INITIAL ENVIRONMENTAL EXAMINATION (IEE)

Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi

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Prepared For

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EXECUTIVE SUMMARY

INTRODUCTION: A sustainable, affordable, and secure energy supply is important for the advancement of socio-economic development. In line with the government's 8th Five-Year Plan, Bangladesh has set a target of achieving 10% of its total power generation capacity from renewable energy sources by 2025. However, the current progress stands at 4%. To bridge this gap, the government aims to add 3 GW of renewable energy capacity within this time, with a focus on incorporating 2.0 GW of solar power. The growing cost-competitiveness of renewable energy sources further enhances their attractiveness, presenting a favorable alternative for the ongoing development of Bangladesh's energy sector. The Ashuganj Power Station Company Ltd. (APSCL), the country's largest power-generating company, has also taken proactive measures by initiating projects to promote renewable energy. As part of this initiative, APSCL has made the decision to establish 120 MW (AC) solar PV power plants in Raipura, Narsingdi. APSCL will do design, engineering, manufacture, finance, complete construction, permit, test, commission, insure, own, operate and maintain the plant for the purpose of generating and supplying electricity to Bangladesh Power Development Board (BPDB) for a period of more than 30 years on an off-take basis.

METHODOLOGY: 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. A questionnaire survey of local people has been done to find and assess the socio-economic conditions of the project area. Discussions were held with stakeholders including community representatives and a wide range of project areas. Focus Group discussion (FGD) and face to face interaction were also undertaken with Project Proponent, local villagers, and project implementation officials. Information and documents were collected from the project site and land details as per requirements. The assessment of socio-economic environment was carried out based on the survey with the help of framed questionnaire to conduct community consultation. Secondary data includes Census 2011, information available on the official website of the district of Narsingdi and other available data on official government websites. Environmental quality test of different parameters has been conducted on 16 October 2023 to 19 October 2023 at the project location and socio-economic surveys, Key informant Interviews and public consultations has been conducted in and around of Chanpur Union of Raipura Upazilla, Narsingdi.

POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK: The main purpose of the IEE study is to identify, evaluate and manage environmental and social impacts that may arise due to implementation and operation of the project. The site visit for the IEE study has been undertaken to assess any potential impacts (both negative and positive) that may arise from the construction, operation, and decommissioning of the solar plant project. The goal of the IEE is to enhance sustainability of vital ecosystems, to improve or restore ecosystem health and biodiversity. This document has been made to comply with the requirements of applicable local and national regulations, i.e., considering the DoE's Environment Conservation Rules, 2023, Government of Bangladesh (GoB) EIA Guidelines, 2021 and so on. Due to the inherent nature and adaptability, solar project activities have very little environmental and social impact. According to DoE ECR, 2023 solar powerplant projects of more than 50 MW fall into the Orange Category. Orange category projects need to have site clearance from DoE before commencing the project work. For the project proponent, the following IEE is a planning and decision-making tool. It allows for the identification and management of environmental impacts that may develop during the construction and operation of the project. The IEE also specifies how the root causes mentioned in the scoping of the report will be handled.

DESCRIPTION OF THE PROPOSED PROJECT: The proposed project is- a 120 MW Solar based power plant to be set up at Chanpur Union, Raipura Upazilla, Narsingdi, Bangladesh. APSCL will do design, engineering, manufacture, finance, complete construction, permit, test, commission, insure, own, operate and maintain the plant for the purpose of generating and supplying electricity to Bangladesh Power Development Board (BPDB). The project will be stablished in 368 acres of barren land (15.49%

Khas/Government owned & 84.51% Private land). To produce 120 MWp of electricity a total of 240000 solar panels will be used, assuming each panel has a capacity of 650 watts. daily a total of 40,000 liters (approx.) of water would be required for cleaning all the panels.

DESCRIPTION OF THE BASELINE ENVIRONMENT: In Narsingdi, the wet season is hot, oppressive, and mostly sunny and the dry season is warm and mostly clear. Over the course of the year, the temperature typically varies from 37.4°C to 10.65°C. Average annual precipitation is 161.7mm, Warmest month is June (29.17°C), Coldest Month is January (10.65°C), Wettest Month is July (361.94mm precipitation), Driest Month is December (2.64mm precipitation). The project area is mostly flat. Narsingdi has an average elevation of 9.52 meters (31.23 feet) above sea level. Narsingdi district, comprised of an area of 1140.76 sq km and and located in between 23°46'N and 24°15'N and 90°34'E and 90°59'E, is a part of the Dhaka division. It is bordered by Kishoreganj district in the north and northeast, Brahmanbaria district in the east and southeast, Narayanganj district in south and southwest and Gazipur district in the west. This district consists of six upazilas, namely Belabo, Monohardi, Narsingdi Sadar, Palash, Raipura, and Shibpur. The area is composed of mostly plain lands including numerous agricultural fields, a vast and densely industrial area housing many textile and jute mills etc., a huge fallow lands and homestead areas, many low- and wet lands and some small hillocks. It includes a total of 89045 hectares of cultivable land and 22154 hectares of fallow land. The Meghna river originates from the south slope of Naga and Manipur. It enters Bangladesh from two branches the Surma and Kushiyara at Sylhet border. The Meghna meets with the old Brahmaputra at Bhairab Bazar passes through Narsingdi and Narayanganj. In case of coast soils, however, the chemical characteristics were also taken into consideration. The main objective of the classification was to make an appraisal of nutrient status of the soils of Bangladesh. A brief description of the seven tracts of Bangladesh follows: (1) Madhupur Tract or Red Soil Tract, (2) Barind Tract, (3) Tista Silt, (4) Brahmaputra Alluvium, (5) Gangetic Alluvium, (6) Coastal Saline Tract, and (7) Hill Tracts. The project area falls under Tista Silt. Tista Silt Comprises parts of the former greater districts of Rangpur, Dinajpur, Bogra and Pabna. It covers an area of approximately 16,000 sq km. The predominant soil texture is sandy loam. The pH of the topsoils ranges from 5.5 to 6.5. The soils are in general fertile and are rich in potassium and phosphorus.

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: Environmental impacts assessment was carried out considering the present environmental setting of the project area, and nature and extent of the proposed activities. Potential environmental impacts associated with the proposed project activities are classified as: (i) impacts during pre-construction and construction phase and ii) impacts during operation phase (iii) impacts during decommissioning phase. During pre-construction phase, the impacts are associated with land use only. Therefore, there are no anticipated impacts during the planning phase of the Project. During construction phases, the major impact associated with environmental quality like air, noise, water, soil quality might be degraded due to improper management of the generated waste. Dust generated from construction machinery and gaseous emissions from vehicular transport as well machineries may deteriorate the air quality of the local area. Noise quality can be deteriorated due to the operation of various machinery and equipment. Various grease and oily substances may be released from the construction machinery and may deteriorate the natural water of the project site. All the impacts will be very much localized in nature. The project contractor has to take responsibility of minimizing environmental impact on the surroundings during construction phases by following the project's Environmental Management Plan (EMP). Other social impacts associated with the visual amenity, health safety of the labors, cultural resources, employment opportunity etc. such type of impacts will be localized in nature and not anticipate to the project. The contractor should follow the rules and guidelines related to the environmental and social mentioned in the EMP. During the operation period, the main impact is associated with heat generation. The heat may be transferred by convection, radiation, and conduction method. To minimize/mitigate the impacts the developer should follow the EMP properly.

ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN: Environmental Management Plan has been developed for addressing all adverse impacts pertaining to the implementation of the project.

The plan presented in tabular form includes impacts, their sources of occurrence, their mitigation measures, factors responsible for implementation of mitigation measures and their responsibilities. Environmental Monitoring Plan has incorporated key environmental components and parameters to be monitored their indicators, frequency, timing and locations of monitoring and the actors responsible for carrying out such monitoring. APSCL is the Executing Agency, responsible for overall project implementation and will establish a Project Implementation or Management Unit (PIU/PMU) to manage the project on their behalf. A Project Director (PD), supported by technical staff who will design the infrastructure, manage selection of Contractors, and supervise construction, will head this. Mitigation is the responsibility of APSCL. The construction contractor engaged by the project authority will implement the EMP along with monitoring and mitigation measures, as part of the contractual obligation during pre-construction and construction phase, and the project HS&E Officer and HS&E Division of APSCL will supervise the work. PIU/PMU and APSCL will provide all kinds of supports to HS&E Division of APSCL for proper monitoring, supervision and implementation of environmental and social monitoring and reporting by independent 3rd party engaged by construction contractor during pre-construction and construction phase and 3rd party engaged by APSCL during operation (plant lifetime) and dismantling phase. The cost for Environmental Monitoring and Mitigation Measures will be included in the DPP and funds will be allocated accordingly. The total budget is estimated as **BDT 25,60,000.00 per year** for Pre-construction phase, **BDT 35,74,000.00 per year** for Construction phase, **BDT 25,90,000.00 per year** for Operation phase and **BDT 290,000.00 per month** for Dismantling phase. This estimate is calculated excluding VAT and AIT, and it may vary with time.

CONCLUSION AND RECOMMENDATION: On the basis of the analysis, it may be concluded that the project stands environmentally sound and sustainable when the recommended mitigation measure and environmental management processes are adopted properly. Severe weather conditions would have an impact on the construction activities. The construction activities may even have to be stopped during these periods. So it is recommended that commencing construction in early winter season may help to reap the benefit of full dry spell of the season. In order to enhance the occupational health and worker safety during the construction period, construction equipment would have to be kept in good order. Adequate safety measures should be taken and safety related equipment including personal protective and safety equipments (PPE), firefighting equipment etc. must be provided in order to reduce the potential for accidents. Solid waste will be generated during the construction period from excavation, refuse and human excretion from construction camps. The major issue is the need to minimize disturbance to the local population in the areas of construction. A positive policy of employing local people during the construction phase should be adopted. Since, the implementation of the proposed project will bring about huge benefit through help to meet countries power demand for development, certain minor environmental impacts of the associated project will have to be compromised for the better interest of the country. But it can be managed and minimized by proper environmental management. This 120 MW solar power plant project could potentially result in a reduction of approximately 126,144 metric tons of carbon dioxide emissions per year compared to conventional fossil fuel-based electricity generation, which will help the government to mitigae Carbon emission. However, the anticipated impacts are mostly of short duration and relatively minor in nature. In view of the above considerations and the fact that the executing agency (APSCL) will maintain standard quality of implementation of the program with due consideration to other standing rules and regulations including to updated ECR 2023 and subsequent amendment of it.

1 INTRODUCTION

1.1 Background

Electricity is a crucial ingredient for poverty alleviation, industrial growth, infrastructure development and quality of living standard of the people and for overall development of the economy. The Government has given top priority to the development of the sector considering its importance in the overall development of the country and has set the goal of providing electricity to all citizens by 2020. A reliable supply of electricity is a pre-condition for poverty reduction and economic development. To alleviate poverty in the face of resource limitations and high population density, Bangladesh requires an economic growth rate of more than 7% p.a. In order to achieve this growth rate, electricity growth of 10% needs to be achieved. By best utilizing the natural, human, and agricultural resources the desired pace of GDP growth could be attained by increasing electricity generation at a much higher rate, which is the key target for development. Electricity plays a pivotal role for the socio-economic development of a country and the Government of Bangladesh has taken several initiatives like 8th Five-Year Plan, Power System Master Plan 2016 (amended in2018). Rapid urbanization, economic growth and increased industrialization cause increased demand for electricity. To cope with the increased demand of power supply, the government has so far insisted on setting up fossil fuel-based power plants. With the depleting reserves of indigenous fossil fuel resources and the adverse effect of conventional power plants on environment provoked Government to consider emerging into renewable energy resources. The Government of Bangladesh has taken diversified fuel-based power generation program to fulfil the vision and commitment of the government as well as to reduce the of greenhouse gas (Carbon) emissions. Ashuganj Power Station Company Ltd. (an enterprise of Bangladesh Power Development Board) is the largest power-generating company in the country with an installed capacity of 1647 MW. The Government of Bangladesh has directed all power generating companies to generate 10% of their total generation power from renewable energy sources, making APSCL's obligation to generate at least 165 MW of renewable energy-based electricity. APSCL has identified a potential land of 368 Acre at Raipura Upazila in Narsingdi District of Bangladesh. The study will be conducted in accordance with Environment Conservation Rules (ECR), 2023 and relevant international policies. According to ECR 2023, the project category for Solar Power Plant Project falls under orange category, item no. 8 of Schedule-1 which requires to prepare an IEE report. The study is based on both primary and secondary data and information. The primary data includes data which will be collected from field observations, discussions with stakeholders and secondary data includes review of the Bangladesh statistical and relevant information from Government Departments. The main purpose of this approach is to obtain a fair impression of the people's perceptions of the project and its environmental and social impacts and mitigation and management measures.

