ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

for

"WMSPL-3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project"

April 2024

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ABBREVIATIONS

AC	Alternating Current
A.M.S.L.	Above Mean Sea Level
AoI	Area of Influence
BBS	Bangladesh Bureau of Statistics
BNBC	Bangladesh National Building Code
DC	Direct Current
DO	Dissolved Oxygen
DoE	Department of Environment
DPHE	Department of Public Health Engineering
ECA	Ecologically Critical Area
EC	Electric Conductivity
ECR	Environmental Conservation Rules
ESIA	Environmental Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FAO	Food and Agriculture Organization
GBV	Gender-based Violence
GDP	Gross domestic product
IDCOL	Infrastructure Development Company Limited
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
kVA	Kilovolt-amps
MW	Mega Watt
MOHFW	Ministry of Health and Family Welfare
MoEFCC	Ministry of Environment, Forest and Climate Change
NYS	Not Yet Selected
ORP	Oxidation-Reduction Potential
PV	Photovoltaic modules
RERED II AF	Rural Electrification and Renewable Energy Development Project II and Additional Financing
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSS	Total Suspended Solid
UNDP	United Nations Development Program
WB	World Bank
WMSPL	Western Monpura Solar Power Ltd.

EXECUTIVE SUMMERY

INTRODUCTION	A sustainable, affordable, and secure energy supply is crucial for the advancement of socio-economic development of a country. Bangladesh, with its population of 160 million, faces challenges in meeting the escalating electricity demand particularly in remote areas. To meet this demand, initiatives, both governmental and private, have been launched to transition to renewable energy for environmental protection and improved living conditions. The present project area, Monpura Island is an off-grid remote sea island of the country. There are about 18,404 potential customers of electricity available on the Island out of which about 10,585 customers are currently using Solar Home Systems. To meet the ongoing demand of electricity, the proposed project involves setting up of a 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant project by Western Monpura Solar Power Ltd. (WMSPL) in Hazirhat Union, Monpura Upazila of Bhola District. The proposed project prioritizes environmental friendliness by minimizing pollution and effluent generation and for this an Environmental and Social Impact Assessment (ESIA) study was done. The main purpose of the Environmental and Social Impact Assessment (ESIA) study is to identify, evaluate and suggest mitigative measures of environmental and social impacts that may arise due to implementation and operation of the project.
POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK	According to the ECR 2023 (published on 05 March 2023) under Environment Division-3, (schedule-1, item no 34) of Ministry of Environment, Forest and Climate change, Government of the Peoples Republic of Bangladesh, the “3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant project is under “Yellow Category”. The Site Clearance Certificate (SCC) has been obtained from DoE, and Environmental Clearance Certificate (ECC) will be collected after construction completed (before starting operation), according to the DoE guidelines. As per the World Bank's safeguard policies, the project falls under “Category B”, and it requires environmental assessment (EA-OP/BP 4.01) to ensure that they are environmentally sound and sustainable. As per IDCOL’s ESMF project classification, this project falls under “medium risk” category. According to IDCOL’s ESMF (REREDP-II AF), all IDCOL financed projects are required to prepare an Environmental and Social Impact Assessment (ESIA) Report covering the potential environmental, occupational, and social impacts as well as possible mitigation measures.
DESCRIPTION OF THE PROPOSED PROJECT	The Project site is located Hazirhat Union of Monpura Upazila of Bhola district. Geographically, the Project is located in the Southern region of Bangladesh within the Longitude of 90°57'56.68"E and Latitude of 22°14'52.13"N. The total land area of the project site is about 30 acres or 90 Bigha. In line with the Government initiatives, Western Monpura Solar Power Ltd. (WMSPL) has signed Implementation Agreement (IA) and Power Purchased Agreement (PPA) for implementation of a 3 MW(AC) Solar PV-Battery-Diesel Hybrid Power Plant at Monpura Island, Bhola district. The Solar Power will initially generate in DC form which will be converted to AC form by inverters. Generated electricity will be stored in energy storage system (batteries) and 3 diesel generators will be installed for backup. Thus, the plant will have 11 MWp of solar PV panels, 22 MWh of Lithium ion (Li-ion) based storage systems and 03 diesel generators of 850 kVA (Kilovolt-amps) each for backup. As per the signed PPA, the generator can supply only up to 10% of the total generated energy per year, and these generators will only be used during natural calamities and harsh weather conditions. No water would be required for cooling or electricity generation except a small quantity will be needed for periodical PV panel cleaning. Ground water could be extracted from deep tube well for the usage of the employees of the project

	as well as for panel cleaning after proper treatment (if required). However, the quantity of groundwater withdrawal will be very less.
TECHNOLOGICAL ASPECTS	The proposed site is potentially suitable for the solar PV Project. The panels will be installed at an inclined position i.e., at 15° degrees facing towards south. The ratio of day and night load would be in the ratio of 30:70. In the proposed system will contain a number of solar panels, inverters, step up transformers, batteries, generator, and other electrical safety, protection, and monitoring equipment The output of inverters is 50Hz AC which will be stepped up to 11 kV through transformer and will be fed to station switchyard. Then the power will be distributed to the load of Monpura through 11 kV WZPDCL distribution line. The WZPDCL will be the responsible authority for upgrading and extending the distribution line. They are following all the national policy, rules and regulations for environmental and social aspects.
ANALYSIS OF ALTERNATIVES	The project has been considered and investigated for several alternatives to reduce the environment and social impacts. The Do Nothing Alternative in respect to 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 property will remain under-utilized. The No Project Option is the least preferred from the socio-economic and environmental since if the project is not done. The technological alternative would involve the use of wind energy as an alternative to 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. 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, with this solar Power Plant is one of the sustainable and ecofriendly power generation system, hence solar power plant much preferable then other technologies. Relocation option to a different site is an option available for the project implementation. The land is currently used by the owner as Western Monpura Solar Power Limited (WMSPL). If consider any other alternative land use like water body or agricultural land outside the factory boundary, the project authority had to purchase the land from the owner. The present location will also be suitable as the existing distribution line can be used in that area. Therefore, the current used land is the best possible land for the project. As per analysis of alternatives, proposed option is the best option for this project.
DESCRIPTION OF ENVIRONMENT AND SOCIAL BASELINE	The baseline environmental quality is assessed through field studies within and around the project site zone for various components of the environment viz. air, water, noise, land, and socio-economic condition etc. According to the climate zone classification, the project area is located in the South-eastern climatic zone. The topography of the specific project location is flat, with many depressions, natural water bodies, bounded by the river's estuary and Bay of Bengal. This project area falls in the seismic zone-2 comprising the part of Bangladesh represents the regions of recent uplifted Pleistocene blocks of the Young Meghna Estuarine Floodplain and the western extension of the folded belt. The project area also has an acceptable limit of Arsenic levels in ground water. No endangered or protected species of flora or fauna are reported at the project site. The maximum and minimum daily temperatures recorded are 36°C and 9°C respectively, monthly average rainfall of Bhola, Monpura varies from 5 to 471 mm, humidity 77% and average wind speed ranges from 1.9 to 2.9 m/s of the project area. The baseline environmental quality has been assessed through field studies on 04 July to 08 July 2023 within the impact zone and analysis the information for various components of the environment, viz. air, noise, water,

	etc. The measurement results showed measurement of all air and noise quality are within national standards. The test result shows that almost all of the parameters are within the national standard except for Total Dissolved Solids in SW_MN-01 [Kumirkhali Khal, Dasherhat, Monpura, Bhola] and BOD_5 in SW_MN_02 location, according to ECR, 23 and some of the remaining parameters are not yet standardized according to DoE (ECR, 2023). For drinking water, the test result shows that almost all of the parameters are within the national standard except for total coliform (TC) and Temperature in GW_MN-01 according to ECR, 23. For soil quality almost all of the parameters are within the national standard such as pb, Cr, Hg, Cd, Zn and as which matches Dutch standards. Data on socio-economic conditions, i.e., population, age/sex composition, household patterns, and sources of drinking water, sanitation facility, and ownership of agricultural land were enumerated from the latest community series census published by the Bangladesh Bureau of Statistics (BBS, 2011 & 21). According to the population and housing census (2011), the literacy rate for the population 7 years and above in the project area national literacy rate of 31.09%. For Monpura Upazila- Population 1,45,000 with 205 density, Primary & high School, Madrasah in total 34. Maximum people are Muslim. For utility service about 75% of the population use tube well and rest use pond, canal, well etc. Lands at the project area are used for agriculture, fisheries, agro-forestry, homestead, homestead forestry and vegetation, animal husbandry, etc. Electricity Facilities within the project AoI are really poor. However, about 86% area is deprived of electricity facilities.
ANTICIPATED IMPACTS AND MITIGATION MEASURES	The determination of effects was based on a review of existing project material, consultations with members of the local community, representatives of the project proponents, and other sector-specific specialists. Potential environmental impacts associated with the proposed project activities of both the projects are classified as: (i) Impacts during pre-construction/design phase; (ii) Impacts during construction phase; (iii) Impacts during operation phase; and (iv) Impacts during decommissioning phase. Some of the important impacts of the proposed project will be associated with land use , land stability , soil compaction and contamination, water availability, water quality of river/stream/canal, groundwater contamination, waste and wastewater disposal, ambient air quality, ambient noise levels, vegetation, fauna (terrestrial and aquatic), drainage pattern, hydrology, climate change, socio economic, places of social/cultural importance (religious structures, community structure), construction material sourcing and occupational health and safety. During planning and Construction phase maximum environmental attributes like Visual and landscape impacts, Geology and Hydrology, Air & Noise Quality, are long term mildly sensitive and prior to mitigation. On the other hand, waste generation is severely negative significance on short term basis. Damaged PV Panels, damaged Batteries, and generator emission and lubricants spillage are the potential major source of pollution. During the decommissioning phase anticipated Impacts will be mainly from Solal panels, energy storage systems and generators. Adequate mitigation measures are devised to mitigate/minimize all likely environmental impacts in chapter 7.
STAKEHOLDER CONSULTATIONS & INFORMATION DISCLOSURE	Three (03) stakeholder consultations were conducted from o4 July 2023 to 8 July 2023- one with respective authority representatives, two with the people living beside the factory. The focus of the consultations was on community members' willingness to participate, as well as their perceptions and concerns about the project's positive and negative social impacts, including impacts on livelihoods. The feedback received from the

	consultation meeting has been used by the project executing agencies to carry out necessary revisions to the technical designs in order to minimize the impacts. Summary Findings of the Public Consultation. As there are very few households around the project area in a distance, there will be- 1) less environmental impact on the environment 2) Small chance of air pollution can conduct due to faraway of the project location. 3) Important for the project's proponent to confirm that no hazardous or waste materials were accidentally spilled or washed into nearby water bodies during construction, particularly during the monsoon. 4) Water quality will not be affected by the Solar Power Plant construction 5) The priority of employment will be provided to local villagers/residents on the basis of their skill and qualification 6) Long-term positive impact on this region's economic and social conditions.
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)	The objectives of Environmental and Social Management Plan (ESMP) for the present project are: (i) Identification of Monitoring requirements and Monitoring indicators; (ii) Mitigation measures to reduce or eliminate negative impacts; and (iii) Enhancement measures to maximize positive impacts. Environmental management plan has to be considered as part of the plant's overall management and it would be part of the plant operational manual. Table 9.1 depicts the Environmental and Social Management Plan (ESMP) with proper mitigation measures of key potential impacts. The project's estimated budget for pre- construction stage is BDT 4,64,000; construction stage- BDT 5,44,000; operation stage is BDT 7,64,000 per year & decommissioning stage is BDT 1,32,000. The grand total estimated budget for implementation of the environmental and social mitigation and monitoring measures proposed in the ESMP is BDT 19,04,000.
GRIEVANCE REDRESS MECHANISM	The Project Management has created a system to respond to project-related questions and complaints, as well as to resolve any inconsistencies in the execution of the standards specified for environmental protection impact assessment and mitigation. The complaints related to plant operation that may create inconveniences to agency/individual should be addressed based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly without resorting to expensive, time-consuming legal actions. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRC will record the details of the complaints and the reasons that led to acceptance or rejection of particular cases. The GRC will keep records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by appropriate authorities and any organizations known to be working with urban development issues. However, it should be noted that the GRC process will not pre-empt and aggrieved person's right to seek redress in the courts of law.
ENVIRONMENTAL AND SOCIAL BENEFIT	The project presents substantial environmental and social advantages. To begin with, through the utilization of solar energy, it diminishes reliance on traditional fossil fuels, thereby curbing greenhouse gas emissions and actively contributing to the global effort to combat climate change. The project will reduce 24,795.3 tons of Carbon Dioxide emission every year, in comparison with other fossil fuel based plants (i.e., diesel generator). Secondly, the integration of battery storage elevates energy reliability and grid stability, ensuring a continuous and dependable power supply for the local community. Thirdly, the off-grid design empowers distant and underserved communities by providing access to clean, sustainable energy, catalyzing economic growth, and elevating overall living standards. Moreover, the project stimulates local employment opportunities across installation, maintenance, and operation, further enhancing the social well-being of the community. Additionally, the project can facilitate the establishment of women-led entrepreneurial ventures, fostering economic resilience and community development. This project will also foster the

	development of local businesses by providing a reliable power supply, encouraging entrepreneurship and productivity (microeconomic development).
CONCLUSIONS AND RECOMMENDATIONS	According to the present study, this can be concluded that the project will be environmentally sound and sustainable if the proposed mitigation measures and environmental management practices are appropriately implemented. There is no significant impact during Pre- Construction phase. During the construction stage, there will be some negative impacts of the project which can be reduced through proper mitigative measures following suggested ESMP. There are no cumulative adverse impacts during operation that are identifiable at this stage. The construction impacts should be very predictable and manageable, and with appropriate mitigation, few residual impacts are likely. Additional human and financial resources will be required to improve environmental capability, and to progress and achieve necessary statutory compliance and environmental clearance certification for the project or associated activities that also require environmental assessment and environmental permits under the environmental laws of Bangladesh. The project is expected to have a negligible "environmental footprint". No endangered or protected species of flora or fauna are reported at the project site. The proposed project activities have no significant adverse environmental impact so far as a time bound execution program with application of advanced construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the proposed project.

1 INTRODUCTION

1.1 Project Background & Rationale

A sustainable, affordable, and secure energy supply is important for the advancement of socio-economic development. The Government of Bangladesh has emphasized the Power System Master Plan (PSMP), directing its focus towards the nation's energy generation, particularly highlighting diversified fuel sources, including renewable energy. Aligning with these initiatives, Western Monpura Solar Power Ltd. (WMSPL) has entered into implementation and Power Purchased Agreements (PPA) with Power Division for establishing a 3 MW (AC) Solar PV-Battery-Diesel Hybrid Power Plant on Monpura island in the Bhola district. The project will be funded by the World Bank through the Infrastructure Development Company Limited (IDCOL) under the Rural Electrification and Renewable Energy Development II Project and Additional Financing (REREDP-II AF).

Monpura Island is an off-grid remote sea island of the country. There are about 18,404 potential customers of electricity available on the Island out of which about 10,585 customers are currently using Solar Home Systems. Another 2500 customers are being provided with electricity from three (3) privately owned solar mini grids with a combined capacity of 675 kWp and 853 customers are being directly supplied with electricity from WZPDCL's 1650 kVA diesel generator plant. To meet the ongoing demand of electricity, the proposed Project involves setting up of a 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant project by Western Monpura Solar Power Ltd. (WMSPL) in Hazirhat Union, Monpura Upazila of Bhola District. The plant will have 11 MWp of solar PV panels, 22 MWh of Li-ion based storage systems and 3 diesel generators of 850 KVA each.

As per Environmental Conservation Rules of 2023 (ECR'23) (published in the gazette on 05 March 2023, Schedule-1, Serial-34), the "3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project" falling within the range of 1 to 50MWp is categorized as "Yellow Category." This classification implies that no Environmental Impact Assessment (EIA) or Environmental & Social Impact Assessment (ESIA) report is mandatory for site clearance and environmental clearance. However, SCC has been collected fulfilling all DoE requirements. As per the World Bank's safeguard policies, the project falls under "Category B", and it requires environmental assessment (EA-OP/BP 4.01) to ensure that they are environmentally sound and sustainable. As per IDCOL's ESMF project classification, this project falls under "Medium Risk" category. According to IDCOL's ESMF (REREDP-II AF), all IDCOL financed projects are required to prepare an Environmental and Social Impact Assessment (ESIA) Report covering the potential environmental, occupational, and social impacts as well as possible mitigation measures. To meet this requirement this ESIA report has been developed for the project.

1.1.1 Project Objectives

The main objectives of the Environmental and Social Impact Assessment (ESIA) study are to assess both positive and negative environmental impacts due to the project activities. Assess the impacts and recommendations for appropriate mitigation measures during preconstruction, construction, and operational phases to minimize negative impacts of the project to acceptable levels. In the preparation Phases, the ESIA shall achieve the following objectives-

- To establish the environmental and social baseline in the study area, and to identify any significant environmental issues;
- To assess these impacts and provide for measures to address the adverse impacts by the provision of the requisite avoidance, mitigation and compensation measures;
- To integrate the environmental and social issues in the project planning and design;
- To develop appropriate management plans for implementing, monitoring, and reporting of the environmental and social mitigation and enhancement measures suggested.

1.1.2 Project Benefits

The 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project offers numerous environmental and social benefits, contributing to the sustainable development and well-being of the community and ecosystem. Here are some of the key benefits:

1.1.2.1 Environmental Benefits

a. **Reduced Greenhouse Gas Emissions:** Unlike fossil fuel-based power plants, the hybrid solar project produces minimal to no direct greenhouse gas emissions during operation. This significantly contributes to mitigating climate change and reducing the project's carbon footprint. This hybrid solar powerplant project will help to reduce about 24,795.3 tons of Carbon Dioxide emission every year.
b. **Air Quality Improvement:** Conventional power plants, especially those using coal or diesel, release pollutants that deteriorate air quality and harm human health. The hybrid solar project's minimal emissions help maintain cleaner air and reduce respiratory and cardiovascular health risks for nearby communities.
c. **Water Conservation:** Fossil fuel power plants often require substantial water for cooling purposes, leading to water scarcity concerns. The solar-battery-diesel hybrid project consumes significantly less water, thus conserving valuable resources.
d. **Noise Reduction:** The solar-battery component of the hybrid project generates electricity silently, reducing noise pollution compared to the continuous noise associated with diesel generators or large-scale power plants.
e. **Minimal Land Disturbance:** The project's smaller footprint compared to conventional power plants helps preserve natural habitats and ecosystems, minimizing land disturbance and supporting biodiversity.

1.1.2.2 Social Benefits

a. **Energy Access for Remote Areas:** The off-grid hybrid project is particularly beneficial for remote or isolated communities with limited access to centralized power grids. It provides these communities with reliable electricity for improved quality of life, education, and healthcare.
b. **Health and Well-being:** By reducing air pollutants and associated health risks, the hybrid project positively impacts community health, especially for vulnerable groups such as children, the elderly, and individuals with respiratory conditions.
c. **Local Job Creation:** Hybrid solar projects require specialized skills for installation, operation, and maintenance, leading to local employment opportunities and skill development within the community.
d. **Community Empowerment:** Off-grid solar projects empower communities by providing them with self-sustaining energy sources, reducing dependence on external energy suppliers, and fostering a sense of ownership.
e. **Resilience and Energy Security:** The hybrid setup combines solar power with battery storage and backup diesel generators, ensuring a consistent energy supply even during adverse weather conditions. This enhances energy security and resilience against power outages.
f. **Reduced Fuel Dependence:** Conventional power plants relying on imported fossil fuels are susceptible to price fluctuations and geopolitical uncertainties. The hybrid project's reduced dependence on such fuels contributes to greater energy stability.
g. **Educational Opportunities:** Reliable electricity facilitates improved educational experiences by providing lighting for schools, enabling the use of digital resources, and supporting educational institutions' infrastructure.
h. **Community Cooperation:** The deployment of clean energy technologies often fosters community cooperation and awareness about sustainable practices, encouraging responsible energy consumption and environmental stewardship.

i. **Entrepreneurship Opportunities:** The availability of electricity can open up new entrepreneurship opportunities for women. They may start businesses related to charging stations for electric vehicles, selling solar-powered appliances, or engaging in other energy-dependent ventures.
j. **Economic Opportunities for Women:** The project can create employment opportunities for women in various capacities, such as technicians, engineers, administrators, and support staff during the construction and operation phases. Women-led micro-businesses, particularly those involved in small-scale manufacturing or processing, may experience a reduction in energy costs due to the availability of solar power. This can contribute to increased profitability and business sustainability.

1.2 The Scope of The ESIA Report

This ESIA report has been prepared keeping in view the Terms of Reference (ToR) as provided by the Client. The scope of the ESIA report describes the following most important features:

- A review of the environmental legislative, regulatory and policy guidelines and considerations relating to the implementation of the project;
- A general description of the project and existing physical, biological and socio-economic conditions;
- Consultation with the locals/stakeholder involving concerned people in order to identify and act on any undocumented or perceived environmental issues;
- Identification and assessment of the potential impacts on the natural and human environment in the project area, from the construction of the hybrid solar system.
- Identification of mitigation measures and monitoring actions in the form of an environmental & social management plan (ESMP); and
- Recommendations and conclusions in order to operate the project in an environmentally safe and sound manner.

1.3 Extent of the Study

This ESIA is carried out based on proposed development. According to ECR'23 (schedule 9) the influence of impact has been defined as 50m around the side from the project location for this yellow category project. However, the study area has been extended up to 50m area on each side of the project. However, for better understanding of the project surroundings 500m primary and 5km secondary buffer were also considered. Geographical Information System (GIS) techniques have also been used based on recent satellite imageries of the project area for the above purposes. Assessment is carried out on the following environmental components: terrestrial and aquatic ecology, soil, water, air, noise, and socio-economic aspects. The impacts on ecologically sensitive areas (e.g., wildlife sanctuaries, biosphere reserve, and protected areas) within 500m primary and 5km secondary buffer of the project areas have also been assessed.

1.4 Approach and Methodology

1.4.1 Approach

WMSPL-3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project has been conducted in accordance with Environment Conservation Rules 2023, Government of Bangladesh (GoB) EIA Guidelines 2021, World Bank Safeguard Policies and IDCOL ESMF (RERED II AF). The route map of this ESIA preparation is given in Figure 1.1. The study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes review of the Bangladesh statistical and relevant information from Government Departments, IDCIL, WB and other agencies. Discussions were held with stakeholders including project representatives and a wide range of community people. The main purpose of this approach was to obtain a fair impression of the people's perceptions of the project and its environmental impacts.

1.4.2 Methodology

The following methodology was adopted for carrying out the ESIA of the proposed project:

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

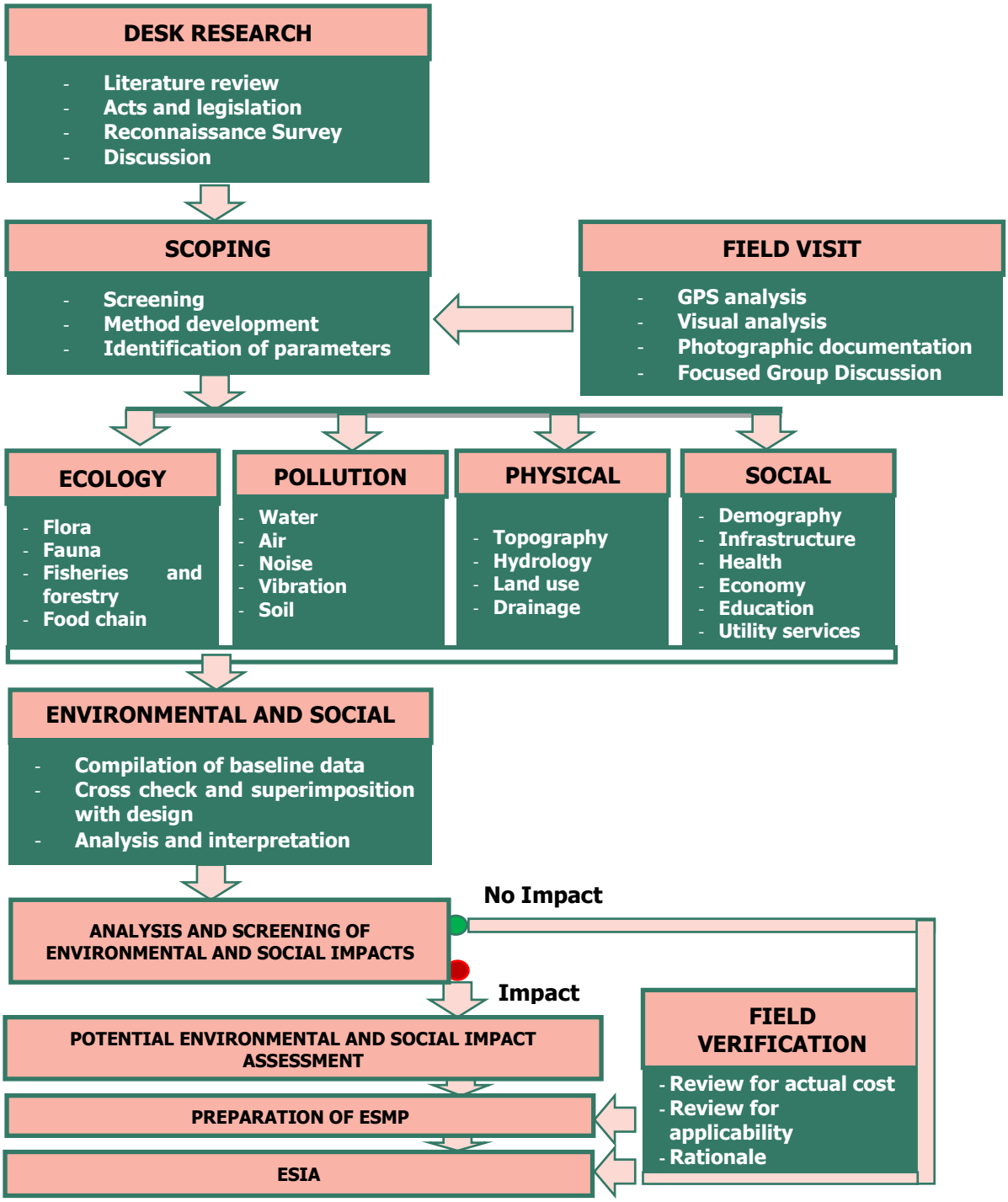


Figure 1-1: Route Map of Environmental and Social Impact Assessment (ESIA)

(ii) Data Collection Planning: Subsequent to 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 identification of specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and other supporting needs for the execution of the data acquisition plan.

(iii) 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 profile for physical, biological, and socioeconomic environmental conditions. The following activities were performed for data collection: Site Reconnaissance; Analysis of Maps and Plans; Literature Review; Desk Research; Field Observations and Studies; Laboratory Analysis.

a. **Physical Environment:** Information was collected about the existing physical environment, particularly as related to existing soil and geology, landscape, aesthetic values and hydrology, with special emphasis on storm water run-off, drainage patterns, topography, water quality, noise, and air quality.

b. **Biological Environment:** The status of the flora and fauna of the project area were determined by an ecological survey, review of literature relevant to the area, and an assessment of terrestrial environment.

c. **Socio-Cultural Environment:** The consultants utilized a combination of desk research, field investigations, census data, structured interviews, maps, reports to generate the data required for 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 - Land use; Transportation and access Roads; Demographics; Livelihoods; Education; Health; Community facilities; Recreational activities; Archaeological and cultural heritage.

(iv) Stakeholder Consultation: Stakeholder consultation is an important component of the 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 mitigation plan.

(v) Impact Assessment and Mitigation: Impact Assessment and Mitigations were undertaken in accordance with the ESIA objectives presented earlier. The general process includes:

a. **Impact Assessment:** Identification and assessment of potential environmental and social impacts with reference to applicable country and international regulations, standards, and guidelines.

b. **Mitigation Measures:** Mitigation measures have been developed with consideration of baseline conditions; identified constraints; concerns and suggestions raised by the community; GoB, IDCOL, and other relevant requirements, and the level of design information available at the time of preparation of this ESIA. Mitigation may include:

- ✓ Environmental controls (e.g., measures for minimizing harmful noise, air, water and waste emissions);
- ✓ Design optimization (e.g., relocation of Solar PV System);
- ✓ Procedural measures (e.g., setting up management committee);
- ✓ Avoidance/reduction (e.g., waste minimization process management);
- ✓ Compensatory measures (e.g., biodiversity offsets); and
- ✓ Timing measures (e.g., no construction at night).

1.5 Environmental and Social Assessment (ESIA) Team

The multidisciplinary team of ESIA experts having experience of conducting Environmental and Social Assessment of large scale industrial and infrastructural development projects are engaged for the study. Table 1.1 presents the professionals' names with their positions.

Table 1-1: ESIA Study Team

Sl. No.	Name	Specialist/Responsibilities
1.	Md. Shafiqur Rahman	International Environmental Expert, Overall Coordination / ESIA Team Leader
2.	Md. Mashiur Rahman	Social Expert
3.	Muhammad Anwar Iqbal	Jr. Environmental Expert
4.	Tasnim Afrin Tamanna	Jr. Social Expert

Sl. No.	Name	Specialist/Responsibilities
5.	RS & GIS Analyst	Rajib Roy
6.	Fojlur Rahman Abir	Surveyor-1
7.	Imon Kumar Rajbongshi	Surveyor-2

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 General

The regulatory oversight for enforcing the Environmental Conservation Act of 1995 (ECA'95) and Environmental Conservation Rules of 2023 (ECR'23) falls under the Department of Environment (DoE), a division of the Ministry of Environment, Forest, and Climate Change (MoEFCC). As per ECR'23 (published in the gazette on 05 March 2023, Schedule-1, Serial-34), the "3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project" falling within the range of 1 to 50MWp is categorized as "Yellow Category". This classification implies that no Environmental Impact Assessment (EIA) or Environmental & Social Impact Assessment (ESIA) report is necessary for site clearance and environmental clearance. After fulfilling all of the DoE requirements, the Site Clearance Certificate (SCC) has already been collected (Annex A). A Site Clearance Certificate (SCC) is required to begin construction activities, and an Environmental Clearance Certificate (ECC) will be required prior to the start of operations (Annex B). WPSPL will apply for ECC after completing all of their construction and before starting their plant operation. However, for fulfilling World Bank's Safeguard Policies (EA-OP/BP 4.01) and IDCOL's ESMF (RERED II AF) requirements this ESIA report has been conducted for ensuring environmentally friendly implementation of the project.

The proposed project will be implemented in compliance with the applicable environmental and social rules and regulations of Bangladesh and other development partners (IDCOL & WB). Bangladesh has environmental and social law frameworks that promotes environmental protection as well as the conservation of natural resources and social considerations of project implementation. This legislative framework for the environmental and social issues applied to the proposed project. In addition, there are several environmental and social rules and regulations in Bangladesh. The following activities have been carried out under the ESIA study to get a clear understanding about the applicable rules and regulations for the project:

- Exploration of environmental and social legislation laws and policy guidelines at the national level.
- Identifying national legal duties in connection to the actions that will be examined as part of the proposed project's ESIA study.
- Identifying international legal obligations and relevant sections of multilateral environmental treaties and agreements that apply to the renewable energy project.
- Exploration of national and international legal provisions on energy sector; and
- Identification of the standard guidelines at the regional and international level related to the project.

2.2 Applicable Policies

2.2.1 National Environmental Policies

According to the national environmental legislation of Bangladesh all development projects are governed by some legal and institutional requirements. Regulatory requirements toward protection and conservation of environment and various environmental resources and also toward protection of social environment from adverse impact of projects and activities associated with them have been enunciated by the GoB as well as the WMSPL relevant requirements are summarized in table 2.1.

Table 2-1: Applicable National Policy/Acts/Rules

Sl	Policy/Acts/Rules	Key Provisions and Purpose	Applicability to the Project
1.	National Environmental Policy, 2018	Major elements of the policy are- • Natural equilibrium provision and overall development of the country through environmental protection and sustainable management	The environmental policy aims at prevention of pollution and degradation of natural resources and also promotes low carbon emission technologies like solar power plants.

Sl	Policy/Acts/Rules	Key Provisions and Purpose	Applicability to the Project
		• Encourage collection and promotion of low carbon emission technology in the country • Identifying and controlling all types of environmental pollution and degradation activities • Actively involved as much as possible with all international environmental initiatives and take necessary actions at local and national levels.	
2.	National Environmental Management Action Plan (NEMAP), 1995	The NEMAP was developed with the following objectives: • to identify key environmental issues affecting Bangladesh; • to identify actions to halt or reduce the rate of environmental degradation; • to improve management of the natural environment; • to conserve and protect habitats and biodiversity; • to promote sustainable development; and • to improve the quality of life.	The plan proposes developing and applying guidelines to avoid environmental pollution due to project implementation.
3.	Environment Conservation Act (ECA), 2010 (amendments)	The main objectives of ECA are: • Conservation and improvement of the environment; and • Control and mitigation of pollution of the environment. • The main focuses of the Act can be summarized as: • Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA); • Regulations in respect of vehicles emitting smoke harmful to the environment; • Environmental clearance; • Regulation of industries and other development activities' discharge permits; • Promulgation of standards for quality of air, water, noise, and soil for different areas for different purposes; • Promulgation of a standard limit for discharging and emitting waste; and • Formulation and declaration of environmental guidelines.	According to this law, no industrial unit or project shall be established or undertaken without obtaining a site clearance and environmental clearance from the DoE in the manner prescribed by rules.
4.	The Water Rules, 2018	The Bangladesh Water Rules 2018 is a set of regulations in Bangladesh related to water management and conservation. These rules were formulated to govern various aspects of water use and management in the country. They address issues such as water extraction, pollution control, and the allocation of water resources. The rules are aimed at ensuring sustainable and responsible management of water resources in Bangladesh.	To regulate water extraction, pollution control, and the allocation of water resources during the construction phase.
5.	Environment Conservation Rules,	The Environment Conservation Rules, 2023, were issued by the GoB to exercise power conferred under the Environment	Following the Environment Conservation Rules (ECR) of 2023, the Project is classified

Sl	Policy/Acts/Rules	Key Provisions and Purpose	Applicability to the Project
	2023 (with all amendments)	Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered: • Declaration of ecologically critical areas; • Classification of industries and projects into four categories; • Procedures for issuing the Environmental Clearance Certificate (ECC); and • Determination of environmental standards.	as a yellow Category, requiring to obtain site clearance and environmental clearance for construction
6.	Environmental Court Act, 2000	This Act sets out policy for effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act, the Director General of the DoE has the power to impose heavy penalties on industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.	According to this act, the government can take legal actions if any environmental problem occurs due to project interventions.
7.	Wetland Protection Act, 2000	The latest Wetland Act - The Playground, Open Spaces, Gardens, and Wetland Conservation Act 2000 - suffers from loopholes and inadequacies regarding the protection of water bodies. Section 1 of this Act suggests that it applies to the water bodies of the cities, divisional and district towns, and municipalities. The water bodies in the rural areas are outside the jurisdiction of this Act.	The Act specifies the fine and imprisonment term for violation of its provisions. This act is not applicable for the project, as the project location is in rural areas.
8.	Forest Act, 2000 (Amendment)	It is the main legislative context for forestry protection and management in Bangladesh. It was enacted to control trespass illegal resources extraction from forests and to provide a framework for the forestry revenue collection system.	This project will be implemented in agricultural land, hence no tree cutting activities will occur under this project, hence no issues with this act for project implementation.
9.	Bangladesh Wildlife (Conservation & Security) Act, 2012 (previously known as Bangladesh Wildlife (Preservation) Order, 1973; amended as Bangladesh Wildlife (Preservation) Act, 1974.	This Act protects 1,307 species of plants and animals under four schedules that mandate imprisonment and fines for wildlife poaching, capturing, trapping, and trading.	This Act is relevant to the sub-project as an intervention may affect wildlife habitation obstruct movement.
10.	National Fisheries Policy, 1999	The National Fisheries Policy focuses on aquaculture and marine fisheries development. The policy suggests, among others, that biodiversity will be maintained in all-natural water bodies and marine environment, and control measures will be taken against activities that harm fisheries, resources, and vice-versa	As the project area is near the Meghna River and there are some nearby waterbodies there, this policy is applicable for ensuring undisturbed habitat of fishes in nearby waterbodies.
11.	National Agriculture Policy, 2018	The National Agriculture Policy of Bangladesh 2018 aims to foster sustainable agricultural growth, diversify agricultural production, promote inclusive practices, enhance research and technology adoption, improve irrigation and water management, develop rural infrastructure, strengthen extension services, address climate resilience, ensure food safety, engage the private sector, and focus on capacity building to	As per the policy, due to project intervention's construction activities, adequate measures should be taken to reduce waterlogging and hampering the irrigation system.

Sl	Policy/Acts/Rules	Key Provisions and Purpose	Applicability to the Project
		support the country's agriculture sector and its stakeholders.	
12.	National Land Use Policy, 2001	The National Land Use Policy of Bangladesh 2011 is a strategic framework that provides guidelines and principles for managing and regulating land use across the country. It aims to promote sustainable and equitable land use practices while addressing various development and environmental challenges.	The proposed project must adhere to this policy to ensure the environmental sustainability of land-use practices.
13.	Bangladesh climate change Strategy and Action Plan, 2022	This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA.	Relevant as the sub-project area is vulnerable to climate change effect
14.	Bangladesh Wildlife (Conservation & Security) Act, 2012	This Order aims to protect and conserve wildlife in Bangladesh. Wildlife preservation, conservation, and management fall within the jurisdiction of the Forestry Department. The previous Wildlife (Preservation) Order, 1973 & Wildlife (Preservation) (Amendment) Act, 1974 have been revamped to Wildlife (Conservation & Security) Act of 2012.	The Act has adopted new types of protected areas for conservation and protection of wildlife resources, created avenue for community conserved areas and also community-based management of protected areas.
15.	National 3R Strategy for Waste Management, 2010	The National 3R Strategy for waste management has been established by Department of Environment in December 2010. Sector specific strategies for promotion of 3R are depicted in this national 3R strategy. The national 3R goal for waste management is achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 and promote recycling of waste through mandatory segregation of waste at source as well as create a market for recycled products and provide incentives for recycling of waste.	During the construction period, some solid, non-hazardous waste may generate. So, this policy is fit in this regard.
16.	Bangladesh Labor Rules (Amendment), 2023	The Bangladesh Labor Rules (Amendment) Bill was enacted by parliament in 2023, to make the present legislation more time-appropriate for workers' wellbeing. The bill was approved with the conditions of legalizing trade unions in factories, assuring worker safety at work, establishing mandatory group insurance, and prohibiting children from working in dangerous environments.	To carry out the civil works, labor will be required to be hired. Therefore, these laws will be triggered to safeguard the interest of the labor, host community, project authorities, Contractors, and other project stakeholders. The project will ensure that the stipulations of the law are duly followed when it comes to labor-related activities
17.	The Building Construction Act 2008	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh	Applicable as the project involves the development of infrastructure
18.	GoB 8th Five Year Plan, 2021-25	The preparatory process of the 8th Five Year Plan is marked by the infestation of major global catastrophe 'COVID-19', which has caused consequential economic conundrum across the world. The Eighth Five Year Plan is unique compared to its preceding two plans as it blends the COVID-19 recovery strategies in the	Applicable as the project involves the development of infrastructure

Sl	Policy/Acts/Rules	Key Provisions and Purpose	Applicability to the Project
		macroeconomic framework as well as developing sectoral strategies in the plan	
19.	Solid Waste Management Regulations 2021	The Solid Waste Management Regulations 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recover	This project will produce a certain number of solid wastes. So, this policy is applicable.
20.	E-Waste Management Rule 2021	In the E-Waste Management Rule 2021, the DOE has limited the use of heavy metals and substances including lead, mercury, chromium VI, polybrominated biphenyls (PBBs), polybrominated biphenyl ethers (PBDEs), di (2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBP), dibutyl phthalate (DBP) and isobutyl phthalate (DIBP) up to 0.1%. The use of cadmium has been limited to 0.01%. The rule roughly states that manufacturers and importers of certain electronic products will be liable for limiting the use of these 10 substances. Also, they must work to collect e-waste that comes out of their brands and help to scrap the goods in a way that the environment is not degraded.	Solar PV panel, lithium-ion batteries and generators may produce e-waste during operation phase, and therefore this policy is applicable.

2.2.2 Other Relevant National Act, Rules, Laws, and Ordinances

2.2.2.1 The Electricity Act, 2018

The primary objective of this act is to amend the laws relating to the modification for developing and reforming the sectors of power generation, transmission, supply, and distribution and for better service delivery to consumers and meeting the increasing demand for electricity. This act comprises of guidelines related to licenses, works, and supply for the supply of energy. It also includes guidelines related to supply, transmission, and use of energy by non-licensees. A licensee is a person authorized by the Government to supply energy in any specified area and permitted to lie down or place electric supply lines for the conveyance and transmission of energy. In Part II of this act, guidelines are provided for power Sector Development and Independent System Operator. Civil Works is provided in Part II of the act. According to this act, licensee is permitted to lay power supply lines within the area of supply or, subject to the terms of his license, beyond the area of supply, the licensee may, as soon as may be, do necessary civil works, with intimation to the concerned person or the local authority, as the case may be, for supplying electricity to that area. Protective Clauses are provided for protection of railways and canals/waterways, docks, wharves, and piers, telegraphic, telephonic, and electric signaling lines. Part IV also includes guidelines for occurrences of any criminal offences such as dishonest abstraction of energy, installation of artificial means, malicious wasting of energy or injuring works, theft of line materials, tower members, equipment etc. and subsequent procedures to follow up that criminal offence.

2.2.2.2 Bangladesh National Building Code (BNBC)

The main purpose of the BNBC is to establish minimum standards for design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property, and public welfare. The installation and use of certain equipment, services and appurtenances related, connected, or attached to such buildings are also regulated herein to achieve the same purpose.

Chapter-3, part -7 of the BNBC has clarified the issue of safety of workers during construction and with relation to this, set out the details about the different safety tools of specified standard. According to this chapter, exhaust ventilation, use of protective devices, medical checkups etc. are the measures to be taken by the particular employer to ensure a healthy workplace for the workers. The proposed project will conduct several civil works including preliminaries, additional survey, excavation and backfill, piling, foundations, all structures, and buildings, as well as bridge crossing, irrigation canal, entrance road, internal roads, plant and site drainage, sewage system, and so on. While conducting the civil works, the BNBC code should be followed properly.

2.2.2.3 Renewable Energy Policy of Bangladesh, 2022

The vision of the draft policy is to develop an efficient, sustainable, secure, affordable, competitive, and environment-friendly power system across the country. The Government of Bangladesh (GoB) initially introduced the Bangladesh Renewable Energy Policy 2008 to promote the development and utilization of renewable energy sources in the country. The policy was designed to support the country's energy security, reduce its dependence on imported fossil fuels, and promote sustainable development. The policy provides an overall guidance of-

- institutional arrangements
- resource, technology, and program development
- investment and fiscal incentives
- regulatory policy

The policy promotes 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 3 MW project that is greater than 1MW. Therefore, according to the above policy, the project developer should make sure no adverse environmental and social impact would result from the development works.

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

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

As the proposed project is a 3 MW plant, a waiver certificate/license will be required, and the project proponent will have to confirm the Commission by letter.

2.2.3 National Social Policies

2.2.3.1 Labor Legislations

Standards for labor and working conditions are defined in Bangladesh Labor Law, 2023 and Bangladesh Labor Rules 2015, Bangladesh Labor Act 2006, and Occupational Health and Safety Policies 2013. These legislations address three areas: (i) Conditions of service and employment including wages and payment, establishment of Wages Boards, employment of young people, maternity benefits, working hours and leave; (ii) health, safety, hygiene, and welfare, and compensation for injury; and (iii) trade unions and industrial relations. Beside this, due to the recent pandemic of COVID-19 World Health Organization (WHO) and Directorate General of Health Services (DGHS), under the Ministry of Health and Family Welfare, provided guidelines for infection prevention and control. The government has incorporated the life-threatening novel corona virus (COVID-19) in 'The Communicable Diseases (Prevention, Control and Eradication) Act, 2018. With the issuance of the gazette the government has got legal power to take action against the people not following the government's direction that relates to COVID-19. The health and safety issues relevant to COVID-19 should be addressed with reference to ILO Occupational Safety and Health Convention, 1981 (No. 155), ILO Occupational Health Services Convention, 1985 (No. 161), ILO Safety and Health in Construction Convention, 1988 (No. 167), WHO International Health Regulations, 2005, WHO Emergency Response Framework, 2017.

2.2.3.2 Gender-based Violence (GBV) related Legislations

In Bangladesh, several legislations developed to ensure women's right. The government of Bangladesh additionally enacted the Citizens Act, which permits women to transfer citizenship to their children. Besides, the government enacted the following laws and ordinances to ensure women's and girls' rights and to protect them from violence, harassment, and discrimination. The Prevention of Women and Children Repression Act, 2000; The Acid Crime Control Act, 2002; The Dowry Prohibition Act, 1980; National Human Rights Act,2009; Domestic violence (prevention and protection) act, 2010; The Child Marriage Restraint Act, 1929; The Dowry Prohibition Act,1980; The Family Court's Ordinance, 1985; The Muslim Family Law's Ordinance, 1961; The Muslim Marriages and Divorces (Registration) Act, 1974; The Dissolution of Muslim Marriages Act, 1939; The Special Marriage Act, 1872; The Hindu marriage registration act, 2012; The Christian Marriage Act, 1872; The Married Women's Property Act, 1874; The Succession Act, 1925; The maintenance of parents act, 2013; and The Child Marriage Restraint Act, 2017 (Judicial Portal Bangladesh, 2022).

The main focusing area of these acts is the enhancement of punishments rather than prevention for the protection of women and girls' rights strategies. Most of these laws and ordinances discriminate against women in marriage, separation, maintenance, and child custody. The legal protections for women and girls are harmonious to other parts of the world as weak application and biases of law enforcing agencies are seen over the country. Policymakers claimed that weak application of existing laws, delay in judicial procedure, lack of women's rights consciousness, sensitivity, and fragile infrastructures are the major reasons for discrimination and violence in the society of Bangladesh. Bangladesh Labor Act also have direction regarding gender issues. Section 332 of the Bangladesh Labor Act, 2006 provides that no person of any establishment shall behave unmannerly or repugnant to the modesty or honor of a female worker.

2.2.3.3 OSH Policy-2013

In the context of global, ethical, and legal obligations to ensure a safe and healthy working environment for all, the National Policy on Occupational Health and Safety was formulated and adopted on 5 November 2013, with the understanding that the implementation of such a National Policy would firstly ensure the safety of workers and secondly, help increase industrial productivity. The Policy applies to all workplaces in Bangladesh, including formal and informal sectors of industries, factories, enterprises, business and commercial entities and farms. The ultimate goal of the Policy is the

nationwide understanding and acceptance of OSH for all women and men who are working in both the formal and informal sectors in Bangladesh. A robust national OSH framework will significantly help reduce the number of deaths, injuries, and occupation-related diseases, thereby fulfilling the constitutional and legal obligations of the state.

2.2.3.4 Community Safety and Health (CSH) Legislations

There is no specific legislative framework for community health and safety aspect of industry or projects but under the government of Bangladesh there are specific laws and acts enacted by various ministries. The project proponent conducting the ESIA may consult ongoing community-based programs and policies of the Ministry of Health to help improve assessment and mitigation planning on community health and safety impacts and risks. Table 2.2 below provides some of the relevant legislations and policy issuances that have relevant provisions on community health and safety of industry projects.

