ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

OF

Installation of 30 MW Grid-Connected Rooftop Solar PV System at Walton Hi-Tech Industries PLC.



Prepared By

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Acronym

BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BPDB	Bangladesh Power Development Board
CO_2	Carbon Dioxide
CDMP	Comprehensive Disaster Management Program
GoB	Government of Bangladesh
DoE	Department of Environment
DAE	Department of Agricultural Extension
DMB	Disaster Management Bureau
ECA	Environment Conservation Act 1995
ECR	Environment Conservation Rules 1997
IEE	Initial Environmental Examination
EIA	Environmental Impact Assessment
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental and Social Management Plan
EMS	Environmental Management System
ESMS	Environmental and Social Management System
ESMMP	Environmental and Social Management Monitoring Plan
ESMF	Environmental and Social Management Framework
GSHAP	Global Seismic Hazard Assessment Program
GIS	Geographic Information System
GPS	Global Positioning System
IDCOL	Infrastructure Development Company Limited
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature

MIM	Management Information & Monitoring
MoEFCC	Ministry of Environment, Forest and Climate Change
NEMAP	National Environmental Management Action Plan
NGO	Non-Government Organization
NOx	Oxides of Nitrogen
$PM_{2.5}$	Particulate Matter < 2.5µm
PM_{10}	Particulate Matter < 10µm
PWD	Public Works Department
SOx	Oxides of Sulfur
SPM	Suspended Particulate Matter
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
UNDP	United Nations Development Program
WB	World Bank
WHTI	Walton Hi-Tech Industries PLC.

Glossary

Adverse Impact: An impact that is considered undesirable.

Ambient Air: Surrounding air.

Aquatic: Growing or living in or near water.

Baseline (Or Existing) Conditions: The "baseline" essentially comprises the factual understanding and interpretation of existing environmental, social, and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e., the "No-development Option".

Beneficial Impacts: Impacts that are considered to be desirable and useful.

Biological Diversity: The variety of life forms, the different plants, animals, and microorganisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity, and ecological diversity.

Ecosystem: A dynamic complex of plant, animal, fungal, and microorganism communities and associated non-living environments interacting as an ecological unit.

Emission: The total amount of solid, liquid, or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.

Endangered Species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from the immediate danger of extinction.

Environmental Effects: The measurable changes in the natural system of productivity and environmental quality, resulting from development activity.

Environmental & Social Impact Assessment (ESIA) / Environmental Assessment: The systematic, reproducible, and interdisciplinary identification, prediction and evaluation, mitigation, and management of impacts from the proposed development and its reasonable alternatives, sometimes known as environmental assessment.

Environmental Impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic, and human receptors.

Environment and Social Management Plan (ESMP): A Plan to undertake an array of follow-up activities that provide for the sound environmental and social management of a project/ intervention so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized, and sustainable development is ensured.

Environmental Management: Managing the productive use of natural resources without reducing their productivity and quality.

Erosion: A Process in which wind and water remove materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation: The process of looking back at what has been done or accomplished.

Fauna: A collective term denoting the animals occurring in a particular region or period.

Field Reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

Flora: All of the plants found in a given area.

Habitat: The natural home or environment for a plant or animal.

Household: A household is identified as a dwelling unit where one or more persons live and eat together with a common cooking arrangement. Persons living in the same dwelling unit having separate cooking arrangements constitute a separate household.

Important Environmental Component: These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.

Initial Environmental Assessment / Evaluation: Preliminary analysis was undertaken to ascertain whether there are sufficient likely significant adverse impacts to warrant a "full" ESIA. In some countries, the use of initial assessment forms a meaning of "screening" proposed projects.

Land use: Types include agriculture, horticulture, settlement, pisciculture, and industries.

Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

Negative Impact: Negative change from the existing situation due to the project. Public involvement / Public consultation: A range of techniques that can be used to inform, consult or interact with stakeholders affected / to be affected by a proposal.

Project: Installation of 30 MW Grid-Connected Rooftop Solar PV System at Walton Hi-Tech Industries PLC.

Reversible Impact: An environmental impact that recovers either through natural process or with human assistance (e.g., Cutting off fish migration by an embankment might be reversible at a later stage if a proper regulator is built).

Terrestrial: Living on land.

Thana: Sub-district level of government administration, comprising several unions under the district.

Union: The smallest unit of local self-government comprising several villages.

Upazila: Sub-district name. Upazila was introduced in 1982.

Zilla: Bengali word of the district.

Executive Summary

This document constitutes the Environmental Impact Assessment (ESIA) of the Installation of 3.3 MWp as the first phase of 30 MW Grid-Connected Rooftop Solar PV System at Walton Hi-Tech Industries PLC and has been developed by a multi-disciplinary team in close collaboration with the management of Walton Hi-Tech Industries PLC.

All the relevant social and environmental risks and potential impacts have been taken due care of as part of the assessment in compliance with the Performance standards set by the World Bank (WB), KfW, and JICA besides following the guidelines set forth by DoE.

The ESIA presents background information about the project. Several national legislations which the project should abide by have been presented. A baseline environmental examination was conducted by the consultants. The project activities were closely examined to find the relationship and dependency between project activities and environmental components. This information was used to identify the impacts of the project activities on the surrounding environment. Later on, the evolution of this impact was done by examining existing environmental components. Several mitigation measures to reduce adverse impacts were suggested. Finally, a management plan with monitoring requirements was developed.

Project definition, location & site

Walton Hi-Tech Industries PLC. has planned to install a 30 MW in Solar On-Grid power system on the roof-top of their existing plant different phases. Currently, Walton is approaching 3.3 MWp of solar rooftop projects. The proposed solar project will be able to generate a good amount of electricity for **Walton Hi-Tech Industries PLC.** situated at Chandra, Kaliakoir, Gazipur, Bangladesh.

Walton Hi-Tech Industries PLC. has proposed to construct the solar project on their Steel Structure Building rooftop. The project is surrounded by other empty lands and highway

In the proposed system some major equipment's will be used which are solar panels, PV modules and inverters. Sun shines on the solar panels to generate DC electricity. The DC electricity produced from the solar panel will be converted to 440V 3-phase AC using the inverters. Then, the energy will be fed into the bus bars of industry. A Zero Export Controller will be used to ensure "net zero export" The aggregated installed capacity of the project will be 30 MW.

Objectives of ESIA Study

The objective of the study is to provide an examination and assessment of the environmental and social impacts of the proposed project. An environmental management and monitoring plan have also been developed with an indication of the extent of work to be done to minimize the impacts. The ESIA is created accordance with the demands of the DoE as well as IDCOL and development partners to obtain an Environmental Clearance Certificate in favor of the project.

ESIA Study Methodology

The ESIA was conducted by following steps:

- Screening of the project and scoping of anticipated impacts through analyzing project components, activities, and stakeholder consultation at the beginning of the study;
- Undertaking field surveys toward the collection of primary baseline environmental and social information about the project area
- Collection of secondary information from different government and non-government portals
- Compilation of survey/monitoring data. Field survey using a prepared questionnaire conversing a wide cross-section of people in the study area to acquire field-level data on the existing environment and socioeconomics and apprehended impacts due to the project;
- Identification of potential impacts and evaluation of their consequences. Impact identification was done using the checklist method.
- Formulation of mitigation and avoidance measures was done for identified impacts;

Existing Environmental and Social Conditions

A baseline survey was conducted to identify existing physical, meteorological, and biological environmental conditions as well as the social condition of the area where the project is going to be established. It has been found that the air (in terms of particulate) & water (in terms of solid concentration) quality of that area is good like typical coastal areas of Bangladesh. The meteorological condition of that area is tropical monsoon. Water, noise, and air quality monitoring were conducted at the project site, details of which are available in section 6.1. The existing ecological environment, biological resources, flora, and fauna are shown in section 6.2. Section 6.3 focuses on the socio-economic status of the project's adjacent area and locality.

Environmental & Social Impacts

The proposed project will have several negative and positive impacts on both constructions, and the operational decommissioning phase. These impacts are identified through a checklist method by studying and assessing project components, activities, and baseline environmental and social conditions. Based on these identified impacts, mitigation measures and a monitoring plan have also been prepared. A list of these positive and negative impacts of the proposed project is given below:

- Creation of Jobs

- Support of Local Businesses
- Revenue to Local Council
- Air Pollution
- Water Pollution
- Waste
- Soil Pollution
- Noise & Vibration

Potential Positive Impacts

Positive impacts of the project are the creation of jobs; support of local businesses; infrastructure development and revenue to the project proponent.

Environmental & Social Management Plan

An Environmental & Social Management Plan has been developed for addressing all adverse impacts of the implementation of the project. The plan presented in the tabular form includes impacts, their sources of occurrence, their mitigation measures, people responsible for the implementation of mitigation measures, and their responsibilities.

The ESMP has been incorporated by their key environmental components and parameters to monitor their indicators, frequency, timing, and locations of monitoring and also the people responsible for carrying out such monitoring.

The mitigation measures are the responsibility of the project authority. They will be implementing the ESMP along with mitigation measures, as part of the contractual obligation, and the project proponent will supervise the work. The cost for Environmental Mitigation Measures and Monitoring will be included in the project cost and allocated funds will be made accordingly.

Environmental Monitoring Plan

For effective implementation of the management plan, a comprehensive monitoring plan has been suggested in the ESIA. The monitoring plan also identified the monitoring location, monitoring parameters, monitoring frequency, and responsible authority as well as the tentative cost of monitoring.

Walton Hi-Tech Industries PLC. is the Executing Agency, responsible for overall project implementation, and will establish a Project Management Unit (PMU) to manage the project. This will be headed by a Project Director (PD), supported by technical staff who will design the infrastructure, management of Contractors, and supervise the construction.

Public Consultation

Public consultation for the establishment of the proposed project was conducted with the local community and local government office. Several people of different ages, gender, and occupation participated in the consultation process.

In the consultation meeting, after the explanation of the project outline which includes project establishment, product, project activity, expected key environmental and social benefits as well as potential negative impacts were explained during the construction and in the operation stage. The whole conversation was organized in the manner of an open-ended question-and-answer session. Some issues were raised by the participants and discussed with the consultant and project proponent. In general, the perception of the local people regarding the project was mostly positive.

Conclusion

An Environmental and Social Impact Assessment (ESIA) study has been carried out for the proposed project in accordance with the demands of the DoE as well as the Japan International Cooperation Agency (JICA) Guidelines for Environmental and Social Considerations, General and Sector-Specific EHS Guidelines of World Bank (WB), Sustainability Guidelines of KfW, and ESMS of IDCOL to obtain an Environmental Clearance Certificate in favor of the project.

WHTI proposed a total 30 MWp in different phases of rooftop solar project on their industrial park's rooftop. In will be installed at the rooftop of 24 buildings and sheds of **WHTI**. The implementation of 30 MWp of rooftop solar will be completed in 3 phases. In the first phase, **WHTI** has already installed 7.33 MWp on their industrial rooftop in the year 2022. In the second phase, 10.22 MWp will be installed in 2023, and in the third phase, 12.25 MWp will be installed by the year 2024. Currently, 3.3 MWp is being installed at the rooftop of **WHTI**. The installation sites of 24 buildings and sheds for 30 MWp are Shed-10 area of 20.2850.64 sq. ft. for 2.16 MW, Shed-10_Block-B area of 158475.36 sq. ft. for 1.85 MW, Footpath Solar Shed area of 63000 sq. ft. for 1.1216 MW, Floating House_Rosulpur Pond-1372 sq. ft. for 0.0159 MW, Building-01_Bloack-B area of 51525 sq. ft. for 0.68 MW, Shed-06_Extension_Block-A area of 45178 sq. ft. for 0.47 MW, Building-03_Block-B area of 63152 sq. ft. for 0.88835 MW, Others (Polyud Blending Shed, Finished Goods Ware House Shed & others) area of 12206 sq. ft. for 0.14 MW, Glass Project area of 246770 sq. ft. for 3.41 MW, Die Casting Shed-01 area of 246692 sq. ft. for 2.84 MW, Building-02_Block-B area of 67949 sq. ft. for 3.41 MW, Building -04_Block-B area of 87889 sq. ft. for 1.16 MW, Building-05_Block-B area of 73948 sq. ft. for 0.95 MW, Building-07_Block-B area of 106221 for 0.95 MW, Building-08_Block-B area of 78448 sq. ft. for 0.96 MW, Building-08 Extension Block-B area of 6380.84 sq. ft for 0.43 MW, Oxygen Plant area of 5775 sq. ft. for 0.08 MW, Shed-05,_Block-A area of 116052 sq. ft. for 0.95 MW, Shed-06_Block-A area of 64254 sq. ft. for 0.52 MW, Die Casting Shed-02 area of 246692 sq. ft. for 2.84 MW, Raw Material Shed (East side of Styrofoam shed) area of 63789 sq. ft. for 0.75 MW, Block Cutting Shed area of 3517 sq. ft. for 0.03 MW, Assembly Line Shed-01 area of 221924 sq. ft. foe 2.84 MW, and Assembly Line Shed-02 area of 221924 sq. ft. for 2.84 MW.

The report has been prepared by identifying the potential impacts, assessing them, and recommending possible mitigating and enhancing measures for negative and positive impacts respectively.

Proper maintenance of the machinery could reduce the emission of air pollutants. Based on the environmental assessment and surveys conducted for the project, associated potential adverse environmental impacts can be mitigated to an acceptable level by the adequate implementation of the measures as stated in the ESIA. Adequate provisions should be made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs. No possible environmental impacts will be made by the operation of the project. Since it is understood that the project proponent (**WHTI**) is committed to taking the necessary steps to address any environmental problems, the selected location seems to be acceptable for the proposed project.

However, no development can be expected without any adverse impact on the environment. The beneficial impacts on the nation, as well as human beings, would only be meaningful and sustainable development would only be possible if the adverse effects are minimized through strict maintenance and control measures as adopted and further suggested for this project.

Finally, it can be concluded that the location of the project is environmentally and socially acceptable and it is expected that the project proponent will follow all environmentally compatible steps during construction and operation which sets a positive example as an environment-friendly industrial facility. No follow-up study would be required for the proposed project.

Chapter One: Introduction

1.1 Project Background

Bangladesh is a densely populated country with 160 million people. To meet the increasing population, demand the generation of electricity is not produced as expected. Despite its large population, Bangladesh has achieved substantial economic growth over the last 15 years.

Deficient infrastructure prevents the country from achieving its full growth potential. This situation is particularly evident in economically disadvantaged remote and rural areas. Whereas access to energy is a priority in the development framework, much work needs to be done on basic infrastructure for rural electrification. Remote and dispersed areas are currently adopting off-grid electrification as a viable alternative to the national grid service. Whereas access to energy is a priority in the development framework, much work needs to be done on basic infrastructure for rural electrification. Remote and dispersed areas are currently adopting off-grid electrification as a viable alternative to the national grid service.

The current electricity cost from the solar plant is almost similar to the grid tariff that is expected to be cheaper than the grid tariff in the future due to the constant fall in the price of solar-based technologies vs. the expected rise in grid tariff to minimize the gap between generation cost and tariff. Thus, financing such kind of projects makes financial sense apart from achieving the country's target to promote renewable energy-based technologies in the country to ensure access to electricity for all. With the advent of solar-based technologies and the current global trend of reduction in solar panel costs, electricity generated using solar-based technologies is expected to become cheaper than electricity generated from traditional sources.

Considering this immense opportunity in the power sector, **Walton Hi-Tech Industries PLC.** proposed a 30 MW rooftop solar project whereas some part of the project has been completed and the remaining is under construction.

In the proposed system, many items will be used, i.e., solar PV modules, solar PV inverters, mounting structures, DC cabling, and Aluminum walkway checker plate. Following is the list of equipment's that will be used in the proposed project.

According to Bangladesh Bank ESRM under the ESDD risk assessment tool, this particular project falls into the "**Low category"** and DoE ECR 2023, Solar sub- projects greater than 1 MW falls into **Yellow Category** but it requires an ECC from DoE. Notably, Solar Rooftop projects itself is **categorized as B** by the World Bank. If the solar project is within the 1-50 MW, it is categorized as an "**Yellow**" project but it requires an ECC/ site clearance certificate.

1.2 Rationale of the Project

In the proposed system two main pieces of equipment will be used which are solar panels and inverters. Sun shines on the solar panels to generate DC electricity. The DC electricity produced from the solar panel will be converted to 440V 3-phase AC using the inverters. Then, the energy

will be fed into the bus bars of industry. A Zero Export Controller will be used to ensure "net zero export" The aggregated installed capacity of the project will be 30 MW.

The GOB has given the highest priority to power sector development in the country and has committed to making electricity available to all citizens by 2021. Matching the growth target, the Power System Master Plan (PSMP) has been revised in 2016, which has forecasted demand to increase as high as 24,000 MW by 2021, 40,000 MW by 2030, and 57,000 MW by 2041.

In the power generation plan of Bangladesh, due importance has been given to developing renewable energy resources. According to Renewable Energy Policy 2008, 10% of total generated electricity is to be added from renewable energy sources by 2021. Thus, it can be anticipated that electricity tariffs for generated power from traditional sources will continue to soar in the future to eliminate the gap.

Generating electricity through PV power is rather pollution-free during operation and compared with the current conventional way of producing electricity, the clean energy produced from renewable energy resources is expected to reduce the consumption of alternative gas/coal/liquid fuels for electricity generation in **Walton Hi-Tech Industries PLC.** and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions. The project will produce clean energy that will contribute to lowering electricity generation costs compared to the current costs associated with other fuels and thus leads to a substantial decrease in the fiscal deficit.

1.3 Project Objectives & Benefits

The main objective of the ESIA study is to assess the positive and negative environmental impacts due to the project's (Industry & Roof Top Solar Project) activities.

Assess the impacts and recommend appropriate mitigation measures during preconstruction,
construction, and operation phases to minimize the negative impacts of the project to acceptable levels. The ESIA will be used as a decision-making tool to ensure that the project design and implementation activities are environmentally sound and sustainable. During the implementation phase, the prepared Environmental and Social Management Plan (ESMP) shall serve as a framework for strengthening the mitigation, enhancement, and environmental monitoring measures and system of the rooftop solar project. In the preparation phase, the ESIA shall achieve the following objectives:

- Present a general description of the project and the technical aspects.
- Identify and describe elements of community and environment likely to be affected by the proposed project, including natural and socio-economic environment;
- Identify the aspects of the project likely to result in significant impacts on the resources/receptors.
- Predict and evaluate the significance of the impacts of the project.
- Identify the (environmental, social, and health) aspects of the project that need to be managed and recommend appropriate and justified mitigation and enhancement measures.
- Conservation of natural resources and biodiversity through proper implementation of mitigation measures.

- Develop plans for management and monitoring of the impacts during the construction and operation of the project.

1.4 ESIA Methodology

The ESIA of the proposed project has been conducted following the ESIA Guidelines for Industries, prepared by the DoE in 2023 following the requirement of the Environment Conservation Rules, 2023 under the Environment Conservation Act 1995 and as well as IDCOL and development partners.

This report is based on the primary data collected during the study period via interviews, field observations, and discussions with the local authority and local people of the project area. The data collection method consists of secondary data from various sources, and information from field visits and the project proponent. Field visits were undertaken to the project location with a view to reconnaissance and a detailed survey of the surrounding areas. These were followed by an evaluation of the information to delineate the major environmental issues relating to the project. During this process, the following steps have been followed:

1.4.1 Orientation

Meetings and discussions were held among the members of the ESIA Team. This activity was aimed at achieving a common ground of understanding various issues of the study.

1.4.2 Data Collection Planning

After the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the ESIA Team. The plan included the identification of specific data requirements and their sources; determining time schedules and responsibilities for their collection and indicating the logistics and other supporting needs for the execution of the data acquisition plan.

1.4.3 Data Collection

In this step, primary and secondary data were collected through field observations, environmental monitoring in the field, concerned departments, and published materials to establish baseline profiles for physical, biological, and socioeconomic environmental conditions. A map in Figure 1 is showing the data collection spots of several environmental features in the project area. The following activities were performed for data collection:

- Site Reconnaissance
- Analysis of Maps and Plans
- Literature Review
- Desk Research
- Field Observations and Studies
- Public Consultations
- Laboratory Analysis

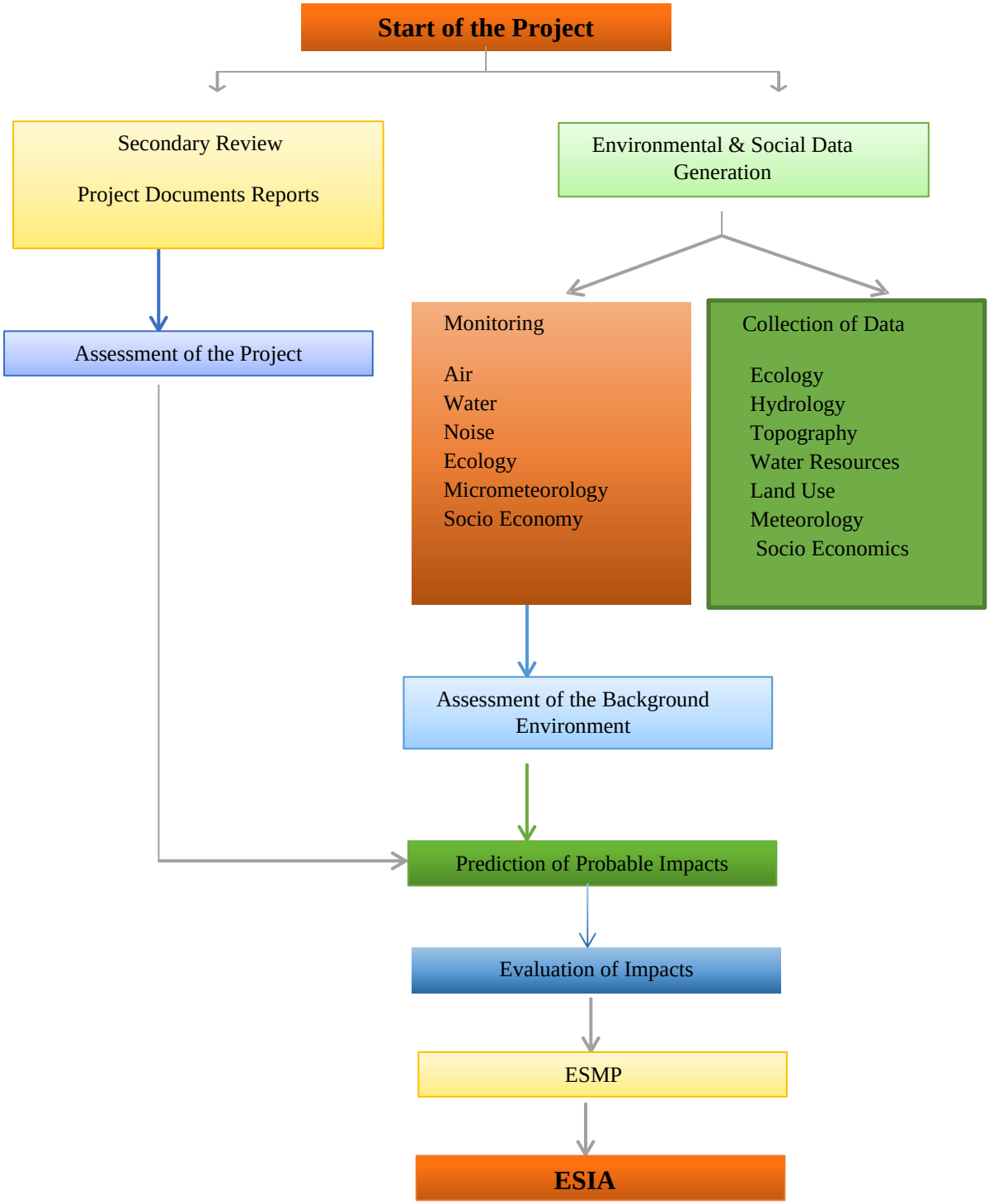


Figure 1: Route Map of Environmental and Social Impact Assessment

1.4.3.1 Physical Environment

Information was collected on the existing physical environment, particularly as related to geology, topography, soils, hydrology and drainage, water quality, air quality, and noise. The primary sample collection map for the environmental issues has been given in Figure 2.

Geology, Topography, Soils

Information was collected on the existing geology, topography, and soil to establish the baseline of the project area and further find out the impacts of the Project during the construction and operational phases.

Hydrology and Drainage

Data related to hydrology and drainage was collected to identify the elements of the hydrological cycle that are likely to have impacts on the project and the possible impacts that the project could have on the hydrological regime. Field assessments included a determination and verification of all the existing inflows into the drain, an assessment of drainage issues, and interviews with local community members.

Air Quality

Ambient air quality measurements are essential to describe the existing conditions, to provide a baseline against which changes can be measured, and to assist in the determination of potential impacts of the proposed construction on air quality conditions. To monitor ambient air quality, Carbon Monoxide (CO), oxides of Sulphur (SOx), oxides of Nitrogen (NOx), Particulate Matter (PM_{10} & $PM_{2.5}$), and Suspended Particulate Matter (SPM) have been included for ambient air quality monitoring.

Noise

The noise monitoring was performed by a trained specialist, using a calibrated Sound Level Meter set to A-weighting, fast response, and statistical analysis settings. The Sound Level Meter (AS804) was held in a position facing the direction of the apparent predominant noise source. The AS804 was programmed to record statistical noise levels for 15 minutes at each location and was calibrated before and after the survey where no significant drift was detected.

Ground /Drinking Water Quality

Sampling and analysis of ground/drinking water have been carried out for the following parameters: Temperature, pH, Chloride (Cl^-), Total Dissolved Solids (TDS), Iron (Fe), Arsenic (As), and Alkalinity, Dissolved Oxygen (DO), Electronic Conductivity (EC).

Surface Water Quality

Sampling and analysis of surface water quality have been carried out for the following parameters: Temperature, pH, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Chloride (Cl^-), Nitrogen (Ammonia), Chemical Oxygen Demand (COD), Biological Oxygen Demand (COD).

1.4.3.2 Biological Environment

The status of the flora and fauna of the project area was determined by an ecological survey, a review of literature relevant to the area, and an assessment of the terrestrial environment.

Flora

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of the stage of growth (mature or sapling), and assessment of canopy cover.

Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

A map showing the sampling locations taken during the visit is shown below in Figure 2.

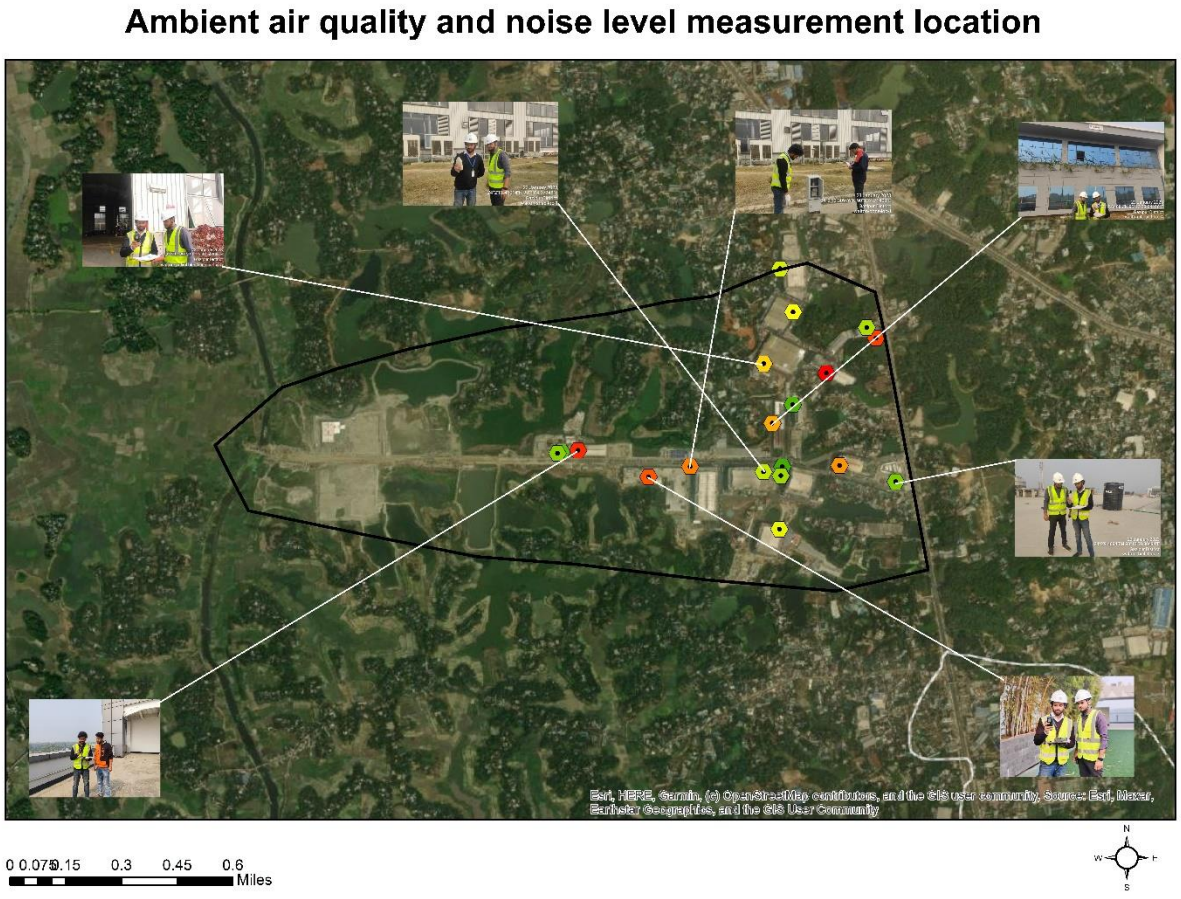


Figure 2: Map Showing the Sampling Location

1.4.3.3 Socio-Cultural Environment

The Consultants utilized a combination of desk research, field investigations, census data, structured interviews, maps, and reports to generate the data required for the description of the existing social environment and assessment of the potential impacts due to the construction of the project. Data was collected on the following aspects given below.

- Land Use
- Transportation and Access Roads
- Demographics
- Livelihoods
- Education
- Health
- Community Facilities
- Recreational Activities
- Archaeological and Cultural Heritage

Public Consultation

Public consultation is an important component of ESIA preparation activities. Local knowledge about the ecosystem and problems associated with the project activities were carefully recorded and used in impact assessment and developing a mitigation plan. Formal public consultation, in tandem with opportunistic informal ones involving local villagers, and people whose livelihood depends on these project areas were executed. A detailed description of public consultation has been presented in Chapter 10.

1.5 ESIA Team

The report has been prepared by a multidisciplinary team of ESIA experts who have experience in conducting Environmental and Social Impact Assessments of medium and large-scale industrial projects. The name of the professionals involved in the study is listed below:

Table 1: ESIA Team Members and Responsibilities

SL	Name	Educational Qualification	Role
1	**Engr. Syed Tasnem Mahmood**	B.Sc. and M.Sc. in Civil and Environmental Engineering, Shahjalal University of Science and Technology, Bangladesh	Team Leader
2	**Anam Ekram**	MS in Environmental Science, JU BSc in Environmental Science, IUB	Environmental Expert
3	**Engr. Fayez Ahammad**	B.Sc. in Civil and Environmental Engineering, Shahjalal University of Science and Technology, Bangladesh	Environmental Expert
4	**Engr. Taufique Tuhin**	B.Sc. in Civil and Environmental Engineering, Shahjalal University of Science and Technology, Bangladesh	Social Expert

Chapter Two: Project Description

2.1 Project Location & Design

Installation of 30 MW Solar On-Grid PV system at Walton Hi-Tech Industries PLC Chandra, Kaliakoir, Gazipur, Bangladesh. The project is connected to the Nabinagar-Chandra Highway Road (R 505)



Figure 3: Project Location

The coordinate of the project site is 24° 2'29.62"N and 90°14'22.41"E. The access route to the project from the Hazrat Shahjalal International Airport, Dhaka is quite easy. It is directly connected to the highway. The proposed project is surrounded by industries areas on its north, south, east and south sides. The access route map, project location map, and satellite map are shown in Figures 4, 5, and 6 respectively.

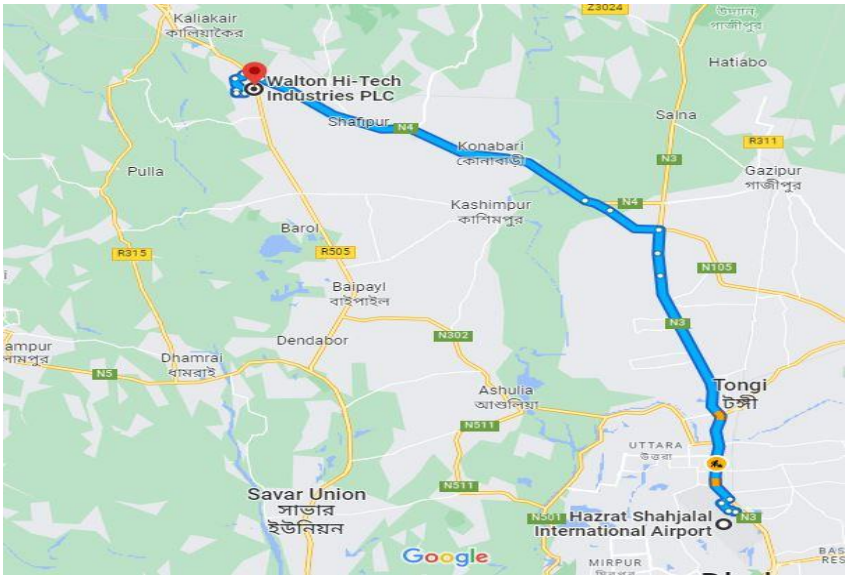


Figure 4: Access Route to the Project Area

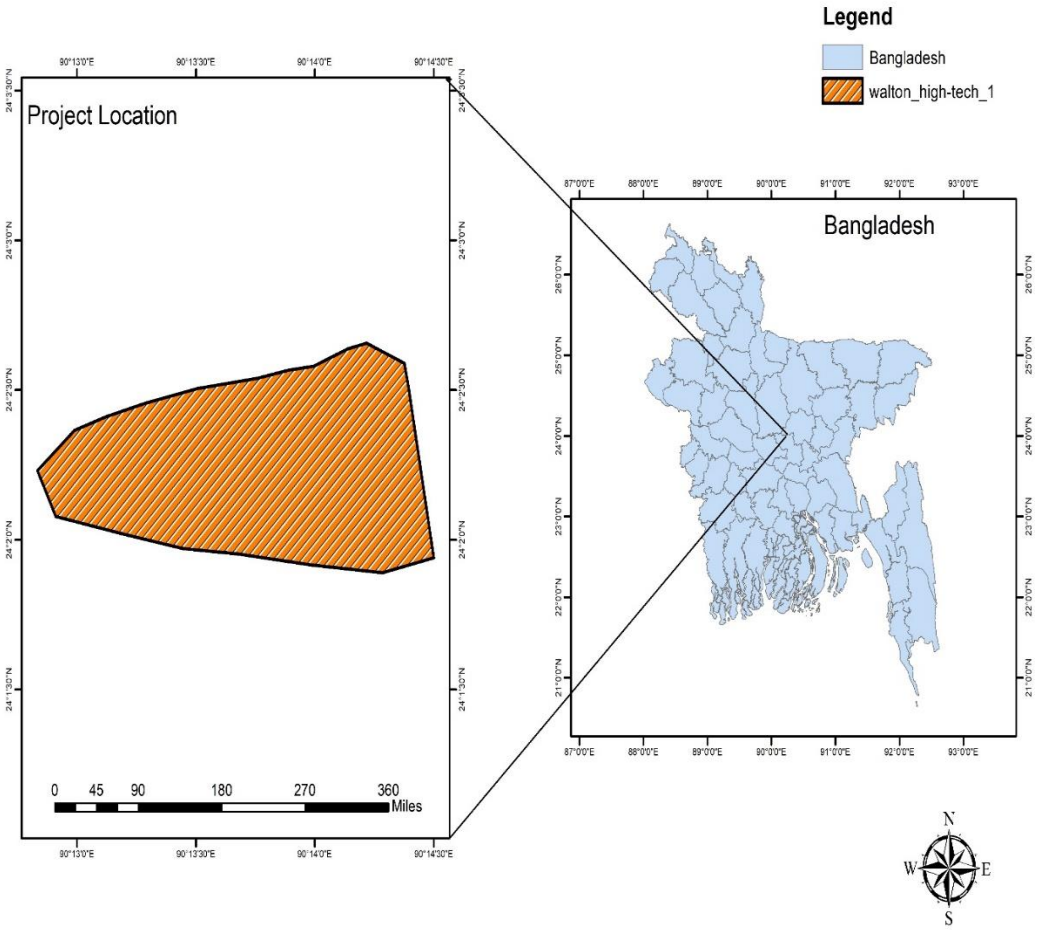


Figure 5: Image of Proposed Project Location



Figure 6: Satellite Image of Proposed Project Location

The total capacity of this new extended project is proposed to be 30 MW which will be completed in 24 different phases. Two types of inverters are considered for the project from Huawei and SMA. A total of 5340 nos of solar panels will be installed at Shed-01 and Shed-02 with a total power of 2.9103MW each. In Building-01 there will be 261pcs of PV modules, 1 pc Inverter with a capacity of 110KW and the total plant capacity will be 148.770KWp.

Similarly, for Dye Casting Shed-02, 5880pcs of Solar panels will be used with a total power of 3.2046MW. Various numbers of PV modules, Solar panels will be used in various sheds with different Power generation capacity which are shown in the figures 7-12.

The DC power produced by PV modules will be fed into the grid-connected inverter. In the grid-connected inverters, the DC will be converted into AC. The output of the AC side of the inverter will be connected to the grid voltage. A set of monitoring systems is planned to be used in this project, including inverter systems and combiner boxes, PV modules, low-voltage power distribution equipment, and DC systems. The monitoring system with remote capability can be sent real-time data and information to superior dispatch centers according to the requirements of the power grid.

2.2 Design Consideration

The design for the proposed solar project has been considered in place of the climatic aspects, solar radiation, and wind directions. The total space available has also an impact on the design considered for the proposed layout and PV modules. The proposed project will be installed in 24 phases having different plant capacities.

The installation phases of the project is given in the table below.

Table 2: Installation Phases of the Project

SL	Building/Shed	Area (Sft)	Plant Capacity in MW (approx.)	Phase-wise Plant Capacity (MW)	Tentative Completion Timeline
1	Shed-10 Block-B	202850.64	2.16	7.33	2022
2	Shed-10 Block-B (Remain 2 Shed)	158475.36	1.85		
3	Footpath Solar Shed	63000	1.1216		
4	Floating House Rosulpur Pond	1372	0.0159		
5	Building-01 Block-B	51525	0.68		
6	Shed-6_Extentsion_Block-A	45178	0.47		
7	Building-03_Block-B	63152	0.88835		
8	Others (Polyul Bending Shed, Finished Goods Ware House Shed & Others)	12206	0.14		
9	Glass Project	246770	3.41	10.22	2023
10	Dye Casting Shed	246692	2.84		
11	Building-02_Block-B	67949	0.91		
12	Building-04_Block-B	87889	1.16		
13	Building-05_Block-B	73948	0.95		
14	Building-07_Block-B	106221	0.95		
15	Building-08_Block-B	78448	0.96	12.25	2024
16	Building-08 Extension Block-B	36380.84	0.43		

SL	Building/Shed	Area (Sft)	Plant Capacity in MW (approx.)	Phase-wise Plant Capacity (MW)	Tentative Completion Timeline
17	Oxygen Plant	5775	0.08		
18	Shed-05_Block-A	116052	0.95		
19	Shed-06_Block-A	64254	0.52		
20	Dye Casting Shed-02	246692	2.84		
21	Raw Material Shed (East Side Of Styrofoam Shed)	63789	0.75		
22	Block Cutting Shed	3517	0.03		
23	Assembly Line Shed-01	221924	2.84		
24	Assembly Line Shed-02	221924	2.84		
Total Capacity In MW (Approx.)			**29.80**	**29.80**	

Currently WHTI is approaching 3.3 MWp of the Solar Rooftop Project. A short description of this 3.3 MWp installation has been given below:

15.92 KWp will be installed on the rooftop of Rasulpur Pond Floating House. Here 35 pcs of PV panels, DC Fuse is 32A and one inverter of 50 KW, AC have been used. 1112.93 KWp Ground Mounted will be installed on the Footpath Solar Plant. Here total 2765 pcs of PV panels, 32A DC Fuse and total no. of 10 inverters (50 KW for 3 inverters and 110KW for 7 inverters), have been used. On the rooftop of Shed-6 extension Block-A 584.785 KWp will be installed. Here, total 1073 pcs of PV Panels, total no. of 4 inverters of 100 KW, and 32A DC Fuse have been used. On the rooftop of Shed-6 Block-A 540.64 KWp will be installed. Here, total 992 pcs of PV Panels, total no. of 5 inverters of 100 KW and 60 KW and 32A DC Fuse have been used .On the rooftop of Shed-12 Die Casting Shed 345.53 KWp will be installed. Here, total 634 pcs of PV Panels, total no. of 3 inverters of 110 KW and 50 KW, and 60 KW and 32A DC Fuse have been used .On the rooftop of Steel Building 700.87 KWp will be installed. Here, total 1286 pcs of PV Panels, total no. of 5 inverters of 110 KW, and 32A DC Fuse have been used.

The layout plans are shown below from figure- 7-12.