1.2 Project Objectives

The project aims to establish a 120 MW AC Grid-Tied Solar Power Plant in Raipura, Narsingdi, with the primary objective of harnessing renewable energy from solar sources to contribute significantly to the region's power supply. By leveraging advanced solar technology, the project seeks to enhance sustainability, reduce carbon emissions, and foster economic development in the area. This initiative aligns with broader goals of promoting clean energy solutions and addressing the growing energy demand in an environmentally conscious manner. The main objectives of the project include:

DEVELOP A 120MW OF SOLAR ENERGY TO INDIRECTLY REDUCE THE EMISSION OF GREEN HOUSE GASES (GHGs) CAUSED BY GENERATION OF SIMILAR QUANTITIES OF ELECTRICITY FROM NON-RENEWABLE OR FOSSIL FUEL SOURCES.

BALANCE THE DEVELOPMENT OF THE SOLAR ENERGY FACILITY WITH THE PROTECTION OF RESOURCES.

DEVELOP A UTILITY-SCALE SOLAR ENERGY PROJECT THAT IMPROVES LOCAL ELECTRICAL RELIABILITY BY PROVIDING A SOURCE OF LOCAL GENERATION.

ENHANCHING THE ECONOMY OF THE LOCAL COMMUNITY, CREATING LOCAL CONSTRUCTION JOBS, AND THUS BRINGING A DEVELOPMENT TO THE LOCALITY AS WELL AS TO THE COUNTRY.

1.3 Rationale of the Project

Bangladesh initiated a successful program of private power production as early as the late 1990s and has since embarked on a large public investment program in the sector as well as a systematic program of electricity imports from India. However, considerable challenges remain. Demand exceeds the supply of power at current prices. Generation capacity is still only 60 percent of Pakistan's, which has a similar-sized population and per capita annual consumption of 392 kilowatts per hour is among the lowest levels in the world. Moreover, power outages are still common in Bangladesh leading to losses of about two to three percent of the country's gross domestic product, or GDP. Inefficient technology, poor operational practices, and inadequate maintenance limit the supply of energy, as does a shortage of natural gas, which fuels about 70 percent of Bangladesh's power. An average of 100% of the population had access to electricity in Bangladesh as of 2022. Bangladesh will need an estimated 34,000 MW of power by 2030 to sustain its economic growth of over 7 percent. Problems in Bangladesh's electric power sector include high system losses, delays in completion of new plants, low plant efficiency, erratic power supply, electricity theft, blackouts, and shortages of funds for power plant maintenance. Overall, the country's generation plants have been unable to meet system demand over the past decade. On the 2nd of November 2014, electricity was restored after a day-long nationwide blackout. A transmission line from India had failed, which "led to a cascade of failures throughout the national power grid," and criticism of "old grid infrastructure and poor management." However, in a recent root-cause analysis report the investigating team has clarified that the fault was actually due to lack of coordination and poor health of transmission and distribution infrastructure

that caused the blackout. On 4 October 2022, 70–80% of the country's 168 million residences were hit with blackouts and only 45% of residences were restored with power by nightfall. There was a shortage of natural gas because of the 2021– present global energy crisis where 77 natural gas power plants had insufficient fuel to meet demand. The electricity sector in Bangladesh is heavily reliant on natural gas. The government stopped buying spot price liquefied natural gas in June 2022; they were importing 30% of their LNG on the spot market this year down from 40% last year. They are still importing LNG on futures exchange markets. Bangladesh has planned to produce 10% of total power generation by 2020 from renewable energy sources like wind, waste, and solar energy. The country plans to increase its renewable energy share to 10% by 2025 (as per PSMP, 2016 & 8th five-year master plan) & 17% by 2041 under its Intended Nationally Determined Contribution (INDC) commitment to reduce greenhouse gas emissions by 5% by 2030. In view of the above, the proposed Project envisages supplying reliable and grid quality electricity to the national grid with competitive price to Bangladesh Government. The project proponent: Ashuganj Power Station Company Ltd, a 120-MW solar based power plant is to be set up at Raipura upazila, Narsingdi district, Bangladesh. APSCL will do design, engineering, manufacture, finance, complete construction, permit, test, commission, insure, own, operate and maintain the plant for the purpose of generating and supplying electricity to Bangladesh Power Development Board (BPDB) for a period of more than 30 years on an off-take basis. Generating electricity through PV power is rather pollution-free during operation and compared with the current conventional way of producing electricity, the clean energy produced from renewable energy resources is expected to reduce consumption of alternative gas/coal/liquid fuels for electricity generation in Bangladesh, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions. The Project will produce clean energy that will contribute to lowering electricity generation costs compared to the current costs associated with other fuels and thus leads to a substantial decrease in the Government of Bangladesh's fiscal deficit. Realizing the potential of this sector, APSCL explored the opportunity of combining their relevant expertise to promote and develop alternative/renewable energy production through Solar Power Plant Project.

1.4 Methodology of IEE Study

1.4.1 Approach

The study is conducted in accordance with Environment Conservation Rules (ECR), 2023 and relevant international policies. According to ECR 2023, the project category for Solar Power Plant Project (>50 MW) falls under orange category, item no. 8 which requires to prepare an IEE report. The study is based on both primary and secondary data and information. The primary data includes data which are collected from field observations, discussions with stakeholders and secondary data includes review of the Bangladesh statistical and relevant information from Government Departments. The main purpose of this approach is to obtain a fair impression of the people's perceptions of the project and its environmental and social impacts and mitigation or management measures.

1.4.2 Methodology

The primary environmental and social data is collected from field observations, and secondary data is collected from Bangladesh statistical and relevant information from Government Departments and different documents will be reviewed. A complete primary data collection programme is initiated in the field survey. An approach and methodology are shown below.

- Desk Research
- Field Visit

- Scoping
  - Ecology
  - Pollution
  - Physical
  - Social
- Environmental Baseline
- Analysis And Screening of Environmental Impacts
- Potential Initial Environmental Examination
- Field Verification
- Preparation of EMP
- IEE

1.4.2.1 Primary Data Collection and Analysis

Primary data collection is aimed to provide a site-specific data set of relevant physical and biological, environmental, and social aspects relevant to the Project. During the data collection process, field surveys and stakeholder consultations have been conducted. Primary data is collected from three (03) different locations of the project area.

The study area and surroundings have been surveyed on foot and by boat. Important environmental features were identified and logged. Hand-held geographic positioning systems (GPS) were used to identify specific features for mapping and further analysis. Features that were recorded or ground-truthed (Verified) with GPS included:

- Habitation and settlement areas.
- Cultural Physical Properties (CPR).
- Plantations.
- Habitat areas.
- Sensitive environments.
- Transportation routes.

Under the primary data collection and field survey the observation that has been conducted is below:

- Vegetation and Flora Survey
- Wildlife Survey
- Fisheries Survey
- Direct Observation
- Environmental and Social Features Survey
- Interviews with Local Residents
- Socioeconomic Field Survey
- Geographical Information Systems (GIS)
- Stakeholder Consultations
- Impact Identification and Assessment

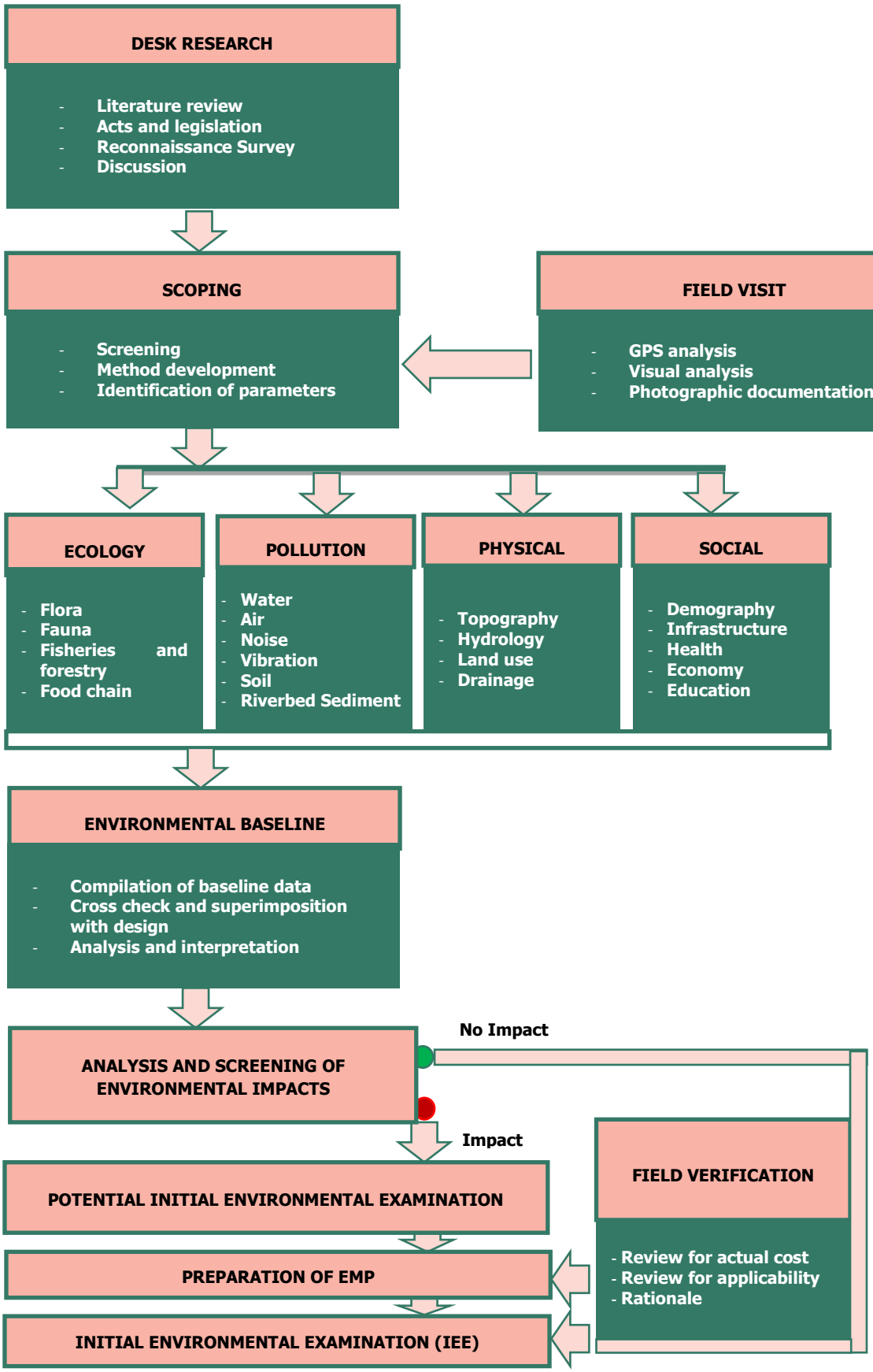


Figure 1-1: Route Map of Initial Environmental Examination (IEE)

1.4.2.2 Secondary Data Collection and Analysis

A review of secondary data collection and informal preliminary field investigations has been conducted to prepare a preliminary assessment of the identified study area's physical and social environment, biodiversity, and conservation significance.

