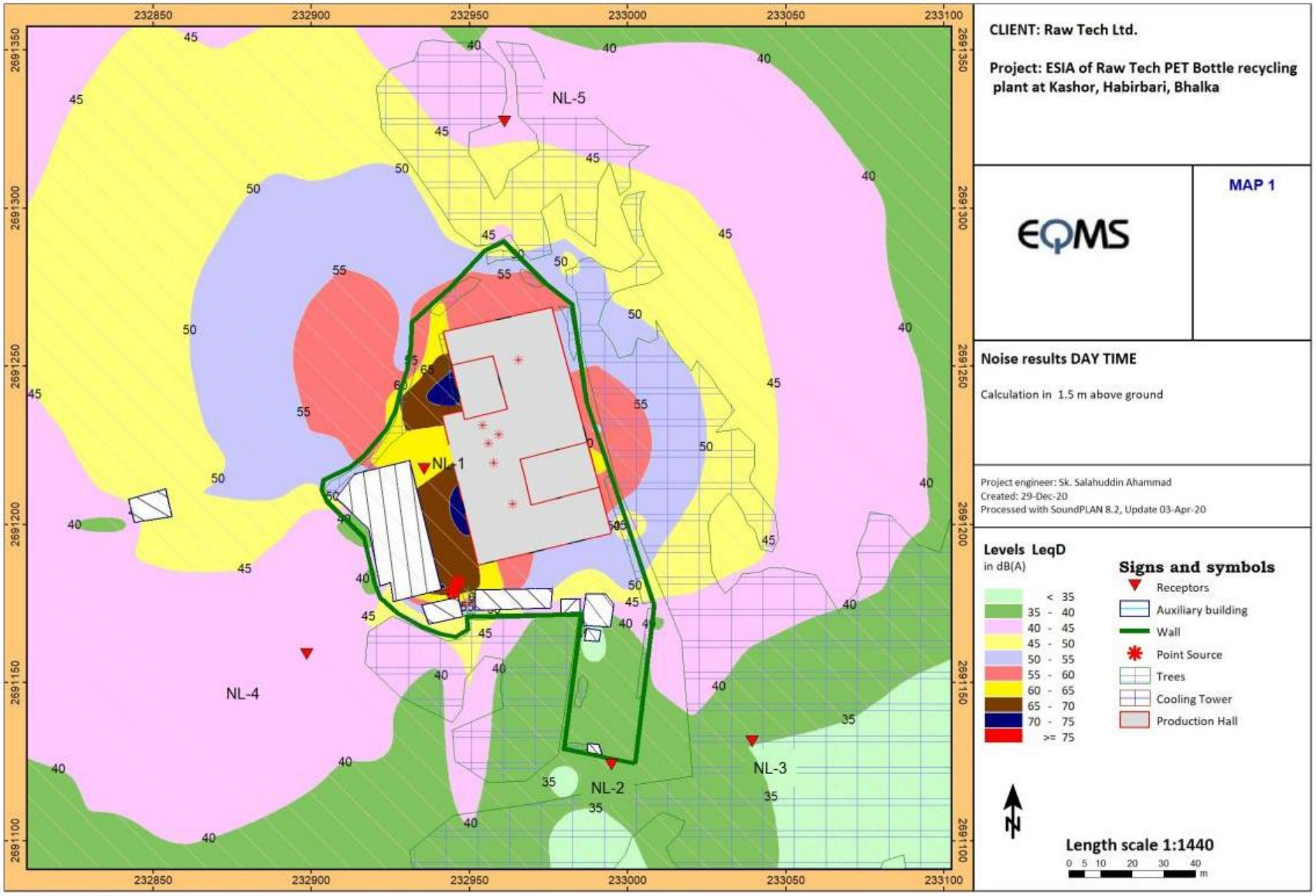


Figure 6-2: Noise contour map for RTL PET Recycling plant operation during day time (Leq day)

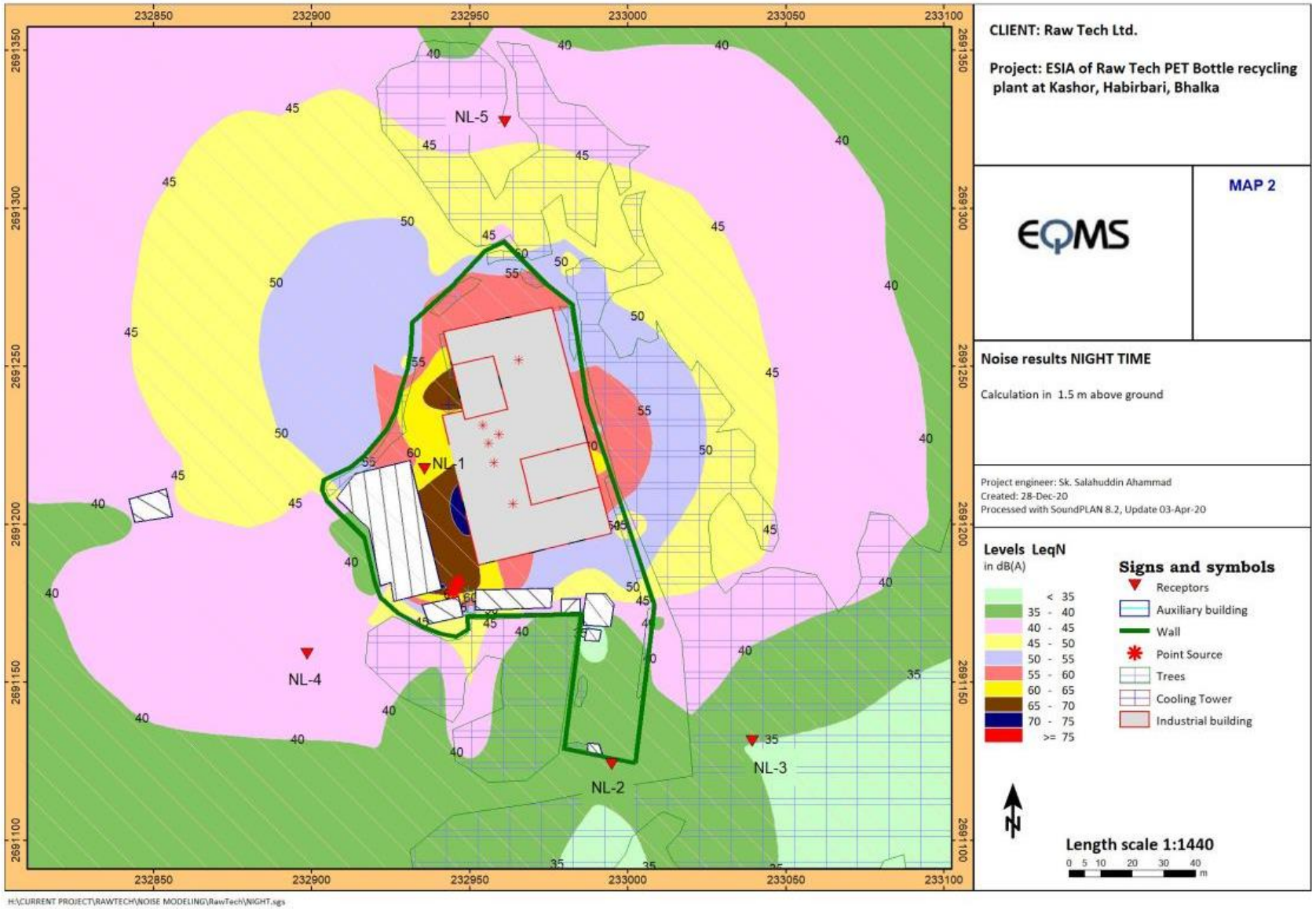


Figure 6-3: Noise contour map for RTL PET Recycling plant operation during night time (Leq day)

Table 6-13: Predicted Noise Levels at Receptors during operation of RTL plant operation

Receptor	Category of Area/Receptor	Distance from plant center point	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[1]		Predicted Sound Pressure Levels at Receptors, Leq (dBA)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA)		Applicable Standard, dB(A) [2] as per Land use	
			Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn
NL1	Mixed	33	56.5	45.8	63.8	63.3	64.5	63.4	60	50
NL2	Mixed	90	51.6	45.2	31.1	30.9	51.6	45.4		
NL3	Mixed	107	48.8	43.2	37.2	37.2	49.1	44.2		
NL4	Mixed	84	49.5	44.2	44.7	44.2	50.7	47.2		
NL5	Mixed	122	51.4	44.5	44.6	44.5	52.2	47.5		
NL6	Mixed	420	54.5	44.8	25.8	25.7	54.5	44.9		

1) Ambient noise levels as monitored during the baseline survey

2) Environmental Conservation Rules, 1997 (Schedule 4) amended September 7, 2006

3) NL6 is not shown in the noise contour map for better presentation. If we include NL6 in the map, then the contour line will be very close to each other.

4) NL1 has been assessed at project site, this was not counted as potential receptor.

Impact Significance

Predicted noise level during day time at the receptors during operation phase is within limiting value set by DoE**.** It has been considered project site (NL1) noise level will be increased significantly. The noise level at project site (NL1) has been crossed the standard limit set by DoE. However, it will not exceed industrial noise standard set by DoE and IFC. Noise barriers should be use to protect the receptor from the impact of noise from the plant. The production unit is confined by wall. Very little noise will escape from the production unit. Machineries in the production floor are acoustically designed to keep low noisy working environment as well surrounding areas. According to the RTL authority maximum noise in the production unit will be 90 dB(A) in some machineries from 1-meter distance. Most of the operating motor in the production house will run at low RPM resulting lower noise. There is a 3-meter boundary wall around the project site which impede noise to reach in the surrounding area. However, noise from 2nd and 3rd floor will be propagated up to the surrounding receptors. As production house is almost sealed in all side very little noise will be felt in the nearby households. Noise from generators, compressors and pumps will be controlled using noise reduction barrier around the equipment. Considering conservative approach impact on ambient noise is ranked as low. The impact assessment matrix is shown in **Table 6-14**.

Table 6-14: Assessment of impact on Ambient noise during operation period

Impact	*Impact on ambient noise*		
Impact Nature	Direct	Indirect	Induced
Impact Scale	up to 200 meters from project site		
Frequency	Entire Operation Phase		

Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low	Medium	High		
Potential for irreplaceable loss of resources	Low	Medium	High		
Magnitude	Low	Medium	High		
Probability of Impact	Low	Medium	High		
Impact Significance	Low	Medium	High		
	Significance of impact is considered as Low				

Mitigation Measures

To keep noise level as low as possible at plant site the following additional mitigation measures should be taken by RTL.

- Install noise attenuation provisions such as silencers and acoustic insulation around noisy equipment
- Regular maintenance of machinery
- Setup/Replace noisy equipment with less noisy equipment (<85 dB)
- Regular noise monitoring in the production hall in various floor two identity high noisy area
- Installation of acoustic enclosures for equipment (e.g., compressor, pumps, generators etc) casing radiating noise
- Green belt development around the project inside boundary to prevent noise propagation route.
- Installation of vibration isolation for mechanical equipment;
- Avoid the unnecessary use of alarms, horns, and sirens
- Periodic ambient noise monitoring is suggested as part of the EMP to monitor the noise levels.
- Provide Personal Protective Equipment (PPE) like ear plug, muffler, etc. to the labors and employees who are working at proximity to noise generating machineries.

6.2.2.4 Impact on Soil Quality

As no waste in the form of solid or liquid will be discharged directly to the surrounding of the project area therefore, there will be no impact on nearby soil/agricultural land due to operation of the plant. The project will operate in following 3R policy. All the waste water will be recycled, recovered, and reused. As a result, from ETP water recovery system around 20-30 kg sludge will be generated daily. This sludge is harmless which contains only silt and clay. RTL should have appropriate solid waste management plan to ensure safe disposal of these wastes through DoE approved agents.

6.2.2.5 Impact on Ecosystem

The potential sources of impact on Ecosystem during the operation phase of the plant are as follows:

- Noise and vibration;
- Transportation of PET Bottle and PFS.
- Illumination.