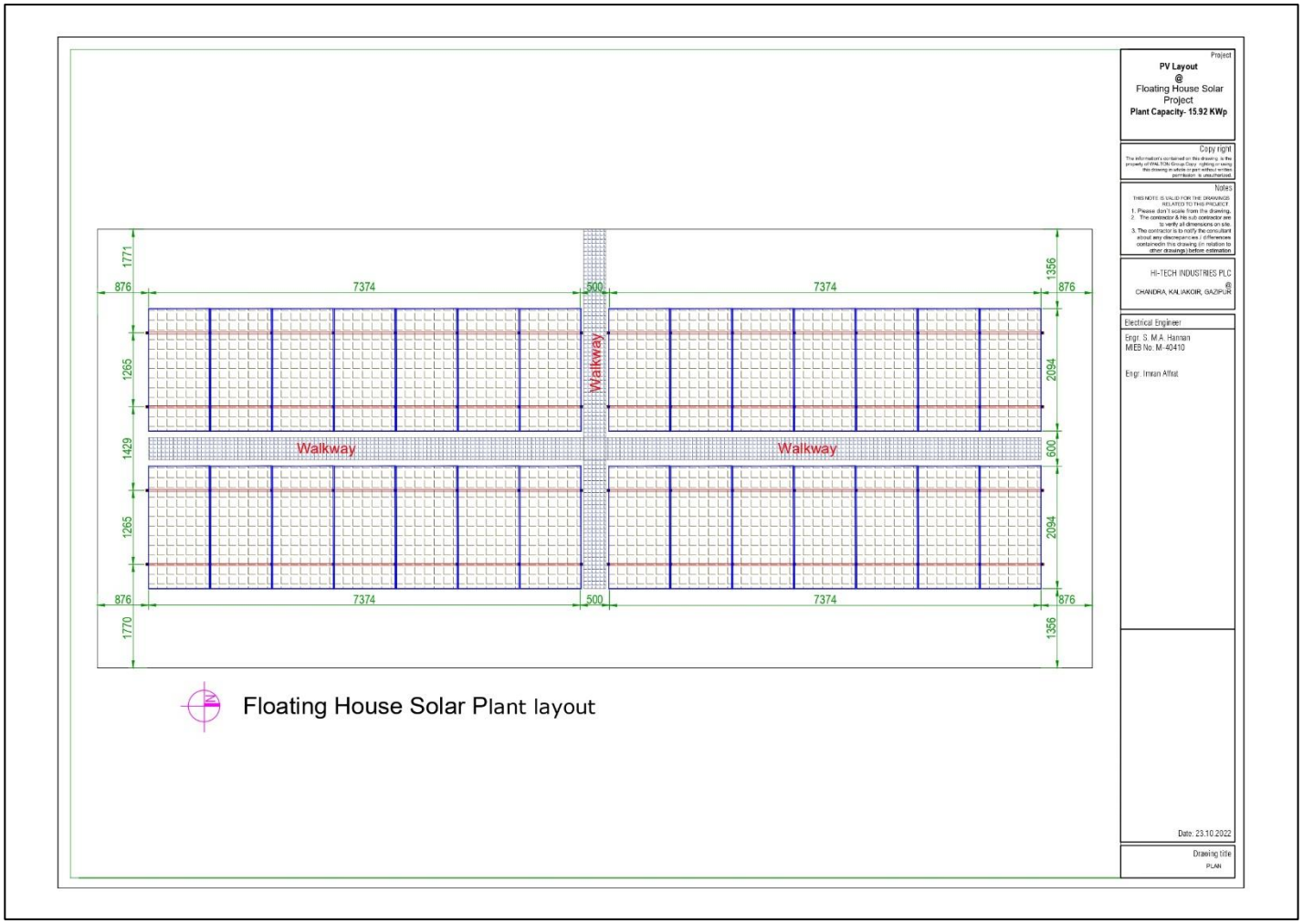


Figure 7: Panel Layout Plan of Floating House

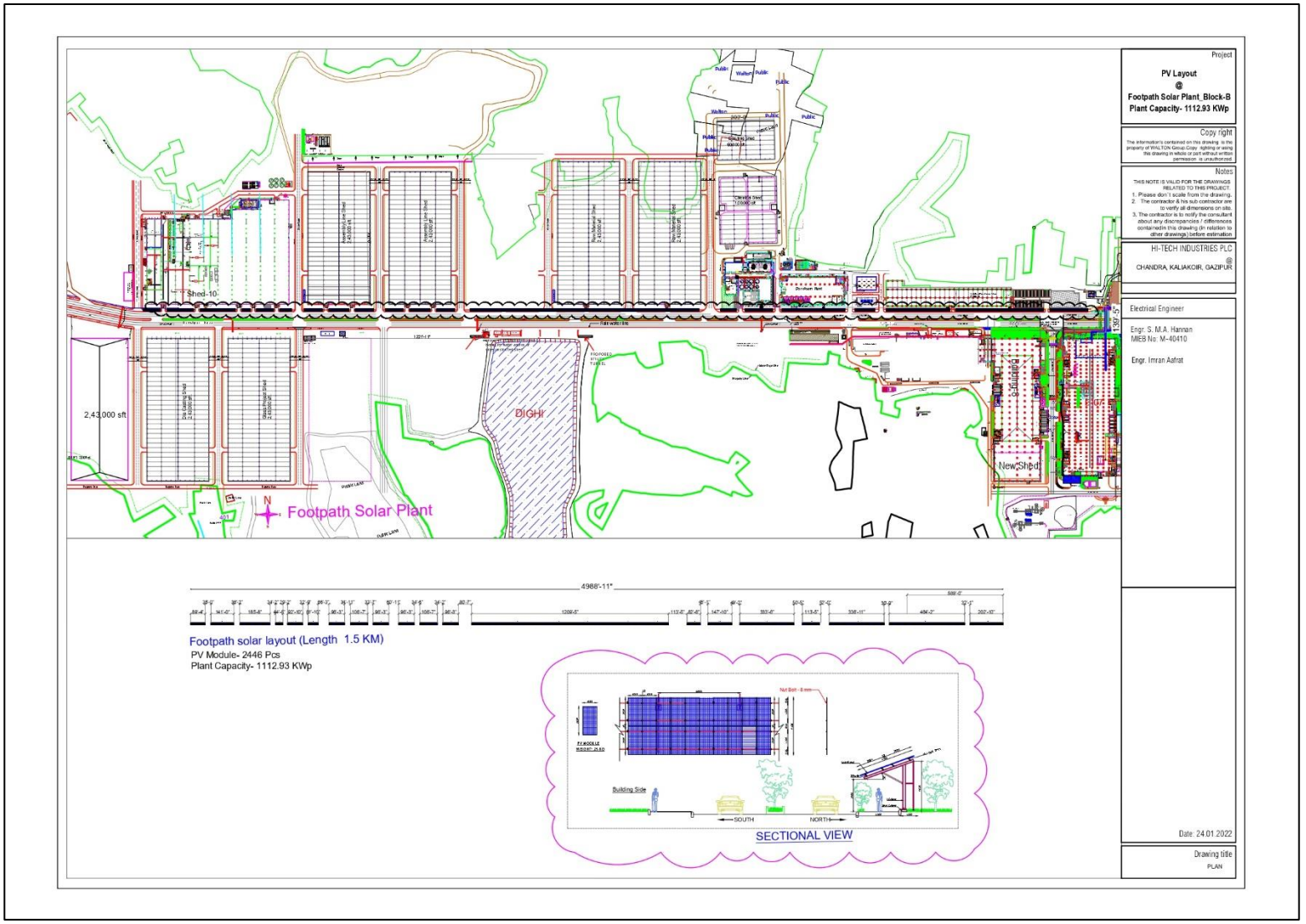


Figure 8: Panel Layout Plan of Footpath Solar Plant

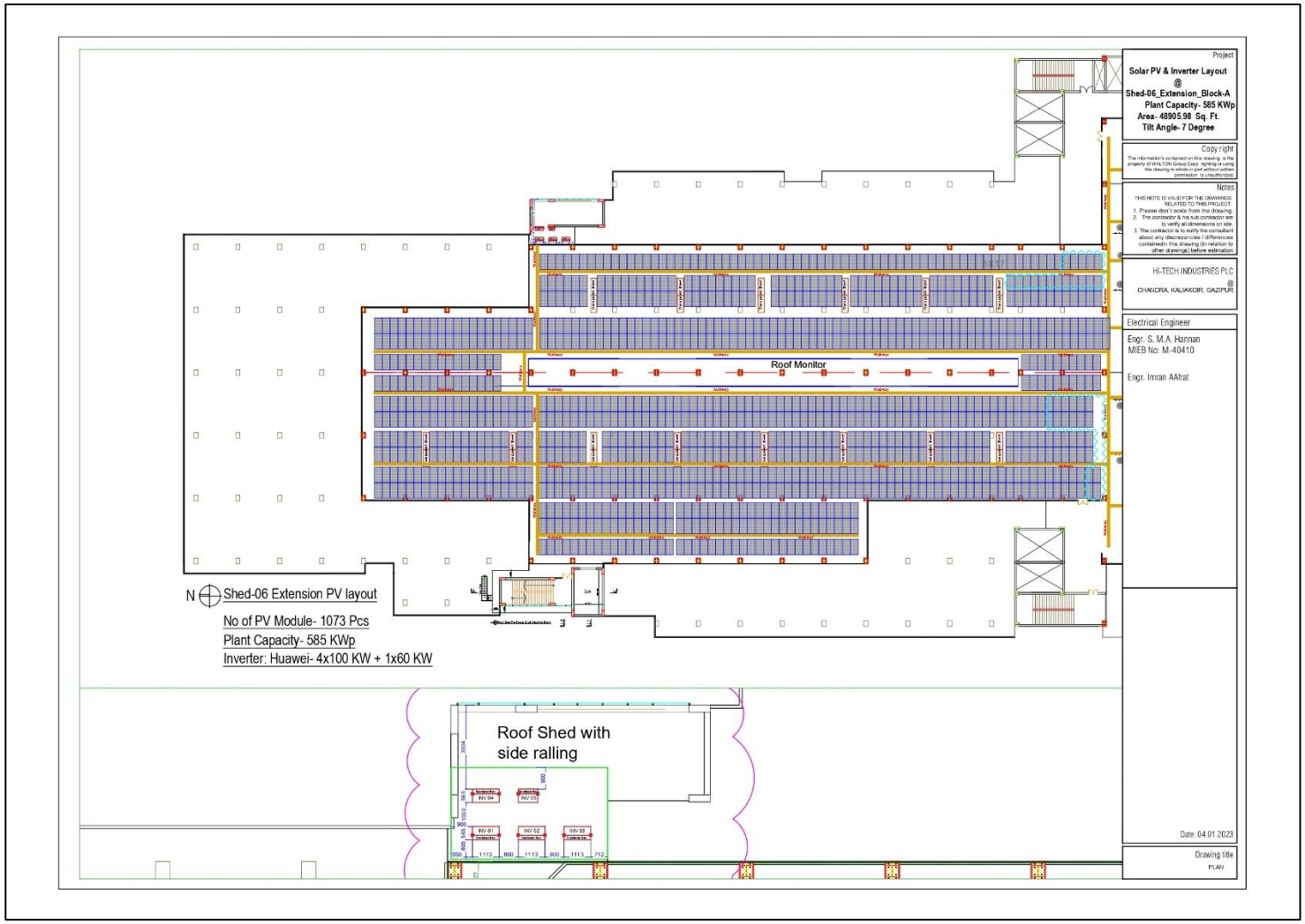


Figure 9: PV Layout Plan of Shed-06 Extension

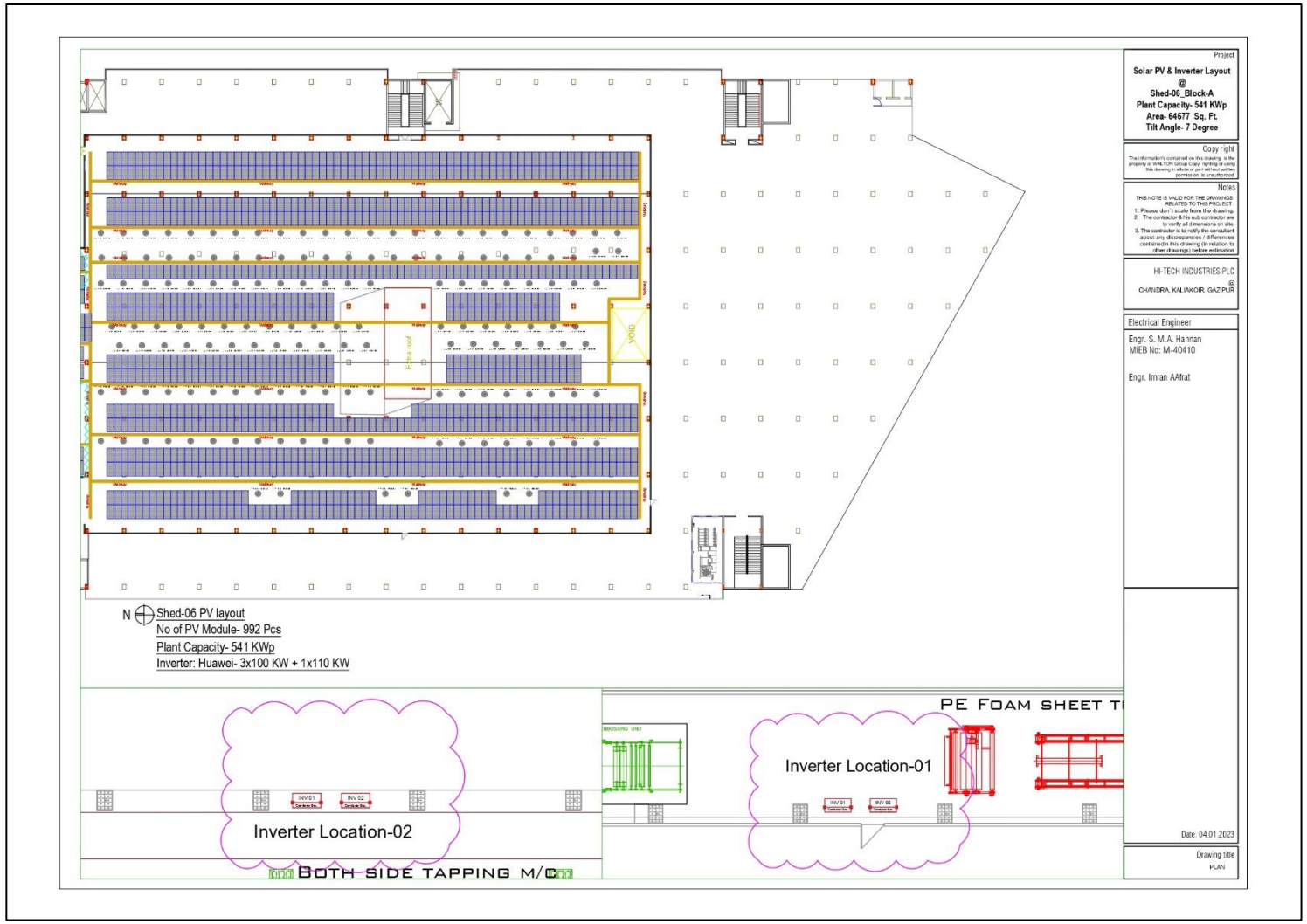


Figure 10: PV Layout Plan of Shed-06

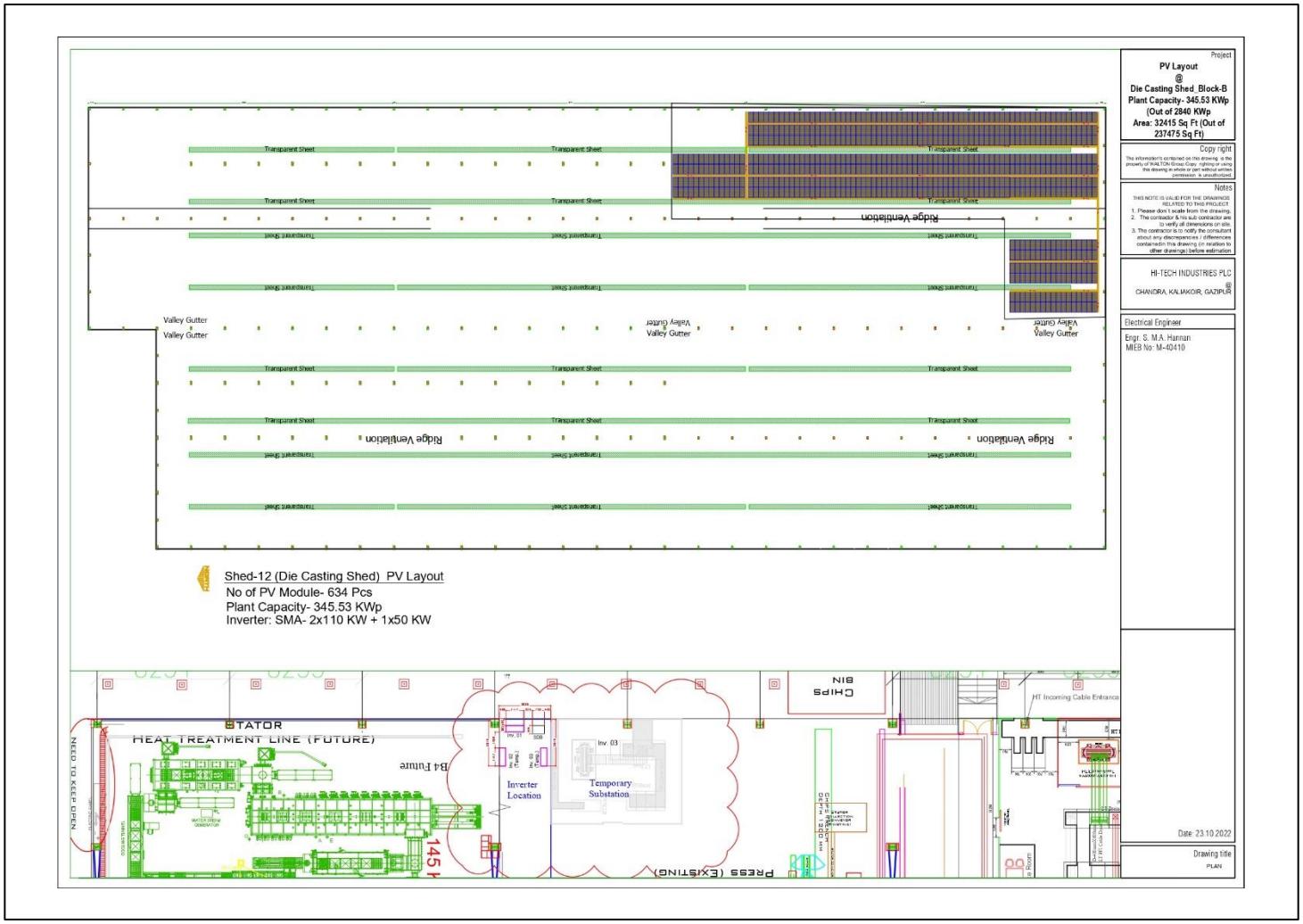


Figure 11: PV Layout Plan of (Die Casting) Shed-12

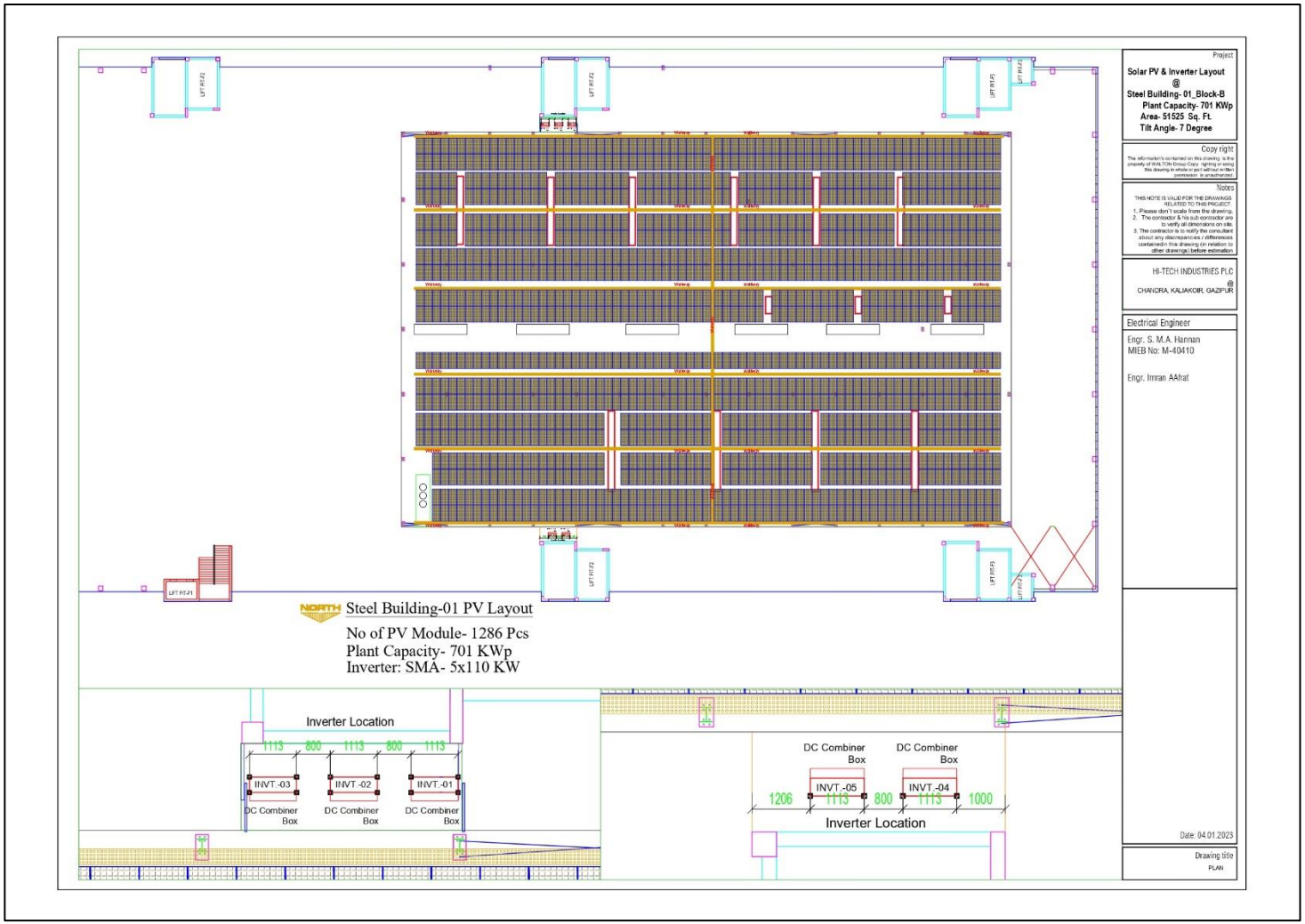


Figure 12: PV Layout Plan of Steel Building-01

2.3 Civil Works

The civil works for the project in Kaliakoir Upazila, Gazipur involve various aspects such as preliminary tasks, surveys, excavation, foundations, structures and buildings, roadways, drainage systems, and sewage systems. The design of all structures and buildings takes into account factors like load components, wind load, seismic activity, temperature effects, deflection, and stress limits. The structures are designed to withstand a minimum wind speed of 45m/s.The project site is located in seismic zone 2 with moderate seismic intensity, the foundations of the PV modules and site infrastructure have been designed in accordance with earthquake-resistant also considering the soil structure and seismic value. The drainage system is designed to divert surface runoff and roof drainage away from the equipment and buildings through open-flow piping, manholes, area drains, a catch basin, and a detention pond.The PV modules are mounted on foundations using driven piles, with the lower side of the modules installed at a minimum height of 1.2m above ground level. The PV modules on the ground are inclined at an optimum tilt for maximizing energy production, while those on the roofs have a tilt of 7° parallel to the roofs to utilize the roof area effectively.

The scope of civil works includes preliminaries, additional survey, excavation, foundations, all structures and buildings, entrance road, internal roads, plant and site drainage, sewage system, and so on.

All structures and their parts are designed to be capable of withstanding the worst practicable components of loads, wind load, seismic, sideways, and temperature effects, deflection, and stress limits. All structures are designed to withstand a minimum wind speed of 45m/s. What is more, the dimensions of all buildings can provide adequate space for the safe installation and proper operation and maintenance of all plants and equipment. The design does take into account the function of the solar project and the local environment.

The project is located within the Kaliakoir Upazila, Gazipur whereas the seismic zoning map indicates that the project site is located in seismic zone 2 where moderate seismic intensity could be expected. The project should incorporate earthquake-resilient designs into the foundations of the PV modules and site infrastructure. The structure and foundation design have taken into account the soil conditions and the seismic value as proposed above.

The drainage system conveys surface runoff and roof drainage away from the equipment and buildings. The drainage system includes open-flow piping, manholes, area drains, a catch basin, and a detention pond.

As to the PV foundation and bracket, the lower side of solar modules is designed to be installed at a min. height of 1.2m above ground level. The type of foundation is driven piles. The mounting structure is fixed mounted, not a tracking system, and can withstand all environmental loads, such as earthquakes, wind, etc. All the structures are made of aluminum and steel. Moreover, all steel sections, bolts, and washers are to be following the recognized authoritative standards. The steel structure will be galvanized steel with a protected zinc coating of 80 microns' thickness for mounting structure. What is needed to emphasize is that the types of brackets on the ground and the roof are very different. The PV modules laid on the ground

are inclined at an optimum tilt to maximize energy production. However, those modules on the roofs have only a tilt of 7°, which are parallel to the roofs. The reason is to make full use of the area of the roofs.

2.4 Project Schedule and Cost Estimation

The construction activity of the proposed project is expected to commence at 2022 and is expected to be finished and handed over to the proponent by 2025 based on the current scenario.

2.5 Decommissioning

Before a project is built, developers create a plan for removing equipment and restoring landowners' property to a useful condition similar to preconstruction conditions when the project is no longer operational. This process is called decommissioning.

In general, solar projects receive approval for construction and operate between thirty and forty years. Upon completion of the economic life of a project or, potentially permit expiration, the project owner will determine whether to apply for a new permit or remove the facility. Solar panels can operate past thirty years - albeit at lower efficiency – the owner can keep the panels, or "repower" the site by upgrading the panels with more efficient solar technology. Otherwise, the project owner can decommission the facility.

Unlike some other forms of development, a decommissioned solar project site can be repurposed for other uses, such as agricultural production. Often solar project permits define how a solar project is to be decommissioned.

Chapter Three: Legacy and Policy Framework

The emerging environmental scenario calls for attention to conservation and judicious use of natural resources. There is a need to integrate the environmental consequences of development activities and for planning suitable measures to ensure sustainable development. Environmental considerations in any developmental process have become necessary for achieving sustainable development. To achieve such goals, the basic principles to be adopted are:

- To enhance the quality of the environment in and around the project area by adopting proper measures for the conservation of natural resources;
- Prevention of adverse environmental and social impact to the maximum possible extent;
- To mitigate the possible adverse environmental and socio-economic impact on the project-affected areas.

3.1 Applicable Policies

3.1.1 National Policies

The government of Bangladesh has developed a policy framework that requires environmental issues to be incorporated into economic development planning. The key tenets of the various applicable policies are detailed in the following subsections:

3.1.1.1 Environment Conservation Act 1995 (subsequent amendments in 2000 and 2002)

The provisions of the Act authorize the Director General of the Department of Environment (DOE) to undertake any activity that is deemed fit and necessary to conserve and enhance the quality of the environment and to control, prevent and mitigate the pollution. The main highlights of the act are:

- Declaration of Ecologically Critical Areas;
- Obtaining Environmental Clearance Certificate;
- Regulation concerning vehicles emitting smoke harmful to the environment;
- Regulation of development activities from an environmental perspective;
- Promulgation of standards for quality of air, water, noise, and soils for different areas and different purposes;
- Promulgation of acceptable limits for discharging and emitting waste; and
- Formulation of environmental guidelines relating to the control and mitigation of environmental pollution, conservation, and improvement of the environment.

3.1.1.2 Environment Conservation Rules, 2023

The Environment Conservation Rules was updated lastly in 2023 subsequently.

In accordance with section 20 of The Bangladesh Environment Conservation of Act Search for Legal Articles No. 1 of 1995, the Government in March, 2023 passed the Bangladesh

Environment Conservation Rules, 2023. This Article discussed various important provision of the Regulation.

Rule -3 Application and Remedies for Environmental Pollution or Degradation Damages Remedies

Sub-section (1) of Section 8 of the Act requires the Director-General to dispose of an application within 30 working days by means of public hearing. The Director General may extend the application period by 15 working days, if necessary, by stating the reason.

Rule-4 Notice for Collection of Samples

According to the provisions of Section 11 of the Act, if an officer authorized by the Director General wants to take samples of air, water, soil or other substances for the purpose of analysis, the owner, occupier or agent of the factory, premises or place concerned shall give a notice in accordance with Form-2.

Rule 5 Classification of Industrial Institutions and Projects for the purpose of issuing environmental and location clearance certificate

Industrial projects and units must be classified based on their activities, pollution, and potential harm to the environment and health. The categories are:

- Green
- Yellow
- Orange
- Red

Obligation to obtain Location Clearance and Environmental Clearance Certificate

Before instituting new yellow, orange and red industries mentioned in rule 5 and taking up the project, first the location clearance and then the Environmental Clearance Certificate should be obtained from the Director.

- For green categories industrial unit Environmental Clearance Certificate must be obtained from the director.

- In the case of all categories of industrial unit or projects set up in government or private export processing zones, economic zones or industrial cities of Bangladesh Small and Cottage Industries Corporation, it is not necessary to take location clearance certificate, only Environmental Clearance Certificate should be taken from the Director.

- Without taking Location Clearance Certificate no development of land or construction of any infrastructure for this purpose shall be allowed for the establishment of an industrial unit of the yellow, orange and red categories.

- Gas, electricity, water, or other essential services cannot be provided to new industries, institutions or projects of yellow, orange and red categories without obtaining Location Clearance Certificate.

- New industrial Units of green, yellow and red categories will not be allowed to conduct trial production or launch projects without obtaining Environmental Clearance Certificate.

Application procedure for Location clearance and Environmental Clearance Certificate

Application should be submitted to the district office, if there is no district office the application should be submitted to the office or departmental office without jurisdiction. In metropolitan area an application should be submitted to metropolitan office. Application must be submitted to district office if there is no separate office for metropolitan area. Application should be submitted to regional office or divisional office if multiple districts under the same division. If the same category is widespread, the application should be submitted to the head office of the department.

Procedure for issuance of Environmental Clearance and Location Clearance Certificate

Procedure for issuance of environmental clearance certificate to green class industrial units and projects- green categories industrial units or project entrepreneurs should fill in the applicable sections as per Form 3 schedule 7 for obtaining environmental clearance certificate. Rule 10 and 11 Procedure to provide projects and industrial units in the yellow category with location clearance certificates as per Form 3 schedule 6. After obtaining the location clearance certificate, yellow class related industrial units or project entrepreneurs should apply for environmental clearance certificate. Rule 12 and 13 for granting Location Clearance Certificate to orange category industrial units and projects- The project entrepreneurs and industrial unit should fill in the applicable sections as per Form 3 schedule 6 and guideline of schedule-9 shall be followed. Within 21 (twenty-one) working days of the application submission, the applicant should receive the Location Clearance Certificate. Provided that if the application is rejected, the concerned applicant shall be notified in writing and the reasons for it within 5 (five) working days of the decision. For granting Environmental clearance certificate to orange category industrial units and projects. The project entrepreneurs and industrial units according to rule-7 should apply to the concerned office of the director.

Within 20 (twenty-one) working days of the application's submission, the applicant should receive the Environmental Clearance Certificate. Provided that if the application is rejected, the concerned applicant shall be notified in writing and the reasons for it within 5 (five) working days of the decision. Rule14 Procedure for granting location clearance certificate to red category industrial units and projects should fill the Form 3 schedule 6 and guideline of schedule-9 shall be followed. Provided, however, that any additional information or documents required may be provided to the applicant for submission within a maximum of 7 (seven) working days. Also provided that, if the application is rejected, the concerned applicant shall

be notified in writing and the reasons for it within maximum 7 (seven) working days of the decision.

Validity period of Location Clearance and Environmental Clearance Certificate-
The period of Environmental Clearance Certificate for green category industrial units or projects shall be 5 (five) years from the date of issue which shall be renewable at 5 (five) year intervals. Yellow Category industrial unit or project Location Clearance Certificate or Environmental Clearance Certificate shall be valid for 2 (two) years from the date of issue which shall be renewable at 2 (two) year intervals. Orange and red Category Industrial units or Project Location Clearance or Environmental Clearance Certificate shall be valid for 1 (one) year from the date of issue which shall be renewable at 1 (one) year intervals. According to Rule-21 and 22 all categories of industrial unit or projects will expire after 30 (thirty) days. For renewal, the concerned industrial unit or project entrepreneurs should apply to the relevant office according to rule 7 by filling Form-4 and paying the fee mentioned in Schedule-7 for renewal of the location clearance certificate and form-5 schedule-7 for renewal of Environmental Clearance Certificate to the concerned industrial unit or project entrepreneur.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition, the number of surrogate pollution parameters like Biochemical Oxygen Demand, Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of wastewater/solid waste. Additionally, specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium, etc. Air emission quality standards refer mostly to the concentration of mass emission of various types of particulates, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances. The Bangladesh standards in general are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period. There is no provision for partial compliance too.

The Bangladesh standards are not for any specific period. There is no provision for partial compliance too. According to the Gazette on Environmental Conservation Rules 2023 under the Ministry of Environment and Forest, Government of the Peoples Republic of Bangladesh, 30 MWp Rooftop Solar System Project which is greater than 1 MW and it is considered as **"Yellow Category".**

3.1.1.3 Renewable Energy Policy of Bangladesh, 2008

The renewable energy policy of Bangladesh has been approved on December 18, 2008, with the target of developing renewable energy resources. This Policy laid out the target of meeting 5% of total power demand from renewable energy sources by 2015 and 10% by 2020. The policy provides an overall guidance of -

- ❖ institutional arrangements
- ❖ resource, technology, and program development

- ❖ investment and fiscal incentives
- ❖ regulatory policy

The policy promotes the appropriate, efficient, and environmentally friendly use of renewable energy. It also suggests that for large biomass electricity projects (i.e., greater than 1 MW) the project developer must demonstrate that the biomass is being sustainably harvested and that no adverse social impact will result from that development. It also restricted the larger-scale production and use of biofuels, which may jeopardize the existing crops.

The proposed project is a 30 MW project that is greater than 1 MW. Therefore, according to the above policy, the project developer should make sure no adverse environmental and social impact would result from the development works.

3.1.1.4 Guidelines for the Implementation of Solar Power Development Program, 2013

It is mentioned in section 3.8 of the guidelines for the implementation of the Solar Power Development Program (2013) that according to the Renewable Energy Policy, to establish a solar mini-grid project with a capacity of up to 5 MW, the entrepreneur will be exempted to get a waiver certificate. Mini-grid projects with a capacity of up to 250 kW will not be required any waiver certificate/license, but the entrepreneur will have to inform the Commission by sending a letter. For the implementation and operation of solar mini-grid projects, a license for a period of a minimum of 20 years may be issued with a condition to renew every year.

3.1.1.5 Bangladesh Labor Law, 2006

This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. In chapter VI of this law safety precautions regarding explosive or inflammable dust/ gas, protection of eyes, protection against fire, works with cranes and other lifting machinery, and lifting of excessive weights are described. And in Chapter VIII, provision safety measures like as appliances of first aid, maintenance of safety record books, rooms for children, housing facilities, medical care, group insurance, etc. are illustrated.

According to this law, the project proponent should provide proper PPE for the workers as well as should ensure their housing facilities, medical care, etc.

3.1.2 International Policies

3.1.2.1 Rio Declaration

The "Rio Declaration" and "Agenda 21" global action plans for sustainable development were adopted at the UNCED in 1992. In accordance with Principle 4 of the Rio Declaration of 1992, which Bangladesh and 178 other nations have signed, "environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

3.1.2.2 Convention on Biological Diversity, 1992

The 1992 Rio de Janeiro Convention on Biological Diversity was adopted and entered into force on June 5, 1992. It entered into force on December 29, 1993. Bangladesh ratified the Convention on 20 March 1994. The Parties to the Convention undertake to:

• Introduction of appropriate procedures requiring environmental impact assessment;

Proposed projects expected to have significant negative impacts on biodiversity

Avoid or minimize such impacts and allow public participation where appropriate such procedure and

• Take appropriate precautions to ensure that environmental impacts are avoided.

Programs or actions that may have significant negative impacts on biodiversity good consideration.

Contracting Parties Obliged to Conduct Environmental Impact Assessments

Projects that may have significant adverse impacts on biodiversity (Article 4)

3.1.2.3 Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar, 1971

This treaty is also known as the Ramsar Convention. Adopted and entered into force on February 2, 1971. It entered into force on December 21, 1975. Bangladesh ratified this convention on her 20th April 2002. This will be a Framework for National Action and International Cooperation for the Conservation and Wise Use of wetlands and their resources. There are 127 Contracting Parties and 1,085 wetlands are designated as wetlands of international importance. This intergovernmental treaty provides the United States with a framework for international cooperation. Wetland habitat conservation. The contracting parties' obligations include the appointment of adding Wetlands to the List of Wetlands of International Importance, Considering Wetland aspects as part of land use planning, and the creation of nature reserves.

3.1.2.4 UNESCO World Heritage Convention

Convention for the Protection of World Cultural and Natural Heritage, Paris, 1972: The treaty has been ratified by 175 states. It defines and preserves World Heritage by creating a list of natural and cultural sites that should be preserved of outstanding value for all mankind. Of the total 730 sites, 144 natural sites, 23 mixed sites and 563 cultural sites are inscribed on the World Heritage List (distributed in 125 countries). These are the "crown jewels" of preservation.

3.1.3 Funding Agencies' Policies

3.1.3.1 World Bank's Guidelines on Environmental and Social Safeguards Policies

There are two types of safeguards requirements of the World Bank-environmental and social. Under these two safeguards, there are several operational policies. Among them, the following operational policies could have relevance to the proposed Project:

OP 4.01 Environmental Assessment

The Bank requires environmental assessment (EA) of projects proposed to ensure that they are environmentally sustainable, and thus to improve decision-making. EA is a process whose extent and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, sitting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and transboundary and global environmental aspects. The borrower is responsible for carrying out the EA and the Bank advises the bower on the Bank's EA requirements.

The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

Category A: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B: The proposed project's potential adverse environmental impacts on the human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases, mitigation measures can be designed more readily than Category A projects.

Category C: The proposed project is likely to have minimal or no adverse environmental impacts.

OP 4.04 on Natural Habitats

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank, therefore, supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats.

3.1.3.2 Environmental and Social Safeguards Framework (ESSF) of IDCOL

IDCOL has an updated Environmental and Social Safeguards Framework (ESSF), which

triggers ESMS for its solar rooftop projects, IDCOL has long and praiseworthy history of energy-based development financing. The Environmental and Social Management System (ESMS) is the system developed by IDCOL as an attempt to ensure continuity of its social and environmental commitments in the designing and implementation of its projects and programs. The ESMS focuses on rooftop solar projects in line with the environmental and social risks associated with those projects.

3.1.3.2.1 Environmental and Social Policy Statement of IDCOL

IDCOL has a mandate of financing the private sector for developing medium to large-scale infrastructure and renewable energy projects in Bangladesh. IDCOL recognizes the significance of environmental, health/ safety, and social considerations in infrastructure development and believes in sustainable development.
To achieve the above, IDCOL is committed to:

- Mainstream environmental, health/safety, and social (E&S) considerations in appraising and financing infrastructure projects to avoid/minimize adverse impacts and risks to the environment and people that may be affected;
- Ensure compliance with all relevant E&S policy and legislative requirements and laws of the lands with which it engages and remain responsive to the E&S requirements of international best practices;
- Avoid/minimize land acquisition and resettlement through the selection of appropriate locations and design of projects;
- Where the land acquisition is unavoidable, the compensatory replacement value of such acquired land/property will be paid before displacement or replaced with the land having equal value and quality together with other facilities such as housing and basic infrastructure facilities;
- Ensure protection of vulnerable groups, such as the economically and socially disadvantaged, women, children, physically handicapped, and ethnic communities, and take appropriate measures to restore their livelihood as relevant.

3.1.3.2.2 Principles on Environmental and Social Risks & Impacts Assessment and Management Procedures

Risks and impacts assessment and management is one of the prime principles of the ESMS.
The principal entails:

- To identify and evaluate environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment;
- To promote improved environmental and social performance of project sponsors through the effective use of management systems;
- To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately;
- To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that

relevant environmental and social information is disclosed and disseminated.

3.1.3.3 Strategy & Management of Environmental and Social Impact Assessment of KfW

The KfW Group sustainability mission statement sets high standards which oblige all those involved to act sustainably. An environmental and social impact assessment is an integral part of every appraisal of the projects we finance in developing and transition countries, as well as in export and project finance operations in countries outside of the EU and the Organization for Economic Cooperation and Development (OECD).

As a general rule, KfW bases the project assessment on the regulations that apply in the country in which the project is to be implemented. These regulations must be consistent with international environmental, social, health, safety, and labor standards. These include the standards set by the EU and leading OECD countries, the Performance Standards of the International Finance Corporation (IFC), and the Environmental, Health, and Safety (EHS) Guidelines of the World Bank Group. These standards are adhered to as regards the information provided to the general public and the involvement of the people directly impacted by the project, as well as when dealing with specific objections to projects. KfW is a signatory to the UNEP Statement by Financial Institutions on the Environment and Sustainable Development.

In terms of the operational implementation of projects, binding sustainability guidelines have been developed for all fields of activity. These guidelines define the specific requirements for the environmental and social impact assessments and set out the working processes to be applied when implementing them.

3.1.3.4 Environmental, Health & Safety Policy Of World Bank

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS Guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. The General EHS Guidelines are divided into four distinct sections and outlines below,

1) Environmental
1.1 Air Emissions and Ambient Air Quality
1.2 Energy Conservation
1.3 Wastewater and Ambient Water Quality
1.4 Water Conservation
1.5 Hazardous Materials Management
1.6 Waste Management
1.7 Noise
1.8 Contaminated Land
2) Occupational Health and Safety
2.1 General Facility Design and Operation

2.2 Communication and Training
2.3 Physical Hazards
2.4 Chemical Hazards
2.5 Biological Hazards
2.6 Radiological Hazards
2.7 Personal Protective Equipment (PPE)
2.8 Special Hazard Environments
2.9 Monitoring
3 Community Health and Safety
3.1 Water Quality and Availability
3.2 Structural Safety of Project Infrastructure
3.3 Life and Fire Safety (L&FS)
3.4 Traffic Safety
3.5 Transport of Hazardous Materials
3.6 Disease Prevention
3.7 Emergency Preparedness and Response
4 Construction and Decommissioning
4.1 Environment
4.2 Occupational Health and Safety
4.3 Community Health and Safety

3.2 Environmental Clearance Procedure

Bangladesh has a very simple administrative framework regarding the environmental aspects. It has a strong interface between the local government and the federal government. The Department of Environment is responsible for the granting of environmental clearance to a project. In addition, there are other ministries to deal with specific areas of importance to the country like Forests, Water.

According to Section 12 of the Environment Conservation Act, no project will be established or undertaken without obtaining permission, in the manner prescribed by the Environment Conservation Rules 2023, an Environmental Clearance Certificate from the Director-General. Therefore, every development project/industry is specified under Schedule 01 of the Environment Conservation Rules 2023 and requires obtaining a site and environmental clearance from the Department of Environment. According to Rule 5 (1) of the Environment Conservation Rules 2023; for issuance of an Environmental Clearance Certificate (ECC), every project, in consideration of its size and impact on the environment and will be classified into four categories, i.e., Green, Yellow, Orange and Red.

The proposed project is a rooftop solar project so it falls under the "**Yellow"** category as it is greater than 1 MW. Thus, ESIA study is required to be carried out for the project.

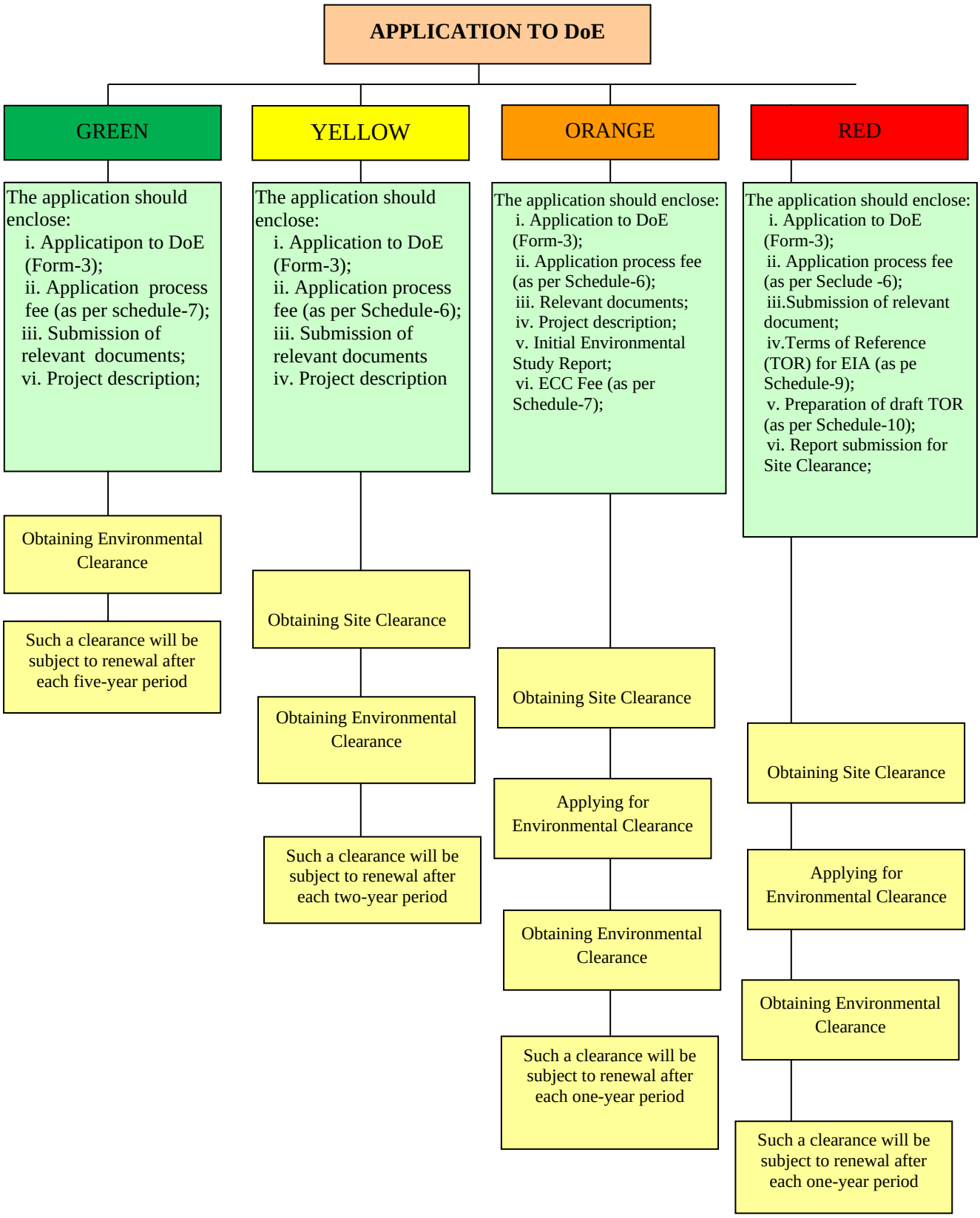
Formal EIA guidelines in Bangladesh are set out in "Rules and Regulations under the Environmental Protection Acts" as published in the official Gazette on 2023. Any proponent planning an industrial project is currently required under Paragraph 12 of the Environmental Protection Acts, 1995 to obtain an "environmental clearance letter:" from the Department of Environment.

The present ESIA study has been conducted for the proposed project complying with the requirement of the Department of Environment, Bangladesh, and applicable IFC/World Bank guidelines. Public consultation has also been conducted to discuss the environmental issues associated with the project.

The procedure for obtaining Environmental Clearance for the proposed solar project has been depicted below.

i. After receiving the Locational Clearance Certificate, the concerned entrepreneur will have to apply for Environmental Clearance Certificate according to form-(3) to run their project.
ii. For the consideration of the mentioned application in sub-rule-(1) the concerned entrepreneur will prepare a report to the concerned officer of the directorate with consistent justification and opinion.
iii. Within seven days of working, the concerned office of the Directorate will evaluate the submitted documents, and if it is satisfactory, the Environmental Clearance Certificate will be provided to the applicant or the application will be rejected mentioning the reasons to the concerned entrepreneur.

A schematic representation of the various steps involved in obtaining the Environment Clearance certificate from DoE, Bangladesh is given in the Figure below:


APPLICATION TO DoE
GREEN
YELLOW
ORANGE
RED
The application should enclose:
i. Applicatipon to DoE (Form-3);
ii. Application process fee (as per schedule-7);
iii. Submission of relevant documents;
vi. Project description;
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each five-year period
The application should enclose:
i. Application to DoE (Form-3);
ii. Application process fee (as per Schedule-6);
iii. Submission of relevant documents
iv. Project description
Obtaining Site Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each two-year period
The application should enclose:
i. Application to DoE (Form-3);
ii. Application process fee (as per Schedule-6);
iii. Relevant documents;
iv. Project description;
v. Initial Environmental Study Report;
vi. ECC Fee (as per Schedule-7);
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period
The application should enclose:
i. Application to DoE (Form-3);
ii. Application process fee (as per Seclude -6);
iii.Submission of relevant document;
iv.Terms of Reference (TOR) for EIA (as pe Schedule-9);
v. Preparation of draft TOR (as per Schedule-10);
vi. Report submission for Site Clearance;
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period

3.3 Recommended Standards

At present, there are environmental standards in operation in Bangladesh promulgated under the Environment Conservation Rules, 2023. There are standards for various water sources, ambient air, noise, odor, industrial effluent, emission discharges, vehicular emission, etc.

The Bangladesh standards intend to impose restrictions on the volume and concentration of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition, the number of surrogate pollution parameters like Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), etc. are specified in terms of concentration and/or total allowable quality discharged in case of wastewater/solid waste. Additional specific parameters depending on the manufacturing process, such as phenol, cyanide, copper, zinc, chromium, etc. Air emission quality standards refer mostly to the concentration of mass emission of various types of particulates, sulfur dioxide, oxides of nitrogen and in some cases volatile organic compounds and other substances.

The standards, which are commonly known as Environmental Quality Standards (EQS), have legal bindings. There is a separate schedule for industry-specific standards, other than the general industrial emission and effluent standards. This schedule covers a wide range of industries fertilizer, tannery, integrated textile, food, cement, etc.

Table 3: Bangladesh Standards for Ambient Air Quality

Parameters	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**CH_2O**	**NO_2**	**SO_2**	**CO**	**CO_2**	**O_3**
Air Pollution Control Rules 2022[1]	65 ($\mu g/m^3$)	150 ($\mu g/m^3$)	*NYS* ($\mu g/m^3$)	*NYS* (ppm)	80$\mu g/m^3$ (0.043 ppm)	80 $\mu g/m^3$ (0 0.031 ppm)	5mg/m^3 (4.36) ppm	*NYS* (ppm)	100 $\mu g/m^3$ (0.051) ppm

(1) Source: Schedule-1, Air Pollution Control Rules (Bangladesh Gazette, 22 July, 2022) (Own authentic translation from original Bengali).

(2) Note:

1. Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions and other government designated areas (if any).

2. Any industrial unit located not in a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.

3. Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

[1] DOE, "Air Pollution Control Rules'2022" Schedule-01, Department of Environment, Govt. of Bangladesh

Table 4: Bangladesh Standards for Noise

Sl. No.	Area Class[2]	Day (dBA)	Night (dBA)
a.	Silent area	50	40
b.	Residential area	55	45
c.	Mix area	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

Source: Noise Pollution Control Rules 2006 Schedule 05, Department of Environment.

Note:

a) Daytime start from 6.00 am morning and end at 9.00 pm night.
b) From night 9.00 pm to 6.00 am morning; identify as nighttime.

[2] Noise Pollution Control Rules 2006 Schedule 05, Department of Environment, Govt. of Bangladesh

Table 5: Standard for Inland Surface Water

SL.No	Way of Usage	Parameter											
		pH	**DO mg/L**	**BOD mg/L**	**NO_3^-N mg/L**	**NH_4^-N mg/L**	**PO_4^-P mg/L**	**Total Cr. mg/L**	**Pb mg/L**	**Hg mg/L**	**Total Coliform CFU/100ml**	**TDS mg/L**	**COD mg/ L**
1.	Source of Drinking water for supply only after disinfecting	6.5-8.5	≥6	≤ 2	7.0	0.1	0.1	0.02	0.03	0.001	≤100	1000	10
2.	Water usable for recreational activity	6.5-8.5	≥ 5	≤ 3	7.0	0.3	0.5	0.2	0.05	0.001	≤ 50	1000	10
3.	Source of drinking water for supply after conventional treatment	6-9	≥ 5	≤ 3	7.0	0.3	0.5	0.02	0.03	0.001	≤5000	1000	25
4.	Water usable by fisheries:	6-9	≥ 5	≤ 6	7.0	0.3	0.5	0.05	0.1	0.004	≤ 5000	1000	50
5.	Water usable by various process and cooling industries	6.5-8.5	≥ 1	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6.	Water usable for irrigation	6.5-8.5	-	≤ 12	5.0	1.5	2.0	0.1	0.1	0.002	≤ 50,000	1000	100

Source: Environmental Conservation Rule-2023, Schedule-31, Standards for inland surface water.

Note: Electrical Conductivity for Irrigation water -2250 µS/cm (at a temperature of 25° C: Sodium less than 26%: boron less than 0.2%).

Table 6: List of the Parameters to be tested for Groundwater

Sl. No.	Parameter
1	Fecal Coliform
2	Total Coliform
3	Free Residual Chorine
4	Nitrate ($NO3^-$)
5	Arsenic (As)
6	Turbidity
7	Aluminum (Al)
8	Ammonia (NH_3)
9	Barium (Ba)
10	Benzene (C_6H_6)
11	Boron (B)
12	Cadmium (Cd)
13	Calcium (Ca)
14	Chloride
15	Carbon tetra Chloride (CCl_4)
16	1,1 Dichloroethane (1,1 $C_2H_4C_{l2}$)
17	1,2 Dichloroethane (1,2 $C_2H_4C_{l2}$)
18	Tetrachloroethane ($C_2H_2C_{l4}$)
19	Trichloroethane ($C_2H_3C_{l3}$)
20	Pentachlorophenol
21	2,4,6 Tricholorphenol
22	Chloroform ($CHCl_3$)
23	Total Chromium (Total Cr)
24	Color
25	Copper (Cu)
26	Cyanide (CN)
27	Fluoride (F^-)
28	Hardness as CaCO3
29	Iron (Fe)
30	Total Kjeldahl Nitrogen
31	Lead (Pb)
32	Magnesium (Mg)
33	Manganese (Mn)
34	Mercury (Hg)
35	Nickel (Ni)
36	Nitrite (NO_2^-)
37	Odor
38	Oil & Grease
39	pH
40	Phenols
41	Potassium
42	Radioactive Materials Emitting Alpha Radiation
43	Overall beta variance
44	Selenium (Se)
45	Silver (Ag)
46	Sodium (Na)
47	Suspended Solids (SS)
48	Sulfide as H_2S

Sl. No.	Parameter
49	Sulfate (SO_4^{-2})
50	Total Dissolved Solids (TDS)
51	Temperature
52	Tin (Sn)
53	Zinc (Zn)
54	Aldrin/Dieldrin
55	Anionic detergents

Source: Schedule 02, Rule 31, ECR 2023

*Note: * sea costal area 1000 mg/L*

Chapter Four: Technical Aspects

4.1 Proposed Process & Technology

Solar energy gathered by photovoltaic solar panels, intended for delivery to a power grid is called a grid-connected photovoltaic system. Technically, power is produced from a PV panel in DC form, and that must be conditioned, or processed for use, by a grid-connected inverter. This inverter sits between the solar array and the grid, and draws energy from each, and maybe a large stand-alone unit or maybe a collection of small inverters, each physically attached to individual solar panels. The inverter must monitor grid network voltage, waveform, and frequency. One reason for monitoring is if the grid is dead or stays too far out of its nominal specifications, the inverter must not pass along any solar energy. An inverter connected to a malfunctioning power line will automatically disconnect following safety rules, for example, UL1741, which vary by jurisdiction. Another reason for the inverter monitoring the grid is that for normal operation the inverter must synchronize with the grid waveform, and produce a voltage slightly higher than the grid itself, for energy to smoothly flow outward from the solar array.

4.1.1 Electrical Design Basics

The total capacity of this new extended project is proposed to be 30 MW. It will be installed in different stage over period of time by 2024, now **WHTI** will install 3.3 MW. The total no. of PV panels is used 6785 and no. 28 inverters have used for this installation and the power of the inverters are 50KW, 110KW, 100KW, 60KW. The capacity of unit inverters varies as there will be two type of inverters used from 2 different companies- Huawei and SMA. To make the subsystem PV modules will be connected in series and then parallel. The DC power produced by PV modules will be fed into the grid-connected inverter. In the grid-connected inverters, the DC will be converted into AC. The output of the AC side of the inverter will be connected to the grid voltage.

A set of monitoring systems is planned to be used in this project, including inverter systems and combiner boxes, PV modules, low-voltage power distribution equipment, and DC systems. The monitoring system with remote capability can be sent real-time data and information to superior dispatch centers according to the requirements of the power grid.

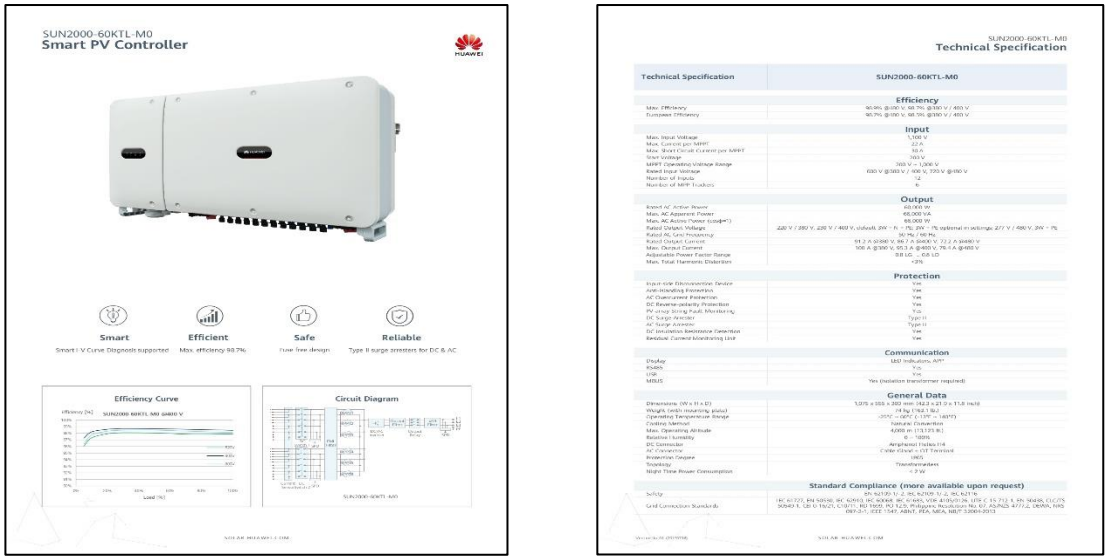


Figure 13:Inverter Specification used for the proposed project

Table 7*: Equipment List for proposed project*

SL No.	Equipment Name
1	AC Cable (Cu & Al)
2	Solar Cleaning Robot MR-G1
3	PV LR-5 Connecting system
4	H-1Z2Z2 K, Solar(UV) Cable 1x4 rm (mm2)
5	PM5310 meter, MODBUS
6	Inverter- 1. Huawei 2. SMA
7	Lightning Protection System (LPS)
8	Mounting Structure
9	Circuit Breaker
10	DC Fuse
11	SPD
12	Smart Logger 3000A
13	Roof Access Stairs
14	FRP Maintain Walkway
15	PVmetTM-200

Electrical Design for the proposed prooject consists of Single Line Diagram for solar plant, Lightning Protecttion System, Eathing System, and Water Lines for cleaning system showing in the figure-14-27.