- Data and information are collected from various government sources relating to site aspects climate (weather), groundwater quality, and soils; secondary ecological data sources were collected and assessed.
- An appraisal is made of all legislation having direct and indirect relevance to environmental management within the Study Area including aspects such as biodiversity conservation, water quality, waste management, natural resource management, and spill response.
- Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles; and
- After that, an information gap analysis is undertaken to identify the areas where further primary data collection would be required to complete the IEE.

1.5 Study Team

Table 1-1: Study Team

No.	Name	Position
1.	Md. Shafiqur Rahman	Team Leader (Senior Environmental Specialist)
2.	Raisin Akhter Feroz	Environmental Specialist
3.	Madhu Shudan Das	GIS Expert
4.	Md. Mashiur Rahman	Mid-level Environmental Specialist
6.	Saiful Islam Imran	Mid-level Social Expert
7.	Muhammad Anwar Iqbal	Jr. Environmental Specialist
8.	Tasnim Afrin Tamanna	Jr. Environmental Engineer
9.	Md. Fojlur Rahman	Environmental and Social Surveyor-1
10.	Md. Bappy Rahman	Environmental and Social Surveyor-2

2 LEGAL AND POLICY FRAMEWORK

2.1 General

According to the national environmental legislation of Bangladesh, all development projects are governed by some legal and institutional requirements. As such, assessment of relevant legal provisions, policies, strategies, and institutional issues are very important for any project proponent or developer before execution of a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary.

The need to comply with the requirements of the IEE Regulations ensures that decision makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimized, or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the IEE Regulations to provide the competent authority with sufficient information in order for an informed decision to be made. The following activities have been carried out under the IEE study:

- Identification of national legal obligations in relation to the interventions which will be required to review under the IEE study of the proposed project.
- Exploration of the national legislative provisions and policy guidelines on environmental sectors.
- Identification of the international legal obligations and relevant provisions of multilateral environmental agreements related to the renewable energy project.
- Exploration of national and international legal provisions on energy sector; and
- Identification of the standard guidelines at regional level related to the project.

2.2 Regulatory Requirements for the Project

According to the national environmental legislation of Bangladesh all development projects are governed by some legal and institutional requirements. As such, assessment of relevant legal provisions, policies, strategies, and institutional issues are very important for any project proponent or developer before execution of a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Department of Environment (DoE), under the Ministry of Environment, Forest, and Climate Change (MoEFCC) is the regulatory body responsible for enforcing the environmental rules and regulations like ECA'95 (amended in 2010), and ECR'23. 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 donor agencies relevant requirements are summarized below-

2.3 Applicable National Policies, Legal and Administrative Framework

2.2.1 The Environmental Conservation Act, 2010 (1st published in 1995)

The Environment Conservation Act (ECA) serves as Bangladesh's primary legislation for environmental protection, emphasizing conservation, standards development, and pollution control. The Act outlines strategies such as designating ecologically critical areas, regulating emissions from vehicles, requiring environmental clearance for projects, managing industrial discharges through permits, and establishing standards for air, water, noise, and soil quality. The Act also mandates limits for waste discharge, environmental guidelines, and necessitates obtaining Environmental Clearance from the

Department of the Environment's Director General for new projects. Amendments in 2000 focus on compensation for ecosystem damage, increased punitive measures, and authority for addressing offenses. The 2002 amendment further restricts polluting automobiles, bans environmentally harmful items, involves law enforcement in environmental actions, and details punitive measures and trial authority. The 2010 amendment introduces restrictions on hill and hillock cutting, mandates proper management of shipbreaking yard hazardous waste, prohibits altering water bodies without clearance, and enforces emission control for pollutants exceeding standards. Overall, the Act and its amendments underscore a comprehensive approach to environmental conservation and pollution control in Bangladesh.

Relevance to the project - According to this legislation, no industrial unit or project shall be formed, constructed, conducted or operated without obtaining the Site Clearance Certificate and Environmental Clearance Certificate from the Department of Environment in compliance with the regulations.

2.2.2 Environment Conservation Rules 2023

The Environment Conservation Rules provide categorization of industries and projects and identify types of environmental assessments required against respective categories of industries or projects. The Rules set:

- The National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.
- The requirement for and procedures to obtain environmental clearance.
- The requirement for IEE and IEE according to categories of industrial and other development interventions.
- This rule is covered "*Solar Project (>50MW)*" under the Orange Category, item no. 08, Schedule-1.

Relevance to the project - According to the Environment Conservation Rules 2023 (ECR 2023), the project has fallen under Orange Category (Schedule-1, Item No. 08: Solar Power more than 50 MW) which needs to obtain the Site Clearance Certificate prior to starting project activities and Environmental Clearance Certificate prior to starting operational activities from the Department of Environment (DoE), Narshingdi District office.

2.2.3 National Environment Policy 2018

The Bangladesh National Environment Policy 2018 sets out the basic framework for environmental action together with a set of broad sectoral action guidelines. Key elements of the Policy are:

a) Has the vision to ensure sustainable development through environmental conservation, pollution control, conservation of biodiversity and by combating the negative impacts of climate change.
b) Has been set with 16 specific objectives that includes: maintaining natural balance and ensuring overall development of the country through conservation of environment and sustainable management; expansion of climate change adaptation programs to reduce its negative impacts; introduce and encourage wide-spread use of low carbon emitting technology; identification control of all types of pollution and degradation of environment; ensuring environment friendly development in all sectors.

Relevance to the project - With regard to the solar power plant sector, the environmental policy aims at prevention of pollution and degradation of resources caused by project activities. The policy mentions that IEE should be conducted before projects are undertaken.

2.2.4 National Environment Management Action Plan (NEMAP), 1995

The NEMAP builds on the National Environmental Policy (NEP) and was developed to address specific issues and management requirements during the period 1995-2005. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

- ✓ 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.

Relevance to the project - The plan proposes development and application of guidelines to avoid environmental pollution. It particularly gives emphasis on different environmental pollution, hamper of natural drainage pattern and agricultural land acquisition due to project implementation.

2.2.5 Environment Court Act, 2010

Bangladesh Environment Court Act, 2010 has been enacted to resolve the disputes and establishing justice over environmental and social damage raised due to any development activities. 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 to industrial polluters.

Relevance to project: According to this act, DoE, Bangladesh can take legal action if any environmental disturbance or problem occurs due to this project interventions.

2.2.6 Wetland Protection Act, 2010

The Bangladesh Wetland Conservation Act, 2010 focuses on the preservation and sustainable management of wetlands within the country. Enacted to safeguard these vital ecosystems, the law designates wetlands as protected areas, recognizing their ecological significance. The Act establishes regulatory measures to control activities that may adversely impact wetlands, aiming to prevent encroachment, pollution, and unsustainable development. It outlines the roles and responsibilities of relevant authorities, including the Department of Environment, in enforcing conservation efforts and ensuring compliance with wetland protection measures. Through this legislation, Bangladesh seeks to balance developmental needs with the imperative to conserve and maintain the ecological integrity of its wetland ecosystems.

Relevance to the project - The Act specifies the fine and imprisonment term for violation of its provisions. It does not direct the government to recover the original characteristics of the water bodies if someone fills them up.

2.2.7 Bangladesh Biodiversity Act, 2017

Bangladesh is a biodiversity rich country owing to its unique geographic location, climatic condition and large seasonal variability and diverse ecosystems including marine and coastal ecosystems, freshwater ecosystems, terrestrial forest ecosystems hill ecosystems and homestead and agro-ecosystems. Despite having a large population in a very small country, the diversity of flora and fauna of the country is significant.

'The Bangladesh Biodiversity Act 2017' was enacted on 19 February 2017 as Act 2 of 2017 to meet the obligations of the Constitution and the obligations of the CBD. The act reflects the aims of the CBD to promote the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. The Act regulates the biodiversity assessment and conservation through management committees from the village to the national level, preparation and periodical amendments of the biodiversity conservation strategy and arising from its components.

Relevance to the project - This Act is relevant to the project as intervention may affect biodiversity of the surrounding project.

2.2.8 National 3R Strategy for Waste Management, 2010

The National 3R Strategy for waste management has been established by Department of Environment (DoE) 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.

Relevance to the project - During the construction and operational period, some solid, non-hazardous waste may be generated. So, this policy fits in with this regard.

2.2.9 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 recovery. The main provisions of the regulations are as follows:

- The principles of management must be followed from waste generation to final disposal when recovering resources from waste. The waste hierarchy, such as the 3Rs, segregation, and reduction are always considered in the principles of management.

Relevance to the project - This project will produce a certain number of solid wastes. So, this policy is applicable.

2.2.10 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.

Relevance to the project - Solar PV panel, and generators or inverter may produce e-waste during operation phase, and therefore this policy is applicable.

2.2.11 Renewable Energy Policy of Bangladesh, 2008

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

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

The policy promotes 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.

Relevance to the project - The proposed project is a 120MW project that is greater than 1 MW. Therefore, according to the above policy, the project developer should make sure no adverse environmental and social impact would result from the development works.

2.2.12 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.

Relevance to the project - As the proposed project is a 120 MW plant, waiver certificate/license will be required, and the project proponent will have to confirm the Commission by letter.

2.2.13 Bangladesh Labor Law, 2023

The Bangladesh Labor law 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. This law provides that the wages of a worker supplied by a contracting agency will not be less than the wages of a permanent worker or employee of a similar rank, and the basic salary of the same cannot be less than fifty percent (50%) of the determined salary.

Relevance to the project - The proposed project must ensure that all the compliances must be meet and workers must be paid accordingly to meet the rules.

2.2.14 Bangladesh Labor Act (Amendment), 2013

The Bangladesh Labor Act (Amendment) Bill was enacted by parliament in 2013, 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.

Relevance to the project - 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.

2.2.15 Occupational health and safety laws and rules in Bangladesh, 2015

As of June 2015, Bangladesh had occupational health and safety laws and rules aimed at protecting the well-being of workers and ensuring safe working conditions. The key legislation related to occupational health and safety during that time included:

1. ***Bangladesh Labor Act, 2018:*** This comprehensive labor law covered various aspects of workers' rights, including occupational health and safety. It set out provisions for safety measures in workplaces, workplace facilities, and welfare arrangements for workers.
2. ***Bangladesh Labor Rules, 2022:*** These rules were formulated to support the implementation of the Bangladesh Labor Act, 2006. The rules provided further details and guidelines regarding workplace safety, occupational health, and welfare measures for workers.

These laws and rules aim to establish and maintain a safe and healthy work environment for all employees in various sectors. Employers were required to comply with these regulations to protect workers from occupational hazards, accidents, and health risks. Inspections and enforcement of these laws were carried out by government authorities to ensure compliance and to take action against violators.

Relevance to the project - The proposed project must ensure that all the workers follow the rules and regulations to keep the occupational health and safety in a proper manner.

2.2.16 Bangladesh 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 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.

Relevance to the project - all the applicable guidelines of this act should be followed accordingly.