Table 2-2: Legislations and policy issuances related to safety in the workplace

Legislations and Issuances	Key Provisions
National Occupational Health and Safety Policy, 2013	Specifies the obligations of all relevant stakeholders and organizations in promoting and enforcing occupational health and safety
Labor Act, 2023 & Labor Rules (2015)	Imposes obligations on the part of the employer on the conditions of service and employment including wages and payment, employment of young people, maternity benefits, working hours and leave; trade unions and industrial relations; and, occupational health, safety, hygiene, and welfare of workers, and compensation for injury.
National Building Code 2006	Provides standards for structural integrity; adequate, accessible, and discernible means of exit/escape in Buildings; fire extinguishing system.
Public Procurement Rule (PPR) 2008	Requires contractors to provide for adequate measures regarding the "Safety, Security and Protection of the Environment' in the construction works.
National Child Labor Elimination Policy, 2010	Sets a policy to eliminate child labour exploitation through enactment of pragmatic laws, implementation of plans and programs, etc.
Fire Prevention and Extinction Act 2003; Fire Prevention and Extinction Rules 2014	Requires the owner of a building to apply for Occupancy Certificate to ensure compliance with the relevant provisions of the Building Code.

2.2.4 International Policies

The Ramsar Convention, the Bonn Convention on Migratory Birds, the Rio de Janeiro Convention on Biodiversity Conservation, and the Kyoto Protocol on Climate Change are among the international treaties, conventions, and protocols on the environment, pollution control, biodiversity conservation, and climate change that Bangladesh has signed. An overview of the relevant international treaties and conventions signed by GOB is shown in Table 2.3.

Table 2-3: Relevant International Treaties, Conventions and Protocols Signed by Bangladesh

Treaty or Convention	Year	Brief description	Responsible Agency
On protection of birds (Paris)	1950	Protection of birds in the wild state	Department of Environment (DOE)
Occupational hazards due to air pollution, noise, and vibration (Geneva)	1977	Protect workers against occupational hazards in the working environments	Ministry of Health and Family Welfare (MOHFW)
Occupational safety and health in a working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MOHFW
Occupational health services (Geneva)	1985	To promote a safe and healthy working environment	MOHFW
International convention on climate changes (Kyoto Protocol)	1997	An international treaty on climate change and emission of greenhouse gases	DoE/MOEF

2.2.5 Funding Agencies' Policies

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

The current environmental and social policies of the World Bank are known as the "Safeguard Policies," the mechanism is for addressing environmental and social issues in project design, implementation, and operation, and they provide a framework for consultation with communities and for public disclosure. Here are some key considerations that will be applicable for the project:

1. **Environmental and Social Impact Assessment (ESIA):** Conduct a comprehensive ESIA to assess the project's environmental impacts. Identify potential risks and mitigation measures related to land use, water resources, air quality, and biodiversity. This ESIA will also evaluate the social impacts of the project on local communities, including potential displacement, livelihood changes, and community well-being. Develop strategies to minimize adverse effects and enhance benefits.
2. **Stakeholder Engagement:** Engage with local communities, stakeholders, and affected parties to gather their input and concerns. Develop a grievance mechanism to address community complaints and ensure transparency.
3. **Indigenous Peoples:** If the project affects indigenous peoples, respect their rights and traditions, and obtain their Free, Prior, and Informed Consent (FPIC) as per World Bank policies.
4. **Health and Safety:** Implement safety measures to protect workers and surrounding communities. Ensure compliance with health and safety standards during construction and operation.
5. **Biodiversity Conservation:** Implement measures to protect local flora and fauna. Avoid or mitigate impacts on critical habitats and ecosystems.
6. **Resettlement and Compensation:** If land acquisition or resettlement is necessary, provide fair compensation, livelihood restoration, and support for affected communities.
7. **Pollution Control:** Implement technologies and practices to minimize air and water pollution, including emissions from diesel components.
8. **Monitoring and Reporting:** Develop a monitoring and reporting system to track project performance and compliance with safeguard policies. Regularly report to the relevant authorities and the World Bank.
9. **Capacity Building:** Invest in local capacity building and skills development to create economic opportunities for local communities.

2.2.5.2 Environmental and Social Management Framework (ESMF) of IDCOL

IDCOL adopted an Environmental and Social Management Framework (ESMF) in 2011, which is to comply with all infrastructure projects that are to be funded by IDCOL. According to the environmental categorization of ESMF, the project has been categorized as a Low-Risk project requiring significant compliance safeguards including comprehensive environmental, social impact assessment, and regular monitoring. In consideration of social categorization, the project has been categorized as a Low-Risk project both for Indigenous People (IP) and for Involuntary Resettlement (IR) perspectives.

The Environmental and Social Management Framework (ESMF) is a standard document used to assess and manage the environmental and social risks and impacts associated with IDCOL's development projects. The ESMF provides guidelines and procedures to identify potential environmental and social risks, define mitigation measures, and establish monitoring and reporting mechanisms. It ensures that IDCOL's projects adhere to environmental and social standards, comply with relevant laws and regulations, and promote sustainable development.

IDCOL's E&S Requirements

IDCOL's Environmental & Social policy statement emphasizes IDCOL's sensitivity and concern to environmental and social issues, commitment towards legal compliance, and responsiveness towards E&S requirements of its development partners and is communicated to all its stakeholders. The E&S

Policy of IDCOL provides the necessary direction for the implementation of the operational framework of the ESMF.

IDCOL has a mandate of financing private sector for developing medium to largescale infrastructure and renewable energy projects in Bangladesh. IDCOL recognizes the significance of environmental, health/safety, and social considerations in infrastructure development and beliefs in sustainable development. In order 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, compensate replacement value of such acquired land/property will be paid before displacement or replace 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 indigenous people and take appropriate measures to restore their livelihood as relevant.

2.2.5.2.1 Rural Electrification and Renewable Energy Development Project-II (REREDP-II)

The Rural Electrification and Renewable Energy Development Project- II (REREDP-II) is a significant initiative in Bangladesh by World bank aimed at extending access to electricity in rural areas and promoting the use of renewable energy sources. The project seeks to enhance energy access for remote and off-grid communities by expanding the electricity grid and installing standalone solar home systems. REREDP-II places a strong emphasis on sustainability, energy efficiency, and environmental responsibility by promoting the use of renewable energy technologies and reducing greenhouse gas emissions. It plays a vital role in improving the living standards of rural populations, supporting economic development, and mitigating the adverse effects of climate change. By providing reliable and clean energy solutions, the project contributes to the government's goal of achieving energy security and inclusive development in rural areas of Bangladesh.

Component B of REREDP-II includes the support to various technologies (minigrid, micro-grid, solar irrigation pumps, biogas and biomass based captive plants etc) to meet the electricity needs of rural household, enterprises, and businesses that could not otherwise be met with SHS. The implementation activities, including selecting the sponsors for establishing, operating, and maintaining the various sub-projects would be undertaken by IDCOL. For mini-grids, sponsor equity will be a minimum of 20% with IDCOL providing the balance funds (including credit and capital buy-down grant to keep the end-user tariff affordable) to the mini-grid schemes building on the lessons learned from the pilots under already completed REREDP. The least cost technology options (solar PV, biomass gasification, etc.) will be used depending on the resource availability in the specific locations of the mini grids. The component would also support biogas based captive plants to supply electricity in rural areas. Depending on demand and viability of the sub-projects, the component can support financing other applications such as solar cooling and drying or advanced hybrid brick kilns. The project sponsor will be required to either possess his own land or have valid lease documents. No land acquisition is allowed under the project. All land will be screened to ensure that no displacement of people (with or without title) will take place.

2.3 Site Clearance and Environmental Clearance

Under the ECR'2023, a classification system was established for development projects and industries on basis of the location, the size, and the severity of potential pollution. There are four categories of

projects: Green, Yellow, Orange, and Red with respectively no, minor, medium, and severe environmental impacts. According to Environment Conservation Rule, 2023 (ECR, 23), this present project falls under 'Yellow' category. Following all the procedures SCC has been collected from the Department of Environment, Bhola for the project (Annex A). As per ECR, 2023, Environmental Clearance Certificate (ECC) will be collected after completing all the construction activities and before starting operations (Annex B). All the DoE conditions mentioned in the SCC will be followed and regularly monitored during the construction phase.

3 PROJECT DESCRIPTION

3.1 Project Location

The Power System Master Plan (PSMP) formulated by the Government of Bangladesh has focused on country's Power generation with diversified fuel especially renewable energy. In line with the Government initiatives, Western Monpura Solar Power Ltd. (WMSPL) has sign Implementation Agreement (IA) and Power Purchased Agreement (PPA) for implementation of a 3 MW(AC) Solar PV-Battery-Diesel Hybrid Power Plant at Monpura Island, Bhola district. The Solar Power will initially generate in DC form which will be converted to AC form by inverters.

The proposed site is potentially suitable for the solar PV Project. Global insolation at horizontal surface is 4.50 kWh/m^2/day (source: PVSyst). The panels will be installed at an inclined position i.e., at 15° degrees facing towards south. The ratio of day and night load should be in the ratio of 30:70.

The Project site is located in Hazirhat, Upazila: Monpura, and District: Bhola. Geographically, the Project is located in the Southern region of Bangladesh within the Longitude of 90°57'56.68"E and Latitude of 22°14'52.13"N. The total land area is about 30 acres or 90 Bigha. The GPS coordinates of the project sites are Latitude between 22.07°N and 22.32°N; and Longitude between 90.90°E and 91. 00°E. The Monpura Upazila (island) is surrounded by Meghna River, so the site is not accessible from any road highway. It is only accessible through the Meghna River by watercraft transport like boat, ship, lunch, sea-track etc.

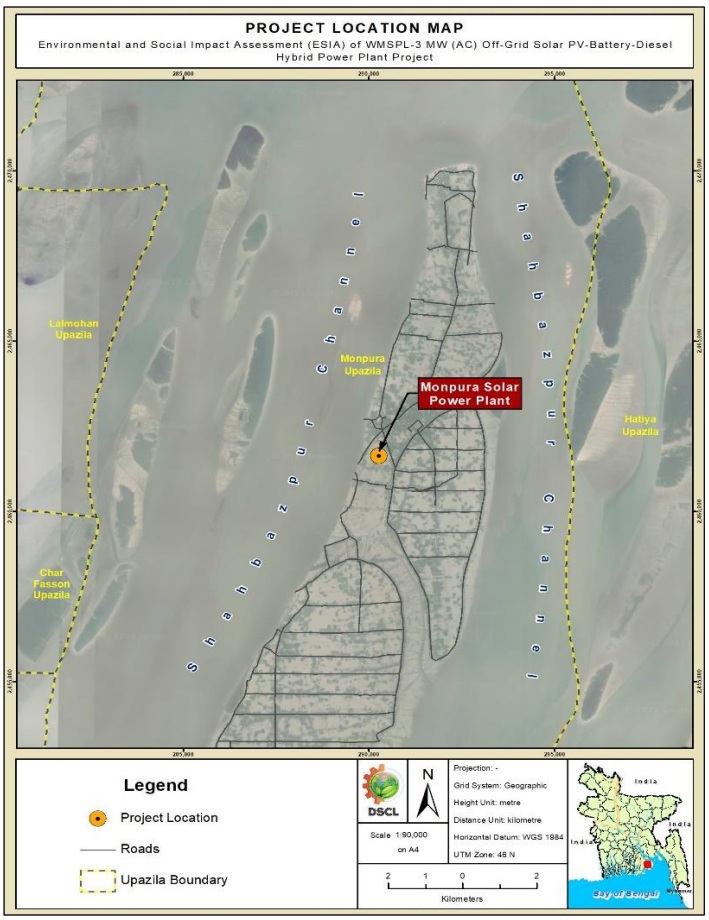


Figure 3-1: Project Location Map

The Plant shall contain a number of solar panels, inverters, step up transformers, batteries, generator and other electrical safety, protection, and monitoring equipment. The PV panels will be mounted on civil structures strong enough to withstand the wind effect of tropical storms, cyclone etc. Solar panels contain many photovoltaic cells linked together which instantaneously convert sunlight into electricity. Several solar PV panels are connected in series to achieve some voltage that is suitable for optimal operation of grid connected inverters. The output of inverters is 50Hz AC which will be stepped up to 11 kV through transformer and will be fed to station switchyard. Then the power will be distributed to the load of Monpura through 11 kV WZPDCL distribution line.

Minimum Annual Energy Requirement- 10,950 MWh and Minimum Monthly Energy Requirement- 912.5 MWh. Energy will be supplied mainly from solar PV systems. Diesel generators will operate only when there is insufficient solar energy. Energy supply from diesel generator will not be more than 10% of the total annual energy supply. In the future, if the grid reaches the island the battery systems can be used to stabilize the voltage. Project area Photographs are presented in Figure 3.1.

Table 3-1: Project Details of WMSPL's Hybrid Power Plant Project

Name of the Project	WMSPL - 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project
Capacity of project	3 MW (AC)
Project Location	Hazirhat, Monpura upazila, Bhola, Bangladesh
Coordinate	Latitude: 22°14'52.13"N, Longitude: 90°57'56.68"E
Project Type	Off-grid Solar PV-Battery-Disel hybrid power plant
Project Sponsor	Western Monpura Solar Power Limited (WMSPL)
Available land	30 Acres

Eastern site of the project area

Northern site of the project area

Western site of the project area

Southern site of the project area

Figure 3-2: Photographs of Location of the Project

The plant will have 11 MWp of solar PV panels, 22 MWh of Li-ion based storage systems and 3 diesel generators of 850 KVA each. The People's Republic of Bangladesh represented by the Power Division, Ministry of power, Energy and Mineral Resources accords its approval on the levelized tariff of BDT 21.25kWh on "No Electricity, no payment" basis to the Western Monpura Solar Power Limited (WMSPL) and grants its permission to design, finance, construct, own, commission, operate and maintain the facility. Net energy output from the facility will be purchased under the power Purchase Agreement by West Zone Poer Distribution Company Limited. The power to be generated by Facility will be evacuated to the 11 KV distribution networks of West Zone Power Distribution Company Limited. The Project site is located in the Hazirhat Union of Monpura Upazilla in Bhola District. The location of this project is shown in Figure 3.2.

3.2 Current Status of Existing Mini Grids and Diesel Generators

3.2.1 Background and Capacity

Monpura's local communities now have access to limited supply of electricity through the three mini-grids and one diesel generator in the following Locations of Monpura Island –

Powerplant Type	Owner	Capacity	Technology	Location
Solar Mini Grid	Western Renewable Energy (Pvt.) Ltd.	279.5 KWp	Solar PV Pannels, Lead Acid Batteries, and Backup Generator	South Sakuchia Union, Monpura, Bhola
Solar Mini Grid	Western Renewable Energy (Pvt.) Ltd.	218.4 KWp		Monpura Union, Monpura, Bhola
Solar Mini Grid	Solar Electro Bangladesh Ltd. (SEBL)	177 KWp		North Sakuchia Union, Monpura, Bhola
Diesel Generator	West Zone Power Distribution Company Ltd. (WZPDCL)	1660 KWp	Diesel Engine (Fuel: Diesel)	Hazirhat Union, Monpura, Bhola

All the mini grids and diesel generator have a total capacity of 2334.9 KWp providing around 5 to 8 hours electricity supply to the customers, which is insufficient for the ongoing growth of electricity demand, and also a great challenge for socio-economic development of Monpura.

3.2.2 Environmental Due Diligence and Their Implementation Status

During the establishment of all of the mini grids and diesel generator plants, all the national and international policies, rules and regulations have been followed. At that time, Environment Conservation Rules, 1997 was the major environmental regulation of the country, and based on it, Environmental and Social Assessment (ESA) reports including Environmental Management Plan (EMP) were prepared and Environmental Clearance Certificate (ECC) were obtained from the Department of

Environment (DoE)[1] and the renewal process is ongoing (documents are attached as Annex U). All of the guidelines and recommendations provided in the Environmental Management Plan (EMP) are being followed and practiced in all of the mini grids and diesel generators.

3.2.3 Major Issues and Their Incorporation in the Present Project

All of the mini grids consist of Solar PV panels, Lead Acid batteries, and backup generators (<500 KV power). One diesel generator supply electricity directly to the grids. All of the major issues from those existing facilities were assessed and incorporated in design and technological planning of the "WMSPL - 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant" Project. As example,

- ✓ Modern technology has been chosen for solar PV panels;
- ✓ Present project will use advance Energy Storage System (Lithium ion container type battery system). These batteries offer high energy density, long lifespan, and exceptional efficiency, making them well-suited for large-scale energy storage applications which contribute to resource conservation, requiring fewer batteries over time. Furthermore, advancements in recycling methods allow for the recovery and reuse of valuable materials from lithium batteries, further reducing environmental impact and promoting a circular economy;
- ✓ To mitigate environmental footprints, diesel generators will only be used during natural calamities and emergency situations (i.e. extreme weather conditions), which will not be more than 10% of the total generation.

3.3 Design Consideration

3.3.1 Electrical Design Basics

The Plant shall contain a number of solar panels, inverters, step up transformers, batteries, generator and other electrical safety, protection, and monitoring equipment. The PV panels will be mounted on civil structures strong enough to withstand the wind effect of tropical storms, cyclone etc. Solar panels contain many photovoltaic cells linked together which instantaneously convert sunlight into electricity. Several solar PV panels are connected in series to achieve some voltage that is suitable for optimal operation of grid connected inverters. The output of inverters is 50Hz AC which will be stepped up to 11 kV through transformer and will be fed to station switchyard. Then the power will be distributed to the load of Monpura through 11 kV WZPDCL distribution line.

The facility will contain 3850 KVA diesel generators, 22 MWh of Li-ion-based storage devices, and 11 MWp of solar PV panels. The Western Monpura Solar Power Limited (WMSPL) has been granted permission by the People's Republic of Bangladesh, represented by the Power Division of the Ministry of Power, Energy, and Mineral Resources, to design, finance, build, own, commission, operate, and maintain the facility at a levelized tariff of BDT 21.25kWh on a "No Electricity, No Payment" basis.

[1] The ESA reports and ECC certificates of existing mini grids can be accessed from the following link: https://drive.google.com/drive/folders/1FIO9MQAuMPSgFHT97tb-pKDDgPAh0VfT?usp=sharing

3.3.2 PV Array Electrical Connection Scheme

A PV module with an inverter mechanically secured to it so that the electrical output is AC, and no DC plug/socket connections are in use between the module and the inverter. Each inverter contains 2 types of module strings i.e. (7 & 9) in the system. The output of each inverter is 400V AC, 50 Hz, three phase AC power. The output of each central inverter is connected with 400V AC grid voltage system. The maximum AC capacity of the installed solar PV system will be 1300 KW (AC).

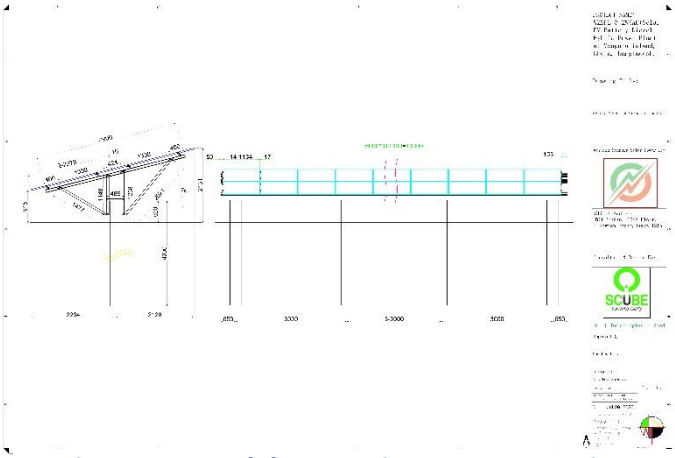


Figure 3-3: Module Mounting Structure Design

3.3.3 Description of Equipment

This 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant involves a combination of different equipment and systems to effectively generate and manage power. Here is a list of some key equipment typically found in such a setup:

Table 3-2: Project Details & Technical & Electrical Information

S.N.	Description	Capacity	Unit
1	Project Capacity (DC)	11.0124	MWp
2	Project Capacity (Ac)	3	MWp
3	Storage	22.352	MWh
4	Solar Panel	570	Wp
5	On Grid Inverter	300	kW
6	Off Grid Inverter	200	kW
7	On Grid Transformer	3.4	MVA
8	Battery Transformer	3.4	MVA
9	Generator Transformer	3	MVA

Table 3-3: List of Major Equipment

SL	Major Equipment	Quantity	Unit
1	Solar Panel	19320	Pcs
2	Transformer	8	Pcs
3	Battery Inverter	44	Pcs
4	Grid Tie Inverter	30	Pcs
5	Diesel Generator	3	Pcs
6	Battery Bank	11	Pcs
7	Static var generator	1	Pcs
8	HT Panel	19	Pcs
9	LT Panel	7	Pcs
10	Residential Building	1	Pcs
11	Office Building	1	Pcs
12	Sub Station	1	Pcs
13	LPS	12	Pcs
14	panel mounting structure	1 Lot	Pcs
15	Dc Cable	1 Lot	Pcs
16	HT (AC Cable)	1 Lot	Pcs
17	LT (AC Cable)	1 Lot	Pcs

3.3.3.1 Solar PV System

a. **Solar Photovoltaic Panels:** The main component that converts sunlight into electricity.

b. **Mounting Structures:** Racks or frames to hold and position the solar panels.

c. **Solar Inverters:** Convert DC (direct current) generated by the panels into AC (alternating current) for distribution.

d. **Combiner Boxes:** Combine multiple strings of solar panels and provide safety features.

e. **DC Cables and Connectors:** Transmit DC power from solar panels to inverters.

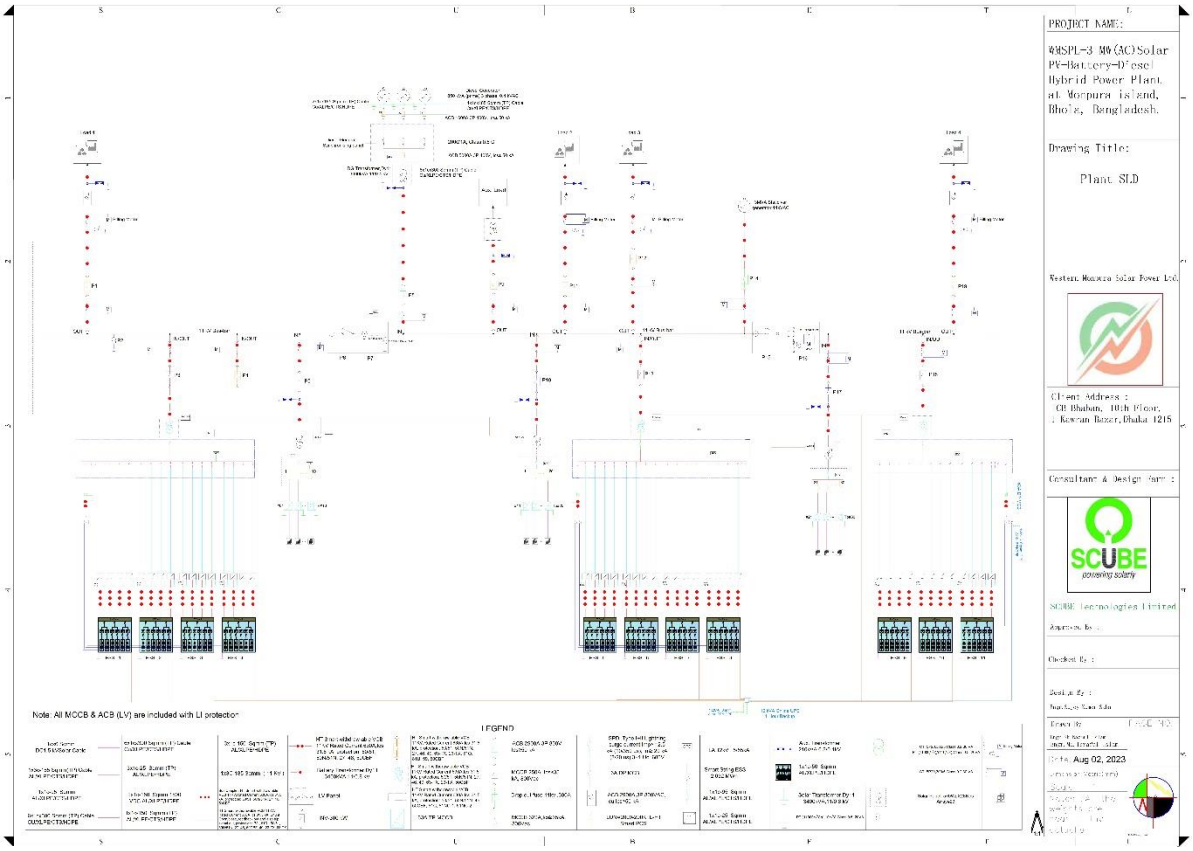


Figure 3-4: SLD of Solar PV generation Plant (source: WMSPL)

3.3.3.2 Battery Storage System

a. **Lithium-ion Batteries:** It Store excess energy generated by solar panels for use during non-sunlight hours. This project will use Huawei Smart String Energy Storage System (Battery) with a capacity of 22 MWh for energy storage. It's a Lithium Ferro Phosphate ($LiFePO_4$) battery storage system, which is often referred to as LFP battery, is a type of rechargeable battery technology known for its high energy density, long cycle life, and excellent safety characteristics. LFP chemistry is prized for its thermal stability, which reduces the risk of overheating and thermal runaway. It also boasts a large number of charge-discharge cycles, making it a reliable choice for long-term energy storage. These features make ($LiFePO_4$) batteries a compelling option for clean energy storage solutions, contributing to the transition to sustainable and efficient energy systems.

b. **Battery Management System (BMS):** The Huawei Smart String Energy Storage System (Battery) Management System is an advanced software and hardware solution designed to monitor, control, and optimize energy storage systems for various applications, including renewable energy integration, grid stability, and energy management. This system offers several key features and functionalities:

- **Monitoring and Control:** The system provides real-time monitoring and control of the energy storage system, allowing operators to track battery performance, state of charge, and overall system health.
- **Data Analysis:** It collects and analyzes data from various sensors and components, enabling users to make informed decisions about energy storage operation and maintenance.
- **Grid Integration:** The management system can integrate with the electrical grid, allowing for bidirectional energy flow, grid stabilization, and support for peak shaving and load shifting.
- **Optimization:** It optimizes battery charging and discharging patterns to maximize the economic benefits of energy storage, reduce electricity costs, and enhance grid reliability.
- **Remote Management:** The system allows for remote monitoring and control, which is especially useful for managing distributed energy storage systems across multiple locations.
- **Safety and Fault Detection:** It includes safety mechanisms and fault detection algorithms to ensure the safe operation of the energy storage system and to respond to any issues or abnormalities promptly.
- **Scalability:** The system is scalable, making it suitable for a wide range of applications, from residential to utility-scale projects.
- **Data Visualization:** It offers a user-friendly interface with data visualization tools, allowing users to easily interpret and analyze the system's performance.

c. **Inverter/Converter:** It will convert DC power from batteries to AC power for distribution.

d. **Battery Racks:** It will be used for safely securing and organizing battery units.

Figure 3-5: Plant Layout Showing Solar PV, Battery, and Diesel Generator Locations (source: WMSPL)

3.3.3.3 Diesel Generator System

Three (3) 850 kVA diesel generators will be used for backup power generation in emergency situations. These generators are a specific type of generator that has a power output capacity of 850 kilovolt-

amperes (kVA) and is powered by a diesel engine. Here are some key characteristics of an 850 kVA diesel generator:

a. **Capacity:** The rating of 850 kVA indicates the generator's electrical capacity, which represents both active (kilowatts, kW) and reactive power (kVA). In this case, it can deliver 850 kVA of total power.
b. **Diesel Engine:** The generator is equipped with a diesel engine, which is commonly used in larger generators due to its durability and reliability. Diesel generators are known for their ability to provide continuous power for extended periods.
c. **Applications:** 850 kVA diesel generators are typically used in various settings, including industrial facilities, hospitals, data centers, commercial buildings, construction sites, and in situations where a reliable and robust source of backup or primary power is required.
d. **Standby and Prime Power:** These generators can serve as standby generators, providing backup power during electrical outages, or as prime power sources in applications where they run continuously.
e. **Fuel Supply:** Diesel generators run on diesel fuel, which is readily available and has a high energy density, making it suitable for applications requiring extended runtime.
f. **Automatic Transfer Switch (ATS):** Many 850 kVA diesel generators are equipped with an Automatic Transfer Switch (ATS) system, which automatically detects power outages and switches the load to the generator when the main power source fails. When the main power is restored, the ATS transfers the load back to the utility grid.
g. **Sizing and Load Matching:** It's crucial to properly size a diesel generator to match the electrical load it needs to support, taking into account factors like the starting current of motor-driven equipment and the power factor of the connected load.
h. **Installation and Maintenance:** Proper installation, routine maintenance, and scheduled testing are essential to ensure the reliable operation of an 850 kVA diesel generator.

3.3.3.4 Potential Diesel needs and Carbon Emission from Diesel Generators

Let's imagine a generator constantly producing 3 MW of electricity for a full day. This scenario would burn through roughly 257 liters of diesel per hour. Over a 24-hour period, that translates to a hefty consumption of 257 liters/hr × 24 hrs x 3 = 18,528 liters of diesel. (using three diesel generators).

The solar plant's standard operating period typically spans 365 days, but for a conservative estimate, we'll consider it to be 345 days. Based on this conservative estimate, the 3 MW generator (three generators) would require a staggering 18,528 liters × 345 days = 6,392,160 liters of diesel annually. The yearly cost of powering this generator with diesel would be enormous, reaching approximately 696.7 million Bangladeshi taka. (We're assuming a liter of diesel costs 109 BDT.)

Even more concerning is the environmental impact. Every liter of diesel burned releases 2.64 kilograms of CO_2. This translates to a significant amount of carbon emissions: 6,392,160 liters/year × 2.64 kg of CO_2 = 16,875,302.4 kg of CO_2, equivalent to 16,875.3 tons of CO_2 emissions per year.

In simpler terms, running these generators for a year would consume a massive amount of diesel, costing nearly 700 million taka and polluting the environment with over 16,875 tons of CO_2 every year.

As only 10% of the total electricity generation might be done by the three (3) diesel generators, there will be 639216 liters per year of diesel required for the diesel generators operations. Therefore, carbon emissions from the diesel generators would be approximately 249.43 tons of Carbon Dioxide annually. However, these generators will only be used during natural calamities and harsh weather conditions, which will not be more than 10% of the total annual electricity generation.

3.3.3.5 Electrical Infrastructure

a. **AC Switchgear:** Controls the distribution of AC power from solar inverters, batteries, and generators.
b. **DC Switchgear:** Manages the distribution of DC power within the system.

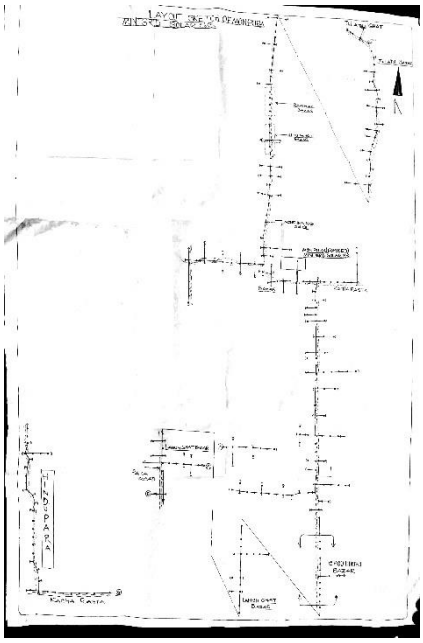
c. **Power Transformers:** Convert voltage levels for transmission or distribution.
d. **Distribution Boards:** Distribute power to various loads and equipment.

3.3.3.6 Monitoring and Control Systems

a. **Supervisory Control and Data Acquisition (SCADA) System:** Centralized control and monitoring of the entire power plant.
b. **Energy Management System (EMS):** Optimize energy usage, battery charging, and generator operation.
c. **Remote Monitoring and Communication Equipment:** Enable remote monitoring and control of the system.

Auxiliary Systems:

a. **Cooling Systems:** Maintain optimal operating temperatures for equipment.
b. **Lightning Protection:** Safeguard equipment from lightning strikes.
c. **Earthing and Grounding Systems:** Ensure electrical safety by providing a safe path for electrical discharge.
d. **Fire Suppression Systems:** Detect and suppress fires to protect equipment and personnel.
e. **Civil Infrastructure:**
   - **Foundations:** Provide stable support for solar panels, inverters, and other equipment.
   - **Access Roads and Paths:** Allow maintenance and servicing of equipment.
   - **Security Fencing:** Secure the power plant perimeter.



3.4 Current Status of Existing Distribution Line

3.4.1 Background and Capacity

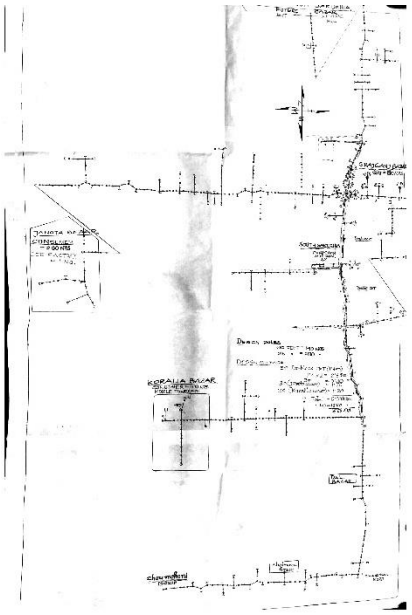


Figure 3-6: Existing Power Distribution System Layout

In Monpura, currently, 2,303 customers are getting electricity from three mini grids, 853 customers from diesel generator. The West Zone Power Distribution Company Limited (WZPDCL) is the implementing agency of power distribution system. They have almost 45km distribution line in Monpura island, recently they are working for up-gradation and extension of power Distribution system in connection with the present 3MW (AC/11MW DC) hybrid power plant project. The West Zone Power Distribution Company Limited (WZPDCL) will buy electricity from WMSPL. Therefore, all the design and civil works related to power distribution system extension and upgradation, will be handled by WZPDCL. The West Zone Power Distribution Company Limited (WZPDCL) is a state-owned electricity distribution company in Bangladesh. The company is responsible for distributing electricity to the western zone of Bangladesh, which includes the Khulna, Barisal, and Faridpur divisions. WZPDCL are well concerned about environmental and social aspects of their work. Their power distribution system upgradation in Monpura will also be done following all the national and international policies, rules, and regulations. The following upgradation and extension activities will be done by them:

- Construction of 11Kv, 11/0.4Kv and 0.4Kv Electric Line for extension of Fakirhat Feeder of Monpura Electric Supply under Bhola Electric Supply.

- Construction of 11Kv Electric Line for synchronizing 3 (Three) number of Solar Power Plant for Monpura Electric Supply under Bhola Electric Supply.
- Construction of 11Kv, 11/0.4Kv and 0.4Kv Electric Line for extension of Dokkhin Shakucia Feeder of Monpura Electric Supply under Bhola Electric Supply.
- Construction of 11Kv and 11/0.4Kv Electric Line for extension of Hazirhat Feeder of Monpura Electric Supply under Bhola Electric Supply.

The West Zone Power Distribution Company Limited (WZPDCL) ensured they will take and follow every necessary step based on national policies, rules and regulations. Here, present project proponent, WMSPL is only responsible for hybrid power construction and electricity generation, and all the power distribution related issues and environmental due diligence will be implemented by the power distribution authority, WZPDCL.

3.5 Operation and Maintenance

The operation of solar power plants is relatively simple and restricted to daylight hours in a day. With automated functions of inverter and switchyard controllers, the maintenance will be mostly oriented towards better upkeep and monitoring of overall performance of the system. The solar PV system requires the least maintenance among all power generation facilities due to the absence of fuel, intense heat, rotating machinery, waste disposal, etc. An electrical inspection to confirm that all the strings of your solar array are operating. Interior inspection of all devices, boxes, inverters, switches, etc. Battery maintenance and/or detailed inspection, if applicable. Infrared inspection of electrical connections looking for loose connections and hot spots. However, keeping the PV panels in good condition, monitoring and correcting faults in the connected equipment and cabling are still required to get maximum energy from the plant. A maintenance schedule needs to be planned as per service/ guarantee terms of supplier to maintain optimum availability of plant at all times. The maintenance functions of a typical solar PV power plant can be categorized as given below-

3.5.1 Day to Day Maintenance Checks

- Ensure security of the power plant
- Monitor power generation and export
- Monitor load-center wise power generation values to detect any abnormality
- Entry of unauthorized person and stray animal at the site

3.5.2 Weekly Maintenance Checks

Inspection of PV panel glass surface clean / wash solar PV panels to free from dust and other dirt like, bird's dropping etc.

3.5.3 Monthly Maintenance Checks

- Inspection of solar PV modules and arrays for any damage
- Check the power terminals for corrosion and proper torque, clean and apply antioxidant jelly, if necessary.

3.5.4 Half Yearly Maintenance Checks

- Check all the wiring for physical damage and for any sign of excessive heating
- Check all the junction boxes for proper covering and sealing
- Check the fasteners of Solar PV panel mounting structure and array for proper torque and tightening.

3.5.5 Yearly Maintenance Checks

- Check for discoloration of solar PV cells
- Check all the connections and ensure that they are not loose

- Checking corrosion, cleaning, and painting switch yard structures

3.6 Water Usage and Management

One of the main elements influencing the production efficiency of solar energy is dust. The energy output of photovoltaic power plants will be significantly reduced by dust pollution. The dirt and dust on the surface of the modules caused an average annual reduction in power efficiency of approx. 6%. During periods of lack of rain, the power efficiency loss can reach 15% or more due to accumulated dirt on t of the modules. For solving these issues, a dedicated solar cleaning system is required with minimal water usage.

To produce 11 MWp of electricity a total of 18,966 solar panels will be used, assuming each panel has a capacity of 580 watts. The water usage for cleaning these solar PV panels varies based on several factors, including the local climate, the level of dust and dirt accumulation, the frequency of cleaning, and the efficiency of the cleaning process. Typically, solar panels require periodic cleaning to maintain their optimal performance. The water usage can be estimated based on guidelines that suggest using around 5 to 7 liters of water per panel for cleaning solar panels.

Therefore, the total water demand for washing this panels will be –

Water usage per cleaning *= (18,966 panel × 5 liters/panel = 94,830 liters per cleaning (approx.)*
And annual water usage *= Water usage per cleaning × Cleanings per Year Annual water usage*
= 94,830 liters/cleaning × 12 cleanings/year = 1,137,960 liters/year

Yearly a total of 1,137,960 liters (approx.) of water would be required for cleaning all the panels. To manage this huge amount of water, a detailed design has been prepared as shown in figure 3.4.

Figure 3-7: Water Line Layout (Source: WMSPL)

However, this is a generic assumption of water requirements. The project area has a low dust ratio, which means that the solar panels will require less cleaning and less water consumption compared to other regions in Bangladesh. Based on the project areas' characteristics, a semi-automatic solar cleaning system has been selected for cleaning, which will reduce water consumption as well as will easily maintain the cleaning cycle for better output. Also, these semi-automatic cleaning systems' spare parts are available in local markets, making maintenance easier. Semi-automatic cleaning systems typically involve a combination of manual intervention and automated processes. Operators may guide cleaning tools or equipment across the surface of solar panels, enhancing the efficiency of cleaning. Semi-automatic cleaning systems often employ rotating brushes or soft bristles to remove dirt and debris from the surface of solar panels. These brushes may be manually operated or integrated into automated cleaning equipment. Semi-automatic cleaning systems aim to optimize water usage by delivering water precisely to the areas requiring cleaning, which can greatly save water, save costs, and improve cleaning efficiency in Bangladeshi weather conditions. Techniques such as targeted spraying help conserve water while effectively removing dirt from solar panels. These semi-automatic systems incorporate water recirculation and filtration mechanisms to minimize water consumption and maintain water quality. Recycled water can be filtered and reused for subsequent cleaning cycles,

reducing the overall water demand. Details and procedures of the solar cleaning system are provided in Annex C. Generated water will be reused for irrigation of vegetation in the project area. Remaining water will be collected in retention pond and further will be used for PV panel cleaning.

3.7 Decommissioning

The solar panels need to be removed at the end of their lifecycle, which is typically 20-40 years. This part is known as Decommissioning. A decommissioning plan outlines required steps to remove the system, dispose of or recycle its components, and restore the place to its original state. Plans may also include an estimated cost schedule and a form of decommissioning security.

3.7.1 PV Panels Decommissioning

Solar photovoltaic panels have an impressive lifespan. Manufacturers provide PV modules warranties for 25 years. At some point, though, even the hardiest of these panels will fail. And, as they are composed of both valuable precious metals and toxic materials (along with easily recyclable aluminum and glass), the panels will require careful end-of-life handling. PV modules for example contain substances such as glass, aluminum, and semiconductor materials up to 85% of their weight can successfully be recovered and reused.

As there are no PV panel decommissioning guidelines in Bangladesh, following national and international guidelines for E-Waste Management, damaged or warranty expired PV panels will be collected and decommissioned by the supplier to the manufacturers. The manufacturer, JA Solar Technology Co., Ltd. has PV Cycle's[2] membership and will follow their suggested guidelines for solar PV panel waste management during reusing, recycling, and disposal of damaged/warranty expired PV panels, as depicted in Annex D. The manufacturers also have "Assurance Statement of GHG emissions" (Annex E), as they are concerned about the environmental aspects of their activities. During the lifetime of solar PV panels (25 years), if any government policy developed for solar PV panel waste management, the supplier will also follow it during the decommissioning and transportation.

3.7.2 Battery Decommissioning and Battery Recycling Process

Huawei Technologies Co. Ltd. are the official manufacturers of Energy Storage System (Battery). They provide 12 years warranty for the Energy Storage System (Battery) and will collect batteries through suppliers for recycling. After collection from the project site, the supplier will recycle every damaged or warranty expired batteries in an environmentally friendly way. Or if the damaged or warranty expired battery remains some capacity, it will further re-use in 2nd categories industry like electric vehicles etc. During the collection and the recycling of damaged or warranty expired batteries, the supplier will follow the environmental, health and social compliances, under the Environmental Social Management Framework (ESMF) of IDCOL.

[2] https://pvcycle.org/

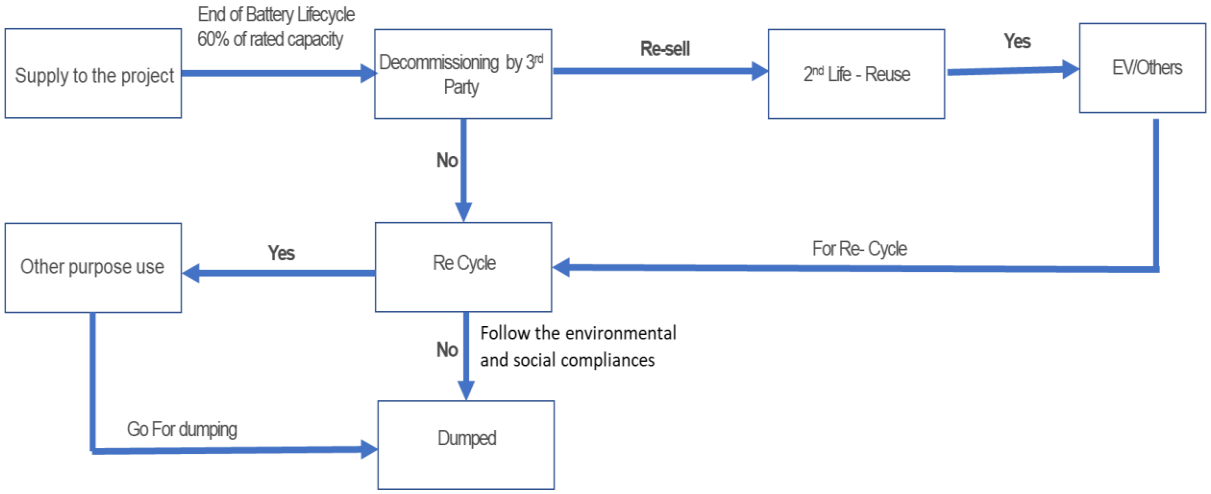


Figure 3-8: Procedure to Collect and Recycle the Batteries

3.7.2.1 Manufacturer and Supplier Capacity and their Environmental Management (EMS) Functionality Status

Huawei Technologies Co. Ltd.: As an official manufacturer of the Energy Storage System (Battery), Huawei Technologies Co. Ltd. is always concerned about environmental safeguards in their battery manufacturing facility. Based on their sustainability report[3] they are well concern about their environmental footprint and merging sustainable practices in their factories. Huawei is doing its part to contribute to a greener and more sustainable digital world. They are working to cut carbon emissions, promote renewable energy, and contribute to more regenerative economic systems. Huawei has established a sustainability management system based on standards such as ISO14001, OHSAS18001, and SA8000[4]. The company has also leveraged the ISO26000 standard to refine their sustainability management system, thereby ensuring the effective execution of their sustainability strategy. Huawei's ensures sustainability to reduce operating risks, and improve stakeholder satisfaction, Huawei established a Corporate Sustainable Development (CSD) Committee more than a decade ago. The CSD committee of Huawei ensures sustainability through -

- Develops corporate-level sustainability strategies, guidelines, objectives, and policies; sets the course; and monitors their implementation.
- Coordinates the creation, implementation, and continuous improvement of the sustainability management system; decides on sustainability related matters; and ensures that Huawei's sustainability management complies with relevant laws and regulations, international standards, and customer requirements.
- Facilitates sustainability-related communication with key stakeholders such as customers, regulators, and industry organizations.
- Drives the resolution of sustainability issues across domains or processes and coordinates sustainability operations from end to end.
- Provides guidance on the development, operation, and improvement of our environment, occupational health, and safety (EHS) management system, and handles major EHS issues.

Strategies for recycling damaged or warranty expired batteries (ESS) are incorporated in Annex F.

Intelligent Express Ltd.: Intelligent Express Limited, a private limited company incorporated and registered under the laws of Hong Kong, having its incorporation number 1219101 dated 19th March 2008 with registered office located at Hong Kong, are the supplier of Energy storage System. Following all the national and international rules and regulations, they will supply energy storage systems to

[3] https://digitalpower.huawei.com/attachments/index/ce39280ca87d434391367e46fa5647cf.pdf
[4]https://www-file.huawei.com/-/media/CORPORATE/PDF/annual report/AnnualReport2015_sustaiable_development_en.pdf

Western Monpura Solar Power Limited (WMSPL). They will also be responsible for collecting and transporting damaged or warranty expired batteries from the project site during operation and decommission phase (Annex G). During collection and transportation of damaged or warranty expired Energy Storage System (ESS), all the national rules and regulations, as well as guidelines from IDCOL and WB will be followed. Detailed procedures to collect and recycle batteries by the suppliers are described in Annex H.

3.7.3 Diesel Generator Decommissioning

Decommissioning diesel generators will involve a systematic approach to ensure an environmentally responsible process. The supplier will provide support for decommissioning those diesel generators. Firstly, all hazardous materials like coolants, lubricants, and other fluids would be carefully removed and disposed of in accordance with local environmental regulations. Emissions control equipment should be addressed to capture and appropriately dispose of pollutants. Site restoration would address any soil contamination or environmental damage, and non-recyclable or hazardous materials will be disposed of according to local regulations. Detailed records would be kept, and compliance with environmental laws and permitting requirements would be maintained during decommissioning.