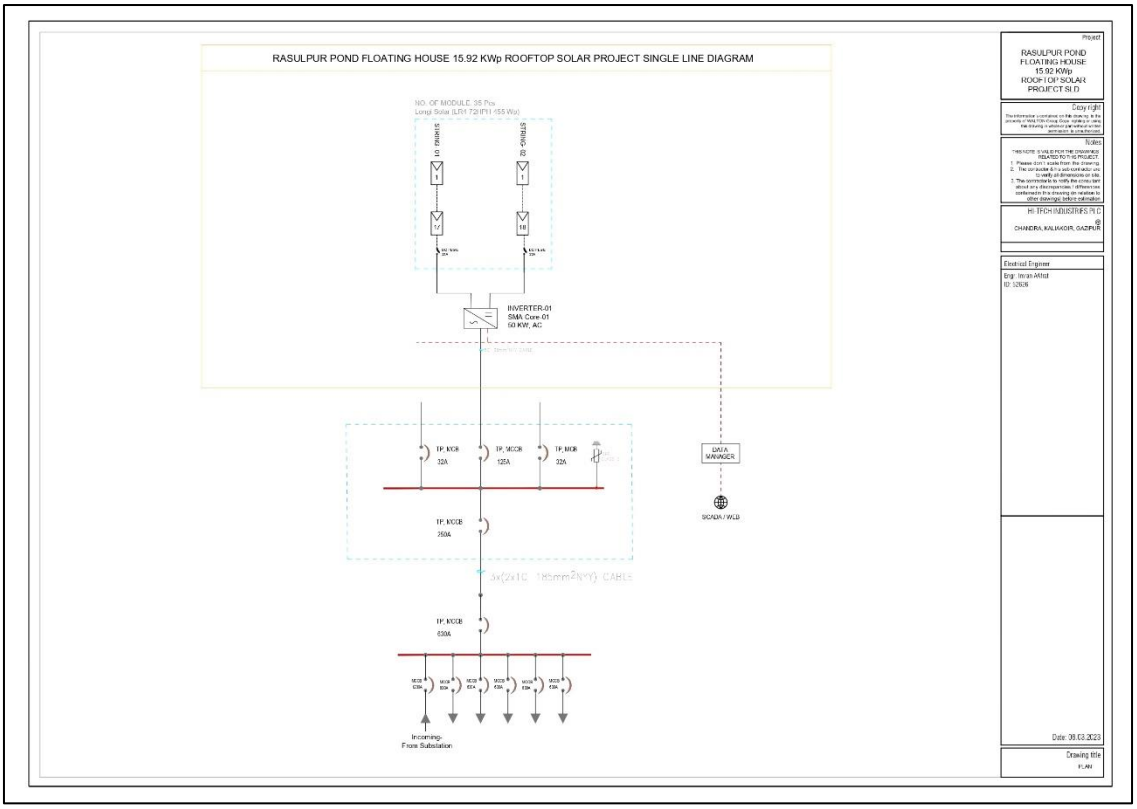


Figure 14:Single Line Diagram of Floating House

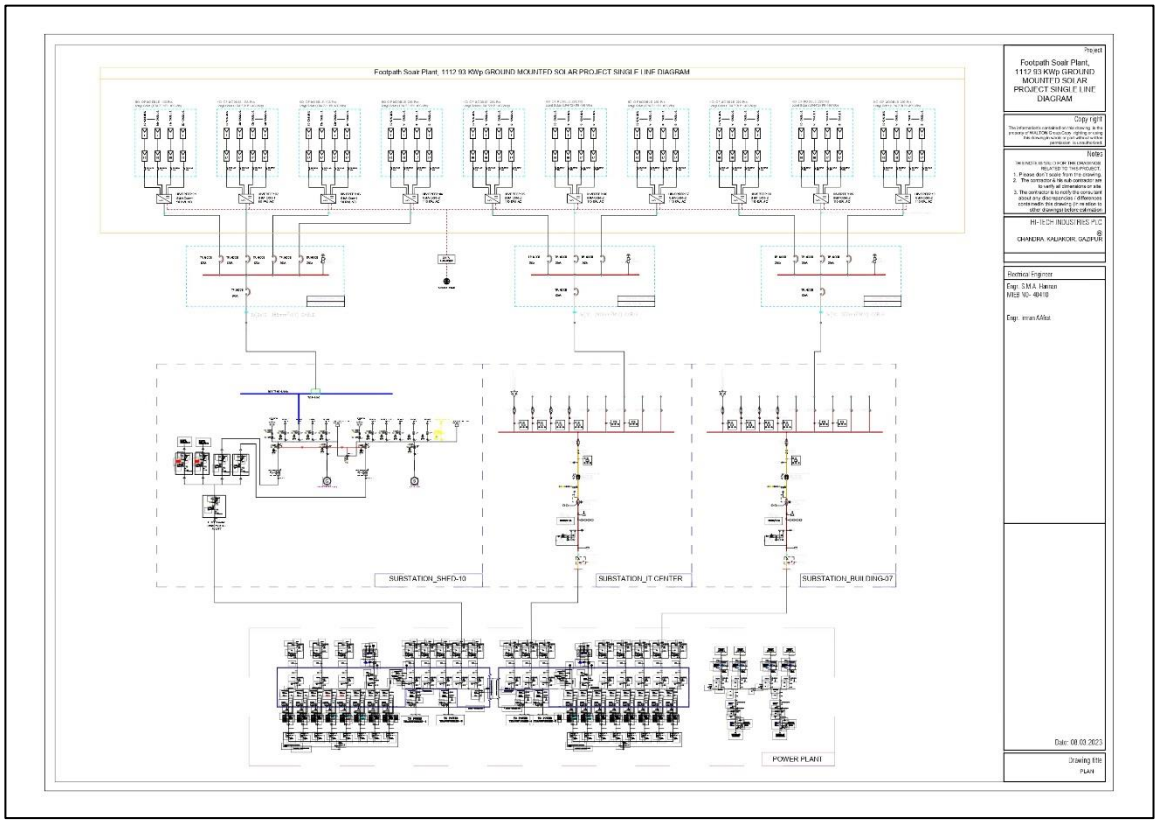


Figure 15:Single Line Diagram of Footpath Solar Plant

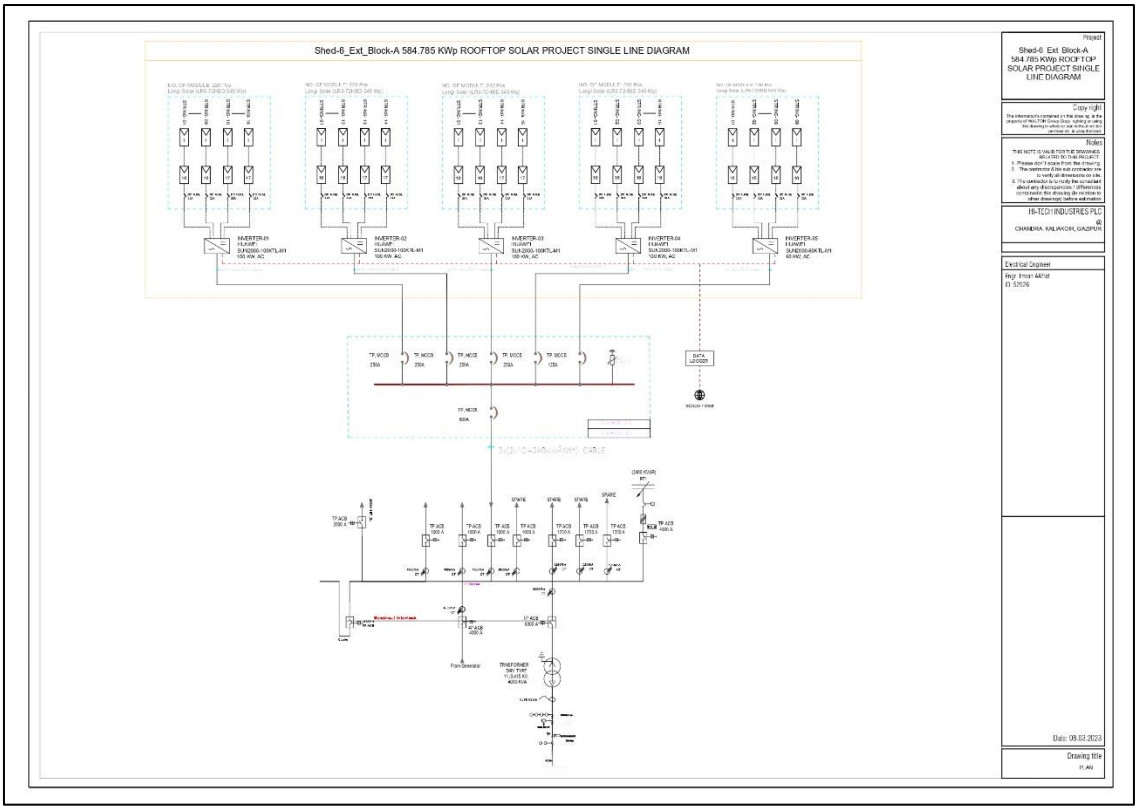


Figure 16:Single Line Diagram of Shed-06 Extention

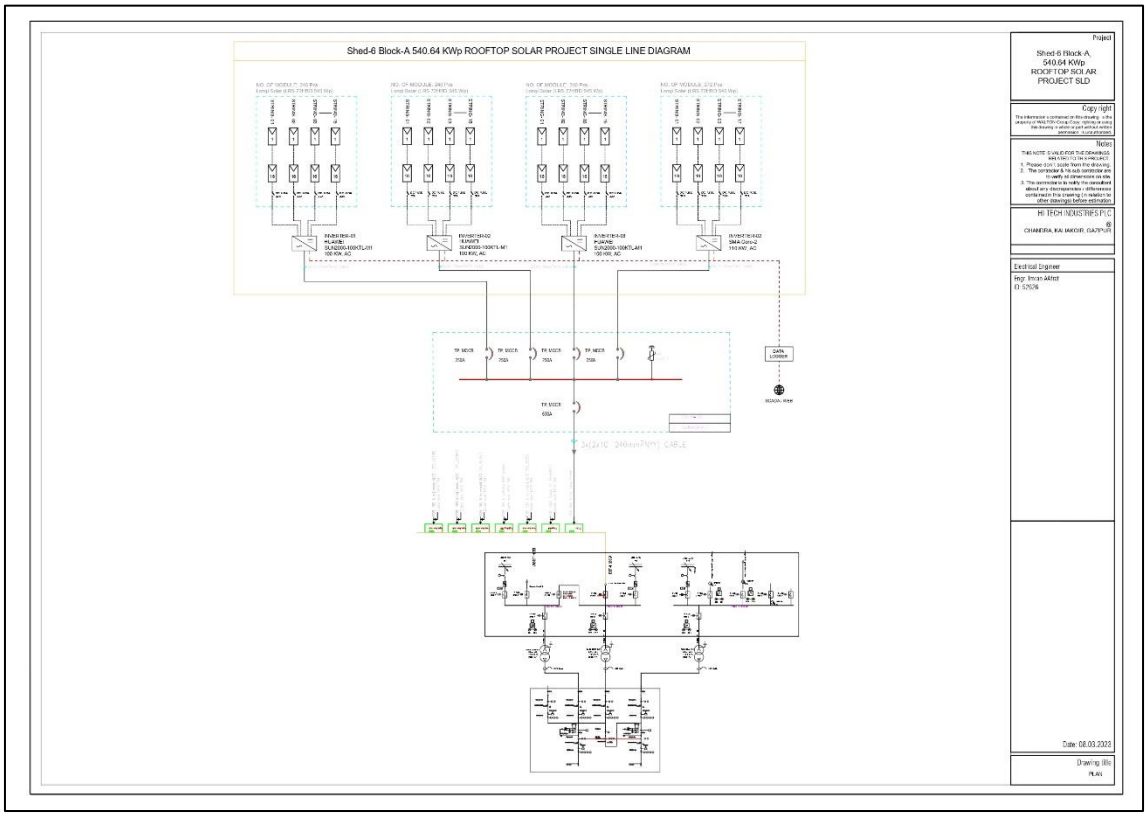


Figure 17:Single Line Diagram of Shed-06

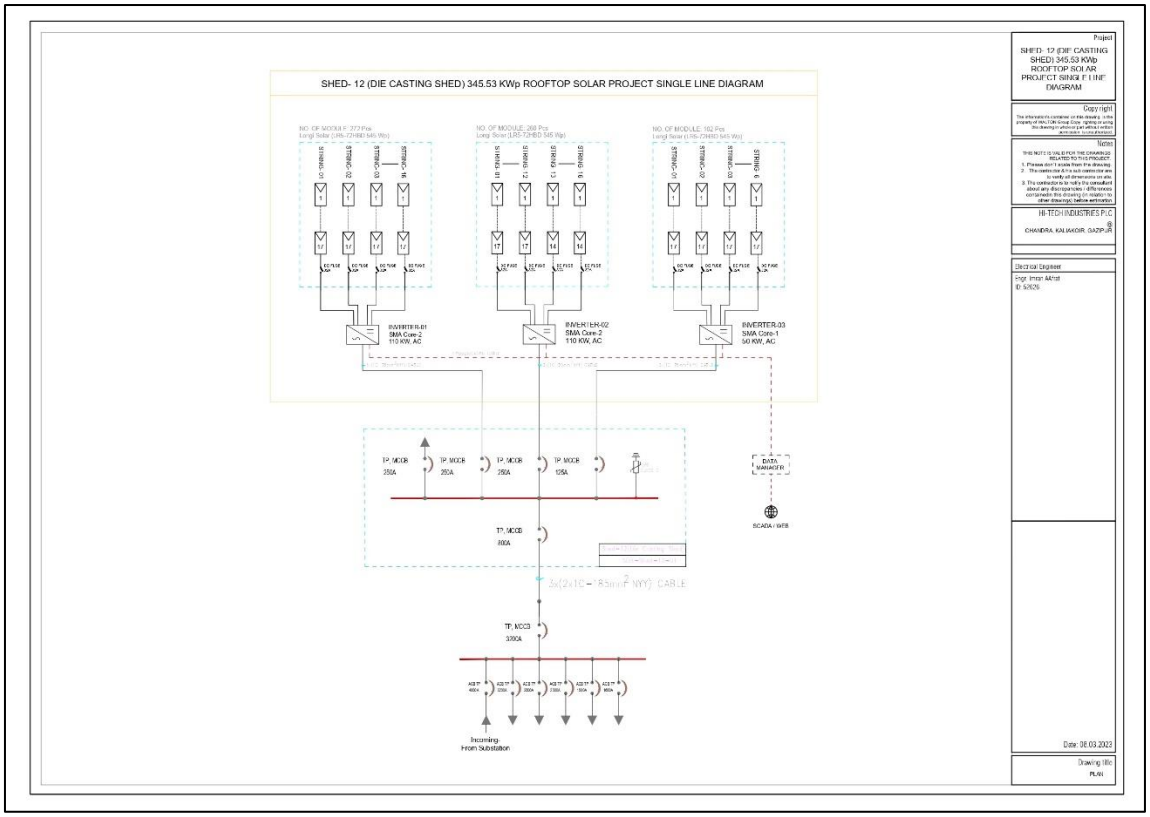


Figure 18:Single Line Diagram of Shed-12 Die Casting

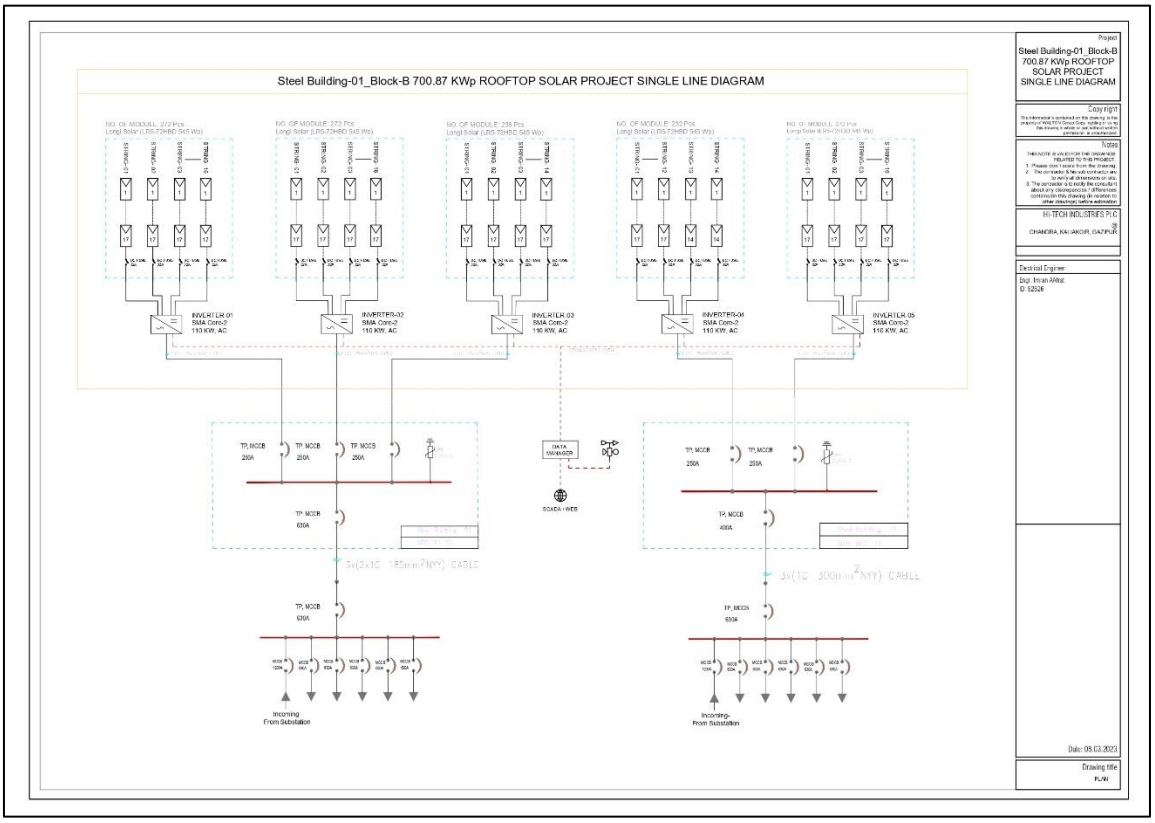


Figure 19:Single Line Diagram of Steel Building-01

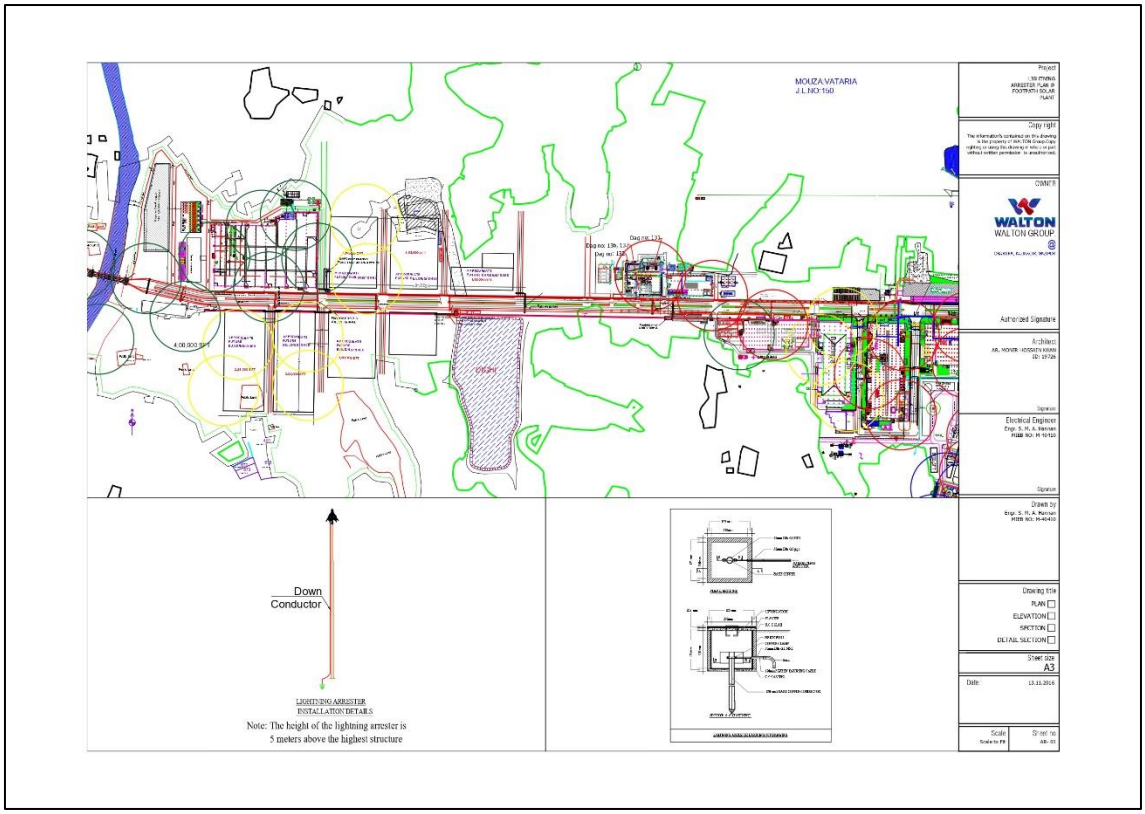


Figure 20:Lightning Protecting System of Footpath Solar Plant

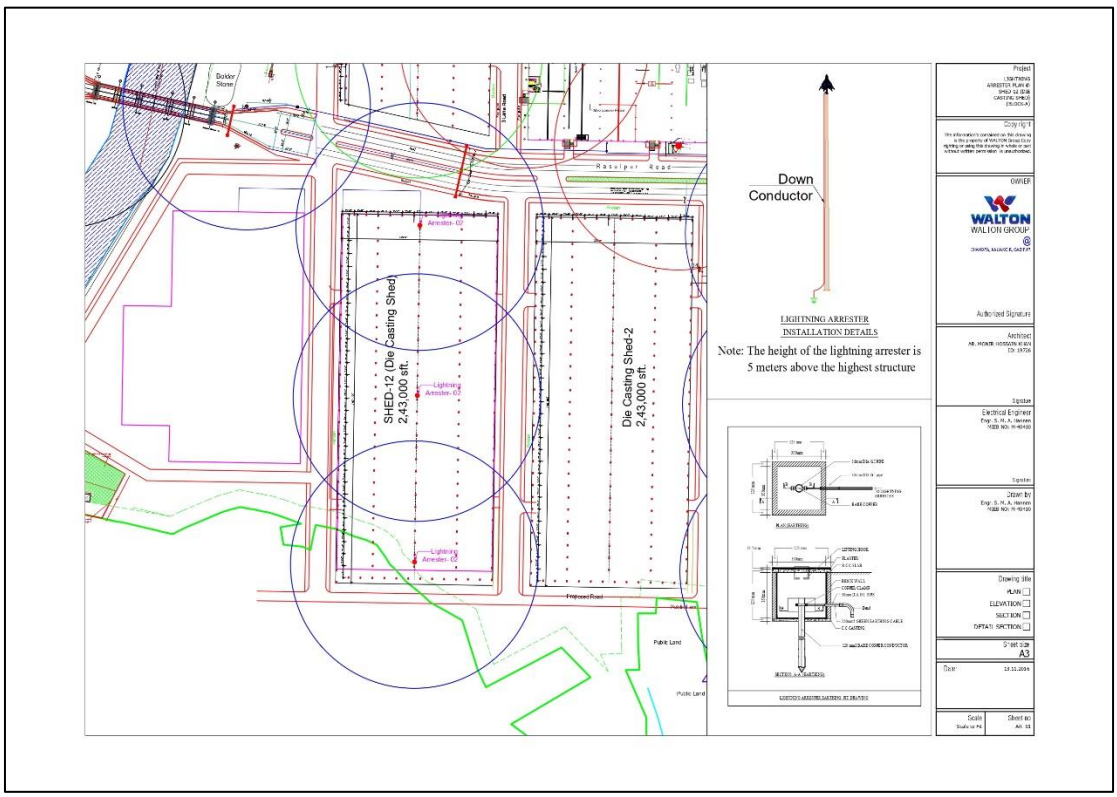


Figure 21: Lightning Protecting System Shed-12 Die Casting

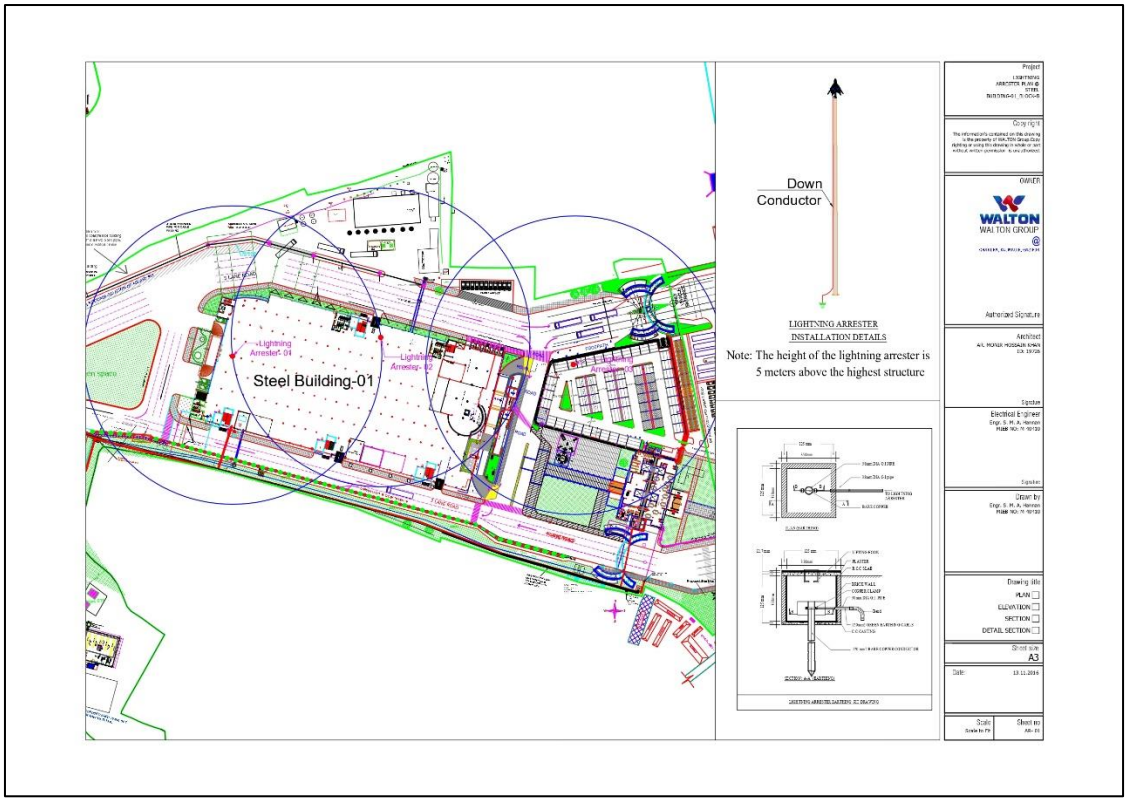


Figure 22:Lightning Protecting System of Steel Building-01

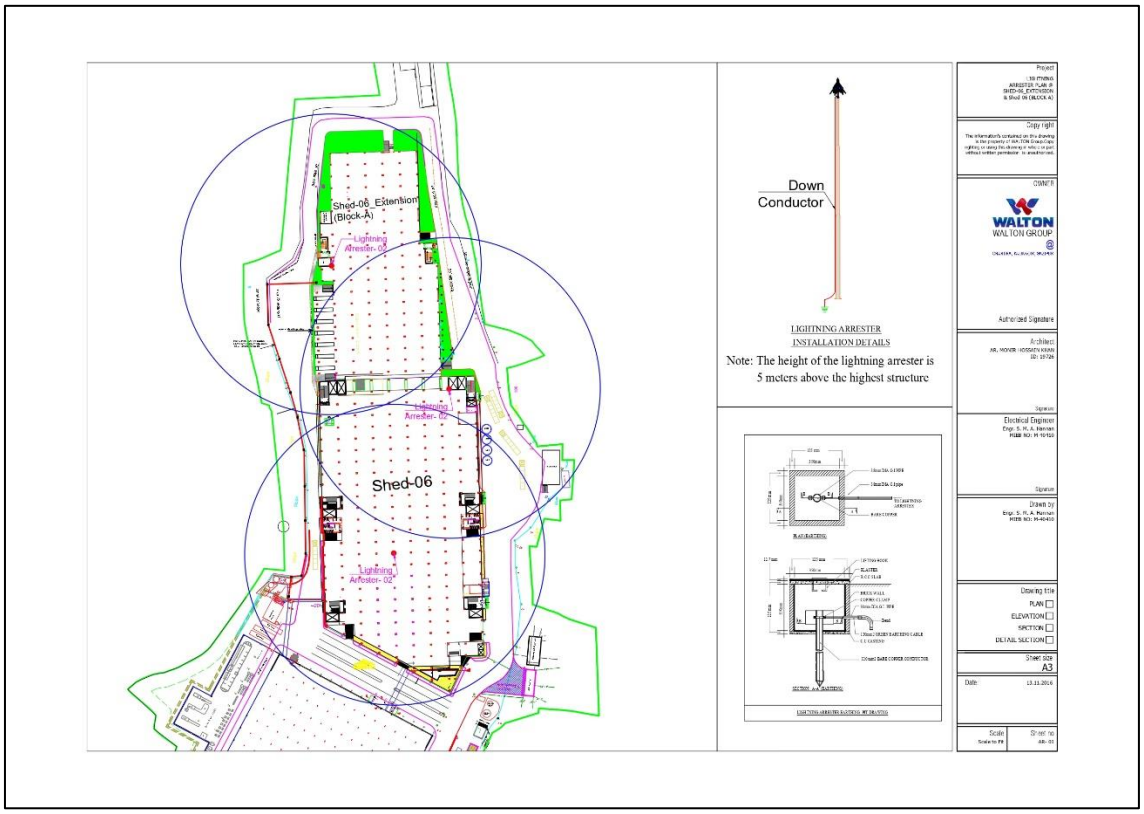


Figure 23:Lightning Protecting System of Shed-06 & Shed-06 Extension

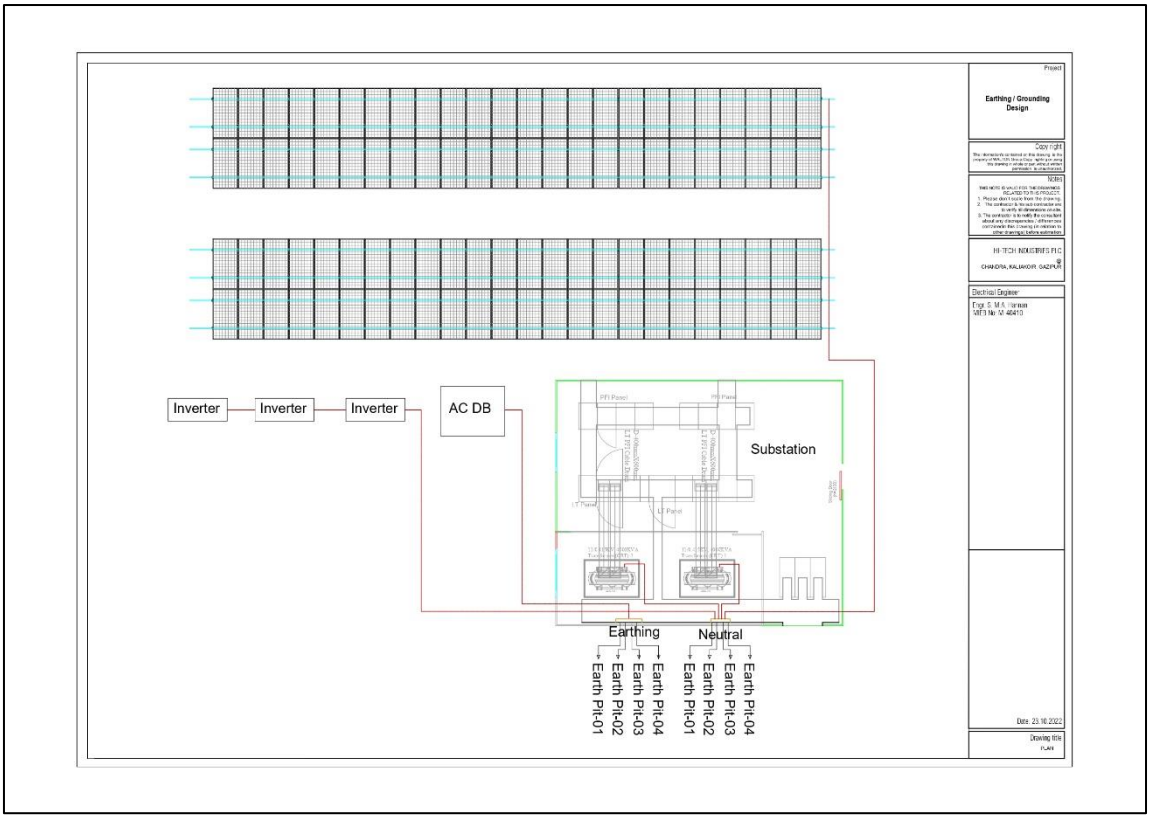


Figure 24:Earthing Design of the Solar Plant

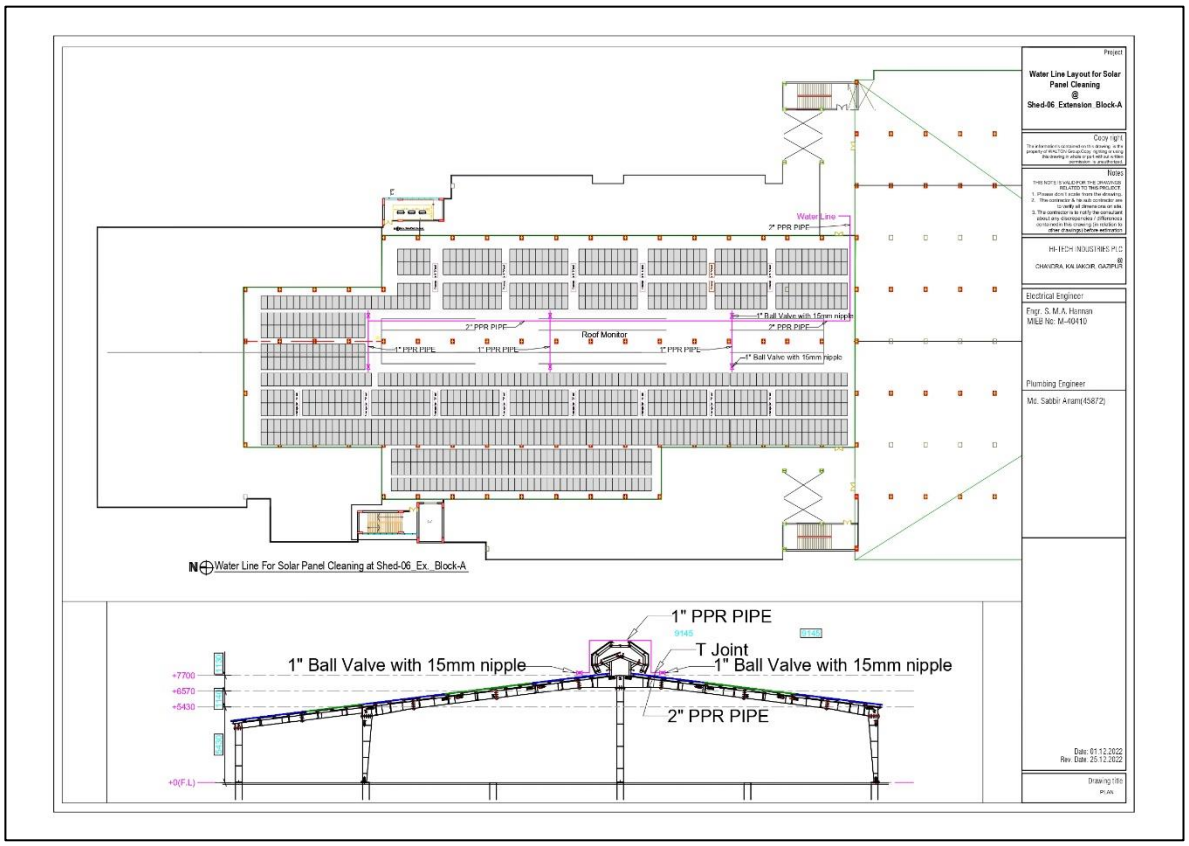


Figure 25:Water Line Layout Shed-06 Extension

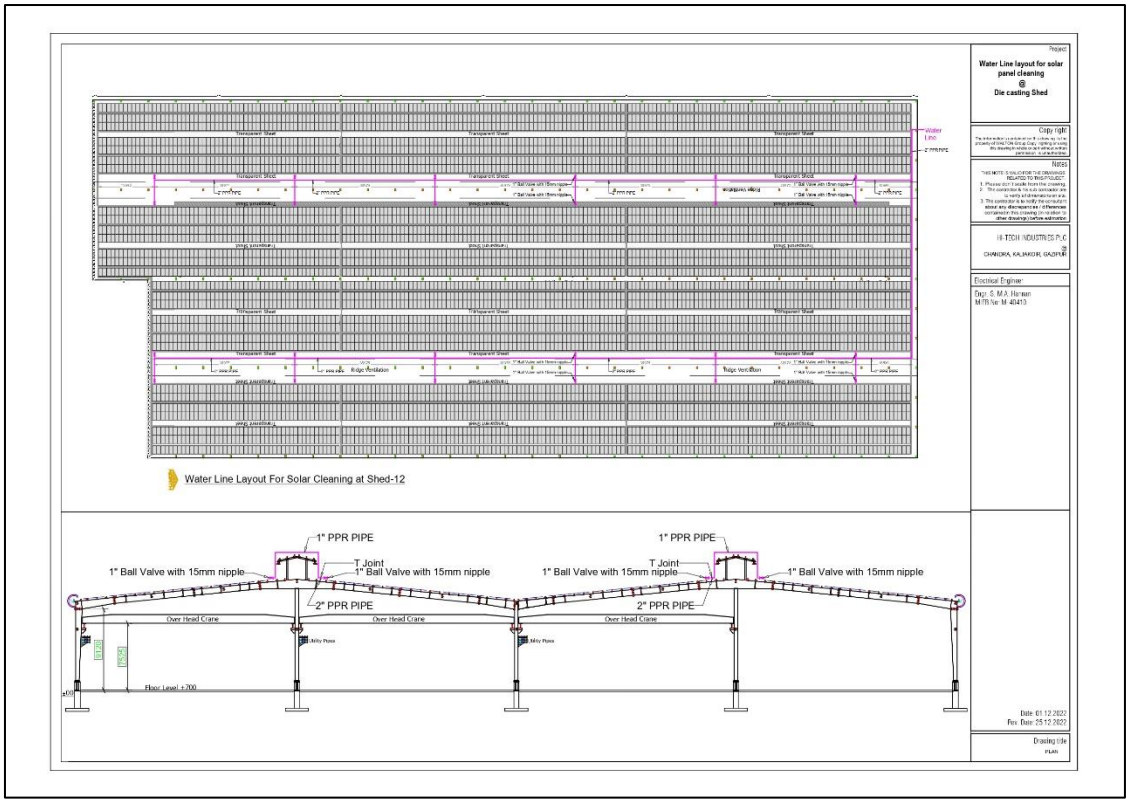


Figure 26:Water Line Layout of Shed-12

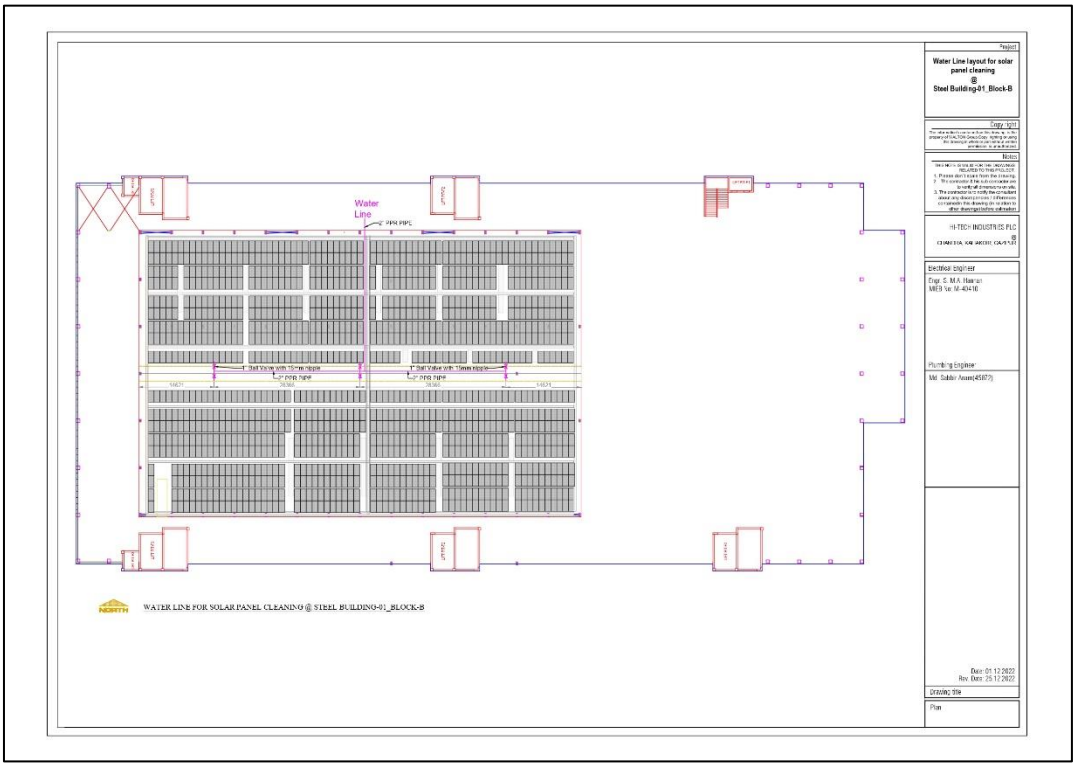


Figure 27:Water Line Layout of Steel Building-01

4.2 Adequacy of Solar Irradiation

The proposed location of the Project is at Chandra, Kaliakoir, Gazipur, Bangladesh. The coordinate of the proposed location is 24° 2'11.01512"N and 90°13'24.41618"E. The solar irradiance profile of the project location is shown in Figure 28.

4.2.1 Sun Path

The analysis of the sun path of the proposed location indicates that the availability of sun at the location is 8-10 hours in winter; while 10-12 hours in summer months. The number of annual effective sunshine hours seems high at the location. The utilization ability of solar radiation availability is a function of the technical specification of identified technology.

4.2.2 Solar Irradiance Profile at Site

It has been observed that Kaliakoir, Gazipur receives a potential amount of solar energy throughout the year with an average of 4.72 kWh/m^2/day (Global) on a horizontal surface and 4.9 kWh/m^2/day on a 5º tilted surface. It can be seen that from February to May maximum energy can be harnessed by a solar panel. Peak sunshine occurs in March which is 5.96 kWh/m^2/day. On the other hand, during monsoon solar irradiance is comparatively lower than in other seasons and the minimum value is 3.6 kWh/m^2/day in July.

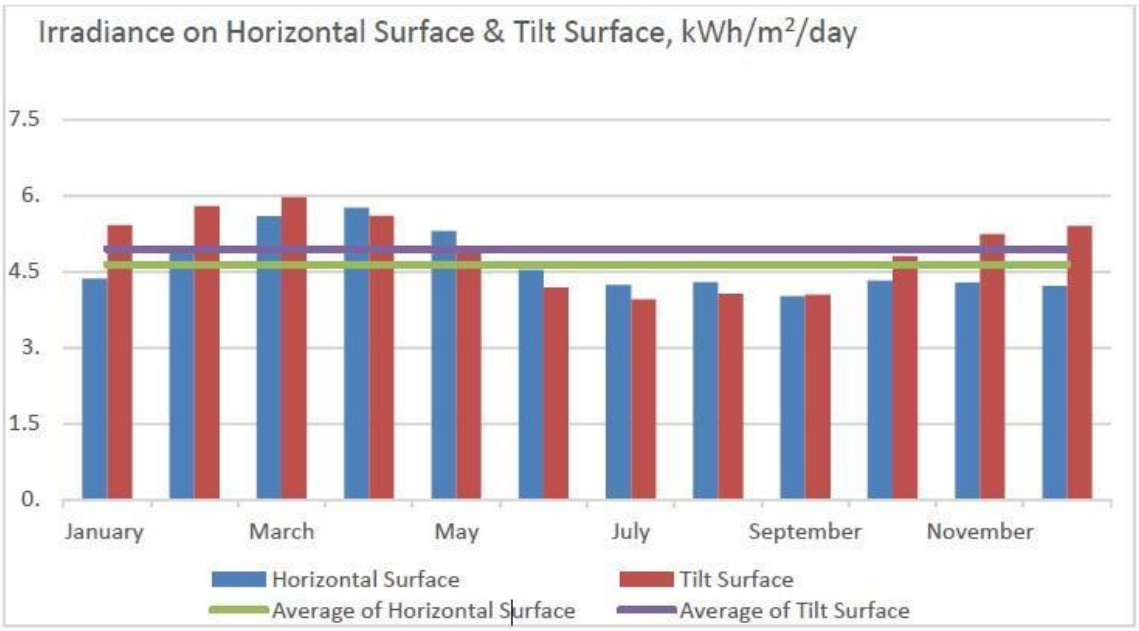


*Figure 28: Average Monthly Irradiation of the Site (NASA Surface Meteorology***)**

4.3 Plant Capacity Selection

The plant capacity of a roof-top solar power project mainly depends on available space and load while other factors to be taken into consideration are the shading effect, the orientation of

the building, the tilt angle of the building, load-bearing capacity, and backup generator capacity. The rural Electrification Board (REB) acts as the main power supply for the plant.

Plant capacity selection is determined based on the load survey and optimization parameters. Optimization parameters for selecting plant capacity are chosen carefully to ensure satisfactory plant performance. The optimization parameters used by the sponsor are (a) consumption of diesel fuel over the year as a percentage of the total consumption, (b) unused solar energy as a percentage of total solar generation, and (c) ratio between capacities of grid-tied inverters. The trade-off analysis of these three parameters is discussed below.

4.4 Adequacy of Generator Size

The generator will play a major role in operating a solar grid when the generation of electricity from solar PV is insufficient to meet the demand. The average estimated electricity consumption on the project are will be 1.5 Kwh/day. In that case, the generator should be able to supply the necessary electricity as per the electricity demand. While undersized generators will be overloaded if the demand is higher than the rated capacity of the generator, using oversized generators will be inefficient as it will result in higher diesel consumption.

Generator will start automatically when the energy stored in the panels goes below the allowable threshold. The higher capacity generator will help to charge quickly along with providing electricity to the customers.

In addition, a generator can also work in parallel with the PV panels if needed for bigger inductive loads e.g., pumps. The selected generators of such capacity will be able to supply electricity to run the peak load even in case of low solar generation, to avoid system shutdown, or to back up high current-driven commercial loads.

Chapter Five: Alternative Analysis

The range of feasible alternatives is selected and discussed in a manner to foster meaningful public participation and informed decision-making. Among the factors that may be taken into account when addressing the feasibility of alternatives are environmental impacts, site suitability, economic viability, social and political acceptability, technological capacity, availability of infrastructure, general plan consistency, regulatory limitations, jurisdictional boundaries, and whether the proponent could reasonably acquire, control, or otherwise have access to an alternative site. An ESIA need not consider an alternative whose effects could not be reasonably identified, whose implementation is remote or speculative, and that would not achieve the basic project objectives.

An ESIA should describe a range of reasonable alternatives to the proposed project or to the location of the proposed project site that could feasibly avoid or lessen any significant environmental impacts of the proposed project while attaining most of the project's basic objectives. An ESIA also must compare and evaluate the environmental effects and comparative merits of the alternatives. This chapter describes alternatives considered but eliminated from further consideration (including the reasons for elimination) and compares the environmental impacts of several alternatives retained with those of the proposed project.

The proposed project has the potential to have significant adverse effects on visual amenities; air quality; noise; biological resources; cultural resources; geology/soils; GHG emission; hazards and hazardous materials; hydrology and water quality; land use and planning; noise; public services; and utilities and service systems within the project area. Even with the mitigation measures described in Chapter 07 of this ESIA, impacts in some of these issue areas would be significant and unavoidable. Therefore, this section discusses alternatives that are capable of avoiding or substantially lessening the effects on these resources.

5.1 Do Nothing

The **No Project** Alternative concerning the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. However, the project activities have already been started. This option will, however, involve several losses both to the project proponent and the donor organization. The area will remain under-utilized. The **No Project** Option is the least preferred from the socio-economic and partly environmental since if the project is not done.

- The economic benefits especially during construction i.e., provision of jobs for skilled and non-skilled workers will not be realized.
- There will be no generation of income by the developer to the Government.
- The local skills would remain under-utilized.
- No employment opportunities will be created who will work in the project area.
- Discouragement for donors to allot this level of standard and affordable developments.

Impacts Compared to Project Impacts

Visual Amenity

In contrast to the proposed project, the project site under the No Project Alternative would remain largely vacant. Under the No Project Alternative, solar arrays and other project components would not be developed at the project site and no views of the project area would be altered. The area surrounding the project site is mostly under agricultural production and undeveloped land. Under the No Project Alternative, no impact on the undeveloped nature of the project area would occur. Therefore, because the project site would remain unchanged under the No Project Alternative, this alternative would result in fewer impacts than the proposed project.

Archaeology and Cultural Resources

Field surveys indicate the presence of very few cultural resources on the project site. Mitigation measures are provided to reduce impacts on these resources to below a level of significance. Under the No Project Alternative, the project site would remain as is, and no ground-disturbing activities would occur. Therefore, unlike the proposed project, the No Project Alternative would not have the ability to accidentally uncover potentially significant cultural, archaeological, or paleontological resources which may be located beneath the surface project site. There would be no impact on cultural resources, and no mitigation measures would be necessary. Accordingly, there would be fewer impacts from the No Project Alternative than the proposed project.

Traffic

In contrast to the proposed project, there would be no development associated with the No Project Alternative. Therefore, the No Project Alternative would not have the potential to affect traffic volumes on nearby roadways as a result of either construction activity. Because transportation and traffic impacts associated with the construction of the project would be greater than existing agricultural operations, the No Project Alternative would result in fewer impacts as compared to the proposed project.

5.2 Alternative Energy Generation Technology

This alternative would involve the use of wind energy as an alternative to the development of a solar site. Similar to solar power, power from the wind is an alternative to energy production from non-renewable resources like coal and oil, or nuclear sources. Wind energy provides several benefits, including, but not limited to the following:

- The wind is a renewable and infinite resource.
- The generation of wind energy does not produce any air emissions, including carbon dioxide (GHG).
- Although wind energy requires a significant upfront capital investment, it is a free resource after the capital cost of installation (excluding maintenance).
- In addition, energy production from wind power would not require the significant water usage associated with coal, nuclear, and combined-cycle sources.

Commercial wind farms typically use three-bladed turbines that range in size from 300 feet up to 500 feet in height, with blades of 150 feet in length that are pointed into the wind by computer-controlled motors. The wind farm would consist of a group of wind turbines placed where sufficient and consistent wind resources exist and electrical power transmission infrastructure is located. The individual turbines would be interconnected with a medium-voltage power collection system and a communications network. Similar to solar energy production facilities, wind energy production facilities also require substations, which would increase the medium-voltage electrical current through a transformer before connection to the high-voltage transmission system. Compared with traditional energy sources, the environmental effects of wind power are relatively minor.

Unlike the proposed project, wind turbines would have the potential to impact avian species in the local area. The development of wind farms would also typically result in greater adverse aesthetic impacts due to the height of the turbines. Agriculture resources would also still be impacted by the presence of wind turbines and associated facilities. Additionally, wind energy production facilities do not reduce short-term construction-related air quality emissions.

While the project area has been identified as suitable for solar projects based on the solar insolation levels (the amount of solar radiation energy) in the area, wind energy production is not well-suited to the project site due to relatively low wind speeds and directionality sufficient to drive wind turbines. No significant facilities have been developed in the project vicinity due to the lack of adequate wind resources.

As noted above, alternatives may be eliminated from detailed consideration in an ESIA if they fail to meet most of the project objectives, are infeasible, or do not avoid or substantially reduce any significant environmental effects. Therefore, this alternative was eliminated from further consideration because:

- It would result in additional/greater impacts than the proposed project (aesthetics and biological resources);
- It would not substantially reduce the significant environmental impacts associated with aesthetics, agriculture resources, air quality, and biological resources;
- It would fail to meet the objectives of the proposed project; and
- The project site is not suited for wind energy production; therefore, a wind energy production facility would not generate as much electricity as solar equipment.
- Wind energy is uncommon in Bangladesh and the production material is not available.

5.3 Alternative Land Use

This alternative would involve the development of several geographically distributed small to medium solar PV systems within existing developed areas, typically on the rooftops of commercial and industrial facilities situated throughout the project area.

Under this alternative, no new land would be developed or altered. However, depending on the type of solar modules installed and the type of tracking equipment used (if any), a similar or

greater number of areas may be required to attain the proposed project's capacity of 30 MW of solar PV generating capacity.

Here are some alternatives land uses for rooftop solar system:

1. Ground-mounted solar farms: Large-scale solar farms can be established on open land instead of installing solar panels on rooftops. These solar farms are typically made of rows of solar panels mounted on the ground. They are commonly propagated in areas with ample available land, such as deserts or open fields. Installing solar panels on deserted land is beneficial for the soil. It can help reduce water evaporation and offer benefits such as reduced land usage and improved efficiency due to the cooling effects of the water. Ground-mounted solar farms can generate significant amounts of renewable energy and can be interconnected to the power grid.

2. Solar canopies and carports: Another alternative is the installation of solar panels on canopies or carports. These structures are built to provide shade and cover for parking lots, walkways, or outdoor recreational areas. By incorporating solar panels into these structures, they can generate electricity while also providing shelter. Solar canopies and carports are particularly useful for commercial buildings, shopping centers, or large parking areas.

3. Floating solar arrays: In certain situations, water bodies can be used for solar energy production. Floating solar arrays involve installing solar panels on specially designed floating platforms or pontoons placed on lakes, reservoirs, or other water bodies. These installations take advantage of the surface area of the water, providing an additional renewable energy option. Floating solar arrays Ground-mounted solar farms: Instead of installing solar panels on rooftops, large-scale solar farms can be established on open land. These solar farms typically consist of rows of solar panels mounted on the ground. They are commonly deployed in areas with ample available land, such as deserts or open fields. Ground-mounted solar farms can generate significant amounts of renewable energy and can be interconnected to the power grid.

4. Building-integrated photovoltaics (BIPV): BIPV refers to incorporating solar panels directly into the design elements of a building, such as windows, facades, or roofing materials. This integration allows the building itself to generate solar power without the need for separate solar panel installations. BIPV can blend seamlessly with the architecture and aesthetics of the structure while providing renewable energy generation.

5. Solar gardens or community solar projects: These initiatives involve the development of solar installations in a shared manner, allowing multiple individuals or businesses to benefit from the generated electricity. Solar gardens can be established on available land or open spaces within a community, enabling those who are unable to install solar panels on their properties to still access the benefits of solar energy. Participants can either purchase or lease a portion of the solar garden's capacity and the electricity generated is typically credited to their utility bills.

These alternative land use options for solar projects offer flexibility in situations where rooftop installations are not practical or sufficient. The choice of which approach to use

depends on various factors such as available land, project scale, local regulations, and the site's specific requirements.

Impacts Compared to the Project Impacts

Traffic

Both the proposed project and the Build-Out of Existing Land Use Alternative would result in short-term increases in traffic volumes on local streets as a result of construction vehicles and equipment traveling to and from the project site. However, the Build-Out of Existing Land Use Alternatives would likely require more equipment and a significantly longer construction period to construct the necessary infrastructure (e.g., utility lines, water quality facilities, etc.), site improvements, and buildings. While the precise length of the construction period cannot be known until a site plan, infrastructure needs analysis, and an accompanying phasing plan is developed, the construction of several residences and continued agricultural operations would require more time than the proposed construction period of the solar project, and also necessitate more construction workers required for the proposed project. Therefore, it is likely that the Build-Out of Existing Land Use Alternatives would result in significantly greater construction-period traffic and transportation impacts.

Once operational, additional vehicle trips associated with the proposed project would be minor and limited to maintenance and monitoring activities and commute trips. Conversely, operational vehicle trips associated with the development of several residences and continued business operations would be greater due to the nature and intensity of the land uses. Therefore, although the exact amount of operational vehicle trips cannot be ascertained for the Build-Out of the Existing Land Use Alternative at this time, it can be assumed that vehicle trips would be higher than the proposed project. As such, impacts on traffic and transportation during the operation of the Build-Out of Existing Land Use Alternative would be greater as compared to the proposed project.

5.4 Alternative Site

Relocation option to a different site is an option available for project implementation. At the moment, there are no alternative sites for the proposed development (i.e., the project proponent doesn't have an alternative site). This means that the proponent has to look for the industrial rooftop if relocation is proposed and the required rooftop is not available and if available it will be too expensive for the proponent to realize his dream.

Looking for the rooftop to accommodate the scale and size of the project and completing an official transaction on it may take a long period. In addition, it is not a guarantee that such a rooftop would be available. It's also worth noting that the said project is already underway in terms of seeking development approvals in various government departments.