2.2.17 Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

The GoB prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised in 2009. 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. It is built around the following six themes:

- ***Food security, social protection, and health*** to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programs focus on the needs of this group for food security, safe housing, employment and access to basic services, including health.
- ***Comprehensive disaster management*** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
- ***Infrastructure*** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
- ***Research and Knowledge management*** to predict that the likely scale and timing of climate change impacts on different sectors of economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- ***Mitigation and low carbon development*** to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- ***Capacity building and Institutional strengthening*** to enhance the capacity of government ministries, civil society, and private sector to meet the challenge of climate change.

Relevance to the project - Relevant as the country is vulnerable to the effect of climate change and this solar project will help to mitigate carbon emission.

2.2.18 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.

Relevance to the project - To regulate water extraction, pollution control, and the allocation of water resources during the construction and operation phase.

2.2.19 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 support the country's agriculture sector and its stakeholders.

Relevance to the project - As per the policy, due to project intervention's construction and operation activities, adequate measures should be taken to reduce waterlogging and hampering the irrigation system.

2.3 Project Categorization by Department of Environment, Bangladesh

Under the ECR 2023, a classification system was established for development projects and industries on the 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 Environmental Conservation Rule, 2023, Solar Power Plant (more than 50 MWp) projects fall under "Orange" category (Item No. 8). A flow diagram (Figure 2-1) showing necessary steps for obtaining site clearance and environmental clearance from DoE is depicted for better understanding.

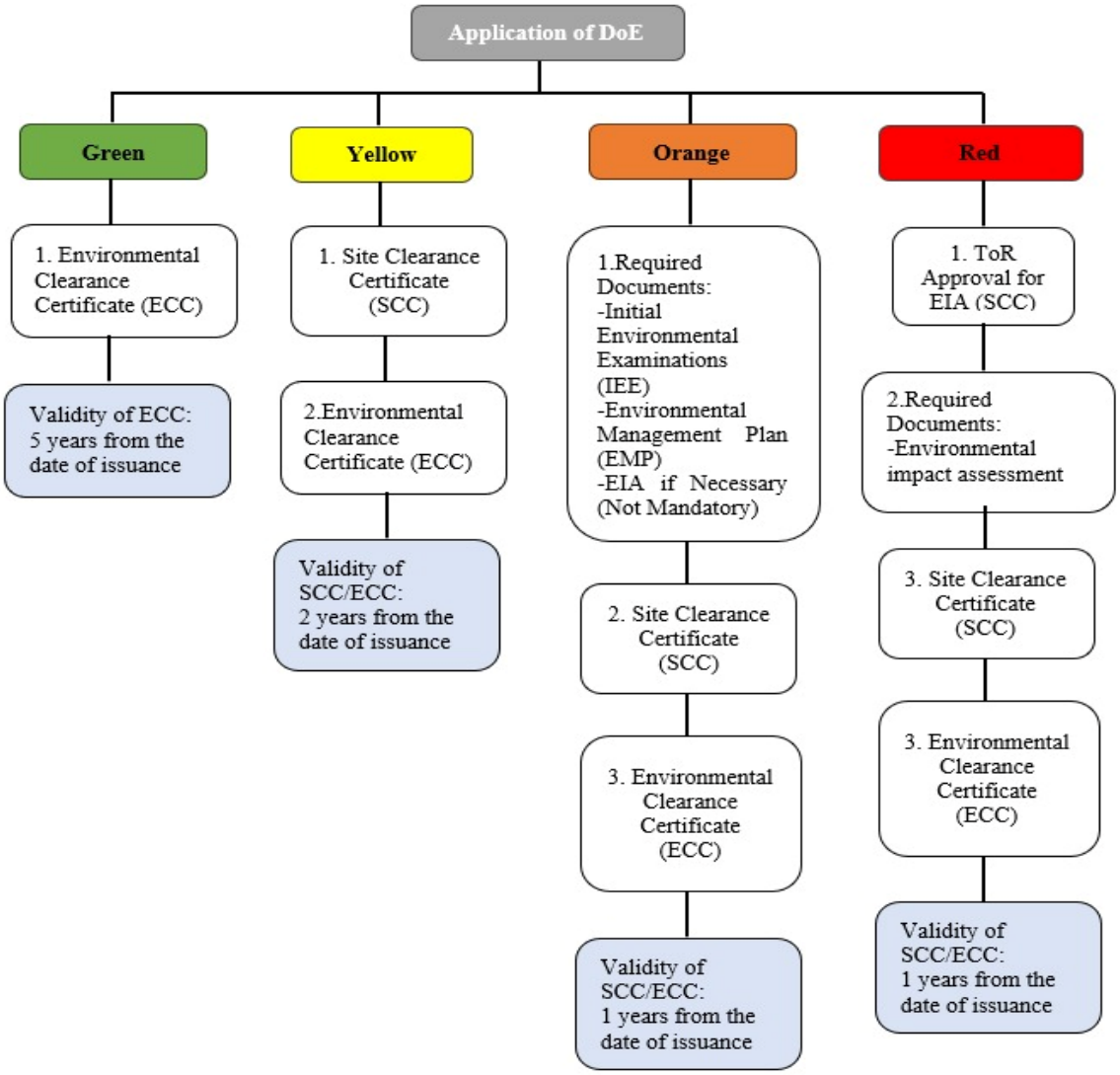


Figure 2-1: Flow diagram for Site Clearance as well as Environmental Clearance.

3 PROJECT DESCRIPTION

3.1 Project Location

The location of the project is in Chanpur Union of Raipura Upazilla of Narsingdi District. The proposed project is lying under three mouza named Majherchar, Chanpur diara & Katuar Char. It is situated on

the bank of the Meghna River. The road distance between Dhaka to the project location is approximately 86.7 km. The project will take place on land of about 368 acres.

Figure 3-1: Location of the Proposed Solar Power Plant

Figure 3-2: Photographs of Proposed Solar Power Plant Location

Table 3-1: Key Project Information

Project at a glance	
The project	Construction of Raipura 120 MW (AC) Grid-Tied Solar Power Plant Project, Raipura, Narsingdi, Bangladesh
Sponsoring Ministry/Division	Ministry of Power, Energy and Mineral Resources/Power Division.
Implementing Agency	Ashuganj Power Station Company Limited
Location of plant	Chanpur Union, Raipura Upazilla, Narsingdi Zilla, Bangladesh.
Project Category	Orange (as per ECR 2023)
Geo-coordinates of the site	23.981056°N, 90.966692°E
Sector & Sub-Sector	Power Sector Renewable Energy
RE technology	Solar PV Plant
Solar Technology	Earth-mounted fixed structures for 120 MW (AC) Grid Tied Solar Panel
Intended application	Development of clean energy solutions for sustainability of the country in terms of environmental (reduction in GHG emissions), social (environmental and livelihood) and economic (reduction in fossil fuel import) benefits
Project Duration	30 months

Source: Feasibility Study Report

3.2 Project Component

The proposed project is- a 120 MW Solar based power plant to be set up at Chanpur Union, Raipura Upazilla, Narsingdi, Bangladesh. Ashuganj Power Station Company Ltd. (APSCL) will do design, engineering, manufacture, finance, complete construction, permit, test, commission, insure, own, operate and maintain the plant for the purpose of generating and supplying electricity to Bangladesh Power Development Board (BPDB).

3.3 Facilities

3.3.1 PV Module

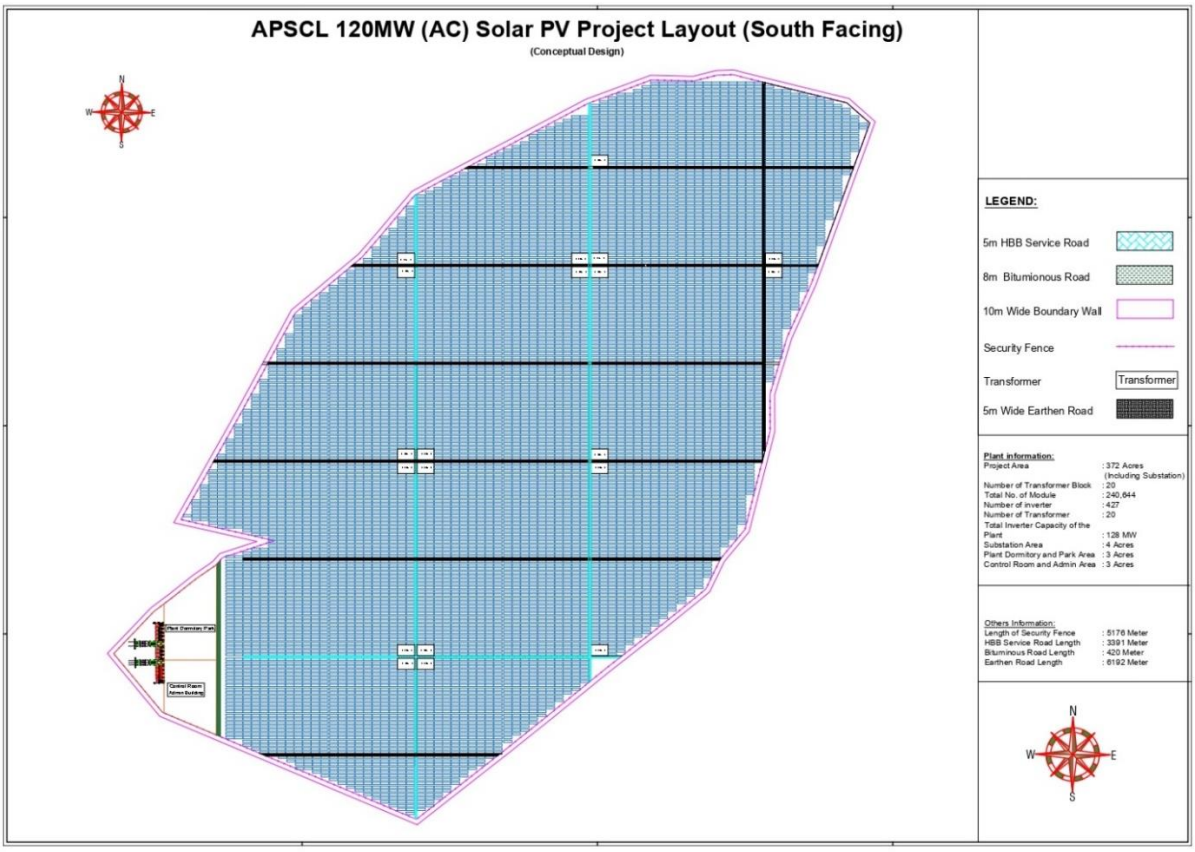
Mono crystalline with Bi-facial solar panels each with the capacity of 650W(P) has been considered. About 2,40,000 panels will be considered to install in the project area for getting the 120 MW (AC) power generation from solar PV.

3.3.2 Transmission Line

The proposed solar power plant will use solar panel modules with DC to AC inverters, step-up transformers of 33/132 KV etc. equipment and produced electricity will be supplied to the national grid through 132 KV transmission lines.

3.3.3 Access Roads

The proposed project area is located on a char land (a river delta) along the Meghna River, so there is no land communication with the mainland. Currently, boats are being used to travel from Lalpur-Chanpur to cross the river. It would be possible to reach the project area from the town of Brahmanbaria district through Lalpur Bazar for the transportation of light goods and public traffic. However, a ferry would be necessary to cross the river. The location on the riverbank offers the advantage of easy conveyance of heavy goods required for the construction of the solar power plant via the river.