4 ANALYSIS OF ALTERNATIVES

4.1 General

The project has been considered and investigated for several alternatives to reduce the environment and social impacts. The alternatives assessed were not limited to environmental and social aspects, but assessment also included the technical and financial impacts of different options. Several alternatives have been considered such as – do nothing; technologies for alternative energy generation; alternative sites and so on.

4.2 Do Nothing

The Do Nothing Alternative in respect to 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 property will remain under-utilized. The No Project Option is the least preferred from the socio-economic and 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 for those who will work in the project area.
- Discouragement for donors to allot this level of standard and affordable developments.

4.3 Technologies for Alternative Energy Generation

This alternative would involve the use of wind energy as an alternative to 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:

- 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, 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 affect avian species in the local area. The development of wind farms would also typically result in greater adverse aesthetics 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 not substantially reduce the significant environmental impacts associated with aesthetics, agriculture resources, air quality and biological resources;
- It would result in additional/greater impacts than the proposed project (aesthetics and biological resources);
- It would fail to meet the objectives for the proposed project;
- 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. And
- Wind energy is uncommon in Bangladesh and the production material is not available.

4.4 Alternative Site

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

Looking for the land to accommodate the scale and size of the project and completing official transactions on it may take a long period. In addition, it is not a guarantee that such land would be available. It is 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 of time on design and approval of the plans by the relevant government departments. The project design and planning before the stage of implantation would call for costs 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 (project) would have been delayed for a long period before implementation. This would also lead to a situation like No Action Alternative. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option.

4.5 Suitable option for the Project

As per alternative analysis, doing nothing alternative is not suitable for the project, as there are huge energy demands in Monpura Upazila. As per findings from technologies for alternative energy generation, as a remote area solar proposed hybrid power plant is the best option. For alternative sites, the land which is being used for the project is owned by the Project Authority. The land is inside the project boundary. As well as it is just beside the roadside. The land is currently used by the owner as Western Monpura Solar Power Limited (WMSPL). If we consider any other alternative land use like water body or agricultural land outside the factory boundary, the project authority had to purchase the land from the owner. As well as the agricultural land would have been ruined. Therefore, the current used land is the best possible land for the project.

5 BASELINE ENVIRONMENTAL CONDITION

5.1 General

In identifying, predicting, and evaluating impacts, it is necessary to establish a baseline of environmental quality in the area of the project's site. For many components of the environment, the baseline environmental quality is assessed by conducting field investigations within an impact zone. Social-survey and disclosure was conducted to carry out information on environmental and social risks and impacts of Projects. The specific Objectives of the baseline study were:

- To document the existing condition of physicochemical, ecological, and prevailing socio-economic conditions of the study area.
- To identify the significant environmental and social aspects that are likely to be affected by the proposed development activities.
- Setting of baseline parameters in order to identify possible adverse & beneficial impacts due to the proposed project activities.

The following section describes the baseline environment in three broad categories:

- **Physical Environment**- factors such climate, geology and hydrology;
- **Biological Environment**- factors related to life such as flora, fauna and ecosystem;
- **Socio-economic Environment**- anthropological factors like demography, income, land use and infrastructure.

5.2 Project Influence Area

The Area of Influence (AOI) of the Project comprises of the Project Site and the surrounding area, where influence of the Project activities is anticipated. As this Solar project has fallen under the yellow category according to the ECR'23, the AoI shall be acknowledged as 50 m. but for better understanding of the project surroundings buffers at 500m and 5km were considered during field survey. The areas likely to be affected by the Project and its associated activities may include:

- Impacts from unplanned but predictable developments caused by the project that may occur later or at a related location such as increase in traffic on the approach road;
- Impacts on biodiversity or on ecosystem services upon which affected communities' livelihoods are dependent;
- associated facilities, that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable;

In this study, considering all of the above-mentioned criteria, 50m, 500m, and 5km buffer areas was selected as the AoI, in which, all the baseline information was collected and described in the following sections-

5.2.1 Overview and Environmental Setting

Monpura is an Upazila, or sub-district, of the Bhola District in Barishal Division of Bangladesh. The project Area of Influence (AoI) is located within Hazirhat, Dasherhat and Grameen Tower Para of Hazirhat Union, Monpura Upazila, Bhola District (Table 5.1). The distinct physical and geological features of the upazila are the key to the ecological assessment done in this report. The main features of the upazila are outlined below:

Monpura has a total area of 373.19 km^2. It is bounded by Tazumuddin upazila on the north, bay of bengal on the south, Hatiya upazila on the east, Lalmohan and Char Fasson upazilas on the west. The Main rivers are meghna; Shahbazpur Channel and Hari Canal are notable. Monpura Upazila is divided into four union parishads: Dakshin Sakuchia, Hazirhat, Monpura, and Uttar Sakuchia. The union parishads are subdivided into 18 mauzas and 30 villages. The annual average temperature is between 18°C and 29°C, with an annual rainfall between 5 millimeters and 471 millimeters.

Table 5-1: Detailed Description of Environmental Setting

Particulars	Detail Description
Location	Hazirhat Union, Monpura Upazila, Bhola District
Nearby villages	Hazirhat, Dasherhat and Grameen Tower Para
Site elevation	elevation variation of 10.85 – 14.94 m a.m.s.l
Nearest Airport	Patuakhali Airport (unused category)
Climatic conditions	Annual average temperature is between 18°C and 29°C Average rainfall between 5 millimeters and 471 millimeters
Archaeologically important places/monuments	None with 10km radius

5.3 Physical Environment

Physical environment of the subproject area has been described that relates to the area-specific conditions pertaining to climate, meteorology, topography, physiographic and soil, geology and seismicity, hydrology and drainage, air quality, noise quality and flooding.

5.3.1 Climate

In order to investigate the climatic condition of the study area, different meteorological parameters have been collected from multiple secondary sources. The proposed project area falls under a tropical climate zone. Basically, this region has a distinct monsoonal season which influences all other climatic parameters. Bangladesh is divided into seven climatic zones (Rashid 1991). According to the classification, project AoI is located the South-Eastern region climatic zone of Bangladesh (Figure 5.1) having a small range of temperature, rarely goes over a mean of 32°C and below a mean of 13°C. In winter dew fall is heavy (Banglapedia 2014). Like other parts of the country, the project area is heavily influenced by the Asiatic monsoon, and it has these three distinct seasons:

Figure 5-1: Climatic Zones of within/around the project AoI

- ✓ Pre-monsoon hot season (from March to May),
- ✓ Rainy monsoon season (from June to October), and
- ✓ Cool dry winter season (from November to February).

There is no weather station in Monpura upazila, weather data from district's weather station will be taken for Bhola district. The detailed description of the temperature, rainfall, humidity, wind speed and wind Direction with directions is given below:

Temperature: The maximum daily temperature recorded are 36°C. The minimum temperatures recorded are 9°C.

Rainfall: The monthly average rainfall of Bhola varies from 5 to 471 mm during 1987 to 2021.

Humidity: The statistical data of humidity from 1987 to 2021 indicates that the maximum average relative humidity was found to be 89% in July. On the other hand, the minimum average relative humidity was 77% in both February and March.

Wind Speed and Direction: The average wind speed ranges from 1.9 to 2.9 m/s during the maximum period in a year.

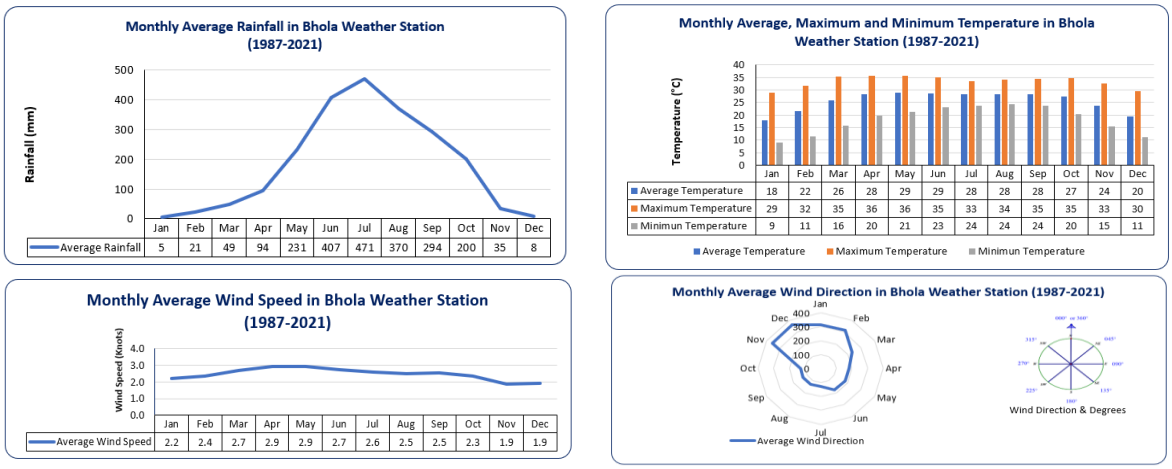


Figure 5-2: Historical data of Temperature, Rainfall, Humidity, Wind speed and Wind Direction

5.3.2 Topography

The general topography of the project area is relatively flat. The topography of the specific project location varies from 0 meters to 3 meters (Figure 5.4). Topographically the cluster of the project location is flat, with many depressions, natural water bodies, bounded by the river's estuary and Bay of Bengal.

5.3.3 Seismicity

The project area is located over the Indian plate, which is moving north. As per the seismic zone map (Figure 5.5), project location falls in zone II comprising the southern part of Monpura Upazila is seismically quiet zone and represented with Seismic Zone coefficient 0.20. It means the project area is prone to moderate seismic intensity. There is no evidence of major earthquakes in the project areas in the recent past. Moreover, some part of the project AoI falls in the zone II which means the project area is prone to severe seismic intensity with Seismic Zone-2 coefficient 0.28.

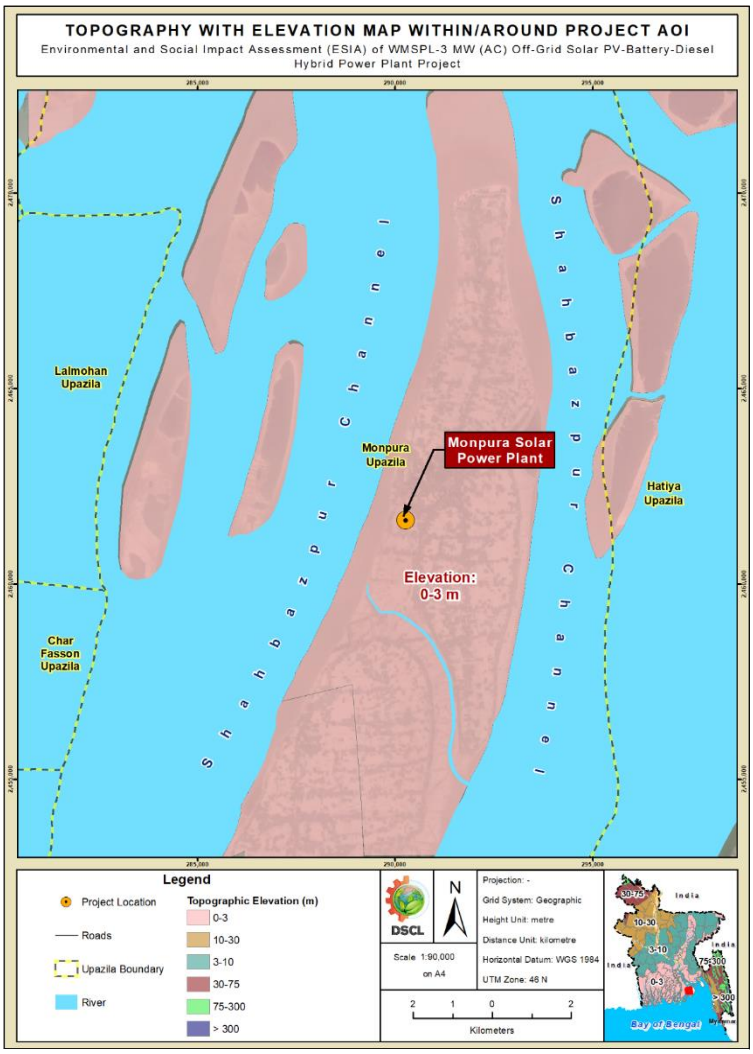


Figure 5-3: Topography with Elevation map

5.3.4 Geology

The geology of the project AoI has underlaid into Hatiya Trough (Figure 5.6). Hatiya Trough represents the deepest trough of Bengal Basin, which received the highest accumulation of clastic sediments. The axis of Bengal Foredeep runs through the apex of Hatiya Trough. East of Hatiya Trough zone is the deepest trough of Bengal Basin which opens southwards to the bay of bengal. The sedimentary sequence here is over 20 km thick.

5.3.5 Physiography

The project area falls under Young Meghna Estuarine Floodplain. This sub-unit occupies almost all the level land within and adjoining the Meghna estuary. New deposition and erosion are constantly taking place on the margins, continuously altering the shape of the land areas. The sediments are deep silts, which are finally stratified and are slightly calcareous. In many, but not all parts, the soil surface becomes saline to varying degrees in the dry season.

5.3.6 Water Resources and Hydrology

From the desktop study, the waterbodies of the project areas were identified (Figure 5.8). The project area is surrounded by the Meghna River estuary and Bay of Bengal. Shahbazpur Channel and Hari Canal are notable. There are also significant numbers of natural water bodies around the project location. In the wet season, a substantial amount of the land in the area is inundated due to flooding.

The overall quality of surface water around the project site and its surroundings varies throughout the year. Typically, water quality improves during the monsoon due to

Figure 5-4: Seismic zones within/around the project AoI

Figure 5-5: Geological zones

the influx of fresh rainwater and worsens during the dry season as water evaporates and the concentration of contaminants increases.

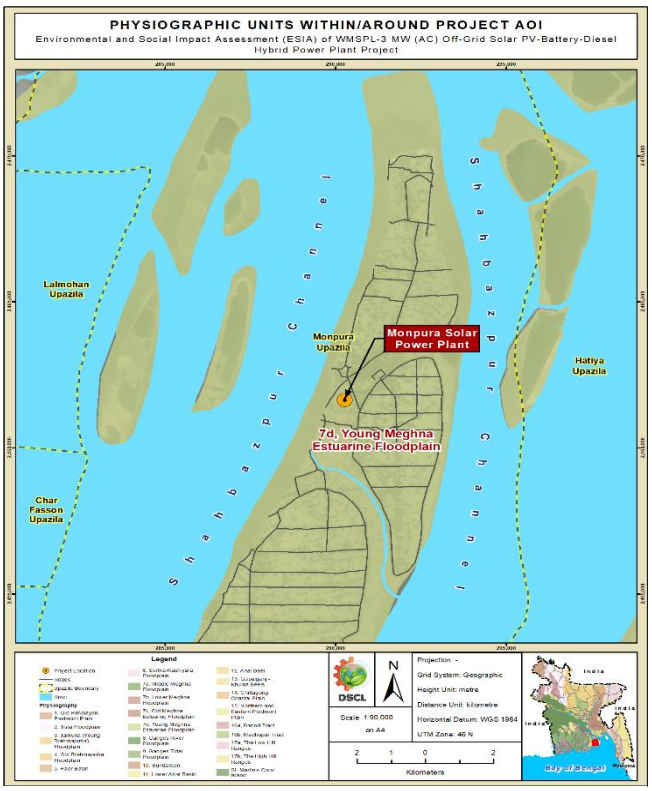


Figure 5-6: Physiographic unit

5.3.7 Groundwater

The groundwater resources in the project area are found in three separate aquifers. Fresh groundwater is relatively carbonate-rich with low total dissolved solid contents of less than 500 milligrams/liter (mg/l).

Based on field observations and interviews with local residents, it was found that groundwater in the area is used as a drinking water source in many instances, as well as for irrigation purposes. Water is generally extracted via hand pumps (tube wells) from the shallow regions of the composite aquifer, and via machine-driven pumps (deep tube wells) which draw from the deeper main aquifers. The ground water reservoir usually recharges from rainfall, floods, and rivers. In summer season, the water table slightly goes down and goes up in rainy season.

5.3.8 Soil Type

The soil of the project area is classified as Calcareous Alluvium (Saline) soils of the category of Bangladesh soil types (Figure 5.9). This soil type has grey matrix cambic B-horizon and lime in the profiles. It ranges from silt loam and silty clay loam on riverbanks and floodplain ridges to silty clays in basins. Soils of this group mainly occur on the Ganges tidal floodplain in the southwest, also minor areas on the river floodplain of the Ganges and Lower Meghna. It is also known as Calcaric Gleysols type soil (FAO, 1961).

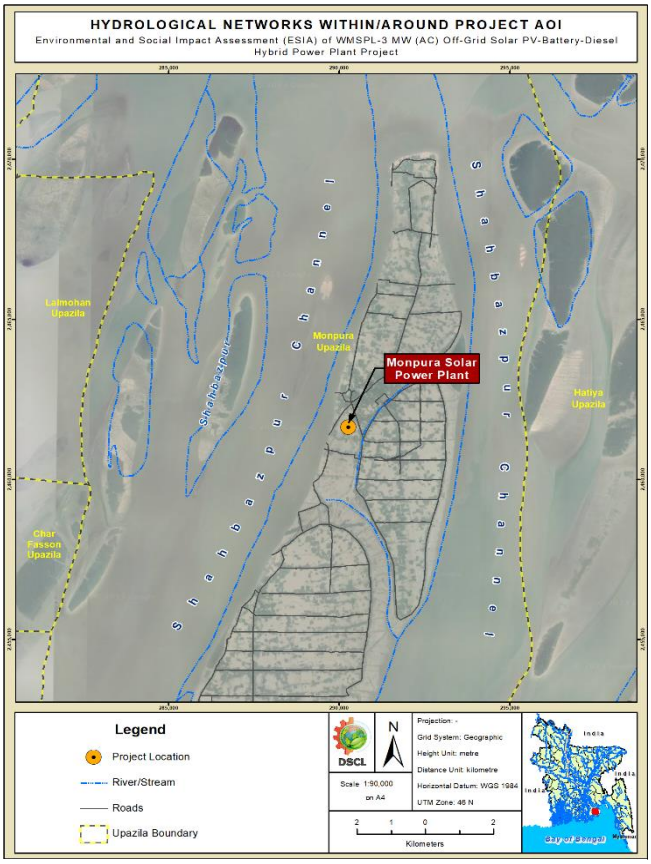


Figure 5-7: Hydrological networks

5.3.9 Climate Change and Natural Disasters

Climate change is having a profound impact on Monpura, Bangladesh. Rising sea levels and increased cyclonic activity are causing frequent and severe coastal flooding, displacing communities, and inundating agricultural land. These changes threaten the livelihoods of many residents who rely on fishing and farming. Additionally, the region is experiencing more erratic rainfall patterns, affecting crop yields and exacerbating food insecurity. The combination of these factors poses a significant threat to the economic and environmental sustainability of Monpura,

making it imperative for local and global efforts to address climate change and support vulnerable communities in adapting to its consequences.

The project area is vulnerable to a range of natural disasters, including cyclones, tidal surges, and riverbank erosion. Cyclones are particularly devastating, causing extensive damage to homes, infrastructure, and agriculture, and leading to loss of life. Tidal surges, often associated with cyclones, result in coastal flooding and saltwater intrusion, which can contaminate freshwater sources and damage crops. Riverbank erosion, driven by the changing course of the rivers in the region, displaces communities and leads to land loss. Details of various natural disasters in the project area are given below-

Flooding: According to Figure 5.10, project AoI has fallen into severe flood zone. Monpura upazila is among those areas that have rivers running through them or are in close proximity to the sea and are prone to severe flooding. Seasonal flooding is mainly shallow, but fluctuates tidally, and is caused mainly by rainwater or non-saline river water. Flooding by salt water occurs mainly on the lamed margins and during exceptional high tides during the monsoon; also, when storm surges associated with tropical cyclones occur.

Cyclones: Monpura Island, like many other coastal areas of Bangladesh, is prone to cyclones and tropical storms that originate in the Bay of Bengal. Cyclones can bring strong winds, storm surges, heavy rainfall, and flooding, causing significant damage to property, infrastructure, and posing risks to human lives.

- In April 1991, Cyclone 02B (also known as the 1991 Bangladesh Cyclone) hit the southeastern coast of Bangladesh. The cyclone and the storm surge from this cyclone affected Bhola and other coastal regions, causing significant damage.

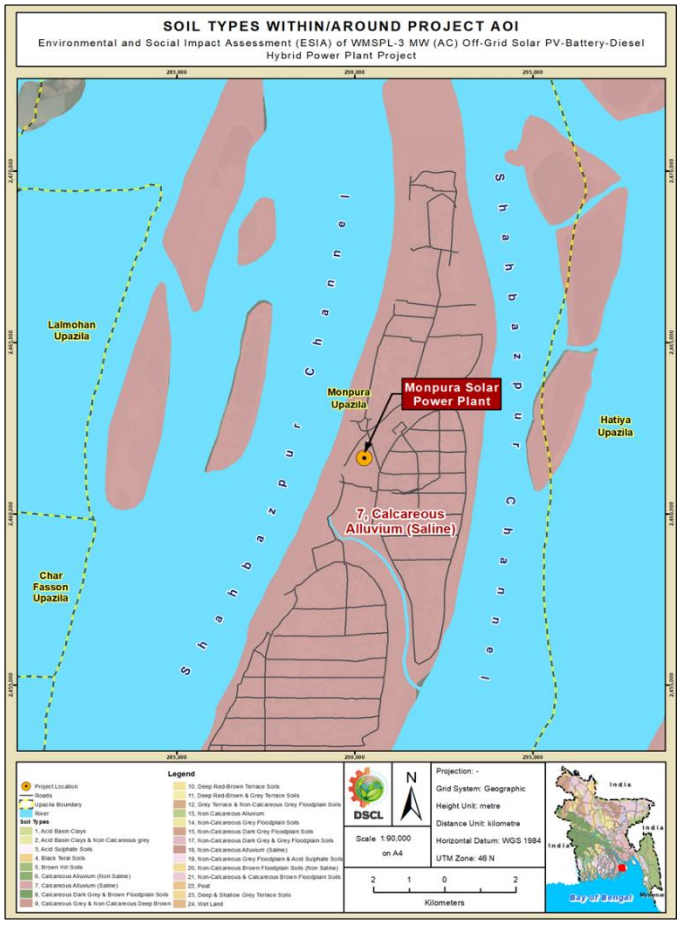


Figure 5-8: Soil type within/around the project AoI

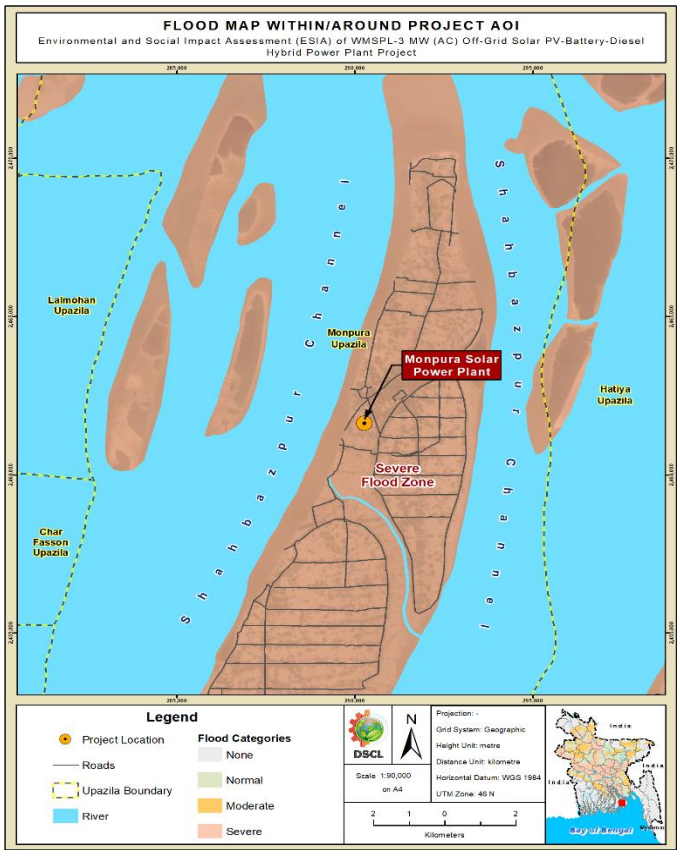


Figure 5-9: Flood Map within/around the project AoI

- In November 2007, Cyclone Sidar affected several coastal districts, including Bhola, causing extensive damage to property and infrastructure. The storm surge associated with this cyclone impacted Bhola, leading to flooding and destruction in the district.
- In May 2009, Cyclone Aila hit the Bay of Bengal and caused severe flooding, displacement, and damage to homes and crops. The storm surge from Cyclone Aila affected Bhola and other coastal areas, leading to widespread inundation and damage.

Erosion: Coastal erosion is a continuous concern for the inhabitants of Monpura Island. Rising sea levels and tidal actions can lead to the erosion of shorelines, causing the loss of land and posing risks to settlements.

Salinity Intrusion: The island's location in the delta region makes it susceptible to salinity intrusion, especially during the dry season when lower river flows can allow seawater to penetrate inland, affecting agricultural lands and freshwater sources.

5.4 Ecological Environment

The baseline ecological surveys were carried out, based on various secondary sources (Forest Department Data, Scientific Studies, and previous similar studies) which are further validated from through field observations and interaction with local people. A present biological assessment was carried out for the project development area and buffer zone (50m radius surrounding the project site is considered as the zone of influence of the project, as per ECR'23).

Survey was undertaken to assess habitat type and quality, species, diversity, rarity, fragmentation, ecological linkage, age, and abundance. A one-time rapid survey from July 4 to July 6, 2023 were done for Identifying if there are any critical habitat and its significance, and protection status.

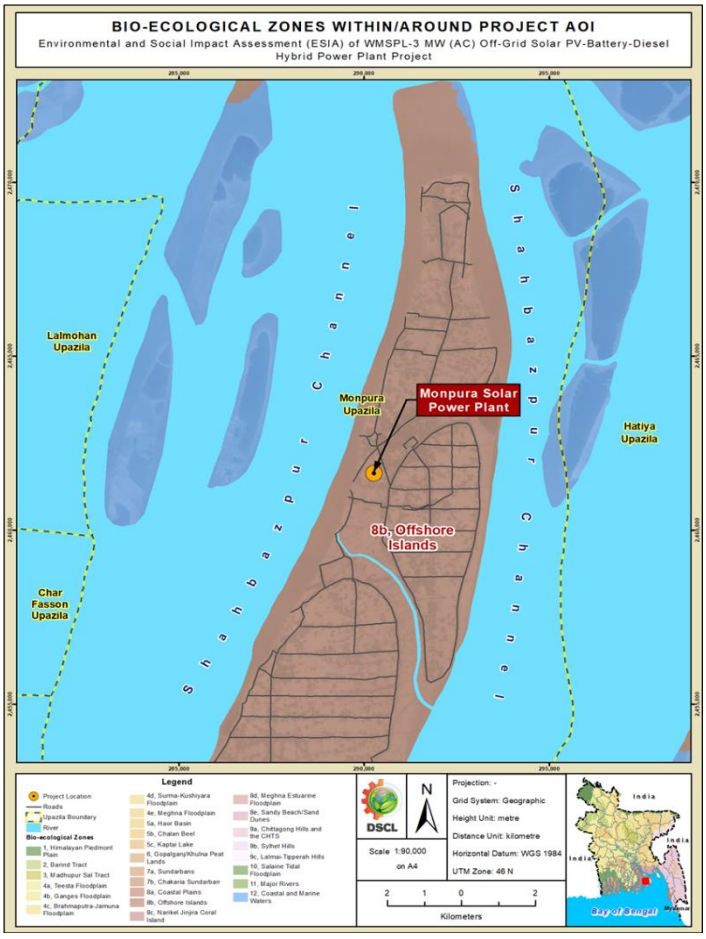


Figure 5-10: Bio-Ecological zones

5.4.1 Bioecological Zone

The ecosystems of this project AoI could be categorized into two major groups, i.e. (i) land based and (ii) aquatic. The land-based ecosystems include forest and hill ecosystems, agro-ecosystems, and homestead ecosystems; while seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats and chars, and marine ecosystems fall into the aquatic category. The project AoI falls in one bio-ecological zone named as Offshore Islands (8b) (Figure 5.16). The region is most dynamic and intense erosion and sedimentation takes place here regularly. As a result, the coastline is irregular and broken. Moreover, there are extensive inter-tidal mudflows composing parts of the islands. Most of these mudflows occur along the island's creeks. Among the rich vegetation observed around the project AoI, there are man-made plantations of mangroves. In addition, a number of common reptile and mammal species occur within this zone (IUCN, 2002).

5.4.2 Agroecological Zone

The project AoI falls in one agro-ecological zone named Young Meghna Estuarine Floodplain (Figure 6.17). This region occupies young alluvial land in and adjoining the Meghna estuary. The major soils are grey to olive, deep calcareous silt loam and silty clay loams, and are stratified either throughout or at shallow depth. Calcareous alluvium and non-calcareous grey floodplain soils are the dominant general soil types. Topsoils and subsoils of the area are mildly alkaline. General fertility is medium but low in N and organic matter (Banglapedia, 2014).

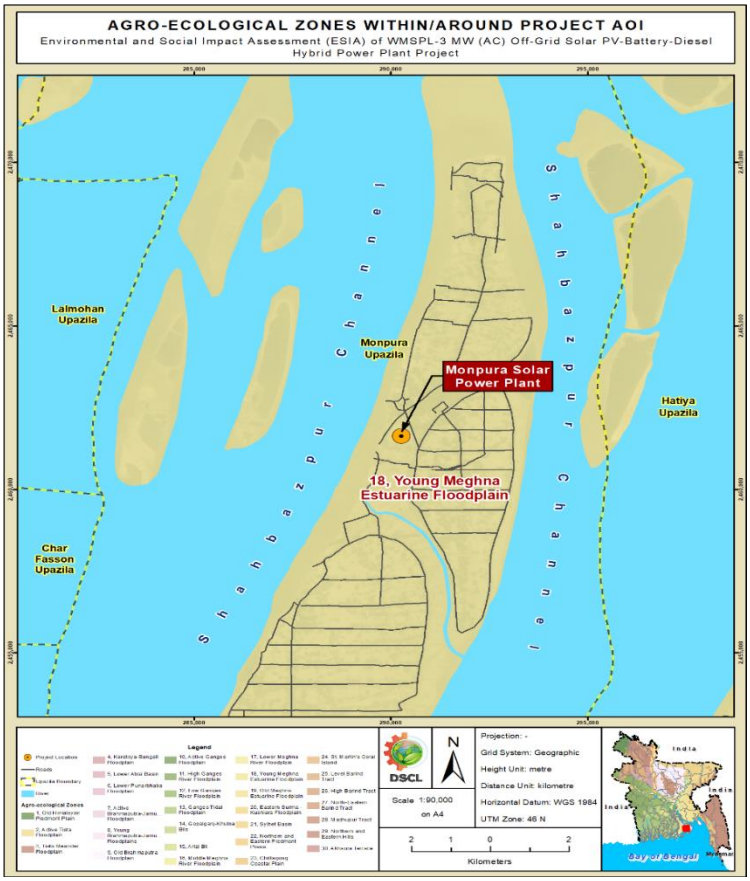


Figure 5-11: Agro-Ecological zones within/Around the project AoI

5.4.3 Terrestrial Ecosystem

The survey of flora and fauna was carried out over a period of three days, from 04 July to 06 July, 2023. During observation and data collection field notes, two pairs of binoculars, digital camera (Cannon auto focus 35 mm and 16 mm equivalent), Video Camera, GPS, distance measuring plastic tape, surgical gloves, google map, paper box and rubber tapes, etc. were used. Data collected in each trip is inputted in the computer to make the systematic data base for each species and categorized according to the taxonomic position. Habitat types, food habits, etc. were also recorded.

5.4.3.1 Flora

Monpura upazila is an intermediate level island but falls within the active delta as there has been diluvian in the east and accretions in the north-west. The whole island is affected by the movements of the lower Meghna channel. Various types of agricultural crops are cultivated on the island. Among cereal crops, Aman covers the largest area followed by Aus, Boro and Wheat. Common fruit crops that are grown in the area are Mango, Jackfruit, Guava, Banana, Papaya, Amra, Chalta, Coconut etc. The groves that surround the village homesteads represent various types of commonly planted trees. Besides the above, the entire coastal belt of the island has recently been covered with trees like Keora (Sonneratia apetala), Jhau (Casuarina equisetifolia), Coconut (Cocos nucifera), etc. Moreover, in different ponds ditches and beels of this area, various hydrophytes, and floating ferns gown in abundance. Following method have been used studying floral Composition:

Quadrats: A total of 4 grids (size: 100 m × 100 m) were selected to study floral composition. A total of 8 days was spent in the field. Observation was started early in the morning and ended at late afternoon in each day (0600 hr – 1800 hr). Unidentified vegetation species were collected (either seed, flower, or leaf) for later identification.

The micro level approach involved mainly the field based primary data collection on different components of the project objectives/scope of work using well established and accepted ecological methods in different habitats identified within the project AoI. The field data collection mainly included

biodiversity status assessment of different life forms of floral elements such as trees, shrubs, climbers, herbs, and grass.

Transect Walk: Alongside quadrated methods, surveyors performed transect walking to randomly identify floral species. These random transect walks were done in-between the quadrate exercises. Some Common Flora within/around the project AoI are given in Annex I. The detailed list of surveyed Flora within/around the project AoI is given in Table 5.2.

Table 5-2: List of Flora within/around the project AoI

No	English Name	Scientific name	Sighting status	IUCN Red Book Status	Use	Type
1	Date	*Phoenix dactylifera*	Very common	-	Juice, fruits, fuelwood, fence, Basket, used in steps of pool	Upper Storey Plant
2	Coconut	*Cocos nucifera*	Very common	LC	Fruits, drinks, fuelwood, fence, handicrafts, used in steps of pool	
3	Betelnut	*Areca catechu*	Few	-	Fruit, Herbal Medicine, used in steps of pool	
4	Almond Nut	*Terminalia catappa*	Very Few	-	Fruit, Fuelwood	
5	Mango	*Mangifera indica*	Common	LC	Fruits, timber, fuel, furniture	
6	Red Date/ Chinese Date	*Ziziphus jujuba*	Common	-	Fruit, Timber	
7	Sapaish Mahagani	*Swietenia macrophylla*	Common	VU	Wood	
8	Indian Siris	*Albizia lebbeck*	Very Common	-	Wood	
9	Velvet Apple	Diospyros discolor	Common	-	Fuelwood, Timber Tannin or dyestuff	
10	Java Apple	S. samarangense	Very Few	LC	Fruit	
11	Indian Tulip tree	Thespesia populnea	Very Few	-	Flower, Timber	
12	Guava	*Psidium guajava*	Few	LC	Fruit, Fuelwood	Second Storey Plant
13	Banana	*Musa acuminata*	Few	LC	Fruit	
14	Papaya	*Carica Papaya*	Common	LC	Fruit	
15	China-rose	*Hibiscus rosa-sinensis*	Very Few	-	Flower	Ornamental Plant
16	Taro root	*Colocasia esculenta*	Few	-	Food	Vegetable
17	Cucurbits/ Bottle gourd	*Lagenaria siceraria*	Very Few	-	Food	
18	Crown flower	*Calotropis gigantea*	Rare	-	Medicinal	shrubs
19	Elephant grass/ Indian reed-mace	*Typha elephantina*	Very few	-	Local Craft	
20	Pink Morning Glory	*Ipomoea Carnea*	Very Few	-	-	
21	Rice	*Oryza sativa*	Few	-	Food	Crops
22	Bamboo	*Melacanna bambusosides*	Common	-	Construction, Food	Bamboo
23	Sea Holly	Acanthus ilicifolius	Rare	-		Mangrove and Char Land Vegetation
24	mangrove apple	*Sonneratia apetala*	Few	LC	Fruit	
25	Whistling Pine/ coastal she-oak	*Casuarina equisetifolia*	Few	-	-	

5.4.3.2 Fauna

Faunal Studies were undertaken in the Project AoI by opportunistic search methods where habitats of the different faunal species were repeatedly visited twice to confirm their presence and usage of the habitats. Focus was given on the larger animals which are under threat of frequent urbanization and industrialization in the area. The target faunal species studied are Mammals, Avifauna, Reptiles and Amphibians.

Cows, goats, buffalo, duck, chicken, dogs, cats, and others fauna were found in/around the study area during the visit. There were no extinct or endangered species found in the project area. However, very few species were detected outside (outside of 1km buffer zone) of the project area. As per discussion with local people it was learned that Asiatic water snakes are present in this region. Some Common Fauna within/around the project AoI are given in Annex J. The detailed list of surveyed Fauna within/around the project AoI is given in Table 5.3.

Table 5-3: List of Fauna found within/around the project AoI

No	English name	Scientific Name	IUCN Red book Status	Habitat	Type
1	Goat	*Capra aegagrus hircus*	LC	Hh	Domestic Mammals
2	Dog	*Canis lupus familiaris*	LC	Hh,Op	
3	Cow	*Bos taurus*	LC	Hh	
4	Asian Water Buffalo	*Bubalus bubalis*	RE	Hh	
5	Sheep	*Ovis aries*	LC	Hh	
7	Pigeon	*Columba livia*	LC	Hh	Avifauna
8	Hen	*Gallus gallus domesticus*	DD	Hh	
9	House sparrow	*Passer domesticus*	LC	Hh	
10	House crow	*Corvus splendens*	LC	Hh	
11	Brown swan	*Cygnus atratus*	LC	Hh	
12	Muscovy duck	*C. moschata domestica*	LC	Hh	
13	Indian spotbill duck	*Anas poecilorhyncha*	LC	Hh	
14	Black drongo	*Diciris macrocercus*	LC	Tt	
15	Indian pond heron	*Ardeola grayii*	LC	Tt, Op	
16	Dragonfly	*Gynacantha subinterrupta*	LC	Hh, Op	Insects
17	Red cotton bug	*Dysdercus cingulatus*	EN	Op	
18	Delta (wasp)	*Delta asina*	LC	Op, Tt	
19	Giant Asian mantis	*Titanodula grandis*	LC	Op	Arthropoda
20	Bengal fiddler crab	*Austruca bengali*	VU	H,Op	
21	Edible crab/ brown crab	*Cancer pagurus*	LC	H, Op	

Note: RE-Regionally Extinct, CR-Critically Endangered, EN-Endangered, VU-Vulnerable, LC-Least Concern, NT-Near Threatened, DD-Data Deficient, NE-Not Evaluated.

5.4.4 Fisheries

Study area consists of different ponds, Rivers, canals, and Sea. In this area, Waterbodies bodies vary from fresh to brackish. Fish habitats of the area are mainly ponds, Rivers, canals, and Sea. Both natural and cultured fisheries exist in the study area. Local people and fishermen mentioned that this negative trend is due to overfishing, indiscriminate fishing of larvae and juveniles, siltation, and pollution. The findings clearly represent the declining trends of fish diversity in the study area which warning the gradual declination of fish diversity of Bangladesh. Some Common Fisheries within/around the project AoI are given in Annex K. The detailed list of surveyed Flora within/around the project AoI is given in Table 5.4.

Table 5-4: List of Fisheries found within/around the project AoI

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*
Dorosomatidae	*Tenualosa ilisha*	Hilsha	Ilish	**LC**
Megalopidae	*Megalops cyprinoides*	Indo-Pacific tarpon/ oxeye herring	Koral	**DD**
Synbranchidae	*Monopterus cuchia*	Asian swamp eel	Kuchia	**LC**
Amblycipitidae	*Amblyceps mangois*	Indian Torrent catfish	Shing	**LC**
Bagridae	*Mystus tengara*	Indian catfish	Tengra	**LC**

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*
	Sperata aor	Long-whiskered catfish	Aair	**VU**
Channidae	*Channa marulius*	Great snakehead	Gojar	**EN**
	Channa striata	Snakehead murrel	Shol	**LC**
	Channa punctata	Spotted snakehead	Taki	**LC**
Cyprinidae	*Labeo bata*	bata Labeo	Bata	**LC**
	Cirrhinus cirrhosus	Minnows and Carps	Mrigel	**LC**
	Labeo calbasu	Orange-fin labeo	kali Baush	**DD**
	Labeo catla	Indian carp	Katla	**LC**
	Puntius chola	Swamp barb	Puti	**LC**
	Labeo rohita	Ruhi	Rui	**LC**
	Puntius sarana	Olive barb	Sorputi	**LC**
Clariidae	*Clarias batrachus*	Walking catfish	Magur	**LC**
Malacostraca	*Penaeus monodon*	Prawn	Chingri	**LC**
Pangasiidae	*Pangasius pangasius*	Shark catfishes	Pangas	**LC**
Clupeidae	*Gudusia chapra*	Indian River Shad	Chapila	**VU**
Clupeidae	*Corica soborna*	Ganges River-sprat	Kachki	**LC**
Gobiidae	*Awaous grammepomus*	Tank goby	Bele	**VU**
Sciaenidae	*Otolithoides pama*	Pama Croaker	Poa	**LC**
Notopteridae	*Chitala chitala*	Indian featherback	Chitol	**EN**
Siluridae	*Wallago attu*	Cyprinidae	Boal	**VU**
Siluridae	*Ompok pabo*	Pabo catfish	Pabda	**CR**
Oxudercidae	***Periophthalmodon schlosseri***	**Giant mudskipper**	**Kolar Dauk**	**LC**

[NB: LC= Least Concern, EN = Endangered, VU = Vulnerable, DD = Data Deficient]

5.4.5 Protected Areas

There are no protected areas near the project AOI. As per ECR'2023, the minimum buffer zone for this yellow category project is 50 meters. Most nearby protected areas from the project area are- Nijhum Dwip (approx. 18 kilometers away from the project AoI), Char Kukrimukri Wildlife Sanctuary (approx. 48 kilometers away from the project AoI), and Sundarbans Reserve Forest (113 kilometers away from the project AoI). As these areas are more than 50 meters away from the project area, these areas probably will not be impacted due to project activities.

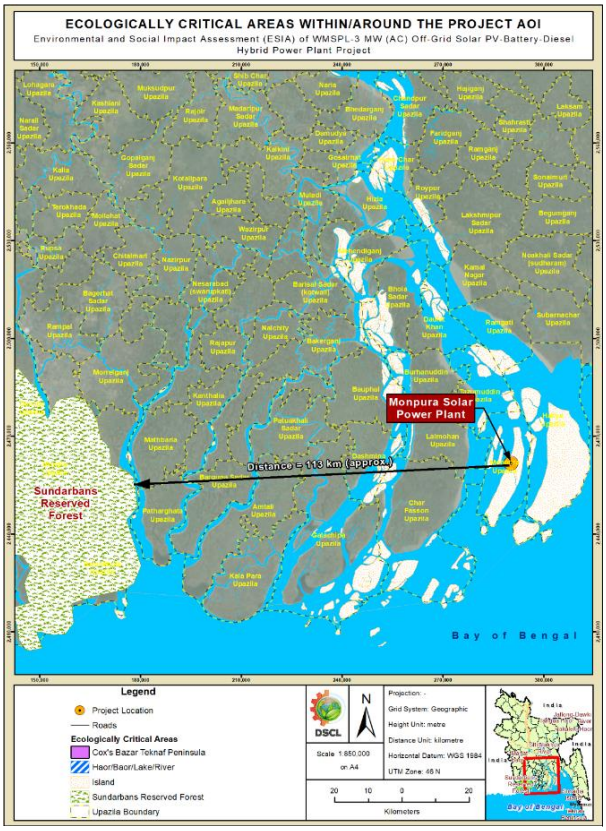


Figure 5-12: Ecologically Critical areas

5.5 Environmental Quality

The existing environmental quality in the project influence area serves as the basis for identification, prediction, and evaluation of potential environmental impacts of the proposed project interventions. The baseline environmental quality has been assessed through field studies from 04 July 2023 to 06 July 2023 within the impact zone and analysis of the information for various components of the environment, viz. air, noise, water, etc. Sampling photographs of environmental quality testing are given in Annex L and sampling location in figure 5.14.

5.5.1 Air Quality

Ambient air quality data at the project site measured to verify the current quality of air. The aim was to collect the baseline air quality data and to compare the data with the air quality data during project activities to check if there is any high air pollution level due to the construction activities and to design adequate mitigation measures, as applicable. The air quality testing was performed at and around the project location from 04 July 2023 to 06 July 2023 (figure 6.26). AEROQUAL Series 500 Portable air quality monitors were used for the measurement of particulate matters (PM_{10} and $PM_{2.5}$), SOx, NOx and O_3. Moreover, CO, Temperature and Humidity were measured by using the Lutron Air Quality Monitor Meter. Air quality monitoring has been done at 0_3 suitable places within/around the project AoI. The laboratory test result is given in Annex M. Results of the air quality monitoring at the project location have been shown in Table 5.5, whereas description of surrounding area has given in Table 5.6.

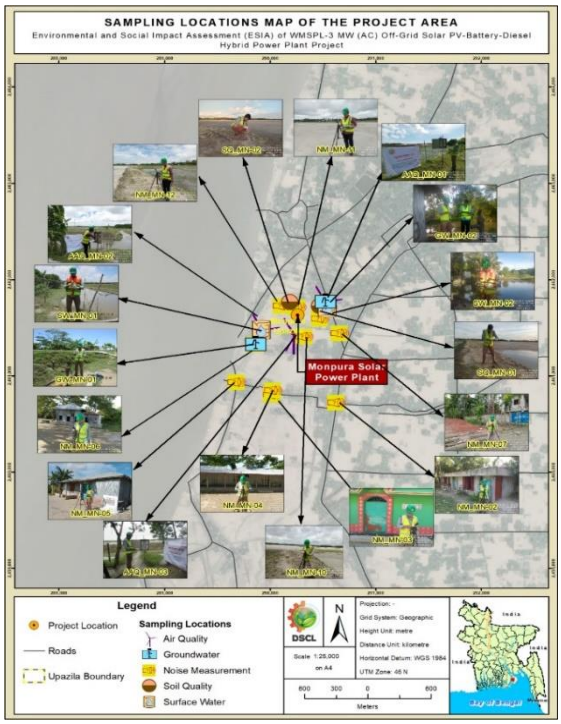


Figure 5-13: Sampling Location Map of the project area

Table 5-5: Test results of Ambient Air Quality Monitoring within/ around the project AoI

Parameter	Unit	AAQ_MN_01	AAQ_MN_02	AAQ_MN_03	Bangladesh Standard**	Duration (hours)	Method of Analysis
		Grammen Tower para, Hazirhat, Monpura, Bhola	Near Dasherhat Jame Mosque, Monpura, Bhola	Dasherhat, Monpura, Bhola			
		22.24872°N 90.96723°E	22.24606°N 90.96150°E	22.24570°N 90.96434°E			
		04 July 2023	05 July 2023	06 July 2023			
$PM_{2.5}$	µg/m³	22.4	24.6	27.6	65	24	AEROQUAL series 500 portable air quality monitors
PM_{10}	µg/m³	65.6	77.5	74.9	150	24	
SO_2	µg/m³	12.31	17.79	9.12	80	24	
NO_x	µg/m³	11.5	6.35	5.48	80	24	
O_3*	µg/m³	16	23.28	17.9	100	8	
CO*	PPM	1	0.08	1	05	8	Lutron AQ 9901
CO_2	PPM	340	300	328	NYS	8	
Weather Condition		Mostly Sunny	Sunny	Cloudy			

[Note:
*** The Bangladesh National Ambient Air Quality Standards have been taken from Air Pollution Control Rules which was published on 26 July 2022; NYS = Not Yet Standardized]*

Table 5-6: Description of the Surrounding Environment

Location	Sample Site Description
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(AAQ_MN_01)**	➢ Low amount of traffic movement was found. ➢ Low amount of people movement was found. ➢ Very Low amount of Visual dust was noticed. ➢ The weather was mostly sunny during the monitoring period. ➢ Air Quality monitoring location is located beside a Madrasa
Near Dasherhat Jame Mosque, Monpura, Bhola **(AAQ_MN_02)**	➢ Moderate amount of traffic movement was found. ➢ Moderate amount of people movement was found. ➢ Low amount of Visual dust particles was found. ➢ The weather was sunny during the monitoring period. ➢ Air Quality monitoring location is located beside a Mosque.
Near Jahangir Patwari's Bari, Dasherhat, Monpura, Bhola **(AAQ_MN_03)**	➢ Low amount of traffic movement was found. ➢ Low amount of people movement was found. ➢ Low amount of Visual dust was noticed.