The project proponent would spend another long period on the design and approvals of the plans by the relevant government departments. The project design and planning before the stage of implantation would call for cost; already encountered in the proposed development i.e. whatever has been done and paid to date would be counted as a loss to the proponent. Assuming

the project will be given a positive response (after relocation) by the relevant authorities including DoE, it (the project) would have been delayed for a long period before implementation. This would also lead to a situation like the No Action Alternative. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option.

Chapter Six: Description of Environmental and Social Baseline

As part of the ESIA, an environmental and social baseline study was carried out in areas surrounding the project site. The specific objectives of the baseline study were to gather information on the existing physical environment, biological-ecological environment, and socio-economic environment of the areas in and around the project site; to gather and assess people's perceptions of different aspects of the proposed project. The data and information gathered during the baseline study provide a detailed description of the existing conditions of the physical, biological as well as socio-economic environment in and around the project area.

This Chapter also describes the existing biological environment of areas in and around the project site based on the baseline survey carried out as a part of the present study. The baseline ecological survey primarily focused on identifying floral and faunal diversity and distribution within and surrounding the project site. Possible impacts of the project activities have been evaluated against these baseline environmental conditions.

A study approach of analyzing the socio-economic parameter like population, geography, land use, and occupational statistics of the surrounding area through secondary data collection from various government and non-government organizations has been adopted. This chapter describes the existing socio-economic environment of areas in and around the project site based on the social studies carried out as a part of the present study.

6.1 Physical Environment

The physical environment describes the existing areas in and around the project, based on the baseline survey and other studies (e.g., water quality, air, and noise level measurements) carried out as a part of the present study. Relevant information on climate, topography, drainage, geology, soils, hydrology, water resources, air quality, noise level, and water quality have been described in this section. The possible environmental impacts of the project activities will be evaluated against these baseline environmental conditions.

6.1.1 Climate

Bangladesh is located in the tropical monsoon region, and its climate is characterized by high temperatures, heavy rainfall, often excessive humidity, and fairly marked seasonal variations. From a 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 which lasts from June through September. January is the coolest month, with temperatures averaging near 26°C, and April is 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 per year.

Most rains occur during the monsoon (June-September) and little occurs in winter (November-February). Moderate rains are also reported in March, April, and October (Rashid 1992).

Locating in the subtropical monsoon region, there are wide differences in the intensity of the seasons in different places in the country. Based on the entire climatic conditions, Bangladesh can be divided into the following seven distinct climatic zones. The familiar pattern of northwest to southeast isopleths is revealed in this classification.

South-Eastern Zone (A): It comprises the Chittagong sub-region and a strip of land extending from southwest Sundarbans to the south of Comilla. The hills over 300m in height have a north-eastern zone climate. The rest of the area has a small range of temperature, rarely going over a mean of 32°C and below a mean of 13°C. Rainfall is heavy, usually over 2,540 mm. In winter dew fall is heavy.

North-Eastern Zone (B): This zone includes most of the east and south Sylhet and a wedge-shaped strip south of the Meghalaya Plateau. Here too, the mean maximum temperature is rarely above 32°C but the mean minimum is 10°C and below. The average humidity is even more than in the southeastern zone. In this zone winter rain is appreciable. Fog is very common in winter. This is the cloudiest part of Bangladesh. The higher hills and mountains of the Chittagong sub-region can also be classified under this zone.

The Northern Part of the Northern Region (C): This is an area of extremes. In summer the mean maximum temperature is well above 32°C whereas in winter the mean minimum is below 10°C. The summer is dry, with a scorching westerly wind, but the rainy season is very wet, with 2,000 to 3,000 mm of rainfall.

North-Western (D): Except that the extremes are less and the rainfall is lower, this zone is similar to the northern part of the northern region. The lower rainfall makes this area both atmospherically and pedagogically drier.

Western Zone (E): It comprises the greater Rajshahi district and parts of adjacent districts. This is the driest area in Bangladesh with rainfall generally below 1,500 mm and summer humidity less than 50%. In summer, it is the hottest and driest of all climatic zones. The mean summer maximum temperature is over 35°C.

South-Western Zone (F): Here the extremes of the zones to the north are somewhat tempered. Rainfall is between 1,500 mm and 1,800 mm. The mean summer maximum temperature is below 35°C. Dew-fall is heavier than in the Western zone.

South-Central Zone (G): In this zone rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in the southeastern zone. This is a transitory zone between the southeastern, Northwestern, and Southwestern zones, and most of the severe hail storms, nor'westers, and tornadoes are recorded in this area.

The Climatic sub-regions of Bangladesh are presented in Figure 29 and the proposed project falls under the **Mid-South Zone (G).** The Bangladesh Meteorological Department monitors

different climate components in 35 weather stations in Bangladesh. The climatic data for the study area were obtained from the meteorological station located in Dhaka which is nearest to the project site.

In the **Mid-South Zone (G)** rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in the South-eastern zone. This is a transitory zone between the South-eastern, North-western, and South-western zones, and most of the severe hail storms, nor'westers, and tornadoes are recorded in this area.

The climate of Bangladesh is heavily influenced by the Asiatic monsoon. The monsoonal influence results in three distinct seasons:

- Pre-monsoon hot season (from March to May);
- Rainy monsoon season (from June to September); and
- Cool dry winter season (from October to February

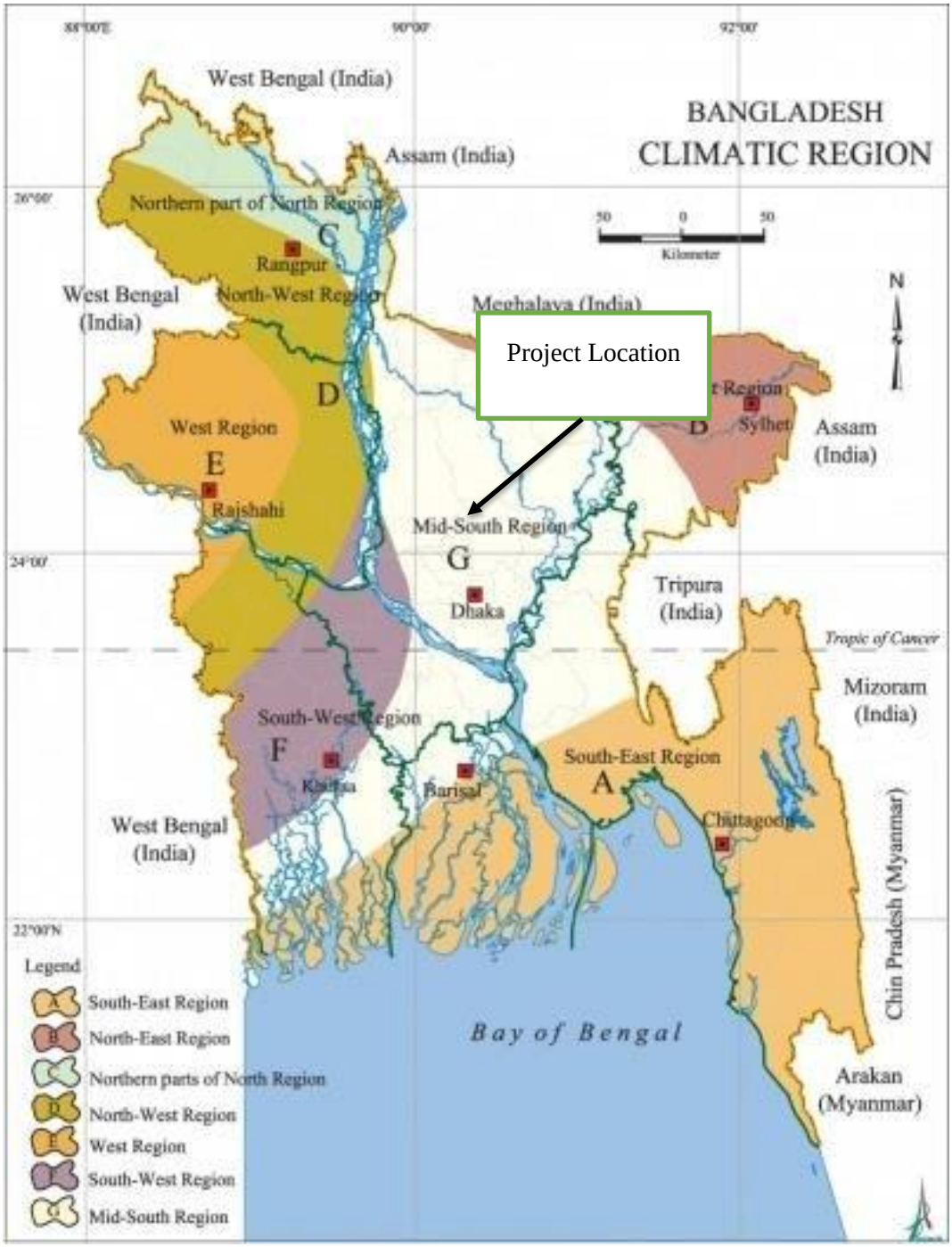
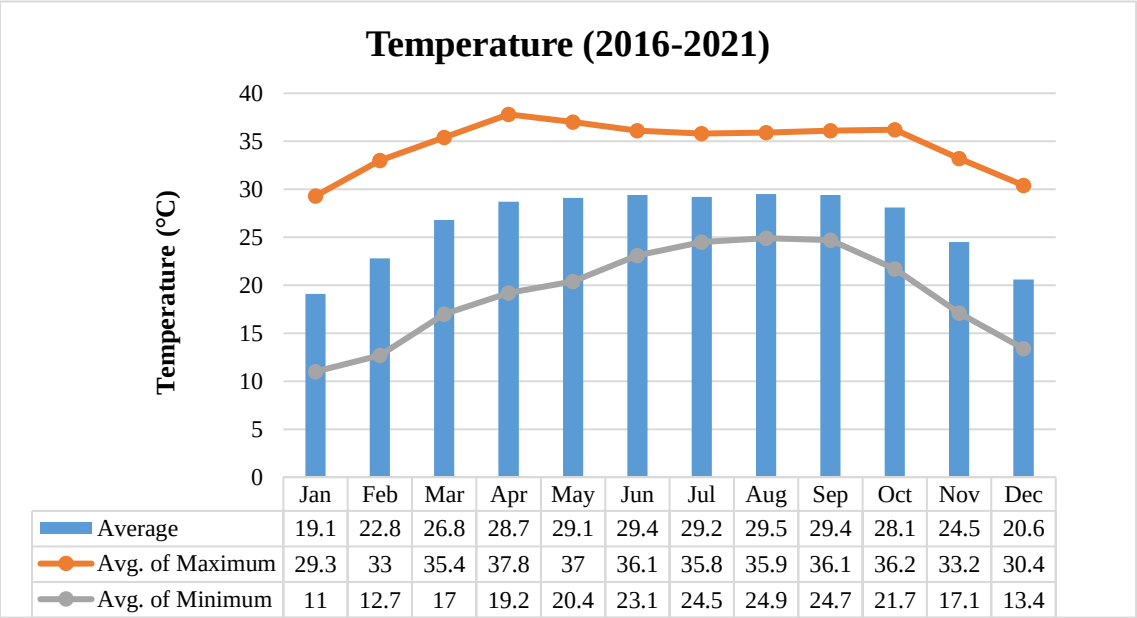


Figure 29: Climatic Zone Map of Bangladesh

6.1.1.1 Temperature

Temperature data of Dhaka Station from the Bangladesh Meteorological Department (BMD) for 06 years (from January 2016- to December 2021) has been analyzed to see the monthly variation of the average maximum temperature which is between 29.8°C to 26.1°C. The monthly variation of the average minimum temperature is 24.9°C to 11°C. The maximum recorded temperature in Dhaka station was 30.4°C, which occurred in April 2016 and April 2021. In January 2020, the minimum temperature was recorded as 10°C in Dhaka. The warmest month of the year is April and the coldest month of the year is January. Figure 30 shows the maximum, minimum, average maximum, and average minimum temperature of Dhaka station from 2016 to 2021.



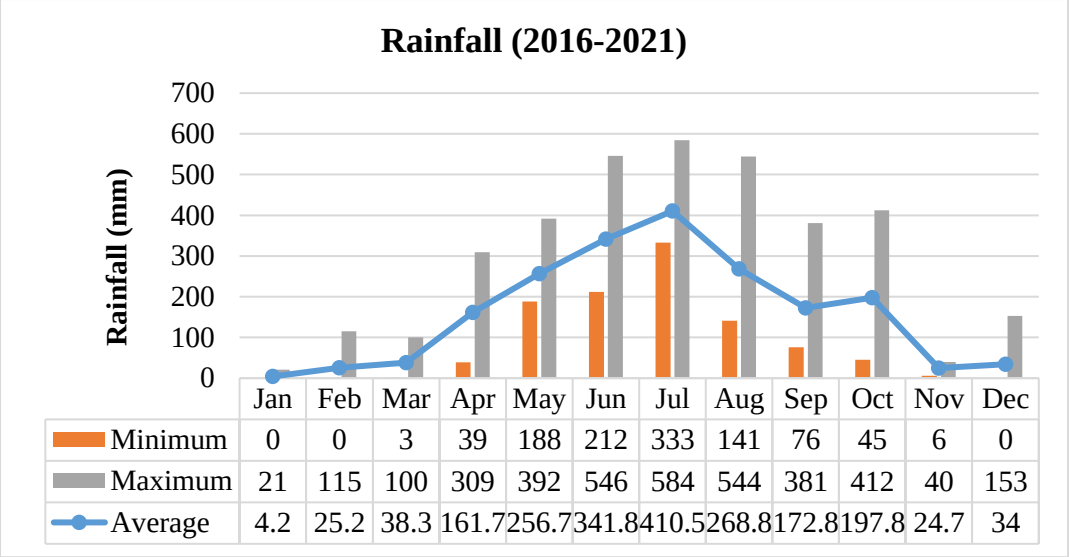
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	19.1	22.8	26.8	28.7	29.1	29.4	29.2	29.5	29.4	28.1	24.5	20.6
Avg. of Maximum	29.3	33	35.4	37.8	37	36.1	35.8	35.9	36.1	36.2	33.2	30.4
Avg. of Minimum	11	12.7	17	19.2	20.4	23.1	24.5	24.9	24.7	21.7	17.1	13.4

Source: Bangladesh Meteorological Department

Figure 30: Monthly Average, Maximum, and Minimum Temperature of the Study Area

6.1.1.2 Rainfall

Monsoon is a prominent season in this area. The average monthly rainfall during the monsoon (June-September) season from 2016 to 2021 is 410.5 mm/month. The variance in the maximum rainfall during the monsoon season is 392 mm/month to 584 mm/month, whereas the variance in the minimum rainfall is 333 mm/month to 03 mm/month. A maximum of 584 mm/month of rainfall was recorded during July of the year 2017. The annual average rainfall is 1936 mm/year and the highest recorded yearly rainfall was 2892 mm in the year 2017. The driest period of the year is winter when the average monthly rainfall varies from 13 mm/month to 3 mm/month. Figure 31 shows the maximum, minimum, and average rainfall from 2016 to 2021.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	0	0	3	39	188	212	333	141	76	45	6	0
Maximum	21	115	100	309	392	546	584	544	381	412	40	153
Average	4.2	25.2	38.3	161.7	256.7	341.8	410.5	268.8	172.8	197.8	24.7	34

Source: Bangladesh Meteorological Department

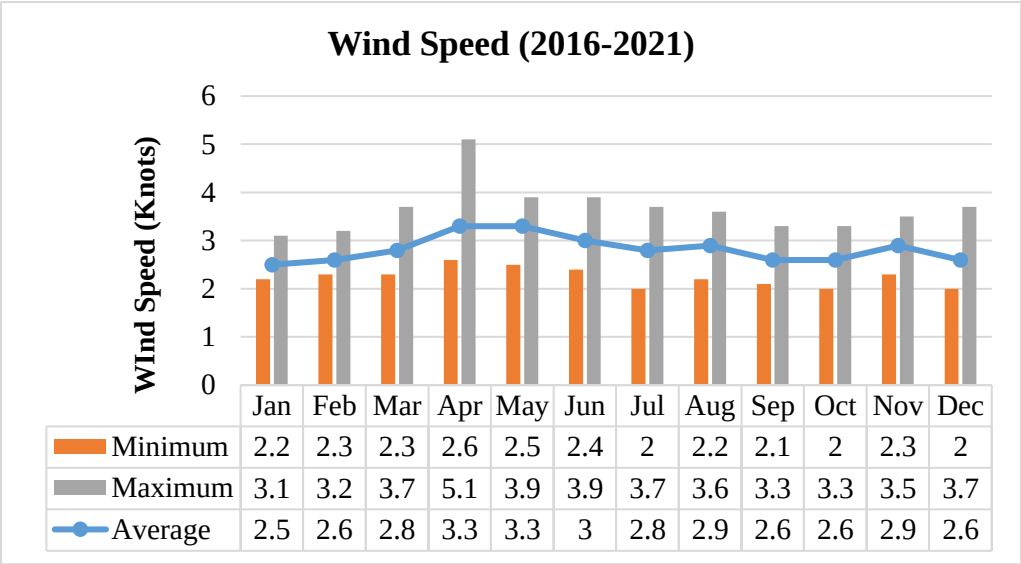
Figure 31: Monthly Average, Maximum, and Minimum Rainfall of the Study Area

6.1.1.3 Wind Speed and Direction

The direction of wind varies depending on the seasons. Therefore, the whole year has been categorized into four clusters of months and these are:

- Cluster-1: December-March,
- Cluster 2: April-June,
- Cluster 3: July to September, and
- Cluster 4: October to December.

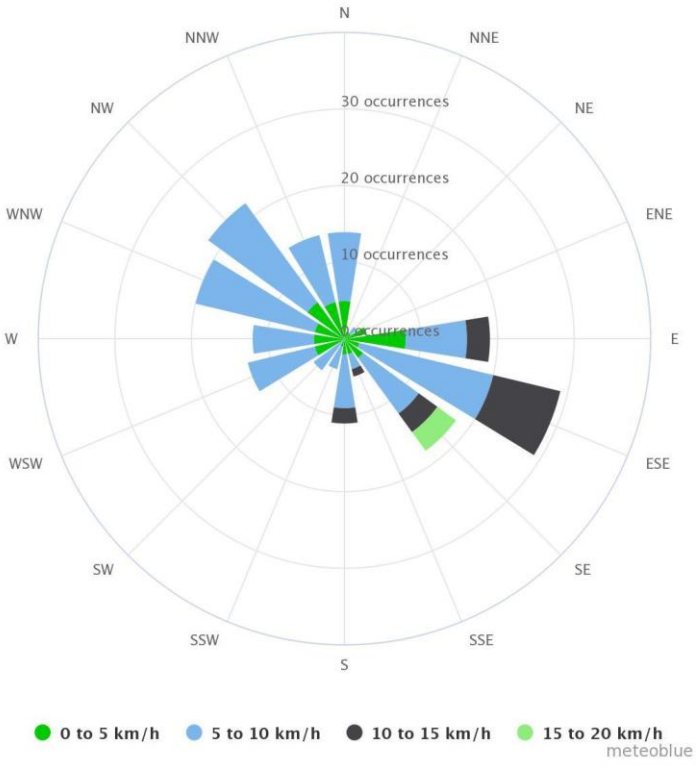
Wind speed data and direction have been collected from the Dhaka BMD station at a height of 10 m from the ground level. During clusters 1- and 4-months' wind direction is predominantly from northwest to southeast direction, inclined towards the east and for clusters 2 and 3, it is predominantly from south and southeast to north and northwest. In cluster 1 calm wind prevails for 27.2% of the total period, similarly, it is 11.0% for cluster 2, 12.5% for cluster 3, and 56.9% for cluster 4, respectively. Figures 32 and 33 present wind speed and diagram graphically around the year.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	2.2	2.3	2.3	2.6	2.5	2.4	2	2.2	2.1	2	2.3	2
Maximum	3.1	3.2	3.7	5.1	3.9	3.9	3.7	3.6	3.3	3.3	3.5	3.7
Average	2.5	2.6	2.8	3.3	3.3	3	2.8	2.9	2.6	2.6	2.9	2.6

Figure 32: Wind Speed of the Study Area

Source: Bangladesh Meteorological Department

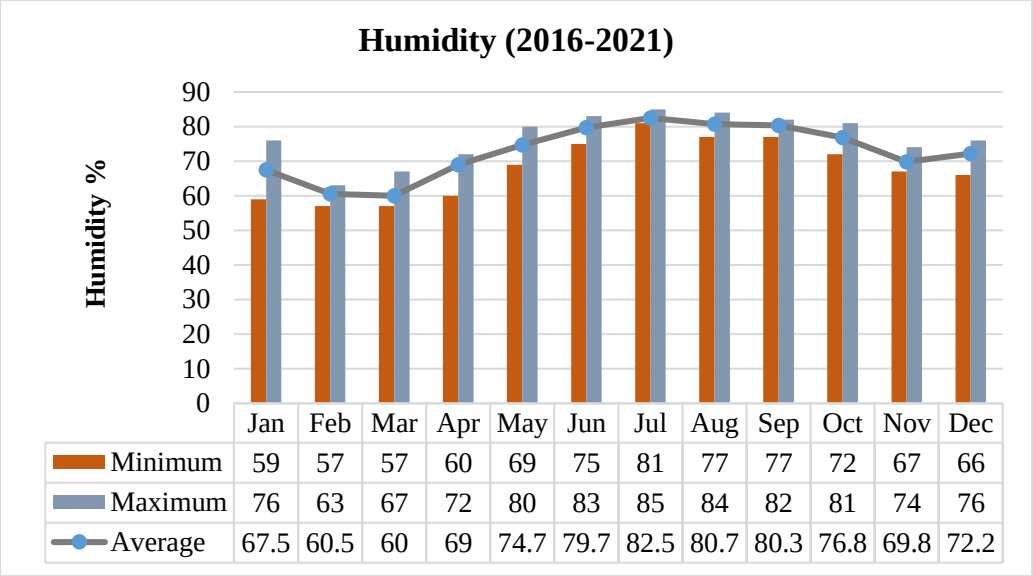


Source: research gate

Figure 33: Wind Rose Diagram of the Study Area

6.1.1.4 Relative Humidity

The average relative humidity remains higher during the monsoon season. The variance in the average relative humidity throughout the year is 82.5% to 56%. Figure 34 shows the maximum, minimum, and average relative humidity of Dhaka station from January 2016 to December 2021.



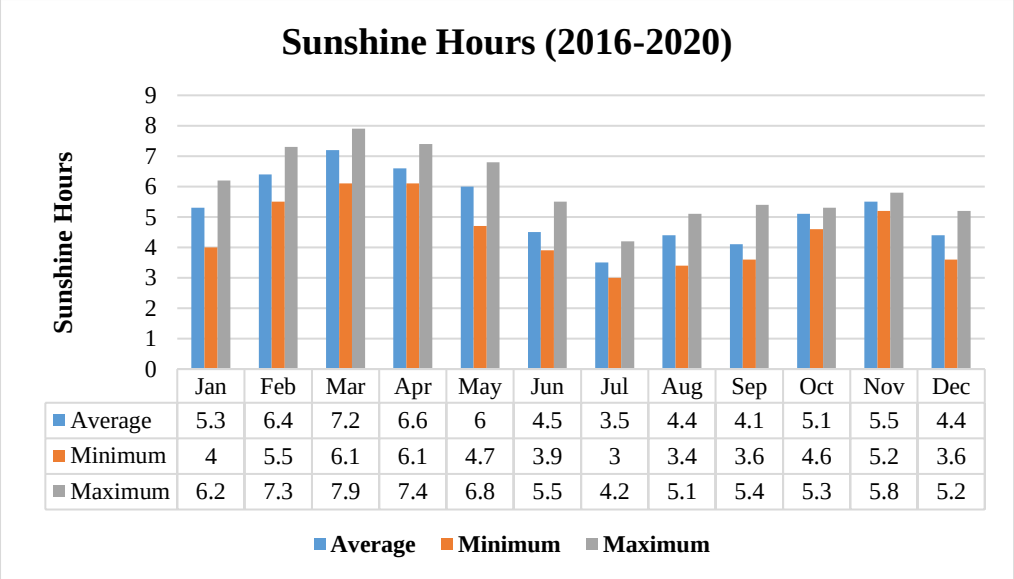
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	59	57	57	60	69	75	81	77	77	72	67	66
Maximum	76	63	67	72	80	83	85	84	82	81	74	76
Average	67.5	60.5	60	69	74.7	79.7	82.5	80.7	80.3	76.8	69.8	72.2

Source: Bangladesh Meteorological Department

Figure 34: Maximum, Minimum, and Average Relative Humidity of the Study Area

6.1.1.5 Sunshine

Sunshine data of Dhaka Station from the Bangladesh Meteorological Department (BMD) for 05 years (from January 2016- to December 2020) has been analyzed to see the monthly variation of the average maximum sunshine hour which is between 7.9 to 4.2 hours. The monthly variation of the average minimum sunshine hour is 6.1 to 3 hours. The maximum recorded sunshine hour in Dhaka station was 8 hours, which occurred in March 2016 and June 2020. In July 2019, the minimum sunshine hour was recorded as 2.8 hours in Dhaka. The highest sunshine hour month of the year is March and the lowest sunshine hour month of the year is July. Figure 35 shows the maximum, minimum, average maximum, and average of the minimum sunshine hour of Dhaka station from 2016 to 2020.



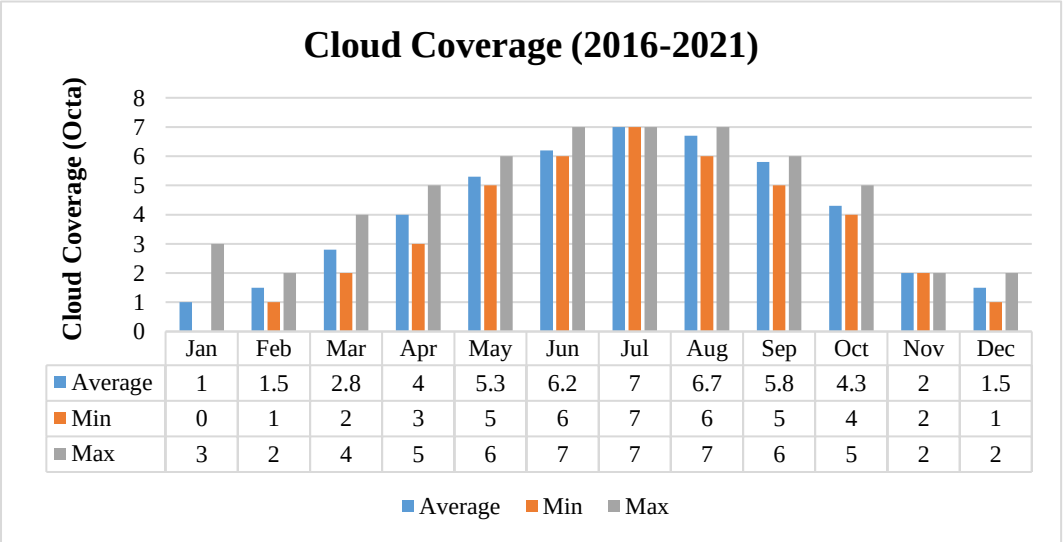
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	5.3	6.4	7.2	6.6	6	4.5	3.5	4.4	4.1	5.1	5.5	4.4
Minimum	4	5.5	6.1	6.1	4.7	3.9	3	3.4	3.6	4.6	5.2	3.6
Maximum	6.2	7.3	7.9	7.4	6.8	5.5	4.2	5.1	5.4	5.3	5.8	5.2

Source: Bangladesh Meteorological Department

Figure 35: Maximum, Minimum, and Average Sunshine Hours of the Study Area

6.1.1.6 Cloud Coverage

Cloud Coverage of Dhaka Station from the Bangladesh Meteorological Department (BMD) for 05 years (from January 2016- to December 2021) has been analyzed to see the monthly variation of the average maximum cloud coverage. The statistical cloud coverage data from shows that average cloud coverage remained maximum from 07 Octas to 05 Octas from May to October. The minimum cloud coverage was 0 Octas in January in the area of Dhaka station. Figure 36 shows the maximum, minimum, average maximum, and average of the minimum sunshine hour of Dhaka station from 2016 to 2021.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	1	1.5	2.8	4	5.3	6.2	7	6.7	5.8	4.3	2	1.5
Min	0	1	2	3	5	6	7	6	5	4	2	1
Max	3	2	4	5	6	7	7	7	6	5	2	2

Source: Bangladesh Meteorological Department

Figure 36: Maximum, Minimum, and Average Cloud Coverage of the Study Area

6.1.2 Ambient Air Quality

Air quality in the study area and its adjacent industrial areas is worsening day by day. Effects from the manmade occurrence along with some natural calamities are causing this condition of air quality. As a process of development, activities like burning fuel, industrial production processes, construction work, and transportation facilities are causing this damage to air quality. Although, the air quality of the rural area of Bangladesh is comparatively good, expanding industrial areas in rural areas will not let this situation stay long.

To understand the air quality around the project site, sampling of ambient air quality has been conducted at **24 different locations** within a radius of 1.5 km from the project site on 23rd and 24th January 2023. Air quality monitoring for major parameters like particulate matter, NOx, CO, CO_2, and SO_2 was conducted through a direct reading instrument, and collected data is given in table 6 of the project. The standards of Ambient Air set by DoE are provided in table 8. The test results are presented in **Annexure A**.

Table 8: Ambient Air Quality Standards

Parameters	$PM_{2.5}$	PM_{10}	NO_2	SO_2	CO
Air Pollution Control Rules 2022[3]	65 ($\mu g/m^3$)	150 ($\mu g/m^3$)	80$\mu g/m^3$ (0.043 ppm)	80 $\mu g/m^3$ (0 0.031 ppm)	5mg/m^3 (4.36) ppm

Table 9: Ambient Air Quality Inspection Result

Sl. No.	Inspection Area Point		SPM ($\mu g/m^3$)	PM_1 ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	CO_2 (ppm)
1	24°2'28.87958"N	90°14'22.72628"E	378.46	150	236	298	484
2	24°2'28.87958"N	90°14'15.76435"E	359.41	123	216	283	383
3	24°2'28.87958"N	90°14'11.0315"E	325.12	124	187	256	385
4	24°2'28.87958"N	90°14'25.48576"E	320.04	110	189	252	484
5	24°2'28.87958"N	90°14'21.41304"E	295.91	98	167	233	387
6	24°2'28.87958"N	90°14'9.27823"E	356.87	126	205	281	419
7	24°2'28.87958"N	90°14'11.0873"E	322.58	123	191	254	421
8	24°2'28.87958"N	90°14'6.97218"E	379.73	160	246	299	419
9	24°2'28.87958"N	90°14'8.17339"E	491.49	150	247	387	385
10	24°2'28.87958"N	90°14'9.5842"E	368.3	130	223	290	385
11	24°2'28.87958"N	90°14'9.59503"E	300.99	122	208	237	392
12	24°2'28.87958"N	90°14'9.43296"E	270.51	100	162	213	385

[3] DOE, "Air Pollution Control Rules'2022" Schedule-01, Department of Environment, Govt. of Bangladesh

Sl. No.	Inspection Area		SPM	PM_1	$PM_{2.5}$	PM_{10}	CO_2
	Point		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(ppm)
13	24°2'28.87958"N	90°14'9.3651"E	266.7	95	147	210	395
14	24°2'28.87958"N	90°14'6.95051"E	261.62	106	126	206	397
15	24°2'28.87958"N	90°14'9.16559"E	265.43	92	153	209	389
16	24°2'28.87958"N	90°14'17.5988"E	266.7	97	145	210	397
17	24°2'28.87958"N	90°14'17.60561"E	314.96	112	183	248	389
18	24°2'28.87958"N	90°14'17.5988"E	372.11	125	215	293	331
19	24°2'28.87958"N	90°13'56.6476"E	262.89	91	152	207	385
20	24°2'28.87958"N	90°13'50.80494"E	233.68	78	135	184	544
21	24°2'28.87958"N	90°13'40.91632"E	228.6	84	130	180	636
22	24°2'28.87958"N	90°13'38.58845"E	257.81	121	164	203	465
23	24°2'28.87958"N	90°13'38.58697"E	330.2	126	169	260	421
24	24°2'28.87958"N	90°13'38.02674"E	266.7	106	159	210	436

Source: Field survey

It shows that in terms of major air quality indicators, the project's surrounding has mixed air quality.

Based on the obtained air quality monitoring data, the ambient air quality around and within the facility area can be considered acceptable as most of the parameters have been found in compliance with the national standard except for particulate matters in most of the locations.

As particulate matter in most of the locations were high compared to the standards, the reason could be the ongoing production activity and its surroundings industries and highway.

Furthermore, movements of vehicales, ongoing construction work within the facility could also be the reason of high concentrated values.

Despite the ambient air quality being high, the project site is being water sprayed twice daily. Also, proper use of masks is being provided to the site workers and officials.

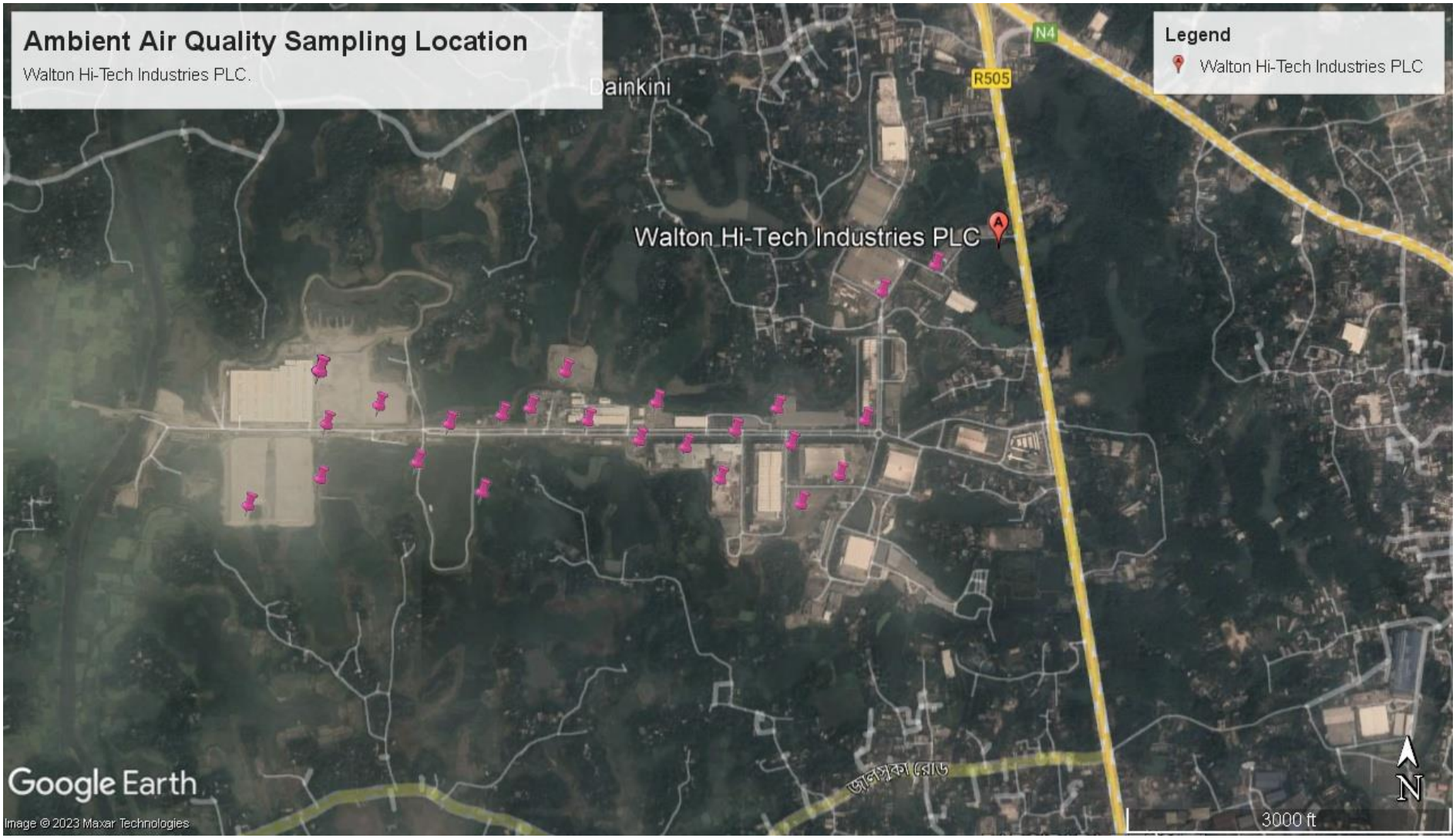


Figure 37: Ambient Air Quality Monitoring Location



Figure 38: Ambient Air Quality Monitoring

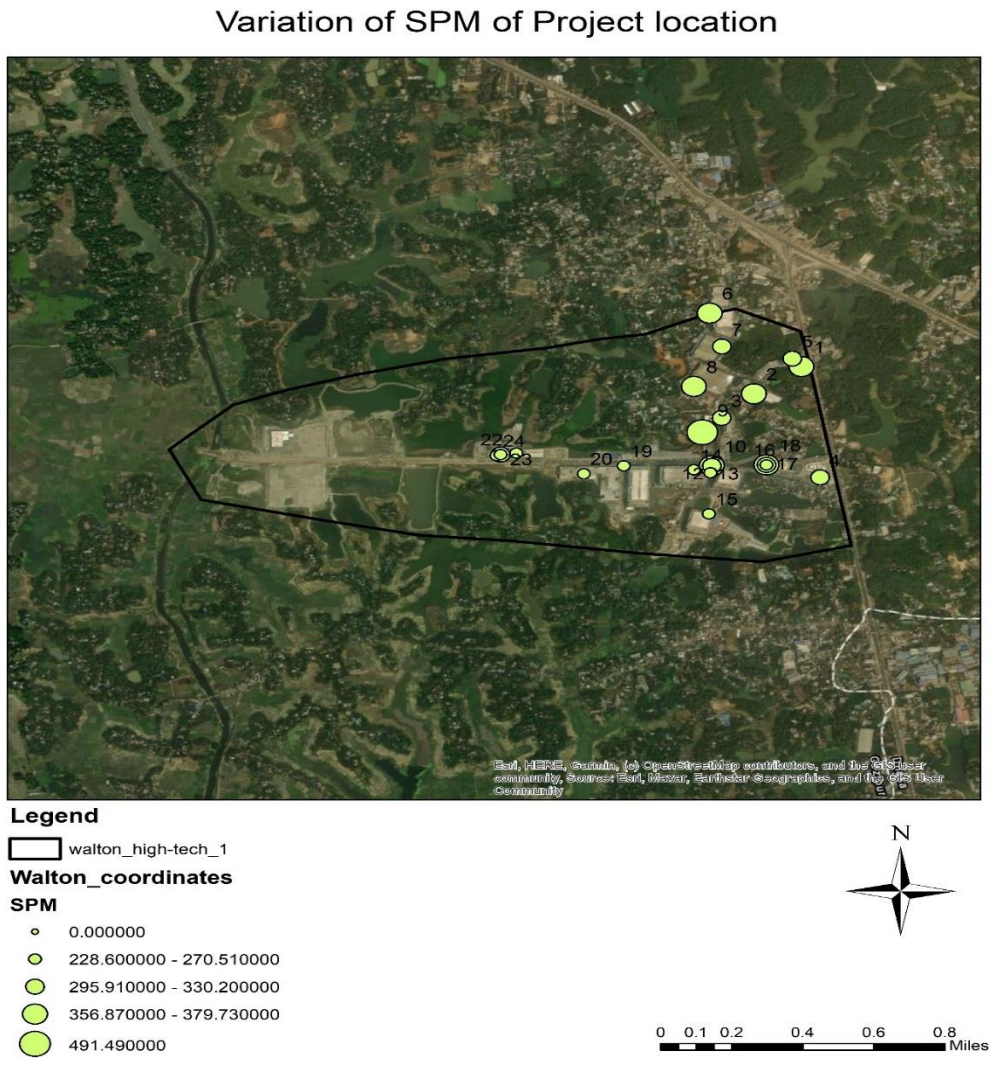


Figure 39: Variation of SPM around the Project Area

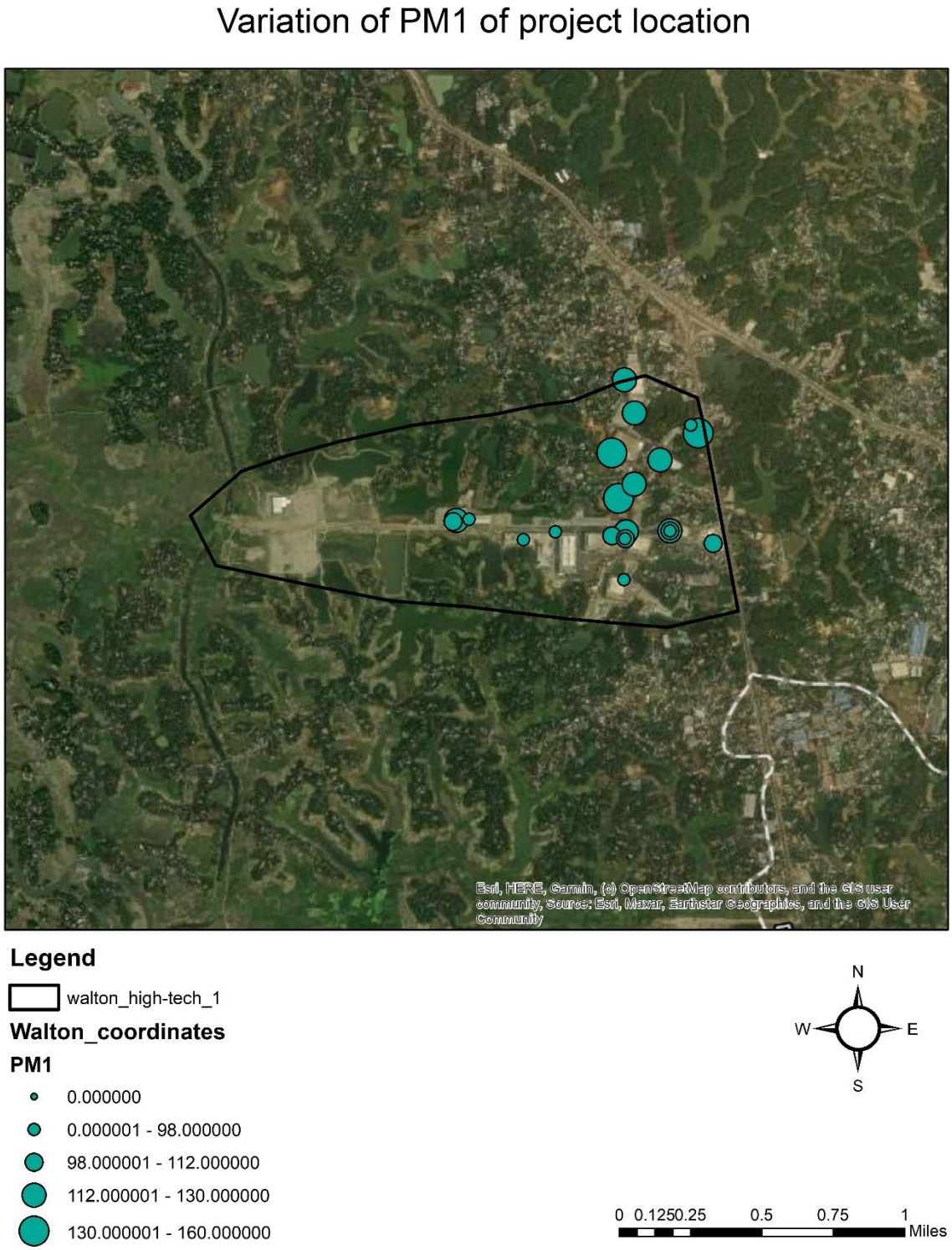


Figure 40: Variation of PM_1 around the Project Area

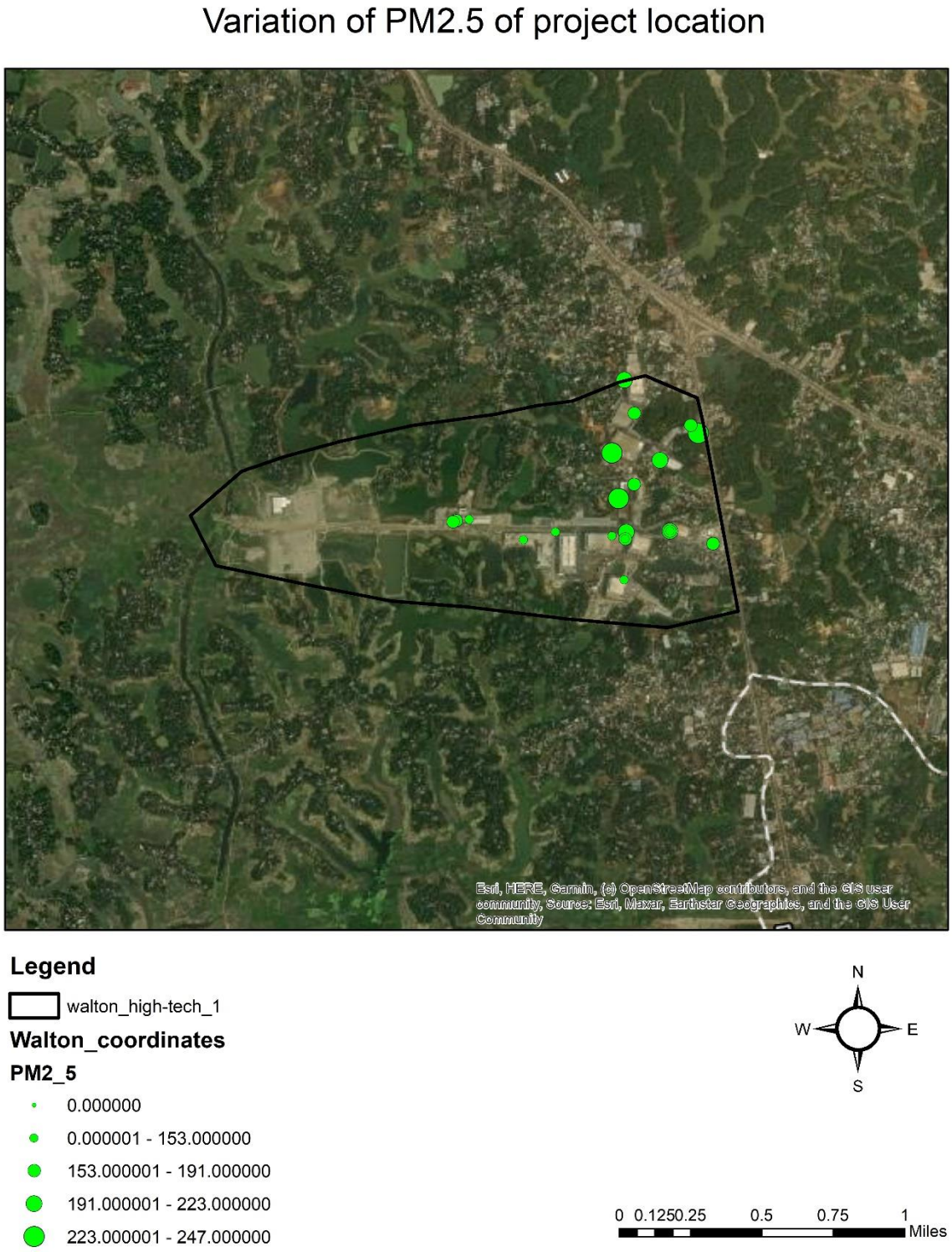


Figure 41: Variation of $PM_{2.5}$ around the Project Area

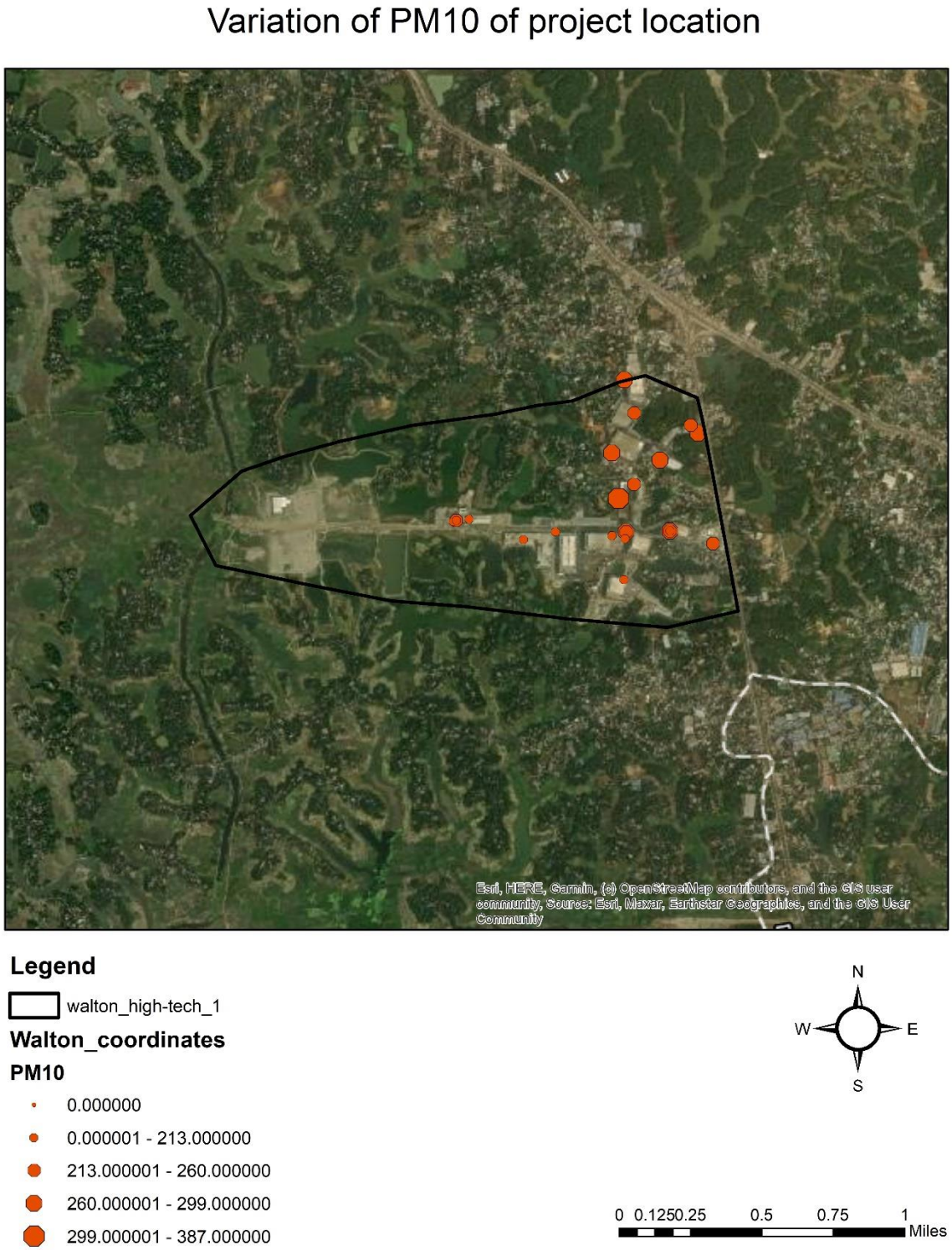


Figure 42: Variation of PM_{10} around the Project Area

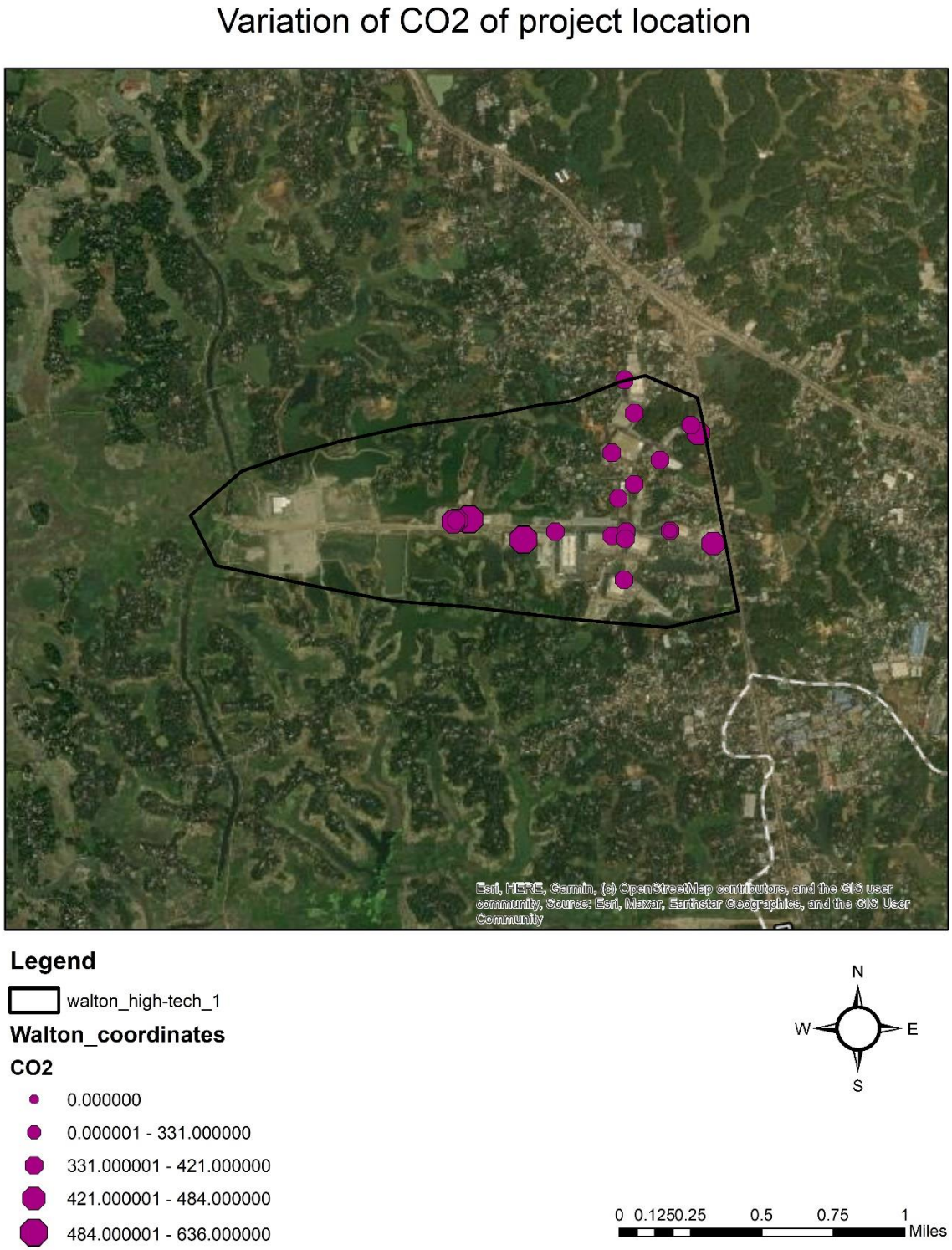


Figure 43: Variation of CO_2 around the Project Area

6.1.3 Physiography

Physiography is the description including form, substance, arrangement, and changes of especially, natural features. The term was introduced in geography in 1869 by Huxley for the study or description of 'natural phenomena in general, but later came to mean, a description of the surface features of the earth, as bodies of air, water, and land', with an emphasis on mode of origin; i.e. it became synonymous with physical geography and embraced geology, pedology, meteorology, and oceanography. Still later, the term was restricted to the part of physical geography that is involved with the description and origin of landforms. Physiographic region/unit refers to a region in 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 the context of physiography, Bangladesh may be classified into three distinct regions

a) floodplains,
b) terraces, and
c) hills each having distinguishing characteristics of its own.