Impact Significance

Noise and light from the recycling plant may disturb surrounding terrestrial fauna. However, well designed green belt will help to keep the terrestrial fauna undisturbed. There will be no impact on aquatic ecosystem during operation phase as the plant will not discharge waste water outside the project site. Considering conservative approach impact on ecosystem during operation phase can be assessed as low. The impact assessment matrix is shown in **Table 6-15**.

Table 6-15: Assessment of impact on ecosystem during operation period

Impact	*Impact on ecosystem during operation period*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	up to 500 meters from project site				
Frequency	Entire Operation Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium		High
Potential for irreplaceable loss of resources	Low		Medium		High
Magnitude	Low		Medium		High
Probability of Impact	Low		Medium		High
Impact Significance	Low		Medium		High
	Significance of impact is considered as Low				

Mitigation Measures

The following mitigation measures need to be implemented to keep the surrounding ecosystem balanced:

- Green belt development around the project site
- Proper maintenance of machineries to minimize noise generation from those machineries.
- Project Site illumination should be in a manner to limit impacts on terrestrial habitats.
- Proper security arrangement so that no terrestrial animal entered in the project site during operation period
- If any animal trapped in the project site it should be rescued and restored in a save place.

6.2.2.6 Impact on Occupational Health and Safety

Source of Impact

During operation phase employees could be impacted in the following way:

- High level noise from machineries may damage hearing system
- Rotating equipment could cause injury if workers not follow cautionary advice

- During hot maintenance work fire could be broken out.
- Physical injury during maintenance work
- Boiler explosion
- Fire in gas line
- Fire hazard from PET bottle and PSF
- Hot steam pipe cracking
- Accident due to human error/negligence

Impact Significance

About 20 employees will be engaged in operation period of the re-cycling plant. All the employee will use proper PPE according to safety requirement. Failure in some risky unit could cause fire and release of hot element. PET and PSF being flammable material 'Fire Hazard' is an important issue. As a consequence of fire death or permanent injury of the employees may happen. However, accident in risky production unit could be reduced with proper maintenance of the production units. The PET/PSF storage areas should be gated out to prevent unauthorized access, fire signs should be posted at appropriate places, fire hoses and sprinklers should be installed as required. Employees will be trained properly to operate the plant smoothly and on fire prevention and control. The management must get fire license for the plant from the Fore Service and Civil Defense Department. The significance on occupational health and safety during operation phase is assessed as medium. The impact assessment matrix is shown in **Table 6-16**.

Table 6-16: Assessment of impact on occupational health and safety during operation period

Impact	*Impact on occupational health and safety*				
Impact Nature	Direct		Indirect	Induced	
Impact Scale	Project site				
Frequency	Entire Operation Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium	High	
Potential for irreplaceable loss of resources	Low		Medium	High	
Magnitude	Low		Medium	High	
Probability of Impact	Low		Medium	High	
Impact Significance	Low		Medium	High	
	Significance of impact is considered as Medium.				

Mitigation Measures

In order to minimize the risk of industrial accidents and fatalities to workers during operations, the following mitigation measures are proposed:

- On job training for the workers shall be carried out;
- Work permit system shall be followed;

- PPE shall be provided and use of PPEs shall be enforced;
- SOPs need to be developed for operation and maintenance of the Plant;
- Strictly follow the Bangladesh Labor Law 2006 and WB OP 4.03 performance Standards;
- Strictly follow the Hazardous Materials Management from WB General EHS Guidelines, 2007.
- Strictly follow the Occupation Health and Safety from WB General EHS Guidelines, 2007.
- The boiler operator must have a legal license to operate the boiler;
- Entrance to the boiler room except permission and selected personals shall be strictly prohibited;
- Preparation of emergency response plant and rescue plan
- Development of inhouse firefighting system
- Obtain fire license from the Fire Service and Civil Defense Department
- Fire extinguishers and fire precaution signage should be placed in appropriate location
- Ensure appropriate first aid to the injured employee
- Ensure quick medical shifting in case of serious injury
- Cautionary signboard should be kept in front of employees on potential OHS dangers awareness build up
- Engaged at least 1 HSE officer to ensure safe work environment in the premises.
- Emergency response team should be trained regularly
- A health checkup facility shall be introduced for the workers.

OHS Hazards

Over-exertion:

- Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries.

Slips and Falls:

- Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are among the most frequent cause of accidents.

Work in Heights:

- Falls from elevation associated with working with ladders, and scaffolding are among the most common cause of fatal or permanent disabling injury at construction site.

Struck by Objects:

- Significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

Moving Machinery:

- Vehicle traffic and use of lifting equipment in the movement of machinery and materials in the factory site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

- Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle.

Trespassing:

- Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and excavations and structures which may pose falling and entrapment hazards.

Other Site Hazards:

- Wastes may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms. Hot jobs or electrical fittings can lead to fire hazards also.

Fire and Explosion:

- PET and PSF are in melt state during production for some periods and such melts are highly inflammable. Leakage of liquid PET are dangerous in that they may cause explosion at spaces other than where they are generated. Workers working on repair works such as wielding, cutting, and other hot jobs are prone to risk of fire and explosion.

Mitigation Measures

RTL shall ensure adequate health and safety measures which shall include:

Over-exertion:

- Training of workers engaged in lifting and materials handling techniques in construction projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary

Slips and Falls:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials / debris in established areas away from foot paths.
- Cleaning up excessive waste debris and liquid spills regularly and locating electrical cords and ropes in common areas and marked corridors

Work in Heights:

- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 100 kg, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface
- Training and use of personal fall arrest systems, such as full-body harnesses and energy absorbing lanyards able to support 2500 kg as well as fall rescue procedures to deal with workers whose fall has been successfully arrested.

Struck by Objects:

- Clear traffic ways shall be provided to avoid driving of heavy equipment over loose scrap which may result in scattering of objects.

- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes shall be made mandatory.

Moving Machinery:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic using one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle
- Ensuring moving equipment is outfitted with audible back-up alarms. Use inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Trespassing:

- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high-risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community

Other Hazards

- Workers should be trained to self-recognize these hazards and take measures such as use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves, and eye protection.

6.2.2.7 Impact on Community Health and Safety

Source of Impact

The major sources of impacts on community health, safety, and security during the operation of the recycling plant are as follows:

- Noise generated from the boiler and other equipment in the production house;
- Transportation of PET bottles and PSF from the project site; and
- Smoke and heat from fires.

Significance of Impact

Noise generated from the production house of RTL and operation of boiler and pumps can disturb nearby community. Movement of vehicles carrying PET bottles and PSF can also create disturbance in the nearby community. Major fire/explosion incidence in the plant could pose risk on nearby community. As there are small number of people live near the project site the impact on the community due to operation of the plant can be signified as low. The impact assessment matrix is shown in **Table 6-17**.

Table 6-17: Assessment of impact on Community Health and Safety during operation period

Impact	*Impact on community health and safety*				
Impact Nature	Direct		Indirect		Induced
Impact Scale	Nearby community				
Frequency	Entire Operation Phase				
Extent and location	Project Site	Local	Regional	National	Trans boundary
Impact Duration	Short Term	Medium Term	Long-term	Permanent – Mitigated	Permanent – no mitigation
Impact Intensity/ severity	Low		Medium		High
Potential for irreplaceable loss of resources	Low		Medium		High
Magnitude	Low		Medium		High
Probability of Impact	Low		Medium		High
Impact Significance	Low		Medium		High
	Significance of impact is considered as Low				

Mitigation Measures

The following mitigation measures should be implemented to minimize social disturbance from RTL operation:

- Prepare a site-specific community health and safety management plan for the construction phase
- Disclose potential disasters and potential risks from the plant to the local community as well as the plan of action on emergency protocol in the event of these accidents.
- Disclose and generate awareness on the DMP as well the measures and protocols prescribed by the same;
- Train employees and plant personnel on health and safety as well as handling and managing disasters and emergency events;
- Maintain harmonious relation with community and create a feedback system;
- Maintain sound labor and management relation to avoid conflict and disruption in operation.
- Firefighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area) and automated fire extinguishers will be provided at strategic locations with clear labeling of the extinguisher type. A main hydrant will also be available around the buildings. An automated fire detection system will be in place on all floors
- Siren and megaphone should be installed to warn the community, if there is a fire
- During cleaning of the soak pit precaution shall be taken so that the sewage is not discharged into surrounding environment.

6.2.2.8 Socio-economic Impact

A. Impact on Employment

The plant will create job facilities for the local people. It will be a positive impact on the society.

B. Impact on Local Business

There will be bloomed in the local business due to the operation of the plant. Many new shops will be set up around the plant. Local people also supply much necessary maintenance equipment in the plant.

6.2.3 Cumulative Impacts

The summary of impacts' assessment in this chapter shows that the impact of RTL activities is expected to be medium after mitigation, but whether these may become significant when added to the existing and potential impacts from other activities or undertakings in the area; must be evaluated in the cumulative assessment. In view of the proportionality theme of the PS, and RTL being a low pollution and medium impact project, the following approach has been adopted in cumulative impact assessment. The impacts of construction and the operation stage of the project have been assessed qualitatively, based on qualitative and semi-quantitative assessments in this chapter. The summary along with the pre-construction ambient status/conditions are given in **Table 6-18**. The worst of the ambient conditions; and the highest of the impacts are taken as the overall status/impacts; during construction and operation stages for any of the parameters. The same approached is utilized for overall impact determination also.

The ambient status of environmental, ecological, and social conditions represents the cumulative impact of all the other activities; in surrounding areas on the project site in all the phases. Overall, the cumulative impact is assessed to be the highest rating for a given stage of the project activity both with and without mitigation. The impact is low during construction without mitigation and low with mitigation. However, during the operation stage the cumulative impact is assessed to be low without mitigation and likely to be low with mitigation.

Table 6-18: Qualitative Cumulative Impact Assessment Summary for the construction and operation stage of RTL project

SL	Parameters	Pre-Construction	Construction Stage Impacts		Operation Stage Impacts	
			Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
1.	Air Quality	Low	Low	Low	Low	Low
2.	Water quality	None	None	None	None	None
3.	Ambient Noise quality	Low	Low	Low	Low	Low
4.	Soil Quality	None	None	None	None	None
5.	Ecosystem	Low	Low	Low	Low	Low
6.	Occupational Health and Safety	Low	Low	Low	Medium	Medium

SL	Parameters	Pre-Construction	Construction Stage Impacts		Operation Stage Impacts	
			Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
7.	Community Health and Safety	Low	Low	Low	Low	Low
8.	Socio-Economic	None	Low (Positive)	Low (Positive)	Medium (Positive)	Medium (Positive)
9.	Cumulative*	Low	Low	Low	Low	Low

* The worst of the ambient condition; and highest of construction and operation impacts are taken as the cumulative status/impacts.

In the construction & operational phase, the socio-economic impacts are beneficial to the local community; and assessed to be of low and medium benefit respectfully. However, it can be increased to 'High' beneficial level with the implementation of CSR initiatives by the project proponent.

There is no large project under construction in the neighborhood of the RTL. The details of any planned industry in the area are not known, so it could not be considered in the evaluation of the cumulative impact.

7 STAKEHOLDER CONSULTATION AND DISCLOSURE

7.1 Introduction

Participation is a process, through which stakeholders influence and share control over development initiatives, the decisions, and the resources, which affects them. The effectiveness of environment and social management plan is directly related to the degree of continuing involvement of stakeholders in the project development process. Participation of stakeholders in the projects is also a primary requirement in developing an appropriate ESMP that addresses project's requirement and suited to the needs of the stakeholders. Stakeholder's involvement is also vastly increasing the probability of successful implementation of management plan. In order to make consultation and disclosure process effective and fruitful, comprehensive planning is required to assure that local government, host population and project staff interacts regularly and purposefully, throughout all stages of the project and contribute toward a common goal.

7.2 Approach and Methodology for Consultation

The approach undertaken for information disclosure and consultation involved the following key processes.