Location	Sample Site Description
	➢ The weather was cloudy during the monitoring period

The air quality monitoring result shows that the time-weighted average value of all parameters such as the $PM_{2.5}$, PM_{10}, SOx, NOx, O_3 and CO concentrations have not exceeded the national standard limit as per the national standard according to DoE, Bangladesh. The air quality standard is not yet developed in the ECR 2023 for Parameter such as CO_2.

5.5.2 Noise Level Measurement

Noise Level Measurement was performed at and around the project location from 04 July 2023 to 06 July 2023. The calibrated Sound Level Meter set to A-weighting, fast response, and statistical analysis settings. The Sound Level Meter (SLM) will be mounted on a tripod at a height of approximately 1.5m, facing in the direction of the apparent predominant noise source. Noise measurement at each location was done continuously for 1 hour both day and nighttime. The laboratory test result and all photos are given in Annex N. Results of the noise level monitoring at the project location have been summarized in Table 5.7 whereas, description of surrounding area has given in Table 5.8. The result shows that the time-weighted average value of the sound monitored around the project is within national standard according to the Noise Pollution (Control) Rules, 2006.

Table 5-7: Test results of Noise Level Monitoring within/around the project AoI

Sample Location	Sample ID	GPS Location	Land Use Category	Date	Measurement Time		Noise Level dB(A) Leq		Bangladesh Standard dB(A) Leq	
					Day	Night	Day	Night	Day	Night
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola	NM_MN-01	22.24871°N 90.96721°E	Residential	4 July 2023	10:20am-10:50am	09:01pm-09:31pm	50.6	41.2	55	45
Near Muslim Para Jame Mosque, Monpura, Bhola	NM_MN-02	22.23933°N 90.96848°E		4 July 2023	11:30am-12:00am	09:45pm-10:15pm	53.1	38.4	55	45
Near Muslim Para Jame Mosque, Monpura, Bhola	NM_MN-03	22.24001°N 90.96258°E		4 July 2023	12:08pm-12:38pm	10:20pm-10:50 pm	49.6	40.6	55	45
Near Char Marium Nurani Hafezia Madrasa, Monpura, Bhola	NM_MN-04	22.24040°N 90.96266°E		4 July 2023	01:10pm-01:40pm	10:55pm-11:25 pm	42.5	36.2	55	45
Near Tofayel's Shop (Local Bazaar) in Dasherhat, Monpura, Bhola	NM_MN-05	22.24113°N 90.95928°E	Commercial	4 July 2023	02:10 pm-02:40 pm	11:30pm-12:00 pm	47.5	41.0	70	60
Near Dasherhat Jame Mosque, Monpura, Bhola	NM_MN-06	22.24473°N 90.96096°E	Residential	4 July 2023	03:15 pm-03:45 pm	12:10 am-12:40 am	51.2	43.8	55	45
Near Grammen Tower, Hazirhat, Monpura, Bhola	NM_MN-07	22.24584°N 90.96870°E		5 July 2023	11:00 am-11:30 am	09:35 pm-10:05 pm	48.67	43.6	55	45
Near Jamal Mia's Home, Grameen Tower para, Monpura, Bhola	NM_MN-08	22.24721°N 90.96687°E		5 July 2023	12:02 am-12:32 am	11:15 pm-11:45 pm	47.3	39.0	55	45
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola	NM_MN-09	22.24828°N 90.96759°E		5 July 2023	12:40 pm-01:10 pm	09:00 pm-09:30 pm	48.1	40.9	55	45
Northern side of Project Area, Monpura, Bhola	NM_MN-10	22.24550°N 90.96543°E		5 July 2023	01:30 pm-02:00 pm	10:15 pm-10:45 pm	44.1	39.9	55	45
Southern side of Project Area, Monpura, Bhola	NM_MN-11	22.24823°N 90.96475°E		5 July 2023	02:10 pm-02:40 pm	12:02 pm-12:32 pm	46.2	36.5	55	45
Western side of Project Area, Monpura, Bhola	NM_MN-12	22.24836°N 90.96334°E		5 July 2023	03:00 pm-03:30 pm	12:45 am-01:15 am	49.2	43.1	55	45

Notes: Land use category is based on the classification provided in the Noise Pollution (Control) Rules, 2006; The sound level standards for commercial area are 70 dBA at day time and 60 dBA at night time; The sound level standards for residential area are 55 dBA at day time and 45 dBA at night time; dB(A)Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. Noise Level is the average noise recorded over the duration of the monitoring period.

Table 5-8: Description of the Surrounding Environment

Sample Location and ID	Sample Site Description
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-01)**	➢ Traffic Movement was low; People movement was low; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-02)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-03)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Char Marium Nurani Hafezia Madrasa, Monpura, Bhola **(NM_MN-04)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Tofayel's Shop (Local Bazaar) in Dasherhat, Monpura, Bhola **(NM_MN-05)**	➢ Commercial Area; Low amount of traffic movement; Low amount of people movement. ➢ Most of the shops has been shuttered down during monitoring period.
Near Dasherhat Jame Mosque, Monpura, Bhola **(NM_MN-06)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Grammen Tower, Hazirhat, Monpura, Bhola **(NM_MN-07)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area
Near Jamal Mia's Home, Grameen Tower para, Monpura, Bhola **(NM_MN-08)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-09)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Northern side of Project Area, Monpura, Bhola **(NM_MN-10)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Monitoring Location was situated inside project area.
Southern side of Project Area, Monpura, Bhola **(NM_MN-11)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Monitoring Location was situated inside project area.
Western side of Project Area, Monpura, Bhola **(NM_MN-12)**	➢ Low amount of traffic movement; Low amount of people movement; Residential Area ➢ Monitoring Location was situated inside project area.

5.5.3 Surface Water Quality

Sampling from water bodies around the project AoI will be conducted for baseline establishment. The data for hydrological features of the project area will be obtained through Surface Water sampling. Surface water samples were taken from two locations in the project area on July 6, 2023. The samples were collected in plastic sampling bottles, kept in an ice cooler. After necessary stabilization/fixing, the sample was analyzed. The pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity, Oxidation-Reduction Potential (ORP), Salinity and Dissolved Oxygen (DO) were tested on-site by field kit. The samples have been sent to the UL VS Bangladesh Ltd. for analysis of the remaining parameters. Summary of the surface water quality testing at the project AoI has been shown in Table 5.9, whereas description of surrounding area has given in Table 5.10. The laboratory test results copy from UL VS Bangladesh Ltd. are given in Annex O of the report.

Table 5-9: Test results of Surface Water Quality within/around the project AoI

Parameters	Unit	SW_MN-01 Kumirkhali Khal, Dasherhat, Monpura, Bhola 22.24605°N 90.96149°E 6 July 2023	SW_MN-02 Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola 22.24822°N 90.96754°E 6 July 2023	Standards for Inland Surface Water** (Best fishing practice)	Arnalysis Method
pH*	-	7.88	7.92	6-9	Multimeter
Temperature*	°C	33.7	32.6	NYS	
Total Dissolved Solids (TDS)*	mg/L	1002	963	1000	
Electric Conductivity (EC)*	µS/cm	1114	1060	NYS	
Oxidation-Reduction Potential (ORP)*	mg/L	-51.4	-55.8	NYS	
Salinity*	mg/L	652	729	NYS	
Dissolved Oxygen (DO)*	mg/L	5.3	6.8	5 or more	DO Meter
Ammonia	mg/L	0.3	0.5	0.3	UV-Visible Spectrophotometer
Phosphate	mg/L	0.60	0.71	0.5	
Arsenic (As)	mg/L	0.00	0.005	NYS	Atomic Absorption Spectrophotometer
Total Suspended Solid (TSS)	mg/L	7	4	NYS	Gravimetric Method

Table 5-10: Description of the Surrounding Environment

Sample Location and ID	Sample Site Description
Kumirkhali Khal, Dasherhat, Monpura, Bhola **(SW_MN-01)**	• Sample was collected from adjacent canal (Kumirkhali Khal) • The depth from where the sample was collected is approximately 6 inches. • Waste dumping & local drains haven't been seen surrounding the sampling location. • This Khal contains water all year round. • This Khal has been used by local people for bathing purpose.
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola. **(SW_MN-02)**	• Sample was collected from a pond which is located beside a Mosque. • The depth from where the sample was collected is approximately 6 inches. • Waste dumping & local drains haven't been seen surrounding the sampling location. • This Pond contains water all year round.

Sample Location and ID	Sample Site Description
	• This pond has been used by Local people for washing and bathing purpose.

The surface water quality standard is not yet developed in the ECR'2023 except for a few parameters. From the test result, it is seen that all the parameters are within national standards except one parameter such as Total Dissolved Solids in SW_MN-01 [Kumirkhali Khal, Dasherhat, Monpura, Bhola].

5.5.4 Groundwater Quality

Groundwater samples were taken from two locations in the project area on July 6, 2023. The samples were collected in plastic sampling bottles, kept in an ice cooler. After necessary stabilization/fixing, the sample was analyzed. The pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity, Oxidation-Reduction Potential (ORP), Salinity and Dissolved Oxygen (DO) were tested on-site by field kit. The samples have been sent to the DPHE & UL VS Bangladesh for analysis of the remaining parameters. Summary of the groundwater quality at the project AoI have been shown in Table 5.11 whereas, description of surrounding area has given in Table 5.12. The laboratory test results copy from UL VS Laboratory are given in Annex P of the report.

Table 5-11: Test results of Groundwater Quality within/around the project AoI

Parameters	Unit	GW_MN-01	GW_MN-02	Standards for Potable Water**	Analysis Method
		Near Dasherhat Jame Mosque, Monpura, Bhola	Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola		
		22.24584°N 90.96870°E	22.24877°N 90.96733°E		
		6 July 2023	6 July 2023		
pH*	-	7.40	7.50	6.5-8.5	Multimeter
Electric Conductivity (EC)*	µS/cm	463	384	NYS	
Total Dissolved Solids (TDS)*	mg/L	635	602	1000	
Salinity*	mg/L	557	480	NYS	
Oxidation-reduction potential (ORP)*	mV	-20.6	-23.3	NYS	
Temperature*	˚C	32.5	29.4	20-30	
Dissolved Oxygen (DO)*	mg/L	6.2	5.8	NYS	DO Meter
Total Suspended Solid (TSS)	mg/L	1	1	10	Gravimetric Method
Total Arsenic (As)	mg/L	<0.02	<0.02	0.05	Acid Digestion with ICP Analysis
Total Coliform (TC)	CFU/100mL	0	0	0	With Reference USEPA 9132
Fecal Coliform (FC)	CFU/100mL	0	0	0	Membrane Filtration

*[Notes: *On-site testing*

***The standard for groundwater is obtained from Schedule-2 (B) of Environment Conservation Rules, 2023.*

NYS = Not Yet Standardized]

Table 5-12: Description of the Surrounding Environment

Sample Location and ID	Remarks
Near Dasherhat Jame Mosque, Monpura, Bhola **(GW_MN-01)**	• This tube well is about 250 feet deep which is established in 2020. • This tube well is mainly used for drinking and washing purposes. • The nearby toilet with an adjacent septic tank is situated approximately 20 meters away from the tube well. • Agricultural land is 10 meters away from this tube well.
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(GW_MN-02)**	• This tube well is about 280 feet deep which is established in 2017. • Water from this tube well is used for drinking and other domestic working purpose. • Nearby toilet is situated 5 meters away from the tube well. • septic tank is 3m away from the tube well • Agricultural land is 2 meters away from the tube well.

The groundwater quality standard is not yet developed in the ECR'2023 except for a few parameters. From the test result, it is seen that all the parameters are within national standards except one parameter such as Temperature in GW_MN-01 [Near Dasherhat Jame Mosque, Monpura, Bhola.

5.5.5 Soil Quality

Soil samples were collected from the project-influenced location on 04 July 2023. The samples were first placed in zipped-lock plastic bags and then transferred to plastic jars/bottles). The samples were sent to UL VS Laboratory for testing for further analysis. The test results of the soil quality at the project locations have been shown in Table 5.13. The laboratory test results copied from UL VS Laboratory are given in Annex Q of the report.

Table 5-13: Test results of Soil Quality within/around project AoI

Test parameters	Unit	Concentration Present		Dutch Standard for Soil	Method of Analysis
		Southern side of Project Area, Monpura	Western side of Project Area, Monpura		
		SQ_MN_01	SQ_MN_02		
		22.24838°N 90.96678°E	22.24872°N 90.96404°E		
		4 July, 2023	4 July, 2023		
Total Lead (Pb)	mg/kg	9.7	11.9	85	Acid Digestion with ICP analysis
Total Chromium (Cr)	mg/kg	28.7	26.3	100	
Total Mercury (Hg)	mg/kg	<0.1	<0.1	0.3	
Total Cadmium (Cd)	mg/kg	<0.5	<0.5	0.8	
Total Zinc (Zn)	mg/kg	33.9	37.6	140	
Total Arsenic (As)	mg/kg	<5	<5	29	

[Notes: NYS-Not Yet Standardized]

There is no Bangladesh regulation/standard for soil. In the absence of standard for soil in local country, it is the environmental consultant's practice to use globally recognized 'Dutch Ministry of Public Housing, Land-use, and Environmental Guidelines - Soil and Groundwater Standards' to assess soil quality and to determine the need, if any, for remedial action. Parameters analyzed in baseline quality of soil were observed to be well below the threshold limits for Intervention as per the Dutch Standards where most of the parameters are not yet set standards according to Dutch Standards. From the test results, the concentration of Total Lead (Pb) in all soil sampling locations from the project AoI is less than 85 mg/Kg, which matches Dutch standards. Lead concentration ranges from 9.7 mg/kg to 11.9 mg/kg. From the test results, the concentration of Total Chromium (Cr) in all soil sampling locations from the project AoI is less than 100 mg/Kg, which matches Dutch standards. Concentration of Total Chromium (Cr) ranges from 26.3 mg/kg to 28.7 mg/kg. There is no Bangladesh regulation/standard for soil. In the absence of standard for soil in local country, it is the environmental consultant's practice to use globally recognized 'Dutch Ministry of Public Housing, Land-use, and Environmental Guidelines - Soil and Groundwater Standards' to assess soil quality and to determine the need, if any, for remedial

action. Parameters analyzed in baseline quality of soil were observed to be well below the threshold limits for Intervention as per the Dutch Standards where most of the parameters are not yet set standards according to Dutch Standards. From the test results, the concentration of Total Lead (Pb) in all soil sampling locations from the project AoI is less than 85 mg/Kg, which matches Dutch standards. Lead concentration ranges from 9.7 mg/kg to 11.9 mg/kg. From the test results, the concentration of Total Chromium (Cr) in all soil sampling locations from the project AoI is less than 100 mg/Kg, which matches Dutch standards. Concentration of Total Chromium (Cr) ranges from 26.3 mg/kg to 28.7 mg/kg. From the test results, the concentration of Total Mercury (Hg) in all soil sampling locations from the project AoI is less than 0.3 mg/Kg, which matches Dutch standards. Concentration of Total Mercury (Hg) from all sampling location have same value is <0.1. From the test results, the concentration of Total Cadmium (Cd) in all soil sampling locations from the project AoI is less than 0.8 mg/Kg, which matches Dutch standards. Concentration of Total Cadmium (Cd) from all sampling location have same value is <0.5. From the test results, the concentration of Total Zinc (Zn) in all soil sampling locations from the project AoI is less than 140 mg/Kg, which matches Dutch standards. Lead concentration ranges from 33.9 mg/kg to 37.6 mg/kg. From the test results, the concentration of Total Arsenic (As) in all soil sampling locations from the project AoI is less than 29 mg/Kg, which matches Dutch standards. Concentration of Total Arsenic (As) from all sampling location have same value is <5.

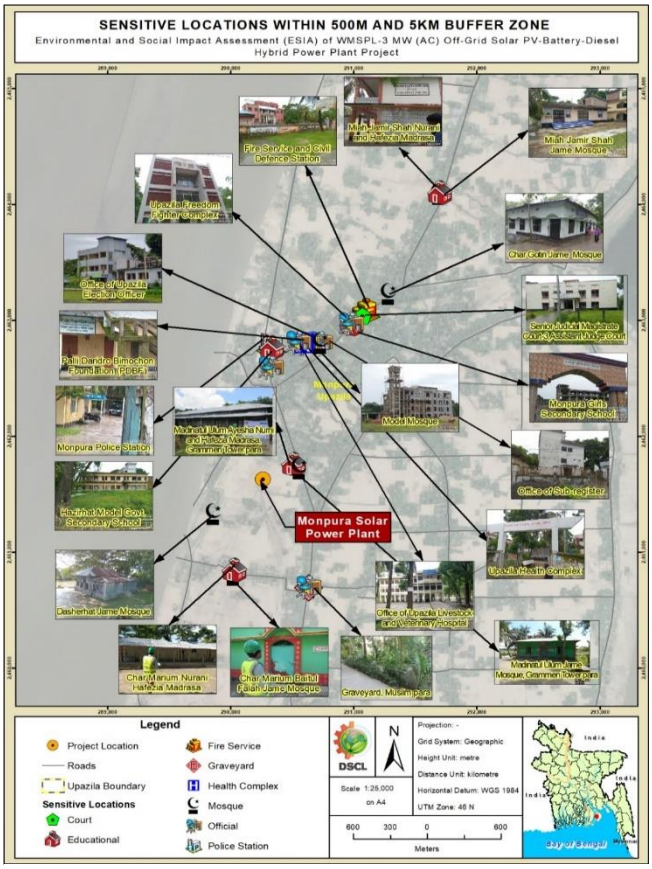


Figure 5-14: Environmental & Social Hotspots within 500 Meter and 5km Buffer zone

5.6 Environmental and Social Hotspot

The construction sites are located in rural areas on land owned by project proponents. The socio-cultural aspects include the educational institutions, hospitals/health centers, religious structures, cultural structures, burial grounds, marketplaces, water bodies, etc., few of which would be affected directly and indirectly through implementation of the project. Such sites could be termed as Environmental Hotspots in relation to project activities and, hence, need to be dealt with with care during the construction phase. Locations of major environmental hotspots in the project area are shown in Figure 5.15. A detailed list of the cultural and sensitive areas located within 1 km radius of the project area is presented in Appendix N. All persons surveyed during the household survey were Bengali, with no indigenous groups recorded. There is no historical archeological site within 1km buffer of the project alignment

6 DESCRIPTIONS OF THE SOCIAL CONDITION

It is essential for every development project, whether small or large, to understand the social, human, and economic aspects of the primary stakeholders, i.e., people living in and around the project site. This section provides a profile and analysis of the socio-economic characteristics and practices that currently exist within the project area. The following tools and techniques were used to collect the relevant data/information on the social and economic aspects of affected people:

- Literature review: In addition, data was enumerated from different official records and published reports of Bangladesh Bureau of Statistics (BBS), Population Census Reports and also reports of other organizations.
- Group discussion; and
- Informal meetings with various professionals.
- Interviews with Local people

6.1 National Context

Bangladesh has experienced steady economic growth and improvement in macroeconomic stability during recent years, particularly in the past decade. This has been despite numerous natural disasters and external forces such as the global economic crisis. In Bangladesh, the population living below the national poverty line dropped to 20.5% in 2019 from 24.3% in 2016. The growth of gross domestic product (GDP) in 2020 is 3.51% and in 2021 is 4.6%. Bangladesh has an impressive track record of growth and poverty reduction.

Despite the improving track record, nearly one-third of the 160 million population is living below the national poverty line, according to World Bank's data in 2010. As such Bangladesh faces considerable challenges, including from ongoing natural disasters such as cyclones and floods, and from the potential impacts from climate change. Key development indicators for Bangladesh are provided in Table 6.1.

Table 6-1: Key Socio-economic indicators for Bangladesh

Key Indicator	Value
GDP (US$ billions), 2021	416.26
GDP per capita (US$), 2021	2,457.9
Exports of goods and services (% of GDP), 2020	11.99%
Imports of goods and services (% of GDP), 2020	18.53%
Agriculture (% of GDP), 2020	12.92%
Industry (% of GDP), 2020	29.54%
Services (% of GDP), 2020	53.4%
Population living below national poverty line, UNDP (2005)	24.3%
Life expectancy (2022)	73.29
Adult literacy rate (% age 7 and above), 2020	74.909%
Population with sustainable access to improved sanitation (%),2016	61%
Population with sustainable access to water source (%),2013	97%

6.2 Administrative Information

It is important to highlight the administrative setup as framed by District and Municipal boundaries of the Project area, as those will be referred to many times throughout the ESIA document. The project Area of Influence (AOI) is located within Hazirhat, Dasherhat and Grameen Tower Para from Hazirhat Union, Monpura Upazila, Bhola District. The upazilla consists of 3 Unions, 21 Mouza and 27 Village. The total area of the Monpura upazila is 373.19 Km2, located in between 22°06' and 22°26' north latitudes and in between 90°52' and 91°01' east longitudes. It is bounded by Tazumuddin Upazilla on

the north, Bay of Bengal on the south, Hatiya Upazila on the east, Lalmohan and Char Fasson upazilla on the west. However, the total area of the South Sakucia union is 40.649 Km^2.

Table 6-2: Administrative areas within/around project AoI

District	Upazila	Union
Bhola	Monpura Upazila	Dakshin Sakuchia
		Hazirhat
		Monpura
		Uttar Sakuchia
Total	**01**	**04**

6.3 Demographic Information

Monpura Upazila is situated in the southern part of Bangladesh, within the administrative boundaries of the Bhola District. The Bhola District is part of the Barisal Division. The upazila is characterized by its riverine landscape, with numerous rivers, water bodies, and wetlands. The region is part of the delta formed by the confluence of several rivers, including the Meghna River. Monpura upazila has an area of 373.19 km^2 with a population of 145000. There are 37 (Govt. – 14 & RG – 23) primary school, 7 high school, 2 college, 25 Madrasha, 35 Masjid, 5 Mandir, 20 Hat-Bazar, 1 govt. hospital, and 10 NGOs. Monpura is surroundd by the Meghna River. The detail of demographic profile of the project area is presented below (Table 6.3). The demographic information is collated from Population Census, 2011 by Bangladesh Bureau of Statistics (BBS).

Table 6-3: Demographic Profile of the project area.

Upazila	Households	Population		Sex Ratio	Population Density
		Male	Female		
Monpura Upazilla	17,080	51%	49%	102	205

6.3.1 Household Size

Comparison of the data collected during household surveys found that the average household size of these villages was 4.48 members per household. The majority of households were headed by males.

6.3.2 Gender Distribution

The sex ratio of the population is defined as the number of males per 100 females. In the country as a whole the sex ratio has increased at around 106.4 since 2001, with the reported ratio for 2011 being 100.3. However, there is a significant urban-rural difference in sex ratios; This difference can mainly be attributed to male labor migration to urban areas.

The sex ratio of the population in the Monpura surveyed within the Project Area was 102 females per 100 males. This ratio is greater than the National rural sex ratio of 100.3 given above. Among total 76582 persons living within the 17080 households surveyed, 38746 (51%) were males and 37836 (49%) were females.

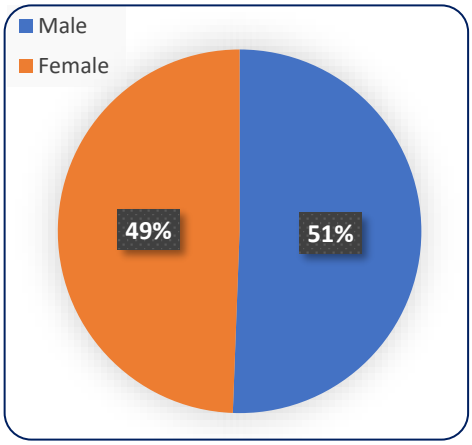


Figure 6-1: Percentage of Gender Distribution

6.3.3 Nutrition and health Issues

Monpura is the one of the most food insecure populations. It faces challenges in accessing a balanced diet, leading to malnutrition, particularly among children and pregnant women. Clean water and proper sanitation facilities are essential for health and in the project AoI, these basic amenities are lacking, leading to waterborne diseases. Access to healthcare services, including hospitals and clinics, is another issue there, making it difficult to address health issues effectively.

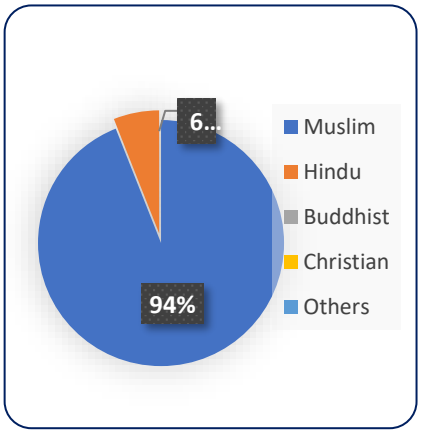


Figure 6-2: Percentage of Religion Variation

6.3.4 Religion

The predominance of the Muslim faith was reflected in the results of the household survey, with 94 percent of persons surveyed recorded as Muslim, and the remaining 6 percent being Hindu.

Table 6-4: Religion Variation within/around the project AoI

Upazila	Total Population	Muslim	Hindu	Buddhist	Christian	Others
Monpura Upazila	17080	94%	5.99%	0	0.01%	0

6.3.5 Ethnicity

There are no ethnic groups in Monpura. During the household survey all the people near project AoI were Bengali, with no indigenous groups recorded.

6.3.6 Education

The literacy rate of this island is 31.9% for both male and female (BBS, 2011). There are 2 colleges, 8 secondary schools, 39 primary schools and 35 madrasahs are in the project location.

Table 6-5: Literacy rate within/around the project AoI

District	Population	Male	Female
	% of Total Literate	% of Males Literate	% of Females Literate
Monpura	31.9	32.2	32.1

6.4 Land Use and Ownership

Lands at the Monpura area are mainly used for agriculture, fisheries, homestead, homestead forestry agro-forestry, and vegetation, animal husbandry, etc. The area where the project is proposed is characterized by an agricultural ecosystem. This Social Due Diligence report (separate SIA and LSA) assessed the land taking procedures for the 3 MW (AC) Off-Grid Solar-Battery-Diesel Hybrid Power Plant Project (the Project), undertaken by Western Monpura Solar Power Ltd. It follows the guidelines of IDCOL's Environmental and Social Framework (ESSF), the World Bank's ESF/WB guidelines, and relevant government policies.

The project required a total of 27.40 acres of land acquired through purchase. The allocation of land for different project components was carefully planned, with approximately 26.00 acres designated for the 3 MW (AC) Off-Grid Solar-Battery-Disel Power Plant solar area and approx. 1.40 acre for free area. The voluntary land transactions were conducted in a transparent and fair manner, with both parties willingly participating in the process. Throughout the land procurement process, proper legal procedures were followed to validate the transactions and protect the interests of all parties involved. Thorough documentation and verification processes were undertaken to establish a clear chain of ownership and ensure the legality of the land transfer.

The allocation of land for different project components was carefully planned, with approximately 26.00 acres designated for the 3 MW (AC) Off-Grid Solar-Battery-Disel Power Plant solar area and

remaining for free area. A separate Land Status Assessment (LSA) report has been prepared regarding this. It was determined that there were 52 private landowners, all of whom were compensated based on the agreed price. The agreed price exceeded the mouza rate and, in most cases, was five times higher. All landowners' farmers were engaged in the cultivation of crops such as rice, nuts, and vegetables/seasonal crops. The affected land was primarily used for one-crop cultivation. But, due to salinity issues these lands are only used once yearly, and as soil fertility is low, lands were barely cultivated there. None of the landowners lost any residential or commercial structures, and they all have existing residential structures in the surrounding areas. As per the LSA report major findings are–

- All the landowners received compensation;
- All the lands are taken through willing buyer willing seller process;
- No lands are taken forcefully; and
- All the landowners confirmed that they have received compensation as per market Rate.

Additional information can be found in the individual SIA and LSA reports, which have been provided separately.

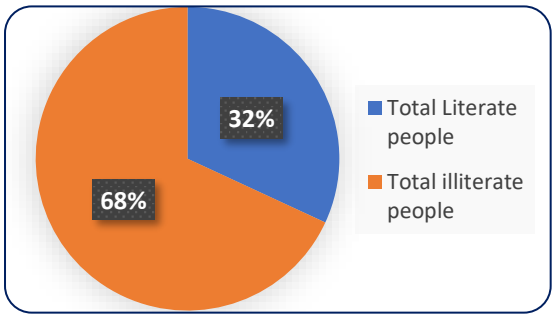


Figure 6-3: Percentage of Literacy rate

6.5 Occupational Patterns

Livelihoods encompass systems of accommodation and settlement, income-generation, and resource use, as well as systems of social interaction, cooperation, and mutual support. Recent reports on socio-economic development in Bangladesh refer to the changing nature of rural livelihoods with most households being shown to be pursuing a diversified range of activities for their livelihoods. Therefore, information provided below on occupational status collected through household surveys provides more of a broad insight into livelihood strategies in the Project area.

6.5.1 Occupational Status

Most people in the Project area are either underemployed or unemployed, though most people disguise their unemployment by minor involvement in economic activities. Being underemployed is defined as "the condition whereby a person's employment is considered inadequate in terms of time worked, income earned, productivity or use of his/her skills and the person is looking for additional work in conformity with his/her education or skill to augment income."

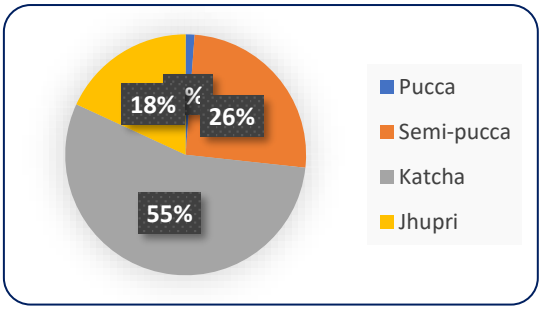


Figure 6-4: Percentage Housing Condition within/around the project AoI

During the study time the primary occupation in the study areas were found as agriculture, business, service holder, shopkeeper, fisherman and others. The study revealed, most of the respondent's occupation is fisherman followed by the farmer, businessman, service holder, Shopkeeper, and others.

6.6 Housing Characteristics

There are some households and bazar take places near the site. The subprojects influence area is predominantly kutcha, semi pucca and pucca houses found in the semi-urban or village area. The dwelling households by type of structure were found that pucca and semi-pucca household structures remain higher in urban area comparing to the

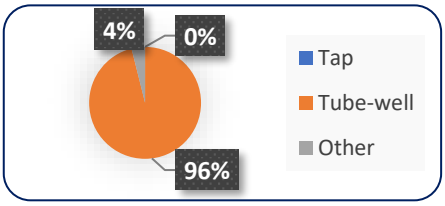


Figure 6-5: Drinking water access

rural area and Upazila. However, the project location is in agricultural land with no households or infrastructures will be affected.

6.7 Utility service

Within the project areas, the major source of drinking water is tube-well where about 75% of the population use tube-well water. On the other hand, rest of the people have access to Supply/pipe water (In house/outside), Govt. well, Fountain, river, pond, or canal.

Table 6-6: Sanitary Facilities within/around the project AoI

Sub-district	No. of HH	Toilet Facility			
		Sanitary (Water sealed)	Sanitary (Without water sealed)	Non-sanitary	None
Monpura Upazila	17016	203	4342	9389	3082

Within the project areas, the major source of drinking water is a tube -well where about 96% of the population use tube-well water. On the other hand, less than 1% of people have access to tap water. The other 4% of people have access to neither tube-well nor tap water and consequently have to rely on nearest surface water sources i.e., river, pond, or canal.

Table 6-7: Water access within/ around the project AoI

Sub-District	No. of HH	Source of Drinking Water (%)		
		Tap	Tube-well	Other
Monpura Upazila	17	8	16344	664

Electricity is an important indicator for measuring quality of life. In these project areas, only 62.40% of the households have electricity connections.

Table 6-8: Electricity Facilities within/around the project AoI

Sub-district	No. of HH	Electricity Connection (%)
Monpura Upazila	17016	2398

Commercial energy consumption in Bangladesh is approximately 71 percent based on natural gas, with the remainder almost entirely oil (and limited amounts of hydropower and coal). Whilst electricity consumption is on the increase, this is mostly apparent in urban areas with rural areas remaining reliant on non-commercial forms of energy such as wood, animal waste, and crop residues. In terms of actual energy or fuel usage, all households surveyed used leaves and straw as the primary energy sources.

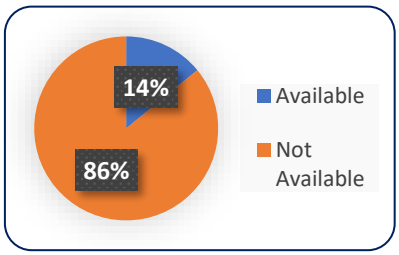


Figure 6-6: Percentage of Electricity Facilities

6.8 Settlement Pattern and Housing

The settlement patterns observed during field visits reflected the rural nature of the Project area, with scattered villages surrounded by agricultural fields. In the villages, a homestead is often occupied by an extended family and typically consists of a few houses and outbuildings, surrounded by fruit trees.

The majority of households surveyed within the Project Area owned their own home (83.5%). Of those not owning their own home, alternative arrangements included living in a house owned by relatives or being a tenant.

6.9 Transport and Communications

The project area is connected with Dhaka by waterways. The modes of transport on the island and to the project areas are motorbike and auto. People of this island are connected with mobile networks for regular communication.

6.10 Poverty

Almost all the families of this island are engaged in some earning activities. During the field visit it was observed that people usually go to the town or further for a better income. Many of them stay abroad and send remittance to their families. Female usually remain at home and do the household work. Among the employed people most are doing business, fishing, working in the agricultural field, some are drivers, some work in industry outside island and rest are doing service.

6.11 Recreational Activities

The social need for recreation has been identified as compulsory. The island people have very limited access to recreational activities. There is no such dedicated place or regular activities for recreational purposes. However, there are some houses that have bought televisions, but not all people have the ability to buy the valuable means of recreation. Additionally, without having access to electricity the available television is not worth it at all sometimes. Because of the lack of electricity people in this area are not interested in establishing any recreational center at all.

6.12 Summary of LSA

6.12.1 Introduction

This Social Due Diligence report assesses the land taking procedures for the 3 MW (AC) Off-Grid Solar-Battery-Diesel Hybrid Power Plant Project (the Project), undertaken by Western Monpura Solar Power Ltd. It follows the guidelines of IDCOL's Environmental and Social Framework (ESSF), the World Bank's ESF/WB guidelines, and relevant government policies.

According to the World Bank's policy, land acquisition is not allowed if the "willing buyer, willing seller" (WBWS) procedure fails. The Project has taken all land through the WBWS modality. It is important to note that the construction of the solar plant is under construction. For the construction, the project has taken 27.40 acres of land through a willing buyer-willing seller basis.

Monpura Island is an off-grid remote sea Island of the country. There are about 18,404 potential customers of electricity available in the Island out of which about 10,585 customers are currently using Solar Home Systems. Another 2500 customers are being provided with electricity from three (3) privately owned solar mini grids with a combined capacity of 675 kWp and 853 customers are directly being supplied with electricity from WZPDCL’s 1650 kVA diesel generator plant.

The purpose of this Social Assessment report is to examine the due diligence procedures involved in land acquisition and ensure compliance with all relevant policies.

6.12.2 Background and Purpose

Energy is a crucial asset for the economic growth of any country, and electricity is widely accepted for both industrial and residential use. In Bangladesh, the current electricity generation is insufficient to meet the increasing demand due to limited resources and technology. However, solar energy holds great promise in the country. Advancements in 21st-century technology have made it easier to generate electricity from solar energy, offering an opportunity to reduce dependency on the national grid.

The purpose of this project is to harness the potential of solar energy and leverage the advancements in solar-based technologies. With the decreasing costs of solar panels globally, electricity generated from solar sources is expected to become more cost-effective compared to traditional sources. This incentivizes industries to install solar PV-based power plants, leading to future savings on electricity expenses. The current cost of electricity from solar plants is already comparable to the grid tariff, and it is projected to become even more affordable than the grid tariff in the future due to the declining prices of solar technologies.

However, it is important to recognize that solar projects have inherent environmental and social impacts. In Bangladesh, solar projects with a capacity of more than 1 MW fall under the 'Orange B' category according to the Department of Environment's (DoE) Environmental Conservation Rules (ECR) 2023. Thus, conducting a Land Status Assessment (LSA) becomes a crucial planning and decision-making tool for the project proponent.

The project aims to generate electricity through PV power, which is a pollution-free method compared to conventional electricity generation. This clean energy production from renewable resources will contribute to reducing the consumption of alternative fuels such as gas, coal, and liquid fuels, leading to a decrease in greenhouse gas emissions and air pollutants. By lowering electricity generation costs compared to conventional fuels, the project will help reduce the fiscal deficit of the Government of Bangladesh. Recognizing the potential of the sector, the Infrastructure Development Company Limited (IDCOL) has explored opportunities to promote and develop solar power plant projects to contribute to alternative and renewable energy production in the country.

6.12.3 Project Description

The proposed project is 3 MW (AC) Off-Grid Solar-Battery-Diesel Hybrid Power Plant by Western Monpura Solar Power Ltd. (WMSPL) The plant will have 11 MWp of solar PV panels, 22 MWh of Li-ion based storage systems and 3 diesel generators of 850 KVA each. The People's Republic of Bangladesh represented by the Power Division, Ministry of Power, Energy and Mineral Resources accords its approval on the levelized tariff of BDT 21.25/kWh on "No Electricity, No Payment" basis to the Western Renewable Energy (Pvt.) Ltd. (WREL) and grants its permission to design, finance, insure, construct, own, commission, operate and maintain the facility. Net energy output from the facility will be purchased under the Power Purchase Agreement by West Zone Power Distribution Company Limited. The electric power to be generated by the Facility will be evacuated to the 11 kV distribution networks of West Zone Power Distribution Company Limited.

Total inhabitants of Monpura upazila are more than 130 thousand. Electricity supply in Monpura upazila comes from 3 small size solar Mini-grid projects with a cumulative capacity of approx. 700 kWp. Apart from that there is a diesel burnt generator which provides limited access to electricity. Under this situation the people of Monpura are facing great electricity scarcity. Therefore, this Off-Grid Solar-Battery-Diesel Hybrid Power Plant will play a significant role in meeting the electricity demand of Monpura.

The PV panels will be mounted on civil structures strong enough to withstand the wind effect of tropical storms, cyclones etc. Solar panels contain many photovoltaic cells linked together which instantaneously convert sunlight into electricity. Several solar PV panels are connected in series to achieve some voltage that is suitable for optimal operation of grid connected inverters. The output of inverters is 50Hz AC which will be stepped up to 11 kV through transformers and will be fed to the station switchyard. Then the power will be distributed to the load of Monpura through 11 kV WZPDCL distribution line.

The Project will be environmentally friendly as it will generate minimum pollution or effluent. It will generate noise only if the backup generator starts. The generator will run only in extreme situations during the rainy, overcast or foggy days. As per the signed PPA, the generator can supply only upto 10% of the total generated energy per year. No water would be required for cooling or electricity generation except a small quantity will be needed for periodical PV panel cleaning. Ground water could be extracted from deep tube well for the usage of the employees of the project as well as for panel cleaning after proper treatment (if required). However, the quantum of groundwater withdrawal will be very less.

Western Monpura Solar Power Ltd. (WMSPL), constituted under The Companies Act (Bangladesh), 1994 and its successors and permitted assigns. The project Company.

Western Monpura Solar Power Limited. (WMSPL) as sponsor and borrower, has implemented a 3 MW (AC) Solar PV- Battery-Diesel Hybrid Power Project on Build-Own-Operate (BOO) basis at Dasher Hat, Hazi Hat Union, Monpura Upazilla, Bhola, Bangladesh.

Western Renewable Energy (Pvt.) Ltd. (WREL), constituted under The Companies Act (Bangladesh), 1994 and its successors and permitted assigns. The sponsor Company.

6.12.4 Impact of the Project

The process of land taking has been completed for the project, and the team has conducted meetings with landowners and thoroughly verified all land documents to ensure that the principles of willing buyer-willing seller were followed, and lands were taken without any coercion. To assess the impact of the project, comprehensive surveys and constructive stakeholder consultation meetings were conducted, covering both household and community levels.

The project required a total of 27.40 acres of land acquired through purchase. The allocation of land for different project components was carefully planned, with approximately 26.00 acres designated for the 3 MW (AC) Off-Grid Solar-Battery-Disel Power Plant solar area and approx. 1.40 acre for free area.

During the land verification process, it was determined that there were 52 private landowners, all of whom were compensated based on the agreed price. The agreed price exceeded the mouza rate and, in most cases, was five times higher. All landowners' farmers engaged in the cultivation of crops such as rice, nuts, and vegetables/seasonal crops. The affected land was primarily used for one-crop cultivation. None of the landowners lost any residential or commercial structures, and they all have existing residential structures in the surrounding areas.

During the construction phase, 80% of the workers were recruited from the local community. Many affected landowners are providing job opportunities in the construction phase, The project has had financial implications for all households, but fortunately, no households have expressed physical displeasure due to the implementation of the project. Through extensive consultations and considering diverse stakeholder perspectives, efforts have been made to ensure that the project progresses with sensitivity and inclusivity, addressing the financial implications while striving to minimize any negative physical impacts on the affected households.

6.12.5 Scoping and Consultation

During preparation of the Land Status Assessment (LSA) report, team has conducted consultations and FGDs with the landowners and non-titled farmers to know the process taken by the Western Monpura Solar Power Ltd. during preparation and implementation stage. During the consultation meeting with the stakeholder, it is confirmed that has incorporated public consultation, including stakeholder identification, to ensure their perspectives are taken into account. During the construction phase of the project, the contractor has developed a detailed stakeholder engagement plan. In terms of land taking acquisition, the project authority has taken acquired the necessary private lands in a manner that benefits both parties and avoids any negative repercussions. The LSA document thoroughly considers all potential impacts that may arise from the project activities and provides appropriate mitigation measures. To address project-related queries, complaints, and grievances regarding the application of social impacts assessment and mitigation guidelines, the Project Management has established a Grievance Redress Mechanism (GRM) committee. This committee is responsible for responding to queries, addressing complaints, and resolving grievances amicably and expeditiously, without the need for costly and time-consuming legal actions.

Consultation meetings are the channels to ensure participation of the project beneficiary and affected population to give their opinions to be integrated in the project planning process. All relevant views of affected people and other stakeholders need to be considered in decision making, such as project design, the sharing of development benefits and opportunities, and implementation. A total of 02-

consultation meetings and 02 FGD meetings have been conducted at in September 2023 during the conducting Land Assessment and Socio-economic survey period on the project site. Consultation meetings were held on 22 and 23 September 2023 at Project area during the conducting Land Assessment survey of the project area. Therefore, female participations also have been ascertained in the meetings, as well as the female household heads were separately interviewed during Land Assessment survey. The focus group meetings were arranged among landowners, as these are the most prominent groups along the alignment. Affected people and other stakeholders were consulted during Land Assessment and Socio-economic survey. The consultation process was adopted to share the necessary information on the project timeline and purposes of the surveys as well as building rapport with the affected households and communities. During community level meetings, people were informed about the project objectives and extensive question and answer sessions were conducted to clarify the project related work and activities.

6.12.6 Socio-Economic Profile

To assess the current socio-economic status, a survey was conducted on 35 households comprising 52 individuals whose land or livelihood were affected. The survey aimed to capture the socio-economic profile of the affected population, including factors such as gender, age distribution, religion, income, expenditure, occupation, and education level in the project-affected area.

The average household size is 5.20 individuals. Male-headed households account for 85.71% of the total, while female-headed households represent only 14.29%. The age-sex distribution indicates that the majority of the population falls within the age range of 30-59 years. However, the population sharply decreases after 60 years of age. In terms of religion, most of the population in the project area are Muslim. Interestingly, the survey findings indicate that females have a higher level of education compared to the male population in the project area.

6.12.7 Summary Finding

1. All the landowners received compensation.
2. All the lands are taken through the willing buyer willing seller process.
3. No land is taken forcefully.
4. All the landowners confirmed that they have received compensation as per market Rate.

7 ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION MEASURES

7.1 General

This section identifies the overall impacts on the physical, biological, and socio-economic environment of the project area. An environmental impact is defined as any change to an existing condition of the environment. Identification of potential impacts has been done on the basis of baseline data collected from secondary and primary sources. Environmental impacts assessment was carried out considering the present environmental setting of the project area, and nature and extent of the proposed activities.

7.2 Impact Magnitude

The potential impacts of the project have been categorized as major, moderate, minor, or nominal based on consideration of the parameters such as: i) duration of the impact; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria. These magnitude categories are defined in table 7.1.

Table 7-1: Parameters for Determining Magnitude

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

7.3 Sensitivity of Receptor

The sensitivity of a receptor has been determined based on review of the population (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity in relation to the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table 7.2.

Table 7-2: Criteria for Determining Sensitivity

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

Assigning Significance: Following the determination of impact magnitude and sensitivity of the receiving environment or potential receptors, the significance of each potential impact has been established using the impact significance matrix shown below in Table 7.3.

Table 7-3: Significance of Impact Criteria

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

7.4 Summary of Assessed Impacts

The project's potential impacts on the key environmental parameters have been assessed and their significance determined using the methodology described in Section 8.3 above. A summary of the potential impacts of the project on the key environmental parameters and significance of these impacts are presented for different phases of this project; the potential impacts are discussed in the subsequent sections. Potential environmental impacts associated with the proposed project activities of both the projects are classified as:

i) Impacts during construction phase;
ii) Impacts during operation phase; and
iii) Impacts during decommissioning phase.

Qualitative and quantitative techniques have been applied for direct and indirect impact identification. Impacts are classified as being insignificant, minor, moderate, and major.

7.5 Corridor Of Impact (CoI)

The corridor of the proposed Impact (CoI) was delineated as the extent, which has direct or indirect impact of project. All direct impacts are constrained within the project boundary. Indirect impacts could be beyond the project boundary. According to the Department of Environment (DoE) guideline the project impact area is divided into two sections. One, those related to the project. Another section is those related to the background environmental features of the project site. This should cover not only the project site properly, but generally an area of 1km radius around the site. In this project area has been considered as core impact zone and 1km as buffer zone for better understanding.