The physiography of the country has been divided into 24 sub-regions and 54 units. Major sub-regions and units are as below:

i) Old Himalayan Piedmont Plain;
ii) Tista Floodplain;
iii) Old Brahmaputra Floodplain;
iv) Young Brahmaputra and Jamuna Floodplain;
v) Haor Basin;
vi) Surma-Kushiyara Floodplain;
vii) Meghna Floodplain - a. Middle Meghna Floodplain, b. Lower Meghna Floodplain, c. Old Meghna Estuarine Floodplain, d. Young Meghna Estuarine Floodplain;
viii) Ganges River Floodplain;
ix) Ganges Tidal Floodplain;
x) Sundarbans;
xi) Lower Atrai Basin;
xii) Arial Beel;
xiii) Gopalganj-Khulna Peat Basin;
xiv) Chittagong Coastal Plain;
xv) Northern and Eastern Piedmont Plain;
xvi) Pleistocene Uplands: a. Barind Tract, b. Madhupur Tract and c. Tippera Surface;
xvii) Northern and Eastern Hills a. Low Hill Ranges (Dupi Tila and Dihing Formations), b. High Hill or Mountain Ranges (Surma and Tipam Formations).

The project area is situated in the Madhupur Tract which is a physiographic region located in the central and northern parts of Bangladesh. It covers an area of approximately 4,000 square kilometers, spanning across parts of the Dhaka, Tangail, Mymensingh, and Jamalpur districts. The region is characterized by a series of low hills, hillocks, and plateaus, and is situated on

the eastern fringe of the Himalayan mountain range. The Madhupur Tract is geologically distinct from the surrounding plains of Bangladesh, with its rock formations being much older and harder than the alluvial sediments that make up the rest of the country. The region's soil is predominantly red, which is due to the high iron content in the rocks.

This region is an important agricultural region in Bangladesh, known for its production of crops such as rice, wheat, and vegetables. The hilly terrain of the region also provides opportunities for horticulture, with fruits such as mango, guava, and litchi being grown in the area.

The Madhupur Tract is also rich in biodiversity, with various species of flora and fauna found in the region. The area is home to several important forest reserves, including the Madhupur National Park and the Bhawal National Park. The forests of the Madhupur Tract are home to numerous species of trees, including sal, teak, and bamboo, as well as a variety of wildlife, including deer, monkeys, and wild boars.

In recent years, the Madhupur Tract has faced a number of environmental challenges, including deforestation, soil erosion, and water pollution. Efforts are being made to address these issues through reforestation programs, soil conservation measures, and improved waste management practices.

Overall, the Madhupur Tract is an important and unique region of Bangladesh, with its distinct geological, ecological, and agricultural characteristics.
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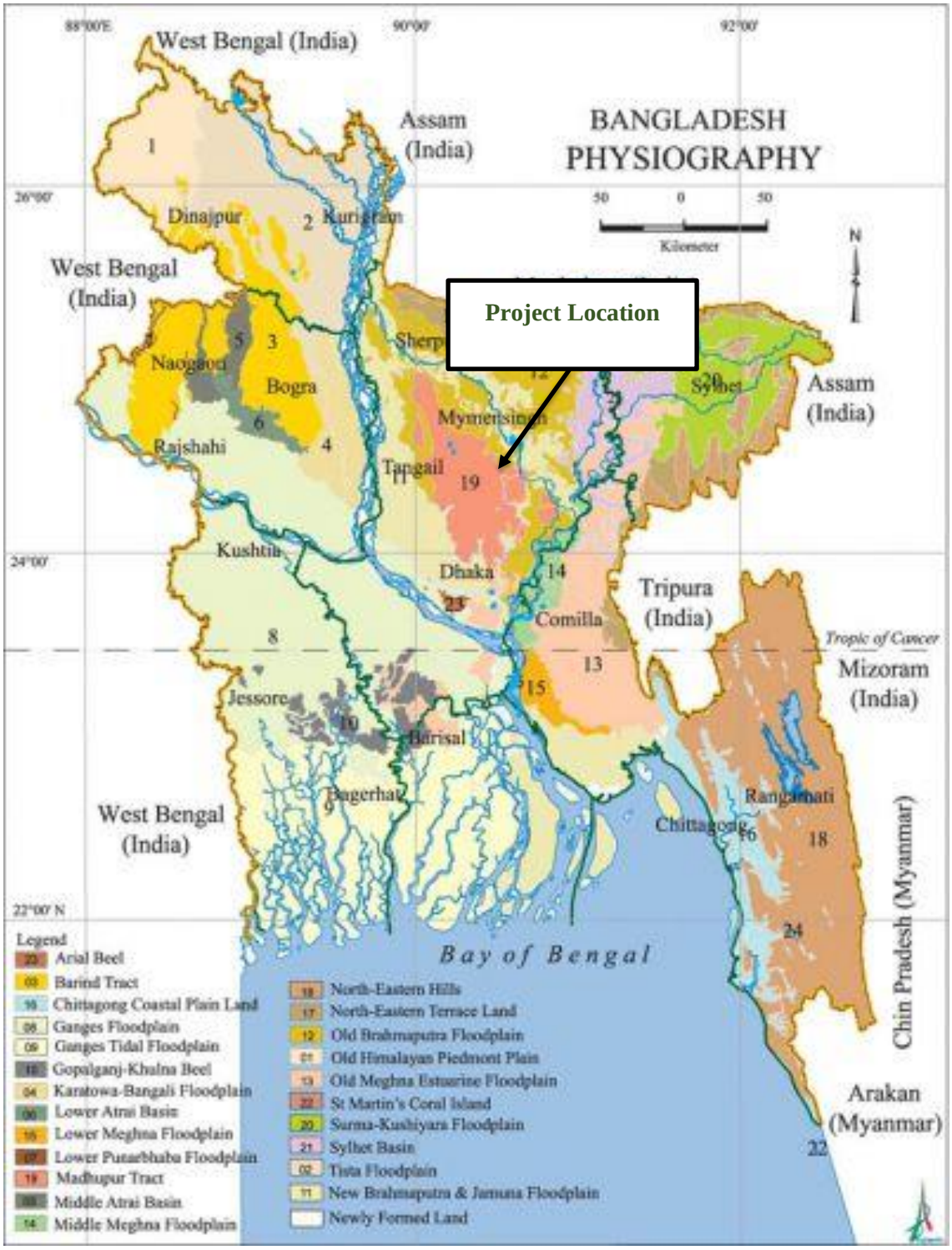


Figure 44: Physiography of the Project Area

6.1.4 Regional & Site Topography

Based on the aforesaid classification, the topography of the project has fallen into the Madhupur Tract under the Pleistocene Terrace. This is a region of complex relief and soils developed over the Madhupur Clay. The landscape comprises level upland, closely or broadly dissected terraces associated with either shallow or broad, deep valleys. Eleven general soil types exist in the area of which deep red-brown terrace, shallow red-brown terrace soils, and acid basin clays are the major ones. Soils in the valleys are dark grey heavy clays. They are strongly acidic in reaction with the low status of organic matter, low moisture holding capacity, and low fertility level. The figure 45 shows the project location on the topography of Bangladesh.

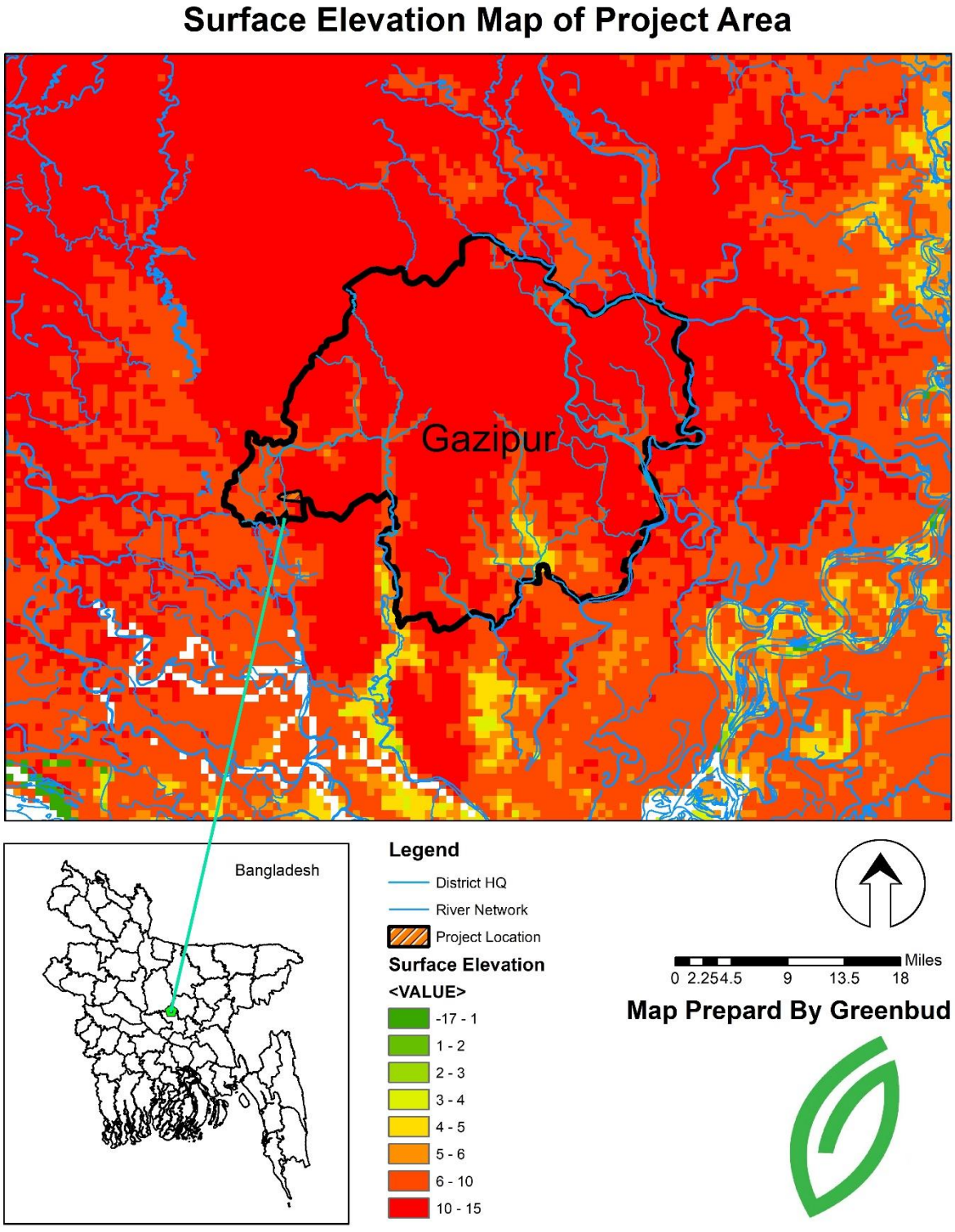


Figure 45: Topography of the Project Area

6.1.5 Geology

Rapid urbanization without considering the geological aspects has brought significant changes in the geo-environment of the city area. Waterlogging, pollution, changes in the hydrogeological system, localized land subsidence, and building collapse are the hazards associated with these changes in the geo-environment. groundwater withdrawal has increased more than 900% over the last 30 years resulting in groundwater mining and lowering the water level by 20m. Water resources of the city are being polluted by the indiscriminate disposal of untreated industrial and municipal wastes in swamps and natural channels in and around the city. The project location is situated in the Madhupur Clay Residuum.

Madhupur Clay highly weathered and deeply oxidized reddish brown deposit exposed in the Madhupur, Barind and Lalmai Hill areas. Madhupur Clay represents several north-south elongated pleistocene terraces, highly dissected during the Late Pleistocene climatic episodes. Madhupur Clay makes beautiful scenery of the lalmai hills, Madhupur and Varendra areas. All the ancient civilisations, flourished at Mahasthangad, Paharpur and Mainamati are located in the Madhupur Clay zones. The Madhupur Clay had played a distinct role in the civil engineering works, art and culture of the ancient Bengal.

These deposits are extensively exposed in Vawal and Madhupur Garhs of Dhaka, Mymensingh and Tangail districts. In the Barind area, these deposits are exposed in the Greater Rajshahi and Bogra districts. In Comilla district, Madhupur Clay capped almost all the hilltops of Lalmai Hills. In Madhupur and Barind areas, these deposits form some north-south elongated landmasses slightly elevated from the adjacent floodplain. These clays are known as the Madhupur Clay Formation. The clay contains halloysite and illite and represents relict palaeosol. Nowadays, in Madhupur and Barind areas, this clay is called Madhupur and Barind formations respectively. Stratigraphically Madhupur Clay has been subdivided into three members: upper one is called Dhaka Clay Member, represented by highly weathered deep clayey materials composed of ferruginous nodules, pipestems and manganese spots. The middle member is called Mirpur Silty-clay Member and the lower one is called the Bhaluka Sand Member, and is represented by yellowish brown highly micaceous sand containing primary sedimentary structures, such as, cross bedding, ripple marks etc. Palaeomagnetical studies showed normal polarity of this formation and has been correlated with the Jaramillo Event of Matuyama Reversed Polarity Epoch. It means that the Clay has the age of about 0.97 to 0.90 million years. The depositional environment of the Madhupur Clay is fluvial.

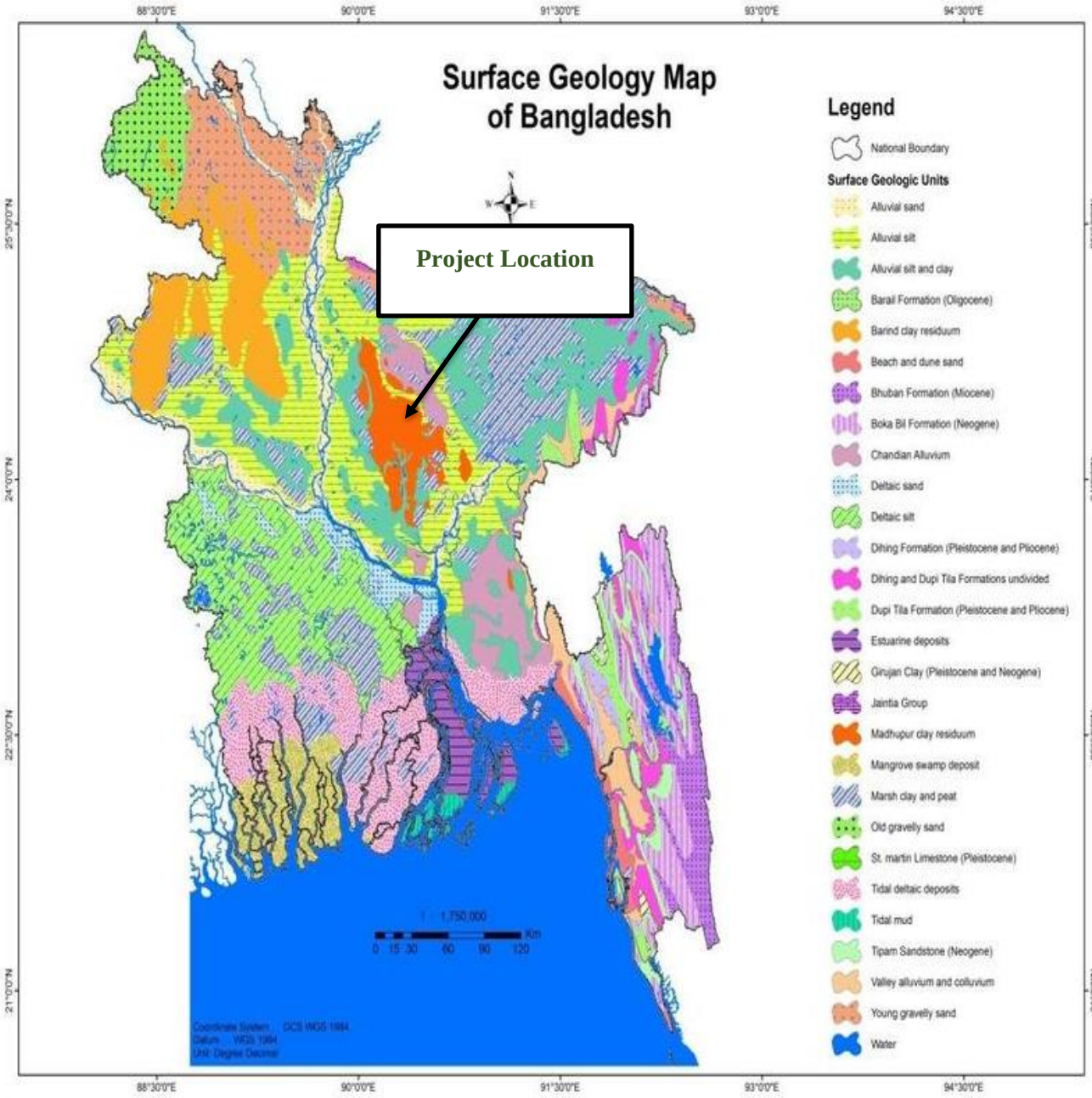


Figure 46: Geology of the Project Area

6.1.6 Soil Quality

Most of the area of Bangladesh is a vast, low-lying alluvial plain, sloping gently to the south and southeast. The major part of Bangladesh is on the delta formed by the three major rivers Brahmaputra, Ganges, and Meghna. These rivers and many of the country's other minor rivers originate outside the national boundary of the country and make up the Ganges-Brahmaputra-Meghna River system.

Soil Texture relative proportions of sand, silt and clay. These fractions are defined in terms of the diameter in mm of the particles. Particles larger than 2 mm in diameter are excluded from soil texture determination. The size of particles in mineral soil is not readily subject to change. Thus, a sandy soil remains sandy, and a clayey soil remains clayey. Since the proportion of each size group in a given soil (the texture) cannot be easily altered, it is considered a basic property of a soil. To convey an idea of the textural make-up of soils and to give an indication of their physical properties, soil textural class names are used. Four broad groups of these classes are recognized: sands, silts, clays and loams. These broad textural classes are as follows: Sandy - soils containing more than 70% sand; Silt - soils containing more than 80% silt; Clay - soils containing more than 40% clay; Loams - intermediate mixture of sand, silt, and clay. Loam soils are considered to be the favorable texture for growing most agricultural crops.

In addition to these general textural classes, in fact soils are technically divided into twelve textural classes. These are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay and clay. The project location is situated in between **Clay Loam region** which is shown in below figure 47.

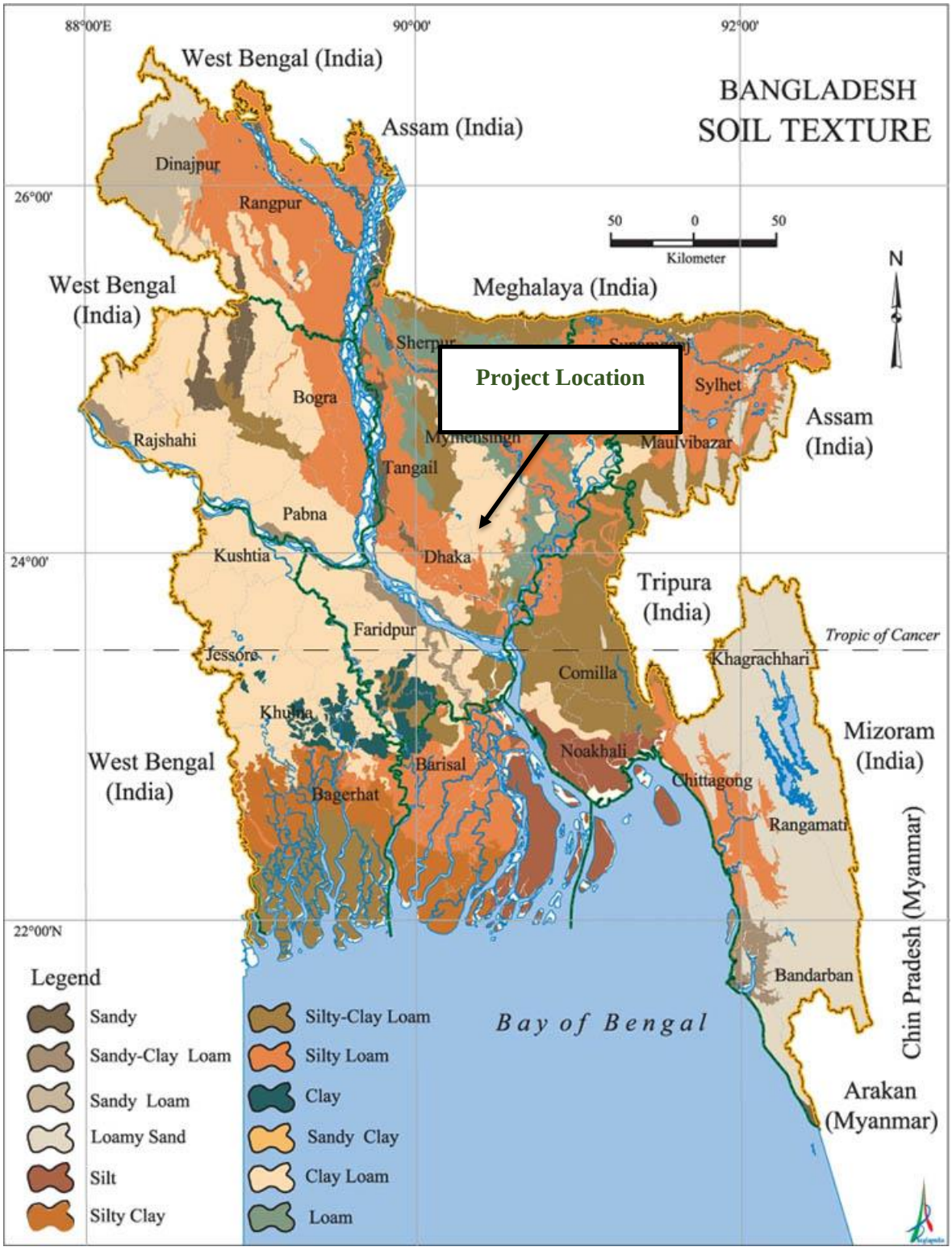


Figure 47: Soil Type of the Project Area

6.1.7 Agro-Ecological Zones within the Project Area

Agro ecological Zone land areas are recognized based on hydrology, physiography, soil types, tidal activity, cropping patterns, and seasons. An agro ecological zone indicates an area characterized by homogeneous agricultural and ecological characteristics. This homogeneity is more prominent in the sub-region and unit levels. The agro ecological zones of Bangladesh have been identified based on four elements such as physiography, soils, land levels of flooding, and agro climatology. Bangladesh has been tentatively divided into 30 agro ecological zones. These 30 zones have been subdivided into 88 agro ecological sub-regions, which have been further subdivided into 535 agro-ecological units.

According to the Bangladesh Agricultural research council‘s Agro-Ecological Zoning map of Bangladesh, the project area falls in the **Madhupur Tract.**

The region comprises of complex relief and soils developed over the Madhupur Clay. The landscape comprises level upland, closely or broadly dissected terraces associated with either shallow or broad, deep valleys. Eleven general soil types exist in the area of which deep red brown terrace, shallow red brown terrace soils and acid basin clays are the major ones. 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.

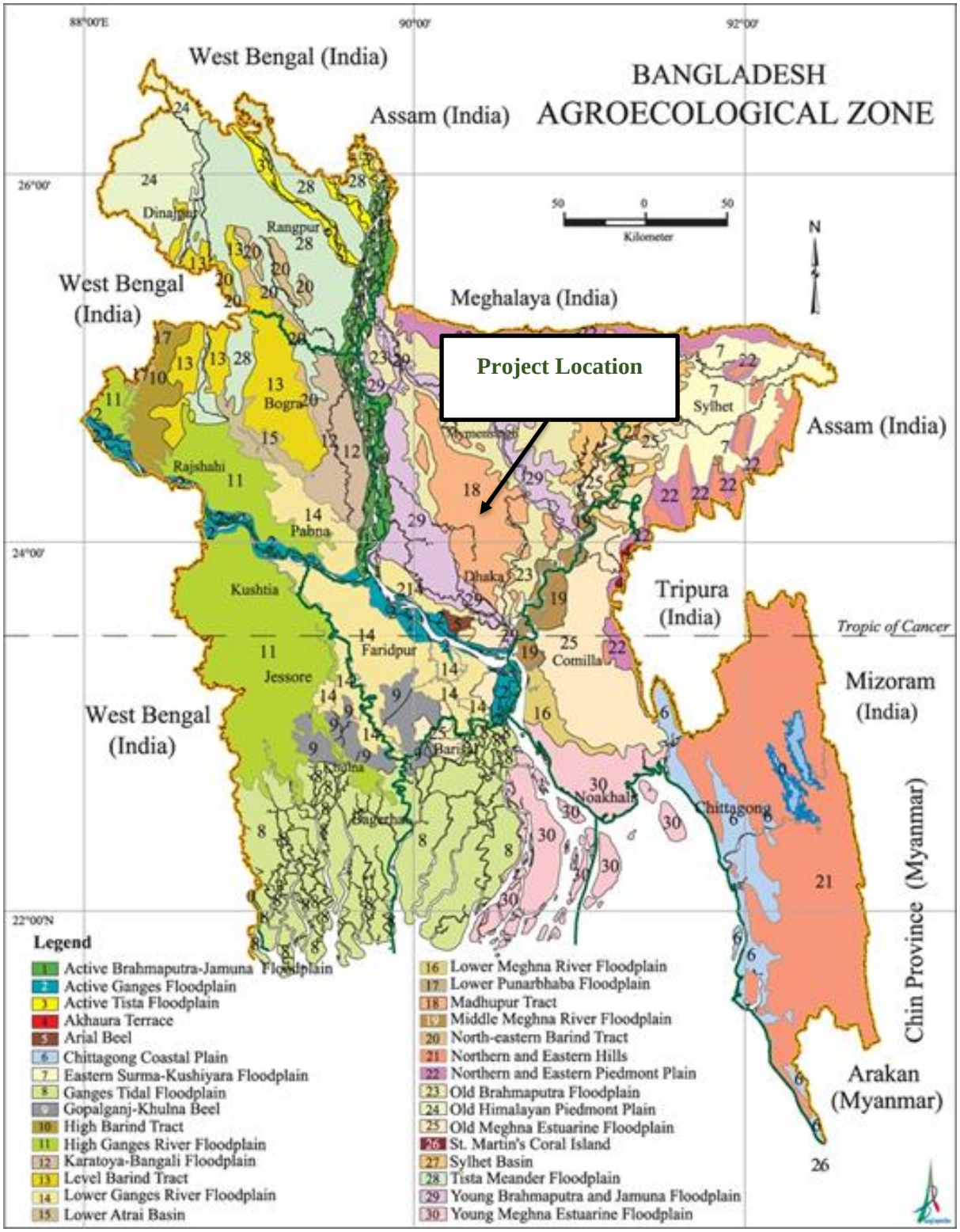


Figure 48: Agro-Ecological Zones of the Project Area

6.1.8 Hydrology

The rivers of Bangladesh are very extensive and distinguish both the physiography of the country and the life of the people. Bangladesh is called a land of rivers as it has about 700 rivers including tributaries. The rivers are not, however, evenly distributed. For instance, they increase in numbers and size from the northwest of the northern region to the southeast of the southern region. The total length of all rivers, streams, creeks, and channels is about 24,140 km. In terms of the catchment's size, river length, and volume of discharge, some of these rivers are amongst the largest on the earth.

Usually, the rivers flow south and serve as the main source of water for irrigation and as the principal arteries of commercial transportation. The rivers also provide sweet water fish, an important source of protein. A large segment of the population is thus engaged in the fishing sector. On the other hand, widespread riverbank erosion and regular flooding of the major rivers cause enormous hardship and destruction of resources hindering development. But it is also true to say that the river system brings a huge volume of new silt to replenish the natural fertility of the agricultural land. Moreover, the enormous volume of sediments that the rivers carry to the Bay of Bengal each year (approximately 2.4 billion tons) builds new land along the seafront, keeping hope alive for future extension of settlement. Finally, during the monsoon, rivers also drain excess discharge to the Bay. Thus, this great river system is the country's principal resource as well as its greatest hazard.

The system can be divided into four major networks:

a) Brahmaputra-Jamuna River System,
b) Ganges-Padma River System,
c) Surma-Meghna River System, And
d) Chittagong Region River System.

The proposed project area falls under the **Brahmaputra-Jamuna River System**.

Brahmaputra-Jamuna and the old Brahmaputra, with their main tributary tista, and a good number of small tributaries and distributaries constitute the largest floodplain of Bangladesh. Excepting for a small portion in the north, the entire floodplain lies within the Pleistocene terrace regions. The floodplain and the Pleistocene terraces almost completely cover two of the six administrative divisions of the country, Rajshahi and Dhaka.

The Brahmaputra enters Bangladesh east of Bhabanipur (India) and northeast of kurigram district. It first flows south and then turns southeast and travels through the madhupur tract to meet the Meghna near Bhairab Bazar. The river seems to be much younger than the Ganges. Along with the Meghna, it is making a major contribution to the building up of the delta. Among the major rivers, Brahmaputra-Jamuna is the most energetic and has the highest stream power. This river, despite having a smaller drainage basin than the Ganges, has a steeper slope, a larger discharge, higher sediment transport, and higher sediment content.

The Brahmaputra-Jamuna receives four major right-bank tributaries - the dudhkumar, dharla, Tista, and hurasagar. The first three are flashy, rising in the steep catchment on the southern side of the Himalayan system between Darjeeling and Bhutan. The Tista is one of the most important rivers of the northern region. Before 1787 it was the principal water source for the karatoya, atrai and Jamuneshwari. A devastating flood of 1787 brought in a vast amount of sand wave through the Tista and choked the mouth of the Atrai; as a result, the Tista burst into the course of the ghaghat river. The Tista has kept this course ever since. The present channel within Bangladesh is about 280 km long and varies between 280 to 550 m in width. It joins the Brahmaputra just south of Chilmari Upazila. The Dharla and Dudhkumar flow parallel to Tista. The Dharla is a fast-flowing river in the monsoon but with the fall of water level, it becomes braided. The Dudhkumar is a small river that flows southeast to join the Brahmaputra. The combined discharge of the Atrai and Karatoya passes through the Hurasagar to the Jamuna.

The old Brahmaputra and the Dhaleshwari are the important left-bank distributaries of the Jamuna. Before the 1787 Assam flood, the Brahmaputra was the main channel; since then the river has shifted its course southward along the Jhenai and Konai rivers to form the broad, braided Jamuna channel. The old course named the Old Brahmaputra is now essentially a high-flow spill channel, active only during the monsoon. Taking off at Bahadurabad, the Old Brahmaputra flows southeast, passes by Jamalpur and Mymensingh towns, and joins the Meghna at Bhairab Bazar. Its average gradient is 4.76 cm/km. Along its southeasterly journey, Dhaleshwari bifurcates at least twice. Two of its important branches are the Kaliganga and buriganga. The Dhaleshwari eventually meets the Shitalakshya at Narayanganj.

6.1.8.1 Water Quality

6.1.8.1.1 Ground Water

The proposed project will require water for its cleaning purposes during the operation phase as well as at present it is used for domestic and drinking purposes. Groundwater will be used for this purpose as groundwater is the main source of domestic, irrigation, and industrial water supply in the project area. Figure 49 is showing the groundwater zoning map which indicated that the project site is located at the area of groundwater level 0-5.3 m. The map shows the different levels of groundwater level in all over Bangladesh. It can be seen that some parts of Dhaka have the lowest levels and other parts have moderately easier access to groundwater as they have higher groundwater levels.

Groundwater aquifers are being recharged mainly by infiltration of rainwater. To determine the quality of groundwater, a water sample was collected from the project site and analyzed for different parameters. Groundwater is available within the project area in a good state. Most of the nearby households use groundwater as their source of water for various uses.

The sample was collected on 23rd and 24th January 2023 in a sealed condition. Later, it was sent for further tests. The result shows that all the parameters remain within the allowable limit of drinking water value as per the Environmental Quality Standards for Bangladesh. The parameters which have been analyzed during this study are presented below in the table and the reference water test report has been attached to **Annexure C**.

Table 10: Groundwater Quality of the Project Site

SL No	Location		pH	Temperature	Electric Conductivity (EC)	Total Dissolved Solids (TDS)	Iron (Fe)	Arsenic (As)	Total Alkalinity	Chloride (Cl^-)	Dissolved Oxygen (DO)
			-	°C	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	24° 2'27.462"N	90°14'81.752"E	7.4	21.2	361	179	0	0	93	17	7.2
2	24° 2'57.87589"N	90°14'23.73166"E	7.3	20.9	348	171	0	0	95	18.9	7.4
3	24° 2'81.3896"N	90°13'25.4216"E	7.4	23.2	349	170	0	0	101	15.1	7.3
4	24° 2'39.504"N	90°14'291.818"E	7.6	22.0	319	157	0.23	0	92	17.2	7.6
5	24° 2'28.81939"N	90°14'22.50269"E	7.5	20.9	350	171	0	0	97	18.3	7.1
6	24° 2'8.088"N	90°14'6.672"E	7.8	21.0	288	129	0.12	0	112	27.9	6.9
7	24° 2'4.182"N	90°14'6.858"E	7.6	22.2	356	161	0.09	0	107	30	7.5
8	24° 2'21.01322"N	90°14'9.05946"E	7.8	20.0	287	122	0	0	103	21	7.3
9	24° 2'19.704"N	90°14'10.818"E	7.6	20.1	360	166	0	0	101	17.7	7.2
10	24° 2'13.674"N	90°13'37.248"E	7.5	20.6	293	125	0	0	109	22.9	7.4
11	24° 2'28.8114"N	90°14'22.50586"E	7.6	21.0	294	129	0.39	0	113	23	7.3
12	24° 2'4.122"N	90°14'6.876"E	7.6	20.9	360	161	0	0	95	19	7.5
13	24° 2'9.864"N	90°14'13.5"E	7.4	20.6	268	116	0.28	0	96	20.1	7.6
14	24° 2'13.662"N	90°13'43.752"E	7.4	20.6	353	153	0	0	117	18.9	7.1
15	24° 2'7.87589"N	90°14'23.73166"E	7.5	20.4	353	154	0	0	98	18.7	7.2
16	24° 2'9.88897"N	90°13'45.48666"E	7.5	22.6	342	148	0	0	93	19	7.3
17	24° 2'18.222"N	90°14'8.676"E	7.4	22.2	341	147	0	0	101	24	7.2
18	24° 2'9.88955"N	90°13'45.48742"E	7.6	22.4	288	118	0	0	99	15.9	7.2

SL No	Location		pH	Temperature	Electric Conductivity (EC)	Total Dissolved Solids (TDS)	Iron (Fe)	Arsenic (As)	Total Alkalinity	Chloride (Cl^-)	Dissolved Oxygen (DO)
			-	°C	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
19	24° 2'47.721"N	90°14'350.189"E	7.6	22.5	173	69	0	0	97	14	7.3
20	24° 2'259.569"N	90°14'18.791"E	7.5	22.4	289	122	0	0	110	11	7.1
21	24° 2'37.282"N	90°14'5.457"E	7.4	23.3	176	73	0.16	0	94	15	7.3
22	24° 2'23.21032"N	90°14'8.05946"E	7.6	23.1	286	122	0.16	0	108	9	7.2
23	24° 2'21.567"N	90°14'17.819"E	7.4	23.6	355	152	0	0	99	14.9	7.4
24	24° 2'37.892"N	90°14'7.902"E	7.5	23.6	267	188	0	0	103	12	7.1
Bangladesh Standard for Drinking Water (ECR'23)			6.5-8.5	20-30	-	1000	0.3-1.0	0.05	-	250	-
Method of Analysis			Electrometric (pH Meter)	APHA METHOD 2550	EC Meter	Electrical Conductivity	USEPA 200.9; SM 3111 B	USEPA 206.2; SM 3111 B	Titrimetric	USEPA 325.6; SM 4500-Cl	APHA 4500-O A

Source: Field survey conducted on 23rd-24th January 2023 and tested on 25th January 2023



Figure 49: Groundwater Sample Collection from Project Site

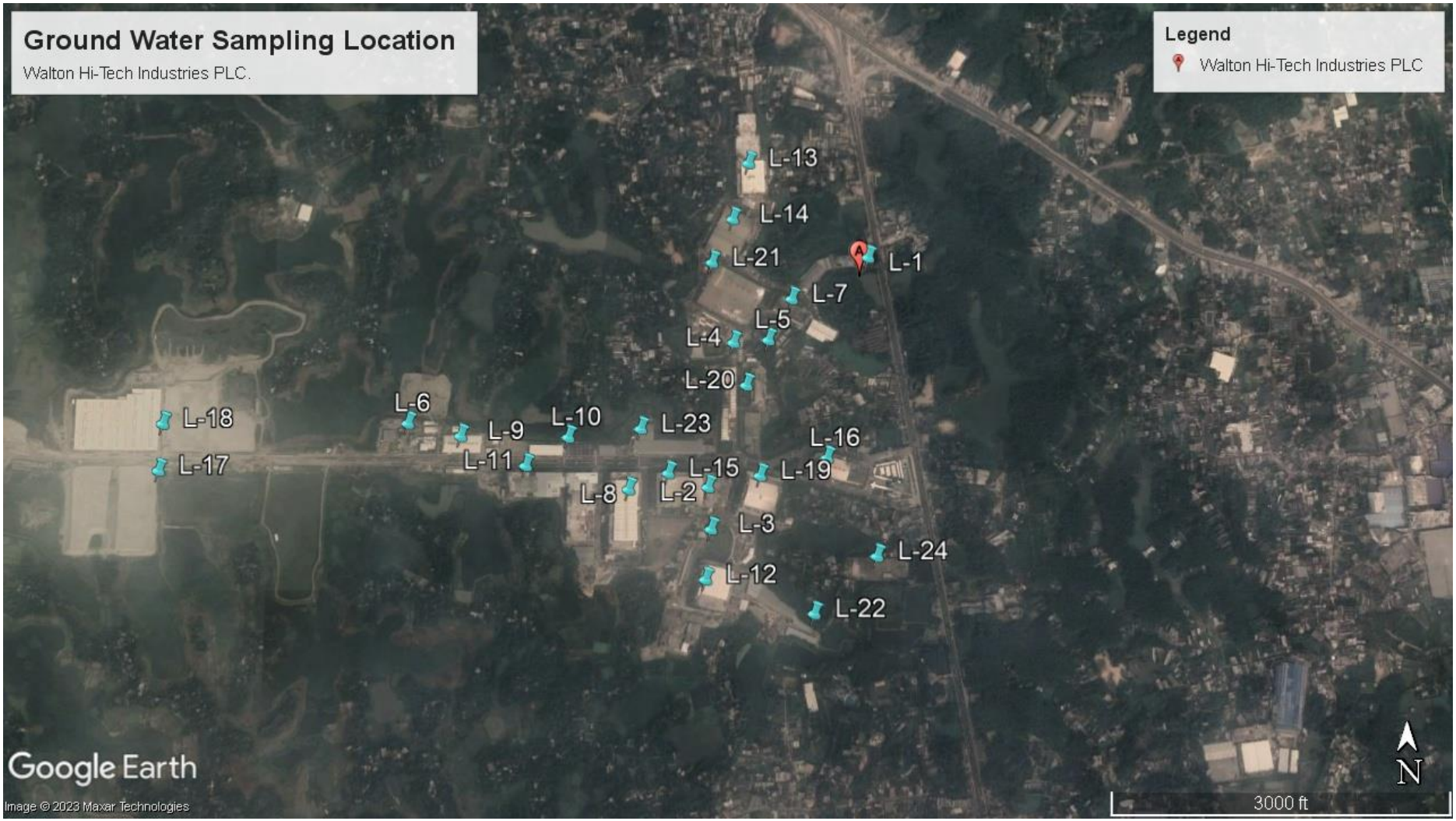
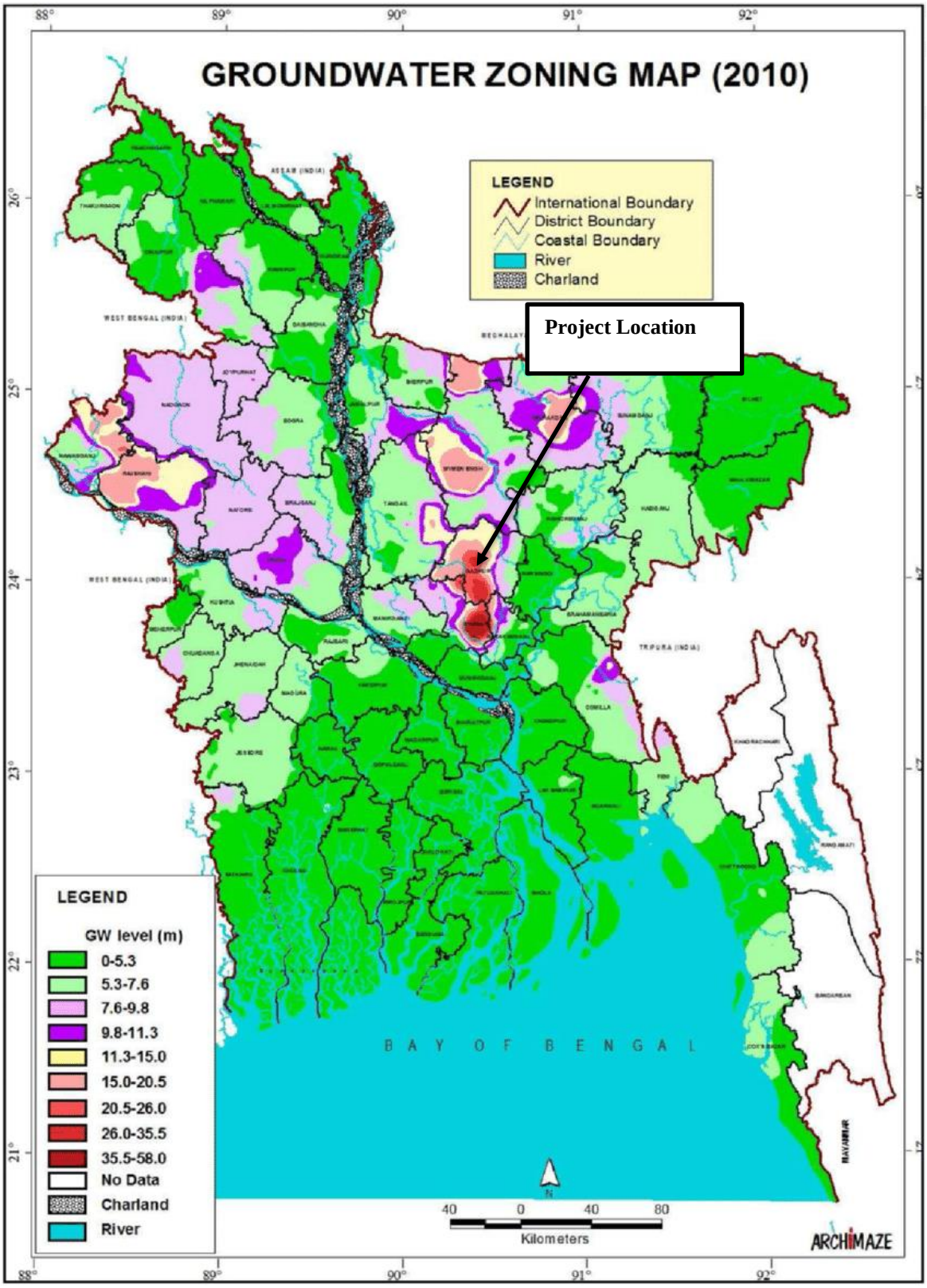


Figure 50: Groundwater Sample Location Map



Source: researchagate

Figure 51: Ground Water Zoning Map of Bangladesh

6.1.8.1.2 Surface Water

To determine the quality of surface water, different water samples were collected from the nearest sources and analyzed for different parameters the samples were collected on 23rd and 24th January 2023 in a sealed condition from nine locations of the project area. Later, it was sent for further tests. The result shows that most of the parameters remain within the allowable limit value except temperature and BOD as per the Inland Surface Water (Water usable by fisheries) Environmental Quality Standards for Bangladesh. The parameters which have been analyzed during this study are presented below in the tables and the reference water test report is attached in **Annexure D**.

Table 11: Surface Water Quality of the Project Site

Sl. No	Location		pH	Temperature	Total Dissolved Solids (TDS)	Chemical Oxygen Demand COD	Nitrogen (Ammonia)	Chloride (Cl^-)	Dissolve Oxygen (DO)	Biological Oxygen Demand (BOD)	Electric Conductivity (EC)
			-	°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm
1	24° 2'21.216"N	90°13'13.11"E	8.1	22.8	202	7.1	0.29	29	6.7	4.9	441
2	24° 2'11.01512"N	90°13'24.418"E	8	23.2	581	19.1	0.28	32	5.5	10.8	1197
3	24° 2'0.94488"N	90°14'28.865"E	7.7	23.2	210	11.6	0.61	33	6	7.2	457
4	24° 2'24.348"N	90°13'11.766"E	7.6	23	210	11.4	0.34	27	6.4	6.6	455
5	24° 1'40.36228"N	90°12'31.95263"E	7.4	20.9	52	13	0.35	38	5.6	5.9	93
6	24° 1'29.82335"N	90°12'55.40296"E	7.9	20.6	174	10.9	0.47	31	3.1	6.1	377
7	24° 2'4.092"N	90°14'7.902"E	8.5	21.2	391	14.4	0.33	33	5	8.7	823
8	24° 1'29.82371"N	90°12'55.39108"E	8.3	20.2	78	8.5	0.46	28	6.6	3.9	184
9	24°2'4.08"N	90°14'8.016"E	8.3	22.4	110	6	0.51	29	6.8	3.4	251
Bangladesh Standard for Inland Surface Water (Water usable by fisheries) (ECR'23)			6-9	-	1000	50	-	-	≥ 5	≤ 6	-
Method of Analysis			Electrometric (pH Meter)	APHA METHOD 2550	Electrical Conductivity	APHA METHOD 5220C	EPA 350.1	USEPA 325.6; SM 4500-Cl	APHA 4500-O A	EPA 405.1	EC Meter

Source: Field survey conducted on 23rd-24th January 2023 and tested on 29th-30th January 2023



Figure 52: Surface Water Sample Collection from Project Site

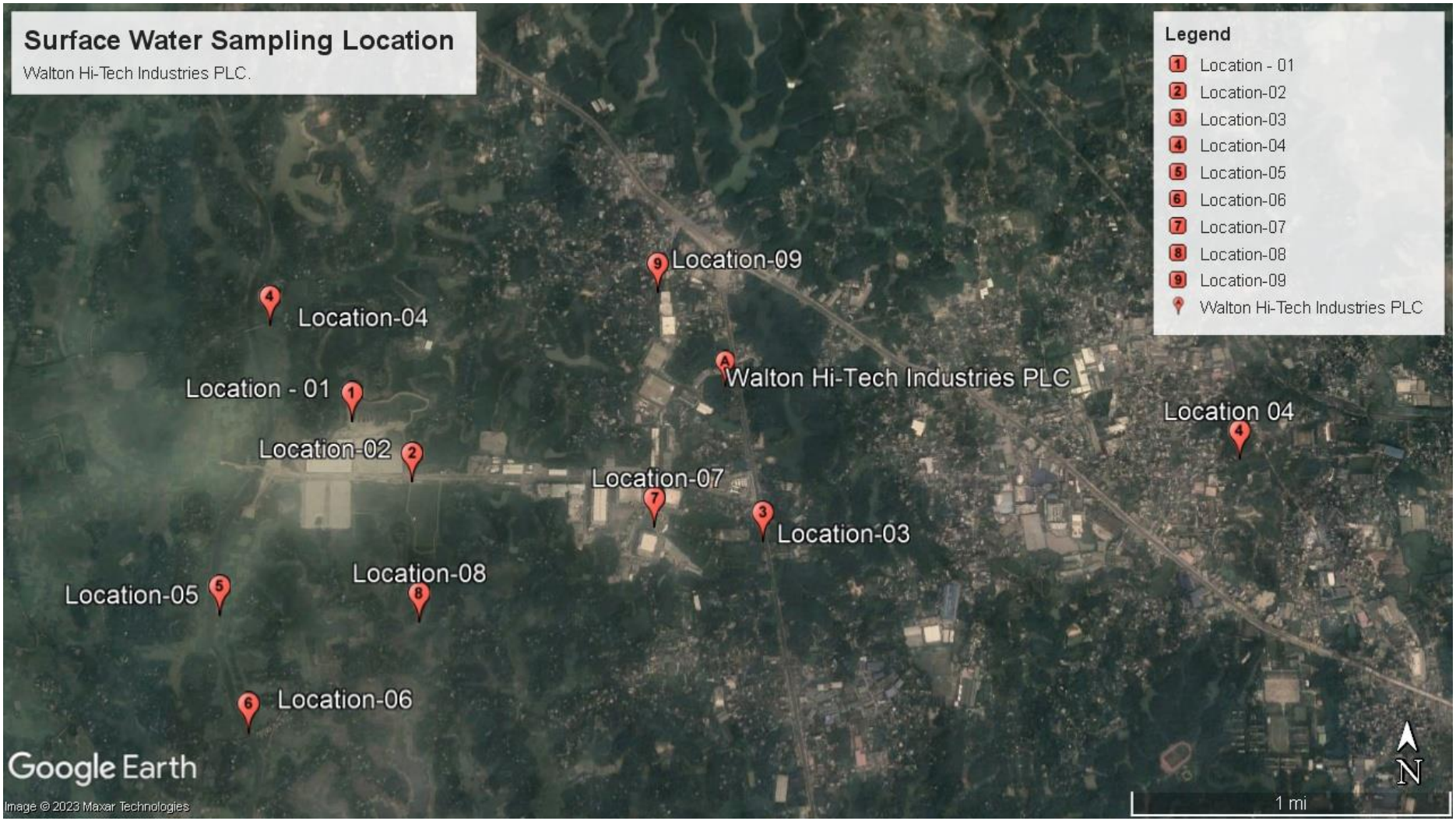


Figure 53: Surface Water Sample Location

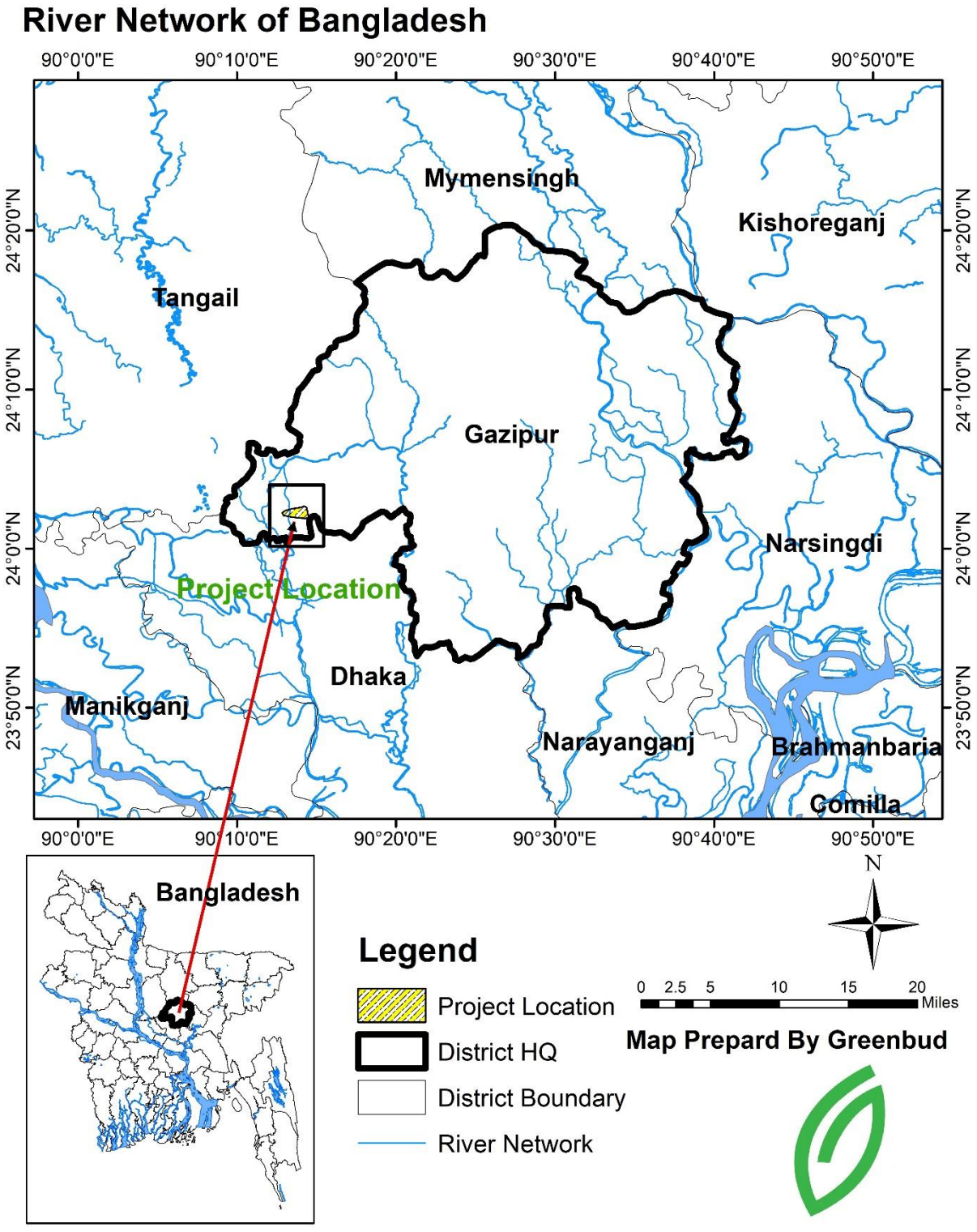


Figure 54: River Network Map of the Project

6.1.9 Ambient Noise Level

The ambient noise environment consists of the total noise generated in the area at various distances around the sampling locations. The noise level varies depending on the type of activities carried out in the surrounding area. The baseline noise environment was studied at the project site as well as the surrounding locations at four locations of the project area. Field visits were conducted on 23rd and 24th January 2023 where noise levels were recorded in the form of noise levels with the help of a digital sound level meter. Noise level data was observed only for daytime a period from 09 am to 05 pm. due to time constraints.