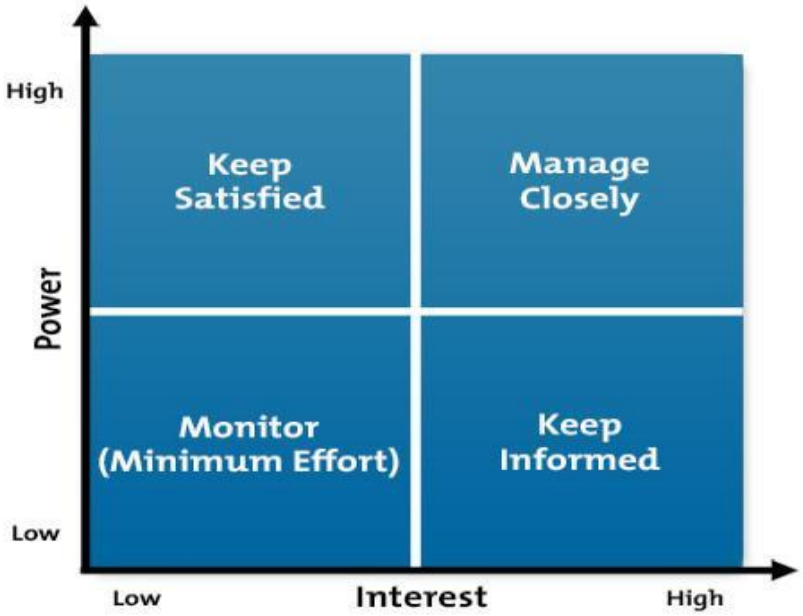
- Mapping and Identification of key stakeholders such as primary (direct project influence) and secondary (indirect project influence) stakeholders;
- Undertaking expert consultations, interviews and focus group discussions (FGD) with the respective stakeholders;
- Undertaking structured on field consultations, interviews and focus group discussions (FGD) with the respective stakeholders;
- Assessing the influence and impact of the project on these stakeholder groups;
- Summarizing of key findings and observations from the consultations; and
- Preparing a future stakeholder engagement strategy consultation plan for a more detailed assessments at a microscopic level considering the various project lifecycle phases and their implications on the stakeholder.

7.3 Stakeholder Assessment

A stakeholder is defined as "a person, group, or organization that has direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies". Stakeholders vary in terms of degree of interest, influence and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- Primary Stakeholders: include people, groups, institutions that either have a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities; and
- Secondary stakeholders: are those that have a bearing on the project and its activities by the virtue of their being closely linked or associated with the primary stakeholders and due to the influence, they have on the primary stakeholder groups.
- Apart from categorization, the stakeholders have also been classified in accordance with the level of influence they have over the project as well as their priority to the project proponent in terms of importance.
- The influence and priority have both been primarily rates as:

- High Influence/Priority (Manage Closely): People who have high power and interest are grouped in this category. They always must be managed closely. This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority for project proponent to engage that stakeholder.
- Medium Influence/Priority (Keep Satisfied/ keep informed): People who have high power but low interest as well as who have high interest but low power should be kept satisfied or informed. This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for project proponent to engage the stakeholder who are neither highly critical nor are insignificant in terms of influence.
- Low Influence/Priority (Monitor with minimum effort): This implies a low degree of influence or interest of the stakeholder on the project in terms of participation and decision making or low priority for project proponent to engage that stakeholder.



Power/Interest Grid for Stakeholder Prioritization

How they are likely to feel about and react to the project, how best to engage them in the project and how best to communicate with them, are measured by getting answers of following questions;

- What financial or emotional interest do they have in the outcome of your work? Is it positive or negative?
- What motivates them most of all?
- What information do they want from the project?
- How do they want to receive information? What is the best way of communicating?
- What is their current opinion? Is it based on good information?
- Who influences their opinions generally?
- If they are not likely to be positive, what will win them around to support the project?
- What should be done to manage stakeholders' opposition?
- Who else might be influenced by stakeholders' opinions?

Stakeholders were talked directly and asked their opinions in building a successful relationship with them.

The stakeholder mapping which is presented in the Annexure L elaborately describes different stakeholders, category of stakeholders, brief profile of the stakeholder, overall influence on the project and the basis of influence rating. However, a table identifying the stakeholders and their category is enlisted in the following **Table 7-1**.

Table 7-1: Stakeholder Mapping for the Project

Stakeholders	Category of stakeholder
Raw Tech Limited	Primary
Project Financiers	Primary
Worker and Labor (local & migrant)	Primary
Primary Suppliers	Primary
Local Community	Primary
Land selling households	Primary
Agricultural Farmers	Primary
Vulnerable Households	Primary
Dept. of Environment, Bangladesh,	Primary
Department of Agriculture	Secondary
Department of Fisheries	Secondary
Department of Public Health Engineering	Secondary
Fire Service and Civil Defense	Primary
Union leaders & local representatives	Secondary
Local NGOs and Community & Social Welfare Groups (CSWG)	Secondary

7.4 Prior Informed Consultations

Number of consultation exercises was conducted during this phase of EIA preparation. The stakeholders consulted include local People, community in the vicinity of project area, local elected representatives, and other external stakeholders such as government officials. The details of consultations held with issues raised or discussed and suggestions provided by the respective stakeholders are presented in **Table 7-2**. Photographs of the stakeholder meeting are shown in Annexure F.

A combination of mixed methods of information disclosure and consultation process was adopted at this stage of ESIA preparation. The method selected for consultation was basically designed keeping in mind 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:

- Individual level consultation/discussion;
- Focus group discussion; and
- Public Consultation

Table 7-2: Details of Consultations Held for the Project

Date	Stakeholder Details	Details of participants	Issues discussed/raised	Outcomes of the Brief
21.10.19	Department of Fisheries	Mr. Tarek Aziz, Upazila Fisheries Officer, Bhaluka Upazilla 01726 679827	▪ Role and responsibility of the local fisheries departments; ▪ Where is the primary fishing point located in and around in Bhaluka and Habirbari union; ▪ Details on the key species of fishes observed in canals in and around of Habirbari Union; ▪ Type of fishing activity; ▪ Available fishing sanctuary; and ▪ Commercial fish drying activity.	▪ The Department of Fisheries (DoF) is under the administrative control of the Ministry of Fisheries and Livestock. It is headed by a Director General, who is assisted by four Directors (one reserve) and 2 Principal Scientific Officer (equivalent to Director). There are administrative set-ups at the division, district and Upazila (sub-district) levels headed by Deputy Director, District Fisheries Officer, and Senior/Upazila Fisheries Officer respectively. ▪ Upazila Fisheries office renders its services to achieve the mission and vision of the DoF. ▪ Fishing is not a major commercial activity within Habirbari Union as there is no substantial surface waterbody in the union. Canals in and around the Habirbari union do not contribute as a major source of fishing activity. *Channa marulius*, *Macrognathus aculeatus*, etc. are the noteworthy fishes found in the natural water bodies in Mymensingh region. ▪ The is no fisheries sanctuary in Habirbari union. ▪ As the project will recycle plastic bottles. ▪ The waste water will be treated and reused; ▪ Solid sludge will be disposed properly; ▪ In addition, the discharge water quality shall be monitored regularly and comply with the national standard. However, it is also important to carryout microbiological monitoring of the discharged water so that it does not affect the fisheries resources.

Date	Stakeholder Details	Details of participants	Issues discussed/raised	Outcomes of the Brief
21.10.19	Department of Agriculture	Md. Anamul Haque, Sub-Assistant Plant Protection Officer, Bhaluka Upazila, 01716712554	▪ Understanding and Broad overview of the agricultural sector in Bhaluka Upazila; ▪ Information on the cropping pattern in the area and agricultural practices; ▪ Agriculture land usage of Habirbari Union; ▪ Crop varieties in the Habirbari Union; ▪ Production cost of major crops; and ▪ Perceived major issue regarding project activities.	▪ Total net agriculture land of the Bhaluka Upazila is 27955 hectors wherein Habirbari Union is 2200 hector represents 7.9% of the whole Upazila. ▪ In the Bhaluka Upazila Single cropped area is 4180 ha, Double-cropped area is 19780 ha, Triple-cropped area is 3755 ha and Fourth-cropped area is 280 ha. On the other hand, in Habirbari Union, Single cropped area is 350 ha, Double-cropped area is 1200 ha and the triple cropped area is 150 ha. ▪ Common agricultural products are Paddy, Grass pea, Tomato, and other vegetables. ▪ Wage rate in agricultural labor varies from season to season 400-500 tk. ▪ Paddy cultivation for 33 decimal land costs approximately 18600 BDT. ▪ There are a Canal goes close to the RTL project site. Farmers use the canal water for irrigation purposes. It has been observed lately that polluted canal water usage for irrigation increases the chance of getting affected by crop bugs and various diseases (Blast, BPH, Leaf Blast, Git Blast & Neck Blast). Therefore, it is recommended not to pollute adjacent canal water.
24.10.19	Department of Public Health Engineering	Haradhan Dey, Assistant Engineer, Bhaluka Upazila, 01711040808	▪ Arsenic and Iron concentration of the project located union and upazila; ▪ Source of water for drink and agriculture; ▪ Testing water quality when installed the tube-well; and	▪ Arsenic and Iron level within the project location is within the standard limit. ▪ Tube-well water is used for drinking and cooking purpose and deep tube-well, pond, and channel are used for agriculture production purposes; ▪ Test for Arsenic and Iron contamination has been considered before tube-well installation.

Date	Stakeholder Details	Details of participants	Issues discussed/raised	Outcomes of the Brief
			▪ Perceived major issue regarding project activities.	▪ Existing depth for shallow tube-well is 200-230 feet and for deep tube-well is 500-620 feet.
24.10.19	Upazila Forest Bit/ Range office	Mr. Shirajul Islam, Forest Guard, Sonagazi Upazila	▪ Any protected area or Sanctuary project surrounding the area; ▪ The project has any impact on the forestry mainly social forestry; and ▪ Future social forestry program of the forest department.	▪ No major influence/impact on project related activities. ▪ The nearest protected area is Kadigrah National Park. The Park is located around 5 km away from the project site; ▪ Albeit Project may not have impacts on forests largely, it is recommended not to hamper trees, wild animals, and birds. ▪ A Plantation program shall be carried out after the completion of construction work and the project company may ask support from forest office in this regard.
24.10.19	Fire Service and Civil Defense	Iqbal Hossain, Station Master, Bhaluka Fire Service & Civil Defense 01730002368	▪ Understanding the overall activities of Bhaluka Fire Service & Civil Defense; and ▪ Safety requirements for establishing factory;	• Bhaluka Upazila is largely industrialized area having about 200 factories. FSCD of Bhaluka is always ready to serve in any time in any emergencies. Nonetheless, project company should implement remedial actions as following; o Get fire license from the respective district; o Layout plan must be designed considering fire risks; o Must have fire safety plan according to the lay out plan and potential risks; o Must have primary firefighting facilities; o Skilled labors or workers having firefighting knowledge.
21.10.19	Habirbari Union Parishad	Mohammed Tofayel Ahammed (Bacchu), Chairman, Habirbari Union Parishad	▪ Awareness regarding the RTL project; ▪ Villages within the 1km Area of influence (AOI);	▪ Habirbari union parishad is aware of this RTL project as Project Company has been communicating with us periodically giving progress of the project activity. ▪ Understanding the value of the project, Habirbari union parishad is always ready to cooperate with this project. Already, No Objection Certificate (NOC) has been issued

Date	Stakeholder Details	Details of participants	Issues discussed/raised	Outcomes of the Brief
			▪ General description of the households & populations within the AOI; and ▪ Any concern regarding the RTL project.	from the union parishad and such kind of cooperation will be continued in future. ▪ After seeing the 1km radius Map, it seems Kashor, Jamirdia, Laban Kota and Barachala (partially) villages fall within 1km radius boundary. ▪ Within the AOI, it is assumed that approximately 800 households are living. Kashor & Jamirdia villagers are closely connected to the RTL area rather than Laban Kota and Barachala as a canal separates these villages from the project area. ▪ Waste water disposal to the adjacent canal may bring threat for the existing fisheries of the canal. Albeit, existing fisheries are already in threat as many industries including textile and knitting factories are disposing untreated waste water. We expect the project company would be concerned regarding this.
22.10.19	Primary Supplier (PET Bottle)	Mr. Suruj Mia, Proprietor, Mosa Enterprise, Habirbari, Bhaluka	• Enterprise's profile • PET demand & supply • Involved labors • Health & safety of labors	▪ The workshop is located at Kashor Chourasta, Habirbari, Bhaluka and verbally agreed to supply clean PET bottles. ▪ Currently, provide supply to a plastic sack making industry. ▪ Based on demand, Mosa enterprise can supply 20 Tons of bottle per day all year around in bales of 250 kg without bottle cap and labelling. ▪ The minimum amount of per day supply is 12 tons clear PET bottles. ▪ The price of per kg bottles will be approximately 27-35 taka. ▪ The bottles are mainly collected from hotels, tourist spots, convention Centre and no child labors are engaged in the bottle collection process. Health and safety of labors

Date	Stakeholder Details	Details of participants	Issues discussed/raised	Outcomes of the Brief
				during bottle collection & process is minimally maintained. ▪ There is no PSF production industry in this upazila where they supply PET bottles.