Source: Feasibility Study Report

Figure 3-3: Tentative Layout of APSCL Project Components

3.3.4 Boundary Wall and Fencing

To protect from infiltration of animals, the unauthorized person inside site area, within the periphery of Solar PV power plant has to be covered by prefabricated/modular concrete wall with elevated barbed wire fencing (concertina). A prefabricated/modular concrete boundary wall will be erected at least of height 1.8 m with elevated spiral type round barbed wire fencing with 150 mm spacing of 1 m height, the total height of the boundary wall will be 2.8 m above finished ground level. Boundary wall's bottom portion of 450 mm will be covered by random rubble or stone masonry to protect the intrusion of surface water from adjacent land. Galvanized Iron (GI) post or concrete post will be provided at a spacing, not more than 3 m. Vertical bracings would also be provided at certain distances for the

overall stability of the fence. Proper arrangements would be made to block outside water. Grills on inlet and outlet of drainage or waterways would be given as per executing agency.

3.4 Resource and Utility Demand

3.4.1 Land Requirement

As per the pre-feasibility study report by APSCL, the project area primarily consists of privately-owned Nul land and some Khas land, with very little cultivation, mostly of spring harvestable. The landowners are positive about acquisition of land. Administrative approval and No-Objection certificates have been obtained from relevant departments (Annex 1).

Table 3-2: Land Classification in the Project Area

Land Class	Area of Land (Acre)	Percentage of total
Nul	225.00	61.14%
Boro	139.00	37.77%
Halot	1.47	0.40%
Others	2.53	0.69%
Total	368	100.00%

Source: Feasibility Study Report

The share of khas and Private owned land is tabulated below:

Table 3-3: Land Ownership Status in the Project Area

Type of Ownership	Area of Land (Acre)	Percentage of total
Khas/Government Owned	57.00	15.49%
Private Owned	311.00	84.51%
Total	368	100.00%

Source: Feasibility Study Report

3.4.2 Water Requirement

Water will be required for both construction and operation phases. Water will be required for foundation structure, office building construction approach road construction during the construction period. Water requirement for construction and operation period will be estimated during the detail design stage. As per the pre-feasibility study, the suitable source of water is an underground aquifer as the water level present only 6m below the surface. On the other hand, surface water also available as the Meghna River and Brahmaputra River are follow close to the project area.

3.4.3 Raw Materials

During construction stage, construction materials like cement, aggregates, steel, paints, solvents etc. will be required. Alongside, other supplies necessary for the project are fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for the construction workforce. Most of the raw materials will be sourced locally. The EPC contractor will be responsible for obtaining the earthen materials to be used in the dike construction. Three options are possible in this respect:

- **Option 1:** Purchase materials from local market or private source or suppliers.
- **Option 2:** Obtaining materials from already available legally dredged stockpiles when the DC offices routinely tender out contracts for removal of soil and sand from river “islands” or riverbeds in order to ensure the navigability of the rivers.

- **Option 3:** EPC contractor can select during the implementation of the project to dredge the material from a nearby river by obtaining proper permission from respective Government authority.

Aggregates will be sourced from Sylhet or imported from the neighboring country. Fuels and oils, and spare parts will be required during the operation period. Besides this adequate food supply is also required for the site staff.

3.4.4 Fuel Requirement

Fuel will be required for the daily operation of machinery as well as backup diesel generator during the construction period and it will be sourced from the local market. The fuel oil will be stored in the diesel drums in the storage yard. Insignificant lubricating will be required during the operation period which will be stored in the designated storage area having secondary containment and proper safety measures.

3.4.5 Power Requirement

Electricity is supplied to Raipura Upazila and other neighboring upazilas through Narsingdi Palli Bidyut Samiti-1 and 2 under Bangladesh Rural Electrification Board (BREB). The project area has been supplied with electricity from Narsingdi Palli Bidyut Samiti-2 since 2020. Raipura Zonal Office, located under Narsingdi Palli Bidyut Samiti 2, provides electricity to the geographical area of Raipura Upazila (23 Unions and 1 Municipality). Besides, diesel generators will be used for power generation during construction and operattion period to meet the power requirement. The power requirement at the site office and monitoring building during operation phase will meet by the BPDB/PBS/Own generation.

3.4.6 Manpower Requirement

The labor requirement varies during the construction phase from the initial phase to the commissioning phase. Necessary manpower like engineer, other officers, officials, technicians, and laborers will be estimated and appointed during construction and separate skilled workers, technicians and officers will be appointed during operation and maintenance phase. It is recommended to appoint the available unskilled, semi-skilled or skilled manpower from local residents as this will greatly minimize mobilization and financial burdens, will create job opportunities as well as cause positive social impact to the locality.

3.5 Project Phases and Activities

The proposed solar project lifecycle can be divided into four phases as follows:

- Planning and Preconstruction Phase
- Construction Phase
- Operation and Maintenance Phase
- Decommissioning Phase

The detailed work involved in these phases has been described in the following subsection.

3.5.1 Planning and Preconstruction Phase

The planning and pre-construction phase involves the conceptualization of the project and has following five components:

- Site Selection;

- Land acquisition process;
- Site surveys as topographic, geotechnical investigations, micro-siting studies, power evacuation arrangements;
- Approvals/clearances/ permits;
- Design and finalization of contractors;
- Mobilization of contractors;

3.5.2 Construction Phase

The proposed construction involves the following activities:

- Site preparation activities such as clearance, excavation, filling, leveling etc.;
- Construction of external connecting road and internal access roads;
- Flood protective measures around the project area;
- Construction of labor camp, site office, equipment and supplies storage areas, fuel storage areas and waste pits;
- Construction of Foundation of the PV module;
- Transportation of equipment including PV module, mounting structure, towers, supply materials, and fuels;
- Completing internal electrical connections of PV module location;
- Erection of internal electrical lines;
- Establishment of pooling sub-station; and
- Commissioning of the PV module.

3.5.3 Operation and Maintenance Phase

During operation of the proposed solar power plant the following activities are required:

- Regular remote monitoring of PV module operation;
- PV module washing;
- Inverter maintenance;
- Breakdown maintenance;
- Changing the broken or disable PV module;
- Internal road repair as and when required;
- Checking the electric connection;

3.5.4 Decommissioning Phase

The solar power plant site, after having remained in operation for the lifecycle estimated at 20 years, will not lose its value. However, it is not yet decided if the project would approach for upgradation/expansion once this project life is completed.

3.6 Technology

The proposed solar power plant will use solar panel modules, DC to AC inverters, step-up transformers of 33/132 KV etc. equipment and will be supplied to the national grid through 132 KV transmission lines.

Table 3-4: List of Major Components

SN.	Component / Equipment	Specification	Total
1	Solar PV Module	700 Wp	240,016 Nos (168 MWp)

SN.	Component / Equipment	Specification	Total
2	String Inverter	300kW @40°C	427 Nos. (128 MW)
3	Inverter Block Transformer (0.8/33kV)	6.6 MVA @40°C	20
4	Power Transformer (33/132V)	60/80 MVA	2
5	Meteo station	-	4

Source: Feasibility Study Report

3.6.1 Solar Panels

Solar panels are the most critical component of a solar power plant. They are made up of photovoltaic cells that convert sunlight into electricity through the photovoltaic effect. The solar panels are usually mounted on racks or frames and arranged in an array to maximize the amount of sunlight they can capture. The panels are made up of silicon cells that can last up to 25 years, making them an excellent investment for the plant. There are three major types of solar panels:

(a) **Monocrystalline Solar Panels:** Monocrystalline solar panels are made from a single crystal of silicon and are known for their high efficiency and uniform appearance. These panels are made by cutting thin wafers from a cylindrical ingot of silicon. They have a higher efficiency rating than other types of solar panels, typically between 18-21% making them ideal for installations where space is limited. However, monocrystalline panels are more expensive to manufacture than other types of panels.

(b) **Polycrystalline Solar Panels:** Polycrystalline solar panels are made by melting multiple fragments of silicon together, creating a single large crystal. The process is less expensive than monocrystalline panels, making them more affordable. Polycrystalline panels have a lower efficiency rating than monocrystalline panels, typically between 15-17%, but are still an excellent choice for larger installations. They also have a unique blue color due to the way the silicon fragments are melted together.

(c) **Thin-Film Solar Panels:** Thin-film solar panels are made using a thin layer of photovoltaic material deposited onto a substrate, such as glass or metal. They are lightweight, flexible, and can be manufactured in a variety of sizes and shapes, making them an excellent option for installations where space is not a concern. Thin-film panels have a lower efficiency rating than crystalline panels, typically between 7-13%, but are less expensive to manufacture. They are also less durable than other types of panels and have a shorter lifespan. Each one of the panels can be subdivided into two categories namely, Mono-facial and Bi-facial solar panels.

Mono-facial Solar Panels: Mono-facial solar panels are the most common type of solar panel and feature a single layer of solar cells on the front side of the panel. These cells are made from crystalline silicon and capture sunlight to generate electricity. Mono-facial panels are typically less expensive to manufacture than bifacial panels. but they are also less efficient at converting sunlight into electricity.

Bifacial Solar Panels: Bifacial solar panels are similar to mono-facial panels, but they have solar cells on both the front and back sides of the panel. This allows them to capture sunlight reflected off the ground or other surfaces, as well as direct sunlight from above. Bifacial panels can increase efficiency by up to 30%, making them a popular choice for large-scale solar power plants. They are also more expensive to manufacture than mono-facial panels, but their increased efficiency can lead to a quicker return on investment.

In this particular Case, considering maximum efficiency of the system, Mono crystalline with Bi-facial solar panels with the capacity of 650W(P) are taken into consideration. PVsyst simulation asserts that the total solar panels required for this power plant will be around 240000. Basic specification of solar PV modules is given in table 3.5.

Table 3-5: Reference Specification of Solar PV Module

SL No.	Parameter	Acronym	Value	Unit
1	Power output Pmax	Pmax	700	Wp
2	Power output tolerances	Pmax	0.5%	%
3	Open Circuit Voltage	Voc	48.6	V
4	Short Circuit Current	Isc	18.32	A
5	Maximum Power Voltage	Vmpp	40.5	V
6	Maximum Power Current	Impp	17.29	A
8	Minimum Module efficiency ηm %	m	22.5	%
9	Maximum system voltage		1500	V (DC)
10	Dimensions (L / W / H)	2384mm / 1303mm / 33mm		
11	Weight		38.3	kg
12	Temperature Coefficient of Isc		+0.04%	/˚C
13	Temperature Coefficient of Voc		-0.24%	/˚C
14	Temperature coefficients of Pmax		-0.30%	/˚C
15	Warranty		30	Year
16	Power attenuation coefficient in 25 years		< 20	%
17	Minimum number of bypass diode per module		3	-

3.6.2 Inverter

Inverters are devices that convert the DC (Direct Current) electricity produced by the solar panels into AC (Alternating Current) electricity. which is compatible with the grid. The inverters are also responsible for managing the voltage and frequency of the electricity, to match the grid's requirements. There are two main types of inverters used in utility-scale grid-tied solar power plants: string inverters and central inverters. Here is a short description of each:

String Inverters: String inverters are the most common type of inverter used in solar power plants. They work by converting the DC electricity generated by the solar panels into AC electricity that can be used by the grid. In a string inverter system, multiple solar panels are connected in series to form a string, and several strings are then connected to the inverter. The inverter converts the DC electricity from the entire string of panels into AC electricity, which is then fed into the grid.

Central Inverters: Central inverters are larger than string inverters and are designed to handle the output from a larger number of solar panels. They work in a similar way to string inverters, but instead of converting the DC electricity from individual strings of panels, they convert the DC electricity from a large array of panels. Central inverters are typically located at a central point in the solar power plant and are connected to the panels via a system of combiner boxes and DC wiring.

The main advantage of string inverters is their lower cost and simpler installation, as they are installed closer to the panels and require less wiring. However, they may not be as efficient as central inverters and may have a shorter lifespan, Central inverters, on the other hand, are more expensive and complex, but they offer higher efficiency and reliability. The choice between string and central inverters depends on the specific needs and constraints of the solar power plant, such as the size of the installation, the layout of the panels, and the cost constraints.