The standards for Noise provided in the Bangladesh Sound Pollution Control Rules-2022[4] is given in the table below.

Table 12: Standard for Noise

No.	Area Class	Day (dBA)	Night (dBA)
a.	Silent area	50	40
b.	Residential area	55	45
c.	Mix area	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

The locations considered for the noise monitoring along with sampling data are given below:

Table 13: Ambient Noise Level Inspection Result

Sl. No.	Inspection Area		Inspection Status				
			Reference of Relevant Standard		Obtained Result (dB)	SPCR,2006 Limit	WHO Limit
	Point		Sound Pollution Control Rules-2006 (dB)	WHO Guide Line (dB)			
1	24°2'28.87958"N	90°14'22.72628"E	75	70	**56**	√	√
2	24°2'23.96558"N	90°14'15.76435"E	75	70	**57**	√	√
3	24°2'19.5508"N	90°14'11.0315"E	75	70	**53**	√	√
4	24°2'8.7392"N	90°14'25.48576"E	75	70	**58**	√	√
5	24°2'30.35389"N	90°14'21.41304"E	75	70	**50**	√	√
6	24°2'38.62345"N	90°14'9.27823"E	75	70	**45**	√	√
7	24°2'32.54186"N	90°14'11.0873"E	75	70	**44**	√	√
8	24°2'25.28974"N	90°14'6.97218"E	75	70	**44**	√	√
9	24°2'16.9413"N	90°14'8.17339"E	75	70	**61**	√	√
10	24°2'10.83725"N	90°14'9.5842"E	75	70	**51**	√	√
11	24°2'10.83692"N	90°14'9.59503"E	75	70	**54**	√	√

[4] Sound Pollution Control Rules,2022 Schedule 01

Sl. No.	Inspection Area		Inspection Status				
			Reference of Relevant Standard		Obtained Result (dB)	SPCR,2006 Limit	WHO Limit
	Point		Sound Pollution Control Rules-2006 (dB)	WHO Guide Line (dB)			
12	24°2'9.5699"N	90°14'9.43296"E	75	70	**56**	√	√
13	24°2'9.57912"N	90°14'9.3651"E	75	70	**70**	√	√
14	24°2'10.12736"N	90°14'6.95051"E	75	70	**68**	√	√
15	24°2'2.08828"N	90°14'9.16559"E	75	70	**66**	√	√
16	24°2'11.00929"N	90°14'17.5988"E	75	70	**67**	√	√
17	24°2'11.00047"N	90°14'17.60561"E	75	70	**61**	√	√
18	24°2'11.00929"N	90°14'17.5988"E	75	70	**62**	√	√
19	24°2'10.8505"N	90°13'56.6476"E	75	70	**64**	√	√
20	24°2'9.40945"N	90°13'50.80494"E	75	70	**59**	√	√
21	24°2'13.13434"N	90°13'40.91632"E	75	70	**61**	√	√
22	24°2'12.9129"N	90°13'38.58845"E	75	70	**62**	√	√
23	24°2'12.91142"N	90°13'38.58697"E	75	70	**59**	√	√
24	24°2'12.70932"N	90°13'38.02674"E	75	70	**63**	√	√

Source: Field survey conducted on 23rd -24th January 2023

Table 14: Hourly Monitoring of the Baseline Noise Level

Hour	***Noise (dBA) (day)***
9:00 am – 10:00 am	59
10:00 am-11:00 am	65
11:00 am-12:00 pm	63
12:00 pm- 01:00 pm	64
01:00 pm- 02:00 pm	61
02:00 pm - 03:00 pm	66
03:00 pm-04:00 pm	64
05:00 pm- 6:00 pm	63

Source: Field survey conducted on 23rd -24th January 2023

It has been observed from the samplings that overall noise levels in and around the project site are comparatively lower than the standards set by DoE. Although the ongoing production activity, vehicle movement to import and export various materials, and ongoing constructions may cause higher noise levels.

The workers are provided with adequate safety facilities to refrain from any kind of health hazard. The use of horns has also been restricted within the project site to prevent any further damage.





Figure 55: Ambient Noise Level Monitoring

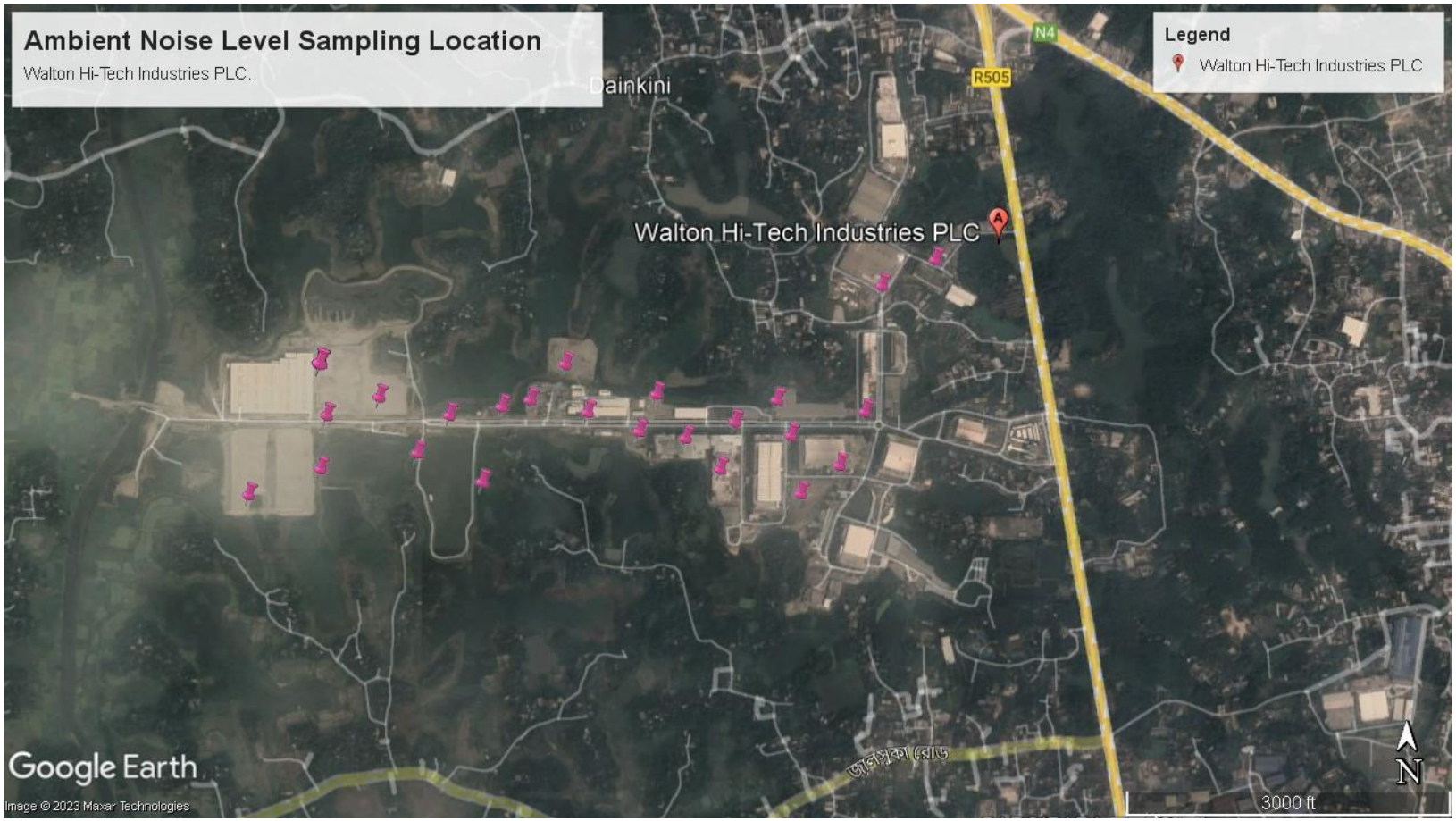
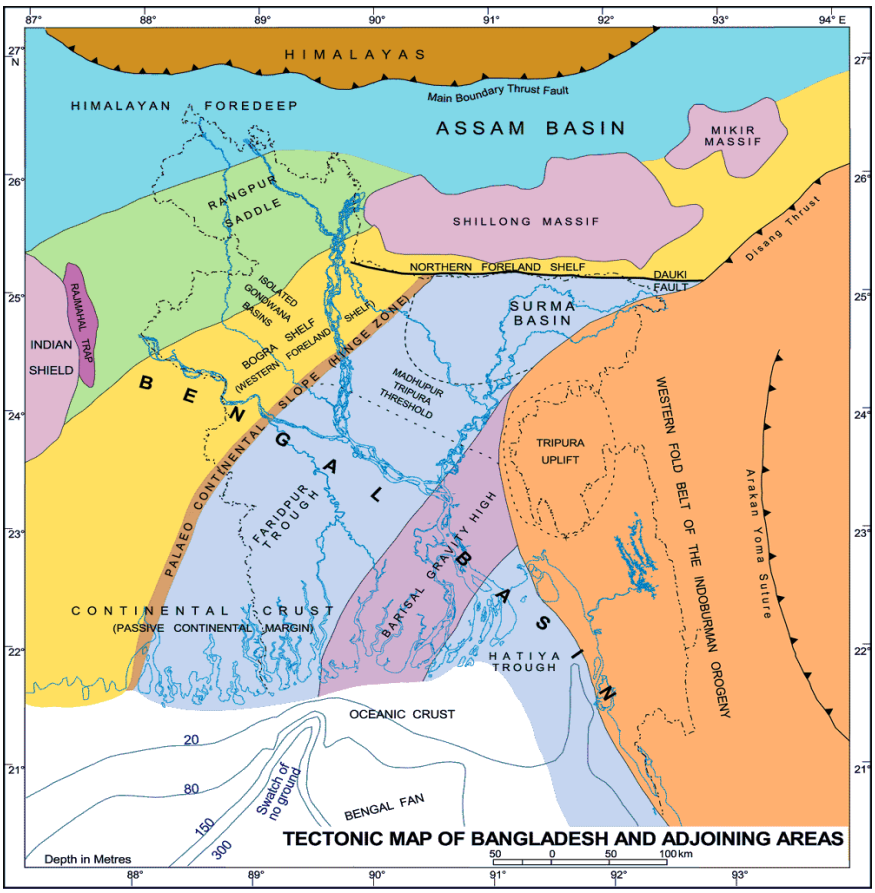


Figure 56 Ambient Noise Level Monitoring Location

6.1.10 Seismology

Bangladesh, a densely populated country in South Asia, is located in the northeastern part of the Indian sub-continent at the head of the Bay of Bengal. Tectonically, Bangladesh lies in the northeastern Indian plate near the edge of the Indian carton and at the junction of three tectonic plates – the Indian plate, the Eurasian plate, and the Burmese microplate. These form two boundaries where plates converge– the India-Eurasia plate boundary to the north forming the Himalaya Arc and the India-Burma plate boundary to the east forming the Burma Arc.

Active faults of regional scale capable of generating moderate to great earthquakes are present in and around Bangladesh. These include the Dauki fault, about 300km long trending east-west and located along the southern edge of Shillong Plateau (Meghalaya- Bangladesh border), and the150 km-long Madhupur fault trending north-south situated between Madhupur Tract and Jamuna flood plain, Assam-Sylhet fault, about 300 km long trending northeast-southwest located in the southern Surma basin and the Chattogram-Myanmar plate boundary fault, about 800 km long runs parallel to Chattogram-Myanmar coast.



Source: researchgate

Figure 57: Regional Tectonic Setup of Bangladesh to Plate Configuration

Kaliakoir, Gazipur is situated in the central part of the country on the bank of the Turag River and at the southern tip of the Madhupur tract dating back to the Pleistocene age. The Madhupur Tract is an area of recent uplift within the delta and the surface of the tract is in general higher on the west, sloping very gently eastward to disappear beneath younger sediments (Fergusson, 1863; Morgan and McIntire, 1956). Gazipur is slightly elevated above the surrounding floodplains and represents mostly flat land with minor undulations. Topographically Comilla is of low relief with many low depressions. According to Alam (1988), the Madhupur Tract is structurally controlled. The Pleistocene sediments of the Madhupur Tract have been affected by numerous episodes of faulting. These faults are probably the branch-out surface faults from the low-dipping western extension of Burma Arc detachment fault. The project area lies within a 50 to 500 km distance from the seismogenic faults and sits on the Burma Arc detachment fault.

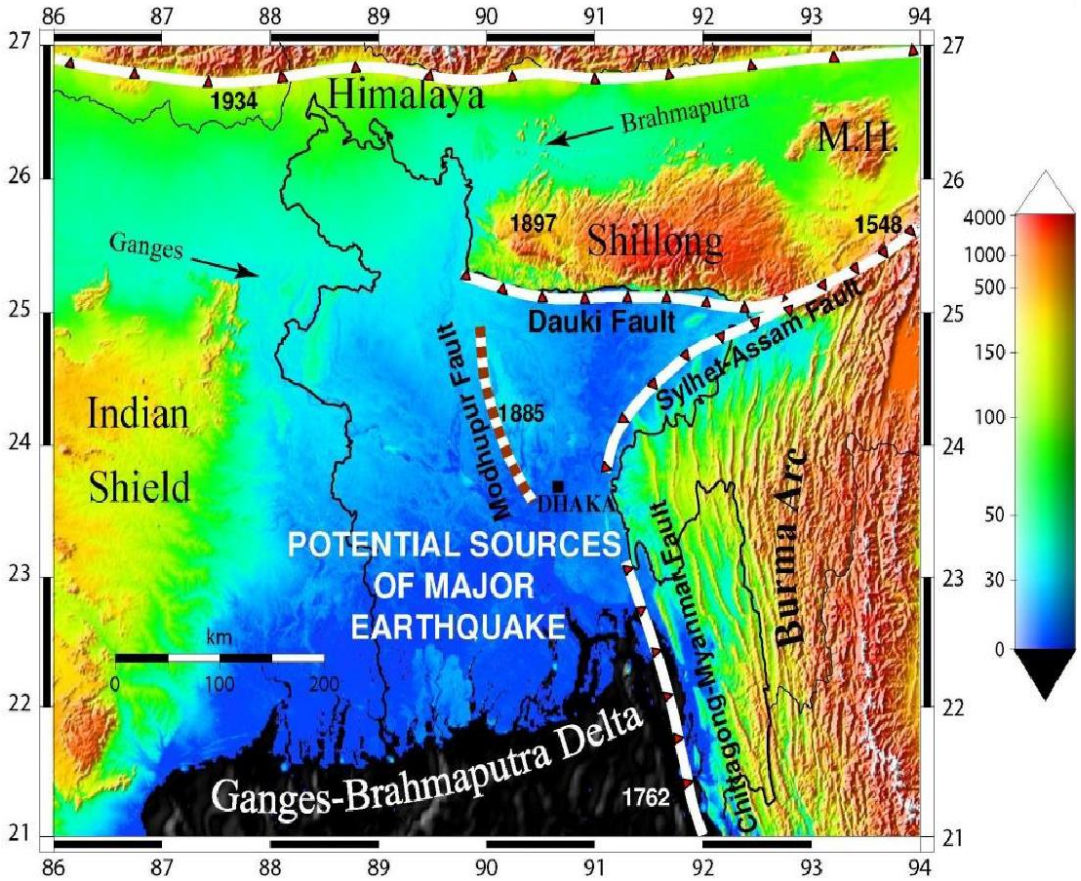


Figure 58: Digital Elevation Model (DEM) Of Bangladesh and its Surroundings

Based on the distribution of earthquake epicenters and the morph tectonic behavior of different tectonic blocks Bangladesh has been divided into four generalized seismic zones (Fig 56).

According to the to-be-revised/published national code, BNBC, Dhaka district falls in the seismic intensity zone with Z=0.20 and a maximum PGA value of 0.20g and that requires rethinking the present issues in practices. According to this published Code, the country has been divided into four seismic zones with different levels of ground motion. Each zone has a seismic zone coefficient (Z) which represents the maximum considered peak ground acceleration (PGA) on very stiff soil/rock (site class SA) in units of g (acceleration due to gravity). The zone coefficients (Z) of the four zones are: Z=0.12 (Zone I), Z=0.20 (Zone II), Z=0.28 (Zone III) and Z=0.36 (Zone IV).

Information on earthquakes in and around Bangladesh is available covering the last 250 years. The earthquake record suggests that since 1900 more than 100 moderate to large earthquakes occurred in Bangladesh, out of which more than 65 events occurred after 1960. There is a slight increase in the frequency of earthquakes in the last 30 years. This increase in earthquake activity is an indication of fresh tectonic activity or propagation of fractures from the adjacent seismic zone. However, the most serious damage has occurred in the northern part of Bangladesh and virtually none has been found in the Dhaka region. **The Project site is located in Zone II and its seismic zone coefficient is 0.20.**

The following table includes a description of the four seismic zones.

Table 15: Seismic Zone of Bangladesh

Seismic Zone	Location	Seismic Intensity	Seismic Zone Coefficient, *Z*
1	Southwestern part including Barisal, Khulna, Jessore, Rajshahi	Low	0.12
2	Lower Central and Northwestern part including Noakhali, Dhaka, Pabna, Dinajpur, as well as Southwestern corner including Sundarbans	Moderate	0.20
3	Upper Central and Northwestern part including Brahmanbaria, Sirajganj, Rangpur	Severe	0.28
4	Northeastern part including Sylhet, Mymensingh, Kurigram	Very Severe	0.36

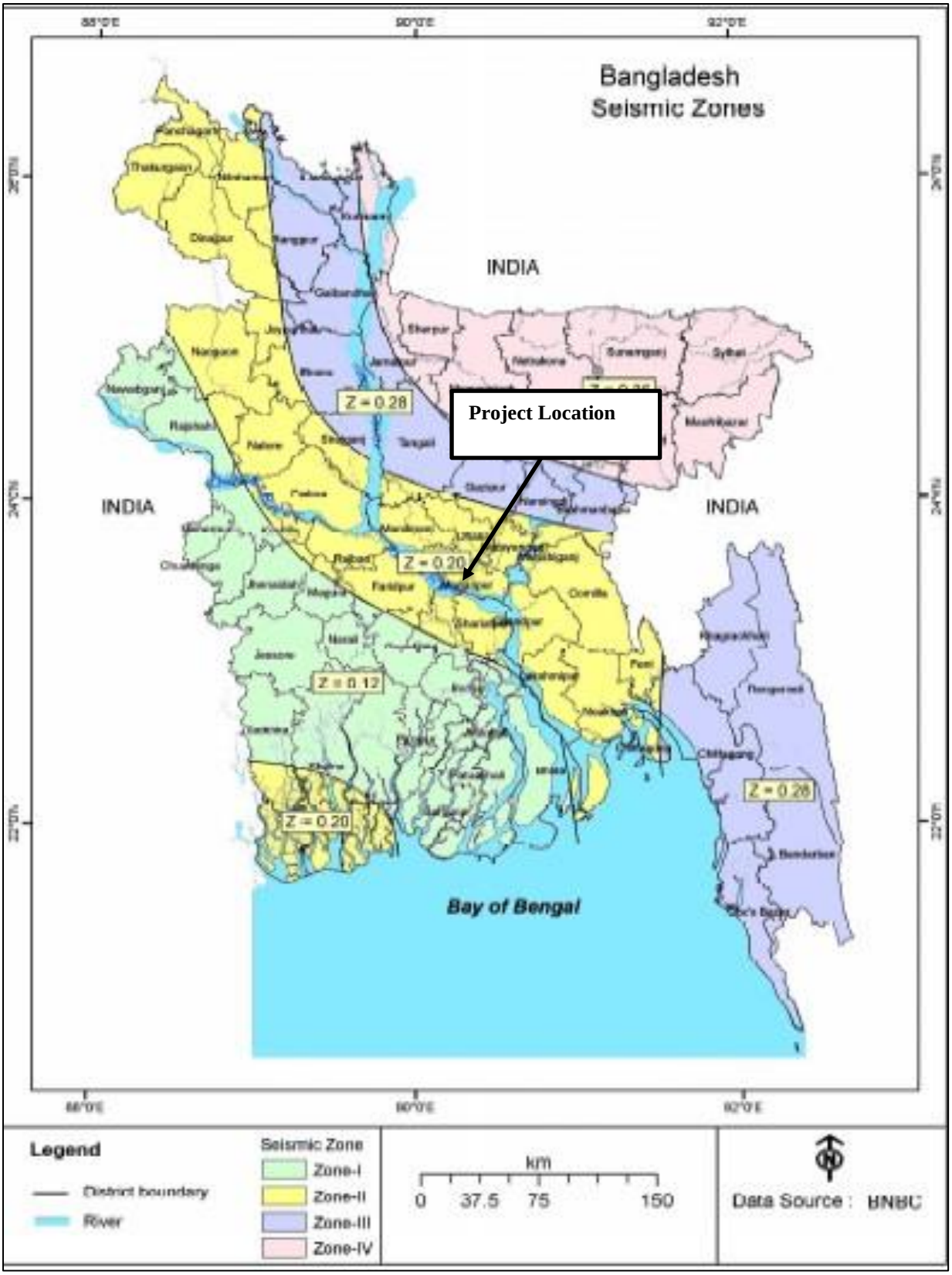


Figure 59: Seismic Zoning Map of Bangladesh

6.1.11 Climate Change and Natural Hazard

Bangladesh is historically known as a disaster-prone country for its geographical location, which makes it one of the most exposed countries to climate change and natural disasters like cyclones, floods, and river erosion. Almost every year, natural calamities like cyclones and coastal floods adversely affect the country and leave a sign of devastating effects which is evident from the loss of lives and livelihoods, and damages to infrastructures. These natural disasters are also expected to have impending adverse effects on Bangladesh's energy sector destroying infrastructure, including national grid lines, electric poles, and renewable energy generation plants.

Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions or the distribution of weather around the average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming". In general, the major impacts of climate change are:

- Sea Level rise
- The intrusion of salinity in groundwater
- Changing rain and snow patterns
- Droughts
- Higher Temperatures and more heatwaves
- Stronger storms
- Warmer oceans

The consequence of Climate Change Impact on the Project

The project is situated within the vicinity of many water bodies and many other industrial, commercial areas. The most common climate stressor in this area is sea-level rise, more frequent floods, and droughts. The project area has been facing many floods in recent years. Due to these, the sea level has also risen a great amount leading to river erosion and loss of vegetation. One of the major climate change stressors in the project area is the increasing demand for urbanization and industrial units. Due to the increased demand, the area has seen a drastic change within the last 10 years. According to the locals and other nearby people if the industrial sector can be minimized and controlled soundly then the environment can be controlled and preserved.

In the following sections, the various consequences of climate change impact relevant to the proposed project are discussed:

Sea Level Rise and Intrusion of Salinity: It is assumed that due to the impact of climate change sea level will rise significantly resulting in the intrusion of salinity, which means the level of water of the Bay of Bengal will rise. But due to its geographical position, the project site is in

an advantageous position. However, due to the proximity of the branch of Turag River recurring floods could be a matter of concern. To address the flood issue, the project site has been raised about 1 meter above the flood level of 1998. In addition, the issue of salinity intrusion in groundwater has not yet taken any concern raising situation in the project area.

Increase of Cyclones: As a consequence of climate change, there is a possibility of increasing the intensity and frequency of cyclones. In the case of cyclonic impact, it has fallen under the category of low-risk area. However, for better safety **Walton Hi-Tech Industries PLC.** is expected to consider the cyclone data of the Gazipur district and adjacent areas for the last 30 years.

Drought: In terms of drought, no significant concern is assumed for the project. Because it requires only $12m^3$ of water per day. So, the depletion of the water table seems not to be an alarming issue for the sustainability of the project.
Based on the aforesaid discussion, it can be said that the adverse impact of climate change and the general trend of natural calamity will not adversely affect the project.

Increase in Ambient Temperature

Although photovoltaic (PV) power capacity is expected to dominate growth in the renewable capacity in the foreseeable future, PV power outputs change with climate; for example, changes in the frequency of warm cloudy conditions can substantially alter PV energy yields. PV energy yields depend on solar irradiance, which is in turn modulated by aerosols and by clouds. PV outputs are also affected by air temperature, with cooler conditions generally improving PV cell performance and hotter conditions reducing it, and by surface wind speed because airflow typically cools the PV module. All these parameters (clouds, aerosols, temperature, and wind) are changing with climate.

6.2 Ecological Environment

As part of the ESIA**,** an ecological baseline study was carried out in areas surrounding the project site. As noted earlier, the specific objectives of the baseline study were to gather information on the existing biological, environment of the areas in and around the project site; to gather and assess people's perceptions of different aspects of the proposed project.

This Chapter describes the existing biological environment of areas in and around the project site based on the baseline survey carried out as a part of the present study. The baseline ecological survey primarily focused on identifying floral and faunal diversity and distribution within and surrounding the project site. Possible impacts of the project activities have been evaluated against these baseline environmental conditions.

6.2.1 Approach and Methodology

The main purpose of the ecological survey was

(i) to enlist the plant and wildlife species with their national and international status,
(ii) to investigate the distribution and abundance of flora and fauna including fish species, and
(iii) to assess the impacts of the project activities on the ecological environment.

These are concentrated among others, on the wildlife (reptiles, amphibians, mammals, and birds), separately on fishes and a floral species (Grass, shrubs, and timber/fuelwood trees and fruit trees) respectively in the following pages.

The area is quite rich in flora and fauna. However, many of those are quite common for different other areas in Bangladesh. The already existing industries in the study area not just brought, some of the utility services, but have also provided a different look at the infrastructure set in the area. This is still not something, which can be called aesthetically unacceptable or directly detrimental to the floral growth of the area. However, the industrial activities along with their discharges may prove quite detrimental to both flora and fauna in the area eventually, provided no appropriate corrective measures are taken.

6.2.2 Bio-ecological Zones

Forests, pasture lands, rivers, surface water, other water bodies, etc. are the most important component of natural ecosystems. They are the foundation on which the conservation of biological diversity depends. Biological diversity, which refers to genetic variation as well as to the diversity of human populations and ecosystems, is a resource that belongs not only to regions and nations but also to all of humankind. Although it is a renewable resource, it can be irreversibly destroyed. Future uses of this resource (medicine, plant breeding. etc.) cannot be foreseen at present, although they will certainly be extensive in scope, and they even are crucial to the survival of humankind.

Every region needs areas set aside to preserve ecological balance (nature reserves, natural vegetation, fallow land) to conserve its biological diversity. The form, extent, and location of these areas must be carefully evaluated in each case. The use of such areas is often of great economic importance to the poorer segments of rural populations. Intense exploitation of such areas is therefore usually accompanied by corresponding social consequences and social costs, even when it appears reasonable on economic grounds.

Each of the ecosystems has many sub-units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty-five bio-ecological zones. The project area is situated in the **Madhupur Sal Tract** Bio-ecological Zone in Bangladesh.

The Madhupur Tract a large upland area in the central part of Bangladesh. 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. Though in its present form it is of Pleistocene age its origin may be in the late Miocene, when the bengal basin was being filled in rapidly. The total extent of this Tract is 4,244 sq km. Unlike the barind tract it is largely in one piece, with seven small outliers. The main section stretches from just south of Jamalpur in the north, to Fatullah of Narayanganj, in the south. Most of Dhaka City is on this Tract. Of the seven outliers four are in the east and three in the north. All of them seem to have been separated atleast superficially, by faults. This part of Bangladesh has been uplifted several times, resulting in numerous longitudinal faults. The most prominent of these are along the western side, where they can be clearly seen at Mirpur (Dhaka City) and near Ghatail and Madhupur further north. Long fault traces are also extant on the eastern side. The climate of

the Tract varies slightly from north to south, the northern reaches being much cooler in winter. Average temperatures vary from 28'C to 32'C in summer, falling to 20'C in winter, with extreme lows of 10'C. Rainfall ranges between 1,000 mm and 1,500 mm annually. Severe storms are unusual but tornadoes have struck the southern areas.

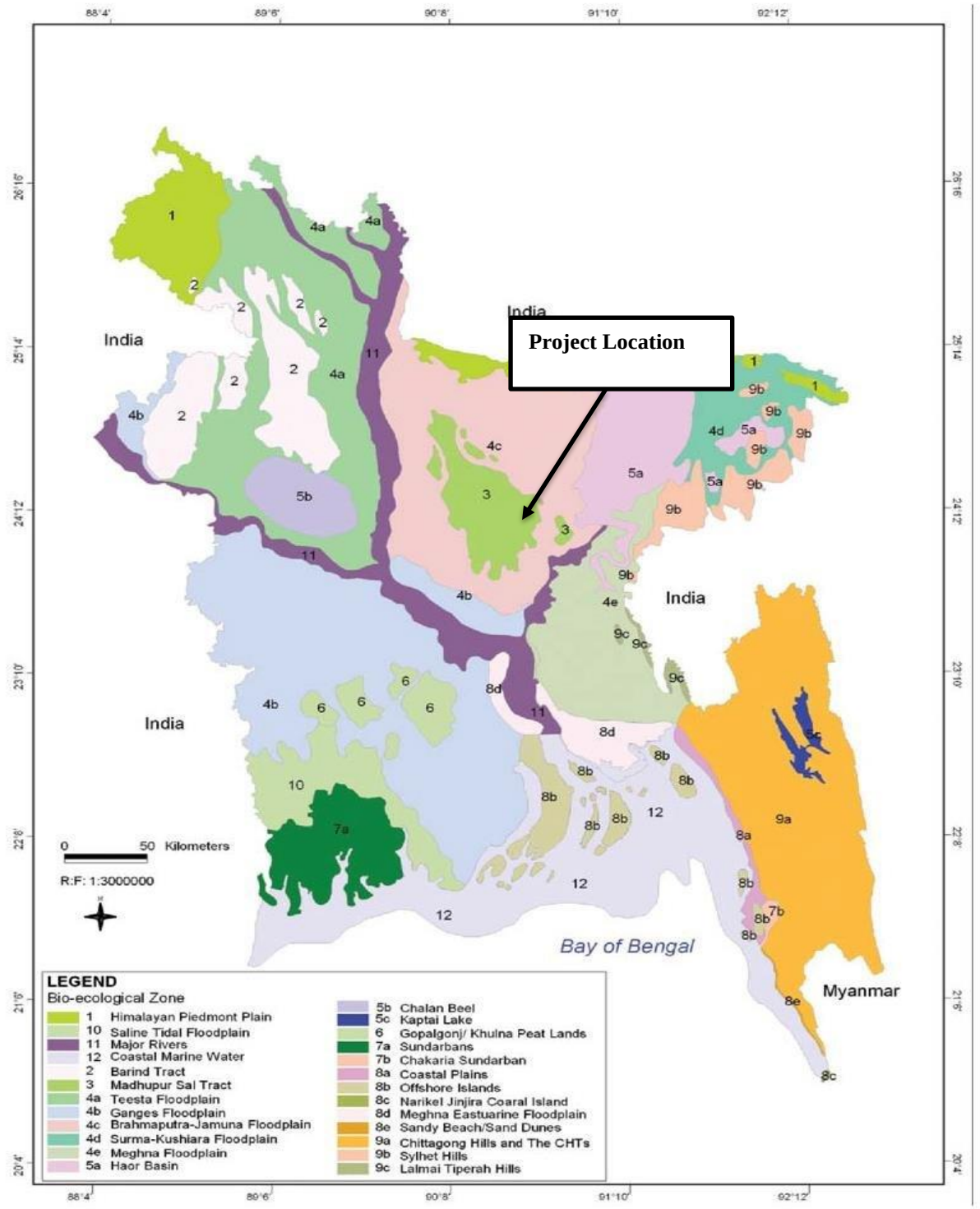


Figure 60: Bio-ecological Zones of Bangladesh

6.2.3 Terrestrial Flora and Fauna

6.2.3.1 Flora

The proposed project is in a rural setting with greenery. This includes homesteads horticulture, roadside forest, natural vegetation, and crops. Besides highland (elevated) afforestation and homesteads, the remaining area is mostly lowland and generally interconnected with certain manmade barriers and kacha roads here and there. Due to roadside forests and certain homestead forests, the area is rich in floral diversities. Different fruit, and fuelwood trees along with various shrubs are abundant. Among the trees, the most widely available ones are Shilkoroi, fulkoroi, Mehagani, Shimul, etc. Also, there are some fruit trees such as Mango, Coconut, Jackfruit, Beetle nut, guava, starfruit, Amra, etc.

Common terrestrial flora in the study area includes Sal-*Shorea Robusta*, Betelnut - *Areca catechu*, Coconut - *Cocos nucifera*, Mango - *Mangifera indica*, Raintree - *Samanea saman*, etc. Three types of terrestrial floral habits - tree, shrub, and herb exist in the project area. Most floral species particularly trees and shrubs are cultivated and ported and these have commercial values.

Table 16: Identified Terrestrial Flora in the Study Area

Name			Habit
Scientific Name	**Family Name**	**Native Name**	
Mangifera indica	Anacardiaceae	Am	Tree
Alternanthera sesilis	Amaranthaceae	Haicha	Herb
Coccos nucifera	Palmae	Narikel	Tree
Areca catechu	Plamae	Supari	Tree
Borassus fiabellifer	Palmae	Tal	Tree
Phoenix sylvestris	Palmae	Khejur	Tree
Artocarpus heterophyllus	Moraceae	Kathal	Tree
Saccharum spontaneum	Graminace	Kash	Herb
Albizia procera	Leguminosae	Koroi	Tree
Acacia auriculiformis	Leguminosae	Akashmoni	Tree
Dalbergia sissoo	Leguminosae	Sisu	Tree
Samanea saman	Leguminosae	Rendi	Tree
Delomix regia	Leguminosae	Krishnachura	Tree
Azadirachta indica	Meliaceae	Neem	Tree
Swietenia mahagoni	Meliaceae	Mehagini	Tree
Musa spp	Musaceae	Kala	Herb
Mimosa invisa	Mimosoidae	Lazzaboti	Herb
Polygonum hydropiper	Polygonaceae	Bishkatali	Herb
Anthocephalus chinensis	Rubiaceae	Kadam	Tree
Zizyphus mauritiana	Rhamnaceae	Boroi, Kul	Tree
Tectona grandis	Verbenaeae	Teak	Tree



Figure 61: Flora Diversity in Project Site

6.2.3.2 Fauna

Mammals & Reptiles

Wild animals that depend on terrestrial habitats are known as terrestrial fauna. Several species of amphibia, reptiles, birds, and mammals are the main components of terrestrial fauna. Areas surrounding the project site have different types of land, including agricultural dry land / seasonal wetland, homestead land, fallow land, and ditches, which provide a typical environment for terrestrial fauna. Terrestrial wildlife is divided into four major groups viz. mammal, bird, reptile, and amphibia.

Bandicoot Rats, Common House Rats, House Mouse, Indian Field Mouse, Indian mole Rats, Flying Foxes, Grey Musk, and Shrew Indian Pipistrelle are the most common mammals found in the project area.

Among reptiles, narrow-headed soft-shell turtles, Smooth Water Snakes, Common Garden Lizards, Rat Snake, Common Wolf Snakes, Common Krait, Common House Lizards, Common Skink Yellow, Monitor Lizards, and Grey Monitor Lizard are mostly found. Among birds, Bok, Salik, Finge, etc. deserve special mention. The common types of reptiles are found in the area, water snakes, house lizards, soft-shell, turtles, etc. The following pictorial view shows the aquatic fauna close to the project site.

Amphibians

Common Toad, Bullfrog, Cricket frog, and Maculated Tree frog is mostly found in the study area.

Aves

River Tern, White-breasted Waterhen, Bronze Winged Jacana, Little Cormorant, House Sparrow, Brown Fish Owl, Common Sandpiper, Striated Grassbird, Common Tailorbird, Asian Pied Starling, Common Myna Fishing cat, Small Indian Mongoose are found in the study area.

Table 17: Identified Terrestrial Fauna in the Study Area

Scientific Name	English Name	Local Name
Class: Amphibia		
Bufo melanostictus	*Bufo melanostictus*	*Bufo melanostictus*
Rhacophorusleucomystax	*Rhacophorusleucomystax*	*Rhacophorusleucomystax*
Ranatigrina	*Ranatigrina*	*Ranatigrina*
Class: Reptilia	Class: Reptilia	Class: Reptilia
Calotesversicolor	*Calotesversicolor*	*Calotesversicolor*
Gecko gecko	*Gecko gecko*	*Gecko gecko*
NajaNaja	*NajaNaja*	*NajaNaja*
Varanusbengalensis	*Varanusbengalensis*	*Varanusbengalensis*
Class: Aves		

Scientific Name	English Name	Local Name
Copsychussaularis	Magpie robin	Doyel
Corvussplendens	Crow	Kaak
Acridotherestristis	Common myna	Shalik
Passer domesticus	House sparrow	Charui
Anatidaeanatidae	Duck	Hash
Eudynamysscolopacea	Asian cuckoo	Kokil
Egrettagarzetta	Little egret	Bok
Gallus gallus	Wild cock	Murgi
Melopsittacusundulatus	Budgerigar	Tia pakhi
Class: Mammalia		
Bostauras	Cow	Goru
Capra aegagrushircus	Goat	Chagol
Canis lupus familiaris	Dog	Kukur
Ovisaries	Sheep	Bhera
Bubalusbubalis	Buffalo	Mohish
Equuscaballus	Horse	Ghora
Herpestesedwardsii	Mongoose	Beji
Viverrazibetha	Large Indian civet	Bon biral
Sciuruscarolinensis	Grey Squirrel	Kathbirali
Mus musculus	Mouse	Nengtiindur
Rattusrattus	Rat	Indur



passer domesticus



Polypedates Tschudi (Gecho Bang)

Figure 62: Terrestrial Faunal Diversity in Project Site

6.2.4 Aquatic Flora and Fauna

6.2.4.1 Aquatic Flora

Aquatic flora is divided into three major types - tree, shrub, and herb. Aquatic floral species grow in rivers, canals, ditches, seasonal wetlands, and low-lying agricultural lands in submerged, free-floating, or rooted floating states. Common aquatic floral species in the study areas include Water hyacinth - *Eichhorniacrassipes*, Khudipana - *Lemnaperpusilla*, and Kalmi - *Ipomoea aquatic*.

Table 18: Identified Aquatic Flora in the Study Area

Name			Habit
Scientific Name	Family Name	Native Name	
Alternanthera philoxeroides	Amaranthaceae	Helencha	Herb
Colocasia esculenta	Araceae	Katchu	Herb
Aponogeton natans	Aponogetonaceae	Ghenchu	Herb
Ipomoea aquatica	Convolvulaceae	Kalmi	Herb
Ipomoea fistulosa	Convolvulaceae	Dholkalmi	Herb
Enhydra fluctuans	Compositae	Helencha	Herb
Ceratophyllum dumersum	Ceratophytaceae	Jhanjhi	Herb
Hygroryza aristata	Gramineae	Phutki janglidhan	Herb
Hydrilla verticillata	Hydrocharitaceae	Janjhi, Kurcli	Herb
Vallisneria spiralis	Hydrocharitaceae	Patajhangi	Herb
Lemna perpusilla	Limnaceae	Khudipana	Herb
Nymphaea sp	Nymphaeaceae	Shapla	Herb
Eichhornia crassipes	Pontederiaceae	Kachuripana	Herb
Monochoria vaginalis	Pontederiaceae	Sarkachu	Herb
Fagopyrum hydropiper	Polygonaceae	Biskhatali	Herb
Utricularia aurea	Utriculariaceae	Jhangi	Herb



Colocasia esculenta



Ipomoea aquatic



Eichhornia crassipes



Fagopyrum hydropiper

Figure 63: Aquatic Floral Diversity in Project Site

6.2.4.2 Aquatic Fauna

Fish is still reasonably available in the area, given the overall and increasing scarcity of fish in the country. Small fishes, which are very popular also in overall Bangladesh, are available and caught and used widely, particularly during the early monsoon and pre-winter season. The fishes include catfishes (Magur and Shing), major carps (Katla, Rui, and Mrigal), minor carps (Puti), and others (Tengra, Boal, Mola, Taki, Shol). Also, prawns, particularly the popular small prawns, are locally known as Ichha, Wildlife, and Reptile.



Tengra (Mystus Tengara)



eel (Anguilliformes)



Rui (Labeo rohita)



Magur (Clarias batrachus)

Figure 64: Aquatic Faunal Diversity in Project Site

6.2.5 Protected Areas and Red Book Species

Floral and faunal species that exist as threatened (endangered, critically endangered, etc.) conditions are known as threatened species. There are specific criteria to declare a species as threatened. A total of 54 freshwater fish and 147 inland wildlife species are threatened species in Bangladesh (IUCN, 2000a; 2000b; 2000c; 2000d; 2002).

No threatened floral species have been identified in the project area. Among the terrestrial fauna, Rat Snake (*Coluber Mucosus*) and Common Wolf Snake (*Lycodon Aulicus*) have been declared vulnerable species, whereas Yellow Monitor Lizard (*Varanus Salvator*), and Fishing cat (*Prionailurus Bengalensis*) have been defined as endangered species. In the case of aquatic fauna, Ganges River Dolphin (*Platanista Gangetica*) has been found endangered (Source: IUCN Red Book of Bangladesh).

In and around the project no environmentally protected areas were found. Construction impacts on the rate of deforestation, loss of habitat, habitat fragmentation, and interruption of wildlife migration patterns are not anticipated. shows that no environmentally sensitive area is present around the project region. There Figure 65 are two protected areas (Bhawal National Park and Bangabandhu Sheikh Mujib Safari Park) present in the study area which are 34.1 Km and 44.2 Km away from the project site respectively. So, there is no protected area available near 1Km perimeter.

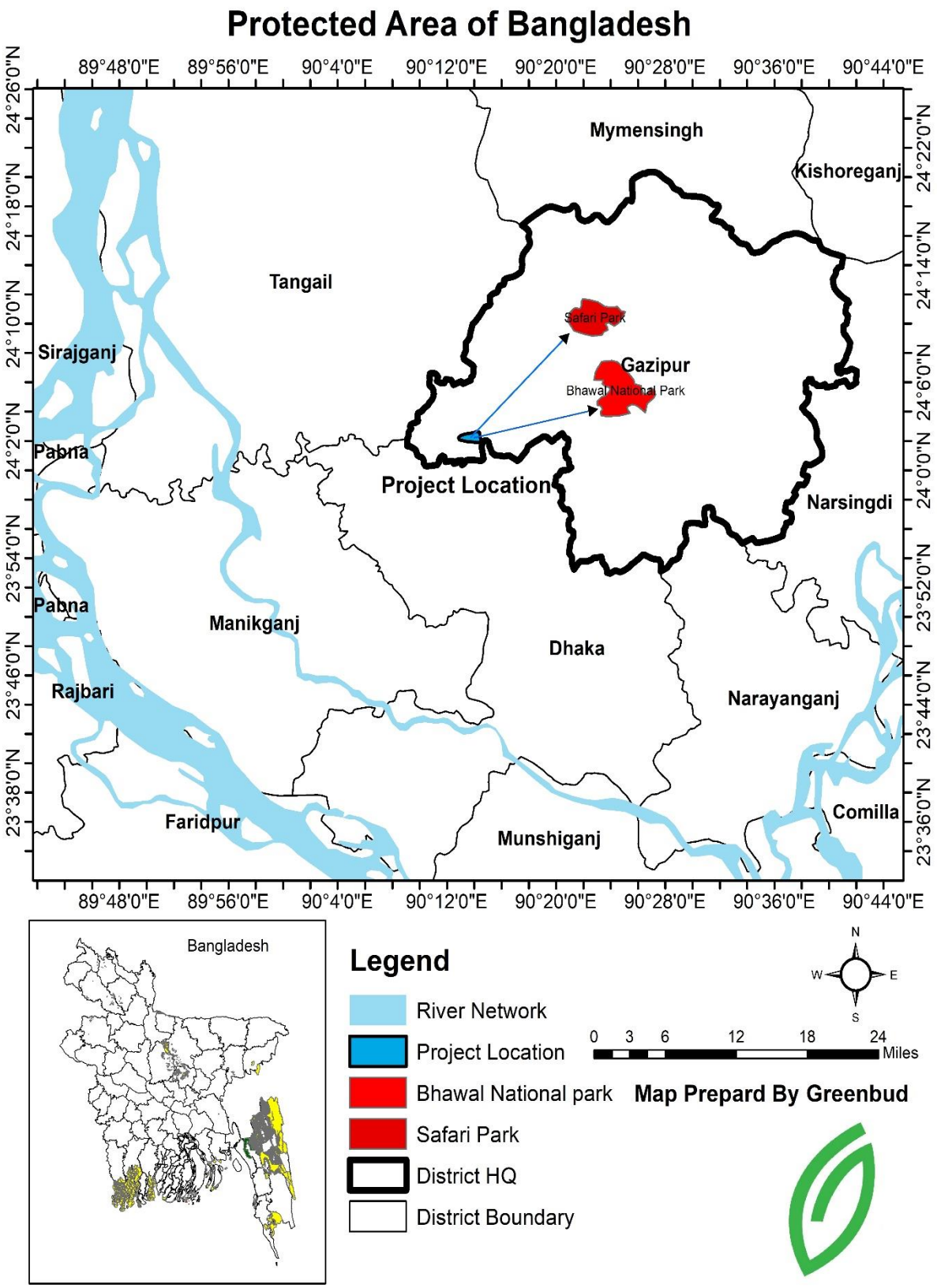


Figure 65: Environmental Protected Areas of Bangladesh

6.3 Social Environment

As stated above, the objectives of baseline study were adopted for gathering information on the existing socio-economic environment of the areas in and around the project site.

A study approach of analyzing the socio-economic parameter like population, geography, land use, and occupational statistics of the surrounding area through secondary data collection from various government and non-government organizations has been adopted. This chapter describes the existing socio-economic environment of areas in and around the project site based on the social studies carried out as a part of the present study.

As the project influence area comprises the Kaliakoir Upazila therefore the socio-economic data has been provided based on it.

6.3.1 Approach and Methodology

A rapid socio-economic study was carried out to assess the current baseline of the socio-economic condition of the areas surrounding the proposed project site. Efforts were made to identify the socioeconomic attributes that may be impacted due to the proposed project activities. The main objectives of the socio-economic study were:

- to understand people's socioeconomic condition
- to understand the extent of people's access to basic services
- to understand people's perceptions regarding the possible impacts of factory
- to get feedback from people regarding mitigation measures

This has been done based on collecting secondary data from different government and non-government organizations. In addition to that, the Bangladesh Bureau of Statistics (BBS), and Banglapedia, concerning books and periodicals were also consulted. Household Questionnaire survey, FGDs, KIIs, etc.

6.3.2 Geography

Kaliakoir Upazila (Gazipur district) area consists of 314.14 sq. km is located in between 23°53' and 24°11' north latitudes and in between 90°20' and 92°30' east longitudes. It is bounded by Mirzapur and Sakhipur Upazila on the north, Savar and Dhamrai Upazila on the south, Gazipur Sadar and Sreepur Upazila on the east, Mirzapur on the west.

6.3.3 Administrative Information

Kaliakoir Upazila was established in 1983 consisting of 1(proposed) Municipalities, 8 Unions, 161 Mauzas, and 198 villages. The density of the population of the Upazila is 1508 per sq. km

6.3.4 Demographic Information

Demography is the scientific study of the population, especially concerning their size, structure, sex distribution, population density, literacy rate, etc.

With an estimated 164.4 million inhabitants and an annual population growth rate of 1.4%, Bangladesh is considered to be one of the most densely populated countries in the world

(UNFPA, 2010). The detail of the demographic profile of the Kaliakoir Upazila is presented below (Table 19). The demographic information is collected from the Population Census, 2022 by the Bangladesh Bureau of Statistics (BBS).

Table 19: Demographic Profile of the Project Area

Upazila	District	Population (Kaliakoir Upazila)		
		Total	Male	Female
Kaliakoir Upazila	Gazipur District	2,67,003	1,38,240	1,28,763

6.3.5 Utility Services

The term utilities can also refer to the set of services provided by different organizations consumed by the public: electricity, natural gas, water, sewage, telephone, and transportation.

6.3.5.1 Sources of Drinking Water

The tube well is the main source of drinking water for the people in Kaliakoir Upazila. Only district headquarters and some Upazila headquarters are provided with piped water supplied by the Department of Public Health Engineering (DPHE). Safe drinking water is not available to many of the households in the area. These residents depend on wells, and ponds as their source of drinking water.
It has been found that sources of drinking water in the Kaliakoir Upazila is -Tube-well 93.16%, tap 1.02%, pond 0.15%, and others 5.67%. At the factory site Gazipur, deep tube well & tube well is the main source of drinking.

6.3.5.2 Electricity

Electricity in whole Bangladesh is still a relatively scarce commodity, which many households cannot afford even if available at their locality. All the wards and unions of the Upazila are under rural electrification net-work. However, 49.52% (urban 56.58% and rural 33.47%) of the dwelling households have access to electricity.

6.3.5.3 Sanitation

It has been found that 45.65% (rural 43.42% and urban 83.39%) of dwelling households of the Kaliakoir Upazila use sanitary latrines and 36.21% of dwelling households use non-sanitary latrines; 18.14% of households do not have latrine facilities.

6.3.6 Land Use

Lands in the project area are used for agriculture, fisheries, agro-forestry, homestead, homestead forestry and vegetation, animal husbandry, etc. The area where the project is proposed is characterized by an agricultural ecosystem.

The average agricultural land owner of Kaliakoir Upazila is about 58.48%, landless 41.52%; agricultural landowner: urban 54.61% and rural 68.92%.