7.6 Anticipated Impacts and Measures

The Environmental Impact Statement enumerates the likely impacts due to the implementation of the project on the six basic environmental parameters, which are listed below-

- Air environment
- Noise environment
- Water environment
- Land environment
- Biological environment
- Socio-economic environment

The impacts on the above parameters have been identified, analyzed and classified as adverse.

7.6.1 Pre-Construction Phase

Following is the brief description of impacts envisaged during the Pre-construction/Design Phase:

7.6.1.1 Land Use

Impact: The project site location is agricultural lands and nearby land use pattern is agricultural land on three side, canal in one side. The conversion of land for solar installations might lead to the loss of agricultural or natural habitats, impacting biodiversity.

Mitigation: The project initiator is to take responsibility of minimizing environmental impact on the surroundings by following the project's environmental & social management plan (ESMP). However extra pre-caution will be taken by the project initiators to mitigate any nearby land alterations and habitat disruptions through eco-friendly construction methods.

7.6.1.2 Noise and Air Pollution

Impact: Pre-Construction activities, including equipment, Dumping, Erection, operation can generate noise and air pollution.

Mitigation: Develop a comprehensive Construction Environmental Management Plan (CEMP) that includes measures to minimize noise levels and control emissions. Use quieter equipment and employ best practices for dust suppression.

7.6.1.3 Water Use and Pollution

Impact: The project may require water for construction purposes, potentially affecting local water resources. Construction and operations can disturb aquatic habitats, affecting local ecosystems and aquatic species.

Mitigation: Implement water-efficient construction practices, such as rainwater harvesting and water recycling. Monitor water usage and adhere to local water regulations to prevent pollution.

7.6.1.4 Cultural Heritage Impact

Impact: Pre-Construction activities may disturb culturally significant sites or artifacts.

Mitigation: There are no cultural heritage sites near the project site, therefore no mitigation measures are required regarding this.

7.6.1.5 Hazardous and non-hazardous wastes

Impact: During the pre-construction period, solid waste from site clearing will be generated. Hazardous materials and wastes that may be used during pre-construction and operation activities. Examples include lithium-ion battery storage system, diesel generators, chemical solvents, oils, and others electronic components.

Mitigation:

- Developing a waste minimization strategy to reduce the generation of hazardous and non-hazardous wastes during the pre-construction phase. This includes optimizing material use, employing efficient construction practices, and avoiding over-ordering materials.
- Implementing a waste segregation system on-site to ensure that hazardous and non-hazardous wastes are appropriately separated. Proper segregation facilitates safe disposal or recycling and reduces the risk of contamination.
- Providing adequate storage facilities for hazardous materials and waste. Ensure that these storage areas comply with safety standards and regulations to prevent spills, leaks, or accidents.
- Developing a spill response plan that outlines the procedures to be followed in case of accidental spills or releases of hazardous substances.
- Establishing proper procedures for the transportation of hazardous and non-hazardous wastes off-site. Use authorized waste transporters to ensure safe and legal disposal.
- Investigating recycling options for certain materials, such as batteries and electronic components, to minimize the volume of waste sent to landfills. Consider on-site treatment or partner with waste treatment facilities when necessary.
- Implementing a monitoring and auditing system to assess the effectiveness of waste management practices during the pre-construction phase. Make adjustments as needed to improve waste handling processes.

7.6.1.6 Flood Hazards

Impact: Flood may damage the Project and its various components. i.e. -

i. **Site Suitability:** Flood hazards can affect the overall suitability of the chosen site for the project. Frequent or severe flooding in the area may render the site unsuitable due to safety concerns and potential damage to equipment.
ii. **Infrastructure Damage:** Floodwaters can cause damage to infrastructure, including roads, foundations, and electrical systems. The project's development might be delayed if flood damage requires repairs before construction can proceed.
iii. **Equipment Damage:** Floodwaters can damage solar panels, PV batteries, and other sensitive electrical equipment. Water intrusion can lead to equipment malfunction or total loss, requiring replacement and additional costs.
iv. **Project Cost Overruns:** Flooding events can lead to unexpected project costs, such as repair and replacement expenses for damaged infrastructure and equipment. This can lead to budget overruns and delays.
v. **Construction Delays:** Flood hazards may disrupt the pre-construction phase by causing delays in equipment delivery, site preparation, and foundation construction.
vi. **Safety Risks:** Flood hazards pose safety risks to workers during the pre-construction phase. If the site becomes flooded during construction, workers may face hazards related to water, electrical systems, and unstable ground conditions.
vii. **Environmental Impacts:** Floodwaters can transport sediment, debris, and potential pollutants, impacting nearby water bodies and ecosystems. Proper sediment and erosion control measures are crucial to minimize environmental impacts.
viii. **Regulatory Compliance:** Flooding events may trigger specific environmental regulations or require additional permitting, resulting in project delays and administrative hurdles.

Mitigation Measures:

- Conducting a detailed flood risk assessment to understand potential hazards and vulnerabilities.
- Choosing a suitable site with low flood risk or implementing elevation measures to protect critical components.
- Designing flood-resistant infrastructure and utilizing flood barriers or levees where appropriate.
- Developing a comprehensive emergency response plan and evacuation procedures for flood events.
- Implementing proper drainage systems and erosion control measures to manage floodwater runoff.
- Considering climate change projections in flood risk assessments and design.
- Ensuring compliance with local, regional, and national floodplain regulations and permits.

7.6.2 Construction Phase

Environmental effects of the construction phase are expected to be temporary. Construction impacts are considered to be minimal as all the construction works will be carried out within the site boundary of the procured land and will be controlled via the mitigation measures defined in the ESMP section. The following is a brief description of impacts envisaged during the construction phase.

7.6.2.1 Visual Amenity

Impact: The construction activities of the power plant that are likely to create a visual intrusion and a disruption to aesthetics include: materials lay down, backfilling, and spoil. There are some close communities that would be within the visual radius of the project. Therefore, visual intrusions are anticipated to be limited to employees. Hence, the visual effects of the construction will be of low significance within the project area and largely limited to affect only employees living in the company's temporary camp facilities during construction (if any).

Mitigation: The project initiator need to be careful while doing construction works as though the adjacent sites and communities do not hamper.

7.6.2.2 Air Quality

Impacts:

- Increase in gaseous emissions by heavy construction equipment and vehicles.
- Increase in dust by construction activities. Earth excavation work, material storage, transportation and handling of construction materials, and wind erosion are the major factors that would produce a temporary, localized increase in PM levels.
- The increased movement of heavy vehicles carrying construction Material.
- Operation of generator sets as standby power back up system would generate gaseous emissions. The degree of dust generated will depend on the soil compaction and moisture content of the ground surface during construction.
- Dust and exhaust particulate emissions from heavy equipment operations will temporarily degrade air quality in the immediate construction zone.

Mitigation Measures:

- A dust control plan is implemented viz. regular daily spraying of water on the roads and dust emission area in the project site.
- Regular maintenance of vehicles and equipment is carried out. The vehicle's Pollution Under Control (PUC) is used during the construction period and an agreement with the contractor for water spraying and use of vehicles with PUC as well as use of environment friendly methods during construction phase is made.
- GI sheets are provided to a height of 5 m all around the project site to control dust;
- Water is sprinkled at regular intervals;
- SO_2 emissions from diesel generators are expected to be low because of usage of low sulfur content diesel;
- Use of efficient machinery and schedule maintenance of the Construction vehicles and equipment.
- If dust or pollutant emissions were found to be excessive, construction activities should be stopped until the source of such emissions have been identified and adequate control measures are implemented;
- Proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
- Mitigation and monitoring measures in the World Bank EHS guidelines on Air Quality and Ambient Air Quality will be followed.

7.6.2.3 Noise

Impact: During construction of solar-based power plant noise might be generated from construction work. Movement of construction materials, handling of equipment, concrete mixer, generator running can cause significant noise which has impact on environment. There are no closest sensitive locations around the project area. Hence, the project site could not be a potential source of noise. However, some reptiles and mammals within the project area can potentially be driven away from the site due to the sound levels.

Mitigation: The following identifies the mitigation measures to be applied by the Contractor during the construction phase and which include:

- Apply adequate general noise suppression measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.

- If noise levels were found to be excessive, construction activities should be stopped until adequate control measures are implemented etc.; and

Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Bangladesh Codes to ensure that for activities associated with high noise levels, workers are equipped with proper Personal Protective Equipment (e.g., Earmuffs).

7.6.2.4 Soil

Impact: As adjacent lands are used for agriculture Soil characteristics may be deteriorated at project site due to accidental spillage of chemicals, and ill planned disposal of solid wastes and effluents at project site.

Mitigation: Handling, operation and storage of noxious chemicals, and other hazardous materials, etc., should be done cautiously and carefully avoiding accidental spillage. Waste and effluents from the project site should be disposed of cautiously in pits dug for the purpose at service areas or elsewhere properly.

7.6.2.5 Surface Water

Impact: Surface water quality at the project site might degrade due to disposal of solid waste, sewage effluents to nearby ponds and ditches spillage of litter and noxious chemicals during different stages. A ETP retention pond is located on the backside of the project area which might be affected due to the waste disposal and also by the discharge of wastewater.

Mitigation: Surface water pollution due to disposal of waste and effluents, spillage of litter and other contaminants can be reduced/mitigated through planned disposal, storage, handling and transportation of these materials. Surface water quality will require to be monitored periodically during every stage of project implementation.

7.6.2.6 Terrestrial Ecology

Impact: The activities anticipated during the construction phase for solar-based power plant will include earthworks, site leveling, 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 on the terrestrial ecology within or in the vicinity of the project site.

Mitigation: Implement proper management measures to prevent damage to the natural vegetation of the site (if any). This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:

- Restrict activities to allocated construction areas only, including 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 onsite
- Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures Ensure proper storage, collection, and disposal of waste streams generated.

7.6.2.7 Waste Management

Impact: Improper management of non-hazardous and hazardous waste generated during construction may lead to impacts on soil, water, visual environment, in addition to health and safety of workers. Non-hazardous waste includes paper, wood, plastic, scrap metals, glass and mud. Hazardous waste includes absorbent material, metal drums, empty chemical containers, waste oil from machinery lubricants, etc.

Mitigation: A Waste Management Plan of proper design shall be prepared. Solid wastes collection system will be essential, which should include separation and collection of solid wastes in the dustbins/

waste containers throughout the project site. A log of the disposal of toxic and other waste materials is to be kept by the project proponent. Wastewater should be disposed through sewerage pipeline. Prior to transport, the container of all liquid materials should be checked by experienced persons properly. Domestic wastewater generated at the site will be collected in septic tanks.

7.6.2.8 Income and Employment

Impact: Positive benefits of the project may arise either from short-term job opportunities during construction, or long-term job opportunities during operation. It is important that construction and operation jobs be targeted to the local people within Monpura Upazila where feasible. The project proponent will be responsible for creating these employment opportunities. Priority will need to be given to the local community for unskilled labor. This may result in an increase in household income.

Recommendation: Contractors as far as practicable will recruit construction workers from amongst the locals (80% as per LSA report) where possible and shall maintain gender equity while employing the locals. 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. Job opportunities should be arranged for the PAPs (if any).

7.6.2.9 Occupational & Community Health & Safety

Impact: The construction activities include site preparation, infrastructure utilities installation, building structures. Therefore, there will be potential impacts on workers' health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death. Construction works and activities bear frequent accidents and health risks for both the laborers and the public general, with varying direct and indirect consequences. Therefore, the project authority needs to make provision for specific medical services, workers insurance policies and indemnities, emergency provisions and a rescue/evacuation plan in case of major accidents.

Mitigation:

- The Contractor, under the supervision of the project initiator, will be committed to ensure all health and safety measures are in place to prevent accidents and\or reduce the consequences of non-conformance events. The contractor shall ensure all prospective risks during the construction phase are assessed and all prevention and mitigation measures are in place accordingly. The contractor shall ensure all workers during construction comply with safety producers through training, awareness, and supervising. Moreover, the contractor shall provide all appropriate resources (Personnel Protective Equipment) onsite to ensure providing first aid for personnel in case of occurrence emergencies.
- The project authority will be requested to prepare an approved Construction Environmental Action Plan (CEAP), which will, among others, delineate all work safety aspects he intends to apply. Focal points of the CEAP will relate to means, type and number of protective clothing, safety precautions at specific work sites, first aid, rescue plans, work hours, and all intended measures for avoiding or proper clearance of hazardous substances, including fueling operations, transport and handling of hazardous materials and explosives, securing measures etc. CEAP will further explain methods and volumes for using any local resource, and how to address common risks associated with public safety. The project authority will disclose the CEAP with the local stakeholders for further developments on the health and safety issue.
- The Health and Safety Manager (HSM) should be engaged for the implementation period of the project. Proper health and safety signboards and appropriate information to the local people about the project activities should be provided. An Occupational and Community Health Safety Plan has been developed for ensuring occupational and community health and safety in the project site (Annex R).

7.6.2.10 Archaeology and Cultural Resources

Impact: The field visits were conducted at the project site, and it is found that no archaeological and cultural resources are located within the 500m radius of the project area. Hence, it can be said that there is no anticipated impact from construction on these receptors; therefore, the impact assessment process for this receptor has yielded low significance.

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

- Timely completion of the construction work and provision of alternative routes during the construction;
- Establishment of construction site camp and labor camp must maintain proper distance from the Households.

7.6.3 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. In order 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, in order to reap the full environmental benefits of the activities and ensure environmental enhancement it would be necessary to implement the following, which are beyond the purview of this project.

7.6.3.1 PV Panel Wash

Impact: It is very important to clean solar photovoltaic panels. Dirt on the solar panels prevents the entry of light. Moreover, solar panels are made to work by allowing light enters the solar cells. Bird poop, dust or pollen prevent the light from reaching the solar cells which eventually leads to less energy production. The functionality of solar panels may be affected when they are dirty. Dirty panels tend to produce less energy than the clean ones under the same circumstances. Furthermore, clean solar power means more efficiency while a dirty one may not be as efficient as needed. This is because dirt prevents light from impacting on the cells.

Mitigation: Dirt should never be scrubbed from the solar panels. Scrubbing can remove the non-reflective coatings that may be on the panels or permanently destroy the glass on the glass of the pane. Some basic things to keep in mind when cleaning solar panel system are:

- Use a soft sponge and biodegradable soap to get rid of dirt and muddy build-up on PV panels
- Avoid using water on the panels when they are hot, for example during midday. The best time to wash the panels is in the morning or evening.
- Not to use any sharp metal objects to remove materials such as bird droppings.

The Cleaning Process is presented below –

- Spray all panels with water to remove any debris or gunk off.
- Mix the cleaning solution with water in the buckets.
- Use a soft bristle brush, dip it in the bucket and scrub the solar panels.
- Continue with this process till effective removal of all the gunk off the panel (this may take some time because bird droppings and sap are not easy to clean.
- Start to squeegee the panels until there is no water left on them.
- Put everything away and repeat the process every six months. By doing this solar panels will remain clean while producing much energy as possible.

7.6.3.2 $LiFe(PO)_4$ Battery Management

Impact: Lithium-ion energy storage system (batteries) contain a few chemicals, including lithium. If the battery is damaged or exposed to high temperatures, these chemicals can be released into the air as toxic fumes. These fumes can be harmful if inhaled and can cause respiratory problems and other health issues.

Mitigation: All the Battery will be frequently monitored and managed to mitigate such type of impacts as per ESMP. Faulty batteries will be replaced immediately and will be recycled by battery suppliers (annex G & H).

7.6.3.3 Visual Amenity

Impact: The presence of a large area of PV panels is not expected to constitute a risk for glare since it is situated in the agricultural land, 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.

Mitigation:

- 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.

7.6.3.4 Heat Generation

Impact

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.

Mitigation

In order to reduce the impact, an air gap between the PV panels could be simulated. These air gaps will be freely connected to the outdoor air to keep the PV panels cool.

7.6.3.5 Noise

Impact: The solar power as a facility is not considered to exhibit any significant noisy operations, although the facility's inverters and transformers may produce noise, but this is not considered a serious issue, since they will not generate any significant noise. In addition, there are some close by sensitive receptors such as a school and some residential dwellings within the project site. In addition, noise generated from inverters is only heard when distance is close (i.e., within 1-2m, however, as distance increases, noise will be greatly reduced, not to mention that they do not generate noise during nighttime. Diesel generators can also contribute to noise generation.

Mitigation:

- Construct sound barriers around generators, perform maintenance during off-peak hours, and comply with noise regulations.
- These noise impacts are not considered to significantly harm animals nor cause impacts on a population level. The increased noise levels are considered occupational noises that require occupational health and safety measures. The worker inside the project area should use earmuffs during the operation of diesel generator.

- The diesel generators have to place away from sensitive areas and consider noise barriers or enclosures to reduce noise pollution.

7.6.3.6 Air Quality

Impact: No emissions are expected to be released during the operation phase, because solar systems 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. However, diesel generators can emit greenhouse gases (GHGs), particulate matter, nitrogen oxides (NOx), and other pollutants during operation.

Mitigation

- The project developer shall be committed to control 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 which 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 maintenance regularly for dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for management of PV panels.
- For mitigating air pollution from diesel generators (which will be used for emergency situations), diesel generators with recent technology for air emissions controlling was selected. For the project, USEPA certified (Tier 4 Final Emission Standards[5]) Kohler Power System (KD series) generators will be used which engines incorporate in-cylinder emissions control technology. It has been developed from the ground up in cooperation with Liebherr, the cylinder heads, combustion chamber, and high-pressure common rail fuel injection system are optimized to enhance power density, decrease noise, and control emissions. For reducing Nitrogen oxide (NOx), Sulfur oxide (SOx), Carbon Oxide (Cox) and Led emissions to meet Tier 4 Final requirements, these generators have incorporated an exhaust aftertreatment system (EATS) for the KD Series generator sets that utilizes selective catalytic reduction (SCR) technology.

7.6.3.7 Soil

Impact: Soil impacts during operation phase are limited to accidental spillage of lubricant, fuel and other chemicals that may potentially cause soil degradation. However, since the project area is designated for solar projects near roadside and settlements area, they do not have any agricultural significance. Another most significant source of soil pollution is the damage of PV panels in case of major accidents. These contain chemicals and may be harmful for soil quality. Fuel spills, leaks, or improper waste disposal can contaminate nearby soil.

Mitigation: Through implanting spill response procedures, and proper storage and handling of any chemicals on site, the impact probability will be reduced. The project proponent should check these devices regularly and have to replace the damaged and expired or bad devices. However, if possible, the damaged and expired devices should be maintained properly and recycled. Develop spill response plans, store fuels appropriately, and ensure proper waste disposal to prevent water pollution.

7.6.3.8 Terrestrial Ecology

Impact: 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.

[5] https://resources.kohler.com/power/kohler/industrial/pdf/Emission_Std_White_Paper.pdf

Mitigation: The anticipated impacts on terrestrial ecology are considered low and hence no particular mitigation measure should be followed. However, vehicular movement should be very limited and proper attention should be given to minimize the disturbance to the surrounding ecological environment.

7.6.3.9 Waste Generation

Impact:

PV modules: PV modules waste are 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 works etc.

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 diselenide (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.

Li-ion Batteries: Lithium iron phosphate batteries contain a few chemicals, including lithium. If the battery is damaged or exposed to high temperatures, these chemicals can be released into the air as toxic fumes. These fumes can be harmful if inhaled and can cause respiratory problems and other health issues.

Others: Waste generation during the operation phase is considered part of daily operations, therefore, it is not considered to have any significant impacts to the environment or health of personnel present on site.

Mitigation: Photovoltaic (PV) is now a proven technology which 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 maintenance regularly for dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for management of PV panels.

Cleaning of solar panels will be conducted on an overcast day, early in the morning or in the evening. If the sun is beating down on the panels, any water used can quickly evaporate and dirt will become smeared. Early morning can be a particularly good time for cleaning as dew that has settled on the panels overnight will likely have softened grime; meaning that will need to use less water and less energy to clean the solar panels. Groundwater will be used for the cleaning purpose but reuse of water will be emphasized.

All the batteries will be frequently monitored and managed to mitigate such types of impacts as per ESMP. Faulty batteries will be replaced immediately and will be recycled by battery suppliers (Annex G & H).

7.6.3.10 Health and Safety

Impact: 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
- Emergency Fire Hazard
- Electrocution of workers
- Electromagnetic radiation from PV modules

a. **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), or 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.
b. **Emergency Fire Hazard:** Since this is a solar power plant, the plant always has 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. Fire hazards associated with batteries, particularly lithium-ion batteries commonly used in various electronic devices, electric vehicles, and renewable energy storage systems, have gained attention due to incidents in which these batteries have caught fire by Chemical Composition, Overcharging and Overheating, Punctures and Physical Damage, Quality Control and Manufacturing Issues ect.
c. **Electrocution of Workers:** Risk of electrocution of workers during performing duties in a power plant is always present. Faulty electrical equipment, electric short circuits, exposed electrical wires may be the chief sources of electrocution. Damaged PV modules with exposed high voltage conductor also present high risk of electrocution.
d. **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.

Mitigation

- The project developer shall ensure all risks from operation activities to be assessed and to establish specific work procedures for tasks during operation phase including all safety prevention and mitigation measures to avoid non-conformance events.
- The Contractor, under the supervision of developer, will be committed to ensure all health and safety measures are in place to prevent accidents and\or reduce the consequences of non-conformance events. The contractor shall ensure all prospective risks during the construction phase is assessed and all prevention and mitigation measures are in place accordingly. The contractor shall ensure all workers during construction comply with safety producers through training, awareness, and supervising. Moreover, the contractor shall provide all appropriate resources (Personnel Protective Equipment) onsite to ensure providing first aid for personnel in case of occurrence emergencies.
- An occupational and community health and safety plan has been proposed in Annex S.

7.6.4 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;

7.6.4.1 Visual Amenity

Impact: During the dismantling of the solar system, removal of ancillary facilities visual intrusions will be likely.

Mitigation: Their consequence will be negligible due to the fact that such impact would be temporary (over a short period). Moreover, the actual dismantling of the solar power plant will reduce or remove the visual impacts witnessed during the operation phase.

7.6.4.2 Noise

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

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

7.6.4.3 Air Quality

Impact: Similar to construction, the decommissioning phase is anticipated to generate dust and exhaust emissions. Decommissioning activities will involve site preparation, dismantling and disassembling of the components of the solar power plant facility, clearance of the site, and rehabilitation if needed.

Mitigation: The project developer shall be committed to control emitted dust and gaseous pollutant from such operations through the proposed emission control procedures described in the environmental & social management plan (ESMP) included in this report. All the Battery will be frequently monitored and managed to mitigate such type of impacts as per ESMP. Faulty batteries will be replaced immediately and will be recycled by battery suppliers (Annex G & H).

7.6.4.4 Soil

Impact: During the decommissioning phase, the decommissioning activities are anticipated to have an impact of medium significance to soil. This is due to possible accidental leakage of fuel, oil, or chemicals during demolition activities.

Mitigation: Proper environmental protection measures should be followed to prevent or control the occurrence of such incidences. Take proper attention in removing the PV panels to prevent any damage as they contain chemicals and might be harmful for soil quality. Batteries should be handled carefully and regularly monitored to ensure that there are no harmful chemical deposition to soil.

7.6.4.5 Terrestrial Ecology

Impact: The activities associated with decommissioning will involve dismantling of the solar power plant and removal of its facilities. This is a temporary phase that could result in some additional noise and dust disturbances. These activities are not anticipated to harm any flora elements and provided dust suppression measures & other procedures are followed. On the other hand, decommissioning activities may cause disturbance to bird species.

Mitigation: The mitigation measures should be the same as they were considered during the construction phase since the decommissioning activities will be same as construction phase.

7.6.4.6 Waste Generation

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

Similar to the construction phase, potential generation of hazardous waste includes absorbent material, batteries, tires, metal drums, empty chemical containers, waste oil from machinery lubricants, etc.

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

PV modules and others: PV modules waste are the 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 works etc.

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 diselenide (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.

End-of-Life Solar Panels: 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 encapsulant (~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.

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

- 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 accompanying Material Safety Data Sheet (MSDS) must present at all times. Spilled material should be tracked and accounted for;
- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.
- Proper decommissioning and recycling of solar panels both ensure 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.

End-of-Life of Energy Storage System (Batteries):

- **Impact:** Dismantling batteries can generate hazardous waste materials.

- **Mitigation:** Energy Storage System (Batteries) have 12 years of warranty period, within which all the damaged/ faulty batteries and its equipment will be replaced by the suppliers. At the end of life of Energy Storage System (Batteries) suppliers will collect this batteries. Suppliers will return them to the manufacturers for proper recycling/reusing for secondary purposes. Therefore, no major issues will be risen from Energy Storage System (Batteries) management.

7.6.4.7 Employment Opportunities

Impact: 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 that 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.

Recommendation: Preference should be given to employing the local communities in various positions.

7.6.4.8 Health and Safety

Impact: The decommissioning activities will include equipment dismantling and demolishing facilities at the project site. As all project components will be recycled after decommissioning, the prospect risks from decommissioning phase will be limited to dismantling and demolishing activities including moving all recyclable components to their final destination. There will be potential impacts on workers' health and safety due to exposure to risks through decommissioning activities.

Mitigation: The project developer will be committed to ensure all health and safety measures are in place to prevent accidents and\or reduce the consequences of non-conformance events. The developer shall ensure all prospect risks during decommissioning phase are assessed and all prevention and mitigations measures are in place accordingly.

7.6.4.9 Traffic

Impact: The anticipated impacts during decommissioning are similar to those for the construction phase, where the heavy machinery that transports disassembled parts of the project solar power plant facility might be of more significance than normal vehicles and pickups.

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

7.6.5 Batteries and Diesel Generator Dismantling

As the lifecycle of the 3MW Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant project comes to an end, the decommissioning phase involves the dismantling of components like batteries and diesel generator. This phase presents potential environmental, health, and safety impacts. Effective mitigation measures are crucial to ensure proper dismantling, waste management, and site restoration.

Impacts:

1. **Waste Generation:**
    - **Impact:** Dismantling batteries and diesel engines can generate hazardous waste materials.
    - **Mitigation:** mitigation measures such as proper ventilation, hazardous components identification, waste segregation, and proper disposal will be followed. Battery waste will be stored separately, and suppliers will recycle this type of waste immediately (within 7 days as per agreements).
2. **Chemical Exposure:**

- Impact: Improper handling of batteries and diesel engines can lead to chemical exposure for workers.
- Mitigation: Provide training, personal protective equipment (PPE), and follow safe handling protocols.

3. **Air and Soil Pollution:**
    - Impact: Dust and emissions from dismantling can contribute to air and soil pollution.
    - Mitigation: Implement dust control measures, use containment systems, and conduct air quality monitoring.
4. **Water Contamination:**
    - Impact: Spills or leaks during dismantling can contaminate soil and nearby water sources.
    - Mitigation: Use spill containment measures, conduct water quality monitoring, and implement spill response plans.

7.6.6 Summary of Anticipated Impacts

Table 7.4, Table 7.5, and Table 7.6 below present a summary of the anticipated impacts during the planning and construction, operation, and decommissioning phase of the Project.

Table 7-4: Summary of Anticipated Impacts during the Planning and Construction Phase

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Geology and Hydrology	The Project site is a agricultural land and a nearby canal. Only some possible impacts are dumping of solid waste to the nearby source during construction.	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
	Risk of soil contamination during the various construction activities from spillage of hazardous material, random discharge of waste and wastewater. No risk of groundwater contamination.	Could be long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	High Positive
Biodiversity	Construction activities could disturb existing habitats (flora, fauna, and avifauna) and any threatened or endangered species which might be present within the Project site. In addition, other impacts could be from improper management of the site (e.g., improper conduct and housekeeping practices).	Long term	Local	Irreversible	Certain	Minor	Mild	Low Negative	High Positive
Air Quality	Construction activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Long term	Local	Reversible	Certain	Medium	Mild	Low Negative	High Positive
Noise	Possible noise emissions to the environment from the	Long term	Local	Reversible	Certain	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities								
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during construction.	Short term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Socioeconomic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Not applicable.							
Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative

Table 7-5: Summary of Anticipated Impacts during the Operation Phase

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Landscape and Visual	The Project is expected to be visible within the immediate vicinity and up to some long distance around the Project site only and thus is likely to create visual impacts related to	Long term	Local	Reversible	Likely	Medium	Low	Low Negative	Low Negative

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	interaction with surrounding landscape.								
	Potential for glare caused by minimal sunlight reflected off the PV panel modules which in turn could affect nearby receptors.	Long term	Local	Reversible	Likely	Medium	Mild	Low Negative	Low Negative
PV panels	The most significant source of soil pollution is the damage of PV panels in case of major accidents. These contain chemicals and may be harmful for soil quality. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication, and acidification and also health effects on people.	Long term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Batteries and Diessel generators	The most significant source of air and soil pollution is the damaged batteries and emission from diesel generators. These contain chemicals and may be harmful for soil quality.	Long term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Heat Generation	Increased heat by radiation, convection and conduction	Long term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low negative
Geology and Hydrology	Risk of soil and groundwater contamination during the various operational activities from	Long term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low negative

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater. However, most significant sources of soil and water pollution are the chemicals from PV panel's damage and from the expired batteries.								
Biodiversity	Impacts limited to improper management of the site (e.g., improper conduct and housekeeping practices).	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	Moderate Positive
Air Quality	Solar systems 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 operations.	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	High Positive
Noise	The only significant noise source from the operation activities will likely include the use of backup generators to ensure continuous power supply.	Long term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living	Not applicable.							

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.								
Occupational & Community Health and Safety	There will be some risks to workers' health and safety during the operation and maintenance activities of the Project.	Long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	Moderate Positive
	Trespassing of unauthorized personnel into the Project site could result in potential risks from several hazards of the various Project components (e.g., electric shock, thermal burn hazards, exposure to chemicals and hazardous materials, etc.). Leaching of materials from broken or fire damaged PV modules. Emergency Fire Hazard. Electrocution of workers. Electromagnetic radiation from PV modules.	Long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	Moderate Positive

Table 7-6: Summary of Anticipated Impacts during the Decommissioning Phase

Environmental Attribute	Likely Impact– Decommissioning Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Geology and Hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Short term	Local	Could be irreversible	Likely	Medium	Low	Moderate Negative	Low Positive
Air Quality	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Short term	Local	Reversible	Certain	Medium	Low	Moderate Negative	Low Negative
Noise	Possible noise emissions to the environment from the decommissioning activities will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities.	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Infrastructure and utilities	Of particular importance related to infrastructure and utilities is the final disposal of the panels at the end of their lifetime. Final disposal of panels, which may contain	Long term	Local	Reversible	Likely	High	Severe	High Negative	Low Negative

Environmental Attribute	Likely Impact– Decommissioning Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	hazardous material, needs to ensure that existing waste facilities would be able accept such solar modules. In addition, it is also important to investigate other disposal options such as buy back and recycling programs.								
Health and Safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative

8 STAKEHOLDER CONSULTATIONS & INFORMATION DISCLOSURE

8.1 Overview

Public consultation and participation have been viewed as a continuous two ways process involving promoting of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. It is a requirement of the national ESIA legislative framework in Bangladesh, as well as development partner's policies on Environmental & Social Safeguards, that stakeholders be involved in ESIAs. Based on ESIA obligations for impacted individuals, the Project's consultation program is fair and inclusive, relying on informed consultation. During the ESIA's environmental and social survey in July 2023, consultation activities were undertaken.

8.2 Stakeholder Consultation

Stakeholders were identified through systematic consultation with project beneficiaries, project affected people, women, vulnerable and poor members of the community, and other stakeholders who may have an influence over the project, in order to prepare a Stakeholder Engagement Plan. As a result, primary stakeholders were consulted: beneficiaries, disadvantaged, poor, and vulnerable groups, and people who could be negatively affected by the project. Secondary stakeholders, such as local community-based organizations (CBOs) and community representatives, as well as government departments, were also consulted.

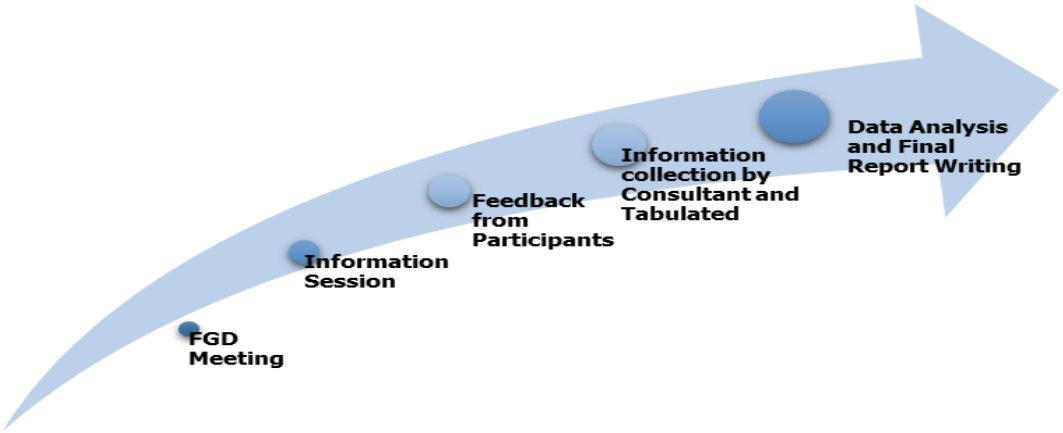


Figure 8-1: Approach of Focus Group Discussion (FGD)

Three (03) Focus Group Discussion (FGD) were conducted on 4thJuly, 6th July and 8th July in 2023 (Table 8.1). The primary objective of these discussions was to gain a comprehensive understanding of project issues and concerns from a diverse group of participants, including those who may be impacted by rising unemployment. The focus of the consultations was on community members' willingness to participate, as well as their perceptions and concerns about the project's positive and negative social impacts, including impacts on livelihoods. The feedback received from the consultation meeting will be used by the project executing agencies to carry out necessary revisions to the technical designs in order to minimize the impacts.

Table 8-1: Summary of Focused Group Discussion (FGD) with Local People

FGD No.	Locations	Coordinate	Date	Time	Participants		
					Male	Female	Total
1	Near Madinatul Ulum Jame Mosque, Grameen Tower, Hazirhat, Monpura	22.24830N 90.96762E	4th July, 2023	5:30 PM	10	-	10
2	Hazirhat Bazar, Monpura, Bhola	22.25474N 90.96519E	6th July, 2023	6:30 PM	14	-	14

FGD No.	Locations	Coordinate	Date	Time	Participants		
					Male	Female	Total
3	Site office of western Monpura Solar Power Ltd., 1 No Monpura Union Parishad, Monpura Upazila, Bhola.	22.30358N 90.98317E	8th July, 2023	10:45 AM	10	-	10

8.2.1 Summary of Comments Received from Participants

The comments raised during public consultation at the project location and replied by project proponent are summarized in Table 8.2.

Table 8-2: Summary Findings of the Public Consultation

Sl. No	Concerns & Expectations/ Key Issues Raised	Participant's opinion, comments, and suggestions
01.	Capacity and Technology adopted for the proposed project	A brief introduction to the proposed project has been given to the local community by the consultant team. It has been told that it is a Solar PV Technology based 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant project.
02.	How will the project impact on surrounding environment? Please mention both positive and negative sites.	As there is a boundary wall around the project area that separated it from the residential area, so, there will be less environmental impact on the environment.
03.	Any air pollution in the area due to the project activities? If yes, how to mitigate?	Because the project site is far away from residential dwellings, there is a small chance of anticipated impact, but proper care of panels, sensitive equipment, and other items should reduce it.
04.	Any impact on the surface water body (river, khal, pond etc.)? If yes, how to mitigate?	Water quality is not affected by the Solar Power Plant construction. It is important for the project's proponent to confirm that no hazardous or waste materials were accidentally spilled or washed into nearby water bodies during construction, particularly during the monsoon season.
05.	Any noise- impact of the project during construction and operation at the locality? If yes how to mitigate?	Because of the construction machinery and workers, the noise level will increase a little bit. Fortunately, the effects will only last for a short time. This means that when all work is completed, the noise level will return to its previous level of comfort.
06.	Will the upcoming solar power plant create employment opportunities for the local people?	During the construction period, the proposed project will provide an employment opportunity to semi-skilled and unskilled workers. The priority of employment will be provided to local villagers/residents on the basis of their skill and qualification.
07.	Will the solar power plant project pose a risk to human health and the environment?	No. It is considered safe to human health and the environment. It does not present any risks to public health and the environment.
08.	Is the proposed area inundated during flood? If yes, how much?	The project area is high land. So, there is no risk of flooding of the project site.
09.	Is there any particular sensitive area near the project that you think should be protected? If yes, where & how far from the project location?	No particularly sensitive area nearby the project area. But there are schools and Mosque within 1 km radius.
10.	Are you in favor of this project? Why?	It is true that we are all in favor of the project. We're grateful for the initiative you've taken on this. These projects have the potential to have a long-term positive impact on this region's economic and social conditions.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

9.1 General

The Environmental and Social Management Plan (ESMP) aims to ensure the compliance of all activities undertaken during the implementation and the operation of the proposed project with the environmental and social safeguard requirements of the donor agencies and Government of Bangladesh. Furthermore, it aims at integrating the environmental and social components of the project with existing initiatives and programs in these fields. The plan consists of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.

9.2 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 all kind of adverse environmental, social and health impacts resulting from the project activities;
- Conducting all project activities in accordance with relevant Bangladesh Legislation and applicable World Bank guidelines.
- Implementation of on-going environmental monitoring programs;
- Periodic review of the Environmental 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.

9.3 Environmental And Social Management Plan (ESMP)

On the basis of identification of the environmental impacts and recommended mitigation measures linked with the project activities, an ESMP has been prepared which will be followed at the pre-construction, construction, operation, and decommissioning stages. While preparing the ESMP, medium and significant impacts are taken into consideration to recommend possible mitigation measures. When a mitigation measure complies with the Environmental Quality Standards (EQS), policies for Environmental and Social Considerations / World Bank Safeguard Policies, and DoE environmental guidelines, as well as other relevant GoB legal requirements, it is considered successful. A relevant international or recognized organization's quality standard will be applied in the absence of a DoE-developed EQS.

Table 9-1: Environmental and Social Management Plan (ESMP)-Mitigation Measures

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Pre-construction Phase						
Land Use	Landfilling/ Earthworks	Soil erosion from the fill material changes in the existing landscape.	Quantity of land use	Consideration of minimum use of agricultural land.	EPC Contractor. Supervision by WMSPL	▪ National Land use Policy, 2001 ▪ National Environmental Policy, 1992 ▪ National Environmental Management Action Plan, 1995 ▪ Industrial Policy, 1986 ▪ Private Sector Power Generation Policy of Bangladesh, 1996 Policy Guideline for small Power Plants in Private Sector, 1997
Cultural Heritage Impact	Pre-Construction activities may disturb culturally significant sites or artifacts.	there are no cultural heritages nearby, therefore no issues regarding this.	-	-	WMSPL	-
Flood Hazards	Flood may damage the Project and its various components.	A land development of approximately 3 meters or higher will be necessary to counteract potential flood levels before establishing the solar power plant. Channels need to be developed for proper drainage of water to the river.	no. of flood	Consideration of flood hazard in project design	EPC Contractor. Supervision by WMSPL	-
Construction Phase						
Visual Amenity	Visual impacts from construction activities such as materials lay down, infrastructure development, etc.	The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times.	Daily	Good housekeeping and tidiness of work areas within the project site.	EPC Contractor. Supervision by WMSPL	National Land use Policy, 2001 National Environmental Policy, 2018 National Environmental Management Action Plan, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Water Resources	As the amount of water requirement is too little, the impact on water resources is not that significant.	The contractor will dispose of the debris material to a designated disposal site. All reasonable measures will be taken to prevent the wastewater produced in construction from entering into creeks and streams. The contractor's camp will be provided with sanitary latrines that do not pollute surface waters. The ground water 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 at construction areas must refrain of discharge any liquid wastes on the ground.	Daily	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	EPC Contractor. Supervision by WMSPL	Environmental Pollution Control Ordinance, 1977
Noise	Increased noise levels during to construction & machinery	The contractor shall use heavy equipment, machinery, and fuels in compliance with national regulations. The contractor shall perform regular maintenance on all equipment, vehicle and machinery to prevent noise emissions. The contractor shall limit idling of engines when not in use to reduce its contribution to noise emissions.	Every week and after receiving any complaints from worker or third parties.	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	EPC Contractor. Supervision by WMSPL	Environmental Pollution Control Ordinance, 1977 Noise Pollution Control Rules (2006) Environmental Conservation Rules (ECR), 2023. Environment Court Act, 2000. Bangladesh Climate Change Strategy and Action Plan (2008)
Air Quality	Dust generation due to construction activities. Exhaust Emissions due to operation of construction plant and machinery.	Setting an appropriate site speed limit to reduce dust generation from vehicles travelling over unmade surfaces. During construction dust generated on unpaved roadways and work areas should be controlled by the application of water on an "as needs" basis. Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soils into trucks.	Daily	No visible dust plumes originating From construction sites. Regular machineries maintenance records.	EPC Contractor. Supervision by WMSPL	Environmental Pollution Control Ordinance, 1977 Environment Conservation Rules (ECR), 2023 Environment Court Act, 2000 Bangladesh Climate Change Strategy and Action Plan (2008)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		Train workers to handle construction materials and debris during construction to reduce fugitive emissions. Ensure adequate maintenance and inspection of vehicles to minimize exhaust emissions. Not running engines for longer than is necessary.				
Soil	Soil characteristics may be deteriorated at project site due to accidental spillage of chemicals, and ill planned disposal of solid wastes and effluents at project site.	Handling, operation and storage of noxious chemicals, and other hazardous materials, etc. cautiously and carefully avoiding accidental spillage. Waste and effluents from project site should be disposed of cautiously in pits dug for the purpose at service areas or elsewhere properly	Daily	-	EPC Contractor. Supervision by WMSPL	ECR 2023
Surface Water	Surface water quality at project site might degrade due to disposal of solid waste, sewage effluents to nearby ponds and ditches spillage of litters and noxious chemicals during different stages.	planned disposal, storage, handling and transportation of disposal of waste and effluents, spillage of litter and other contaminants materials.	Daily	-	EPC Contractor. Supervision by WMSPL	ECR 2023
Terrestrial Ecology	Potential disturbance to birds	Minimize human and vehicular contact with fauna, including their burrows / nests and feeding grounds. Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site.	Daily	N/A	EPC Contractor. Supervision by WMSPL	Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft) National Forest Policy and Forest Sector Review (1994, 2005) The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry) National Biodiversity Strategy and Action Plan (2004)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during construction.	The contractor shall segregate storage for different types of wastes, such as hazardous, non-hazardous recyclable construction material, plastic, paper, etc. to facilitate proper disposal. The contractor shall provide a separate storage area for hazardous materials. The hazardous materials/products must be labeled with proper identification of its hazardous properties. Chemical waste shall be stored in accordance with the provisions of Material Safety Data Sheets (MSDS). The contractor shall keep MSDS onsite. The contractor shall establish regular intervals for waste collection and disposal as per the contractor's waste management procedures. The sanitary and organic wastes shall be collected in a septic tank to be installed on site and disposed of regularly.	Daily	Compliance with Waste management procedures. Current and Complete records of regular waste pickup and disposal.	EPC Contractor. Supervision by WMSPL	Environmental Pollution Control Ordinance, 1977 The Environment (Pollution Control) Act, 1995 Environmental Conservation Rules (ECR), 2023
Income and Employment	The project proponent will be responsible for creating these employment opportunities. Priority will need to be given to the local community for unskilled labor. This may result in an increase on household income.	Contractor as far as practicable will recruit construction workers from amongst the locals where possible and shall maintain gender equity while employing the locals	-	-	-	-
Occupational & Community Health & Safety	Potential exposure to safety events such as tripping, working at height activities, fire from hot works, smoking, failure in	▪ All construction equipment used for the execution of the project works shall be fit for purpose and carry valid inspection certificates and insurance requirements.	Continuously	Total Recordable Incidence Rate (TRIR) Lost Time Incidence Frequency	EPC Contractor. Supervision by WMSPL	Bangladesh Labour act, 2006 Bangladesh Labor Rules, 2022 Bangladesh Labor Law, 2023

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	electrical installation, mobile plant and vehicles, and electrical shocks. Exposure to health events during construction activities such as manual handling and musculoskeletal disorders, hand-arm vibration, temporary or permanent hearing loss, heat stress, and dermatitis.	▪ Risk assessment shall be prepared and communicated prior to commencement of work for all types of work activities on site. ▪ Maintain applicable Work Permit (PTW) during all works. ▪ Provide walkways that are clearly designated as walkways; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting.		Fatal Accident Rate Number of safety Training performed Number of nonconformance events Reports. Medical Treatment Case (MTC) HSE Training Hours		
Archaeology and Cultural Resources	No anticipated impact from construction on these receptors; therefore, the impact assessment process for this receptor has yielded the low significance.	Timely completion of the construction work and provision of alternative routes during the construction; Establishment of construction site camp and labor camp must maintain proper distance from the cultural sites..	Regularly	N/A	EPC Contractor. Supervision by WMSPL	
Operation Phase						
Visual Amenity	Reflection from the solar panel will create visual intrusion.	The used technology has Anti-Reflective coating (ARC) that significantly reduces the reflectance of the Panels (from 2.5% to 2.6% only).	N/A	N/A	Project Developer	National Land use Policy, 2001 National Environmental Policy, 1992 National Environmental Management Action Plan, 1995
Noise	Significant sound pollution from backup generator	Establish the generator inside an insulated room and use noise reduction canopy to keep the environment free from sound pollution. A noise barrier should also be given around the generator room.	Every week and after receiving any complaints from worker or third parties.	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Project Developer	Environmental Pollution Control Ordinance, 1977 Noise Pollution Control Rules, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		The worker inside the project area should use earmuffs during the operation of diesel generator.				
Air Quality	Very low air emissions of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds, and the greenhouse gas carbon dioxide.	Check regularly to identify potential sources of air pollutants. Replace the damaged and expired tools, equipment, PV panels and batteries as soon as it is noticed.	Daily	No visible dust plumes originating from project site. Regular machineries maintenance records.	Project Developer	Environmental Pollution Control Ordinance, 1977 Environmental Conservation Rules (ECR), 2023 Environment Court Act, 2000 Bangladesh Climate Change Strategy and Action Plan (2008)
Water Resources	Surface and ground water quality in the adjacent rivers, channels, ponds and plant site might insignificantly degrade during operation stage due to disposal of solid wastes, sewage effluent, and dredged materials, accidental spillage of petroleum products, cement, and noxious chemicals. The problem will be more dangerous if any construction and maintenance work continues even in the monsoon when the flood occurrence is very high.	▪ The contractor will dispose of the debris material to a designated disposal site. ▪ All reasonable measures will be taken to prevent the wastewater produced in construction from entering into creek and stream. ▪ The contractor's camp will be provided with sanitary latrines that do not pollute surface waters. ▪ The ground water in the project area has been used for different purposes like drinking and irrigation, hence proper mitigation measures must be ensured at construction site to avoid any spillage and leakage of oil. All the staffs at construction areas must be refrained of discharge any liquid wastes on the ground. Check regularly (monthly) the surface, ground and drinking water quality to assess the impact.	Weekly	▪ Number of spills or incidents to be recorded during onsite audits. Training records of Personnel trained in spill response procedures must be filed	WMSPL	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995 ▪ Environmental Conservation Rules (ECR), 2023
Soil	Potential spillage of stored oil and chemicals	Specific procedures shall be developed for the removal of waste or spilled fuel, oil and contaminated soil at approved disposal facilities.	Post rainfall event Weekly	Maintain readily available records of all workers training	Project Developer	Environmental Pollution Control Ordinance, 1977; The Environment

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil.		on spill response procedures.		(Pollution Control) Act, 1995
Terrestrial Ecology	Potential disturbance and harm to birds	Minimize human and vehicular contact with resident birds including their burrows / nests and feeding grounds. Ground nests found on site shall be translocated outside the project boundary. Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site.	Weekly	No reported harm to birds.	Project Developer	Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft); National Forest Policy and Forest Sector Review (1994, 2005) The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry) National Biodiversity Strategy and Action Plan, 2004
Waste Generation	Solid wastes from PV modules which contains toxic metals. Wasted PV modules 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 works etc.	A proper temporary storage facility is needed for the wasted batteries to avoid potential lithium contamination. Collect the domestic waste in septic tanks to treat according to the approved procedure.	Continuously	Compliance with Waste management procedures. Current and Complete records of regular waste pickup and disposal.	Project Developer	Environmental Pollution Control Ordinance, 1977 The Environment (Pollution Control) Act, 1995
PV panels	The most significant source of soil pollution is the damage of PV panels in case of major accidents. These contain chemicals	Photovoltaic (PV) is now a proven technology which is inherently safe as opposed to some dangerous electricity generating technologies. Photovoltaic systems make no air pollution and cause no pollution in operation. PV panel should be clean and maintenance	Continuously	Compliance with DoE Regular machineries maintenance records.	Project Developer	Environmental Pollution Control Ordinance, 1977 Environmental Conservation Rules (ECR), 2023 Environment Court Act, 2000

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	and may be harmful for soil quality. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication and acidification and also health effects on people. Wasted PV modules 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 works etc.	regularly for dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for management of PV panels. The project proponent should check these devices regularly and have to replace the damaged and expired or bad devices. However, if possible, the damaged and expired devices should be maintained properly and recycled.				
Batteries and diesel generators	Lithium-ion batteries contain a few chemicals, including lithium. If the battery is damaged or exposed to high temperatures, these chemicals can be released into the air as toxic fumes. These fumes can be harmful if inhaled and can cause respiratory problems and other health issues. Diessel generators may emit greenhouse gases while in operation.	All the Battery will be frequently monitored and managed to mitigate such type of impacts as per ESMP. Faulty batteries will be replaced immediately and will be recycled by battery suppliers (Annex G & H). Diessel generators will only be used in emergency situations. Proper maintenance and regular emission monitoring will be performed regularly.	Continuously	Compliance with DoE Regular machineries maintenance records.	Project Developer	Environmental Pollution Control Ordinance, 1977 Environmental Conservation Rules (ECR), 2023 Environment Court Act, 2000, E-waste Management Rules, 2021

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Health and Safety	Leaching of materials from broken or fire damaged PV modules Emergency Fire Hazard Electrocution of workers Electromagnetic radiation from PV modules Slipping and tripping, working at height activities Lead can enter body in two ways: by breathing or by swallowing it. Lead Sulfide dust enters the body through breathing. Very fine lead particles may penetrate into the lungs result in absorption in the bloodstream. As a power plant, the plant has always some risks of fire hazards. Electrical equipment is the main source of a potential fire hazard. Risk of electrocution of workers during performing duties in a power plant is always present.	Provide walkways that are clearly designated as a walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. Ensure all works and storage areas are tidy, all material deliveries shall be planned to minimize accumulated materials at project site. Signpost any slippery areas, provide proper footwear during working within slippery areas. Carry out fire risk assessment during operation to identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire. Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. Establish and communicate emergency response plan with all parties, the ERP to consider such things as specific foreseeable emergency situations, organizational roles and authorities, responsibilities and expertise, emergency response and evacuation procedure, in addition to training for personnel. Adequate first aiders shall be on site in accordance with Bangladesh Labour Law requirements. First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site.	Continuously	Total Recordable Incidence Rate (TRIR) Lost Time Incidence Frequency Number of safeties Training performed Number of nonconformance events.	Project Developer	Bangladesh Labour Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Decommissioning Phase						
As can be noted from the impact assessment chapter 8, 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, batteries and generators 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 encapsulant (~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. Lifecycle of Li-ion batteries are 12 years and after that all the batteries and associated generated waste will be recycled by suppliers as per annex G & H. Proper decommissioning and recycling of solar panels, batteries, and generators should be done both for ensuring 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 and energy storage system (Batteries) industries are acting voluntarily to implement product take-back and recycling programs at the manufacturing level.					