7.4.1 Public Meetings and Major Findings

The Public discussion meeting was held on 24th October 2019 at project site area in Kashor of Habirbari Union. An advertisement of the public consultation meeting with specific time and location was published in a local newspaper "Daily Swajan'' on 23rd October 2019 (Annexure F). Land selling households, local community and relevant stakeholders participated in this Public Consultation Meeting. The proceedings commenced at 4:00 pm. The meeting was attended by a total of 34 people. The list of participants and attendance sheet has been provided in Annexure F. Public Consultation meeting outcome has been given in **Table 7-3**.

Table 7-3: Brief overview of the Public Consultation Meeting

SL.	Issues	Concern	Replies
1.	Community Health and Safety	• There are 5/6 households residing near to the project site on both east and west side. Whether these households are safe from various hazards/risks.	• Project will design considering all potential risks so that all impacts may remain within the standard limit. Moreover, air, nose and waste control measures will be taken also. • Project Company will develop Hazardous Waste Management Plan or a Hazardous Materials Management Plan and implement it properly. • Moreover, Project Company will address emergencies related to the project. To do so, company will complete the Risk Hazard Assessment (RHA) and develop Emergency Response Plan (if requires).
2.	Adjacent Canal	• On north side, a canal passes near to the project that is many cases being used for irrigation purpose. Waste water disposal may pollute canal water, hence, it may ultimately impact agriculture production.	• RTL will treat waste water and reuse. No water will be discharged in the canal.
3.	Traffic System	• Due to the project activities traffic will be increased and may produce risks to pedestrians and to important aspects of community cohesion, for example, from bisecting communities or pedestrian routes, creating transport nodes, or affecting	• Better/improved traffic system will be proposed to develop including to manage traffic speeds, or provide controls for single-lane two-way traffic to address noise and control dust and drainage issues so that local community including students, elder persons, women etc. can move more conveniently.

SL.	Issues	Concern	Replies
		access to or traffic on a road.	
4.	GRM Procedure	• What if the promises are not kept and if someone wants to complain, where and how can they complain?	• Any person as a part of community can complain at community level GRM. • Any person as a local worker can complain at Worker Level GRM • Any person as a direct affected person form land acquisition can complain at specific GRM developed in accordance to RAP study. • These three types of GRM will be proposed to develop and share with the communities. • To keep the GRM transparent, involvement of local stakeholders will also be proposed and designed as well.
5.	Employment Opportunity	• Will there be any job opportunities for the community people?	• Consultants will propose to create provision for the local labors.

7.4.2 Focused Group Discussion

The affected persons including sharecroppers and local community were consulted through FGD regarding the project goal and objective, potential social and other impacts on them and their suggestions about mitigating measures. The discussions were held with special focus on the type of their losses. The affected people, community were brought together in groups based on homogeneity. Women engagement on economic activities is very limited, and they are mostly engaged in household work. It is the men who usually make decision on land purchase and selling activities. Thus, after a series of invitation for FGDs, no women wanted to participate in the FGD meetings. But they have participated during census and IOL survey. At that time women were informed about the project objectives, impacts and benefits. As per Table below, the consultant sought the opinion of the affected people about potential adverse impacts and their suggested mitigation measures.

Discussion was held with the local people at near the RTL project site. Date, location, and the number of participants of each discussion is listed in **Table 7-4** . Different categories of local people were grouped and discussed with many issues to capture their perceptions. The summary of focus group discussion (FGD) is shown in **Table 7-5**. List of participants and photographs of focus group discussion are shown in Annexure F.

Table 7-4: Details of Focus Group Discussion (FGD)

Sl.	Date	Location of the FGD	Participants	Category of participants
1.	22.10.2018	Kashor	9	Local Community
2.	22.10.2018	Kashor	6	Land Selling Households
3.	23.10.2018	Kashor	6	Farming Community

Table 7-5: Summary of Focus Group Discussion with Local Community

FGD Group	Issues Discussed	Discussion Outputs
Community	• General perception and awareness about the proposed project; • Community dependency on the proposed project site; • Any critical issue or concern by the local people regarding the project? • Does any indigenous, tribal or minority community live in and around the project site who may be affected by the project intervention? • Expected community benefits from the proposed project; • Grievance Mechanism; and • Support of local people for the proposed project.	Most of the participants are aware of the proposed project through the various activities that have taken places by the project company. Project site was privately owned and used by the owners before the land procurement. Hence, community had no connections or dependency on that procured land. In both construction & operation period, traffic flow or volume on the existing road may increase due to carrying construction materials and row materials. People of Kashor & Jamirdia use the road, thus the chance of traffic accident may increase especially on pick time. Therefore, materials carrying should be done on night maintaining minimum speed limit and cautions. This proposed project will produce a large amount of waste periodically. Most of the participants believed that in absence of proper waste management plan and proper implementation, living standards of surrounding community will be hampered. Around community consists people with Muslim and Hindu population. Hindu community contributes almost 3-5% of total population. Besides this, there are no tribal communities around the project site. No such group will be affected by the proposed project. Employment opportunity is expected to increase in the project area. Participants expected that local people might be given priority for employing in the required fields. Accepting the various negative impacts of project activities on community, participants thought that these impacts are manageable and suggested to consider communities opinion regarding different issues in different project stages.
Farming Community	• General perception and awareness about the proposed project; • Agriculture practices around the project site area; • Cropping variety & productivity;	Participants are aware of the proposed project through the various activities that have taken places by the project company. Most of agriculture lands around the project site are single cropped. Cultivation is happened only in Kharif-2 season (Mid-March to Mid-July) and the major crops are Aman and summer vegetables. In addition, few agriculture lands are also used for boro

FGD Group	Issues Discussed	Discussion Outputs
	• Concern issue related to agriculture activities; and • Way to minimize the risk.	cultivation (boro rice and winter vegetables) during Mid-November to Mid-March. Most importantly, agriculture fields remain fallow during Aus season (Mid-March to Mid-July) as most of the field lie under water. Amon production per Bigha (33 decimal) is 10 mon (10x40kg=400kg) valuing BDT 7000-8000 (10x700/800BDT), where production cost per Bigha is approximately BDT 15000-18000. Thus, production for commercial purpose doesn't bear any profit; therefore, most of the farmers cultivate their land for household consumption. Farmers expressed their concern regarding waste water disposing. They suggested not to pollute adjacent canal as canal water is being used for irrigation purposes. Farmers who cultivate on northern side from the proposed project site conveyed their concern regarding the pipeline to be set for disposing waste water. Pipeline will go under their land. They opined that they will support with all the activities but project company must consider the production loss incurred due to the pipeline set up activities. They also suggested that to start the pipeline set up activities during Mid-March to Mid-July when field remains unused so that pipeline set up activities does not impact the cultivation activities.
Land Selling Households	• General perception and awareness about the proposed project; • Land Procurement Procedure • Land value • Dependency on land • Were there any sharecroppers involved?	Since the beginning of the land procurement period, participants are aware of the proposed project. Land procurement procedure was started since 2014. After a series of meeting with the land owners regarding finalizing the exchange value of the procured land, final registration of exchanged land was completed in 2017. Land purchase value was determined for low land BDT 114,000 and for medium low land BDT 200,000. Low land was cultivated once where medium low land was cultivated twice in a year. Land was cultivated for household consumption and no sharecroppers were involved during the land procurement period. Participants confirmed that they did not have direct dependency on that exchanged land. Land owners are involved other occupations

FGD Group	Issues Discussed	Discussion Outputs
		rather than involving solely on farming i.e. working in industries or services. Yields of the land were used for household consumptions only. They also confirmed that they have additional land also for continuing cultivation for household consumption.

7.5 Public Disclosure of the ESIA Document

The draft ESIA report was disclosed in the RTL website (https://www.rawtechltd.com/) for public comments on 24-10-2019. The final ESIA will be made available at accessible places (e.g. local government offices, libraries, community centers, etc.), and the executive summary translated into local language (Bengali) will be posted in the RTL and Bangladesh Bank websites. The final ESIA document will be shared with WB for approval and once it is approved, the document will be disclosed according to the procedures of WB. As a part of the disclosure, all versions (Bengali and English) will be available at the project office in addition to RTL's website.

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Introduction

The Environment and Social Management Plan (ESMP) for the Project has been developed with an aim to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures. This includes:

- Mitigation of potentially adverse impacts;
- Monitoring of impacts and mitigation measures during different Project phases of implementation and operation;
- Integration of the ESMP with Project planning, design, construction, and operation;
- Institutional capacity building and training; and
- Compliance to statutory requirements;

The ESMP for the project will also align with the WB OP 4.03 Performance standard and Bangladesh Bank Environmental and Social Policy and Procedures (ESPP).

8.2 Environmental and Social Management Plan

The operation of the plant will be stated from June 10, 2021. Key environmental and social impacts have been identified for ongoing construction and upcoming operational activities and reported in Chapter 6 along with mitigation measures. The ESMP for the project for compliance with WBG PSs is given in **Table 8-1**.

Table 8-1: Environmental and Social Management Plan for the project for compliance with WBG PSs

S.N.	Summary of Material Measures and Actions To Mitigate Project's Potential E&S Risks and Impacts	Status/Time Frame	Responsibility	Date of Completion
A)	**PS1: Assessment and Management of Environmental and Social Risks and Impacts**			
1.1	Organizational Structure and Operation Control: Management Functions for Environmental and Social Aspects	The RTL Management Structure Partially Implemented.	RTL	Will be upgraded and implemented as and when necessary; with the progress of the project.
1.2	Environmental and Social Policy:	Already in Place.	RTL	Throughout the Project Implementation
1.3	Management programs, communications, tools, and instruments: The Stakeholder Engagement Plan and Grievance Redress Mechanism is the Key Environmental and Social Instrument for the Project and Includes Information and Address Community Requirements	Already in Place.	RTL	Throughout the Project Implementation
1.4	Permit, consents, and authorizations: The Project is Required to obtain various E&S Permits from Appropriate Authorities and able to Maintain Compliance thereof	All Required Permits have been obtained	RTL	Will be renewed as and when necessary throughout the Project Implementation

S.N.	Summary of Material Measures and Actions To Mitigate Project's Potential E&S Risks and Impacts	Status/Time Frame	Responsibility	Date of Completion
1.5	Monitoring and audit: RTL is Responsible to Monitor and Report on Implementation of the ESMP and Construction Time E&S Monitoring (For Each Sub Activities). Audits will be done by a Third Party/Bangladesh Bank.	Monitoring is done by the RTL ES Personnel	RTL	Throughout the Project Implementation
1.6	Sep Preparation and Implementation: The Stakeholder Engagement Plan (SEP) is Already Prepared and to be Implemented Hereinafter to Continue Stakeholder Consultations.	SEP is Prepared	RTL	Throughout the Project Implementation
1.7	Grievance Redressal Mechanism (GRM): GRM is already Prepared and Implement a Grievance Mechanism	GRM is Prepared	RTL	Throughout the Project Implementation
1.8	Monitoring and Reporting: ensure that Monitoring and Reporting on All E&S Activities are Conducted Separately along with Regular Reporting	Regular Yearly Reports to the World Bank.	RTL through BB	Throughout the Project Implementation
B)	***PS2: Labor and Working Conditions***			
2.1	Labor Management Procedures: The Labor Management Procedures of RTL will be Reviewed for Consistency With PS 2. Labor Health And Safety Procedures will be included in the Project Construction and Operation Contracts under this Project	Already in Place	RTL	Throughout the Project Implementation
2.2	Grievance Mechanism for Project Workers: Develop and Maintain a Grievance Mechanism for Project Workers	Already in Place	RTL	Throughout the Project Implementation
2.3	OHS Measures and Emergency Preparedness: Develop and Implement Occupational, Health and Safety (OHS) Measures, Including Emergency Preparedness and Response Measures, Consistent with The OP 4.03 And World Bank Group Environmental Health and Safety Guidelines	OHS Management Plans are Prepared.	RTL	Throughout the Project Implementation
2.4	Project Workers Training: Implement Training of Project Workers Designed to Heighten Awareness of Risks and to	Training Plan Prepared.	RTL	Throughout the Project Implementation