In this particular case, about 134 nos. of String Inverter with a capacity of 300KW are considered for the study of the Power Plant (table 3.6).

Table 3-6: Specifications of String Inverter

Technical Specifications	
Inverter Type	String
Max. Efficiency	>99.0%
European Efficiency	>98.8%
Input	
Max. Input Voltage	1,500 V
Max. Current per MPPT	65 A
Max Short Circuit Current Per MPPT	115 A
MPPT Operating Voltage Range	500 V ~ 1,500 V
Number of independent MPP Inputs	6
Output	
Rated AC Active Power	330kW @30℃, 300kW @40℃,
Rated Output Voltage	800 V, 3W+PE (subject to change inverter vendor)
Rated AC Grid Frequency	50 Hz / 60 Hz
Max. AC Output Current	238. 2 A
Adjustable Power Factor Range	0.8 LG 0.8 LD
Max. Total Harmonic Distortion	＜1%
Protection	
DC Input protection	Yes
AC Output protection	Yes
Over voltage Protection	Yes
Insulation monitoring	Yes
Ground fault monitoring	Yes
Overheat protection	Yes
Communication	
RS485	Yes
MBUS	Yes
General	
Cooling Method	Smart air Cooling
Max. Operating Altitude without Derating	4000m
Protection Degree	IP66
Topology	Transformer less

Source: Feasibility Study Report

3.6.3 Combiner Boxes

A combiner box is used to combine the DC output of several solar panels before it is fed into the inverter. The combiner box has several strings of solar panels connected to it, and each string is fused to prevent damage in the event of a short circuit.

3.6.4 Transformers

Once the DC electricity is converted into AC electricity by the inverter, it is sent to a transformer to increase the voltage to match the grid's requirements. Transformers step-up the voltage to minimize transmission losses and to ensure efficient power transmission. In this project Smart Transformer Station (STS) will be used. STS are generally used in the transmission network to increase or decrease the AC voltage level. In this Project, there will be a ground mounted String Solution PV Power Plant. Therefore, 0.8/33 kV Transformer are to be used in this Project. 7 nos. of 6600 kVA will be required to

step-up the voltage for solar park of 50 MWp of capacity. The following table shows the basic parameters required for the Smart transformer Station.

Table 3-7: Reference specification of smart transformer Station

Technical Specifications	
Type	Three phase, outdoor three winding
Rating	6,600 kVA @40℃ / 6,050 kVA @50℃ 1
Voltage ratio	33/0.8kV
Winding connection and Vector Group	HV-LV1, LV2, Dy11-y11
Rated frequency	50Hz
Cooling system	ONAN
Tapping Range	+ 5% ± 2 x 2.5%

Source: Feasibility Study Report

3.6.5 Switchgear and Protection System

The Solar PV System and the associated Power evacuation system shall be protected as per relevant International Standards (IS). Detailed design calculations shall be provided on fault power calculations and the philosophy of protective relaying with respect to short circuit kVA calculations.

3.6.5.1 33kV Switchgear and Equipment

General: Power generated in PV module shall be primarily delivered to 33kV Switching sub-station through LV/33kV, 3 winding Power transformer. Insulated (XLPE), sheathed and armored Cable shall be used for connection between AC output of the transformer of the Medium Voltage Power Platform (MVPP) and 33kV Bus of 33kV sub-station. The scope of supply of 33kV Switchgear and equipment shall include, but is not `limited, to the following main elements:

1. 33 kV circuit breaker
2. 33 kV Current Transformers
3. 33 kV Voltage Transformers
4. 33 kV Lightning Arresters
5. 33 kV Isolator with Earthing Blade
6. 33 kV XLPE (Single-Core) cable including Two end termination and one spare core (3+1) with necessary hardware from 33 kV MVPP to 33kV Switching Sub- Station

The design of 33 kV Switchgear and Equipment shall be as follows: System Voltage

The system shall be as follows:

- Nominal system voltage : 33 kV

- Highest system voltage : 36 kV

3.6.5.2 Insulation level

The insulation level of the switchgear, equipment shall be as follows:

Lighting impulse withstand test : 170 kV (Peak) Voltage (1.2 / 50 micro sec)

Power frequency insulation level (for 1 mm.): 70 kV

3.6.5.3 Outdoor Conductor

Insulated (XLPE), sheathed and armored (Cu Cable) shall be used for connection between AC output of the Transformer of the Medium Voltage Power Platform and 33kV Bus of 33kV sub-station.

3.6.5.4 Design Conditions

Switchgear equipment shall be designed to avoid local corona formation and discharge likely to cause radio interface, and to endure short circuit current without thermal and mechanical failure for 1 (one) second. All cubicles and enclosures shall be vermin proof, dust resistance and weatherproof. One 33 kV Circuit Breakers (630 A) Type Three (3) pole, porcelain type, high speed, indoor, trip free in any position, motor operated or hydraulic & spring operated SF6 gas puffer, single flow type complete with hydraulic pump, tank, piping, conduit, wiring, and all other necessary accessories.

3.6.5.5 Use

For paralleling, control and protection

3.6.5.6 Ratings

a. Rated voltage : 33 kV

b. Rated insulation level - Lighting impulse withstands test voltage: 170 kV (peak) (1.2/50 micro sec) Power frequency withstand voltage : 170 kV (for 1 mm)

c. Rated frequency: 50Hz d. Rated nominal current: 630A

e. Rated short circuit breaking current: 25 kA [rms, 3 sec]

d. Rated transient recovery voltage for terminal faults and rated characteristics

for short line faults shall be in accordance with IEC 56

g. Rated short circuit making current: 65 kA

h. Rated operating time : Less than 40 msec

i. Rated operating sequence (<2.5 cycles): O-0.3sec-CO-3min- CO

3.6.5.7 Control System

The rated supply voltages of closing and opening devices shall be 110/115 VDC, and the operation of circuit breaker shall be performed safely under the following conditions:

For tripping operation (-30% to +10%) : 77 to 121 VDC For closing operation (-15% to +10%) : 94 to 121 VDC. The rated hydraulic pressure shall be recommended by the Contractor.

3.6.5.8 Requirements for Design and Construction

i. The circuit breakers shall have an automatic trip free mechanism.
ii. Time difference between contacts of three (3) poles shall not be more than 0.006 sec.
iii. In case of phase open trouble, all phases of the circuit breaker shall be opened by a protection circuit.
iv. The arcing contact shall be of an arc proof metal and the main contact shall be covered with silver
v. electroplated. Five (5) pairs of “a-b“ spare contacts shall be equipped with the auxiliary switches.
vi. The tripping current of the trip coil shall not be more than 2 A per phase.
vii. The porcelain insulator or bushings shall have sufficient strength to withstand stress due to breaker operation. The glazing colour shall be brown. The creepage distance shall not be less than 25 mm / kV of phase-to-phase voltage.

viii. Integrating time register for hydraulic pump shall be driven by a self-starting synchronous motor through mechanical gears to record operating hours of hydraulic pump and shall be able to perform four operations without AC power.

ix. Gas circuit breaker shall be provided with gas density detector responding to gas density and pressure. This gas density detector shall have two (2) different functions according to the gas condition.

x. The first step gives alarm and the second step locks the operating mechanism. Operating mechanism which employs compressed air or hydraulic for driving the circuit breaker shall be provided with pressure detector which have two (2) different functions according to compressed air or hydraulic condition: The first step gives alarm and the 2nd step locks the operating mechanism.

xi. The weather and dust proof type control box shall be furnished with the circuit breakers. The control box shall be equipped with all necessary parts to operate the circuit breaker, such as control solenoids, operating switch of remote and local control, auxiliary switch, terminal blocks, protective devices, indicating lamp sockets, and other accessories. An anti-condensation electric heater with thermostatic switch shall be provided inside the control box.

xii. The circuit breakers shall be provided with an emergency push button switch with cover to prevent inadvertent switching.

xiii. The circuit breakers shall be provided with an electrical anti pumping relay.

xiv. The supporting structure shall be free from mechanical vibration and loosening under long term use.

xv. The circuit breakers shall be designed to facilitate inspection, especially for those parts which need inspection frequently.

xvi. The circuit breakers shall be filled with sufficient SF6 gas. xv. SF6 gas leak detector shall be furnished.

xvii. The circuit breakers shall be driven by hydraulic and spring latch. Hydraulic supplying system shall be furnished with the circuit breakers and shall be installed in weather dust proof type housing. The operating mechanism shall be designed to meet the requirements of IEC 56

xviii. Temperature limitation shall be in accordance with IEC 56.

xix. The Contractor shall furnish all control cables, pipes or ducts and fittings between each phase and control box.

xx. The indicating lamp signals which display “on (red) “and " off green)" of the main contacts shall be furnished on each control box of circuit breaker.

3.6.6 Protection and Relaying System

The Solar PV System and the associated Power evacuation system shall be protected as per relevant International Standards (IS). Over Current relays, Reverse Power Relays, Differential Protection Relays and Earth fault relays have to be provided. Detailed design calculations shall be provided on fault power calculations and the philosophy of protective relaying with respect to short circuit KVA calculations.

3.6.6.1 Lightning & Over Voltage Protection:

a. The SPV Power plant should be provided with Lightning and over voltage protection connected to proper Earth mats. The main aim of over voltage protection is to reduce the over voltage to a tolerable level before it reaches the PV or other sub-system components.

b. The Lightning conductors shall be made as per applicable International Standards in order to protect the entire Array Yard Lightning stroke.

c. The lightning conductor shall be earthed through flats and connected to the Earth mats as per applicable International Standards with Earth pits. Each Lightning conductor shall be fitted with individual Earth pit as per required Standards including accessories, and providing masonry

enclosure with Cast Iron cover plate having locking arrangement, watering pipe using Charcoal or Coke and Salt as per required provisions of IEC or equivalent international standard.

d. The bidder shall ensure adequate lightning protection to provide an acceptable degree of protection as per IEC or equivalent international standard for the array yard. If necessary more number of Lightning conductors may be provided. Theoretical design calculations and detailed explanations shall be provided.

e. The Control Room building is to be protected from lightning stroke with Lightning conductor as per requirements of IEC or equivalent international standard.

f. All Building Earth conductors shall be interconnected through the concept of Earth Mats for interconnection with separate earth pits.

3.6.6.2 DC, UPS & Auxiliary Power Supply

The Bidder shall supply, all requested auxiliaries (but not limited to), such as:

- UPS Battery Emergency Power Supply (DC and Safe AC)
- internal/external lighting and emergency lighting systems in Control building
- air conditioning in Control building
- power supply of CCTV
- fire alarm system

The Bidder shall submit the proposed auxiliary supply system with his Proposal. Power supply systems may be categorized into essential and non-essential groups. Essential supplies should be continuously available without any interruption, whereas non-essential ones may be allowed to be subject to interruptions. Low-voltage AC and DC systems shall be designed in accordance with the IEC 60364.

3.6.6.3 DC and Safe AC

The uninterruptable power supply system (UPS) shall serve the customers which have to remain in operation in the event of a network failure i.e. emergency lighting, measuring, control room, CCTV, fire alarm system etc. Some equipment (e.g. MV switchgear circuit breaker heaters) may require the provision of changeover power supplies. The 100% load of 230/400 V AC (Safe AC), 110 V DC and 24 V DC are to be defined by the Contractor providing classification of consumers and their required backup time values.

The UPS system shall consist of:

- rectifier/battery/inverter set
- static switch by-pass and maintenance by-pass set
- Three phase AC distribution board.

The DC system shall consist of:

- AC/DC rectifier
- DC distribution board.