6.3.7 Transports & Communications

In Kaliakoir Upazila, there is 175.25 km of Pucca road, 1785.45 km of mud road, 68km of semi-pucca road, 126.99 nautical miles of water way and 15 km railway. Extinct or nearly extinct traditional transport includes Palanquin, horse carriage, bullock cart. However, all the Upazilas are connected with the district headquarters with metaled roads. Bus, minibus, and three-wheelers ply the district.

6.3.8 Livelihoods

As in other parts of the country, the majority of the population in Kaliakoir Upazila is engaged in agriculture. Besides that, 15.4% of the population is engaged in service. The below table shows the different occupations in the project area.

Table 20: Occupation of the People in the Kaliakoir Upazila

Occupation	Percentage
Agriculture	51.5%
Non-Agricultural Laborer	3.6%
Commerce	13.63%
Transport And Communication	3.39%
Service	15.04%
Others	12.48%

Source: http://en.banglapedia.org/

6.3.9 Education

The average literacy rate of Kaliakoir Upazila is 48.4% of which male is 54.9% and females 41.5%.

Noted Educational Institutions: Kaliakoir Degree College (1968), Chapair BB High School (1910), Bhingoraj Talibabad Multilateral High School (1928), Kaliakoir Baraibari AKU Institute and College (1949), Akkel Ali High School (1968), Ansar VDP High School (1985), Bhupenashari Girls' High School

The below table shows the different educational institutions in the Kaliakoir Upazila.

Table 21: Number of Educational Institutions in the Kaliakoir Upazila

Educational Institutions	Number
College	6
Secondary School	35

Educational Institutions	Number
Primary School	115
Madrasa	15

6.3.10 Health

There are 1 Upazila health complex, 4 satellite clinics, 8 family planning centers, 1 diabetic hospital and 4 hospitals at Kaliakoir Upazila.

There are also a large number of private clinics located in each district town, which are within a few kilometers of the project area.

6.3.11 Recreational Activities

The social need for recreation has been identified as compulsory.

The amusement centers of Kaliakoir Upazila consists of Nandan Park, Shiddhimadhav Pillar, Ansar VDP Academy, Bangladesh Scouts' National Training Centre, Baliadi Zamindar Bari, Sreefaltali Zamindar Bari, Talibabad Satellite Ground Centre.

6.3.12 Archaeological and Cultural Heritage

Shiddhimadhav Sakashwar Buddhist Pillar, remnants of historical relics and Kotamoni Dighi of' Dholsamudra, Chandra Mosque at Mouchak.

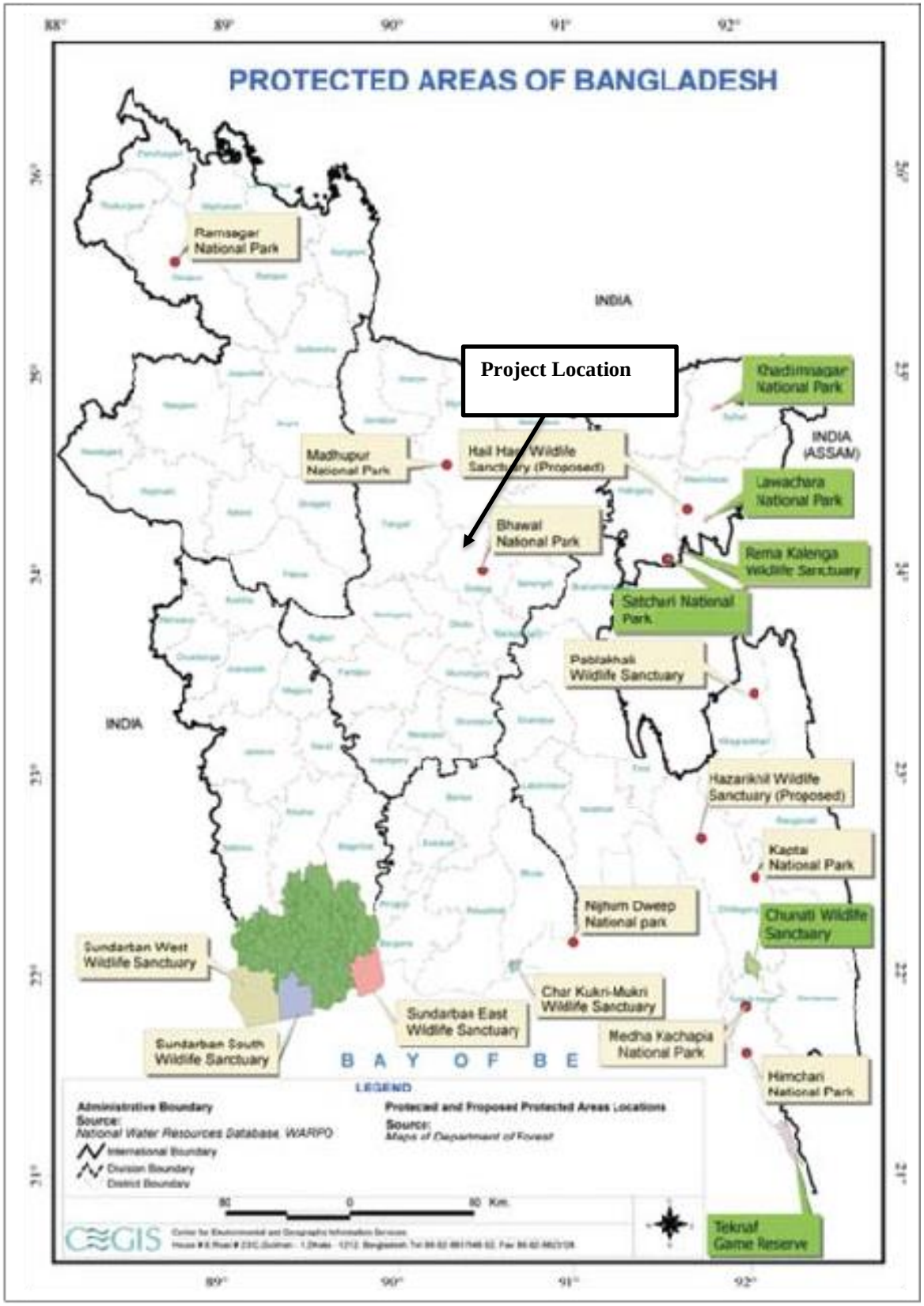


Figure 66: Cultural and Sensitive Structures within 1km Radius of the Project Location

6.3.13 Community Organizations

The list of the number of cultural organizations is given in the table below.

Table 22: Number of Cultural Organizations in the Kaliakoir Upazila

Cultural Organizations	Number
Library	1
Club	140
Museum	1
Theatre Group	1
Cinema Hall	1
Women's organization	1
Stadium	1

Chapter Seven: Anticipated Impacts and Mitigation Measures

7.1 Environmental & Social Considerations

Every possible impact that may arise from the proposed project has been considered in account of mitigation measures. The interaction of the project with the physical, biological, and social environment has been assessed in this chapter. All the impacts and mitigation measures have been described for all the phases of project activities. The regional and national economic benefits associated with the implementation of the project are considered to fall outside the scope of the ESIA, and therefore not considered here. However, the project will make a contribution to the improvement in the quality of life of the local population.

Likewise, the indirect benefits of strengthening of technical capabilities of local persons through association with foreign experts and other training elements that may form part of a project have been considered to fall outside the scope of ESIA.

This chapter identifies and evaluates the potential environmental and social impacts of the proposed solar power project on the physical, social and human environment within the area of influence of the proposed project. The likely impacts were assessed for all activities in the

- construction
- installation
- operation and maintenance
- and decommissioning/abandonment phases of the project development.

All potential impacts from the proposed project have been evaluated as part of the ESIA process –ambient air quality, noise, surface water, groundwater, geology, terrestrial and aquatic ecology, and socio-economics.

Based on the characterization of the environment (Description of the Environment) conducted by the consultancy team, describing the physical, biological, socioeconomic, and archeological conditions of the zone of location of the project, the potential impacts, as well as the environmental factors to be affected and the impacting activities to be performed in the stages of construction, operation and decommissioning phase of the Project have been determined.

During the construction and decommissioning phase, the impacts may be regarded as temporary or short-term; while long-term impacts may be observed during the operation stage. Spatially the impacts have been assessed over the study area of a 01 km radius of the project site.

The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever-increasing demand for power and bridge the gap between Demand and Supply of Power.

7.2 Scoping of Impacts

To assess the likely significant environmental impacts, potential environmental impacts of the project were preliminarily identified based on the project description, and overall

environmental and social conditions in and around the project area. The potential impacts were identified using a simple checklist method. Criteria used to identify and categorize the impacts are described below:

7.3 Significant Environmental & Social Impacts

An environmental impact is defined as any change to an existing condition of the environment. The ESIA study, based on the screening and scoping, review of civil works, review of similar environmental assessment reports, baseline monitoring, and stakeholder consultations has identified several environmental impacts that are expected from the project.

Findings of the assessment are presented according to pre-construction, construction, operation & maintenance, and decommissioning phases. This chapter describes the source of origin of these impacts, mitigation measures, and potentiality of the impacts caused by the project both tentatively during pre-construction, and construction and permanently during operation & maintenance, and decommissioning.

7.3.1 Impact during the Pre-Construction Phase

7.3.1.1 Land Use

Impact Origin

'The project will be installed on the Walton Hi-Tech Industries PLC rooftop. There were no homesteads, farms, or other land uses on the property, which belonged to the project's proponent. No homestead, wetland, or agricultural land is lost as a result of this project.'

Therefore, the area's landscape has not been significantly altered. There were no property purchases or homestead relocations necessary for the proposed project. There was no loss of a useful location or cultural, historical, or aesthetic interest in the project land. Therefore, the aforementioned effects are negligible.

Impact Potentiality Level: **Minor**

Mitigation Measure

By adhering to the project's environmental and social management plan (ESMP), the project developer is responsible for minimizing the environmental impact on the environment. The little impact is anticipated to be acceptable because these actions will only be carried out temporarily. If any construction activity causes damage, the owner shall be promptly compensated in a fair manner.

7.3.2 Impact during Construction Phase

7.3.2.1 Visual Amenity

Impact Origin

Materials placement and the removal of ancillary facilities are two construction tasks that might cause visual obstructions and aesthetic disruptions.

The industry's rooftop serves as the project location. There are a few nearby neighborhoods, including some houses, that would be visible from the project. Therefore, it is expected that only workers would experience visual intrusions. As a result, the construction's visual impacts will be minimal inside the project area and mostly restricted to the workers who will be staying in the company's temporary camp facilities while building is underway (if any).

Impact Potentiality Level: **Moderate**

Mitigation Measures

The contractor must be careful while doing construction works as though the adjacent operational practices and close communities do not hamper.

7.3.2.2 Impact on Air Environment

Impact Origin

The local air shed might be impacted by dust produced during site preparation, civil construction, mechanical construction, handling, and stocking of construction supplies. The wind may carry dust from building sites into the atmosphere, polluting it. The most important direct possible impact on the neighborhood is probably construction dust. In youngsters and elderly personnel, dust mites are frequently the cause of asthma. Furthermore, poor air quality may result from the building of rooftop solar energy generating plants. These dangers include the discharge of pathogens carried by soil, which raises air particulate matter levels and contaminates water reservoirs.

During the building phase, burning of petroleum products in project-related vehicles, equipment, generators, etc., may release carbon dioxide and nitrogen oxides. Due to the fact that the pollutant emission activities (point and area sources) will be restricted inside the project boundary and that they will only last for the duration of the construction phase, their influence on the quality of the air will not be significant.

Impact Potentiality Level: **Moderate**

Mitigation Measures:

This impact may further be minimized by adopting the following mitigation measures:

- The sprinkling of water at the construction site and haul roads
- Trucks transporting fine materials, and waste to and from the project site will be covered to reduce the release of dust
- Construction materials and other debris should be stored under covered sheds
- Generators, electric cutters, and other equipment are to be shut down when not infused
- Provision of face masks to workers to minimize inhalation of dust particles

- ❖ Construction vehicles and machinery should be regularly serviced and checked for pollution control
- ❖ Low Sulphur diesel should be used for running construction equipment and vehicles
- ❖ Air emission monitoring program to be undertaken quarterly by the contractor
- ❖ A green buffer will be developed all along the project boundary.

7.3.2.3 Impact on Water Resources

Impact Origin

Solar panel installation requires very little to no water. Although it's possible that groundwater and surface water are both necessary for some building tasks like layering and equipment washing. Additionally, solar generators require water to clean dust and debris off the front of the modules since unclean modules have lower cell performance. Depending on the technology, large-scale solar can consume a significant quantity of water. The construction worker will also need water from the ground for drinking and sanitary needs.

In addition to that, the necessary quantity of water for drinking purposes will be taken from the groundwater source, which may cause the groundwater level to decrease.

Impact Potentiality Level: **Moderate**

Mitigation Measures

To reduce the impact on groundwater and surface water, the project proponent may adopt the following mitigation measures:

- ❖ All reasonable measures will be taken to prevent the wastewater produced in construction from entering the creek and stream.
- ❖ A water trigger nozzle will be used instead of open pipe flow to reduce water wastage
- ❖ Reduce usage of surface water and prompt groundwater use.
- ❖ Recycled water should be used for construction equipment cleaning.
- ❖ Awareness will be increased through proper training, monitoring, posturing, and signage.
- ❖ Increasing water storage in the reservoirs.
- ❖ The temporary camp shall be provided with sanitary latrines that do not pollute surface waters.
- ❖ The groundwater in the project area has been used for different purposes like drinking and irrigation, hence proper mitigation measures must be ensured at the construction site to avoid any spillage and leakage of oil. All the staff in construction areas must have refrained of discharge any liquid wastes on the ground.

7.3.2.4 Impact on Noise Environment

Impact Origin

The operation of different types of machinery and equipment for construction activities and regular vehicular movement for equipment transport may generate noise during the

construction period. The produced noise may have an impact on the existing acoustic environment. Local inhabitants may feel disturbed due to noise from line sources (traffic movement). The Impacts of noise will potentially affect the following.

a. Impacts of Noise on Immediate Neighbors

- ❖ Continuous exposure of neighbors to noise nuisance may result in noise-induced hearing loss;
- ❖ Noise nuisance may reduce the concentration of neighbors

b. Noise Impacts on Employees

- ❖ The high noise level will force employees to shout when communicating with one another;
- ❖ Exposure of employees to high noise levels (above 85dB) continuously for 8 hours per day may result in noise-induced hearing loss;
- ❖ Exposure of the ear to peak sound level instantaneously may result in deafness.

Continuous exposure of neighbors to noise nuisance may result in noise-induced worker hearing loss. The waste extractor or waste collector truck movement will be the main source of noise pollution. Vehicles and machinery may generate noise. However, low-noise construction vehicles will be used and construction work will not do at night hours. Moreover, the construction period will be completed as soon as possible.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- ❖ The machinery to be used should comply with the noise standards prescribed by DoE;
- ❖ Vehicles and machinery should be regularly serviced and checked for pollution control;
- ❖ Employees who work at high noise areas should be provided earplugs;
- ❖ No noise-generating activity shall be carried out at the night;
- ❖ No construction activities are to be undertaken during night hours to prevent any disturbance to nearby residents and laborers in labor camps;
- ❖ Fitting noise machines with noise reduction devices;
- ❖ Temporary noise barriers should be provided near the high noise generating areas like metal or tiles cutting sites, generator rooms, etc.;
- ❖ Any employee who may complain about ear-related pain and or complication while at work to access medical attention at the expense of the contractor or project proponent;
- ❖ Regular noise monitoring.

7.3.2.5 Impact on Sanitation

Impact Origin

If the arrangement of sanitation and drinking water is not guaranteed effectively and properly, it might have an influence on the health of the project staff, construction workers, and labourers living at the construction site. There will be enough workers in the project area for the next stage of building. They will produce a lot of rubbish from people. As different insects will predominate in the transmission of illnesses, these are the probable source for their dissemination. There is also a risk for the transmission of illnesses that are water-borne.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- A proper sanitation system should be provided and regular, proper, and safe disposal of human waste is being ensured.
- A sufficient number of drinking water facilities would be provided.
- An adequate number of toilets and bathrooms would be made for the workers and a proper disposal system for sewage waste has been developed.
- Necessary awareness and warning signs and posters have already been installed on the project site.

7.3.2.6 Impact on Fossil Fuel Depletion

Impact Origin

Construction operations consume energy in various forms but have never been sufficiently accounted for. A considerable portion of energy utilization on construction sites is associated with the operation of machinery and vehicles for transportation, leveling, lifting, etc. The major forms of energy used in construction processes on site are diesel, and petrol referred to as fossil fuels.

Impact Potentiality Level: **Minor**

Mitigation Measures

The reduction of fossil fuel use in the construction activity should be classified as the secondary scope of the mitigation as the project manager will not have direct control over the operation of the construction machinery and process. The contractor will primarily be responsible for this kind of management. However, some mitigation measures can be taken like

- Preventive maintenance of the machinery
- leakage identification to reduce fuel loss
- on-site use of secondary containment to reduce fuel spill
- Proper training and awareness-raising, posturing, and signage should be provided to the construction worker and machinery operator

7.3.2.7 Impact on Occupational Health Safety

Impact Origin

Under a controlled situation, an accident is not expected. However, occasionally it occurs during construction works. An accident may occur during construction works and the installation of heavy machinery. The protection of the head, eye, ear, hand, and foot of the workers, laborers, and project personnel could be affected if a proper and adequate arrangement is not ensured.

Impact Potentiality Level: **Minor**

Mitigation Measures

- The workers would wear PPE such as safety goggles, helmets, vests, and other necessities.
- Health & safety training would be conducted daily and monthly on-site.
- The workers and laborers would be made aware of their safety.
- Ensuring safety measures taken by the on-site workers would be made by the EHS Manager.

7.3.2.8 Impact on Terrestrial Ecology

Impact Origin

It may cause temporary disturbance to resident birds with ground nests due to noise, dust, and particulate emissions, and possible illegal hunting by construction workers. Moreover, reptiles present within the project site may temporarily move to adjacent locations during construction activities, however, are expected to return as construction is completed.

Installing a rooftop solar photovoltaic (PV) system requires lopping/pruning of tree branches to ensure a shadow-free area. Additionally, it also requires removal of existing rooftop vegetation/gardening if there is any.

The activities anticipated during the construction phase will include site clearance and the operation of construction machinery and equipment. However, according to the baseline description, the project area does not encompass natural systems, which means that no significant flora and fauna are present.

As a result, construction activities are not anticipated to pose any risks to the terrestrial ecology within or in the vicinity of the project site.

Impact Potentiality Level: **Minor**

Mitigation Measures

To reduce the impact on the atmosphere, the project proponent may adopt the following mitigation measures:

- Restrict activities to allocated construction areas only, including the movement of workers and vehicles to allocated roads within the site, and prohibit off-roading to minimize disturbances.
- Prohibit hunting at any time and under any condition by construction workers on site
- Always avoid unnecessary elevated noise levels at all times. In addition, to ensure the proper storage, collection, and disposal of waste streams generated, applying of appropriate general noise-suppressing measures is needed.
- Installation of garden pots and small trees

7.3.2.9 Impact on Natural Drainage

Impact Origin

No new drainage system will be made during the construction phase for the discharge of the runoff and domestic waste. No damage to the natural drainage system will be made.

Impact Potentiality Level: **Minor**

Mitigation Measures

- Cover the drainage for less pollution
- Proper management of the drainage for less contamination
- Site drainage controls to isolate potentially contaminated areas from discharge to the environment.

7.3.2.10 Impact due to Solid Waste

Impact Origin

Solid waste from the planned project will be both hazardous and non-hazardous. Both home and commercial activities will produce non-hazardous solid wastes such as waste poly, plastic, paper waste, wood, scrap metal, broken glass, dirt, etc. Absorbent materials, metal drums, used machine oil, and other hazardous wastes need to be disposed of correctly. Uncontrolled disposal of these wastes will seriously degrade the quality of the soil and water, block the drainage system, and harm the ecosystem.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- Effective storage facility with protection from rain and leachate generation will be built for both hazardous and non-hazardous waste;
- Solid waste will be stored in the storage area before selling to the authorized third party;
- Environmental training and awareness programs for tenant workers should be required;
- All waste generated at a construction site will be managed as per the Contractor's Waste Management procedures.

7.3.2.11Impact on Traffic Safety

Impact Origin

Due to the proximity of the residential area, traffic safety is one of the most important concerns during the construction phase. So, the project proponent has to adopt the required measure.

Vehicle traffic can cause congestion on road networks around and within the site and thereby leading to potential accidents.

During the construction phase traffic is expected to increase to a certain degree due to the nature of activities that will take place such as the transport of equipment and materials to and from the site through the surrounding road network. Additional traffic load will be evident at certain times during the day, especially if there are slow-moving heavy vehicles transporting material to and from the site.

The above potential traffic impacts can occur during construction, especially during working hours. However, this is considered a short-term impact. This impact is likely to happen but is not anticipated to cause any permanent effect on the receiving environment.

Impact Potentiality Level: **Minor**

Mitigation Measures

- Control and monitor the traffic system on the project site
- Heavily loaded vehicles shall not be allowed to enter the project area during daytime
- A proper Traffic Management Plan should be prepared by the contractors and followed strictly.
- The project vehicle should carry the construction materials during off-peak hours.

7.3.2.12Impact on Archaeology and Cultural Resources

Impact Origin

After conducting field investigations, it was discovered that there are no nearby schools, mosques, madrasahs, or bazaars. The impact assessment procedure for this receptor has produced minimal significance, indicating that there is no projected impact from building on these receptors.

Impact Potentiality Level: **Minor**

Mitigation Measures

This impact is temporary and minor negative in nature. Mitigation measures will include:

- The establishment of construction site camps and labor camps must maintain a proper distance from the cultural sites.
- Timely completion of the construction work and provision of alternative routes

7.3.2.13Impact on Employment Opportunities

Impact Origin

Positive benefits of the project may arise either from short-term job opportunities during construction, or long-term job opportunities during operation. Construction and operation jobs must be targeted to the local people within the vicinity of the project area where feasible.

Impact Potentiality Level: **Moderate**

Mitigation Measures

Contractors as far as practicable should recruit construction workers from amongst the locals

where possible, and shall maintain gender equity while employing the locals. Priority shall always be given to people from amongst the PAPs and from those unemployed and belong to the lower income group. Additional benefits will be derived by setting aside areas within contractor camps/labor sheds for local people to sell their products or to provide additional services to the workers. Replacement in a suitable location in a better form will be done with the help and consent of the affected local community.

7.3.3 Impact during Operation Phase

Due to increased activities and efficient operational systems, there will be some impacts on the environmental set-up in the project area, which are discussed hereunder. To achieve sustainability of the development works, it is necessary to ensure the effectiveness of mitigation measures even after construction, as some adverse environmental impacts may result from the operation of the project facilities. Therefore, to reap the full environmental benefits of the activities and ensure environmental enhancement it would be necessary to implement the following which is beyond the purview of this project and may require national-level involvement

7.3.3.1 Impact on Visual Amenity

Impact Origin

The presence of a large area of PV panels is not expected to constitute a risk for glare since it is situated far from any significant areas, nor residential dwellings. Moreover, no potential visual disturbance to birds is expected given the fact, and as a result, there is no migratory birds fly way over the project area.

Impact Potentiality Level: **Minor**

Mitigation Measures

It is not anticipated that visual impacts will be generated due to the PV system design, which is specifically designed to include dark, light-absorbing materials and covered with an anti-reflective coating (ARC) for glass surfaces, which reduces the reflectance from PV panels to 2.5%-2.6% while at the same time improving their efficiency.

It is essential to point out that the intensity of light reflected from a PV module surface depends on factors such as the amount of sunlight reaching the surface and will therefore vary based on, among others, geographic location, time of year, cloud cover, and PV module orientation.

7.3.3.2 Impact on Air Quality

Impact Origin

It is worth mentioning that solar projects have very low air emissions of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds, and the

greenhouse gas carbon dioxide during operation compared to fossil fuel power generation facilities since solar power plants do not involve combustion processes.

No emissions are expected to be released during the operation phase, because solar PV power plants do not release greenhouse gases or any toxic pollutants during their operation, as a result, no impacts on ambient air quality are anticipated during the operation phase. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication and acidification, and also health effects on people due to maintenance.

Impact Potentiality Level: **Minor**

Mitigation Measures

- The project developer shall be committed to controlling emitted dust and gaseous pollutant from such operations through the proposed emission control procedures described in the environmental and social management plan (ESMP) included in this report.
- Photovoltaic (PV) is now a proven technology that is inherently safe as opposed to some dangerous electricity-generating technologies. Photovoltaic systems make no air pollution and cause no pollution in operation.
- PV panels should be cleaned and maintained regularly to dust free.
- The supplier will collect wastage PV panels for maintenance and destruction and they will be responsible for the management of PV panels
- Development of a green belt (3.5 m) all along the project boundary

7.3.3.3 Impact due to Solid Waste

Impact Origin

Risks associated with the disposal of PV panels used in the solar plant will present a challenge to the project's long-term sustainability.

Solar panels are manufactured using hazardous materials, such as sulfuric acid and phosphine gas, which make them difficult to recycle. They cannot be stored in landfills without protection against contamination. They contain toxic metals like lead, which can damage the nervous system, as well as chromium and cadmium, known carcinogens that can leak out of existing e-waste dumps into drinking water supplies. Moreover, solar panels create about 300 times more toxic waste per unit of electricity generated than nuclear power plants.

Uncontrolled discharge of these wastes will severely damage the soil quality, and water quality, clog the drainage system as well as damage the natural environment.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- ❖ Implement the national 3R ((Reduce, Reuse and Recycle) Strategy during the operation phase for both solid and liquid waste management;
- ❖ Effective storage facility with protection from rain and leachate generation will be built for both hazardous and non-hazardous waste;
- ❖ Solid waste will be stored in the storage area before selling to the authorized third party;
- ❖ The contractor should prepare a disposal training program
- ❖ Site drainage controls to isolate potentially contaminated areas from discharge to the environment
- ❖ Solar panels need to be replaced accordingly and also need to maintain regular maintenance
- ❖ Environmental training and awareness programs for tenant workers should be required

7.3.3.4 Impact on Noise and Vibration

Impact Origin

In the operation phase of the project, no major noise or vibration will be generated from the operation of any machinery, although the facility's inverters and transformers may produce noise, this is not considered a serious issue, since they will not generate any significant noise. In addition, there are some close sensitive receptors such as a school and some residential dwellings within the project site.

In addition, noise generated from inverters is only heard when the distance is close (i.e., within 1-2 m); however, as distance increases, the noise will be greatly reduced, not to mention that they do not generate noise during nighttime. Photovoltaic (PV) systems make no noise and cause no pollution in operation. Solar energy is clean, silent, and freely available.

Impact Potentiality Level: **Moderate**

Mitigation Measures

The following mitigation measures should be taken to prevent noise pollution during the operation phase:

- ❖ A separate utility room will be built with an enclosing wall
- ❖ Generator and pumps should be fitted in an acoustic enclosure to reduce noise generation;
- ❖ Use of ear-muffs and ear-plugs by industries personnel working in the utility area
- ❖ Plantations should be developed all along the project boundary to form a natural barrier. This will help in reducing the noise level significantly;
- ❖ Regular noise monitoring, especially at the hospital and residence located close by

7.3.3.5 Impact Due on Water Resources

Impact Origin

The proposed project will require groundwater for cleaning purposes. The amount of water will be extracted from the groundwater source through pumps. The extraction of groundwater may eventually lower the water level although it will be cleaned occasionally.

Impact Potentiality Level: **Moderate**

Mitigation Measures

The following mitigation measures should be taken to reduce the impact of water extraction during the operation phase:

- Before the operation, an emergency response plan for spills of hazardous materials and oil will be prepared.
- Groundwater quality monitoring will be carried out as per the schedule suggested in the Environmental and Social Monitoring Plan.
- The surface water quality monitoring will also be carried out at defined intervals and for environmental quality monitoring parameters suggested in the Environmental and Social Monitoring Plan. If these parameters are above the prescribed limits, suitable control measures will be taken.

7.3.3.6 Impact due to Heat Generation

Impact Origin

The presence of the PV panels will reflect heat and increase the surrounding temperature. The heat may be transferred by convection, radiation, and conduction method. Theoretically, the solar thermal placement in the shell of the buildings could increase fire risk and water intrusion into the roof.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- To reduce the impact, an air gap between the PV panels may be simulated.
- The air gaps will be freely connected to the outdoor air to keep the PV panels cool;
- Formal energy conservation should be developed and implemented.

7.3.3.7 Impact on Occupational Health Safety

Impact Origin

There are many hazards associated with a solar PV power plant if sufficient precautions are not taken during the operation stages. The impact origins are in the following sectors:

- Leaching of materials from broken or fire-damaged PV modules
- Electrocution of workers
- Electromagnetic radiation from PV modules
- Emergency Fire Hazard

Leaching of materials from broken or fire-damaged PV modules: The potential for chemical releases appears to be small since the chemicals are present in the sealed PV modules when completed installations of photovoltaic systems for power generation. Releases are likely to occur only due to fires or other unusual accidents. Cadmium could be a potential concern in this setting with thin-film technologies, as would arsenic and zinc to a lesser extent.

Other chemicals that have inhalation toxicity factors are present only during the manufacturing process. Solar PV modules may contain heavy metals like lead, mercury, cadmium, chromium, polybrominated biphenyls (PBBs), brominated diphenyl ethers (PBDEs), etc. Leaching of metals from the installed modules is not likely to be a concern, as documented in a study by Steinberger (1998). Leaching from small cells used in electronic devices is also unlikely to be a concern, given the small amounts of chemicals present and the sealed nature of the devices.

Electrocution of Workers: The risk of electrocution of workers during performing duties in a solar project is always present. Faulty electrical equipment, electric short circuits, and exposed electrical wires may be the chief sources of electrocution. Damaged PV modules with exposed high-voltage conductors also present a high risk of electrocution.

Electromagnetic radiation from PV modules: The strength of electromagnetic fields produced by photovoltaic systems do not approach levels considered harmful to human health established by the International Commission on Non-Ionizing Radiation Protection. Moreover, the small electromagnetic fields produced by photovoltaic systems rapidly diminish with distance and would be indistinguishable from normal background levels within several yards.

Emergency Fire Hazard: Since this is a rooftop-based solar project, the plant has always some risks of fire hazards. Electrical equipment is the main source of a potential fire hazard. In the event of fire catching a solar module, it is theoretically possible for hazardous fumes to be released and inhalation of these fumes could pose a risk to human health. However, researchers do not generally believe these risks to be substantial given the short duration of fires and the relatively high melting point of the materials present in the solar modules. Moreover, the risk of fire at ground-mounted solar installations is remote because of the precautions taken during site preparation including the removal of fuels and the lack of burnable materials mostly glass and aluminum contained in a solar panel.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- Protective clothing, earplug, helmets, shoes, hand gloves, protective goggles, and accessories will be provided to the workers;
- Adverse impact on worker's safety could be minimized by implementing a comprehensive occupational health and safety program;
- A regular medical checkup will contribute to the soundness of health for employees and workers;
- Safe drinking water and sufficient sanitation facility will be provided;

- ❖ Sufficient training will be provided to the employees about safe chemical and waste handling, machine operation, firefighting, etc.

7.3.3.8 Impact on Traffic Safety

Impact Origin

Impacts from traffic are not expected to occur during the operation phase due to the small number of personnel present within the project site. Therefore, the increased traffic load is not considered a significant impact.

Impact Potentiality Level: **Minor**

Mitigation Measures

- ❖ to involve community representatives in traffic safety strategy
- ❖ it includes awareness-raising about how to respond in case of various options
- ❖ Speed hump, traffic barriers, change of road surface, etc. including engineering measures.
- ❖ Evaluation of the accident record regularly, the effectiveness of implemented measures, and the overall level of cooperation from the relevant community;

7.3.3.9 Impact due to Seismic Risk

Impact Origin

The project is located at the Seismic Zone of Zone-2 (Seismic zone co-efficient of **0.20)** according to BNBC 2020. The project area is likely less risky to seismicity and holds major value.

Impact Potentiality Level: **Minor**

Mitigation Measures

- ❖ The project shall be built following the Bangladesh National Building Code 2020.
- ❖ All safety precautions shall be kept in mind while constructing the project
- ❖ Safety training to be provided to the workers and employees on seismic severity.

7.3.3.10Impact on Biodiversity

Impact Origin

The project area does not encompass any natural systems. The anticipated impacts on terrestrial ecology are considered low, however, activities such as vehicular movement may cause disturbance to resident birds and their ground nests.

Additionally, the discharge of wastewater and sediment during operations may result in the introduction of invasive aquatic species

Impact Potentiality Level: **Minor**

Mitigation Measures

- Potential impacts to shoreline vegetation, wetlands, fisheries, birdlife, and other sensitive aquatic and near-shore habitat habitats during operation should be fully assessed with special consideration for areas of high biodiversity value or those required for the survival of critically endangered or endangered flora and fauna;
- The depth of the project should be considered during the design phase in terms of habitat destruction and the amount and nature of dredging required.

7.3.3.11Impact on Socio-Economic

Impact Origin

The proposed project will contribute to covering the increasing demand for solar projects which is a beneficial operation factor. Site development will not lead to the loss of any jobs; instead, will create new job opportunities for the local workers.

On the other hand, during the construction activities, jobs and income opportunities will be created and as such per capita income will be enhanced in this area. For operation, several long-term skilled and unskilled personnel will be required which will create employment opportunities for the local inhabitants also.

Since there was no habitation located inside the proposed site, resettlement would not be necessary for the project. But migration will be increased due to the creation of new job opportunities in the project area.

People in the neighborhood are expected to get benefit from the employment that would be generated and from the increased business activities during the construction period. There is no religious, cultural, or historic place near the site, so the noise and air pollution during the construction of the project would not create any potential impact. People of the surrounding area will be benefited from the development of local small businesses due to the increase in migration in the area.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- During the recruitment of workers and other professionals, local poor and distressed people followed by project-affected and poor men should be given priority as per their competence and skill.
- While recruiting and giving wage gender equity must be maintained.

7.3.4 Impact during Decommissioning Phase

The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. However, some of the major impacts are described below.

7.3.4.1 Impact on Visual Amenity

Impact Origin

During the dismantling of the solar rooftop, the removal of ancillary facilities and visual intrusions will be likely.

Impact Potentiality Level: **Minor**

Mitigation Measures

Their consequence will be negligible because such an impact would be temporary (over a short period). Moreover, the actual dismantling of the solar project will reduce or remove the visual impacts witnessed during the operation phase.

7.3.4.2 Impact on Air Quality

Impact Origin

The decommissioning phase is anticipated to generate dust and exhaust emissions. Decommissioning activities will involve dismantling and disassembling the components of the solar power plant facility, and clearance of the site.

Impact Potentiality Level: **Moderate**

Mitigation Measures

- The sprinkling of water at the construction site and haul roads
- Trucks transporting fine materials, and waste to and from the project site will be covered to reduce the release of dust
- Construction materials and other debris should be stored under covered sheds
- Provision of face masks to workers to minimize inhalation of dust particles

7.3.4.3 Impact due to Noise/ Vibration

Impact Origin

The decommissioning activities of dismantling the solar power plant and removing the ancillary facilities are associated with potentially increased noise levels. The receptors of the increased noise level will be only the workers of decommissioning activities.

Impact Potentiality Level: **Moderate**

Mitigation Measures

As the only receptors will be the workers at the site and within the proposed facilities within the vicinity of the solar project, these increased noise levels are considered occupational noises that require occupational health and safety measures.

7.3.4.4 Impact due to Waste Generation

Impact Origin

It is not expected that hazardous wastes will be generated from dismantling the solar power plant since the project developer may opt for recycling PV panels of the facility.

Waste generated during decommissioning is limited to non-hazardous and inert wastes such as scrap metals, paper, wood, and plastic, given that the contractor will adhere to his waste management procedures.

Potential generation of hazardous waste includes absorbent material, tires, metal drums, empty chemical containers, waste oil from machinery lubricants, etc.

End-of-Life Solar Panels: While the solar cell is the heart of a photovoltaic system, on a mass basis it accounts for only a small fraction of the total materials required to produce a solar panel. The outer glass cover constitutes the largest share of the total mass of a finished crystalline photovoltaic module (approximately 65%), followed by the aluminum frame (~20%), the ethylene vinyl acetate encapsulate (~7.5%), and the polyvinyl fluoride substrate (~2.5%), and the junction box (1%). The solar cells themselves only represent about four percent (4%) of the mass of a finished module.

The solar PV panels that will be used in the project will have a life span of 25 years. Disposal of wasted solar PV modules is very important because if not properly decommissioned, the greatest health risk from end-of-life crystalline solar modules arises from lead-containing solders. Under the right conditions, it is possible for the lead to leach into landfill soils and eventually into water bodies.

PV modules and others: Ground-mounted PV solar arrays are typically made up of panels of silicon solar cells covered by a thin layer of protective glass attached to an inert solid underlying substance (or "substrate"). While the vast majority of PV panels currently in use are made of silicon, certain types of solar cells may contain cadmium telluride (CdTe), copper indium dieseline (CIS), and gallium arsenide (GaAs). All solar panel materials, including the chemicals noted, are contained in a solid matrix, insoluble and non-volatile at ambient conditions, and enclosed. Therefore, releases to the ground from leaching to the air from volatilization during use, or from panel breakage, are not a concern.

PV module wastes are the other waste besides a few other solid wastes generated during the operational stage. These include end-of-life solar PV modules, electrical wastes, metallic wastes, and stationary wastes of office work, etc.

Impact Potentiality Level: **Moderate**

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities:

- If spillage on soil occurs, spill must be immediately contained, cleaned up, and contaminated soil disposed of as hazardous waste;

- ❖ Proper decommissioning and recycling of solar panels both ensure that potentially harmful materials are not released into the environment and reduce the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.
- ❖ Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another.
- ❖ Maintain a register of all hazardous materials used and the accompanying Material Safety Data Sheet (MSDS) must be present at all times. Spilled material should be tracked and accounted for to ensure proper handling and management.

7.3.4.5 Impact on Traffic Safety

Impact Origin

The heavy machinery that transports disassembled parts of the project solar power plant facility might be of more significance than normal vehicles and pickups.

Impact Potentiality Level: **Minor**

Mitigation Measures

Proper management actions with adequate mitigations can reduce significantly such anticipated impacts.

7.3.4.6 Impact on Employment Opportunities

Impact Origin

Short-term job opportunities may arise during decommissioning; however, this can negatively impact permanent personnel at the solar power plant since the facility will cease its operations, therefore permanent staff may lose their jobs.

Although this impact is very unlikely given the fact that an upgrade is expected for the facility during its post–design life, however, the consequence is considered critical to permanent personnel if the facility underwent decommissioning, yielding a low impact significance.

Impact Potentiality Level: **Moderate**

Mitigation Measures

Additional benefits will be derived by setting aside areas within contractor camps/labor sheds for local people to sell their products or to provide additional services to the workers. Replacement in a suitable location in a better form will be done with the help and consent of the affected local community.
Preference should be given to employing the local communities in various positions.

7.4 Cumulative Impacts

According to the Environment Safeguards Sourcebook, Cumulative Impacts are described as: "The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project."

The objective of the current cumulative impact assessment is to evaluate the combined effects of proposed developments along the proposed project route. The project's adverse impacts have been broadly classified as impacts on land, structures (residential, commercial, residential cum commercial, and others) impacts on other immovable assets, impacts on other property assets, impacts on community property resources (religious structures, madrasah, school, passenger shelter, etc.), impacts on livelihood, etc.

7.4.1 Cumulative Negative Impacts

7.4.1.1. Deterioration of Water Quality

The project activities will not make a direct impact on the deterioration of water quality. The electricity is generated by the PV panels through the absorption of the sunlight and here, there is no requirement for water use. However, there is little amount of water usage for the purpose of the manufacturing, installation, or maintenance of PV panels. The type of waste generated during production and maintenance are manufacturing scrabs and chemical waste such as lubricants and solvents. These indirect impacts on the water quality can be mitigated, by the implementation of effective waste management practices, establishing recycling programs, and complying with environmental regulations. It is noteworthy to mention that the generated waste by the PV panels is comparatively less significant than the other industries. The PV technology is environmentally friendly having clean energy production and emission of lower greenhouse gas compared to fossil fuel-based energy sources.

7.4.1.2 Residual Impacts

The quantities of CO, SO_2, NOx, PM_{10}, and $PM_{2.5}$ have been noted after an investigation of the air quality. The number of pollutants this project releases into the air is negligible.

It may be inferred from the cumulative effect evaluation that the planned project won't make a major initial contribution.

Due to an increase in background concentration, only particulate matter may exceed the acceptable limits of the Air Pollution Control Rules 2022. As a result, it is necessary to implement an environmental management strategy at the policy level to minimize particulate matters.

7.4.1.3 Noise Level

No other development works are going on nearby the location except for some building construction works of localities. The proposed project will create some construction noise during the construction period. However, during the operation stage, there is no such possibility.

Mitigation Measures

Construction-related cumulative impacts would be effectively minimized by adopting proper mitigation measures, including:

- Coordination between all project components and other projects (if any) in the area of influence in terms of the construction schedule, possible access road and disposal sites sharing;
- Contractors will develop a material transport plan with the consultation of the local community;
- Enforcement of good construction management to minimize dust, noise, and waste generation;
- Education of construction workers to minimize social disturbance and cultural conflict;
- Provision of temporary access to local traffic;
- Proper maintenance of the access roads and timely restoration/strengthening upon completion. With the effective implementation of good construction management measures, these common construction-related cumulative impacts can be adequately mitigated to acceptable levels.

7.4.2 Cumulative Beneficial Impacts

The cumulative beneficial impact of the project will result in

- Increased employment
- Energy conservation
- Decrease demand on the power supply from REB

7.4.3 Induced Impacts

The sourcebook also describes Induced Impacts as "Adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur at later or at a different location".

After the construction of the project, many developments are expected to take place due to the decrease in electricity supply from the national grid. With the completion of the project, a lot of trade and commerce improvement and industrialization are expected within the project vicinity.

7.4.3.1 Deterioration of Roadside Air Quality

Construction activities of the project will generate air emissions including dust that will affect the population and communities along the route. However, during the operational stage, no extra air pollution is expected.

7.4.3.2 Employment

Employment generation will occur due to the project implementation and the increased commercial and business activities induced by the electricity supply.

7.4.3.3 Deterioration of Surface Water Quality

The proposed project will generate several types of waste during their construction and O/M stages. Typical wastes are likely solid such as manufacturing scrabs and liquid such as water used for cleaning purpose that may further be classified as hazardous/toxic and non-

hazardous/non-toxic. Water is generally used in photovoltaic (PV) panels for the purpose of cooling and Cleaning. Disposal of these wastes without treatment will contaminate the surface water surrounding the dumping sites. Contamination of surface water quality will have a potentially significant negative impact on the biological functions of surface water as well as fish/aquatic life resources therein. However, There will be no deterioration of the surface water quality by the wastes generated from the PV panels if the appropriate methods of waste disposal is undertaken.

7.4.3.4 Deterioration of Groundwater Quality

Deterioration in groundwater quality is very less likely to occur as there is no use of water in the production of electricity by the solar panels. It might occur to some extend if the scrabs of solar panels after its end of life don't dispose in a sustainable manner. It can easily be minimized by syending it to the recycling site rather than dispose to landfill.

7.4.3.5 Wastes

Wastes will be generated during construction and O/M of the proposed project, and unless they are properly managed, they will cause a severe impact on the environment. Particularly hazardous wastes would affect the health quality of the workers as well as will contaminate soil and water at their dumping locations.

Mitigation Measures

The proposed project will not have any significant impacts. Only some impacts could be generated due to improper management of the project. So, the proper management and monitoring and following the ESMP during the project implementation may reduce the possibility of the induced impacts.

7.5 Summary of Significant Impacts

A checklist is a comprehensive list of environmental effects and impact indicators designed to stimulate analysts to think broadly about the possible consequences of contemplated actions. Table 23 represents the checklists developed for the project. In this checklist, actions, which may affect the various stages of the project activities are listed, and the magnitude of the anticipated Environmental Impacts (EIs) and their probability of occurrence are shown. Impact identification is priorities according to the severity of the possible consequence and the probability of its occurrence refer to tables 24 and 25. In the checklist, the pre-construction, construction, operational, and decommissioning phases of the project are considered. As can be observed from the checklists, major environmental components, which will be adversely affected by the activities of the project are water, noise, and air quality. All these impacts will arise in the construction and decommissioning phase of the project. It should be noted that the identification indicated in the Checklist relates to the significant level of impact.

Table 23: Classification of Severity

Health & Safety		Social	Environment
Catastrophic	Destruction of protected wildlife or plants or their habitat	Multiple deaths Community complaints received with impact at National level	Severe destruction of the natural environment Very long-term effect on the environment and nearby habitant
Major	Severe impact on human health Prolong exposure may cause epidemic/death	Severely affecting the health of a local community Community complaints received with impact at State/National government level	Destruction of flora, fauna, or their habitat Long term environmental damage or pollution Contamination to a large area of land/water body
Significant	Prolong exposure causes mental/physical instability or disease Long term health damage	Legally actionable activity Community complaint received with impact at local Council level	Severely affect wildlife or plants Emission/discharge exceeding legal standard and is reportable to a government authority
Moderate	Damage work environment Prolong exposure causes nuisance/minor illness	Concern by the local community, social matter	Minor level pollution can be alleviated by simple mitigation measures Natural resource depletion Non-compliance with internal environmental target
Minor	No impact on human health & safety	No community complaints No breach of regulation or consent	No direct pollution to any environmental component No natural resources depletion

Table 24: Classification of Probability

Almost Certain	Likely	Possible	Unlikely	Rare
The event is expected to occur on most occasions.	The event is expected to occur on many occasions.	The event is expected to occur on some occasions.	The event is expected to occur infrequently.	The event may occur in exceptional circumstances.
Frequency: Regularly	Frequency: Weekly/at least once per month	Frequency: Monthly/at least once per 6 months	Frequency: At least once a year	Frequency: < once in 10 year/ not anticipated to occur

Table 25: Impact Identification Checklist for Project

Project Phase	Action Affecting Environmental Resources & Values	Environmental Impacts without Mitigation Measures										Type		Remarks
		Severity					Probability							
		Minor	Moderate	Significant	Major	Catastrophic	Rare	Unlikely	Possible	Likely	Almost Certain	Adverse	Beneficial	
Pre- Construction Stage	Land value depreciation		x				x					x		No land value changes have been anticipated
	Loss of and displacement from homestead land		x				x					x		No loss of and displacement from homesteads land anticipated
	Loss of and displacement from agricultural land		x				x	x				x		No loss of and displacement from agricultural land anticipated
	Damage to nearby operation	x					x					x		No possible impact has been anticipated
	Disruption to drainage pattern		x						x			x		The drainage system may be clogged if the construction materials are thrown into it. However, no new drainage system will be needed to be constructed
	Encroachment into precious ecological environment				x		x					x		No precious ecological issues anticipated
Construction Stage	Run off erosion				x			x				x		No erosion occurred
	Impact on Ecology		x					x				x		Based on the scale and intensity of the construction phase of the project, it is assumed that the project will not result any significant threat to the ambient ecology.
	Impact on Topography			x				x				x		No requirement to cut any big tree
	Worker accident			x					x			x		Irregularly may occur during construction period
	Dust emission				x					x		x		Dust emission may occur during construction activity

Project Phase	Action Affecting Environmental Resources & Values	Environmental Impacts without Mitigation Measures										Type		Remarks
		Severity					Probability							
		Minor	Moderate	Significant	Major	Catastrophic	Rare	Unlikely	Possible	Likely	Almost Certain	Adverse	Beneficial	
Construction Stage	Surface Water Contamination		x				x					x		Irregularity may occur during construction period
	Surface Water Scarcity		x					x				x		No anticipated impact as no surface water will be used for construction activity
	Ground water depletion		x						x			x		No anticipated impact as no groundwater will be used for construction activity
	Solid Waste		x								x	x		Solid waste may generate during construction
	Sanitation diseases hazard		x						x			x		Concentration of labor force may create un-hygienic condition
	Fossil fuel depletion		x							x		x		Fossil fuel will be used to operate construction machineries and vehicles
	Noise/ Vibration passage				x						x	x		equipment installations and construction activities and vehicular movement may generate noise
	Traffic congestion			x					x			x		Carrying of construction materials may create traffic congestion
	Blockage of wildlife passage				x		x					x		No wildlife in the area; no impact anticipated
	Employment				x						x		x	Major employment opportunity during construction
O&M Stage	Pollution from solid waste		x						x			x		Hazardous & non-hazardous solid waste may be generated
	Air quality Degradation		x				x					x		no impact anticipated
	Occupational health hazard		x					x				x		Discreetly may occur during the maintenance
	Surface Water Scarcity		x				x					x		no impact anticipated as no surface water will be used during operation period

Project Phase	Action Affecting Environmental Resources & Values	Environmental Impacts without Mitigation Measures										Type		Remarks
		Severity					Probability							
		Minor	Moderate	Significant	Major	Catastrophic	Rare	Unlikely	Possible	Likely	Almost Certain	Adverse	Beneficial	
	Surface Water Contamination		x				x					x		no impact anticipated as Surface water body will be used
O&M Stage	Groundwater depletion		x								x	x		Groundwater will be used for cleaning and maintenance purposes
	Odor hazard	x					x					x		No obnoxious odor will be generated
	Fossil fuel depletion		x								x	x		Fossil fuel will be used for utility operation
	Traffic congestion	x					x					x		No traffic congestion will occur
	Noise Hazard	x							x			x		Minor noise may be generated during the maintenance
	Heat Generation		x						x			x		Thermal pollution may occur from the solar PV
	Employment				x						x		x	Major Employment opportunity during operation
Decommissioning Stage	Worker accident			x						x		x		Irregularly may occur during the decommissioning
	Dust emission				x						x	x		Dust emission will occur during decommissioning
	Solid Waste		x								x	x		Solid waste will generate during decommissioning
	Noise/ Vibration passage				x						x	x		equipment removal will generate noise
	Traffic congestion			x					x			x		Carrying of equipment's may create traffic congestion
	Employment				x						x		x	A moderate amount of employment opportunity during the phase
	Air quality Degradation		x								x	x		Removal of the equipment's will result in dust emissions and air quality degradation
	Occupational health hazard		x				x					x		Discretely may occur during the decommissioning

Chapter Eight: Environmental & Social Management Plan

8.1 General Considerations

The Environmental & Social Management Plan (ESMP) is the synthesis of all proposed mitigation and monitoring actions, set to a time frame with specific responsibilities assigned and follow-up actions defined. ESMP is a plan of action for avoidance, mitigation, and management of the negative impacts of the project. Environmental & Social enhancement is also an important component of ESMP. A detailed set of mitigation measures have been compiled given the likely impacts associated with the development of the proposed project.

The ESMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction, and operation stages of the project. The ESMP has been designed keeping in view the regulatory and other requirements to ensure the following:

a) Minimum disturbance to the native flora and fauna
b) Compliance with the air, water, soil, and noise level norms
c) Conservation of water and energy to the extent possible.

8.2 Objectives

This Environmental and Social Management Plan (ESMP) aims at ensuring the application of the mitigation and monitoring measures needed to reduce and control the various environmental and social impacts associated with the implementation of the proposed project.

The key objectives of the ESMP are summarized below:

- Minimizing any adverse environmental, social, and health impacts resulting from the project activities;
- Conducting all project activities by relevant Bangladesh Legislation and applicable World Bank guidelines.
- Implementation of ongoing environmental monitoring programs;
- Periodic review of the Environmental and Social Management programs to allow for iterative improvement;
- Ensure that all stakeholder concerns are addressed.

Overall, this ESMP aims at ensuring the application of the mitigation and monitoring measures needed to reduce and control the various environmental and social impacts associated with the implementation of the proposed project.

8.3 Environmental & Social Management Plan

The project will install 30 MW over the course of numerous phases; now, WALTON will install 3.3 MW, and the remaining MW will be executed in stages. The ESMP will remain unchanged for each stage, and the effect assessment is described here in that way. The proposed project may have some impacts on the environment and society which are identified in previous sections of this report. An Environmental and Social Management Plan along with Health &

Safety Plan has been incorporated in the table-26,27 & 28. Details of these are given in the table below. The implementation of the ESMP shall be the responsibility of **Walton Hi-Tech Industries PLC.** who will implement a part of it through the contractor.

8.3.1 Management Plan for Pre-Construction, Construction Phase, Operation and Decommissioning Phase

A mitigation measure will be considered as successful when it complies with the Environmental Quality Standards (EQS), policies, legal requirements set by The Development Partners', and DoE environmental guidelines & other relevant GoB legal requirements. In absence of DoE's own EQS, other relevant international or other recognized organization quality standards will be applied.

A summary of mitigation measures identified for the Pre-Construction, Construction Phase presented in Table 26, Operation presented in Table 27 , and Decommissioning Phases of the project is presented in Table 28. This also identifies the r presented in Table 28esponsibility for implementing the mitigation measures and sources of funds for such implementation.