S.N.	Summary of Material Measures and Actions To Mitigate Project's Potential E&S Risks and Impacts	Status/Time Frame	Responsibility	Date of Completion
	Mitigate Impacts on Local Communities.			
C)	***PS3: Resource Efficiency and Pollution Prevention and Management***			
3.1	Avoid or Minimize Adverse Impacts: to Avoid or Minimize Adverse Impacts on Human Health and The Environment by Avoiding or Minimizing Pollution From Project Activities, Through Implementation of ESMP	ESSDMP Prepared	RTL	Throughout the Project Implementation
3.2	Reduce Project-Related GHG: Project to Offset Reduce Direct/Indirect GHG Emissions.	Operation Stage	RTL	After Completion
3.3	Construction and Trial Operation Of ETP.	Operation Stage	RTL	Before Operation
D)	***PS4: Community Health and Safety***			
4.1	Traffic and Road Safety: Develop and Implement Measures and Actions to Assess and Manage Traffic and Road Safety Risks.	ESIA Already Addressed the Issues and to be Implemented	RTL	Throughout the Project Implementation
4.2	Community Health and Safety: Develop and Implement Measures and Action to Assess and Manage Specific Risks and Impacts to the Community Arising from Project Activities, in Relation to Project Workers and any Risks of Labor Influx	ESIA Already Addressed the Issues and to Be Implemented	RTL	Throughout the Project Implementation
4.3	Community Awareness: Conduct Community Capacity Building to Heighten Awareness of Risks and to Mitigate Impacts as Outlined in the SEP and Training Thereof	ESIA Already Addressed the Issues and to Be Implemented	RTL	Throughout the Project Implementation
E)	***PS 5: Land Acquisition, And Involuntary Resettlement***			
5.1	Minimize Adverse Social and Economic Impacts from Land Acquisition or Restrictions on Land use by Providing Compensation for Loss of Assets	All Issues Settled	RTL	Community Consultations Will Include Landowners, Throughout the Project Implementation
F)	***PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources***			
6.1	Biodiversity: Monitoring o Project Activities and Site-Specific Detailed Assessments and Mitigation Measures (If required).	ESIA Already Addressed the Issues and to Be Implemented	RTL	Both Construction and Operation Stage by Implementation of ESMP Prepared for Respective Stages

A summary of mitigation measures identified for the ongoing construction and upcoming operation phases of the PET recycling plant is presented in **Table 8-2** along with fund arranger and responsible person for implementation.

Table 8-2: Environmental and Social Management Plan of the project

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
On-going Construction Phase							
Air Quality	▪ Ongoing Civil Construction work; ▪ Operation of diesel generators; ▪ Dust generated from stockpiles of materials, waste, loose earth, handling and transporting wastes etc; ▪ Loading and unloading construction materials; ▪ Handling and mixing of cement;	Dust generation	▪ Implementation of a regular watering and sprinkling dust suppression regime, during the dry season; ▪ Restricting heights from which materials are dropped as far as practicable, to minimize the fugitive dust arising from unloading/loading; ▪ Stockpiles will be maintained at site only, which is a fenced area. No stockpiles will be maintained outside, and maximum Possible distance between the stockpiles and receptors will be maintained; ▪ Use effective dust suppression techniques, such as on-site watering and street cleaning; ▪ All diesel-powered equipment will be regularly maintained and idling time reduced to minimize emissions; ▪ Dusty activities should be re-scheduled where possible if high-wind conditions are encountered; ▪ Waste from construction will not be burned.	RTL	On site Project Management team and designated HSE team of RTL	Monthly report by 3rd party Organization to RTL	RTL Cost
Noise	▪ Noise generated from various	Increase in ambient noise levels which	▪ Normal working hours of the contractor will be between 06:00 and 21:00 hours. If work needs to be	RTL	On site Project Management team and	Monthly report by 3rd party	RTL Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
	activities such as welding, hammering, cutting, motor testing etc; ▪ Noise generated during civil construction work; ▪ Loading and unloading of material from truck; ▪ Transportation related activities;	will disturb local community and ecosystems	undertaken outside these hours, it should be limited to activities that do not exceed the noise criteria at nearby noise sensitive receptors; ▪ Only well-maintained equipment will be operated on-site; ▪ Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn out components should be conducted; ▪ Machinery and construction plant that may be in intermittent use (e.g. trucks) shall be shut down or throttled down during non-work periods; ▪ Low noise equipment shall be used as far as practicable; ▪ The number of equipment operating simultaneously shall be reduced as far as practicable; ▪ The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of OSHA 2007); ▪ The contractor should undertake additional post development noise monitoring in accordance with		designated HSE team of RTL	Organization to RTL	

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
			National and International noise standards; ▪ Developer shall instruct their Safety Officers to arrange for inherently quiet construction equipment and machines to maintain the noise level to minimum; ▪ Only limited construction activities shall be carried out during night-time; ▪ Rubber padding/noise isolators will be used for construction equipment. ▪ Temporary noise barriers shall be provided surrounding the high noise generating construction equipment; ▪ The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels; ▪ Construction vehicles and machinery will be well maintained and not kept idling when not in use;				
Ecosystem	▪ Construction activities at the site; ▪ Noise and vibration; ▪ Fugitive emission and	Disturbance of ecosystems	▪ The noise generating activities should be scheduled during the daytime only; ▪ Construction activities should be planned and undertaken in a phased manner; ▪ Project related activities should be avoided during the night time;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
	deposition on vegetation; ▪ Transportation of man and material by road; ▪ Illumination;		▪ Strict prohibition will be implemented on trapping, hunting or injuring wildlife; ▪ Plantation of local species for stabilization of the filled in material and plantation in surrounding areas; ▪ Project Site illumination should be in a manner to limit impacts on terrestrial habitats;				
Occupational Health and Safety	▪ Noise from construction activities; ▪ Impure drinking water; ▪ Unhygienic sanitation system; ▪ Accidental injury;	Project workers will be injured	▪ The Contractor will prepare and implement a Health and Safety Plan prior to commencing work; ▪ Measures will be implemented to reduce the likelihood and consequence of the hazards resulting from falling from height, falling into water, entanglement with machinery, tripping over permanent obstacles or temporary obstructions, slipping on greasy walkways, hit by falling objects, asphyxiation, explosion, contact with dangerous substances, electric shock, mistakes in operation, variable weather conditions, lifting excessive weights; ▪ A Permit to Enter system will be established to ensure that only authorized persons get entry to the site;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
			▪ All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor; ▪ All workers will be properly informed, consulted and trained on health and safety issues; ▪ Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips; ▪ Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the makers; ▪ All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded; ▪ Safety hoops or cages will be provided for ladders with a height in excess of two meters; ▪ Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise				

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
			levels indicate an Leq of more than 90 dB(A); ▪ The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress;				
Community Health and Safety	▪ Changes the environment quality at construction site; ▪ Construction site activity; ▪ Construction Noise; ▪ Transportation of man and material by road;	Local community will be disturbed	▪ Water sprinkler system should be installed for dust suppuration; ▪ High noise generating construction should be suspended during night hours; ▪ Slow vehicle movement in the approach road to avoid accident; ▪ Workers movement should be restricted beyond the project site protect community privacy and security;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL Cost
Construction of Approach Road	▪ During re-construction of the approach road small disturbance will be realized by the user of road due to temporary obstacles;	Local community will be disturbed and may impact on ecosystem	▪ Sufficient tree plantation to replenish loss of trees besides the road; ▪ Restricting heights from which materials are dropped as far as practicable, to minimize the fugitive dust arising from unloading/loading; ▪ Effective water sprays should be used to control potential dust emission sources;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
	▪ Some trees might need to be cut to widen the approach road; ▪ Temporary drainage problem may be occurred due to road construction activities;		▪ Cover haul vehicles carrying dusty materials moving outside the construction site; ▪ Limit the idling time of vehicles not more than 2 minutes; ▪ Set up proper drainage system underneath the approach road;				
Operation Phase							
Air Quality	▪ Operation of gas burned boiler; ▪ Dust from handling of the pet bottles and handling of produced fiber; ▪ Operation of emergency Diesel Generator Set; ▪ Transportation of PET bottles and PSF from the project site;	Emission	▪ Ensure excess air to ensure complete combustion of gases in boiler; ▪ Stack height should be sufficient of disperse air pollutant over the nearby community; ▪ Regular road cleaning; ▪ Transportation vehicles should have fitness certificate; ▪ Greenbelt development; ▪ Regular monitoring of air quality in and around the project site to ensure effectiveness of mitigation measures;	RTL	On site Project Management team and designated HSE team of RTL	Quarterly report by 3rd party Organization to RTL	RTL O&M Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
Noise Level	▪ Noise generated from crusher, screw conveyer, boiler etc; ▪ Noise generated from Pumps, compressors etc; ▪ Operation of emergency generator;	Increase in ambient noise levels which will disturb local community and ecosystems	▪ Install noise attenuation provisions such as silencers and acoustic insulation around noisy equipment ▪ Regular maintenance of machinery ▪ Setup/Replace noisy equipment with less noisy equipment (<85 dB) ▪ Regular noise monitoring in the production hall in various floor two identity high noisy area ▪ Installation of acoustic enclosures for equipment (e.g., compressor, pumps, generators etc.) casing radiating noise ▪ Green belt development around the project inside boundary to prevent noise propagation route. ▪ Installation of vibration isolation for mechanical equipment; ▪ Avoid the unnecessary use of alarms, horns, and sirens ▪ Periodic ambient noise monitoring is suggested as part of the ESMP to monitor the noise levels. ▪ Provide Personal Protective Equipment (PPE) like ear plug, muffler, etc. to the labors and employees who are working at close proximity to noise generating machineries.	RTL	On site Project Management team and designated HSE team of RTL	Quarterly report by 3rd party Organization to RTL	RTL O&M Cost
Ecosystem	▪ Noise and vibration;	Disturbance of ecosystems	▪ Green belt development around the project site;	RTL	On site Project Management	Visual Inspection	RTL O&M Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
	▪ Transportation of PET Bottle and PFS; ▪ Illumination;		▪ Proper maintenance of machineries to minimize noise generation from those machineries; ▪ Project Site illumination should be in a manner to limit impacts on terrestrial habitats; ▪ Proper security arrangement so that no terrestrial animal entered in the project site during operation period; ▪ If any animal trapped in the project site it should be rescued and restored in a save place;		team and designated HSE team of RTL		
Occupational Health and Safety	▪ High level noise from machineries may damage hearing system; ▪ Rotating equipment could cause injury if workers not follow cautionary advice; ▪ During hot maintenance work fire could be broken out;	Project workers may be injured	▪ On job training for the workers shall be carried out; ▪ Work permit system shall be followed; ▪ PPE shall be provided and use of PPEs shall be enforced; ▪ SOPs need to be developed for operation and maintenance of the Plant; ▪ Strictly follow the Bangladesh Labor Law 2006 and WB OP 4.03 performance Standards; ▪ The boiler operator must have a legal license to operate the boiler; ▪ Entrance to the boiler room except permission and selected personals shall be strictly prohibited; ▪ Preparation of emergency response plant and rescue plan;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL O&M Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
	▪ Physical injury during maintenance work; ▪ Boiler explosion; ▪ Fire in gas line; ▪ Fire in PET/PSF storage areas; ▪ Hot steam pipe cracking; ▪ Accident due to human error/ negligence;		▪ Development of inhouse firefighting system; ▪ PET/PSF storage areas are to be gated out; ▪ Fire signs to be posted in appropriate places; ▪ Fire license to be obtained from Fire Service and Civil Defense Department; ▪ Quarterly fire drill to be conducted regularly; ▪ Firefighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area) and automated fire extinguishers will be provided at strategic locations with clear labeling of the extinguisher type. A main hydrant will also be available around the buildings. An automated fire detection system with alarm will be in place on all floors and storage areas; ▪ Ensure appropriate first aid to the injured employee; ▪ Ensure quick medical shifting in case of serious injury; ▪ Cautionary signboard should be kept in appropriate location to warn employees on the potential dangers and for awareness build up;				