The rectifiers and inverters shall be arranged in sheet steel cubicles, which shall be matched to the distribution cubicles in respect of height and other dimensions. The rectifiers and inverters shall be designed for operation with natural cooling. If forced air-cooling is required, then 2 x 100% air fans

with monitoring and local and remote alarm signals must be provided. The DC distribution is to be fed by 1x100% batteries and rectifier. The digital control system (DCS) shall be supplied from a 24 V DC system. A redundant 24V DC distribution system shall be provided. The cubicles of 24 V DC consumers shall be supplied by redundant feeders. Redundant Safe AC system shall be provided. 230 V Safe AC systems comprises one inverter with static bypass switch unit and a safe busbar. The inverter shall be supplied from sections of the 110 V DC main distribution. The static bypass switch shall be supplied from the 0.4 kV essential switchgear. The 230 V Safe AC system supplies the equipment requiring uninterrupted supply (UPS) e.g. measuring, control system etc. The 110/24 V DC/DC converters serve as supply for I&C cabinets and other consumers requiring 24 V DC supply. Each DC/DC converter is supplied via coupling diodes from both sections of the110 V DC main distribution. The outgoing circuits in the safe DC and AC main distribution shall be equipped with monitored fuse- and load-break switches, fuses and contactors, mini-circuit breakers, etc.

The individual cubicles shall be bulk headed against one another by sheet metal walls or equivalent material. The DC UPS shall be located inside an air-conditioned room, the rectifier / charger and distribution board shall be rated for continuous operation at 40° C. Sizing of battery shall be based on a minimum of -3° C and maximum of 55° C ambient. The temperature derating factor and ageing factor of the battery shall be based on the above temperatures.

3.6.6.4 Internal/external lighting and emergency lighting system

The installation method differs between internal lighting (offices, rooms for similar purposes, technical rooms) and exterior lighting. All lighting fittings and all equipment comprising the lighting sub-distribution units shall meet the operational requirements in full at an ambient temperature of 40°C and for a relative humidity of up to 100%. The lights must be connected in a 3-phase circuit, so that in an event of failure of the phase only each third lamp will go out. The cable cross section shall be calculated according to the IEC 60364-5-52. Location of the lighting and small power equipment shall be reviewed before installation so that satisfactory co-ordination with walkways, streets, fences, gates, crossings, entries, PV panel support structures, cable ways and other installations can be assured. The lighting systems are to be classified as follows:

- Normal lighting fed from normal supply: shall provide desired and required illumination levels in the various indoor and outdoor areas and roads.
- Emergency lighting fed from safe AC supply (UPS): In case of failure of normal lighting, emergency lighting shall provide sufficient illumination to allow safe movement of personnel.

In coordination with the design of the alarm and CCTV systems outdoor lighting as a minimum shall be provided for perimeter of the plant and at the entrances of all buildings on site including the transformer stations. Indoor lighting can be operated manually and/or using automatic motion detecting devices where suitable. In control room, switchgear rooms flush-mounted fluorescent tube fittings are to be provided. The lightning fittings are to be designed with required louvers for mounting in the suspended mineral fiber acoustic tiles. In battery room explosion-proof lighting fitting (EExd II CT2) are to be provided. Outdoor lighting at the entrances of buildings and where suitable shall be operated automatically (motion detection) and also shall permit remote control from the main control room and shall be included in the concept for intrusion alarm. The perimeter lighting shall be operated centrally and also included in the security concept for the plant. The lighting shall be designed so that the lighting illumination density listed in DIN EN 12464-2 will be achieved. In that respect an aging

factor of 20 % is to be taken into account so that new lighting densities must be achieved as a minimum in the acceptance measurement.

3.6.6.5 Fire alarm system and fire fighting

The detectors shall be stable against environmental influences (ambient temperature, humidity etc.) and shall be so positioned as to avoid the possibility of spurious operations due to air current from pressurization, ventilation or air-conditioning grills. A manually operated alarm system shall be provided in each building with an alarm initiating point at each room exit. This system shall be fully integrated with the automatic fire detection and alarm system. Alarms shall be signaled locally (audible and visible) and in the plant control room and should also permit remote connection. All MVAC systems must be shut down in case of fire to prevent spread of fire. Suitable firefighting equipment shall be provided in the control buildings, transformer stations, and transformers compounds as required.

- The design and installation of the fire protection and alarm systems shall be in accordance with Section 6.2.4;
- The design and installation of the fire protection and alarming systems shall be in accordance with highest international recognized standard, preferably the relevant NFPA-Codes and international standards

The fire detection and alarm shall be DC operated by UPS All fire equipment & system installed outdoor must be IP65.

3.6.6.6 Energy Meter

The metering system shall be capable of obtaining and interpreting readings and performing the adjustments, if required, to comply with the pertinent information concerning Plant performance required. The system shall be part of the Plant's control and measurement installations, provided it complies with the criteria specified below.

3.6.6.6.1 Technical Specifications of Programmable Tariff Meter

- Technical Specifications of Programmable Tariff Meter shall be compatible with BPDB automated meter reading system.
- Standard Metering Protocol for Remote Interface. 4G GPRS (able to support 3G and EDGE) communication module with necessary accessories. Ethernet port along with RS232/485 port for communication.

i. Meter must support DLMS protocol

ii. Optical head and software to Upload and Download of billing and analytical meter data

Software password protection facility is a must for meter programming or for Meter configuration which will be assigned and preserved by BPDB.The meter must be capable to display & record meter ID, Program, Total kWh, kVarh, kVAh, kW, kVar, kVA, PF, per phase (voltage, current, phase angle), load profile at 30 min intervals with minimum 16 channel storage data for minimum 120 days, Event log, power failure etc. A meter shall be installed at plant's side.

3.6.7 Weather Station

There shall be a weather station which will measure the ambient temperature, PV panel temperature, solar radiation, wind speed with direction etc. and send the data to the data logger through RS-485

communication link. The data logger will also collect power/energy related data from digital energy meters through RS-485 link and will provide the data to the computer. There must be a monitoring and display system comprising of computer, monitor and appropriate software to gather all the data from data logger, process the data and display the data in the monitor's window as well as store data. The Solar Power plant shall be designed with 4 (four) Nos Weather Monitoring system, which comprises of: -

i. Global Horizontal Irradiance (GHI) Pyranometer
ii. Global Inclined Irradiance (GII) Pyranometer
iii. Module Temp. Sensor
iv. Ambient Air Temperature cum Relative Humidity Sensor
v. Control Room Temperature Sensor
vi. Wind velocity Sensor
vii. Wind direction sensor.
viii. Dust fall verification for determination of soiling losses by means of two inclined reference cells on the planes of array (POA). The first reference cell shall be cleaned on a weekly basis and the second one shall be cleaned together with all the modules of the PV Plant.

3.6.7.1 Lighting and Illumination

The following lighting and small power arrangements shall be provided as a minimum by the Contractor.

Table 3-8: Summary of Lighting and Illumination

No	Location	Illumination Level (Lux)	Type of Fitting
a.	**PV Plant Area**		
	PV Plant Area	20	LED Flood light
	Road or path	10	LED streetlight
b.	**132/33 kV Switchyard**		
	Around Switchgear	20	LED Flood light
	Roadways	10	LED streetlight
c.	**Control Room cum Office Building**		
	Control room	500	LED Lighting system
	Electrical room and cable room	50	LED Lighting system
	Office	500	LED Lighting system
	Toilet, corridor, etc.	50	LED Lighting system

Source: Feasibility Study Report

3.6.7.2 Emergency Lighting

The Contractor shall design DC emergency lighting and power supply system for the power station, and illumination level of DC emergency lighting shall be as follows.

The lighting shall consist of 125 V DC operated incandescent luminaries.

Location	**Illumination Level (Lux)**
Control room and inside of control package	: 15
Inside of other package	: 1
The other area surrounding the plant	: 0.5

Additional emergency lighting arrangement, independent emergency light units operated from built in charger and batteries charged by 230 V AC shall also be provided strategically. Total ten units shall be included in the Tender.

3.6.8 PV Module Cleaning System

The PV Module washing system is used to improve peak output performance of their Solar Power Plants by washing photovoltaic arrays. Solar panel washing is achieved with a combination of water and gentle foam-brush friction. A sophisticated brush with ultrasonic sensors shall be used to adjust the brush to maintain feather light pressure on the PV panels during cleaning and to avoid damage in case of rough terrain. Solar panel washing shall have a combination of water and gentle foam -brush friction system.

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- Double joystick operator servo-controls (left-travel, right-boom and brush control)
- Three element telescoping boom. Washing capacity up to 20' height/length
- Brush length up to 12'
- Full hydrostatic machine with load sensing hydraulic distributor for better boom control
- Water pressure spray bar to 580psi (40bar)
- Water tank capacity 650 gallon (2400l)
- Swivel seat and boom, able to wash right or left. Machine able to wash in fwd/rev

3.6.9 Fire Detection & Fighting Facilities

3.6.9.1.1 General:

The Contractor shall design, manufacture, delivery to the Site, install, test and commission the firefighting system to protect the Solar PV Plant and all associated equipment and Outdoor yard. Fire detection and Alarm system for office building and control & equipment room shall be provided. In particular, the following shall be included:

- Dry Chemical Powder Fire Extinguishers.
- Water Hydrant System including electric motor, water reservoir, hydrant stands, hoses etc.
- Sand Buckets
- Fire Detection and Alarm system

3.6.9.1.2 Design Requirements:

All fire protection installations shall comply with the requirements of the codes of practice of the National Fire Protection Association, Boston, Massachusetts, U.S.A as appropriate for the respective sys tems, subject to the approval of the Engineer. The codes and practice of the Japanese Fire Protection may also be considered.

3.6.9.1.3 Dry Chemical Powder Fire Extinguishers:

The Dry Chemical Powder Fire Extinguisher shall be Upright type of capacity 8 Kg conformed to NFPA Codes and Standard. The fire extinguisher shall be suitable for fighting fire of oils, solvents, gases, paints, varnishes, electrical wiring, live machinery fires, all flammable liquid & gas.

3.6.10 Security and Surveillance Facilities

3.6.10.1 Security and Surveillance Facilities General:

The Contractor shall design, manufacture, delivery to the site and install Communication and Security. System which shall be comprised of but not limited to the following: Closed Circuit Television (CCTV) System (IP based) for plant security; One IP telephone set (Cisco) with accessories.

3.6.10.2 Closed Circuit Television (CCTV) System:

Security and surveillance of different operating areas in the plant as an aid to operators, IP based CCTV system shall have to be provided. Adequate number of dome type cameras with facilities like Zoom, pan, tilt etc. would be provided at various operating areas. The camera shall have a resolution of at least 1280 horizontal lines. The camera pictures shall be displayed at the Administrative Building (Manager), Central Control Room (CCR) and Security Supervisor room where the camera view or combination of views selected by an operator shall be displayed on colour LCD video monitors. A digital video recording system shall also be provided to allow a permanent record to be made of all or selected channels. The system shall store the CCTV data for at least 1 (one) month. The complete system, as specified including, but not limited to the following: -

- High resolution colour cameras including lenses, mountings and housings.
- Camera for CCTV have capabilities to cover capturing outdoor video ranging minimum 30 meter.
- Colour Monitors
- Pan/tilt units for moveable cameras
- Video matrix switcher and control system
- Hard Disk / DVD recorder
- Video multiplexers
- Video transmission system including cabling, launch, line, equalizing, repeating amplifiers, etc.

These specific areas as listed below shall be considered as minimum requirements. As minimum, the following areas of the plant shall be covered by video surveillance (CCTV).