9.4 Environmental And Social Monitoring Plan (ESMP)

9.4.1 General

An Environmental and Social Monitoring Plan will be prepared to provide guidelines for environmental and social management plans during the construction and operation phases of the project. 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 9.2. Sample Monitoring Report Template is provided in Annex T.

9.4.2 Objectives

The objective of environmental 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:

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

Table 9-2: Environmental and Social Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
Pre-Construction Stage					
Air Quality	SO_2, NO_x, CO, CO_2, $PM_{2.5}$, PM_{10}	Air quality standard by DoE, Bangladesh	Once	Contractor	WMSPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	Contractor	WMSPL
Surface Water Quality	**Surface water:** pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity (EC), Oxidation-Reduction Potential (ORP), Salinity, Dissolved Oxygen (DO), Ammonia, Phosphate, Total Suspended Solid (TSS), and Arsenic (As) **Ground water:** pH, Electric Conductivity (EC), Total Dissolved Solids (TDS), Salinity, Oxidation-reduction potential (ORP), Temperature, Dissolved Oxygen (DO), Total Suspended Solid (TSS), Total Arsenic (As), Total Coliform (TC) and Fecal Coliform (FC)	Surface water quality standard by DoE, Bangladesh	Once	Contractor	WMSPL
Soil Quality	Total Lead (Pb), Total Chromium (Cr), Total Mercury (Hg), Total Cadmium (Cd), Total Zinc (Zn), Total Arsenic (As)	-	Once	Contractor	WMSPL
Flora and Fauna	Ensure that the existing flora and fauna along the project AOI are unharmed as far as possible. Information regarding the species along the project AOI needs to be collected and informed to the respective local authority and take measures to compensate where necessary (e.g., if trees need to be cut).	-	Once	Contractor	WMSPL
Construction Stage (Per Year)					
Air Quality	SO_2, NO_x, CO, CO_2, $PM_{2.5}$, PM_{10}	Air quality standard by DoE, Bangladesh	Once	Contractor	WMSPL
Dust	Dust control	Air quality standard by DoE, Bangladesh	Once	Contractor	WMSPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	Contractor	WMSPL
Water Quality	**Surface water:** pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity (EC), Oxidation-Reduction	Water quality standard by MoEFCC, Bangladesh	Once	Contractor	WMSPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
	Potential (ORP), Salinity, Dissolved Oxygen (DO), Ammonia, Phosphate, Total Suspended Solid (TSS), and Arsenic (As) **Ground water:** pH, Electric Conductivity (EC), Total Dissolved Solids (TDS), Salinity, Oxidation-reduction potential (ORP), Temperature, Dissolved Oxygen (DO), Total Suspended Solid (TSS), Total Arsenic (As), Total Coliform (TC) and Fecal Coliform (FC)				
Waste	▪ Check storage, transportation, disposal, handling of hazarders waste ▪ Waste and effluents to be collected and disposed safely from camp. ▪ Wastes and garbage from construction sites to be disposed safely	Monitoring	Weekly	Contractor	WMSPL
Occupational Health and Safety	▪ Check quality of food and accommodation at construction camp; ▪ Check safe water supply, hygienic toilet at camp, construction of drain at camp site; ▪ Check toilets are close to construction site; ▪ First Aid Box with required tools and medicines; ▪ The heavy construction material to handled and stored safely putting due care on public safety; ▪ Heavy construction materials at construction site to be stored and handled safely; and ▪ Check of personal protective equipment (PPE) for worker at the sites	Monitoring	Regularly	Contractor	WMSPL
Operation Stage (Per Year)					
Air Quality	SO_2, NO_x, CO, CO_2, $PM_{2.5}$, PM_{10}	Air quality standard by DOE, Bangladesh	Once	WMSPL	DOE/IDCOL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	WMSPL	DOE/IDCOL
Water Quality	**Surface water:** pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity (EC), Oxidation-Reduction Potential (ORP), Salinity, Dissolved Oxygen (DO),	Water quality standard by DOE, Bangladesh	Once	WMSPL	DOE/IDCOL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
	Ammonia, Phosphate, Total Suspended Solid (TSS), and Arsenic (As) **Ground water:** pH, Electric Conductivity (EC), Total Dissolved Solids (TDS), Salinity, Oxidation-reduction potential (ORP), Temperature, Dissolved Oxygen (DO), Total Suspended Solid (TSS), Total Arsenic (As), Total Coliform (TC) and Fecal Coliform (FC)				
Accident and Public Safety	Record of accidents, different level of disabilities/fatalities.	Non-Specific	-	WMSPL	DOE/IDCOL
PV panels	Chemicals	-	Once	WMSPL	DOE/IDCOL
Decommissioning Stage (1 year)					
Air Quality	SO_2, NO_x, CO, CO_2, $PM_{2.5}$, PM_{10}	Air quality standard by DOE, Bangladesh	Once	Contractor	WMSPL /IDCOL
Dust	Dust control	Air quality standard by DOE, Bangladesh	Once	Contractor	WMSPL /IDCOL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	Contractor	WMSPL /IDCOL
Water Quality	**Surface water:** pH, Temperature, Total Dissolved Solids (TDS), Electric Conductivity (EC), Oxidation-Reduction Potential (ORP), Salinity, Dissolved Oxygen (DO), Ammonia, Phosphate, Total Suspended Solid (TSS), and Arsenic (As) **Ground water:** pH, Electric Conductivity (EC), Total Dissolved Solids (TDS), Salinity, Oxidation-reduction potential (ORP), Temperature, Dissolved Oxygen (DO), Total Suspended Solid (TSS), Total Arsenic (As), Total Coliform (TC) and Fecal Coliform (FC)	Water quality standard by MoEFCC, Bangladesh	Once	Contractor	WMSPL /IDCOL
Waste	▪ Check storage, transportation, disposal, handling of hazarders waste ▪ Careful and proper handling of PV panels and batteries ▪ Waste and effluents to be collected and disposed safely from camp. ▪ Wastes and garbage from worker sites to be disposed	Monitoring	Weekly	Contractor	WMSPL /IDCOL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
	safely				
Occupational Health and Safety	▪ Check quality of food and accommodation at worker camp; ▪ Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; ▪ Check toilets are close to construction site; ▪ First Aid Box with required tools and medicines; ▪ Check of personal protective equipment (PPE) for worker at the sites	Monitoring	Regularly	Contractor	WMSPL /IDCOL

9.5 Environmental And Social Budget

The estimated budget for implementation of the mitigation and monitoring measures proposed in the ESMP is presented in Table 9.3. 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 total budget is estimated as BDT. 19,04,000.00. 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 9-3: Environmental Budget

Component	Item	Unit	Quantity	Rate (In BDT)	Amount (BDT)
PRE-CONSTRUCTION STAGE					
Air Quality	Measuring air quality	No.	3	20,000	60000
Noise Level	Measuring ambient noise level	No.	12	8,000	96000
Water Quality	Surface water quality	No.	2	22,000	44000
	Groundwater quality	No.	2	22,000	44000
Soil Quality	Measuring soil quality	No.	2	10,000	20000
Flora-Fauna Survey	Quadrat, transect walk, Transect Line	Lump-sum			100,000
Sensitive Location Survey	Throughout the Project AOI	Lump-sum			100,000
Sub Total					**464,000**
CONSTRUCTION STAGE (per year)					
Air Quality	Measuring air quality	No.	3	20,000	60,000
Noise Level	Measuring ambient noise level	No.	12	8,000	96,000
Water Quality	Surface water quality	No.	2	22,000	44,000
	Groundwater quality	No.	2	22,000	44,000
Soil Quality	Measuring soil quality	No.	2	10,000	20000
Tree Plantation and Management	Along the Project AOI	Lump-sum			100,000
Water Spraying for Dust Suppression	Along the Project AOI	Lump-sum			50,000
Waste Disposal and Management	Disposal and management of construction waste	Lump-sum			30,000
Training & Workshop	Health and Safety, Environmental and social issues, Traffic Management, GBV issues etc.	No.	4	10,000	40,000
Health & Safety	Health check-up camps for construction workers	Lumpsum			60,000
Total					**544,000**
OPERATION STAGE (per year)					
Air Quality	Monitoring air quality	No.	3	20,000	60,000
Noise Level	Monitoring ambient noise level	No.	12	8,000	96,000

Component	Item	Unit	Quantity	Rate (In BDT)	Amount (BDT)
Water Quality	Monitoring of surface water quality	No.	2	22,000	44,000
	Monitoring of groundwater quality	No	2	22,000	44,000
Soil Quality	Measuring soil quality	No.	2	10,000	20,000
Environmental and Social Survey	Lump-sum				200,000
Environmental and Social Management	Lump-sum				300,000
Sub Total					**764,000**
DECOMMISSIONING STAGE (1 Year)					
Air Quality	Measuring air quality	No.	2	20,000	40,000
Noise Level	Measuring ambient noise level	No.	6	8,000	48,000
Water Quality	Surface water quality	No.	1	22,000	22,000
	Groundwater quality	No.	1	22,000	22,000
Total					**132,000**
Grand Total (BDT)					**1,904,000**

10 DISASTER RISK ASSESSMENT AND EMERGENCY RESPONSE PLAN

10.1 General

Disaster Risk assessment" are going to be formulated as outcomes of the preparatory study or detail design stage. The following are general matters regarding the plans. Tangible and detailed contents will be described on the final report of the preparatory study or detail design study. Disaster can occur due to subsidence, accidents, fire hazards, etc. during construction while system failure (power supply, breakdown etc.), fire hazards and accidents during operation stage. The BR should include Preventive Action, Full Proof Communication System, Emergency Action Committee and Emergency Measures.

Disaster Impact Assessment (DIA) is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the DIA, it should be widely circulated, and personnel training is to be provided through rehearsals/drills.

To tackle the consequences of a major emergency inside the plant or immediate vicinity of the plant, a DIA has to be formulated and this planned emergency document is called the DIA.

10.2 Disaster in Bangladesh

Disasters are natural or man-made events that have a negative impact on an area's entire environment, including people, shelters, and essential resources for survival. Bangladesh is now regarded as one of the world's most vulnerable countries to natural and anthropogenic hazards. In comparison to other countries, the population density is also very high. The country's geographic location and meteorological characteristics have made it vulnerable to various geo- and hydro-meteorological hazards. Floods, cyclones and storm surges, droughts, tidal surges, tornadoes, flash floods, earthquakes, erosion, landslides, and landslides are among the major natural and manmade disasters in the country.

However, Bangladesh is a country prone to various natural disasters due to its geographical location and climate. Some of the common disasters in Bangladesh include cyclones, floods, and landslides. The frequency and severity of these disasters can vary from year to year, and the government and international organizations are continuously working on disaster preparedness and response to minimize the impact on the population.

10.3 Disaster Impact Scenarios of the Project Area

A disaster impact scenario refers to a hypothetical description or simulation of the potential consequences and effects of a specific disaster event. It aims to assess the magnitude of the impact on various aspects of the affected area, including infrastructure, environment, economy, human health, and social well-being. The scenario is typically developed based on available data, historical records, and scientific models related to the type of disaster being studied.

Key components of a disaster impact scenario may include:

- Type of Disaster
- Location
- Magnitude and Intensity
- Extent of Impact
- Impact on Infrastructure
- Environmental Consequences
- Economic Impact
- Social Implications
- Response and Recovery Challenges

- Preparedness and Mitigation Measures

This project will pass through Bhola District, which falls under the Barisal division.

10.4 Major Hazards in the Project Area

Monpura Island is located in the Bhola District of Bangladesh and is vulnerable to various hazards due to its geographical location and environmental factors. Some of the major hazards faced by Monpura Island include:

- **Cyclones and Storm Surges:** Monpura Island is situated in a region prone to cyclones and storm surges, especially during the monsoon season. These natural disasters can cause widespread damage to infrastructure, homes, and agriculture, leading to loss of life and livelihoods.
- **Flooding:** The island is at risk of flooding from heavy rainfall, overflowing rivers, and tidal surges. This can lead to damage to homes, crops, and infrastructure, as well as displacement of residents.
- **Erosion and Land Degradation:** Coastal erosion is a significant problem for Monpura Island. Rising sea levels and the loss of protective mangrove forests contribute to the erosion of the shoreline, leading to land loss and displacement of communities.
- **Saltwater Intrusion:** Rising sea levels and tidal surges can result in the intrusion of saltwater into freshwater sources, such as ponds and wells. This can contaminate drinking water and harm agricultural productivity.
- **Lack of Infrastructure:** Monpura Island may face challenges related to inadequate infrastructure, including roads, bridges, and healthcare facilities. This can impede disaster response and recovery efforts.
- **Limited Access to Services:** Due to its remote location, access to essential services such as healthcare, education, and emergency response might be limited, making the population more vulnerable to hazards.
- **Poverty and Socioeconomic Vulnerability:** The island's population often faces poverty and limited access to resources. These socioeconomic factors can exacerbate the impacts of hazards, making it difficult for residents to recover from disasters.

10.5 Disaster Management

Disaster is an unexpected event due to sudden failure of the system, external threats, internal disturbances, earthquakes, fire, and accidents. The first step is to identify the causes which develop/ pose unexpected danger to the structural integrity. The potential causes are excessive load, cracks, failure and malfunctioning of sensing instruments, accident, etc. These need to be looked into with care.

Disaster management cycle is a framework that defines the stages of a disaster. It can be used by both organizations and individuals to prepare for and respond to disasters of every kind, including natural disasters, technological disasters, and human-made disasters.

To mitigate the impact of these disasters and enhance disaster risk management, several measures and strategies are typically implemented at various levels, including local, regional, and national. Here are some common components of disaster risk management in Barisal Division:

Early Warning Systems: Implementing effective early warning systems for cyclones, floods, and other natural disasters is crucial. This involves setting up weather monitoring stations, disseminating timely alerts to the community, and conducting drills to ensure everyone knows how to respond during emergencies.

Evacuation Plans: Developing and practicing evacuation plans is essential to ensure a swift and safe evacuation of the population in case of an approaching cyclone or flood. Identifying safe shelters and ensuring their readiness is vital.

Figure 10-1: Disaster Risk Management Cycle

Infrastructure Resilience: Building infrastructure with resilience to withstand the impact of natural disasters is essential. This may include constructing cyclone-resistant buildings, flood embankments, and raised roads.

Community Awareness: Raising awareness among the local population about the risks and potential impacts of disasters is critical. This includes educating them about preparedness measures, evacuation protocols, and safety precautions.

Strengthening Local Institutions: Empowering and building the capacity of local institutions, such as community-based organizations and government agencies, is essential for effective disaster risk management. They can play a significant role in coordinating disaster response efforts and providing support to affected communities.

Disaster Preparedness Drills: Conducting regular disaster preparedness drills and exercises helps ensure that the community is well-prepared to handle emergencies. These drills can include mock evacuations, search and rescue exercises, and medical response simulations.

Natural Resource Management: Implementing sustainable natural resource management practices can help mitigate the impacts of disasters. Activities such as reforestation and mangrove conservation can act as natural barriers against storm surges and reduce soil erosion.

International Cooperation: Collaboration with international organizations and neighboring countries can provide additional support, expertise, and resources during disaster response and recovery efforts.

10.6 Preventive Action

Once the likelihood of a disaster is suspected, action has to be initiated to prevent a failure. Engineers responsible for preventive action should identify sources of repair equipment, materials, labor, and expertise for use during emergencies.

Early Warning Systems: Establish and improve early warning systems for cyclones, floods, and other potential disasters. This includes installing sirens, community-based warning systems, and utilizing various communication channels to reach a broader population.

Disaster Awareness and Education: Conduct regular awareness campaigns and educational programs to inform the local population about potential risks, safety measures, and evacuation procedures. People should be trained to respond appropriately during emergencies.

Infrastructure Development: Invest in resilient infrastructure that can withstand disasters, such as elevated roads and buildings, reinforced bridges, and flood protection embankments. Proper urban planning can also help to reduce the vulnerability of settlements.

Climate-Resilient Agriculture: Encourage the adoption of climate-resilient agricultural practices to minimize the impact of extreme weather events on crops and livelihoods.

Mangrove Conservation: Protect and restore mangrove forests along coastal areas as they act as natural barriers against storm surges and help to reduce the impact of cyclones.

Urban Drainage Management: Improve the city's drainage system to reduce the risk of flooding during heavy rainfall or cyclonic events.

Health and Sanitation: Strengthen healthcare facilities and sanitation infrastructure to handle potential health emergencies and prevent disease outbreaks in the aftermath of disasters.

Community-Based Disaster Management Committees: Establish community-based disaster management committees to develop local strategies, coordinate response efforts, and ensure that vulnerable groups are accounted for during disaster planning.

Public-Private Partnerships: Foster collaborations between government agencies, non-governmental organizations (NGOs), and private sectors to pool resources and expertise for disaster risk reduction initiatives.

Climate Change Adaptation: Integrate climate change adaptation measures into development planning to address the long-term impact of changing weather patterns.

Ecosystem Restoration: Support initiatives to restore and protect natural ecosystems like wetlands, which can help regulate water flow and act as buffers during disasters.

Strict Building Codes: Enforce and update building codes and regulations to ensure that new constructions are resilient to potential disasters.

Invest in Research and Data Collection: Support research and data collection efforts to better understand the region's vulnerabilities and strengthen the evidence-based approach to disaster risk reduction.

Community Resilience Programs: Foster community resilience by promoting livelihood diversification, savings groups, and micro-insurance to help communities recover quickly from disasters.

Institutional Capacity Building: Strengthen the capacity of local government agencies, disaster management authorities, and other relevant stakeholders to effectively respond to disasters.

10.7 Communication System

An efficient communication system is absolutely essential for the success of any disaster management plan. This has to be worked out in consultation with local authorities. More often, the entire communication system gets disrupted when a disaster occurs. The damaged areas need to be clearly identified and provided with a temporary and full proof communication system.

- **Public Awareness Campaigns:** Conduct regular public awareness campaigns to educate the population about potential risks, preparedness measures, and evacuation procedures. This can be done through TV and radio broadcasts, posters, leaflets, and community engagement events.
- **Emergency Hotlines:** Establish dedicated emergency hotlines that the public can call to report incidents, seek help, or obtain information during disasters. These hotlines should be staffed with trained operators who can provide appropriate guidance.

- **Mobile Alerts and SMS:** Utilize mobile phone networks to send mass text messages (SMS) or push notifications to inform the public about impending disasters, evacuation orders, and safety instructions.
- **Social Media and Online Platforms:** Leverage social media platforms and websites to disseminate real-time information, emergency updates, and safety guidelines. Social media can also be used to monitor public sentiment and gather feedback from affected communities.
- **Two-Way Radio Communication:** Establish two-way radio communication systems for emergency responders, government agencies, and volunteer groups to maintain seamless communication during disaster response operations.
- **Satellite Communication:** In remote or disaster-prone areas with limited communication infrastructure, satellite communication can be deployed to ensure connectivity and information exchange.
- **Community-Based Communication:** Engage local leaders, community organizations, and volunteers to act as communication focal points in their respective areas. This helps ensure that information reaches even the most isolated and vulnerable communities.
- **Collaboration with Media:** Work closely with media outlets to relay accurate and timely information to the public. Press conferences and media briefings can be organized to keep journalists updated and informed.
- **Multi-Lingual and Accessible Information:** Provide information in multiple languages and accessible formats (e.g., braille, audio) to cater to diverse populations, including those with disabilities and non-native speakers.
- **Coordination Platforms**: Establish communication platforms for different stakeholders involved in disaster management, such as government agencies, NGOs, and international organizations, to facilitate coordination and information sharing.
- **Simulation Exercises and Drills**: Regularly conduct simulation exercises and drills to test the effectiveness of the communication system and identify areas for improvement.
- **Public Address Systems:** Install public address systems in critical locations, such as evacuation centers and public buildings, to convey important announcements and safety instructions.

10.8 Risk Assessment

The risks affecting solar projects appear throughout the entire project lifetime. Some examples are the risk of environmental damage, hand injury, fatigue and ergonomics, the collapse of scaffold or ladder, falls, electrocution, and fire. In managing the risks associated with the solar project it is important to carry out a risk assessment which will involve-

1. Identifying all the activities, processes, or day-to-day operations to be carried out during the project.
2. Dividing the identified activities into steps.
3. Identifying the hazards and risks associated with each step and deciding who may be harmed and how serious it could be.
4. Developing measures to manage the identified risks to a level that is tolerable and as low as reasonably practicable (ALARP principle).
5. Recording the findings and continually reviewing the risk assessment.
6. Taking account of new working practices, new machinery, or more demanding work targets. Based on the risk assessment conducted for the project/activity the controls can be defined based on the following Hierarchy of Controls

10.9 Emergency Response

Project personnel will meet with local emergency response groups to review the Fire Safety Plan, discuss the type of work taking place, duration of project schedule and emergency procedures. The following course of action should be taken if an emergency situation develops:

- Evacuation procedures and assembly are contained in the Evacuation plan, which will be posted in all office trailers. Maintain site security and control.
- Notify proper emergency services for assistance. Dial 999 or direct-dial emergency contact numbers if possible.
- Notify Onsite O&M Primary Contact and all affected personnel at the site through use of site communication devices.
- Once emergency personnel have been notified, an employee will then be designated to meet the emergency personnel and then guide them to the incident location.
- Only after the emergency is declared over by the Onsite O&M Primary Contact can all other communication resume.
- Prepare a summary of the incident as soon as possible and no later than 24 hours after the incident.

Without fulfilling the health and safety requirements of the project sites, construction activity must not be compromised at this time. If an activity cannot be undertaken safely, it should not take place. Emergency services are also under great pressure and may not be able to respond as quickly as usual. The PIU & Contractors need to take into consideration in the planning of work activities, first aid, fire and emergency responses. Contractor must have in place effective arrangements for monitoring and reviewing their compliance with Bangladesh government guidelines during any disaster occurrence.

11 GRIEVANCE REDRESS MECHANISM

11.1 General

Public participation, consultation and information disclosure undertaken as part of the local ESIA process have discussed and addressed major community environmental concerns. Continued public participation and consultation has been emphasized as a key component of successful project implementation. As a result of this public participation during the initial stages of the project, major issues of grievance are not expected. During the operational phase of the project, the complaints that may be anticipated are mostly related to noise & vibration of the generator. However, unforeseen issues may occur. To settle such issues effectively, an effective and transparent channel for lodging complaints and grievances will be established. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process. It should also be readily accessible to all sections of the community at no cost and without retribution.

The Grievance Mechanism will be implemented during both the construction and operational period of the project to ensure that all complaints from local communities are dealt with appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties.

The mechanism will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple means of using this mechanism, including face-to-face meetings, written complaints, telephone conversations should be available. Confidentiality and privacy for complainants should be honored where this is seen as necessary or important.

A grievance redress mechanism & procedure is set up to provide opportunity for project affected persons to settle their complaints and grievances amicably. The established grievances redress procedures and mechanism ensure that project affected persons are provided with the appropriate compensations and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably.

11.2 Requirements Of the Development Partner's

Environmental and social safeguard requirements of all partner agencies were carefully considered during the preparation of this ESIA. The description of a grievance redress mechanism (GRM) is not required under the GoB environmental legislation but is mandatory as per donor agencies requirement. To that end a step-by-step process is defined in this chapter.

Grievance redress refers to the set of actions available to anyone negatively impacted by the project and not properly dealt with, ignored, or overlooked the implementation of mitigative and monitoring measures defined in the ESIA. The overriding principle of any GRM is that it must be non-threatening, easily accessible, quick and impartial, delivering decisions to the complainant in an unbiased a-political manner. GRM's have been developed for many past donor-funded projects and have been accepted by the GoB and been reasonably successful in doing what they are supposed to do.

11.3 Objectives

The objective of grievance redress mechanism (GRM) is to improve the response efficiency and accountability level to the project beneficiaries, ensuring the prompt complaints and feedback consideration and processing, as well as problems identification and finding their solutions together with the stakeholders.

11.4 Steps Of Redressing/Resolving Grievance

The Developers while developing the Grievance Mechanism are required to adhere to the following steps:

11.4.1 Development of Procedures

The developers should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Grievance Officer at Site level) who will be responsible for receiving and addressing the grievances at the site level and handling the cases at the escalation level. The procedures to be developed should include assessment procedures, procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.

11.4.2 Develop Resolution Options and Response

Once Developers developed procedures, formal and informal resolution options should also be developed along with preparation of formulating a response. General approaches to grievance resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using a third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.

11.4.3 Publicize the Grievance Mechanism

Once the procedures for Grievance Mechanism have been developed by the developers, it has to be publicized through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan and should be disseminated to the developer as well. The Developers should inform the local community in the first instance and then on remind them of this mechanism on a regular basis during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updating. The grievances redress mechanism (GRM) shall be documented in English and Bangla and copies shall be kept at the project site office and corporate office. The GRM is also to be displayed on a notice board at the project site office and training on the GRM shall also be provided during orientation. Developer is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All pertinent contact information will be made available to them.

11.4.4 Recording of Grievances

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

11.4.5 Appeal

If the grievance redressal solution is not acceptable or agreed by the complainant, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made

should be set by the developers so that accountability and transparency is promoted by them in every step.

11.4.6 Resolve and Follow Up

Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close the case accordingly. Developers are required to provide regular (yearly) reports to Western Monpura Solar Power Ltd. (WMSPL) that track the number of complaints received, resolved, not resolved and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support the identification of developing risks.

11.5 Proposed Grievance Redress Mechanism For (WMSPL)

The Grievance Redress Mechanism outlines the process for lodging of grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the satisfaction of the complainant (community members, project affected persons and workers). All complaints shall be recorded and addressed in a uniform and consistent manner. The GRM for the proposed project is presented below with time bound schedules and specific persons to address grievances.

11.5.1 Grievance Redress Committee

A site level approach is proposed to be developed for redressing all cases of grievances. All grievances are to be redressed at this stage. The representatives proposed for the grievance committee is provided below,

- Site Supervisor
- EHS Manager
- Admin Officer and
- Safety Officer.

The functions of GRC are as follows:

- To provide support to affected communities on problems arising from environmental or social impacts;
- To record grievances of the affected community by categorizing and prioritizing them, and provide solutions within a stipulated time period; and
- To report to the aggrieved parties, developments regarding their grievances and decisions of the GRC.

The steps of grievance redressal for Developer have been provided below:

11.5.2 Receive and Register a Complaint

The developers in order to implement the Grievance Redress Mechanism is required to nominate a Grievance Officer for registering the grievances, initiating the process of registering and action taken thereon for the resolution of the grievance and the timeline required in each step. The contact details of the Grievance Officer shall be maintained and updated in the following format displayed at prominent places available to the public and the project area.

- Any stakeholder such as worker, person from local community or any other stakeholder, with concerns pertaining to onsite work such as community health and safety, local employment, community risk, migrant labor or any issues etc., may register their complaint in writing to the nominated person/grievance officer at site level;
- All grievances will be addressed by the developers during the construction and operation phase. For any unresolved grievances or any grievances related to land, the developer will

forward the grievances to WMSPL who in turn will subsequently forward them to appropriate authority for redressing;

- Secured grievance boxes shall be placed at the entrance of the site office.
- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box; and
- Once a complaint has been received it shall be recorded in the grievance log register or data system.

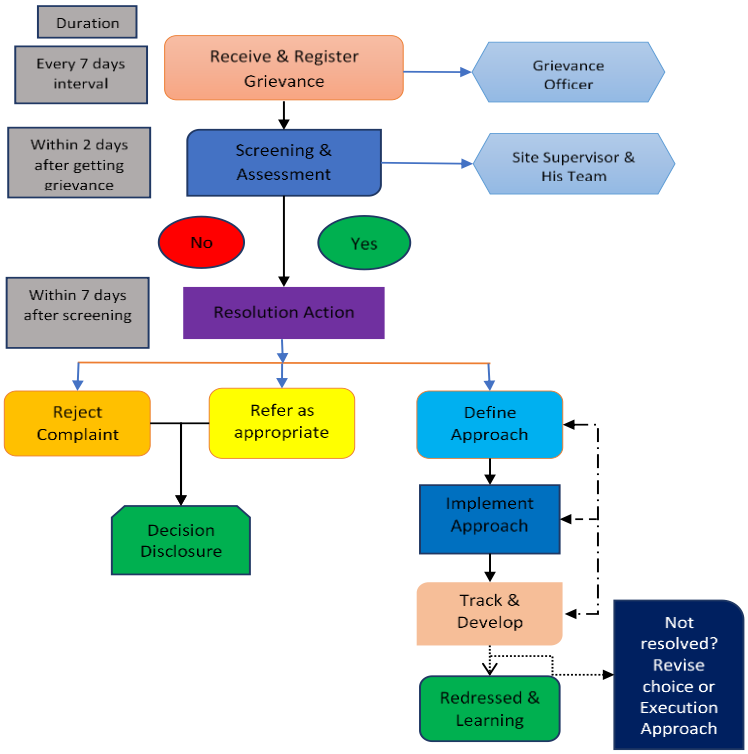


Figure 11-1: Proposed Grievance Mechanism for Developer

Details of grievance received shall be maintained by the Grievance Officer in a register as per the following format.

11.5.3 Assessment and Addressal of Complaint

- The Grievance Officer will open the grievance boxes once every week and register the grievance in the Grievance Log Register as per the format provided above;
- The Grievance Officer will then forward the grievances after registration to the Site Supervisor for further action;
- The grievance will be assessed by the Site Supervisor within two (2) working days to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not;
- During the assessment of complaints, the GRC team (EHS Manager Admin Officer, Site Supervisor & Safety Officer) will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved.
- The grievances will be redressed at the Site Level by the GRC within seven (7) working days;
- If the grievance fails to be addressed at this level the complainant will have the option to approach the appropriate court of laws for redress; and
- The complainant will have the opportunity to be present at the committee meetings and discuss the grievance faced by him/her.

The Grievance Mechanism proposed for Developer to consider and implement has been provided in Figure 11.1 above.

11.5.4 Documentation

- The Grievance Redress Mechanism will be documented in English and Bangla and copies will be kept at the project site office;
- The GRM will also be displayed at notice board at the project site office and labor camp sites and will be included in worker documentation;
- The developers/EPC should inform the local community and workers about Grievance Redress Mechanism during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays and face to face meetings;
- The Contractor or Admin Officer will inform the workers about the grievance mechanism at the time of recruitment or induction training and make it easily accessible to them;
- The Grievance Officer's contact number will be made available to them. The project office phone number will be posted in public areas within the project area;
- The mechanism will address concerns promptly, using an understandable and transparent process and provide timely feedback to the concerned stakeholder;
- Verifiable records of implementation of corrective action like dated photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation should be kept;
- A Grievance Log or database emphasizing the records and status of the grievance shall be maintained by the Grievance Officer at the site level.

12 ENVIRONMENTAL AND SOCIAL BENEFIT

12.1 Introduction

Renewable energy is recognized internationally as a major contributor in protecting our climate, nature, and the environment as well as providing a wide range of environmental, economic, and social benefits that will contribute towards long-term global sustainability.

Increasing the supply of renewable energy would allow replacing carbon-intensive energy sources and significantly reducing global warming emissions. Generating electricity from renewable energy offers significant public health benefits. The air and water pollution emitted by coal and natural gas plants is linked to breathing problems, neurological damage, heart attacks, and cancer.

Solar systems generate electricity with no associated air pollution emissions. While solar energy systems emit some air pollutants, total air emissions are generally much lower than those of coal and natural gas-fired power plants. In addition, solar energy essentially requires no water to operate and thus does not pollute water resources or strain supply by competing with agriculture, drinking water systems, or other important water needs.

12.2 Energy and Climate Concern

The negative environmental impacts from generating electricity through conventional fossil fuel burning at thermal power plants are very well known. This most importantly includes air pollutant emissions such as ozone, sulfur dioxide (SO_2), Nitrogen Dioxide (NO_2), particulate matter, and other gases, which are the cause of some serious environmental concerns such as smog, acid rain, health effects, and many others.

In addition, the burning of fossil fuels results in carbon dioxide emissions; a primary greenhouse gas emitted through human activities, which contributes to global warming. The main human activity that emits CO2 is the combustion of fossil fuels for electricity production and transportation. Concurrently, global climate change has become an issue of concern and so reducing greenhouse gas emissions have also emerged as primary issues to be addressed as the world searches for a sustainable energy future.

Electricity produced using solar energy emits no greenhouse gases (GHGs) or other pollutants. As with any electricity-generating resource, the production of the PV systems themselves requires energy that may come from sources that emit GHGs and other pollutants. Since solar PV systems have no emissions once in operation, an average traditional PV system will need to operate for an average of four years to recover the energy and emissions associated with its manufacturing. A thin-film system currently requires three years. Technological improvements are anticipated to bring these timeframes down to one or two years. Thus, a residential PV system that can meet half of average household electricity needs is estimated to avoid 100 tons of carbon dioxide (CO2) over a 30-year lifetime.

12.3 Energy and Livelihood Concern

The belief that the provision of electricity through renewable resources can bring about desired socio-economic changes (increased economic opportunities, improved health, and education facilities. With the availability of energy livelihood strategy changes connecting the industrial production, output, cost and other variability. The changes come from using renewable resource technology is positive and sustainable for the livelihood strategy and running business.

The development of micro-enterprises in rural areas is linked with the increase in access and use of grid electricity services, leading to changes in micro-enterprises, and changes in livelihood characteristics of entrepreneurs, employees, and community members in areas where these enterprises located. Micro-enterprises are important in their role as contributors to the economy of the rural poor especially women, technological development of rural people and in their potential for employment creation.

12.4 Energy and Economy Concern

Bangladesh has major problems with energy shortage, persisting poverty and environmental degradation. Per capita energy use is only 180 kW-h (Energypedia-2014). With only 59.60% of Bangladesh's having access to electricity connection whereas the national grid could so far cover only 42 percent of 161 million of the total population.

Energy is a foundation stone of the modern industrial economy. Energy provides an essential ingredient for almost all human activities: it provides services for cooking and space/water heating, lighting, health, food production and storage, education, mineral extraction, industrial production, and transportation. Modern energy services are a powerful engine of economic and social development, and no country has managed to develop much beyond a subsistence economy without ensuring at least minimum access to energy services for a broad section of its population. Throughout the world, the energy resources available to them and their ability to pay largely determine the way in which people live their lives. Nevertheless, it is critical to recognize that what people want are the services that energy provides, not fuel or electricity per se. Many factors play a role in influencing energy supply, not least of which is its availability, price, and accessibility. The regional endowment of energy sources and the pace at which they are developed and distributed are not uniform around the world.

The last two centuries have seen massive growth in the exploitation and development of energy sources, and the world has gained many benefits from these activities. The magnitude of energy consumed per capita has become one of the indicators of development progress of a country, and as a result, energy issues and policies have been mainly concerned with increasing the supply of energy. This approach is now seen as a vision that needs challenge.

In the last two years, countries around the world have added almost as much new solar photovoltaic (PV) capacity as had been added since the invention of the solar cell. Nearly 38,000 megawatts of PV came online in 2013, a new annual record. In all, the world's installed PV generating capacity is now close to 140,000 megawatts. Falling costs and effective policies continue to drive tremendous growth in solar power.

Solar PV generation increased by a record 270 TWh (up 26%) in 2022, reaching almost 1 300 TWh. It demonstrated the largest absolute generation growth of all renewable technologies in 2022, surpassing wind for the first time in history.

13 CONCLUSION AND RECOMMENDTION

13.1 Conclusion

According to the above analysis, we can conclude that, if the recommended mitigation measures and environmental management processes are adopted properly, the project will be environmentally sound and sustainable.

Primarily the national economy will benefit from the project. Benefits in the project area will be significant except for some short term's employment and business opportunities during the construction phase. However, the needs of the solar photovoltaic power plant are obvious and for that the livelihood of the area will be developed. Developed livelihood will directly influence the growth of the economy of the area.

During the construction stage, there will be some negative impacts of the project. There are no significant cumulative adverse impacts during operation that are identifiable at this stage. The construction impacts should be very predictable and manageable, and with appropriate mitigation few residual impacts are likely. Additional human and financial resources will be required to improve environmental capability, and to progress and achieve necessary statutory compliance and environmental clearance certification for the project or associated activities that also require environmental assessment and environmental permits under the environmental laws of Bangladesh.

The project is expected to have a small "environmental footprint". Some endangered and protected species of flora or fauna are reported at the project site. The proposed project activities have no significant adverse environmental impact so far as a time bound execution program with application of advanced construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the proposed project.

13.2 Recommendation

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The potential cumulative and residual impacts of the project are classified as not highly sensitive or complex.

The ESMP, its mitigation and monitoring programs, contained herewith shall be included within the Bidding documents for project works. The Bid documents state that the contractor shall be responsible for the implementation of the requirements of the ESMP through his own Site-Specific Environmental Management Plan, which will adopt all of the conditions of the ESMP. This ensures that all potential bidders are aware of the environmental requirements of the project and its associated environmental costs.

The ESMP and all its requirements shall then be added to the contractor's contract, thereby making implementation of the ESMP a legal requirement according to the contract. To ensure compliance with the ESMP the contractor should employ an environmental specialist to monitor and report project activities throughout the project life cycle.