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
			▪ Engaged at least 1 HSE officer to ensure safe work environment in the premises; ▪ Emergency response team should be trained regularly; ▪ A health checkup facility shall be introduced for the workers; ▪ Phone contact numbers for emergency services should be prominently displayed;				
Community Health and Safety	▪ Noise generated from the boiler and other equipment in the production house; ▪ Transportation of PET bottles and PSF from the project site;	Local community will be disturbed	▪ Prepare a site-specific community health and safety management plan for the construction phase; ▪ Disclose potential disasters and potential risks from the plant to the local community as well as the plan of action on emergency protocol in the event of these accidents; ▪ Disclose and generate awareness on the DMP as well the measures and protocols prescribed by the same; ▪ Train employees and plant personnel on health and safety as well as handling and managing disasters and emergency events; ▪ Maintain harmonious relation with community and create a feedback system;	RTL	On site Project Management team and designated HSE team of RTL	Visual Inspection	RTL O&M Cost

Project Stage/ Affected Aspect	Project Activity/ Criteria	Proposed Impacts	Proposed Mitigation Measures	Mitigation Implementation Responsibility	Supervision Responsibility	Reporting Requirements	Mitigation Cost Source
			▪ Maintain sound labor and management relation to avoid conflict and disruption in operation; ▪ Siren/Megaphone should be installed to warn the community in case of fire and other emergencies; ▪ During cleaning of the soak pit precaution shall be taken so that the sewage is not discharged into surrounding environment;				
	▪ CSR activities	Community Development	▪ Supply pure drinking water to the neighbouring community; ▪ Contribute to improve nearby mosque, school & health center etc; ▪ Financial aid to most vulnerable peoples in the Kashor village; ▪ Tree Plantation; ▪ Enhance employment opportunities by maximizing utilization of the local population, as far as possible;	RTL	On site Project Management team and designated HSE team of RTL	Annual Progress Report	CSR Cost

8.3 Environmental Monitoring

The environmental monitoring plan has been prepared with the following objectives:

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project AoI.

8.3.1 Performance Indicators and Monitoring Schedule

Physical, biological, and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for ongoing construction and upcoming operation phases of the Project and is presented in **Table 8-3**. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

8.3.2 Reporting Mechanism for Environmental and Social Monitoring Program

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flow of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Before the civil works start, the HSE team of RTL will finalize the format for reporting on the status and progress of environmental monitoring. The format will be designed to meet all the compliance conditions associated with the environmental clearance from the Department of Environment. A health and safety incident/accident report will be prepared. Independent verification of the effectiveness of the mitigation measures during the construction phase can be done by RTL HSE team with a periodic third-party audit.

During the operation phase of the Project, HSE Personnel will monitor the effectiveness of the ESMP implementation, monitoring the implementation of social components of the ESMP. He/ she will also responsible for implementation of corporate social responsibility (CSR) activities to be conducted by RTL. HSE Manager will further report to the Plant Manager, who will be overall in-charge of the Plant operations and management.

The quarterly reports of the management activities and measures will form an integral part of the Quarterly Progress Reports that can be submitted to the lenders. Additional compliance reports to the Regional Office and Head Office of the DoE required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats.

Table 8-3: Environmental and social Monitoring Plan (Construction and Operation Phase)

Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	*Cost
Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in RTL Manual	Project activity areas	Visual inspection of all active work areas	Daily	HSE Team of RTL	RTL Cost (1xHSE Manager & 2xExecutive)
Ambient Air Quality	Dust generation	SPM, PM_{10}, $PM_{2.5,}$ NOx, SO_2, CO	1. Center of the project 2. Nearby house	24-hour	Monthly	3rd Party Environmental Consultant	RTL Cost 60,000 BDT/month
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night and hourly Leq	1. Project site 2. Nearest house at north side 3. Nearest house at east side 4. Nearest house at west side 5. Nearest house at south side	24-hour	Monthly	3rd Party Environmental Consultant	RTL Cost 15,000 BDT/month
Water	Ground water quality	pH, EC, TDS, Hardness, Chloride, Iron, Manganese, Magnesium, Arsenic, Chlorine, Fecal Coliform, Total Coliform, Heavy Metal	1. Labor camp tube well 2. Tube well of adjacent to the project area	Standard analytical methods	Monthly	3rd Party Environmental Consultant	RTL Cost 20,000 BDT/month
Ecology	Impact on Terrestrial Ecology	Species composition and counts (Birds), Fish and Dolphin)	Project AOI	In number	Bi-annually	RTL's HSE Team	RTL Cost
Ecology	Impact on Aquatic Ecology	Species composition and counts	Project AOI	In number	Bi-annually	RTL's HSE Team	RTL Cost

Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	*Cost
Occupational Health and safety	Accidents or incidents due to ongoing construction activities workers health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction camp area	As defined in construction phase health & safety plan to be prepared by RTL	As defined in H & S plan	HSE Team of RTL	RTL Cost (1 x HSE Manager, 2 x Executive)
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accident, incidents, and complaints	Access Road connecting site	Incidents, accidents, and community complaints	Based on occurrence	HSE team of RTL	RTL Cost (1xHSE Manager, 2 x Executive)
	Public concerns	Complaints from community	Neighboring communities around the project activity areas	As per the grievance redress mechanism	Continuous	Plant Manager	Grievance Management Budget of RTL
Environmental and Social Issue	Training need	1 – day training for those people of Contractor who involved in environmental and social issues - Compliance Audit	At project site	As per national and IFC/ WB standard guideline	Before construction start	RTL through 3rd party engagement	RTL Cost (500,000 BDT)
Operation Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	HSE Team of RTL	Included in operation and maintenance (O&M) cost of RTL
Air pollution	Dust generation & Emission	SPM, PM_{10}, $PM_{2.5}$, NOx, SO_2, CO	1. Project site 2. Nearest house	Standard Method	Quarterly	3rd party Environmental Consultant	Included in operation and maintenance (O&M) cost of RTL (60,000 BDT/Quarterly)

Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	*Cost
Noise	Ambient Noise	Noise levels in Leq, Leq day, Leq night and hourly Leq	1. Project site 2. Nearest house at north side 3. Nearest house at east side 4. Nearest house at west side 5. Nearest house at south side	Noise monitoring with data logger	24- hour observations with hourly noise levels, quarterly	3rd party Environmental Consultant	RTL O&M Cost (15,000 BDT/ Quarterly)
Water	Ground water	Drinking water quality parameters as per schedule 3 of ECR 1997; pH, EC, TDS, Hardness, Chloride, Iron, Manganese, Magnesium, Arsenic, Chlorine, Fecal Coliform, Total Coliform, Heavy Metal	1. Labor camp tube well 2. Tube well of adjacent to the project area	Standard Methods	Quarterly	3rd party Environmental Consultant	RTL O&M Cost (20,000 BDT/ Quarterly)
Ecology	Impact on Aquatic Ecology	Species composition and counts	Adjacent water body	In number	Bi-annually	3rd party Environmental Consultant	RTL O&M Cost (1xHSE Manager, 2xExecutive)
Occupational Health and safety	Accidents or incidents due to operation activities workers health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction camp area	As defined in operation phase health & safety plan to be prepared by RTL	As defined in H & S plan	HSE Team of RTL	RTL O&M Cost (1 x HSE Manager, 2 x Executive)
Community Health and safety	Community disturbance and potential safety hazard due to road and river traffic	Accidents, incidents and complains	Adjacent road	Accidents, incidents and complains	Based on occurrence	Visual Inspection report by HSE Team of RTL	RTL O&M Cost (1xHSE Manager, 2x Executive)

Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	*Cost
	Public Concern	Complains from community	Neighboring communities	As per grievance redress mechanism	Continuous	Visual Inspection report by HSE Team of RTL	RTL O&M Cost (1xHSE Manager, 2xExecutive)
CSR Activities	Community Development	Activities/ programs and no of beneficiaries	Affected group around the project activities area	No of beneficiaries and outcome of the activities	Annually and need based /as per CSR policy.	HSE Team of RTL	CSR Budget Total=BDT 500,000/annually

8.4 Institutional Setting and Implementation Arrangements

RTL has act as an EPC contractor for the construction of the project. RTL's staff, specifically the HSE Manager, Environmental Executive and Safety Executive will monitor the implementation of these mitigation measures at the site. These three officers will be responsible for the field level monitoring of the project. The roles and responsibilities of the RTL for implementation and monitoring are outlined below:

- Obtaining statutory clearance required during construction of the project
- Obtain fire license from Fire Service and Civil Defense Department
- Overall project co-ordination and management supported by third party environmental consultants
- Review of ESMP by third party Environmental Consultant
- Interaction and reporting to DoE and lenders
- Effective implementation of ESMP and monitoring of ESMP implementation
- Environmental monitoring through Third Party Environmental Consultant
- Preparation of various plans for effective implementation of ESMP
- Keeping records of all permits.
- Overall supervision of ESMP implementation
- Addressing grievances of local community and information dissemination

The whole ESMP implementation process requires supervision, checking, documentation and verification so that problems are identified and properly addressed before they get out of hand. In order to ensure proper execution of the ESMP, implementation reviews will be conducted by the Plant Manager such as the weekly construction meetings, construction log book, monthly and other construction reports etc.

Records of these minutes of the weekly meeting, monthly reports, and special reports on implementation of the mitigating measures will also be maintained and available for review by the Plant Manager. It is suggested to identify documents and records that require templates and accordingly suitable templates shall be developed, which shall include but not limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contract lists, action plans etc. Further, all these templates shall be communicated to all potential users. All these records will be archived at the plant manager and will be maintained by the HSE manager. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved. RTL will document the process for creating, allocating, and approving unique identifiers and will communicate this to relevant staff. RTL shall employ HSE Manager, Environmental Executive and Safety Executive for implementation ESMP for the project. The Environment and social management organogram of RTL is shown in **Figure 8-1**.

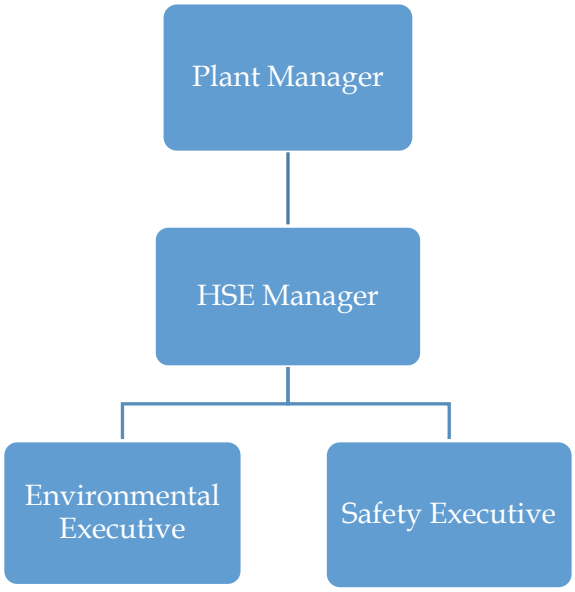


Figure 8-1: Organization Chart for Environmental and Social Management

8.5 Training

8.5.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in house/ external expert will be appointed by RTL to develop and deliver a training program on implementation of the ESMP, environmental monitoring and reporting in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the EPC contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- HSE management plans prepared by the EPC Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines;
- Internal reporting and response system;
- Hazardous chemicals and waste handling;

In addition, specific training will be provided to the team involved in environmental monitoring and reporting, which will include:

- Applicable environmental guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation, and analysis procedures;
- Solid and hazardous waste management;
- Quality assurance and quality control;
- Environmental monitoring report preparation

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the construction phase will be semi-annual and the reports will be submitted to the Lenders.