Table 26: Environmental & Social Mitigation and Management Plan for Pre-construction & Construction

Project Phase	Project Activity	Affected Component	Anticipated Impact	Proposed Mitigation Measures	Implementing Organization	Mitigation Cost Source
Pre-construction and Construction Phase	Site clearance, leveling activities, Civil construction, mechanical construction, operating construction machinery, handling and hauling of construction materials	Landscape	Change in landscape	Ensure modern architectural design	WHTI Authority	Expenses by WHTI
		Air Quality	Air Pollution	Sand and other such dispersible material should be stored at the site for a minimum working period. Material transportation truck should be covered Ensure safe working procedures Regular water sprinkled to bare surfaces Use low Sulphur diesel to reduce emission	Appointed Contractor	Expenses included in contract cost by Contractor
		Water Quality	Water pollution from surface run-off Blockage of drainage network	Surface drainage shall be controlled to divert surface runoff away from the construction area Strict supervision should be maintained to avoid blockage of the nearby river	Appointed Contractor	Expenses included in contract cost by Contractor
		Soil Quality	Soil Pollution Chemical Spillage	Minimize waste generation; Generated waste will be stored separately by labeling under covered sheds; Store debris under covered sheds and should be disposed-off properly;	Appointed Contractor	Expenses included in contract cost by Contractor
		Noise Level	Noise Pollution	Noisy construction works to be limited to daytime hours Ensure strict enforcement on user of ear protectors at noisy areas Temporary noise barriers should be provided near the high noise generating areas like metal cutting sites, generator rooms etc. Regular noise monitoring	Appointed Contractor	Expenses included in contract cost by Contractor
		Human Health & Environment	Sanitation and Health hazard	Proper sanitation system would be provided Ensuring sufficient numbers of toilets Ensure safe potable water supply to the workers	Appointed Contractor	Expenses included in contract cost by Contractor

Project Phase	Project Activity	Affected Component	Anticipated Impact	Proposed Mitigation Measures	Implementing Organization	Mitigation Cost Source
		Natural Resource	Water resource depletion Destruction of flora	Ensure minimal vegetation removal Instead of open pipe flow, use water trigger nozzle Use recycled water for equipment cleaning Regular site inspections for leaks, wastage Increase awareness through briefing and posters, notices.	Appointed Contractor	Expenses included in contract cost by Contractor
		Health and Safety	Occupational Health Hazard	Ensure safe working procedure Strict use of PPEs	Appointed Contractor	Expenses included in contract cost by Contractor

Table 27: Environmental & Social Mitigation and Management Plan for Operation Phase

Project Phase	Project Activity	Affected Component	Anticipated Impact	Proposed Mitigation Measures	Implementing Organization	Mitigation Cost Source
Operational & Maintenance Phase	Regular Operation & Maintenance of the solar project	Water Quality	Deterioration of the surface water quality from – Unplanned discharge of sewage Natural causes like excessive runoff from rain	Regularly monitor sewage discharge quality Minimize impervious surfaces and increase tree plantation A planned site for solid waste storage Monitor drainage situation especially during the wet season Ensure proper sanitation facilities Increase awareness and training	Appointed Contractor	Expenses by WHTI
		Noise Level	Noise pollution due to- Routine operation of machinery Workplace noise Vehicular movement,	Noise shielding by a baffle wall Green belt development Strict use of PPEs inside noisy areas Regular noise quality monitoring Proper management of vehicular traffic and swift work practice at the entrance	WHTI Authority	Expenses by WHTI
		Air Quality	Air Pollution from Emission from project and maintenance activities Discreet solid waste disposal	Regular cleaning of the solar panel and project works Proper management of solid waste Effective control of vehicular traffic Proper solid waste management system Restrict open waste disposal	WHTI Authority	Expenses by WHTI
	Regular Operation & Maintenance	Groundwater	Depletion of ground water level	Use low flow water faucet & shower head Use recycled water for equipment cleaning Rain water harvesting Awareness and training	WHTI Authority	Expenses by WHTI

Project Phase	Project Activity	Affected Component	Anticipated Impact	Proposed Mitigation Measures	Implementing Organization	Mitigation Cost Source
	of the solar project	Soil Quality	Soil quality may degrade through: Discharge of hazardous waste to open space Non-biodegradable solid waste disposal into open land	Proper solid waste management system Sufficient number of waste handling bins Separate collection and storage for hazardous and non-hazardous waste Awareness and training Reuse biodegradable waste as compost	WHTI Authority	Expenses by WHTI
		Health & Safety	Health hazard of employees and workers	Implementation of proper pollution control measures Provision of medical centers and regular health check up Provision of sufficient First Aid facilities Operators training regarding safe operation and maintenance works Provision of sufficient PPE, ensure strict PPE use Develop Emergency response and disaster management plan Develop and maintain safety related resource manuals Effective firefighting systems	WHTI Authority	Expenses by WHTI
		Traffic congestion due to vehicular traffic movement		Sufficient parking facility should be provided Proper marking on road and proper signaling facility Everybody should abide by traffic rules	WHTI Authority	Expenses by WHTI

Table 28: Environmental & Social Mitigation and Management Plan for Decommissioning Phases

Project Phase	Project Activity	Affected component	Anticipated Impacts	Proposed Mitigation Measures	Implementing Organization	Mitigation Cost Source
Decommissioning Phases	The solar power plant facility is considered a large-scale long-term investment that will contribute to economic benefits to the country through provision of power supply, designed in accordance with best practice, taking into account all relevant national and internal codes and legislation. The design life of the facility will be approximately 20 years. Therefore, the post-design life is expected to involve rehabilitation, upgrading and modernization of the facility, with a possible expansion (retrofitting and addition of new technology). As a result, impacts from decommissioning are not expected to arise in the near future unless retrofitting and upgrade of the facility was not feasible. However, this, ESIA Study has considered potential decommissioning impacts in case there was a need for the facility to be dismantled and end operations. As can be noted from the impact assessment chapter 7, no impacts with high significance are anticipated to take place during decommissioning of the project since all facilities will be removed, solar power plant decommissioned, and PV panels will be dismantled and sent for recycling or disposal. The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. The solar PV panels that will be used in the project will have a life span of 25 years. Disposal of wasted solar PV modules is very important because if not properly decommissioned, the greatest health risk from end-of-life crystalline solar modules arises from lead containing solders. Under the right conditions it is possible for the lead to leach into landfill soils and eventually into water bodies. While the solar cell is the heart of a photovoltaic system, on a mass basis it accounts for only a small fraction of the total materials required to produce a solar panel. The outer glass cover constitutes the largest share of the total mass of a finished crystalline photovoltaic module (approximately 65%), followed by the aluminum frame (~20%), the ethylene vinyl acetate encapsulates (~7.5%), the polyvinyl fluoride substrate (~2.5%), and the junction box (1%). The solar cells themselves only represent about four percent (4%) of the mass of a finished module. Proper decommissioning and recycling of solar panels both ensures that potentially harmful materials are not released into the environment and reduces the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.					

	Anticipated positive impacts of the project are: Creation of jobs; Beautification of locality; Support of local businesses; Infrastructure development; Revenue to Local Municipal Council; and Gains to the economy.	Local people should be given preference in case of recruiting new staffs The authority should regularly pay all local taxes Should sponsor local development and beautification works Should take part in social activities Conduct social awareness training	WHTI Authority	Expenses WHTI

8.4 Enhancement Plan

The proposed project involves the installation of a new rooftop solar project on their industrial rooftop. Local people and surroundings will also be enthused to get involved in the project due to the establishment of the project.

As an enhancement plan, it is proposed that the management authority should develop a thick green belt all around the project site, proper storm water drainage, and a rainwater harvesting system to harvest rainwater and use it to meet daily water demand and reduce pressure on groundwater resources.

8.5 Environmental & Social Monitoring Plan

8.5.1 General

An Environmental and Social Monitoring Plan will be prepared to provide guidelines for the environmental management plan during the construction and operation phases of the rooftop The environmental components that will be monitored are those that will be positively or negatively affected, or expected to be affected, by construction activity. Environmental management is a sustainable way of planning, arranging, supervising, organizing, and developing the environment for the maintenance of the preservation of natural resources and the prevention or reduction of damage to the environment. The major environmental impact, monitoring method, responsible organization, and expense for each environmental item in the construction and operation phases for the proposed development are listed in Table 29.

8.5.2 Objectives

The objective of environmental and social monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. The main objectives of the pre-construction, construction, and operation phase monitoring plans will be to:

- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the ESIA;
- Monitor the actual impact of the works on physical, biological, and socioeconomic receptors within the project area for indicating the adequacy of the ESIA;
- Ensure the safe disposal of excess construction materials.
- Ensure compliance with legal and community obligations including safety on construction sites;
- Evaluate the effectiveness of the mitigation measures proposed in the ESMP and recommend improvements, if and when necessary;
- Appraise the adequacy of the ESIA concerning the project's predicted long-term impacts on the physical, biological and socio-economic environment;

8.5.3 Monitoring Indicator

The physical, biological, and social components, which are of particular significance to the proposed project, are listed below:

- Air Quality
- Water Quality
- Noise Levels
- Solid & Hazardous Waste Management
- Soil Contamination & Soil Erosion

These indicators will be evaluated periodically based on the monitoring results, baseline conditions, predicted impacts, and mitigation measures.

A monitoring schedule has been developed based on the environmental components that may be affected during the construction and operation of the project is given below in Table-29

Table 29: Environmental & Social Monitoring Plan

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Frequency	Responsibility	Cost
Pre-Construction Phase						
Ambient Air Quality	Air Pollution	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	Around the project site	Once	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
Ambient Noise Level	Increase in ambient noise levels	Noise levels	Around the project site	Once	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
Water Quality	Contamination of surface water	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus, and total coliform	Nearby water body	Once	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
	Groundwater quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn, and Coliforms	Groundwater source	Once	Contractor/ 3rd Party Environmental	Contractor Cost
Occupational Health & Safety	Accidents or incidents due to pre-construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in H&S Plan	Contractor/ EHS Team of Contractor	Contractor Cost
Laborers	Labor Standards	Random check of 10% of the labor force, and check that laborers have contract letters and check age, working conditions and documentation	Project Site	Regularly	Contractor/ EHS Team of Contractor	Contractor Cost

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Frequency	Responsibility	Cost
Construction Phase						
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP	Project Activity areas and construction workers camp	Daily	EHS Team of Contractor	Contractor Cost
Ambient Air Quality	Air Pollution	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	Around the project site	Quarterly	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
Ambient Noise Level	Increase in ambient noise levels	Noise levels	Around the project site	Quarterly	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
Soil Quality	Quality of filling earth/ sand	pH, salinity, NH4+, total- P, heavy metals, oil & grease	Project site	Once	Contractor/ 3rd Party Environmental	Contractor Cost
Water Quality	Contamination of surface water	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform	Nearby water body	Quarterly	Contractor/ 3rd Party Environmental Consultant	Contractor Cost
	Contamination of Groundwater	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn and Coliforms	Groundwater source	Quarterly	Contractor/ 3rd Party Environmental	Contractor Cost
Occupational Health & Safety	Accidents or incidents due to construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in H&S Plan	Contractor/ EHS Team of Contractor	Contractor Cost

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Frequency	Responsibility	Cost
Operation & Maintenance Phase						
General	Inspection Of Mitigation Compliance	General compliance with mitigation measures presented in the ESMP	Project Activity areas	Daily	EHS Team of WHTI	Included in WHTI O&M cost
Air Quality	Ambient Air Quality	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2, Temperature	Around the project site	Quarterly	WHTI Authority	WHTI cost
Ambient Noise Level	Ambient Noise Level	Noise Level	Noise at different locations	Quarterly	WHTI Authority	WHTI cost
Water Quality	Ground Water Quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn and Coliforms	At ground water extraction point	Quarterly	WHTI Authority	WHTI cost
Solid & Hazardous Waste	PV panels	Solid waste	Waste storage area	Yearly	WHTI Authority	WHTI cost
Worker Health And Safety	Accidents or incidents due to operation and maintenance activities, workers health	Near-misses, incidents, occupational diseases, dangerous occurrence etc.	Project activities areas	As defined in H&S plan	WHTI Authority	WHTI cost

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Frequency	Responsibility	Cost
Decommissioning Phase						
General	Inspection Of Mitigation Compliance	General compliance with mitigation measures presented in the EMP	Project Activity areas and construction workers camp	Daily	EHS Team of WHTI	Included in WHTI cost
Air Quality	Ambient Air Quality	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	Around the project site	Quarterly	WHTI Authority	WHTI cost
Ambient Noise Level	Ambient Noise Level	Noise Level	Noise at different locations	Quarterly	WHTI Authority	WHTI cost
Water Quality	Ground Water Quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn and Coliforms	At ground water extraction point	Quarterly	WHTI Authority	WHTI cost
	Surface Water Quality	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform	At surface water extraction point	Quarterly	WHTI Authority	WHTI cost
Solid & Hazardous Waste	PV panels	Solid waste or chemicals from PV panels	Waste storage area	Yearly	WHTI Authority	WHTI cost
Works Health And Safety	Accidents or incidents due to decommissioning activities, workers health	Near-misses, incidents, occupational diseases, dangerous occurrence etc.	Project activities areas	As defined in H&S plan	WHTI Authority	WHTI cost

8.6 Cost Estimation for Environmental & Social Monitoring

The project will install 30 MW over the course of numerous phases; now, **WHTI** will install 3.3 MW, and the remaining MW will be executed in stages. The ESMP will remain unchanged, and the effect assessment is described here in that way. The estimated budget for the implementation of the mitigation and monitoring measures proposed in the ESMP is presented in Table 30, Table 31 & Table 32. The overall costs of the ESMP will comprise.

- ❖ Environmental and social monitoring through sample collection and analysis;
- ❖ Any remedial measures necessary to reduce or avoid environmental and social damage;
- ❖ Designing and implementing all mitigating and enhancement measures;

The following are the cost of monitoring the environmental and social parameters during the pre-construction, construction, and operation period of the proposed project respectively.

The total budget is estimated as BDT **Tk. 08, 24,000**. This budget does not include the decommissioning stage since the minimum operation period is 20 years and the rate will vary largely from the present cost.

Table 30: Tentative Cost for Environmental & Social Monitoring During Pre- Construction Phase

Item	Parameters	Unit Cost (Taka)	Frequency Per Year	Total Cost Per Year (Taka)
Ambient Air Quality	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	20,000.00	01	20,000.00
Groundwater Quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn, and Coliforms	10,000.00	01	10,000.00
Surface Water Quality	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform	8,000.00	01	8,000.00
Ambient Noise Level	Noise at different locations	10,000.00	01	10,000.00
Health And Safety Measures	PPEs for workers, safety equipment's, monitoring	60,000.00	01	60,000.00
Total Cost				**1,08,000.00**

Table 31: Tentative Cost for Environmental & Social Monitoring During Construction Phase

Item	Parameters	Unit Cost (Taka)	Frequency Per Year	Total Cost Per Year (Taka)
Ambient Air Quality	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	25,000.00	04	1,00,000.00
Groundwater Quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn, and Coliforms	12,000.00	04	48,000.00
Surface Water Quality	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform	10,000.00	04	40,000.00
Soil Quality	pH, salinity, NH4+, total- P, heavy metals, oil & grease and soil quality	1,00,000.00	01	1,00,000.00
Ambient Noise Level	Noise at different locations	10,000.00	04	40,000.00
Health And Safety Measures	PPEs for workers, safety equipment's, monitoring	80,000.00	01	80,000.00
Total Cost				**4,08,000.00**

Table 32: Tentative Cost for Environmental & Social Monitoring During Operational Phase

Item	Parameters	Unit Cost (Taka)	Frequency Per Year	Total Cost Per Year (Taka)
Ambient Air Quality	SPM, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$, CO_2	25,000.00	04	100,000.00
Groundwater Quality	pH, TDS, Chloride, Alkalinity, Hardness, Phosphate, As, Fe, Mn, and Coliforms	12,000.00	04	48,000.00
Surface Water Quality	TSS, TDS, COD, BOD, pH, Oil & grease, Total Nitrogen, Total Phosphorus and total coliform	10,000.00	04	40,000.00
Ambient Noise Level	Noise at different locations	10,000.00	04	40,000.00
Health And Safety Measures	PPEs for workers, safety equipment's, monitoring	80,000.00	01	80,000.00
Total Cost				**3,08,000.00**

Chapter Nine: Environmental & Social Benefit

9.1 General

One of the most crucial fundamental components needed to reduce poverty and promote a nation's socioeconomic growth is energy. The sources of energy in the planet are fossil fuels, sunshine, air, water, and nuclear power plants. Fossil fuel is still a significant energy source, but the supply is running low. Although fossil fuels are used, they produce greenhouse gases that threaten both sustainable development and the fight against global warming. Sustainable and reliable energy is currently a key global problem. In light of these conditions, a transformation is taking place in the energy industry. It is taking place as a result of the decreasing supply of fossil fuels, the decrease of global emissions to combat climate change, and energy security.

In light of the new perspective, solar energy in particular is gaining popularity due to its relevance in addressing global climate change and the potential for carbon trading. For the Clean Development Mechanism (CDM), the United Nations Framework Convention on Climate Change (UNFCC) has taken the lead. In light of this, solar energy is being used as a source of energy on a global scale. Many industrialized nations now employ solar energy as a sustainable source to supply the rising need for power in businesses, transportation, and domestic usage. This not only meets a greater share of the energy demand, but it also has major socioeconomic advantages and promotes environmental cleanliness.

Bangladesh is a developing nation, and as such, it has frequent power and electrical shortages. Currently, only 321 KWh of energy are consumed per person annually (including renewable energy) and around 62 percent of the population has access to power (source: Power Division, GoB website). The expensive kerosene and natural resources are the only sources of energy for the other 38% of the population.

Bangladeshi people has a fantastic potential to use solar electricity for nearly every part of our rural, urban, and semi-urban way of life because to the geographic position and favorable climate conditions. It might be a good solution to meet the demand for electricity in these off-grid regions because upgrading the national grid in such remote places is highly expensive and not cost-effective. Despite having a high upfront cost, Solar Home Systems (SHS) are increasingly being used to generate solar power in recent years.

Solar electricity is increasingly being used in a wide range of off-grid applications. Since the introduction of SHS, Bangladesh has installed approximately 5 million units. The present study is intended to identify the factors associated with the implementation of solar energy and solar power system and how far it has succeeded in reducing the need for an external power supply.

9.2 Energy & Climate Concern

The technological innovation of solar energy enables solar panels to capture the heat of the sun and utilize the energy to generate power and electricity for homes, buildings, and cities. Solar panels help maximize the earth's resources and conserve energy. However, many environmental benefits can result from the use of solar energy including,

Solar reduces the need for finite resources: Renewable energy is solar. The sun produces an astounding 173,000 terawatts of solar energy per second, making it the most plentiful energy source in the whole universe. That amount of energy may be utilized again and is equivalent to more than 10,000 times the whole amount of energy consumed worldwide. Fossil fuels, on the other hand, are non-renewable, and although they may appear to be plenty right now, eventually they will run out. Or the price of locating and exploiting these sources will rise to an unaffordable level. By then, the harm to our financial system and the environment could be irreparable. The easiest approach to prepare for the fact that fuel supplies are limited is to switch to solar power right away.

Solar reduces air pollution: Fossil fuels, our main source of energy, are the main cause of harmful carbon dioxide and methane emissions, which are major factors in global warming and deteriorating air quality. But using solar power to generate electricity results in zero emissions of greenhouse gases. As much as 16.8 million metric tonnes of carbon dioxide are estimated to be offset annually by the solar capacity that is now deployed in the United States. That's a significant step towards reducing the effects of climate change on people.

Solar reduces water pollution: While water is a necessary component of many manufacturing processes, solar photovoltaic cells can produce power without it. One of the most significant yet least discussed environmental advantages of solar power is this. Traditional biomass and geothermal power plants, like those that use natural gas or coal as fuel, need a lot of water to provide their essential cooling needs. Solar energy does not pollute local water supplies, and its operation—which again requires NO water—does not put a burden on existing supplies by competing with water requirements for drinking, agriculture, and other essential uses.

9.3 Energy & Livelihood Concern

It is thought that supplying electricity to rural regions can result in the desired socioeconomic improvements (more employment possibilities and better facilities for health and education). First, it is said that electrification mainly affects homes with abundant resources, and second, that it depletes the rural economy's limited supply of resources. Changes in electrified regions, however, could have some positive effects.

The growth of micro-enterprises in rural areas is associated with an increase in access to and use of grid electricity services, which has an impact on how these businesses operate as well as how their owners, employees, and local residents make a living. Microbusinesses are significant because they help the rural poor, particularly women, build their economies, advance rural society's technical advancement, and have the ability to provide jobs.

9.4 Energy & Economy Concern

Less investment during installation: Extra than the original cost of the solar panels, there are no extra expenses associated with producing solar electricity. Going off the grid can save money that can easily be used towards other endeavors. Not only may many industries accomplish this, but also people. Since they guarantee the use of solar energy for powering various machinery and equipment, commercial solar projects are also advantageous for many enterprises.

Power in remote areas: Due to their remoteness, many places, including mountains, or remote islands, do not have access to electricity. For these locations, solar energy is undoubtedly a blessing in disguise. Power is currently being used by remote and rural communities to launch a variety of local development initiatives. As a result of the advent of solar electricity, these localities now have more educational and medical services.

Power in the hand of the masses: The dominance of capitalists in controlling energy and manufacturing continues to lead to heightened exploitation of the masses. Their most potent tool lies in controlling energy resources. However, solar energy presents a transformative shift, transferring this power to the hands of the masses, empowering communities and smaller groups to disconnect from the conventional power grid.

Chapter Ten: Stakeholder Consultation

10.1 General

Stakeholder or public consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability. Community input (both knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making.
Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the ESIA process in Bangladesh but also to improve and enhance the social and environmental design of the project.

For this section, public participation & community consultation was conducted inside the premises as well as in the adjacent areas.

10.2 Objectives of Stakeholders Consultation

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference Agenda 21. Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding humanitarian action with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

For projects that have environmental and social impacts, consultation is not a single conversation but a series of opportunities to create understanding about the project among those it will likely affect or interest, and to learn how these external parties view the project and its attendant risks, impacts, opportunities, and mitigation measures.

Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help a company to identify and control external risks. It can also form the basis for future collaboration and partnerships.

For stakeholders, a company's consultation process is an opportunity to get information, as well as to educate company staff about the local context in which a project will take place, to raise issues and concerns, ask questions, and potentially help shape the project by making suggestions for the company to consider and respond to.

Through the public consultation process, **WHTI** hopes to:

- Promote a better understanding of the project, its objective, and its likely impact;
- Identify and address concerns of all interested and affected parties of the project area;
- Provide a means to identify and resolve issues before plans are finalized and development commences, thus avoiding public anger and resentment and potentially costly delays;

- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership.

10.3 Consultation Process

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Bangla language. During these meetings, a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis and interpretation.

By reaching out to a wider segment of the population and using various communication tools—such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal—ESIA involved the community in active decision-making. This process will continue even after this ESIA has been submitted, as well as during future ESIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues in the context of a proposed project.

Secondary stakeholder consultation includes face-to-face meetings and telephonic conversations with representatives of local government offices, welfare organizations, NGOs, and nearby hospitals. They were briefed on the ESIA process, the project design and function, and the potential negative and positive impact of the project on the area's environment and communities.

It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings to avoid undue conflict with local leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the ESIA report.

10.4 Stakeholder Consultation Technique

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is also important to examine how community skills, resources, and 'local knowledge can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory techniques were employed during stakeholder consultations:

- Informal meetings and interviews with communities in surrounding areas.
- Focus Groups with women, elders, and men participants in the surrounding areas.

10.5 Stakeholder Consulted

In the consultation process for ESIA, the following key stakeholders were consulted:

- Local communities, men, and local elders attended meetings.
- Social Development oriented NGOs

Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men. The location of the meetings, the process followed, and the outcomes are discussed in this section.

10.6 Questionnaire of the Consultation

The following questions were asked to conduct the public consultation. The images of the questionnaire survey are mentioned below here**.**

Questions
Do you know what kind of project will be constructed here? Do you have a solar project installed in your house? Do you know the importance of the solar project? What is your opinion on solar projects? What do you think about the employment opportunity this project will create? What do you think about the environmental impacts this project will generate? Do you think this project will develop the surrounding area? What is your opinion on the establishment of the project? Do you face any problems due to the construction of the project?

10.7 Stakeholder Concerns and Recommendations

The findings of the Community consultations are considered and all these have been addressed in various sections of the ESIA, and the mitigation plans have been incorporated into the ESMP. A summary of the various stakeholder consultations is given below.

10.7.1 Focus Group Discussion with Affected Community

As a part of a focus group discussion with affected communities, on 23rd and 24th January 2023, there were consultations with the workers working on the project site. In addition, there were consultations with female respondents as well. During this consultation, it has been tried to ensure the presence of all classes of people has been documented, which is in the following sections:

Outcome:

The major findings of large public consultation are:

- Local people are aware of the proposed project;
- They are expecting employment during the construction and operation phases of the project;
- The workers seem afraid of noise and dust emitted by vehicles during the construction period and also the same coming from different types of loading and unloading activities during the operation phase.

- ❖ The health safety relevant to traffic movement appears to be a major concern for the community
- ❖ Inadequate attention to the scope of oil spillage may result in adverse outcomes for the community.

10.7.2 Consultation with Government Official

As part of the consultation with government officials, on 23rd -24th January 2023, the ESIA Team consulted with the Thana Nirbahi Officer, Kaliakoir Upazila. The team tried to communicate with other officials as well but they couldn't reach them.

10.7.3 Consultation with Locals

As part of the consultation with local elites, on 23rd-24th January 2023, there was a consultation with many local people of all ages.

Outcome:

The major findings of consultation with government officials are:

- ❖ There should be job opportunities for the local people on a priority basis;
- ❖ Adequate health safety is to be ensured in relevant to traffic movement.
- ❖ This project offers an opportunity to income generate for the community
- ❖ The local community will provide all sorts of required facilities for the project

The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities was evident. The consultations were considered a good gesture and appreciated, especially by the workers.

The average economic condition of the local communities is such that communities are looking to any project proponent to improve their financial well-being to a great extent**. Walton Hi-Tech Industries PLC.** recognizes that benefits from the project should be distributed judiciously and equitably especially among primary stakeholders in the project area and will continue to ensure that this principle is followed in its projects and community development program.

The proposed project will be located on the industrial rooftop of **Walton Hi-Tech Industries PLC.** As no case of relocation or land acquisition is needed, therefore, the resettlement issue does not apply to the proposed project.

Communities in the project area emphasized that local people should be given priority when employing people for various project-related works and activities according to their skills.

A non-local workforce coming into the project area that will not be aware of the local customs and norms may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

Chapter Eleven: Conclusion

11.1 Conclusion

An Environmental and Social Impact Assessment (ESIA) study has been carried out for the proposed project according to the requirement of the DoE, IDCOL, and the Development Partners' for necessary environmental clearances. The ESIA has been prepared by identifying the potential impacts, assessing them, and recommending possible mitigation and enhancing measures for negative and positive impacts, respectively. While impact assessment, minimal negative environmental impacts on location, planning, design, pre-construction, construction, operation, and decommissioning phase are anticipated, mostly during the construction and operation of the project.

Proper maintenance of the machinery could reduce the emission of air pollutants. Based on the environmental assessment and surveys conducted for the project, associated potential adverse environmental impacts can be mitigated to an acceptable level by the adequate implementation of the measures as stated in the ESIA. Adequate provisions should be made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs. No possible environmental impacts will be made by the operation of the project. Since it is understood that the project proponent (**WHTI**) is committed to taking the necessary steps to address any environmental problems, the selected location seems to be acceptable for the proposed project.
The findings of this ESIA suggest that the project involves some environmental impacts (mostly localized in nature) to which further careful attention should be given to the construction, operation, and maintenance of the project to minimize/mitigate and offset the adverse effects. The possible negative impacts are not severe, and the adverse impacts if duly addressed, as stated in the ESMP, could be minimized without much effort, though they would require attention and positive commitment from the plant management.

The location of the project is environmentally advantageous condition as has already been mentioned. However, adequate and effective pollution prevention, abatement, and control measure, proper and careful operation and maintenance, and regular and effective environmental monitoring with adequate staff and budgetary provision, and reporting to DoE, IDCOL, and the Development Partners' should be ensured.

However, no development can be expected without any adverse impact on the environment. The beneficial impacts on the nation, as well as human beings, would only be meaningful and sustainable development would only be possible if the adverse effects are minimized through strict maintenance and control measures as adopted and further suggested for this project.
Finally, it can be concluded that the location of the project is environmentally acceptable and it is expected that the project proponent will follow all environmentally compatible steps during construction and operation which sets a positive example as an environment-friendly industrial facility. No follow-up study would be required for the proposed project and Environmental Clearance Certificate could be issued in favor of the project.

11.2 Recommendations

Recommendations made for the project development based on the ESIA study are given below:

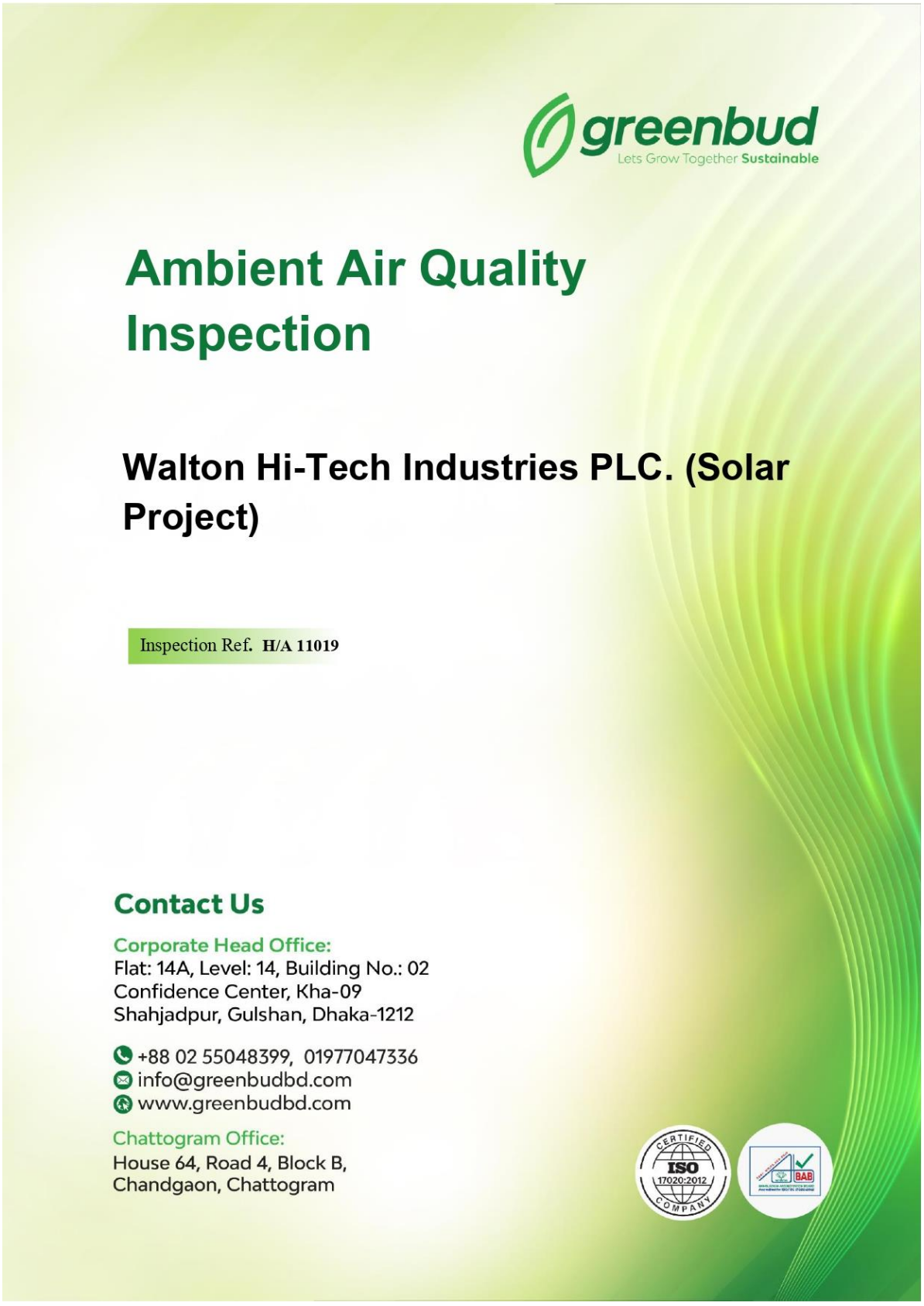
- The proposed environment and social management plan should be implemented strictly in both the operation and construction phase
- The provision of green belt development and segregated storm water drainage should have been adhered to.
- A waste management system should be developed by implementing a national 3R strategy.
- Proper training in maintaining the environment, health, and safety should be given to the project management unit in both the construction and operation phases.
- The Environmental Health and Safety system should be upgraded continuously with further expansion to maintain sustainable development.
- Traffic management should be monitored and proper mitigation measures should be taken accordingly.
- Regular road watering/spraying should be done and ensured by the EHS head to reduce the dust emission as much as possible
- Monthly health inspections and training as per the training calendar should be conducted and maintained by **Walton Hi-Tech Industries PLC.**
- Proper use of PPEs (helmet, safety shoe, mask, harness, etc.) and their implementation should be made sure.
- An On-site, emergency response team should be present.

References

1. BBS (2011), "The Statistical Yearbook of Bangladesh." Bangladesh Bureau of Statistics, July 2011, Gazipur, Bangladesh.
2. Bio-ecological Zones of Bangladesh. IUCN. 2002. ISBN 9843110900.
3. DOE (2022) "Air Pollution Control Rules", Department of Environment, Govt. of Bangladesh.
4. DOE (1995) "Environmental Conservation Act", Department of Environment, Govt. of Bangladesh.
5. DOE (2002) "A Compilation of Environmental Laws", Department of Environment, October 2002, Govt. of Bangladesh.
6. GOB, (1992), “Bangladesh Environmental Policy”.
7. GOB, (1995), “National Environmental Management Action Plan (NEMAP)”.
8. GOB (2005), SRO No. 220-Rule/2005, Revision of the Environment Conservation Rules 1997, Ministry of Environment and Forest, Government of the People’s Republic of Bangladesh.
9. IFC (2002), Occupational Health and Safety Guidelines, International Finance Corporation, World Bank Group.
10. Khan, M. Monirul H. (2008). Protected Areas of Bangladesh - A Guide to Wildlife. Dhaka, Bangladesh: Nishorgo Program, Bangladesh Forest Department. OCLC 795008978.
11. Peavy& Rowe (1985), “Environmental Engineering”, McGraw-Hill Inc., Singapore.
12. Zia Uddin Ahmed, ed. (2009). Encyclopedia of Flora and Fauna of Bangladesh. Asiatic Society of Bangladesh, NHBS. ISBN 984-300-000286-0. Archived from the original on 2017-06-06. Retrieved 2017-07-07.

Annexure

Annexure A



Inspection Reference No: **H/A 11019**

General Information		
Invoice Reference No:		Inspection Date: 23.01.2023
Inspection Reference No: **H/A 11019**		Inspection Duration: 10am-5pm
Report Generation Date:	13.04.2023	Inspection location: Around of project premises
Report Submission Date:	15.04.2023	Inspection Description: Ambient Air Quality Inspection
Inspection Standards: 2004/108/EEC		
Company Name: **Walton Hi-Tech Industries PLC. (Solar Project)** *Address: Chandra, Kaliakair, Gazipur, Bangladesh*		Contact Person: **Md. Mostafizur Rahman Razu** *Deputy Director*

On Site Inspection Team	
Md. Ismail Hossain *Jr. Executive (Operation)* *Environmental Engineer*	**Imran Hossen** *Executive (Operation)* *Environmental Engineer*
Report Prepared by:	**Quality Checked:**
Taufique Tuhin *Executive (Operation)* *B.Sc. in Civil and Environmental Engineering*	**Fayez Ahammad** *Sr. Executive (Operation)* *B. Sc. in Civil & Environmental Engineering*

Report Approved by:

Engr. Syed Tasnem Mahmood
Chief Environmental Engineer & CEO,
B.Sc. & M.Sc. (Civil and Environmental Engineering)
MIEB No.: M/35960

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Method of Sampling:

Analysis of the ambient air quality parameters was done using direct reading instruments. So, there was no separate sampling conducted for this analysis. During the analysis, a standard work instruction stated in the TP-GB-04 was followed.

Method of Analysis:

The following methods were used to analyze the air quality parameters:

Parameters	Methods
SO_2 (Sulfur Dioxide)	Electrochemical
CO (Carbon Monoxide)	Electrochemical
CO_2 (Carbon Dioxide)	Non-Dispersive Infrared (NDIR)
Suspended Particulate Matter (SPM)	Calculated
Nitrogen Dioxide (NO_2)	Electrochemical
Particulate Matter	Electrochemical
Volatile Organic Compound (VOC)	Electrochemical
Formaldehyde (CH_2O)	Electrochemical

Reference Standard:

Parameters	$PM_{2.5}$	PM_{10}	VOC	CH_2O	NO_2	SO_2	CO	CO_2	Pb	NH_3	O_3
Air Pollution Control Rules 2022[1]	65 ($\mu g/m^3$)	150 ($\mu g/m^3$)	*NYS* ($\mu g/m^3$)	*NYS* (ppm)	80$\mu g/m^3$ (0.043 ppm)	80 $\mu g/m^3$ (0 0.031 ppm)	5mg/m^3 (4.36) ppm	*NYS* (ppm)	0.25 $\mu g/m^3$	100 $\mu g/m^3$	100 $\mu g/m^3$ (0.01) ppm

[1] DOE, "Air Pollution Control Rules'2022" Schedule-01, Department of Environment, Govt. of Bangladesh

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Inspection Reference No: **H/A 11019**

Ambient Air Quality Inspection Result:

Sl. No.	Inspection Area Point		SPM (µg/m³)	PM_1 (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	VOC (mg/m³)	CH_2O (mg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	CO (ppm)	CO_2 (ppm)	O_3 (ppm)
1	24°2'28.87958"N	90°14'22.72628"E	378.46	150	236	298	0.1	0.003	0	0	0	484	0
2	24°2'23.96558"N	90°14'15.76435"E	359.41	123	216	283	0.09	0.002	0	0	0	383	0
3	24°2'19.5508"N	90°14'11.0315"E	325.12	124	187	256	0.08	0	0	0	0	385	0
4	24°2'8.7392"N	90°14'25.48576"E	320.04	110	189	252	0.12	0.003	0	0	0	484	0
5	24°2'30.35389"N	90°14'21.41304"E	295.91	98	167	233	0.1	0.002	0	0	0	387	0
6	24°2'38.62345"N	90°14'9.27823"E	356.87	126	205	281	0.07	0	0	0	0	419	0
7	24°2'32.54186"N	90°14'11.0873"E	322.58	123	191	254	0.1	0	0	0	0	421	0
8	24°2'25.28974"N	90°14'6.97218"E	379.73	160	246	299	0.06	0	0	0	0	419	0
9	24°2'16.9413"N	90°14'8.17339"E	491.49	150	247	387	0.07	0	0	0	0	385	0
10	24°2'10.83725"N	90°14'9.5842"E	368.3	130	223	290	0.05	0	0	0	0	385	0
11	24°2'10.83692"N	90°14'9.59503"E	300.99	122	208	237	0.03	0	0	0	0	392	0
12	24°2'9.5699"N	90°14'9.43296"E	270.51	100	162	213	0.1	0.003	0	0	0	385	0
13	24°2'9.57912"N	90°14'9.3651"E	266.7	95	147	210	0.13	0.004	0	0	0	395	0
14	24°2'10.12736"N	90°14'6.95051"E	261.62	106	126	206	0.11	0.003	0	0	0	397	0
15	24°2'2.08828"N	90°14'9.16559"E	265.43	92	153	209	0.1	0.002	0	0	0	389	0
16	24°2'11.00929"N	90°14'17.5988"E	266.7	97	145	210	0.09	0	0	0	0	397	0
17	24°2'11.00047"N	90°14'17.60561"E	314.96	112	183	248	0.08	0	0	0	0	389	0
18	24°2'11.00929"N	90°14'17.5988"E	372.11	125	215	293	0.12	0.002	0	0	0	331	0

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Inspection Reference No: **H/A 11019**

Sl. No.	Inspection Area Point		SPM (µg/m³)	PM_1 (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	VOC (mg/m³)	CH_2O (mg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	CO (ppm)	CO_2 (ppm)	O_3 (ppm)
19	24°2'10.8505"N	90°13'56.6476"E	262.89	91	152	207	0.11	0.002	0	0	0	385	0
20	24°2'9.40945"N	90°13'50.80494"E	233.68	78	135	184	0.03	0	0	0	0	544	0
21	24°2'13.13434"N	90°13'40.91632"E	228.6	84	130	180	0.04	0	0	0	0	636	0
22	24°2'12.9129"N	90°13'38.58845"E	257.81	121	164	203	0.05	0	0	0	0	465	0
23	24°2'12.91142"N	90°13'38.58697"E	330.2	126	169	260	0.07	0	0	0	0	421	0
24	24°2'12.70932"N	90°13'38.02674"E	266.7	106	159	210	0.05	0	0	0	0	436	0

***Abbreviations & Acronyms:** *SPM = Suspended Particulate Matter; $PM_{2.5}$ = Particulate Matter 2.5; PM_{10} = Particulate Matter 10; CO = Carbon monoxide; CO_2 = Carbon dioxide; SO_2 = Sulfur Dioxide; NO_2 = Nitrogen Dioxide.*

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Ambient Air Quality Test Report

Annexure B

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Ambient Noise Level Inspection

Walton Hi-Tech Industries PLC. (Solar Project)

Inspection Ref. No: I/N 10734

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CERTIFIED ISO 17020:2012 COMPANY

BAB

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Inspection Reference No: **I/N 10734**

General Information		
Invoice Reference No:		Inspection Date: 23.01.2023
Inspection Reference No: **I/N 10734**		Inspection Duration: 10am-5pm
Report Generation Date:	13.04.2023	Inspection Description: Ambient Noise Level
Report Submission Date:	15.04.2023	Inspection location: Around Project Premises
Inspection Standards: 2004/108/EEC		
Company Name: **Walton Hi-Tech Industries PLC. (Solar Project)** *Address: Chandra, Kaliakair, Gazipur, Bangladesh*		Contact Person: **Md. Mostafizur Rahman Razu** *Deputy Director*

On Site Inspection Team	
Md. Ismail Hossain *Jr. Executive (Operation)* *Environmental Engineer*	**Imran Hossen** *Executive (Operation)* *Environmental Engineer*
Report Prepared by:	**Quality Checked:**
Taufique Tuhin *Executive (Operation)* *B.Sc. in Civil and Environmental Engineering*	**Fayez Ahammad** *Sr. Executive (Operation)* *B. Sc. in Civil & Environmental Engineering*

Report Approved by:

Engr. Syed Tasnem Mahmood
Chief Environmental Engineer & CEO
B.Sc. & M.Sc. (Civil and Environmental Engineering)
MIEB No.: M/35960

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Method of Analysis:

Inspection of noise level was done using direct reading instruments. During the analysis, a standard work instruction stated in the TP-GB-02 was followed.

Ambient Noise Level Inspection Result:

Sl. No.	Inspection Area: Point		Inspection Status: Reference of Relevant Standard: Sound Pollution Control Rules-2006 (dB)	Reference of Relevant Standard: WHO Guide Line (dB)	Obtained Result (dBA)	SPCR,2006 Limit	WHO Limit
1	24°2'28.87958"N	90°14'22.72628"E	75	70	56	√	√
2	24°2'23.96558"N	90°14'15.76435"E	75	70	57	√	√
3	24°2'19.5508"N	90°14'11.0315"E	75	70	53	√	√
4	24°2'8.7392"N	90°14'25.48576"E	75	70	58	√	√
5	24°2'30.35389"N	90°14'21.41304"E	75	70	50	√	√
6	24°2'38.62345"N	90°14'9.27823"E	75	70	45	√	√
7	24°2'32.54186"N	90°14'11.0873"E	75	70	44	√	√
8	24°2'25.28974"N	90°14'6.97218"E	75	70	44	√	√
9	24°2'16.9413"N	90°14'8.17339"E	75	70	61	√	√
10	24°2'10.83725"N	90°14'9.5842"E	75	70	51	√	√
11	24°2'10.83692"N	90°14'9.59503"E	75	70	54	√	√
12	24°2'9.5699"N	90°14'9.43296"E	75	70	56	√	√
13	24°2'9.57912"N	90°14'9.3651"E	75	70	70	√	√
14	24°2'10.12736"N	90°14'6.95051"E	75	70	68	√	√
15	24°2'2.08828"N	90°14'9.16559"E	75	70	66	√	√
16	24°2'11.00929"N	90°14'17.5988"E	75	70	67	√	√
17	24°2'11.00047"N	90°14'17.60561"E	75	70	61	√	√
18	24°2'11.00929"N	90°14'17.5988"E	75	70	62	√	√
19	24°2'10.8505"N	90°13'56.6476"E	75	70	64	√	√
20	24°2'9.40945"N	90°13'50.80494"E	75	70	59	√	√
21	24°2'13.13434"N	90°13'40.91632"E	75	70	61	√	√
22	24°2'12.9129"N	90°13'38.58845"E	75	70	62	√	√
23	24°2'12.91142"N	90°13'38.58697"E	75	70	59	√	√
24	24°2'12.70932"N	90°13'38.02674"E	75	70	63	√	√

****Abbreviations and Acronyms:** *DoE = Department of Environment; SPCR=Sound Pollution Control Rules; WHO = World Health Organization; dB = decibel*

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Ambient Noise Level Test Report

Annexure C

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Water Test Report

Reference No	GW 10246	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B-B & B-9 Canteen
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	21.2	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	361	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	179	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	93	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	17	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10247	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Micro lift B3 Computer mobile
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.3	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.9	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	348	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	171	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	95	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	18.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.4	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10248	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B-9
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.2	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	349	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	170	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	101	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	15.1	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10249	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Microtech gate
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	319	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	157	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.23	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	92	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	17.2	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.6	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10250	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	High-tech gate-2
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.9	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	350	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	171	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	97	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	18.3	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.1	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

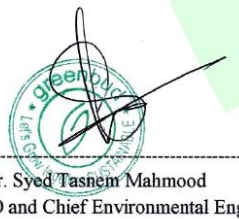
Reference No	GW 10251	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	High-tech main gate
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.8	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	21.0.	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	288	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	129	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.12	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	112	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	27.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	6.9	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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Water Test Report

Reference No	GW 10252	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B7
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.2	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	356	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	161	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.09	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	107	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	30	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.5	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10253	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S4)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.8	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	287	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	122	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	103	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	21	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

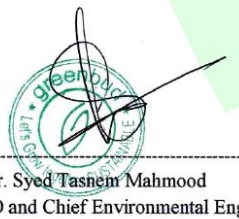
Reference No	GW 10254	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	IT Building
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.1	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	360	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	166	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	101	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	17.7	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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Reference No	GW 10255	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S-6)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	293	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	125	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	109	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	22.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.4	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	GW 10256	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S-5)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	21	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	294	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	129	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.39	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	113	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	23	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10257	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B-6
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.9	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	360	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	161	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	95	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	19	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.5	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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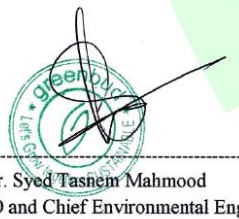
Reference No	GW 10258	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Hold & Dye
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	268	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	116	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.28	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	96	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	20.1	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.6	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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Reference No	GW 10259	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B-5
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	353	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	153	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	117	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	18.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.1	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10260	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	B-8
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.4	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	353	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	154	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	98	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	18.7	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10261	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Micro electric (B-2)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	342	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	148	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	93	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	19	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10262	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Stryro foam Shed
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.2	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	341	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	147	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	101	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	24	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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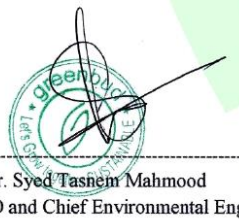
Reference No	GW 10263	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-D (B-2)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	24.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.4	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	288	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	118	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	99	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	15.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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Reference No	GW 10264	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S1)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.5	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	173	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	69	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	97	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	14	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10265	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S-3)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.4	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	289	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	122	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	110	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	11	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.1	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	GW 10266	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (S-2)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.3	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	176	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	73	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.16	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	94	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	15	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.3	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

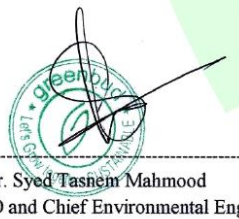
Reference No	GW 10272	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Block-A (B-1)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.1	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	286	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	122	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0.16	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	108	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.2	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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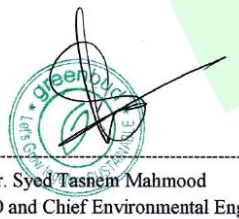
Reference No	GW 10273	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Micro B-4
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	355	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	152	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	99	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	14.9	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.4	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.



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Reference No	GW 10274	**Test Name**	Ground Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Ground Water
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Micro (B-1) TV
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	25.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Ground Water (ECR'97)	Method of Analysis
1	pH	-	7.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.6	20-30	APHA METHOD 2550
3	Electric Conductivity (EC)	µS/cm	267	-	EC Meter
4	Total Dissolved Solids (TDS)	mg/L	188	1000	Electrical Conductivity
5	Iron (Fe)	mg/L	0	0.3-1.0	USEPA 200.9; SM 3111 B
6	Arsenic (As)	mg/L	0	0.05	USEPA 206.2; SM 3111 B
7	Total Alkalinity	mg/L	103	200 – 500	Titrimetric
8	Chloride (Cl^-)	mg/L	12	150-600	USEPA 325.6; SM 4500-Cl
9	Dissolve Oxygen (DO)	mg/L	7.1	≥6	APHA 4500-O A

Comments:

1. **All the parameters are within the acceptable limits set for the Ground Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Ground Water Test Reports

Annexure D

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Water Test Report

Reference No	SW 10275	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-1
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	River Bonshi-2
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	28.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	8.1	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.8	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	202	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	7.1	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.29	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	29	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	6.7	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	4.9	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	441	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Reference No	SW 10276	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-2
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	North side (mold & dye)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	28.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	8	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.2	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	581	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	19.1	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.28	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	32	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	5.5	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	10.8	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	1197	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10277	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-3
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Big pond
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	28.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	7.7	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23.2	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	210	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	11.6	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.61	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	33	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	6	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	7.2	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	457	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10278	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-4
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Out sail pond-2 (Day-2)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	28.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	7.6	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	23	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	210	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	11.4	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.34	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	27	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	6.4	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	6.6	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	455	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10279	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-5
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Outside pond-1 (Day-2)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	23.01.2023
		Date of Test	28.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	7.4	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.9	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	52	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	13	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.35	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	38	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	5.6	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	5.9	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	93	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10280	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-6
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Pond in front of B-3
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	29.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	7.9	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.6	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	174	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	10.9	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.47	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	31	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	3.1	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	6.1	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	377	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10281	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-7
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Pond near the garden
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	29.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	8.5	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	21.2	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	391	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	14.4	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.33	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	33	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	5	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	8.7	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	823	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10282	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-8
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	Hold & dye (pond south of)
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	29.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	8.3	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	20.2	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	78	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	8.5	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.46	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	28	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	6.6	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	3.9	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	184	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Water Test Report

Reference No	SW 10283	**Test Name**	Surface Water Test
Company Name	**Walton Hi-Tech Industries PLC.**	**Sample Type**	Surface Water-9
Contact Person	Md. Mostafizur Rahman Razu *Deputy Director*	**Sampling Location**	River Bonshi
Company Address	Chandra, Kaliakair, Gazipur.	**Date of Sampling**	24.01.2023
		Date of Test	29.01.2023

ANALYSIS RESULT

Sl. No	Water Quality Parameters	Unit	Result	Bangladesh Standard for Surface Water (ECR'97)	Method of Analysis
1	pH	-	8.3	6.5-8.5	Electrometric (pH Meter)
2	Temperature	°C	22.4	-	APHA METHOD 2550
3	Total Dissolved Solids (TDS)	mg/L	110	-	Electrical Conductivity
4	Chemical Oxygen Demand COD	mg/L	6	-	APHA METHOD 5220C
5	Nitrogen (Ammonia)	mg/L	0.51	-	EPA 350.1
6	Chloride (Cl^-)	mg/L	29	-	USEPA 325.6; SM 4500-Cl
7	Dissolve Oxygen (DO)	mg/L	6.8	5 or more	APHA 4500-O A
8	Biological Oxygen Demand (BOD)	mg/L	3.4	6 or less	EPA 405.1
9	Electric Conductivity (EC)	µS/cm	251	-	EC Meter

Comments:

1. **All the parameters are within the acceptable limits set for the Surface Water in ECR 1997.**
2. Sample was collected from the project.
3. Sample was received in sealed condition.

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Surface Water Test Reports

Annexure E










Pictorial Evidence of Stakeholder Engagement