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ANNEXURE

Annex A: Site Clearance Certificate (SCC) from DoE

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
ভোলা জেলা কার্যালয়
রহিমা ভিলা (নিচতলা), পৌরকাটালি, সদর, ভোলা।
www.doe.gov.bd

অবস্থানগত ছাড়পত্র

ছাড়পত্র নং: ২৩-১১০৩৪৫

পরিবেশগত ব্যবস্থাপনা নিশ্চিতকরণ সাপেক্ষে সংযুক্ত শর্তে নিম্নবর্ণিত প্রতিষ্ঠান/প্রকল্পের অনুকূলে অবস্থানগত ছাড়পত্র প্রদান করা হলো :

প্রতিষ্ঠান/প্রকল্পের নাম	:	WMSPL - 3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant
উদ্যোক্তার নাম	:	S.M. Qaiyum Bappy
সনাক্তকরণ নং	:	১৫৩০৪২
প্রতিষ্ঠান/প্রকল্পের কার্যক্রম	:	Other
প্রতিষ্ঠান/প্রকল্পের শ্রেণী	:	Yellow
প্রতিষ্ঠান/প্রকল্পের ঠিকানা	:	Western Monpura Solar Power Limited, TCB Bhaban (10th Floor), 1-Kawran Bazar, Dhaka-1215
প্রদানের তারিখ	:	14 November, 2023
মেয়াদ উত্তীর্ণের তারিখ	:	13 November, 2025

এ ছাড়পত্র সনদের সাথে পৃথকভাবে সংযুক্ত প্রদত্ত শর্তাবলী যথাযথভাবে প্রতিপালন করতে হবে, অন্যথায় ছাড়পত্র বাতিল/ক্ষতিপূরণ আদায়সহ যে কোন আইনানুগ ব্যবস্থা গ্রহণ করা হবে।

বিঃদ্রঃ এটি একটি সিস্টেম জেনারেটেড ছাড়পত্র এবং এতে কোনোরূপ স্বাক্ষরের প্রয়োজন নেই।

ছাড়পত্রটি যাচাই করতে ভিজিট করুন: https://ecc.doe.gov.bd/certificate_verification
Page 1 of 3

সনাক্তকরণ নং: ১৫৩০৪২ WMSPL - 3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant

ছাড়পত্র নং: ২৩-১১০৩৪৫

অবস্থানগত ছাড়পত্র জন্য প্রযোজ্য শর্তাবলী:

১ . বিশেষ শর্তসমূহ :

এই ছাড়পত্র নিম্নোক্ত তফসিলভূক্ত জমিতে স্থাপিত শিল্প কারখানা/প্রকল্পের জন্য প্রযোজ্য :

মৌজার নামঃ দাসের হাট, খতিয়ান নং-৭১৫, দাগ নং-৫৭৫, ৫৭৪, ৫৭৩, ৫৯৭, ৫৯৮, ৫৭৬, ৬০৭, ৬০৮, ৫৭৮, ৭৬৪, ৭৬৬, ৫৯১, ৫৯২, ৫৯৩, ৫৯৪, ৫৯৫, ৫৯৬, ৫৯৭, ৫৮৪, ৫৮৫, ৫৮৬, ৫৮৭, ৫৮৮, ৭৪৭, ৫৮৯, ৫৯০, ৫৭৪, ৫৭৭, ৭৫০

২ . এই ছাড়পত্র নিম্নোক্ত দ্রব্য/পণ্য উৎপাদন বা কার্যক্রম পরিচালনার জন্য প্রযোজ্য :

(ক) ৩ মেগাওয়াট (এসি) সোলার পিভি-ব্যাটারী-ডিজেল হাইব্রিড পাওয়ার প্লান্ট স্থাপন এবং

(খ) সৌর বিদ্যুৎ উৎপাদন ও বিতরণ।

সাধারণ শর্তসমূহ :

৩ . প্রতিষ্ঠানটির অবকাঠামো উন্নয়ন কার্যক্রম দ্বারা কোনোভাবেই পরিবেশ (মাটি,পানি, বায়ু) দূষণ করা যাবে না।

৪ . পরিবেশ অধিদপ্তরে পূর্বানুমতি ব্যতীত উৎপাদন প্রক্রিয়া বা কার্যক্রম বৃদ্ধি, নতুন যন্ত্রপাতি স্থাপন, জায়গা সম্প্রসারণ বা তৎসংশ্লিষ্ট কোনো প্রকার পরিবর্তন করা যাবে না।

৫ . প্রতিষ্ঠাটির কার্যক্রম দ্বারা সৃষ্ট শব্দের মাত্রা শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা, ২০০৬- এর তফসিল -১ এ বর্ণিত মানমাত্রার মধ্যে রাখতে হবে।

৬ . প্রতিষ্ঠানটির নির্মাণ কার্যক্রমের ফলে সম্ভাব্য বায়ুদূষণ নিয়ন্ত্রণে নির্মাণ সামগ্রি ঢেকে রাখতে হবে এবং উন্মুক্ত স্থান হতে ধুলা-বালি নিয়ন্ত্রণে নির্দিষ্ট সময় পর পর পানি স্প্রে করতে হবে ।

৭ . কার্বণ নিঃসরণ হ্রাসের লক্ষ্যে প্রতিষ্ঠানটিতে সোলার পাওয়ারসহ ও লাইটিং কাজে এনার্জি সেভিং বাল্ব ব্যবহার করতে হবে।

৮ . ভূগর্ভস্থ পানির ব্যবহার হ্রাসকল্পে Rain Water harvesting System গড়ে তুলতে হবে।

৯ . প্রতিষ্ঠানের খালি জায়গায় দেশিয় জাতির গাছ লাগিয়ে সবুজায়ন করতে হবে।

১০ . প্রতিষ্ঠানের কর্মরত স্টাফ/কর্মচারী/শ্রমিকদেরকে পেশাগত স্বাস্থ্য রক্ষার্থে সকল ব্যবস্থা সার্বক্ষনিক চালু রাখতে হবে।

১১ . প্রতিষ্ঠানটিতে কর্মরত শ্রমিক কর্মচারীদের জন্য সুপেয় পানীয় জলের ব্যবস্থা নিশ্চিত করতে হবে এবং প্রতিষ্ঠানটিতে স্বাস্থ্যসম্মত টয়লেট ব্যবস্থা গড়ে তুলতে হবে এবং তা সর্বদা পরিস্কার পরিচ্ছন্ন রাখতে হবে।

১২ . অবস্থানগত ছাড়পত্রের মূলকপি প্রতিষ্ঠানটিতে সংরক্ষণ করতে হবে এবং পরিবেশ অধিদপ্তরের কোনো কর্মকর্তা পরিদর্শনে গেলে তা প্রদর্শন করতে হবে।

১৩ . প্রতিষ্ঠানটির অবকাঠামোর নির্মাণ, যন্ত্রপাতি স্থাপন এবং পরিবেশ দূষণ নিয়ন্ত্রণমূলক ব্যবস্থা বাস্তবায়নের পর পরিবেশগত ছাড়পত্রের জন্য আবেদন

সনাক্তকরণ নং: ১৫৩০৪২ WMSPL - 3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant
ছাড়পত্র নং: ২৩২১০৩৪৫
দাখিল করতে হবে।

১৪. পরিবেশগত ছাড়পত্র গ্রহণ ব্যাতিরেকে শিল্প প্রতিষ্ঠান বা প্রকল্পের উৎপাদন কার্যক্রম শুরু বা প্রকল্প চালু করা যাবে না।

১৫. প্রতিষ্ঠানের কার্যক্রম পরিচালনার জন্য প্রযোজ্য অন্যান্য দপ্তর বা সংস্থার প্রয়োজনীয় লাইসেন্স/অনাপত্তি/ছাড়পত্র গ্রহণ করতে হবে।

১৬. এ ছাড়পত্র ০১ (এক) বছরের জন্য প্রযোজ্য। ছাড়পত্রের মেয়াদ শেষ হওয়ার অন্তত ৩০ (ত্রিশ) দিন পূর্বে নবায়নের জন্য আবেদন দাখিল করতে হবে।

১৭. এ ছাড়পত্র প্রতিষ্ঠানটির ভূমির মালিকানা/স্বত্ব নির্ধারণ করে না।

১৮. এ পর্যায়ে প্রাপ্ত পরিবেশিত তথ্যের ভিত্তিতে এ ছাড়পত্র প্রদান করা হলো। পরবর্তীতে কোনো তথ্য অসম্পূর্ণ ,ত্রুটিপূর্ণ, অসত্য কিংবা গোপন করা হয়েছে মর্মে প্রমাণিত হলে এ ছাড়পত্র বাতিল হতে পারে।

১৯. উপর্যুক্ত শর্ত এবং অবস্থানগত ছাড়পত্রের প্রদত্ত অন্যান্যা শর্তাবলী প্রতিপালনে ব্যর্থ হলে ছাড়পত্র বাতিল হতে পারে এবং বাংলাদেশ পরিবেশ সংরক্ষণ আইন ১৯৯৫ (সংশোধিত-২০১০) এবং তদধীন প্রণীত বিধিমালা অনুযায়ী আইনগত ব্যবস্থা গ্রহণ করা হবে।

Annex B: DoE Guidelines for SCC and ECC

রেজিস্টার্ড নং ডি এ-১

বাংলাদেশ গেজেট

অতিরিক্ত সংখ্যা

কর্তৃপক্ষ কর্তৃক প্রকাশিত

রবিবার, মার্চ ৫, ২০২৩

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ, বন ও জলবায়ু পরিবর্তন মন্ত্রণালয়

প্রজ্ঞাপন

তারিখ: ১৭ ফাল্গুন, ১৪২৯ বঙ্গাব্দ/২ মার্চ, ২০২৩ খ্রিষ্টাব্দ

এস, আর, ও নম্বর ৫৩/আইন/২০২৩।—বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫ (১৯৯৫ সনের ১ নং আইন) এর ধারা ২০ এ প্রদত্ত ক্ষমতাবলে সরকার, নিম্নরূপ বিধিমালা প্রণয়ন করিল, যথা :—

১। শিরোনাম ও প্রবর্তন।—(১) এই বিধিমালা পরিবেশ সংরক্ষণ বিধিমালা, ২০২৩ নামে অভিহিত হইবে।

(২) ইহা অবিলম্বে কার্যকর হইবে।

৬। **অবস্থানগত ছাড়পত্র ও পরিবেশগত ছাড়পত্র গ্রহণের বাধ্যবাধকতা।**—(১) বিধি ৫ এ উল্লিখিত হলুদ, কমলা ও লাল শ্রেণির নূতন শিল্প প্রতিষ্ঠান স্থাপন এবং প্রকল্প গ্রহণের পূর্বে অধিদপ্তরের নিকট হইতে প্রথমে অবস্থানগত ছাড়পত্র ও পরবর্তীতে পরিবেশগত ছাড়পত্র গ্রহণ করিতে হইবে:

তবে শর্ত থাকে যে, সবুজ শ্রেণির নূতন শিল্প প্রতিষ্ঠান স্থাপন ও প্রকল্প গ্রহণের পূর্বে, উহা যেখানেই স্থাপন করা হউক না কেন, অবস্থানগত ছাড়পত্র গ্রহণের প্রয়োজন হইবে না, অধিদপ্তরের নিকট হইতে কেবল পরিবেশগত ছাড়পত্র গ্রহণ করিতে হইবে:

আরও শর্ত থাকে যে, সরকারি বা বেসরকারি রপ্তানি প্রক্রিয়াকরণ অঞ্চল, অর্থনৈতিক অঞ্চল বা বাংলাদেশ ক্ষুদ্র ও কুটির শিল্প করপোরেশনের শিল্প নগরীতে স্থাপিতব্য সকল শ্রেণির শিল্প প্রতিষ্ঠান বা প্রকল্পের ক্ষেত্রে অবস্থানগত ছাড়পত্র গ্রহণের প্রয়োজন হইবে না, অধিদপ্তরের নিকট হইতে কেবল পরিবেশগত ছাড়পত্র গ্রহণ করিতে হইবে।

(২) অবস্থানগত ছাড়পত্র গ্রহণ ব্যতীত হলুদ, কমলা ও লাল শ্রেণির কোনো শিল্প প্রতিষ্ঠান স্থাপন বা প্রকল্পের জন্য ভূমির উন্নয়ন বা এতদুদ্দেশ্যে কোনো প্রকার অবকাঠামো নির্মাণ করা যাইবে না।

(৩) অবস্থানগত ছাড়পত্র গ্রহণ ব্যতিরেকে হলুদ, কমলা ও লাল শ্রেণির নূতন শিল্প প্রতিষ্ঠান বা প্রকল্পে গ্যাস, বিদ্যুৎ, পানি বা অন্যান্য প্রয়োজনীয় পরিষেবা প্রদান করা যাইবে না।

(৪) পরিবেশগত ছাড়পত্র গ্রহণ ব্যতিরেকে সবুজ, হলুদ, কমলা ও লাল শ্রেণির নূতন শিল্প প্রতিষ্ঠানে পরীক্ষামূলক উৎপাদন করা বা প্রকল্প চালু করা যাইবে না।

১১। **হলুদ শ্রেণির শিল্প প্রতিষ্ঠান ও প্রকল্পসমূহকে পরিবেশগত ছাড়পত্র প্রদান পদ্ধতি।**—(১) অবস্থানগত ছাড়পত্র পাইবার পর হলুদ শেণির সংশ্লিষ্ট শিল্প প্রতিষ্ঠান বা প্রকল্পের উদ্যোক্তাকে উহা চালু করিবার লক্ষ্যে পরিবেশগত ছাড়পত্র প্রাপ্তির জন্য আবেদন করিতে হইবে।

(২) উপ-বিধি (১) এ উল্লিখিত আবেদন বিবেচনা করিবার ক্ষেত্রে অধিদপ্তরের সংশ্লিষ্ট কার্যালয় কর্তৃক সংশ্লিষ্ট শিল্প প্রতিষ্ঠান বা প্রকল্প সরেজমিনে পরিদর্শন করিয়া যৌক্তিকতা ও অভিমতসহ প্রতিবেদন প্রস্তুত করিতে হইবে।

(৩) উপ-বিধি (১) এর অধীন আবেদন প্রাপ্তির অনধিক ৭ (সাত) কার্যদিবসের মধ্যে দাখিলকৃত আবেদন, পরিদর্শন প্রতিবেদন, অবস্থানগত ছাড়পত্রের শর্তাবলি প্রতিপালন, ইত্যাদি বিবেচনা করিয়া অধিদপ্তরের সংশ্লিষ্ট কার্যালয় সন্তুষ্ট হইলে সংশ্লিষ্ট উদ্যোক্তার অনুকূলে পরিবেশগত ছাড়পত্র প্রদান করিবে, অথবা সন্তুষ্ট না হইলে আবেদনটি নামঞ্জুর করিয়া উহার কারণ উল্লেখপূর্বক আবেদনকারীকে লিখিতভাবে অবহিত করিবে।

Annex C: Technical Description of Solar Cleaning System

Technological aspects of solar panel cleaning system and water usage

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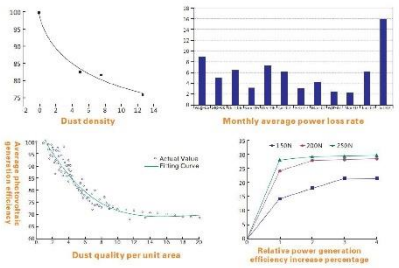
Introduction

As the adoption of solar energy continues to grow, the maintenance of solar panels becomes increasingly important to ensure optimal efficiency. This report explores the technological aspects of semi-automatic solar panel cleaning systems and their implications for water usage.

Importance of Solar Cleaning System

One of the main elements influencing the production efficiency of solar energy is dust. The energy output of photovoltaic power plants will be significantly reduced by dust pollution. At least 5% annually is estimated. The global installation capacity is projected to reach 500 GW by 2020, based on estimations. Up to $5 billion will be lost economically each year because of the reduction in dust in electricity generation. This loss will increase in severity as the power plants installed capacity rises. The estimated cost of the economic losses due to dust is $13 billion by 2030, when the global installation capacity reaches 1400 GW.



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According to measurements, the dirt and dust on the surface of the modules caused an average annual reduction in power efficiency of 6%. During periods of lack of rain, the power efficiency loss can reach 15% or more due to accumulated dirt on of the modules.

Semi-Automatic Cleaning System

Semi-automatic cleaning systems typically involve a combination of manual intervention and automated processes. Operators may guide cleaning tools or equipment across the surface of solar panels, enhancing the efficiency of cleaning while reducing the need for extensive manual labor.

Cleaning Mechanisms

Semi automatic cleaning systems often employ rotating brushes or soft bristles to remove dirt and debris from the surface of solar panels. These brushes may be manually operated or integrated into automated cleaning equipment.

Water Usage Optimization

Semi-automatic cleaning systems aim to optimize water usage by delivering water precisely to the areas requiring cleaning, which can greatly save water, save costs, and improve cleaning efficiency in Bangladeshi weather conditions. Techniques such as targeted spraying help conserve water while effectively removing dirt from solar panels.

Recirculation and filtration

These semi-automatic systems incorporate water recirculation and filtration mechanisms to minimize water consumption and maintain water quality. Recycled water can be filtered and reused for subsequent cleaning cycles, reducing the overall water demand.

Data analysis

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By collecting data on cleaning cycles, water consumption, and panel performance, semi-automatic systems enable operators to analyze trends and identify opportunities for further optimization, enhancing overall efficiency and sustainability.

The project of **Western Manpura Solar Power Limited (WMSPL)** will be installed on an island in Daser Hat, Haji Hat Union, Manpura Island, Manpura, Bhola, Bangladesh. The area has a low dust ratio, which means that the solar panels will require less cleaning and less water consumption compared to other regions in Bangladesh.

That's why we are choosing this type of semi-automatic solar cleaning system, which reduces water consumption as well as easily maintains the cleaning cycle for better output. Also, these semi-automatic cleaning systems' spare parts are available in local markets, making maintenance easier.

Conclusion

Semi-automatic solar panel cleaning systems offer a balance between manual intervention and automation, providing efficient solutions for maintaining the cleanliness and performance of solar energy systems. By optimizing water usage and incorporating advanced monitoring capabilities, these systems contribute to the sustainability and effectiveness of solar energy as a renewable resource.


Solar Cleaning Machine
Dust is one of the key factors affecting the efficiency of solar energy generation, dust pollution will greatly reduce the energy generation of photovoltaic power plants, estimated at least 5% per year.
Scube Technologies Limited
Powering Solarly
SCUBE
Why Clean Solar
Solar panels work by allowing light into the small cells. The more light that hits a panel, the more power it will generate. Due to the upwards angle of solar panels, they are more prone to bird droppings and a build up of general dust and dirt that does not wash off with just rain. This reduces the amount of light hitting the panel and reduces its output. As the projected energy figures claimed by solar panel manufacturers and installers are based on the optimum performance of clean solar panels, this build-up of dirt can adversely affect the panel's ability to meet those projections. So it is important to clean solar panels in order to protect and maintain your investment. Regular solar panel cleaning will also help you to make the most of the government feed in tariff. While solar panel cleaning in the World is relatively new, in other parts of the world solar panel cleaning has been around for a long time. Early adopters of the technology soon realised that if their solar panels were not cleaned regularly, they would not run at their optimum performance.
Dry Cleaning
The water cleaning brush has the characteristics of low water consumption, strong atomization and high conversion rate, which can greatly save water, save cost and improve cleaning efficiency.
Increase Power Generation in winter
It can increase the power generation of photovoltaic power plants in winter, increase the power generation income of power stations in winter, and reduce the load caused by snow on the ground racking system.
Cleaning Bird Droppings
The brush head is light, the point of attachment is accurate, the disturbance power is large, and the cleaning power is strong.
+88 0255029143
74, Mirpur Road, Dhanmondi, Dhaka-1205
info@scube.com.bd


Solar Cleaning Machine (STL-SCM01)
Technical Parameter
Product Feature
Top quality, made by German equipment.
Supplied from factory directly with reasonable price.
Offer samples according to your demands.
High cleaning efficiency and easy to operate.
Product Description
SCUBE


Solar Cleaning Machine (STL-SCM02)
Technical Parameter
Product Feature
Top quality, made by German equipment.
Supplied from factory directly with reasonable price.
Offer samples according to your demands.
High cleaning efficiency and easy to operate.
Product Description
X42 lithium battery version
SCUBE


Solar Cleaning Machine (STL-SCM03)
Technical Parameter
Product Feature
Product Description
SCUBE


Solar Cleaning Machine (STL-SCM04)
Technical Parameter
Product Feature
Top quality, made by German equipment.
Supplied from factory directly with reasonable price.
Offer samples according to your demands.
High cleaning efficiency and easy to operate.
Product Description
SCUBE

Annex D: PV Panel Decomissioning & Associated Waste Management Procedures by Suppliers

Certificate n° 965K-VN9E-WQN0-8AR4-1L1B-J38F

PV CYCLE GLOBAL CERTIFICATE 2023

www.pvcycle.org

PV CYCLE a.i.s.b.l.
hereby declares that based on current commitments

JA Solar International Limited

(Business registration nr.: 66148624-000-05-21-6)

1) benefits from collection and treatment services* for discarded PV panels and solar energy equipment

2) adheres to the high principle of PV CYCLE's PV waste management program

3) advocates and supports the development of sustainable PV waste management on a global scale

4) contributes to sustainable PV waste management by informing customers about legal developments and requirements

This certificate is valid until 31/12/2023 around the globe excluding the European Union Member States, UK, the EFTA countries and any other countries or regions where Extended Producer Responsibility legislation is in place or where it is not possible for PV CYCLE to deliver services due to political instabilities and uncontrollable factors.

Brussels, 13/12/2022

Jan Clyncke
Managing Director

*this membership does not cover the financing of collection, recycling and treatment of discarded PV panels and solar energy equipment. Details can be found in the signed terms and conditions.

The validity of this certificate can only be confirmed on https://portal.pvcycle.org/en-US/VerifyMemberCertificate/
PV CYCLE a.i.s.b.l. is registered in Brussels, Belgium with BE 0893.027.827.

PV CYCLE
STANDARD INSTRUCTIONS FOR THE COLLECTION OF PV PANEL WASTE

Read the Instructions!

WHAT TO DO WHEN I HAVE PV PANEL WASTE ?

WHAT TO DO WHEN I HAVE PV PANEL WASTE ?

Complete the QUOTATION ORDER form (for collection)

Instructions to prepare the Collection:

Instructions to prepare the Collection:

Instructions to prepare the Collection:

Safety instructions:

Examples of properly packed PV panel waste

Examples of incorrectly packed PV Panel waste

What do we NOT collect?

SPECIAL CASES?

Annex E: Assurance Statement of carbon emissions

鉴衡认证 CHINA GENERAL CERTIFICATION

温室气体排放验证声明

Assurance Statement of GHG emissions

证书编号： Certificate No.：	CGC-CC&SS-CN20230002
企业名称： Company Name：	晶澳太阳能科技股份有限公司 JA Solar Technology Co., Ltd.
地址： Address：	河北省邢台市宁晋县 Ningjin County, Xingtai City, Hebei Province
报告周期： Reporting Period：	2022 年 1 月 1 日 – 2022 年 12 月 31 日 01/01/2022- 31/12/2022
温室气体排放量化标准： Applied Standards：	ISO 14064-1:2018 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
报告边界： Reporting Boundary：	全球运营范围内的温室气体排放量 GHG emissions from global operations
温室气体类别： GHG Included：	☒CO_2 ☒CH_4 ☒N_2O ☒HFCs ☐PFCs ☒SF_6 ☐NF_3
温室气体排放量： GHG Emissions：	直接温室气体排放量（类别 1）：45,268 tCO_2e 来自输入能源的间接温室气体排放量（类别 2）：1,834,111 tCO_2e 以上经量化的总排放量：1,879,379 tCO_2e

本机构根据 ISO 14064-3 验证，上述组织层面温室气体核算符合选定的标准，结果准确、保守、可信。

The organization verifies in accordance with ISO 14064-3 that the above organization-level GHG accounting complies with the selected standards and that the results are accurate, conservative and credible.

北京鉴衡认证中心有限公司
China General Certification Center
2023 年 03 月 17 日

Annex F: Manufacturer's Battery (ESS) Collecting and Recycling Strategies

HUAWEI

Procedure to Collect and Recycle the Batteries

WMSPL – 3 MW (AC) Solar PV-Battery-Diesel Hybrid Power Project at Monpura Island of Bholar District, Bangladesh will use Huawei Smart String ESS (Battery) capacity of 22 MWh.

We, Huawei Technologies Co., Ltd. (hereinafter referred to as the "Huawei"), Who are official manufacturers of Energy Storage System (Battery) having factories at Huawei Industrial Base Bantian, Longgang Shenzhen 518129 People's Republic of China, do hereby Authorize Intelligent Express Limited (IE). (hereinafter referred to as the "Company") to supply the following [Energy Storage System (Battery)], manufactured by Huawei Brand

The Supplier shall provide warranty services of 12 (Twelve) years to the Buyer for the Batteries subject to the terms and conditions mentioned as per the contract.

Steps of Recycle/Re-use the Batteries:

The Supplier shall collect the Batteries from the Project Site at its own cost and arrangement within 07 (Seven) number of days from the date of being informed of damage of Battery/expiry of Warranty Period:

a. If the Batteries are damaged during the Warranty Period; or
b. Upon expiry of the Warranty Period.

The supplier under their responsibility may introduce third party for collection of the batteries.

After collection from the Project Site, the Supplier shall recycle every damaged or warranty expired Batteries in environment friendly way. Or If the battery remains some capacity, it will further re-use in 2nd categories industry like Electric vehicles etc.

www.huawei.com

HUAWEI TECHNOLOGIES CO., LTD.
Huawei Industrial Base,
Bantian Longgang
Shenzhen 518129 P.R. China
Tel: +86 755 28780808

During the collection and the recycling of damaged or warranty expired Batteries, the Supplier shall follow the environmental, health and social compliances, under the Environmental Social Management Framework (ESMF) of IDCOL.

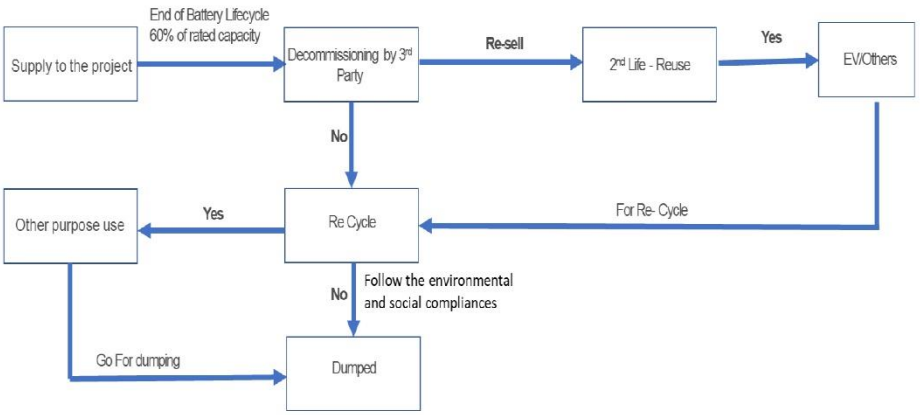
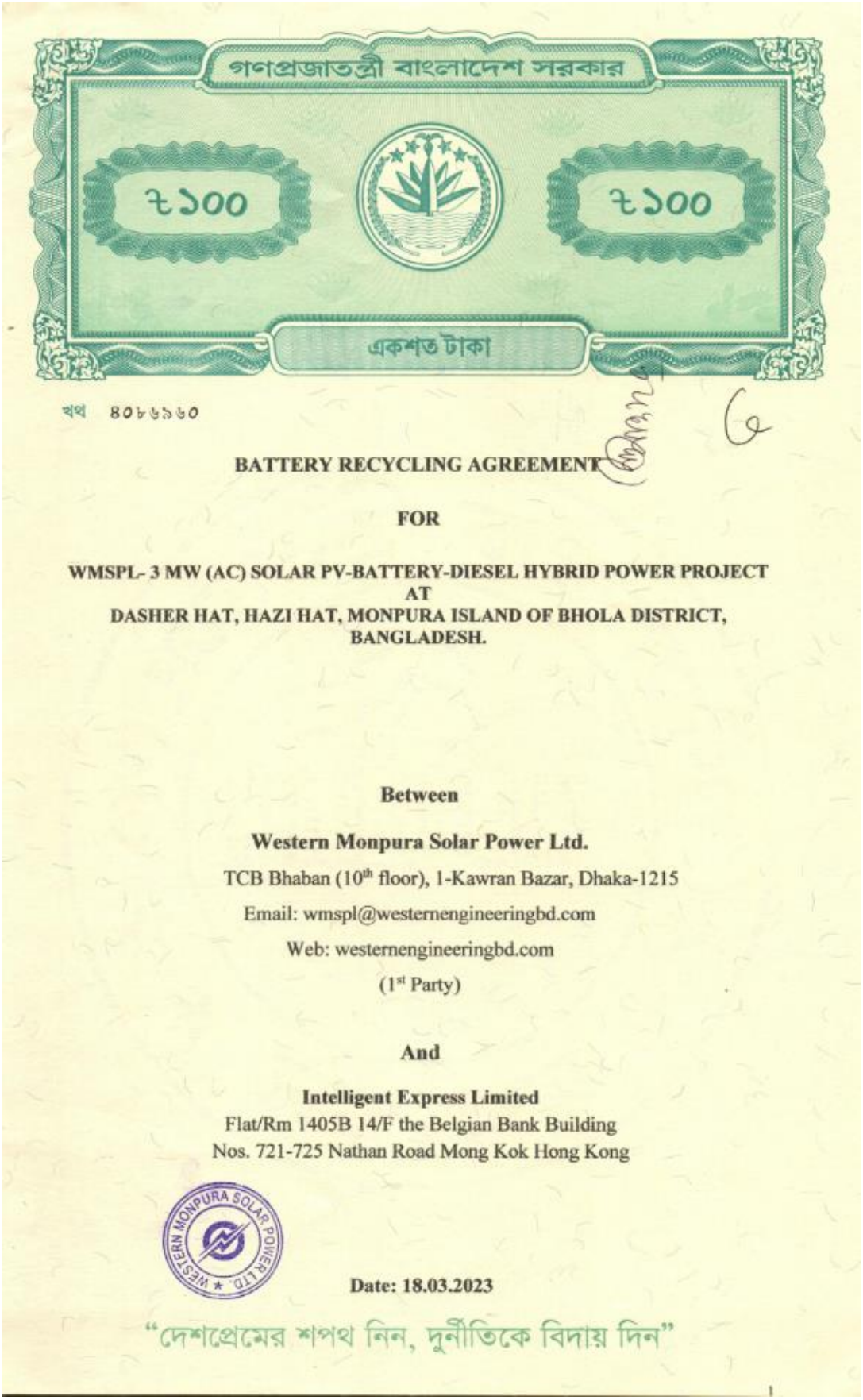


Fig: Procedure to Collect and Recycle the Batteries

www.huawei.com

HUAWEI TECHNOLOGIES CO., LTD.
Huawei Industrial Base,
Bantian Longgang
Shenzhen 518129 P.R. China
Tel: +86 755 28780808

Annex G: Battery Recycling Contract Agreement Copy



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

৳১০০ ৳১০০

একশত টাকা

খথ ৪০৮৬৯৬০

BATTERY RECYCLING AGREEMENT

FOR

WMSPL- 3 MW (AC) SOLAR PV-BATTERY-DIESEL HYBRID POWER PROJECT AT DASHER HAT, HAZI HAT, MONPURA ISLAND OF BHOLA DISTRICT, BANGLADESH.

Between

Western Monpura Solar Power Ltd.

TCB Bhaban (10th floor), 1-Kawran Bazar, Dhaka-1215

Email: wmspl@westernengineeringbd.com

Web: westernengineeringbd.com

(1st Party)

And

Intelligent Express Limited

Flat/Rm 1405B 14/F the Belgian Bank Building

Nos. 721-725 Nathan Road Mong Kok Hong Kong

WESTERN MONPURA SOLAR POWER LTD.

Date: 18.03.2023

"দেশপ্রেমের শপথ নিন, দুর্নীতিকে বিদায় দিন"

ক্রম ৪০৮৬১৫৬

THIS AGREEMENT is made on the Saturday of 18 March, 2023, (the Agreement) between **Western Monpura Solar Power Ltd (WMSPL).**, having its registered Head Office at TCB Bhaban (10th floor),1-Kawran Bazar, represented by its Managing Director (the Buyer) and **Intelligent Express Limited.**, [mentioned as Supplier] a private limited company incorporated and registered under the laws of Hong Kong, having its incorporation number 1219101 dated 19th March 2008 with registered office located at Flat/Rm 1405B 14/F The Belgian Bank Building Nos. 721-725 Nathan Road Mong Kok Hong Kong represented by its Director Mr. Wenqin He (Fred)

WHEREAS:

WMSPL- 3 MW (AC) SOLAR PV-BATTERY-DIESEL HYBRID POWER PROJECT AT DASHER HAT, HAZI HAT, MONPURA ISLAND OF BHOLA DISTRICT, BANGLADESH.

A. The Buyer is going to set up a 3MW(AC) Solar PV-Battery-Diesel Hybrid Power Plant at Dasherhat, Hazihat Union, Monpura Island, Under Bhola District. (the Project Site) for which it requires 22 MWh $LiFe(PO)_4$ Battery (the Batteries) and the Supplier has been selected for supplying the Batteries through a competitive process.

B. With a view to recycling the Batteries, the Buyer and the Supplier have decided to enter into an agreement to determine the terms and condition of collection and recycling of the Batteries.

NOW THE PARTIES HEREBY AGREE THAT

Section 1. Warranty Service of the Supplier

The Supplier shall provide warranty services of 10 (Ten) years to the Buyer for the Batteries subject to the terms and conditions mentioned in the quotation submitted by the Supplier at the time selection.

Section 2: Collection of Batteries

The Supplier shall collect the Batteries from the Project Site at its own cost and arrangement within 07 (Seven) number of days from the date of being informed of damage of Battery/expiry of Warranty Period:

a. If the Batteries are damaged during the Warranty Period; or
b. Upon expiry of the Warranty Period.

The supplier under their responsibility may introduce third party for collection of the batteries.

WESTERN MONPURA SOLAR POWER LTD.

"দেশপ্রেমের শপথ নিন, দুর্নীতিকে বিদায় দিন"

2

Section 3: Recycling of the Batteries

After collection from the Project Site, the Supplier shall recycle every damaged or warranty expired Batteries in environment friendly way.

Section 4: Compliance with Environmental Social Management Framework (ESMF)

During the collection and the recycling of damaged or warranty expired Batteries, the Supplier shall follow the environmental, health and social compliances, under the Environmental Social Management Framework (ESMF) of IDCOL.

Section 5: Price of warranty expired Batteries

The Supplier shall pay the Buyer for the warranty expired Batteries and the Supplier shall pay the price on or before the collection of warranty expired Batteries upon mutual negotiation.

Section 6: Liquidated damages for delay in collection of damaged/warranty expired Batteries

The Supplier shall be liable to pay liquidated damages if the warranty expired Battery isn't collected within 14 (fourteen) days of delay in collection of Batteries after mutual negotiation as per section 5.

Section 7: Sale of the damaged/warranty expired Batteries to any third party

If the Buyer sells the damaged/warranty expired Batteries to any third party, the Supplier shall be discharged from its liabilities for collection and recycling of damaged/warranty expired Batteries under this Agreement and the Buyer shall be responsible to enter into necessary arrangements for collection and recycling of the damaged/warranty expired Batteries with that third party.

Section 8: Dispute Resolution

8.1.Negotiation. Any dispute that may arise between the Buyer and the Supplier in connection with or under this Agreement shall be tried to be amicably resolved through mutual negotiation of both parties.

8.2.Mediation. If any dispute referred to in paragraph (8.1) above arises and cannot be resolved through negotiation, it will be referred to a third party mediator selected by both parties for a mediated resolution; and the cost of such mediation will be shared jointly by both parties.

8.3.Arbitration. In case a dispute is not resolved through methods as per paragraphs (8.1) and (8.2) above, it shall be referred to arbitration under the Arbitration Act 2001 (the **"Act"**) of Bangladesh as the last resort; the arbitral award thereon shall be final and binding; and the cost of such arbitration shall be shared jointly by the parties or as may otherwise be determined under the Act.

WESTERN MONPURA SOLAR POWER LTD.

3

খথ ১৯৩৪৯২৩

IN WITNESS WHERE OF, the parties have caused this Agreement to be signed in their respective names on the date first above written.

FOR ..... Bashir Ahmed
Managing Director
Western Monpura Solar Power Ltd.

1. Witness

BY.....

For and on behalf of
INTELLIGENT EXPRESS LIMITED

FOR ..... INTELLIGENT EXPRESS LIMITED

(Authorized Signature(s))

2. Witness

1. BY.....

2.

WESTERN MONPURA SOLAR POWER LTD.

"দেশপ্রেমের শপথ নিন, দুর্নীতিকে বিদায় দিন"

Annex H: Procedure to Collect and Recycle the Batteries

Intelligent Express Limited

Procedure to Collect and Recycle the Batteries

WMSPL – 3 MW (AC) Solar PV-Battery-Diesel Hybrid Power Project at Monpura Island of Bholar District, Bangladesh will use Huawei Smart String ESS (Battery) capacity of 22 MWh.

We, Intelligent Express Limited (IE). (hereinafter referred to as the "Company") to supply the following [Energy Storage System (Battery)], manufactured by Huawei Brand

The Supplier shall provide warranty services of 12 (Twelve) years to the Buyer for the Batteries subject to the terms and conditions mentioned as per the contract.

Steps of Recycle/Re-use the Batteries:

We or our nominated recycler shall collect the Batteries from the Project Site at its own cost and arrangement within 07 (Seven) number of days from the date of being informed of damage of Battery/expiry of Warranty Period:

a. If the Batteries are damaged during the Warranty Period; or
b. Upon expiry of the Warranty Period.

The supplier under their responsibility may introduce third party for collection of the batteries.

After collection from the Project Site, the Supplier shall recycle every damaged or warranty expired Batteries in environment friendly way. Or If the battery remains some capacity, it will further re-use in 2nd categories industry like Electric vehicles etc.

During the collection and the recycling of damaged or warranty expired Batteries, the Supplier shall follow the environmental, health and social compliances, under the Environmental Social Management Framework (ESMF) of IDCOL.

Intelligent Express Limited

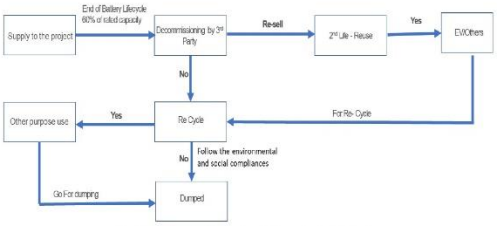


Fig: Procedure to Collect and Recycle the Batteries

We will recycle the battery process in Bangladesh under our Environmental and Social Safeguards Specialist.

1. LiFePO4 battery recycling pre-treatment

LiFePO4 battery recycling refers to the process of dismantling batteries, extracting or utilizing valuable metals. Due to the many components of used batteries, the first step in recycling requires a pre-treatment step to separate the cathode active material from the battery casing, separator, current collector, electrolyte, carbonaceous additives, and battery hook-up components.

Pre-treatment requires dismantling of the shell and separation of the different valuable components. Use external resistors or immerse waste batteries in salt solution for discharge treatment to prevent electric shock, fire, explosion and some potential chemical hazards.

LiFePO4 battery recycling pre-treatment

Then use machinery to directly crush the battery. The crushed components are sorted by specific gravity according to different properties such as density, particle size, magnetism and hydrophobicity, and the battery case, separator, plastic, aluminium foil, cathode and anode are initially separated, and then recycled separately.

FLAT/RM 1405B 14/F The Belgian Bank Building Nos 721-725 Nathan Road Mongkok KL Hongkong

Intelligent Express Limited

2. Recycling of LiFePO4 battery cathode material in LiFePO4 battery recycling

Waste LiFePO4 battery recycling mainly focuses on cathode materials. The lithium element in a fully discharged lithium-ion battery mainly exists in the cathode of the battery, and the cathode waste generated during the battery production process also has important recycling value.

At present, the mainstream process for the recovery of cathode active materials is the wet process, which mainly recovers the most economically valuable Li element, and can simultaneously recover Fe, Al and other metals.

Dissolve the cathode sheet with NaOH lye, make the current collector aluminium foil enter the solution in the form of NaAlO2, after filtration, the filtrate is neutralized with sulfuric acid solution, and Al(OH)3 is precipitated to realize the recovery of Al. The filter residue is a mixture of LiFePO4, conductive agent carbon black, and LiFePO4 surface-coated carbon.

3. LiFePO4 battery anode material recycling

With the widespread application of lithium-ion batteries, including 12v battery, 24v lithium battery, 36v lithium battery, etc., the demand for graphite anodes has also increased. The proportion of graphite in waste lithium batteries is 12% to 21% (mass fraction), which is a considerable amount.

Anode material recycling process in LiFePO4 battery recycling

In addition, in the anode, copper foil is expensive and the recycling process is simple in LiFePO4 battery recycling, which has high recycling value. Anode materials can usually be recovered by heat treatment, leaching, or grinding flotation.

4. Electrolyte material recycling in LiFePO4 battery recycling

In the power battery, the electrolyte accounts for about 15% of the battery cost, which contains relatively rich lithium ions and has a certain recycling value. At present, the recycling of electrolyte in LiFePO4 battery recycling includes vacuum pyrolysis treatment, organic solvent extraction recycling treatment, and CO2 supercritical recycling method.

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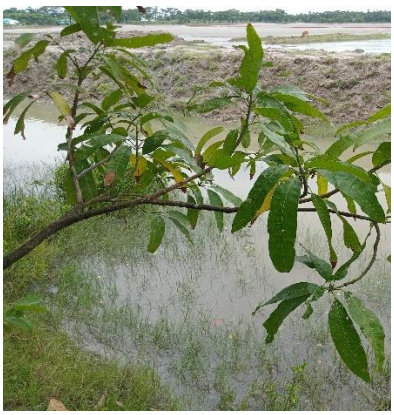
Annex I: Flora along the project AoI


Mango


Red date/ Chinese date


Mangrove apple


Sapaish Mahagani


Indian Siris

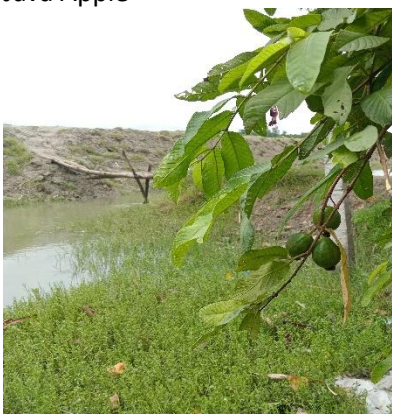

Sea Holly


Velvet Apple


Java Apple


Bamboo


Indian tulip tree


Guava


Whistling Pine/ coastal she-oak


Banana


Papaya


Pink Morning Glory


China-rose


Taro root


Elephant grass/ Indian reed-mace

Annex J: Fauna along the project AoI


Sheep


Pigeon


Edible crab/ brown crab


Hen


House sparrow


Bengal fiddler crab

House crow

Brown swan

Giant Asian mantis

Muscovy duck

Indian spotbill duck

Delta (wasp)

Black drongo

Indian pond heron

Red cotton bug

Annex K: Fisheries Survey along the project AoI

	
Freshwater Shrimp	Freshwater Keo Fish

Annex L: Sample Photographs of Environmental Monitoring

Sample Photographs of Ambient Air Quality Monitoring Activities

Sample Photographs of Noise Level Measurements Activities

Sample Photographs of Surface water Sampling Activities

Sample Photographs of Groundwater Sampling Activities

Sample Photographs of Soil Sampling Activities

Annex M: Air quality test report

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Environmental and Social Impact Assessment (ESIA) of WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project
Description of Sample	Ambient Air Quality Analysis
Sample Collector	Collected by DSCL Personnel
Sampling Date	4-6 July 2023

Test Result of Ambient Air Quality Analysis

Parameter	Unit	AAQ_MN_01	AAQ_MN_02	AAQ_MN_03	Bangladesh Standard**	Duration (hours)	Method of Analysis
		Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola	Near Dasherhat Jame Mosque, Monpura, Bhola	Near Jahangir Patwari's Bari, Dasherhat, Monpura, Bhola			
		22.24872°N 90.96723°E	22.24606°N 90.96150°E	22.24570°N 90.96434°E			
		04 July 2023	05 July 2023	06 July 2023			
$PM_{2.5}$	µg/m³	22.4	24.6	27.6	65	24	AEROQUAL series 500 portable air quality monitors
PM_{10}	µg/m³	65.6	77.5	74.9	150	24	
SO_2	µg/m³	12.31	17.79	9.12	80	24	
NO_x	µg/m³	11.5	6.35	5.48	80	24	
O_3*	µg/m³	16	23.28	17.9	100	8	
CO*	PPM	1	0.08	1	05	8	Lutron AQ 9901
CO_2	PPM	340	300	328	NYS	8	
Weather Condition		Mostly Sunny	Sunny	Cloudy			

*[Note: ** The Bangladesh National Ambient Air Quality Standards have been taken from Air Pollution Control Rules which was published in 26 July 2022 NYS = Not Yet Standardized]*

Sample Site Description

Location	Sample Site Description
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(AAQ_MN_01)**	➢ Low amount of traffic movement was found. ➢ Low amount of people movement was found. ➢ Very Low amount of Visual dust was noticed. ➢ The weather was mostly sunny during the monitoring period. ➢ Air Quality monitoring location is located beside a Madrasa
Near Dasherhat Jame Mosque, Monpura, Bhola **(AAQ_MN_02)**	➢ Moderate amount of traffic movement was found. ➢ Moderate amount of people movement was found. ➢ Low amount of Visual dust particles was found. ➢ The weather was sunny during the monitoring period. ➢ Air Quality monitoring location is located beside a Mosque.

Page 1 of 2

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Location	Sample Site Description
Near Jahangir Patwari's Bari, Dasherhat, Monpura, Bhola **(AAQ_MN_03)**	➢ Low amount of traffic movement was found. ➢ Low amount of people movement was found. ➢ Low amount of Visual dust was noticed. ➢ The weather was cloudy during the monitoring period

Test Performed By
Md. Fojlur Rahman Abir
Jr. Environmental Specialist

Checked By
Anwar Iqbal
Deputy Manager

Approved By
Rajib Roy
Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

Annex N: Test Result of Noise Level Measurement

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Environmental and Social Impact Assessment (ESIA) of WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project
Description of Sample	Noise Level Measurement
Sample Collector	Collected by DSCL Personnel
Sampling Date	4-5 July 2023

Test Result of Noise Level Measurement

Sample ID	GPS Location	Land Use Category	Date	Measurement Time		Noise Level dB(A) Leq		Bangladesh Standard dB(A) Leq	
				Day	Night	Day	Night	Day	Night
NM_MN-01	22.24871°N 90.96721°E	Residential	4 July 2023	10:20 am-10:50 am	09:01 pm-09:31 pm	50.6	41.2	55	45
NM_MN-02	22.23933°N 90.96848°E		4 July 2023	11:30 am-12:00 am	09:45 pm-10:15 pm	53.1	38.4	55	45
NM_MN-03	22.24001°N 90.96258°E		4 July 2023	12:08 pm-12:38 pm	10:20 pm-10:50 pm	49.6	40.6	55	45
NM_MN-04	22.24040°N 90.96266°E		4 July 2023	01:10 pm-01:40 pm	10:55 pm-11:25 pm	42.5	36.2	55	45
NM_MN-05	22.24113°N 90.95928°E	Commercial	4 July 2023	02:10 pm-02:40 pm	11:30 pm-12:00 pm	47.5	41.0	70	60
NM_MN-06	22.24473°N 90.96096°E	Residential	4 July 2023	03:15 pm-03:45 pm	12:10 am-12:40 am	51.2	43.8	55	45
NM_MN-07	22.24584°N 90.96870°E		5 July 2023	11:00 am-11:30 am	09:35 pm-10:05 pm	48.67	43.6	55	45
NM_MN-08	22.24721°N 90.96687°E		5 July 2023	12:02 am-12:32 am	11:15 pm-11:45 pm	47.3	39.0	55	45
NM_MN-09	22.24828°N 90.96759°E		5 July 2023	12:40 pm-01:10 pm	09:00 pm-09:30 pm	48.1	40.9	55	45
NM_MN-10	22.24550°N 90.96543°E		5 July 2023	01:30 pm-02:00 pm	10:15 pm-10:45 pm	44.1	39.9	55	45
NM_MN-11	22.24823°N 90.96475°E		5 July 2023	02:10 pm-02:40 pm	12:02 pm-12:32 pm	46.2	36.5	55	45
NM_MN-12	22.24836°N 90.96334°E		5 July 2023	03:00 pm-03:30 pm	12:45 am-01:15 am	49.2	43.1	55	45

Notes:

- Land use category is based on the classification provided in the Noise Pollution (Control) Rules, 2006.
- The sound level standards for commercial area are 70 dBA at day time and 60 dBA at night time.
- The sound level standards for residential area are 55 dBA at day time and 45 dBA at night time.
- dB(A)Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. Noise Level is the average noise recorded over the duration of the monitoring period.

Page 1 of 3

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

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Sample site Description

Sample Location and ID	Sample Site Description
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-01)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-02)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-03)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Char Marium Nurani Hafezia Madrasa, Monpura, Bhola **(NM_MN-04)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Tofayel's Shop (Local Bazaar) in Dasherhat, Monpura, Bhola **(NM_MN-05)**	➢ Commercial Area. ➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Most of the shops has been shuttered down during monitoring period.
Near Dasherhat Jame Mosque, Monpura, Bhola **(NM_MN-06)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Grammen Tower, Hazirhat, Monpura, Bhola **(NM_MN-07)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area
Near Jamal Mia's Home, Grameen Tower para, Monpura, Bhola **(NM_MN-08)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-09)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Northern side of Project Area, Monpura, Bhola **(NM_MN-10)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Monitoring Location was situated inside project area.

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Development Solutions Consultant Limited

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Sample site Description

Sample Location and ID	Sample Site Description
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-01)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-02)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Muslim Para Jame Mosque, Monpura, Bhola **(NM_MN-03)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Char Marium Nurani Hafezia Madrasa, Monpura, Bhola **(NM_MN-04)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Madrasa.
Near Tofayel's Shop (Local Bazaar) in Dasherhat, Monpura, Bhola **(NM_MN-05)**	➢ Commercial Area. ➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Most of the shops has been shuttered down during monitoring period.
Near Dasherhat Jame Mosque, Monpura, Bhola **(NM_MN-06)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Near Grammen Tower, Hazirhat, Monpura, Bhola **(NM_MN-07)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area
Near Jamal Mia's Home, Grameen Tower para, Monpura, Bhola **(NM_MN-08)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola **(NM_MN-09)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Noise monitoring location is located beside sensitive location such as Mosque.
Northern side of Project Area, Monpura, Bhola **(NM_MN-10)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Monitoring Location was situated inside project area.

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Sample Location and ID	Sample Site Description
Southern side of Project Area, Monpura, Bhola **(NM_MN-11)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Monitoring Location was situated inside project area.
Western side of Project Area, Monpura, Bhola **(NM_MN-12)**	➢ Low amount of traffic movement. ➢ Low amount of people movement. ➢ Residential Area ➢ Monitoring Location was situated inside project area.

Test Performed By
Md. Fojlur Rahman Abir
Jr. Environmental Specialist

Checked By
Anwar Iqbal
Deputy Manager

Approved By
Rajib Roy
Manager

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Annex O: Surface water quality test report

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DSCL Environmental Laboratory

Name of the Project	Environmental and Social Impact Assessment (ESIA) of WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project
Description of Sample	Surface Water Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	6 July 2023

On-site Surface Water Quality Test

Parameters	Unit	SW_MN-01 Kumirkhali Khal, Dasherhat, Monpura, Bhola 22.24605°N 90.96149°E 6 July 2022	SW_MN-02 Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola 22.24822°N 90.96754°E 6 July 2022	Standards for Inland Surface Water* (Best fishing practice)	Analysis Method
pH	-	7.88	7.92	6-9	Multimeter
Temperature	°C	33.7	32.6	NYS	
Total Dissolved Solids (TDS)	mg/L	1002	963	1000	
Electric Conductivity (EC)	µS/cm	1114	1060	NYS	
Oxidation-Reduction Potential (ORP)	mg/L	-51.4	-55.8	NYS	
Salinity	mg/L	652	729	NYS	
Dissolved Oxygen (DO)	mg/L	5.3	6.8	5 or more	DO Meter

[Note:
**Standards for Inland Surface Water is followed from Water for Aquaculture of Schedule-2, (A-1(4)) of Environment Conservation Rules (ECR), 2023*
NYS = Not Yet Standardized]

Description of the Surrounding Environment

Sample Location and ID	Sample Site Description
Kumirkhali Khal, Dasherhat, Monpura, Bhola **(SW_MN-01)**	• Sample was collected from adjacent canal (Kumirkhali Khal) • The depth from where the sample was collected is approximately 6 inches. • Waste dumping & local drains haven't been seen surrounding the sampling location. • This Khal contains water all around the year. • This Khal has been used by local people for bathing purpose.
Near Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura, Bhola **(SW_MN-02)**	• Sample was collected from a pond which is located beside a Mosque. • The depth from where the sample was collected is approximately 6 inches. • Waste dumping & local drains haven't been seen surrounding the sampling location. • This Pond contains water all around the year. • This pond has been used by Local people for washing and bathing purpose.