8.5.2 Operation Phase

Prior to the commencement of the Plant operation, a suitably qualified in-house/ external environmental expert will be engaged by RTL to develop and deliver a training program on operation phase environmental monitoring and reporting. The topics will be mostly same as that during the construction phase. However, it will also include following modules, which are specific to the operation phase:

- Daily emission monitoring;
- Solid Waste Management;
- Hazardous chemicals and waste management;
- Occupational health and safety including fire safety programs;
- Emergency response plan

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental performance of the Project. The reporting and verification during the operation phase will be annual and the reports will be submitted to the Lenders.

8.6 Labor Management and Occupational Safety

About 40 workers are currently employed; of which only about 12 are female. Most of employees are either locals or live-in rented accommodation in nearby communities and others commute to work; some even from Dhaka as RTL is well connected by road. There is no significant migrant workers as most workers are employed on long term basis. There are no permanent work camps inside RTL. The raw material supply contract ensures that no child labor in involved in the PET bottle supply chain. ESIA has identified the labor management issues and a labor management plan has been followed as per Bangladesh labor rules, 2015. Its implementation will ensure both compliance with WB OP 4.03 and GoB requirements; and, ILO conventions to which GoB is a signatory. ESIA provides for the implementation of required EHS regulations e.g., WB EHGS and sectoral EHS guidelines for worker safety. The ESIA document has proposed an Emergency Response (ER) Plan; that will help to reduce occupational hazards and health risks; and use of tools and procedures for proper implementation of ER measures including fire protection. RTL currently has no specific HR policy and a policy document specific to the RTL will be prepared in compliance with the Labor rules and the new 2019 labor law as soon as possible.

8.7 Emergency Response Plan

An Emergency Response Plan (ERP) is a written document which is required for an organization according to occupational health safety standards and must be displayed at every job site with a certain number of employees (usually five to ten). It is a detail step-by-step procedure to follow in emergencies situation such as fire or a major accident. An emergency response plan also includes information such as whom to notify, who should do what, and location of emergency stock. The Emergency Response Plan includes any measures that should be in place at all facilities to combat an accident resulting from fire, explosion or due to any natural calamities (e.g. Earthquake, cyclones, fire). The detailed Emergency Response Plan is given in Annexure-M.

9 GRIEVANCE REDRESS MECHANISM AND STAKEHOLDER ENGAGEMENT PLAN

9.1 Objectives of the Grievance Redress Mechanism

The requirement of the grievance redress mechanism is included in Performance Standard 1, under which project sponsors need to establish a grievance mechanism; to receive and facilitate resolution of affected communities' concerns and grievances about the project sponsor's Environmental and Social performance. Now, the construction is ongoing, the grievance redress mechanism will receive and facilitate resolution of complainants from project affected people (individuals) and, local communities arising out of the ongoing construction and upcoming operation of the plant. The mechanism should be able to address the aggrieved parties concerns and complaints promptly by using an understandable impartial and transparent grievance addressing process which is readily accessible by all segments of the population.

A grievance redress mechanism and procedures provide opportunity for project affected persons/communities to settle their complaints and grievances amicably. The grievance redress procedures and mechanism ensure that the project affected persons are provided with the appropriate redress and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably. In case, a dispute is not resolved by mechanism established, then if any of the parties disagree, the aggrieved party has the right to appeal to the ordinary courts of law.

A grievance form is presented below and hard copies of both English and Bangla will be made available at the RTL project office.

9.2 Grievance Mechanism Development and It's Requiring Steps

The Project Company while developing the Grievance Mechanism is required to adhere to the following steps:

9.2.1 Development of Procedures

The Project Company should ensure that procedures for lodging and registering of grievances are in place as soon as possible; within three months of the commissioning of the plant. The main Grievance Redress Mechanism will comprise of a committee with local community representation. A representative deputed by Habirbari UP will be included in the committee. Such representation will be a sign of impartiality of the committee and a measure for acceptance by the community. The composition of the proposed committee is discussed latter in this chapter. Although, GRC will be driven internally by RTL, the local community representation in the committee, makes to build trust and confidence in the system in the community. The grievance redress committee decisions have to unanimous, as RTL representative are in the majority.

9.2.2 Publicize the Grievance Mechanism

The Grievance Mechanism has to be publicized through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan. The Project Company should inform the local community in the first instance and then on remind them of this mechanism on a regular basis during the project operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updating. The grievances redress mechanism (GRM) shall be documented in English and Bangla

and copies shall be kept at the project site office and corporate office. The GRM is also to be displayed at notice board at the project site office and training on the GRM shall also be provided during orientation. Developer(s) is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All the relevant contact numbers to be made available to them.

9.2.3 Training/ Workshops on Grievance Redress Mechanism

A separate training/ workshop should be undertaken by the Project Company at the community and worker level to discuss the process of how a grievance gets registered, the local contact person's/grievance officer details of receiving grievances, the significance of grievance boxes, the timelines for addressing the grievances and the personnel's involved in the redressal process. These trainings should be held every half yearly and feedback/suggestions from the community should be acknowledged and changes to the GRM should accordingly be undertaken to make it more user friendly.

9.2.4 Recording of Grievances

Once the stakeholders are aware of the mechanism and access it to raise grievances, Project Company is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, developer(s) is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasizing the records and status of the grievance is to be maintained by the identified Grievance Officer (admin officer) at the site level. The Grievance Log can be used to analyze information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that the project proponents might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.

9.2.5 Appeal

If the grievance redressal solution is not acceptable or agreed by the complainant, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by the Project Company so that accountability and transparency is promoted by them in every step.

9.2.6 Resolve and Follow Up

Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close the case accordingly. Project Company is required to keep regular (yearly) reports that track the number of complaints received, resolved, not resolved, and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support identification of developing risks.

9.3 Proposed Grievance Redress Mechanism for Raw Tech

The Grievance Redress Mechanism outlines the process for lodging of grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the

satisfaction of the complainant (community members, project affected persons and workers). All complaints shall be recorded and addressed in a uniform and consistent manner. The GRM for the RTL project is presented below with time bound schedules and specific persons to address grievances.

9.3.1 Grievance Redress Committee

A site level approach is proposed to be developed for redressing of all cases of grievances. All grievances are to be redressed at this stage. The representatives proposed for the grievance committee is provided below,

- General Manager
- Plant Manager
- Admin Officer (Grievance Officer)
- A representative deputed by Habirbari UP.

The functions of GRC are as follows:

- To provide support to affected communities on problems arising from environmental or social impacts;
- To record grievances of the affected community by categorizing and prioritizing them, and provide solutions within a stipulated time period; and
- To report to the aggrieved parties, developments regarding their grievances and decisions of the GRC.

The steps of grievance redressal for Developer have been provided below:

9.3.2 Receive and Register a Complaint

- The Project Company in order to implement the Grievance Redress Mechanism is required to nominate an Admin Officer (Grievance Officer) for registering the grievances, initiating the process of registering and action taken thereon for the resolution of the grievance and the timeline required in each step. The contact details of the Grievance Officer shall be maintained and updated in the following format displayed at prominent places available to public and the project area.

Table 9-1: Contact Details of Grievance Officers

Sl. No	Name of the Grievance Officer	Telephone No.
1	Mohammad Bashir Uddin	01729042445

- Any stakeholder such as worker, person from local community or any other stakeholder, with concerns pertaining to onsite work such as community health and safety, local employment, community risk, migrant labor, or any issues etc., may register their complaint in writing to the nominated person/grievance officer at site level;
- All grievances will be addressed by the Project Company during the construction and operation phase. For any unresolved grievances the Plant Manager will forward the grievances to General Manager who in turn will subsequently forward them to appropriate authority for redressing;
- Secured grievance boxes shall be placed at the entrance of the site office;
- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box; and
- Once a complaint has been received it shall be recorded in the grievance log register or data system.

Details of grievance received shall be maintained by the Grievance Officer in a register as per the following format.

Table 9-2: Records of Grievance Received

Sl.	Date of Receipt	Particulars of Complainant				Particulars of Grievance			
		Name	Address	Contact No	Whether acknowledgement given at time of receipt	Subject of the Grievance	Office	Brief Description	Date of acknowledgement/ Date of redress

9.3.3 Assessment and Addressal of Complaint

- The Grievance Officer will open the grievance boxes once every week and register the grievance in the Grievance Log Register as per the format provided above;
- The Grievance Officer will then forward the grievances after registration to the Site Supervisor for further action;
- The grievance will be assessed by the Plant Manager within two (2) working days to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not;
- During the assessment of complaints, the GRC team (General Manager, Plant Manager & Admin officer) will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved;
- The grievances will be redressed at the Site Level by the GRC within seven (7) working days;
- If the grievance fails to be addressed at this level the complainant will have the option to approach the appropriate court of laws for redress; and
- The complainant will have the opportunity to be present at the committee meetings and discuss the grievance faced by him/her.

The Grievance Mechanism proposed for Developer to consider and implement has been provided in figure below.

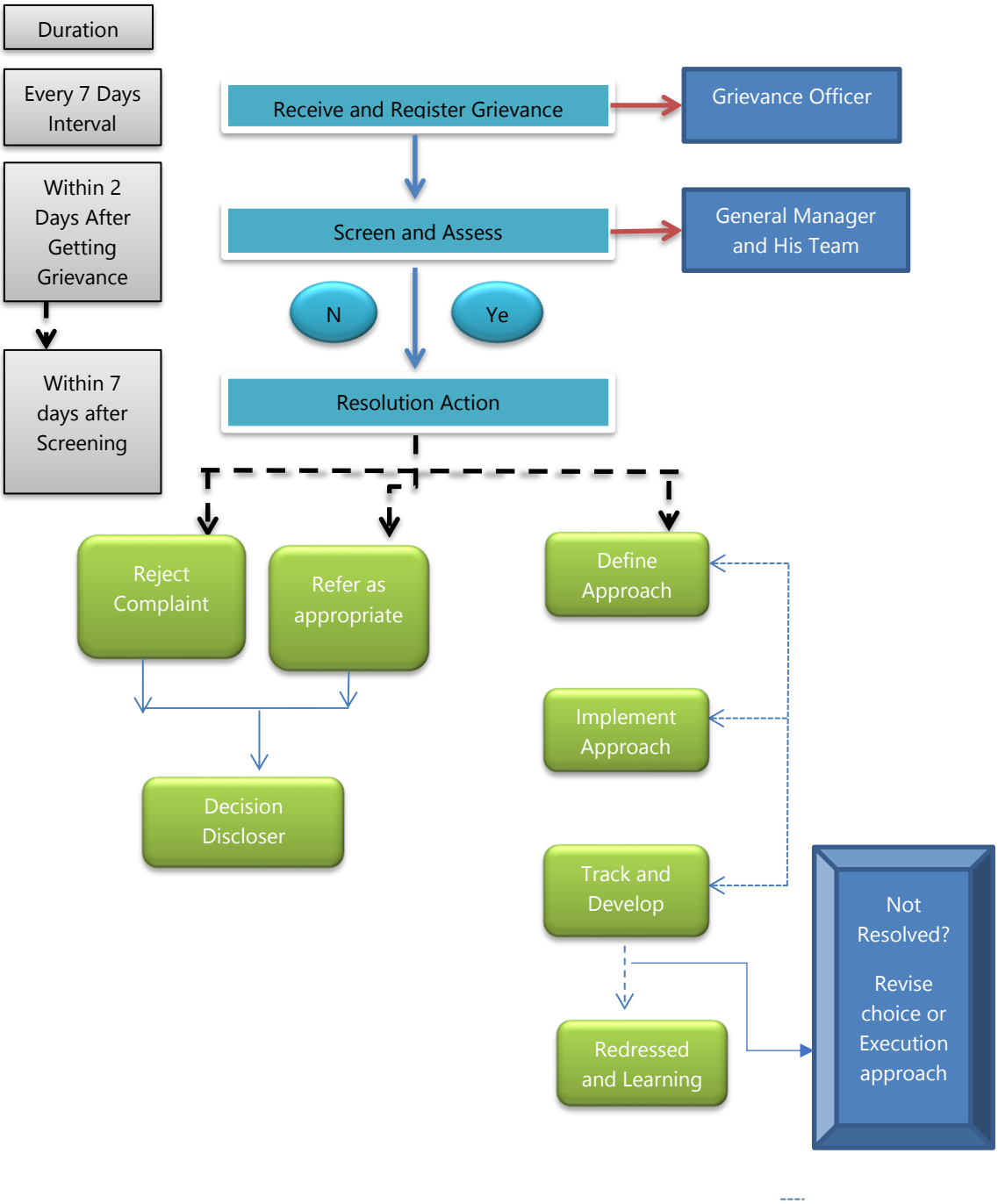


Figure 9-1: Proposed Grievance Mechanism for Developer

9.3.4 Documentation

- The Grievance Redress Mechanism will be documented in English and Bangla and copies will be kept at the project site office;
- The GRM will also be displayed at notice board at the project site office and labor camp sites and will be included in worker documentation;
- The Project Company should inform the local community and workers about Grievance Redress Mechanism during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays and face to face meetings;

- The Admin Officer will inform the workers about the grievance mechanism at the time of recruitment or induction training and make it easily accessible to them;
- The Grievance Officer's contact number will be made available to them. The project office phone number will be posted in public areas within the project area;
- The mechanism will address concerns promptly, using an understandable and transparent process and provide timely feedback to the concerned stakeholder;
- Verifiable records of implementation of corrective action like dated photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation should be kept;
- A Grievance Log or database emphasizing the records and status of the grievance shall be maintained by the Grievance Officer at the site level.

9.4 Resources Required for Grievance Mechanism Implementation

A Grievance Mechanism becomes successful if adequate resources are assigned in its implementation. Adequate resources here refer to people, systems and processes and associated financial resources. In order to incorporate the responsibility of designing, implementing, and monitoring the grievance mechanism, the senior management of the Project Company at the corporate level should be involved in executing the various tasks. For a grievance mechanism to function effectively, it is important to establish a governance structure and assign responsibilities for the mechanism's implementation. The following roles and responsibilities have been identified for grievance mechanism implementation:

9.4.1 Nominated Grievance Officer

Admin Officer based at the Site Level is to be nominated as the Grievance Officer. The incumbent is to work in tandem with the Plant Manager & General Manager. They cumulatively form the Grievance Committee at the site level.

9.4.2 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.

9.4.2.1 Monitoring

Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal and external audits (third party consultants) every once in a year based on the complexity of the nature of grievances can be adopted by the Project Company. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, Project Company can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost-effective manner.

9.4.2.2 Reporting

All grievances registered must be recorded and regularly updated. The Grievance Officer is responsible to discharging this responsibility and he should be able to produce this document

whenever any audits take place. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user-friendly.

10 DISCUSSIONS AND CONCLUSION

Raw Tech Limited, A Hong Kong Bangladesh Joint Venture Private Limited Company intends to build PSF production Plant by recycling PET bottles at Kashor, Habirbari, Bhaluka, Mymensingh. In this project discarded plastic bottles will be used as raw material and PSF will be produced. Thus, this project will reduce the number of plastic wastes that were likely to have ended up in the landfills and waterbodies.

General Issues and Categorization

As a part of the construction phase some land developments such as filling and levelling were done. As result of these activities, the area has settled down to a new ambient condition. The area which was a parcel of fallow land with a small pond, has now been transformed into a high value industrial lot. Detailed analysis of impacts/risks in this document shows that the risks involved are low in the construction stage and medium in the operation stage on environmental and social issues.

According to the Department of Environment (DoE), the aforesaid Project has been categorized as Orange B, which require IEE and ESMP only. As Raw Tech Ltd. has applied for funding from the Bangladesh Infrastructure Finance Fund Limited (BIFFL), which is in consistent with the Investment Promotion and Financing Facility (IPFF) II of the Bangladesh Bank, so Raw Tech Ltd. should follow the GoB law as well as IFC / WB E&S compliance guideline according to OP 4. 03. As per IPFF-II project's ESPP document project falls under the medium risk Category (i.e., Category-B under OP 4.03) and it is required to conduct an ESIA study.

Construction Related Issues

The construction phase of this projects involves both the construction of plant and ancillary buildings and installation of production machineries. The works were carried out by workers appointed by RTL. The project activities during construction phase impacting the physicochemical environmental parameter such as noise pollution and air pollution, have been identified through ES audit. The measures for mitigation in the construction phase were undertaken and these were successful; and no significant problem arose.

Drainage and Wastewater

RTL will adopt Zero discharge plan. Therefore, no wastewater will be discharged beyond the project boundary. Based on the water requirement the plant's ETP has been designed. Required capacity is 60 m^3/Day, but ETP is designed for 108 m^3/Day. Therefore, the system is designed has a good safety margin. A small amount of water is likely to be drained in to the pond situated north-east corner of the project site during the monsoon. However, the discharged water is not expected to be polluted.

Water Resources

The RTL plant will be using a moderate quantity of groundwater extracted through a few six-inch diameters tube well, while another well is kept standby. Impact of extraction of ground water for has been evaluated and it is found that no substantial impact is likely to occur. However, the groundwater level should be monitored by installing a piezometer at a strategic location. This will provide reliable information on the seasonal variation in the groundwater level, which may be used to assess the sustainable availability of water for the neighboring locality.

Air and Noise

During construction phase there was no significant air emission sources except for the diesel generator. However, this generator was only operated in case of power failure. Therefore, impact on air quality due to construction activities were Low.

During the construction phase ambient noise levels were monitored in and around the project site. All the monitoring levels were found to be within the standard limit for Mixed zone set by DoE, Bangladesh.

Diesel generator and boiler exhaust gas is the major sources of air pollution during operation period. However, diesel generator will be operated infrequently (only during grid failure) and boiler will be operated with natural gas fuel. Therefore, the contribution to air pollution from this source will be low.

The noise level within the premises of the RTL has been modelled and found to be below the allowable limits in general for industrial area. The modelling results also show that at 100 m from the center of the plant, the noise levels are within DoE standards for mixed area.

Soil Contamination

As no waste in the form of solid or liquid will be discharged directly to the surrounding of the project area therefore, there will be no impact on nearby soil/agricultural land due to operation of the plant. The project will operate in following 3R policy. All the waste water will be recycled, recovered, and reused. As a result, from ETP water recovery system around 20-30 kg sludge will be generated daily. This sludge is harmless which contains only iron oxides/hydroxides, silt, and clay. RTL has appropriate solid waste management plan to ensure safe disposal of these wastes on site or through DoE approved agents.

Occupational Health and Safety

Potential sources of impacts on the health and safety of ongoing construction workers are Noise from construction activities; impure drinking water, unhygienic sanitation system, accidental injury. However, no injury or health problem has been reported since the construction begins.

During operation phase employees could be impacted due to high level noise in the production hall, injury occurred by rotating equipment, boiler explosion, fire, steam pipe cracking, human error/negligence. About 20 employees will be engaged in operation period of plant. All the employee will use proper PPE according to safety requirement. Failure in some risky unit could cause fire and release of hot elements. As a consequence, death or permanent injury may happen to the employees. However, accident in risky production units and storage areas will could be avoided with proper maintenance of the production units and by securing storage areas. Employees will be trained to operate the fire control equipment and fire drills will be done on quarterly basis. The plant will also obtain a fire license from the Fire and Civil Defense authority. With the measures in place to mitigate impact significance on occupational health and safety, the OHS risk during operation phase is assessed as medium.

Community Health and Safety

Ongoing construction activities involved are mainly machine installation which generates some noise. Some minor civil construction works is also continuing. The civil construction work may create dust and pollute the surrounding area. However, the pollution level will be low as the project site has 3-meter-high wall and the nearby households has dense vegetation. As air

emissions are low, it is expected that air quality in the VEC is not impacted. There was no discharge of wastewater outside the project boundary during the construction phase. Some vehicles were used for carrying construction equipment and materials to the project site. Small number of vehicles did not pose much accident risk and no accident happened in the community neighborhood.

Noise generated from the production activities of RTL, such as operation of boiler and pumps can disturb nearby community. Movement of vehicles carrying PET bottles and PSF can also create disturbance in the nearby community. Major fire/explosion incidence in the plant could pose risk on nearby community. As there are small number households near the project site, the impact on the community due to operation of the plant is assessed low. RTL will install road signs and provide traffic attendants to watch over the traffic during heavy vehicle movement to and from the plant. These measures are likely to eliminate the possibility of accidents risks to the pedestrians.

Cumulative Impacts

The ES audit has found that most of the adverse impacts resulting from the project during construction phase was low. As the air emission is low from the plant, it will not significantly increase the current levels. The wastewater will be reused after treatment at the ETP.

The ambient status of environmental, ecological, and social conditions represents the cumulative impact of all the other activities, in surrounding areas on the project site in all the phases.

The impact was low during construction without mitigation and low with mitigation. However, during the operation stage the cumulative impact is assessed to be medium without mitigation and likely to be medium even with mitigation, due to fire risk, as both the raw materials (PET) and product (PSF) are flammable.

Land Acquisition

Although land acquisition was involved, these were all through willing-buyer, willing-seller arrangement. The private land transaction process was verified in the ESIA process, through consultation and has been documented (Annexure C). None of the land-owners exercised their right to opt out. There was no settlement on the land prior to commencement of pre-construction works; so, there was no resettlement issues. Consultations with the host community and other stakeholders have been carried out and will continue throughout the project lifecycle.

Environmental & Social Management Plan

An Environmental & Social Management Plan (ESMP), including monitoring requirements, has been developed, to ensure implementation of the "mitigation and abatement measures" identified in the environmental/social assessment. Proper mitigation measures, as suggested in the ESMP, will be followed to reduce the adverse impacts to the extent possible. The ESMP has provided suggestions on tree plantation, pond preservation and green area delineation which should be ensured by the RTL management.

Public Participation and Community Concern

During the operational phase, the project is likely to bring about significant benefit for the local community and the country. Social issues are likely to play important role during the construction as well as the operational phases. The project activities are likely to generate opportunity for significant employment. Coordination among the RTL personnel and the community members

needs to be ensured through participatory approach. Harmonious relationship between the community and the project personnel for safety and security will be ensured through a participatory program.

Labor Management and Occupational Safety

About 40 workers are currently employed; of which only about 12 are female. Most of employees are either locals or live-in rented accommodation in nearby communities and others commute to work; some even from Dhaka as RTL is well connected by road. There is no migrant workers, as most of the workers are employed on long term basis. There are no permanent work camps inside RTL. The raw material supply contract ensures that no child labor in involved in the PET bottle supply chain. ESIA has identified the labor management issues and a labor management plan has been made as per Bangladesh labor rules, 2015. Its implementation will ensure both compliance with WB OP 4.03 and GoB requirements; and ILO conventions, to which GoB is a signatory. ESIA provides for the implementation of required EHS/OHS regulations e.g., WB EHGS and sectoral EHS guidelines for worker safety. The ESIA document has proposed an Emergency Response (ER) Plan; that will help to reduce occupational hazards and health risks; and use of tools and procedures for proper implementation of ER measures including fire protection.

Grievance Redress Mechanism

A Grievance Redress Mechanism has been proposed with due procedures; through which aggrieved parties may launch complaint, which will be addressed by a committee upon formal hearing and investigation. This procedure will include the mechanism and composition of the Grievance Redress Committee (GRC) involving NGOs, local elites and representatives of local government to ensure accountability and transparency of the grievances addressed.

Compliance with PSs and Management Plan

As RTL is no longer a greenfield project, an 'Environmental Audit' was conducted recently and some lapses on EHGS compliance were found. RTL management has promised to rectify these. For compliance with the requirements of the OP4.03 Performance Standards and an Environmental and Social Management Plan (ESMP) has been formulated; which needs to be followed by the RTL. The plan implementation will be overseen, monitored, and audited by RTL management and implemented by a dedicated team in the plant. The Project will make its best effort to minimize the environmental and social impacts unavoidably associated with the Project; during its entire life cycle by implementing proposed mitigation measures and management plans as described in this ESIA to ensure compliance with the requirement of the World Bank PS and EHS guidelines. Provision for indicative budget resources have been provided for the purpose. RTL management will ensure that the Project conforms to all the legal, regulatory and policy objectives and ensure that all the necessary permits are obtained and renewed from time to time as necessary.

Disclosure

The ESIA document has been disclosed on the RTL website and has also been posted on the website of the Bangladesh Bank.

Finally, it is expected that all necessary information/ evidence contained in this ESIA report are enough to meet all requirements for the operation of the RTL plant and facilities in accordance with WB OP4.03 and applicable WBG guidelines and standards.

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