Test Performed By
Md. Fojlur Rahman Abir
Jr. Environmental Specialist

Checked By
Anwar Iqbal
Deputy Manager

Approved By
Rajib Roy
Manager

Page 1 of 1

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 056/ CC, DPHE, CL, Dhaka

Date: 20-07-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023070101	Sample Receiving date: 09-07-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 09-07-2023	Sample Source: Surface Water
Sent by:Anwar Iqbal ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Bhola, Upa:
Care Taker: DSCL (Sample ID : MN_SW_01)	Union:, Vill.:Dasherhat, Manpura
Sample Collection date:	Date of Testing: 09/07/2023-20/07/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Ammonia	0.5	0.30	mg/L	UVS	0.10
2	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
3	Phosphate	6.0	0.60	mg/L	UVS	0.10
4	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, LOQ - Limit of Quantitation.

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature: Alam 20.07.2023

2.) Name: Taslima Akhter
Designation: Sample Analyzer
Signature: Lina 20.07.2023

Countersigned/Approved by:

1.) Name: Mita Sarker
Designation: Senior Chemist
Signature: 20/07/2023

2.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Md. Biplab Hossain
Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 056/ CC, DPHE, CL, Dhaka

Date: 20-07-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023070102	Sample Receiving date: 09-07-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 09-07-2023	Sample Source: Surface Water
Sent by:Anwar Iqbal ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Bhola, Upa:
Care Taker: DSCL (Sample ID : MN_SW_02)	Union:, Vill.:Hazirhat, Manpura
Sample Collection date:	Date of Testing: 09/07/2023-20/07/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Ammonia	0.5	0.34	mg/L	UVS	0.10
2	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
3	Phosphate	6.0	0.71	mg/L	UVS	0.10
4	Total Suspended Solid (TSS)	10	4	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 20.07.2023	1.) Name: Mita Sarker Designation: Senior Chemist	20/07/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	20.07.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Annex P: Groundwater quality test report

DSCL

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DSCL Environmental Laboratory

Name of the Project	Environmental and Social Impact Assessment (ESIA) of WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project
Description of Sample	On-site Groundwater Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	6 July 2023

On-site Groundwater Quality Test

Parameters	Unit	GW_MN-01	GW_MN-02	Standards for Potable Water*	Analysis Method
		Near Dasherhat Jame Mosque, Monpura, Bhola	Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola		
		22.24584°N 90.96870°E	22.24877°N 90.96733°E		
		6 July 2023	6 July 2023		
pH	-	7.40	7.50	6.5-8.5	Multimeter
Electric Conductivity (EC)	µS/cm	463	384	NYS	
Total Dissolved Solids (TDS)	mg/L	635	602	1000	
Salinity	mg/L	557	480	NYS	
Oxidation-reduction potential (ORP)	mV	-20.6	-23.3	NYS	
Temperature	°C	32.5	29.4	20-30	
Dissolved Oxygen (DO)	mg/L	6.2	5.8	NYS	DO Meter

*[Notes: *The standard for groundwater is obtained from Schedule-2 (B) of Environmental Conservation Rules, 2023. NYS = Not Yet Standardized]*

Description of the Surrounding Environment

Sample Location and ID	Remarks
Near Dasherhat Jame Mosque, Monpura, Bhola **(GW_MN-01)**	• This tube well is about 250 feet deep which is established in 2020. • This tube well is mainly used for drinking and washing purposes. • The nearby toilet with an adjacent septic tank is situated approximately 20 meters away from tube well. • Agricultural land is 10 meters away from this tube well.
Near Madinatul Ulum Ayesha Khanum Nurani and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura, Bhola **(GW_MN-02)**	• This tube well is about 280 feet deep which is established in 2017. • Water of this tube well is used for drinking and other domestic working purpose. • Nearby toilet is situated 5 meters away from the tube well. • septic tank is 3m away from the tube well • Agricultural land is 2 meters away from the tube well.

Test Performed By
Md. Fojlur Rahman Abir
Jr. Environmental Specialist

Checked By
Anwar Iqbal
Deputy Manager

Approved By
Rajib Roy
Manager

Page 1 of 1

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Lab Memo: 056/ CC, DPHE, CL, Dhaka — Date: 20-07-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023070103	Sample Receiving date: 09-07-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 09-07-2023	Sample Source: Tube Well
Sent by:Anwar Iqbal ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Bhola, Upa:
Care Taker: DSCL (Sample ID : MN_GW_01)	Union:, Vill.:Dasherhat, Manpura
Sample Collection date:	Date of Testing: 09/07/2023-20/07/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	20.07.2023	1.) Name: Mita Sarker Designation: Senior Chemist	20/07/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	20.07.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 056/ CC, DPHE, CL, Dhaka — Date: 20-07-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023070104	Sample Receiving date: 09-07-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 09-07-2023	Sample Source: Tube Well
Sent by:Anwar Iqbal ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Bhola, Upa:
Care Taker: DSCL (Sample ID : MN_GW_02)	Union:, Vill.:Hazirhat, Manpura
Sample Collection date:	Date of Testing: 09/07/2023-20/07/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	20.07.2023	1.) Name: Mita Sarker Designation: Senior Chemist	20/07/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	20.07.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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TEST REPORT NO: 1001998457 Jul.17,2023
UL ORDER NO: 14883476
Page : 1 of 4

Applicant : DEVELOPMENT SOLUTIONS CONSULTANT LIMITED **Test Date :** Jul.9 – 17, 2023
Address : HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH

Contact Person : MR. ANWAR IQBAL

Sample Description: GROUNDWATER
Testing Protocol: Self-Reference
Project Name: Environmental and Social Impact Assessment (ESIA) Of "WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant Project"
Sample ID: MN_GW-01, MN_GW-02
Source: Tube well
Location: Dasherhat, Monpura, Bhola.
Grameen Tower para, Hazirhat, Monpura,Bhola

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	GROUNDWATER SAMPLE	MN_GW-01
002	GROUNDWATER SAMPLE	MN_GW-02

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

TEST REPORT NO: 1001998457 Jul.17,2023
UL ORDER NO: 14883476
Page : 2 of 4

TEST	Sample ID	
	001	002
Total Arsenic (As)	NC	NC
Total Coliform (TC) ♦	NC	NC
Faecal Coliform (FC) ♦	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; "" = test result(s) will be added later**
♦ Marked test was subcontracted to an ISO 17025 accredited laboratory.

TEST REPORT NO: 1001998457 Jul.17,2023
UL ORDER NO: 14883476
Page : 3 of 4

(01) Total Arsenic (As)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	MN_GW-01	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC
002	MN_GW-02	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC

"<" means "less than" ; "mg/L" means "milligram per litre"

(02) Total Coliform (TC)
Test Method: With reference USEPA 9132

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	MN_GW-01	0	-	NC
002	MN_GW-02	0	-	NC

"<" means "less than" ; "CFU" means "colony forming units"

(03) Faecal Coliform (FC)
Test Method: Membrane Filtration

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	MN_GW-01	0	-	NC
002	MN_GW-02	0	-	NC

"<" means "less than" ; "CFU" means "colony forming units"

UL VS Bangladesh Ltd
The Pearl Trade Center (5th,14th&15th floor), Cha- 90/3, Progoti Sharani, North Badda, Dhaka 1212, Bangladesh.
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Annex Q: Soil quality test report

TEST REPORT NO: 1001998828 **Jul.18,2023**

UL ORDER NO: 14883509

Page : 1 of 5

Applicant : DEVELOPMENT SOLUTIONS CONSULTANT LIMITED **Test Date :** Jul.10 – 18, 2023
Address : HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH

Contact Person : MR. ANWAR IQBAL

Sample Description: SOIL SAMPLES

Testing Protocol: Self-Reference

Project Name: Environmental and Social Impact Assessment (ESIA)Of "WMSPL-3 MW (AC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant" Project

Sample ID: SQ_MN_01, SQ_MN_02

No. of Samples: 2 Samples

Location: Monpura, Bhola

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	SOIL SAMPLE	SQ_MN_01
002	SOIL SAMPLE	SQ_MN_02

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

TEST REPORT NO: 1001998828 **Jul.18,2023**

UL ORDER NO: 14883509

Page : 2 of 5

TEST	Sample ID	
	001	002
Total Lead (Pb)	NC	NC
Total Zinc (Zn)	NC	NC
Total Cadmium (Cd)	NC	NC
Total Chromium (Cr)	NC	NC
Total Arsenic (As)	NC	NC
Total Mercury (Hg)	NC	NC

Note: P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later

TEST REPORT NO: 1001998828 **Jul.18,2023**

UL ORDER NO: 14883509

Page : 3 of 5

(01) Total Lead (Pb)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Lead (Pb)	7439-92-1	5	9.7	-	NC
002	SQ_MN_02	Lead (Pb)	7439-92-1	5	11.9	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

(02) Total Zinc (Zn)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Zinc (Zn)	7440-66-6	10	33.9	-	NC
002	SQ_MN_02	Zinc (Zn)	7440-66-6	10	37.6	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

(03) Total Cadmium (Cd)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
002	SQ_MN_02	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

(04) Total Chromium (Cr)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Chromium (Cr)	7440-47-3	5	28.7	-	NC
002	SQ_MN_02	Chromium (Cr)	7440-47-3	5	26.3	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

UL VS Bangladesh Ltd
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TEST REPORT NO: 1001998828 **Jul.18,2023**

UL ORDER NO: 14883509

Page : 4 of 5

(05) Total Arsenic (As)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Arsenic (As)	7440-38-2	5	<5	-	NC
002	SQ_MN_02	Arsenic (As)	7440-38-2	5	<5	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

(06) Total Mercury (Hg)
Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SQ_MN_01	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC
002	SQ_MN_02	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC

"<" means "less than" ; "mg/kg" means "milligram per kilogram"

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Annex R: List of Environmental and Social Hotspot

Serial No.	Location	GPS Coordinate		Photographs	Remarks
		Latitude	Longitude		
1)	Madinatul Ulum Ayesha Nurni and Hafezia Madrasa, Grammen Tower para, Hazirhat, Monpura	22.24871°N	90.96721°E		Within 500m Buffer zone
2)	Madinatul Ulum Jame Mosque, Grammen Tower para, Hazirhat, Monpura	22.24837°N	90.96767°E		Within 500m Buffer zone
3)	Dasherhat Jame Mosque, Dasher hat, Monpura	22.24473°N	90.96096°E		Within 500m Buffer zone
4)	Muslim para Jame Mosque, Monpura, Bhola	22.23913°N	90.96855°E		Within 5km Buffer zone
5)	Graveyard in Muslim para, Monpura, Bhola	22.23910°N	90.96850°E		Within 5km Buffer zone
6)	Miah Jamir Shah Nurani and Hafezia Madrasa, Monpura, Bhola	22.26999°N	90.97839°E		Within 5km Buffer zone

Serial No.	Location	GPS Coordinate		Photographs	Remarks
		Latitude	Longitude		
7)	Char Gotin Jame Mosque, Monpura, Bhola	22.26204°N	90.97450°E		Within 5km Buffer zone
8)	Fire Service and Civil Defence Station, Monpura, Bhola	22.26071°N	90.97264°E		Within 5km Buffer zone
9)	Senior Judicial Magistrate Court-3 and Assistant Judge Court	22.26033°N	90.97244°E		Within 5km Buffer zone
10)	Office of Sub-register, Monpura, Bhola	22.25816°N	90.96917°E		Within 5km Buffer zone
11)	Office of Upazila Election Officer, Monpura, Bhola	22.25809°N	90.96813°E		Within 5km Buffer zone
12)	Palli Daridro Bimochon Foundation (PDBF), Monpura, Bhola	22.25809°N	90.96795°E		Within 5km Buffer zone

Serial No.	Location	GPS Coordinate		Photographs	Remarks
		Latitude	Longitude		
13)	Upazila Health Complex, Monpura, Bhola	22.25816°N	90.96786°E		Within 5km Buffer zone
14)	Office of Upazila Livestock and Veterinary Hospital, Monpura, Bhola	22.25816°N	90.96744°E		Within 5km Buffer zone
15)	Monpura Police Station, Monpura, Bhola	22.25786°N	90.96531°E		Within 5km Buffer zone
16)	Hazirhat Model Govt. Secondary School, Monpura, Bhola	22.25777°N	90.96533°E		Within 5km Buffer zone
17)	Caritas Monpura Upazila Office, Hajirhat, Monpura, Bhola	22.25615°N	90.96529°E		Within 5km Buffer zone
18)	Upazila Land Office, Monpura, Bhola	22.23910°N	90.96850°E		Within 5km Buffer zone

Annex S: Occupational and Community Health Safety Plan

The Occupational and Community Health Safety Plan aims to ensure the well-being of workers during the construction and operation phases of the "WMSPL - 3 MW (AC/11MW DC) Off-Grid Solar PV-Battery-Diesel Hybrid Power Plant" project, as well as to safeguard the health and safety of the local community. By implementing this comprehensive plan, this project can prioritize the health and safety of both workers and the local community, ensuring a secure and sustainable project environment.

Aspects	Management Measures
Occupational Health and Safety (OHS) Training	- Provide comprehensive OHS training for all workers and contractors involved in the project. - Training topics should include hazard identification, proper equipment usage, emergency response procedures, and adherence to safety protocols.
Personal Protective Equipment (PPE)	- Ensure that all workers have access to and consistently use appropriate PPE, including helmets, safety glasses, gloves, high-visibility vests, and other necessary gear as per the nature of their work.
Hazardous Materials Management	- Implement strict protocols for the handling, storage, and disposal of hazardous materials. - Provide training on the safe use of chemicals and ensure the availability of Material Safety Data Sheets (MSDS).
Construction Site Safety	- Establish clear safety guidelines for construction sites, including signage, designated walkways, and restricted zones. - Conduct regular safety inspections to identify and rectify potential hazards.
Emergency Response Plan	- Develop and communicate a detailed emergency response plan that covers potential accidents, injuries, and other emergencies. - Conduct regular drills to ensure that all workers are familiar with emergency procedures.
First Aid Facilities	- Install fully equipped first aid facilities at strategic locations within the construction site. - Ensure that trained personnel are available to provide immediate assistance in case of injuries or health emergencies.
Health Monitoring	- Implement a health monitoring program for workers, including regular check-ups and screenings for occupational-related health risks. - Maintain health records for all personnel involved in the project.
Community Health and Safety	- Engage with the local community to assess and address any potential health and safety concerns. - Establish communication channels for addressing community inquiries and promptly addressing any health-related issues.
Air and Noise Pollution Control	- Implement measures to control and minimize air and noise pollution during construction and operation. - Regularly monitor air quality and noise levels to ensure compliance with established standards.
Waste Management	- Develop a comprehensive waste management plan to handle construction and operational waste responsibly. - Promote recycling and proper disposal methods to minimize environmental impact.
Disease Prevention	- Implement measures to prevent the spread of diseases, including proper sanitation facilities and hygiene education for workers and the local community.
Stakeholder Engagement	- Regularly communicate with stakeholders, including workers, local communities, and relevant authorities, to address concerns, provide updates on safety measures, and foster a collaborative approach to health and safety.
Periodic Safety Audits	- Conduct periodic safety audits to assess the effectiveness of the health and safety measures in place. - Use audit findings to continually improve the Occupational and Community Health Safety Plan.

Annex T: Environmental and Social Assessment Checklist as per RERED II AF

ENVIRONMENTAL AND SOCIAL ASSESSMENT CHECKLIST

Project Settings

(a) Location :

(b) GPS Coordination :

(c) Description of land :

- Nature of land ownership :
- Level from the road :
- Lower level from the road :
- Requirement for land filling :

(d) Description of the project site

- Distance from the east side :
- Distance from the west side :
- Distance from the north side :
- Distance from the south side :

(e) Proposed customers

- Households :
- Shops :
- Offices :
- Educational institutions :
- Mosque :
- Union Parishad :
- Rice mills :
- Husking mills :

Environmental Screening

CRITERIA	Details
PROJECT SITTING	Buffer Zone : 1 km
IS THERE ANY CULTURAL HERITAGE SITE LOCATED IN THE PROJECT AREA?	
IS THERE ANY PROTECTED AREA LOCATED NEAR THE PROJECT AREA?	
IS THE PROJECT SITE PRONE TO FLOODING OR NOT?	
IS THERE ANY MANGROVE IN THE PROJECT SITE	
Will the project cause any damage of historical /cultural monuments (mosque/ temple/ church/ madrasa/ school/ college/ grave yard etc.) of the	

project site?	
Will the project cause any Encroachment into precious ecosystem (e.g. sensitive habitats like protected forest areas or terrestrial wildlife habitats)?	
Will the project cause any dislocation or involuntary resettlement of people?	
Will the project cause any risks vulnerabilities related to occupational health and safety due to physical, chemical hazards during project construction and operation?	
Will the project cause any aesthetic degradation and property value loss due to establishment of plant and ancillary facilities?	
Will the project cause any risks for community safety due to the transport, storage, and use and/or disposal of materials such as raw materials, fuel and other chemicals during construction and operation?	
Is there any tree clearing required in the project site?	
Name of the Flora (0-200 meter form the project site):	
Name of the Fauna (0-200) meter form the project site):	

Social Screening

CRITERIA	Details
PROJECT SITTING	Buffer Zone : 1 km
Is there any recorded litigation issue associate with the site?	
Is there any local communities (para/village) live near (200 meter) the project site? Please explain	
Any Local conflicts of Interest in the proposed project site?	
Does the water usage in the project might affect the surround communities?	
Is there any minorities / indigenous (IP) communities live near the Project site?	
Is there any impact of the project on livelihood pattern of tribal people?	

Environmental & Social Benefits from the Proposed Project

Environmental benefits	
Social benefits	

Potential Environmental and Social Impacts

Aspect	Key potential impact	Mitigation measures	Performance indicator
Pre-construction Phase			
Land Use	The proposed project may degrade surrounding agricultural land.		
Flood Hazards	Flood may damage the Project and its various components.		
Land Filling/ Earth Filling (approximately XX feet)	▪ Pollution from overflow of filled earth (dredged materials). ▪ Top soil loss if earth filling by the agricultural land erosion from the filled materials and side slope of filled lands. ▪ Leaching from the filled sediments may damage nearby agricultural lands. ▪ Reducing flood plain storage area and increase local flooding.		
Construction Phase			
Visual Amenity	Visual impacts from construction activities such as materials lay down, excavation and backfilling		
Air Quality	▪ Dust generation due to construction activities. ▪ Exhaust Emissions due to operation of construction plant and Machinery.		

Aspect	Key potential impact	Mitigation measures	Performance indicator
Noise	Increased noise levels during the construction & machinery handling period		
Soil	Soil disturbance due to removal of top soil and potential accidental spillage		
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during construction.		
Health and Safety risks	▪ Potential of exposure to safety events such as tripping, working at height activities, fire from hot works, smoking, failure in electrical installation, mobile plant and vehicles, and electrical shocks Exposure to health events during construction activities such as manual handling and musculoskeletal disorders, hand-arm vibration, temporary or permanent hearing loss, heat stress, and dermatitis.		
Operation Phase			
Visual Amenity	Potential glare from PV panels		
Air & noise	PV panel damage, Battery damage or acid spillage. Vibrational Noise from the backup generator		
Soil	Potential spillage of stored oil and chemicals		
Health and Safety	Potential of exposure to safety events during operation activities such as slipping and tripping, working at height		

Aspect	Key potential impact	Mitigation measures	Performance indicator
	activities, and fire		
Social Impacts			

Compliance Scenario

DOE Requirement

According to the categorization of Department of Environment (DOE), the Project seems to fall in **RED category**. For taking up a project, the sponsor needs to obtain the clearance from the DOE in three stages as per requirement of the country:

- Initial stage : Site Clearance Certificate (SCC)
- Advanced stage : Environmental Clearance Certificate (ECC)
- Follow-up stage : Annual renew of ECC

Initial Stage

Without the SCC, the sponsor cannot apply for approval of the civil design of the project to the local authorities. For obtaining the SCC the following two documents need to be submitted to the DOE:

- An Initial Environmental Examination (IEE) Checklist
- A TOR for detailed Environmental Impact Assessment (EIA)

After SCC is obtained, the sponsor can proceed for land development and other primary civil works.

Advanced Stage

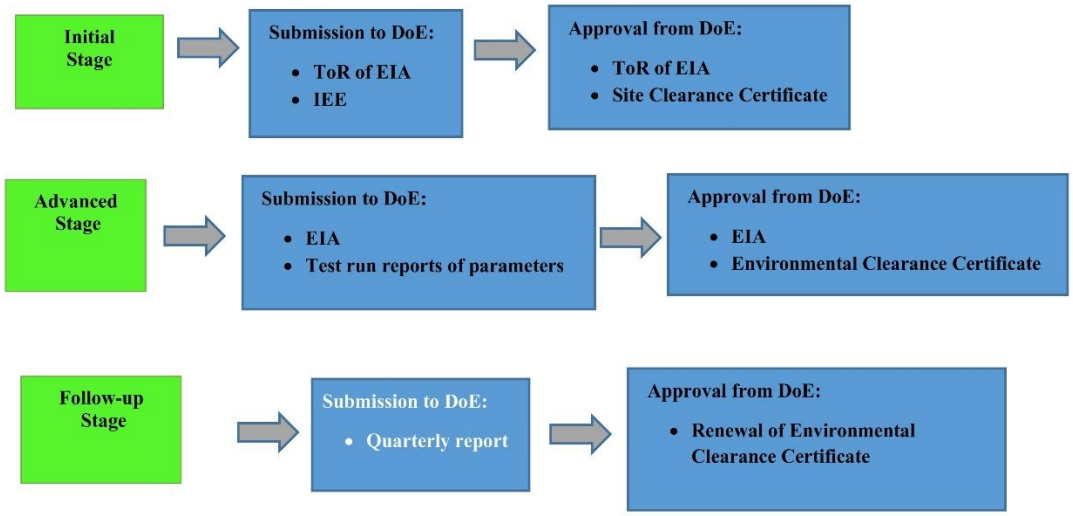
After having SCC the sponsors need to proceed for ECC. For obtaining ECC the EIA has to be submitted to DOE. The EIA will include the following documents:

- No objection certificate from local authority
- Outline of the plan for relocation and rehabilitation (If applicable)
- Feasibility Report
- Environmental Management Plan (including process flow diagram, layout plan, effluent treatment plant and its effectiveness)
- Emergency Plan relating to adverse environmental impact and plan for mitigation of the effects of pollution
- Detail Plan for addressing the TOR already submitted

Construction of super-structure and erection of capital machinery can be done after obtaining the ECC.

Follow-up Stage

The follow-up stage starts after having ECC and starting commercial operation. The Project Company has to submit quarterly test report of certain parameters like Sox, NOx, Co, PM10, PM2.5, water quality etc. according to the EMP as mentioned in the approved EIA. The most important activity under follow-up stage is to **renew ECC** every year. The aforesaid three stages have been presented in the following:



The Project Company has been informed about the required environmental compliance process. They are in the process of engaging an EIA Consultant.

SCREENING OF SOCIAL COMPLIANCE (WB)

A. Involuntary Resettlement Aspect

- Is any land acquisition required for the project?
- Type of land (public, private or lease)
- Is there any settlement present in the site?
- Is there any recorded litigation issue associate with the site?
- Is there any close relationship between the general livelihood pattern and the site in the project area?
- Does the project require physical or economic displacement of any person/household/community?

B. Tribal People Aspect

- Is the project site located within the habitat of tribal people?
- Is there any impact of the project on religious and cultural practice and belief of tribal people?
- Is there any impact of the project on livelihood pattern of tribal people?
- Is there any settlement recorded (present and near past) in the site?
- Is there necessity of displacing (physically or economically) any person/household/community?
- What local language(s) is (are) used by the IP population?
- Are the PO staffs conversant in these languages and is the information material relevant to the terms and conditions of purchasing the services and operation and maintenance of equipment available in local languages?

Annex U: Previous Environmental Clearance Certificates and Challan Copies for Renewal of ECC

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর,
বরিশাল বিভাগীয় কার্যালয়,
৩৯৯,নবগ্রাম বরিশাল,বরিশাল
www.doe.gov.bd

পরিবেশগত ছাড়পত্র

ছাড়পত্র নং: ১৯-২৫০২৬

পরিবেশগত ব্যবস্থাপনা নিশ্চিতকরণ সাপেক্ষে সংযুক্ত শর্তে নিম্নবর্ণিত প্রতিষ্ঠান/প্রকল্পের অনুকূলে পরিবেশগত ছাড়পত্র প্রদান করা হলো :

প্রতিষ্ঠান/প্রকল্পের নাম	:	218.4 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at Monpura Union, Monpura Upazilla, Bhola
উদ্যোক্তার নাম	:	Western Renewable Energy (Pvt.) Ltd.
সনাক্তকরণ নং	:	৭২৩৩৮
প্রতিষ্ঠান/প্রকল্পের কার্যক্রম	:	Other
প্রতিষ্ঠান/প্রকল্পের শ্রেণী	:	Green
প্রতিষ্ঠান/প্রকল্পের ঠিকানা	:	Monpura Union, Monpura Upazilla, Bhola,Manpura ,Bhola
প্রদানের তারিখ	:	19 June, 2019
মেয়াদ উত্তীর্ণের তারিখ	:	18 June, 2022

এ ছাড়পত্র সনদের সাথে পৃথকভাবে সংযুক্ত প্রদত্ত শর্তাবলী যথাযথভাবে প্রতিপালন করতে হবে,
অন্যথায় ছাড়পত্র বাতিল/ক্ষতিপূরণ আদায়সহ যে কোন আইনানুগ ব্যবস্থা গ্রহণ করা হবে।

বিঃদ্রঃ এটি একটি সিস্টেম জেনারেটেড ছাড়পত্র এবং এতে কোনোরূপ স্বাক্ষরের প্রয়োজন নেই।

ছাড়পত্রটি যাচাই করতে ভিজিট করুন: http://ecc.doe.gov.bd/certificate_verification
Page 1 of 3

সনাক্তকরণ নং: ৭২৩৩৮ 218.4 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at Monpura Union, Monpura Upazilla, Bhola ছাড়পত্র নং: ১৯-২৫০২৬

পরিবেশগত ছাড়পত্র জন্য প্রযোজ্য শর্তাবলী:

১ . এ ছাড়পত্র কেবলমাত্র 218.4 কিলোওয়াট সৌরবিদ্যুৎ উৎপাদনের জন্য প্রযোজ্য হবে। প্রকল্পের উৎপাদন ক্ষমতা বৃদ্ধি, জায়গা সম্প্রসারণ, উৎপাদন প্রক্রিয়া বা তৎসংশ্লি¬ষ্ট কোনো প্রকার পরিবর্তনের জন্য পরিবেশ অধিদপ্তরের পূর্বানুমতি/ছাড়পত্রের প্রয়োজন হবে।

২ . বিদ্যুৎকেন্দ্র সৃষ্ট সীসা মিশ্রিত কঠিনবর্জ্য কোন ক্রমেই পরিবেশে নিক্ষেপ করা যাবে না। এ ধরণের বর্জ্য পুনঃব্যবহারে জন্য পরিবেশ অধিদপ্তরের ছাড়পত্রধারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও বিক্রয় অথবা ব্যবহার করা যাবে না।

৩ . ধ্বংসযোগ্য মালামাল সমূহ (লৌহজাত স্ক্রাপ) পরিবেশ অধিদপ্তরের ছাড়পত্রধারী রি-রোলিং/ষ্টীল মিল এবং রিসাইকেলএবল দ্রব্যাদি সমূহ অধিদপ্তরের ছাড়পত্রধারী রি-সাইক্লিংকারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও বিক্রয় অথবা ব্যবহার করা যাবে না।

৪ . ইলেক্ট্রনিক ওয়েস্ট যেমন-সার্কিট বোর্ড) বস্তুনমূহ হ্যান্ডলিং ও অপসারনের ক্ষেত্রে ISM(Isolate, Store, Monitor) পদ্ধতি অনুসরণ করতে হবে। অধিদপ্তরের ছাড়পত্রধারী নির্ধারিত রি-সাইক্লিংকারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও ইলেক্ট্রনিক ওয়েস্ট বিক্রয় অথবা ব্যবহার করা যাবে না অথবা ইলেক্ট্রনিক ওয়েস্ট বিদেশে রিসাইক্লং-এর জন্য রপ্তানী করতে হবে।

৫ . প্লাস্টিক জাতীয় কঠিন বর্জ্য সাইক্লিংকারী করতে হবে। কোন ধরনের পিভিসি অথবা প্লাস্টিক দ্রব্য রি-রোলিং মিলে অথবা অন্য কোনভাবে পোড়ানো যাবে না।

৬ . জেনারেটরের জন্য বায়বীয় বর্জ্য নির্গমণের জন্য স্থাপিত Exhaust চিমনী সমূহ সার্বক্ষণিক কার্যক্ষম রাখতে হবে।

৭ . জেনারেটরের Spent Lubricating Oil এবং Oil Filter পরিবেশ অধিদপ্তরের ছাড়পত্র গ্রহণকারী প্রতিষ্ঠান ব্যতিরেকে অন্য কোনো Vendor এর কাছে বিক্রয় করা যাবে না।

৮ . জেনারেটর থেকে সৃষ্ট Residual Filtrate অথবা তৈল মিশ্রিত বর্জ্য কোন জলাশয়ে ফেলা যাবে না।

৯ . ইআইএ প্রতিবেদনে উল্লিখিত সকল মিটিগেশন মেজার্স সার্বক্ষণিক কার্যকরীভাবে চালু রাখতে হবে।

১০ . পরিবেশগত ভারসাম্য রক্ষার্থে বিদ্যুৎ কেন্দ্রের চারপার্শ্বে অব্যবহারযোগ্য ন্যুনতম ৩৩% জায়গা উপযুক্ত প্রজাতির ফলজ ও বনজ গাছ লাগিয়ে সবুজায়ন করতে হবে।

১১ . বিদ্যুৎ কেন্দ্রে ডমেস্টিক কাজে সৃষ্ট তরলবর্জ্য যথোপযুক্ত সেটলিক ট্যাংকে রেখে সেপটিক ট্যাংক ও সোকপিটের মাধ্যমে নির্গমণ করতে হবে।

১২ . প্রকল্পের পরিবেশগত ব্যবস্থাপনার জন্য প্রশিক্ষিত জনবল রাখতে হবে।

১৩ . পেশাগত স্বাস্থ্য রক্ষার্থে সকল ব্যবস্থাদি যথাঃ শ্রমিকদের সর্বদা হেলমেট, প্লাভস, বুট, নোজ মাস্ক, First Aid সুবিধাদি সার্বক্ষণিক চালু রাখতে হবে।

১৪ . অগ্নি দূর্ঘটনা রোধকল্পে বিদ্যুৎ কেন্দ্রে যথোপযুক্ত অগ্নি নির্বাপক যন্ত্রপাতি সার্বক্ষণিক কার্যকরী রাখতে হবে এবং ফায়ার সার্ভিসের লাইসেন্স গ্রহণ করতে হবে।

১৫ . প্রকল্পের কার্যক্রমে সৃষ্ট শব্দ এবং তরল/বায়বীয় বর্জ্যরে নিঃসরণ/নির্গমণ মাত্রা যথাক্রমে শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা-২০০৬ এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ বর্ণিত মানমাত্রার মধ্যে সীমাবদ্ধ থাকতে হবে। এর ব্যত্যয় ঘটলে এ ছাড়পত্র বাতিল বলে গণ্য হবে।

১৬ . এ ছাড়পত্র ভূমির মালিকানা স্বত্ব নির্ধারণ করে না।

১৭ . এ ছাড়পত্র জারীর তারিখ থেকে ৩(তিন) বছরের জন্য বহাল থাকবে। ছাড়পত্রের মেয়াদ শেষ হওয়ার ৩০(ত্রিশ) দিন পূর্বে নবায়ন ফি প্রদান পূর্বক নবায়নের জন্য অনলাইনে আবেদন করতে হবে।

১৮ . এ ছাড়পত্র কোনো অবস্থাতেই হস্তান্তর করা যাবে না।

১৯ . বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫ (সংশোধিত-২০১০) এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ প্রদত্ত ক্ষমতাবলে উপরোল্লি¬খিত শর্তসমূহ (Enforce) করা হবে।

সনাক্তকরণ নং: ৭২৩৩৮ 218.4 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at Monpura Union, Monpura Upazilla, Bhola ছাড়পত্র নং: ১৯-৮০৯৬

১৩ . পরিবেশ অধিদপ্তরের পরিদর্শক ও পরিদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ প্রতিষ্ঠানটি পরিদর্শনকালে ছাড়পত্র/নবায়নপত্র দেখতে চাইলে তা দেখাতে হবে এবং ছাড়পত্র/নবায়নপত্র ওয়ার্কশপের এমন স্থানে ঝুলিয়ে রাখতে হবে যাতে তা সহজে দেখা যায়।

২১ . ভবিষ্যতে উদ্যোক্তা কর্তৃক দাখিলকৃত তথ্য ভুল প্রমাণিত হলে এ ছাড়পত্র বাতিল বলে গণ্য হবে।

২২ . ক্রমিক নং (১-২০) বর্ণিত শর্তের যে কোনোটি ভঙ্গ করা হলে এ ছাড়পত্র বাতিল বলে গণ্য হবে এবং আপনার প্রতিষ্ঠানের বিরুদ্ধে বাংলাদেশ পরিবেশ সংরক্ষণ
আইন, ১৯৯৫ (সংশোধিত-২০১০) মোতাবেক আইনগত ব্যবস্থা গ্রহণ করা হবে।

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর,
বরিশাল বিভাগীয় কার্যালয়,
৩৯৯,নবগ্রাম বরিশাল,বরিশাল
www.doe.gov.bd

পরিবেশগত ছাড়পত্র

ছাড়পত্র নং: ১৯-২৫০২০

পরিবেশগত ব্যবস্থাপনা নিশ্চিতকরণ সাপেক্ষে সংযুক্ত শর্তে নিম্নবর্ণিত প্রতিষ্ঠান/প্রকল্পের অনুকূলে পরিবেশগত ছাড়পত্র প্রদান করা হলো :

প্রতিষ্ঠান/প্রকল্পের নাম	:	279.5 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at South Sakucia Union, Monpura Upazilla, Bhola
উদ্যোক্তার নাম	:	Western Renewable Energy (Pvt.) Ltd.
সনাক্তকরণ নং	:	৭২৩৪২
প্রতিষ্ঠান/প্রকল্পের কার্যক্রম	:	Other
প্রতিষ্ঠান/প্রকল্পের শ্রেণী	:	Green
প্রতিষ্ঠান/প্রকল্পের ঠিকানা	:	South Sakucia Union, Monpura Upazilla, Bhola,
প্রদানের তারিখ	:	১৯ জুন ২০১৯
মেয়াদ উত্তীর্ণের তারিখ	:	১৮ জুন ২০২২

এ ছাড়পত্র সনদের সাথে পৃথকভাবে সংযুক্ত প্রদত্ত শর্তাবলী যথাযথভাবে প্রতিপালন করতে হবে,
অন্যথায় ছাড়পত্র বাতিল/ক্ষতিপূরণ আদায়সহ যে কোন আইনানুগ ব্যবস্থা গ্রহণ করা হবে।

বিঃদ্রঃ এটি একটি সিস্টেম জেনারেটেড ছাড়পত্র এবং এতে কোনোরূপ স্বাক্ষরের প্রয়োজন নেই।

ছাড়পত্রটি যাচাই করতে ভিজিট করুন: http://ecc.doe.gov.bd/certificate_verification
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সনাক্তকরণ নং: ৭২৩৪২ 279.5 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at South Sakucia Union, Monpura Upazilla, Bhola ছাড়পত্র নং: ১৯-২৫০২০

পরিবেশগত ছাড়পত্র জন্য প্রযোজ্য শর্তাবলী:

১ . এ ছাড়পত্র কেবলমাত্র ২৭৯.৫ কিলোওয়াট সৌরবিদ্যুৎ উৎপাদনের জন্য প্রযোজ্য হবে। প্রকল্পের উৎপাদন ক্ষমতা বৃদ্ধি, জায়গা সম্প্রসারণ, উৎপাদন প্রক্রিয়া বা তৎসংশ্লি¬ষ্ট কোনো প্রকার পরিবর্তনের জন্য পরিবেশ অধিদপ্তরের পূর্বানুমতি/ছাড়পত্রের প্রয়োজন হবে

২ . বিদ্যুৎকেন্দ্র সৃষ্ট সীসা মিশ্রিত কঠিনবর্জ্য কোন ক্রমেই পরিবেশে নিক্ষেপ করা যাবে না। এ ধরণের বর্জ্য পুনঃব্যবহারে জন্য পরিবেশ অধিদপ্তরের ছাড়পত্রধারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও বিক্রয় অথবা ব্যবহার করা যাবে না

৩ . ধ্বংসযোগ্য মালামাল সমূহ (লৌহজাত স্ক্রাপ) পরিবেশ অধিদপ্তরের ছাড়পত্রধারী রি-রোলিং/ষ্টীল মিল এবং রিসাইকেলএবল দ্রব্যাদি সমূহ অধিদপ্তরের ছাড়পত্রধারী রি-সাইক্লিংকারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও বিক্রয় অথবা ব্যবহার করা যাবে না

৪ . ইলেক্ট্রনিক ওয়েস্ট যেমন-সার্কিট বোর্ড) বস্তুনমূহ হ্যান্ডলিং ও অপসারনের ক্ষেত্রে ISM(Isolate, Store, Monitor) পদ্ধতি অনুসরণ করতে হবে। অধিদপ্তরের ছাড়পত্রধারী নির্ধারিত রি-সাইক্লিংকারী প্রতিষ্ঠান ব্যতীত অন্য কোথাও ইলেক্ট্রনিক ওয়েস্ট বিক্রয় অথবা ব্যবহার করা যাবে না অথবা ইলেক্ট্রনিক ওয়েস্ট বিদেশে রিসাইক্লিং-এর জন্য রপ্তানী করতে হবে

৫ . প্লাস্টিক জাতীয় কঠিন বর্জ্য সাইক্লিংকারী করতে হবে। কোন ধরনের পিভিসি অথবা প্লাষ্টিক দ্রব্য রি-রোলিং মিলে অথবা অন্য কোনভাবে পোড়ানো যাবে না

৬ . জেনারেটরের জন্য বায়বীয় বর্জ্য নির্গমণের জন্য স্থাপিত Exhaust চিমনী সমূহ সার্বক্ষণিক কার্যক্ষম রাখতে হবে

৭ . জেনারেটরের Spent Lubricating Oil এবং Oil Filter পরিবেশ অধিদপ্তরের ছাড়পত্র গ্রহণকারী প্রতিষ্ঠান ব্যতিরেকে অন্য কোনো Vendor এর কাছে বিক্রয় করা যাবে না

৮ . জেনারেটর থেকে সৃষ্ট Residual Filtrate অথবা তৈল মিশ্রিত বর্জ্য কোন জলাশয়ে ফেলা যাবে না

৯ . ইআইএ প্রতিবেদনে উল্লিখিত সকল মিটিগেশন মেজার্স সার্বক্ষণিক কার্যকরীভাবে চালু রাখতে হবে

১০ . পরিবেশগত ভারসাম্য রক্ষার্থে বিদ্যুৎ কেন্দ্রের চারপার্শ্বে অব্যবহারযোগ্য ন্যুনতম ৩৩% জায়গা উপযুক্ত প্রজাতির ফলজ ও বনজ গাছ লাগিয়ে সবুজায়ন করতে হবে

১১ . বিদ্যুৎ কেন্দ্রে ডমেস্টিক কাজে সৃষ্ট তরলবর্জ্য যথোপযুক্ত সেটলিক ট্যাংকে রেখে সেপটিক ট্যাংক ও সোকপিটের মাধ্যমে নির্গমণ করতে হবে

১২ . প্রকল্পের পরিবেশগত ব্যবস্থাপনার জন্য প্রশিক্ষিত জনবল রাখতে হবে

১৩ . পেশাগত স্বাস্থ্য রক্ষার্থে সকল ব্যবস্থাদি যথাঃ শ্রমিকদের সর্বদা হেলমেট, প্লাভস, বুট, নোজ মাস্ক, First Aid সুবিধাদি সার্বক্ষণিক চালু রাখতে হবে

১৪ . অগ্নি দূর্ঘটনা রোধকল্পে বিদ্যুৎ কেন্দ্রে যথোপযুক্ত অগ্নি নির্বাপক যন্ত্রপাতি সার্বক্ষণিক কার্যকরী রাখতে হবে এবং ফায়ার সার্ভিসের লাইসেন্স গ্রহণ করতে হবে

১৫ . প্রকল্পের কার্যক্রমে সৃষ্ট শব্দ এবং তরল/বায়বীয় বর্জ্যরে নিঃসরণ/নির্গমণ মাত্রা যথাক্রমে শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা-২০০৬ এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ বর্ণিত মানমাত্রার মধ্যে সীমাবদ্ধ থাকতে হবে। এর ব্যত্যয় ঘটলে এ ছাড়পত্র বাতিল বলে গণ্য হবে

১৬ . এ ছাড়পত্র ভূমির মালিকানা স্বত্ব নির্ধারণ করে না

১৭ . এ ছাড়পত্র জারীর তারিখ থেকে ১(এক) বছরের জন্য বহাল থাকবে। ছাড়পত্রের মেয়াদ শেষ হওয়ার ৩০(ত্রিশ) দিন পূর্বে নবায়ন ফি প্রদান পূর্বক নবায়নের জন্য অনলাইনে আবেদন করতে হবে

১৮ . এ ছাড়পত্র কোনো অবস্থাতেই হস্তান্তর করা যাবে না

১৯ . বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫ (সংশোধিত-২০১০) এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ প্রদত্ত ক্ষমতাবলে

সনাক্তকরণ নং: ৭২৩৪২ 279.5 kWp Stand-Alone AC Coupled Solar Photovoltaic based Mini Grid Project at South Sakucia Union, Monpura Upazilla, Bhola ছাড়পত্র নং: ১৯-২৫০২০

উপরোল্লি- শর্তসমূহ (Enforce) করা হবে।

২০ . পরিবেশ অধিদপ্তরের পরিদর্শক ও পরিদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ প্রতিষ্ঠানটি পরিদর্শনকালে ছাড়পত্র/নবায়নপত্র দেখতে চাইলে তা দেখাতে হবে এবং ছাড়পত্র/নবায়নপত্র ওয়ার্কশপের এমন স্থানে ঝুলিয়ে রাখতে হবে যাতে তা সহজে দেখা যায়।

২১ . ভবিষ্যতে উদ্যোক্তা কর্তৃক দাখিলকৃত তথ্য ভুল প্রমাণিত হলে এ ছাড়পত্র বাতিল বলে গণ্য হবে।

২২ . ক্রমিক নং (১-২০) বর্ণিত শর্তের যে কোনোটি ভঙ্গ করা হলে এ ছাড়পত্র বাতিল বলে গণ্য হবে এবং আপনার প্রতিষ্ঠানের বিরুদ্ধে বাংলাদেশ পরিবেশ সংরক্ষণ
আইন, ১৯৯৫ (সংশোধিত-২০১০) মোতাবেক আইনগত ব্যবস্থা গ্রহণ করা হবে।

ব্যাংকের কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
প্রধান কার্যালয়, পরিবেশ অধিদপ্তর	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৮৯৮৪৪১	১৪২২৩১৯-পরিবেশগত ছাড়পত্র ফি	৪০,০০০.০০

নতুন কোড: 1450301124572-110000000-11001000-1422319 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৪০,০০০.০০
টাকা (কথায়): চল্লিশ হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।

গ্রাহকের কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
প্রধান কার্যালয়, পরিবেশ অধিদপ্তর	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৮৯৮৪৪১	১৪২২৩১৯-পরিবেশগত ছাড়পত্র ফি	৪০,০০০.০০

নতুন কোড: 1450301124572-110000000-11001000-1422319 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৪০,০০০.০০
টাকা (কথায়): চল্লিশ হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।

প্রধান কার্যালয়, পরিবেশ অধিদপ্তর -এর কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
প্রধান কার্যালয়, পরিবেশ অধিদপ্তর	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৮৯৮৪৪১	১৪২২৩১৯-পরিবেশগত ছাড়পত্র ফি	৪০,০০০.০০

নতুন কোড: 1450301124572-110000000-11001000-1422319 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৪০,০০০.০০
টাকা (কথায়): চল্লিশ হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।

ব্যাংকের কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
শুল্ক, আবগারী ও ভ্যাট কমিশনারেট, খুলনা	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৯৯৮৪০১	১১৪১১০১-দেশজ পণ্য ও সেবার ওপর মূসক	৬,০০০.০০

নতুন কোড: 1110204102021-110000000-11001000-1141101 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৬,০০০.০০
টাকা (কথায়): ছয় হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।

গ্রাহকের কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
শুল্ক, আবগারী ও ভ্যাট কমিশনারেট, খুলনা	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৯৯৮৪০১	১১৪১১০১-দেশজ পণ্য ও সেবার ওপর মূসক	৬,০০০.০০

নতুন কোড: 1110204102021-110000000-11001000-1141101 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৬,০০০.০০
টাকা (কথায়): ছয় হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।

শুল্ক, আবগারী ও ভ্যাট কমিশনারেট, খুলনা -এর কপি

টি.আর.ফরম নং-৬ (৪)
(এস আর অনুচ্ছেদ ৩৭ দ্রষ্টব্য)

চালান ফরম

চালান ভেরিফিকেশন QR কোড

ব্র্যাক ব্যাংক লিমিটেড, বিকাশ - ব্র্যাক ব্যাংক লিমিটেড শাখায় টাকা জমা দেওয়ার চালান

যে সরকারি প্রতিষ্ঠানের অনুকূলে অর্থ জমা হচ্ছে	যার মাধ্যমে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	যে ব্যক্তির/প্রতিষ্ঠানের পক্ষ হতে টাকা প্রদত্ত হলো তার নাম, সনাক্তকরণ নম্বর ও ঠিকানা	চালান নং	কি বাবদ জমা দেওয়া হলো তার বিবরণ	জমার পরিমাণ
শুল্ক, আবগারী ও ভ্যাট কমিশনারেট, খুলনা	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	WESTERN RENEWABLE ENERGY (PVT.) LTD. ***Identity not shown*** 1, KAWRAN BAZAR, TCB BHABAN (7TH FLOOR), TEJGAON , Dhaka,	২৩২৪-০০৩৭২৯৯৮৪০১	১১৪১১০১-দেশজ পণ্য ও সেবার ওপর মূসক	৬,০০০.০০

নতুন কোড: 1110204102021-110000000-11001000-1141101 অন্যান্য বিবরণ/মন্তব্য (যদি থাকে):

মোট (অংকে) = ৬,০০০.০০
টাকা (কথায়): ছয় হাজার টাকা

তারিখ: ১৩/০৫/২০২৪ খ্রি.

এটি একটি সিস্টেম জেনারেটেড চালান, কোন স্বাক্ষর প্রয়োজন নেই।