- Control Room (4 Unit)
- Building gate entrance area. (2 Unit)
- Security gate (2 Unit)
- Sub-station (2 Units)
- Solar PV Array area (Minimum 50 Units)

3.6.10.3 IP telephone System

IP phone uses voice over IP technologies for placing and transmitting telephone calls over an IP network, such as the Internet, instead of the traditional public switched telephone network (PSTN). The telephone set shall be installed in the Central Control Room (CCR).

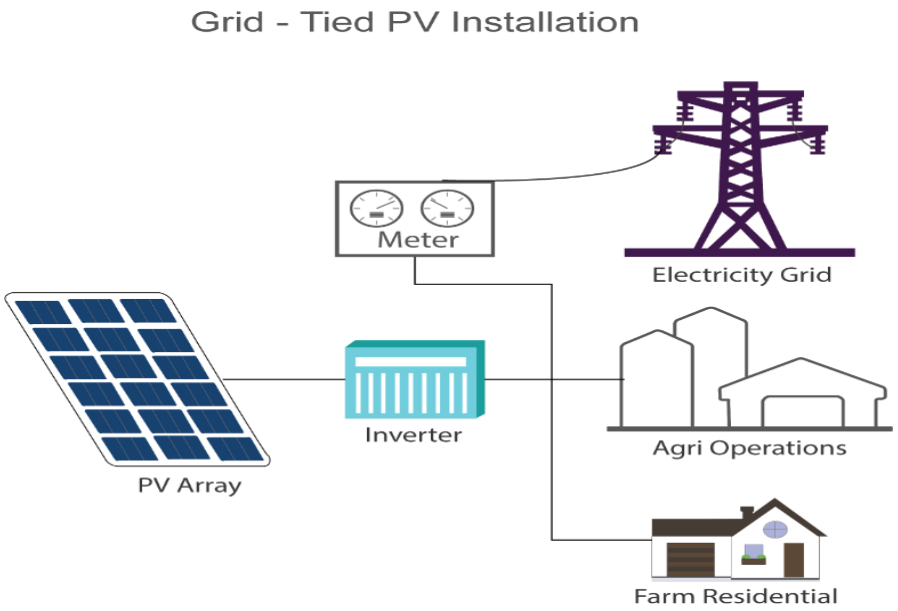


Figure 3-4: Grid Tied Solar Plant Operational Diagram

3.7 Project Rationale

Though there is improvement in the power generation capacity of Bangladesh, about half of the population is still outside the grid coverage. Some key investment considerations of the project are given below:

- ✓ The sponsors are well experienced in the field of power generation and have a successful track record of implementing power projects.
- ✓ The power sector of Bangladesh has enormous potential since large scale of population is yet to be covered under the national grid.
- ✓ The capacity payments are sufficient to service the debt.

3.8 Project Cost and Means of Finance

The project cost and means of financing proposed for meeting the project cost and key project. Financial highlights are shown in the below tables:

Table 3-9: Project Cost and Means of Finance

Total Project Cost	133,723,018 US$ (147,095.32 Taka in Lakh; Considering Exchange Rate USD 1= BDT 110, dated 19.11.2023)		
Plant and Equipment	41.87 %		
Mandatory Spares	0.34 %		
Power Evacuation	10.02 %		
Civil Works	25.55 %		
Design and Engineering Services	1.27 %		
Transport, Tax, AIT, VAT etc.	7.40 %		
Non-Turnkey expenditure	6.78 %		
Miscellaneous	4.04		
Contingency	2.72		
Debt	85%	%	*BERC Gazette for PSDF*

Equity	15%	%	
Interest Rate	2.0%	Rate	
Tenure of Loan	16	year	*Including Grace Period*
Grace Period	1	year	*BERC Gazette for PSDF*
Repayment Period	15	year	

Source: Feasibility Study Report

4 ANALYSIS OF ALTERNATIVES

4.1 General

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

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

The proposed project has the potential to have significant adverse effects on visual amenity; air quality; noise; biological resources; cultural resources; geology/soils; GHG emission; hazards and hazardous materials; hydrology and water quality; land use and planning; noise; public services; transportation and traffic; and utilities and service systems within the County. Therefore, this section discusses alternatives that are capable of avoiding or substantially lessening effects on these resources.

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 Alternative Energy Generation Technology

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 nonrenewable 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 IEE if they fail to meet most of the project objectives, are infeasible, or do not avoid or substantially reduce any significant environmental effects. Therefore, this alternative was eliminated from further consideration because:

- It would result in additional/greater impacts than the proposed project (aesthetics and biological resources);
- It would not substantially reduce the significant environmental impacts associated with aesthetics, agriculture resources, air quality and biological resources.
- It would fail to meet the objectives for the proposed project; and

- The project site is not suited for wind energy production; therefore, a wind energy production facility would not generate as much electricity as solar equipment.
- Wind energy is uncommon in Bangladesh and the production material is not available.

4.4 Alternative Land Use

The land which is being used for the project is acquired by the Project Authority. The land is inside the project boundary. The project location is beside barren land, this makes it suitable for the transmission line establishment. The land is currently an open space that is sometimes used as a playing ground for cow grazing or for dung drying. If we consider any other alternative land use like water body or agricultural land outside the boundary, the Project authority would have to purchase more 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.

4.5 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.

5 BASELINE ENVIRONMENTAL AND SOCIAL DATA

5.1 General

In order to identify and mitigate the possible impacts from any project activities, it is first to be ensured that the environmental and social baseline data are collected properly. This will help us detect any kind of change or alteration in the surrounding natural environment due to the project activities and help mitigate them eventually. The main environmental components of survey were:

1. Physical environment
2. Biological environment and
3. Socio-economic environment

The sub-components include, environmental quality test of ambient air quality, noise level measurement, soil quality analysis, surface water and groundwater quality identification of the project areas. On the other hand, meteorological data like temperature, rainfall, humidity, wind speed and direction during the period of 1987 to 2021 has been collected from secondary source (Bangladesh Meteorological Department). Moreover, satellite images of project areas, statistical databased documents collected and reviewed the relevant previous projects/ studies and documents. In addition, the field investigation of different components, Key Informant Interviews (KII) and information of public consultations (PCM and FGD) data have been collected, analyzed, and used in the report. Environmental safeguards are identified which includes assessment of impacts and mitigation.

5.2 Physical Environment

Physical environment of the project area has been described that relates to the area-specific conditions pertaining to climate, topography, land use, physiographic features, geology, soil, air quality, noise quality and seismicity, water resources and hydrology, seismicity, natural hazards, and most importantly environmental sensitive locations which is identified as environmental hotspots.

5.2.1 Climate

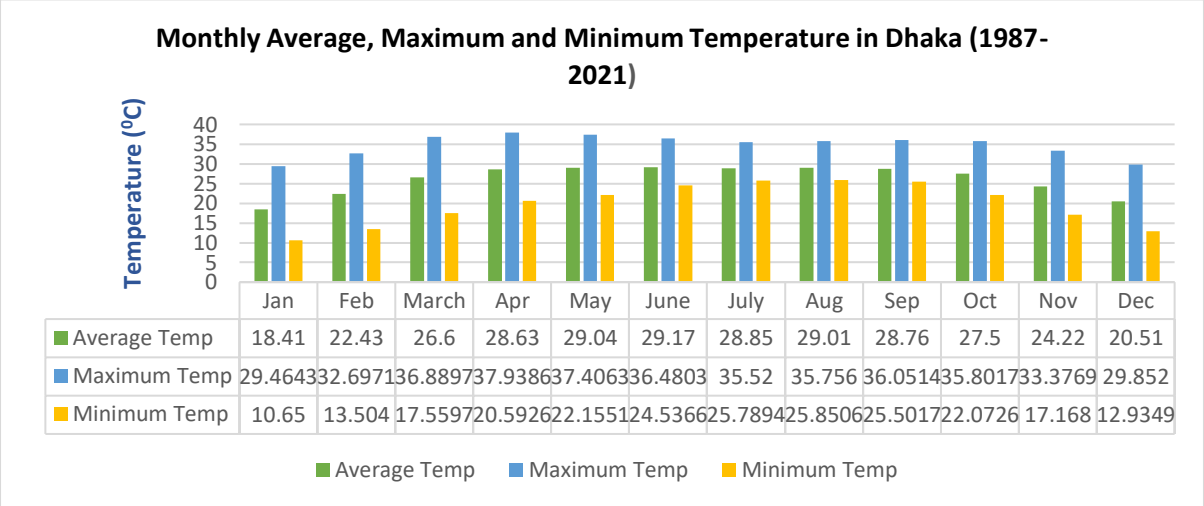
In order to investigate the climatic condition of the study area, meteorological parameters have been collected from secondary sources. Narsingdi has no weather station. For better and authentic understanding, Dhaka weather station has been considered in this study. The climatic zone falls into the south-central region according to the following figure 5-1.

Figure 5-1: Climatic Zone Map of the Proposed Project Area

5.2.1.1 Temperature

The highest average recorded temperature in this weather station was 29.17°C in June. The lowest average recorded temperature was found in the month of January, which was 10.65°C. Both of the

average monthly temperature graphs show that this area faces high temperatures from April to September and lowest temperature during winter remains from December to February in the year (Figure 5.2).



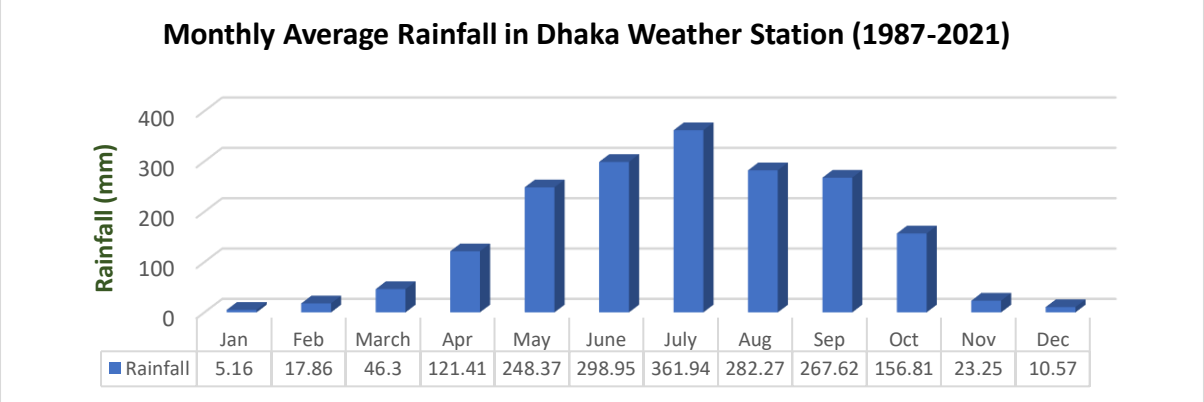
	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Average Temp	18.41	22.43	26.6	28.63	29.04	29.17	28.85	29.01	28.76	27.5	24.22	20.51
Maximum Temp	29.4643	32.6971	36.8897	37.9386	37.4063	36.4803	35.52	35.756	36.0514	35.8017	33.3769	29.852
Minimum Temp	10.65	13.504	17.5597	20.5926	22.1551	24.5366	25.7894	25.8506	25.5017	22.0726	17.168	12.9349

Source: Bangladesh Meteorological Department (BMD)

Figure 5-2: Monthly Average, Maximum and Minimum Temperature of Dhaka

5.2.1.2 Rainfall

In Dhaka City rainfall is not abundant, being above 1890 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in the South-western zone. This is a transitory zone between the North-eastern, South-western, and western zones. The rainfall data collected from the above stated station represents that maximum rainfall occurs during June to September and the lowest rainfall occurs in November to February during winter season. Statistical data from 1989 to 2019 shows that Dhaka experienced more than 350 mm rainfall during monsoon. In the months of December and January of winter season around 10 mm rainfall occurred in the region of Dhaka weather station (Figure 5.3).



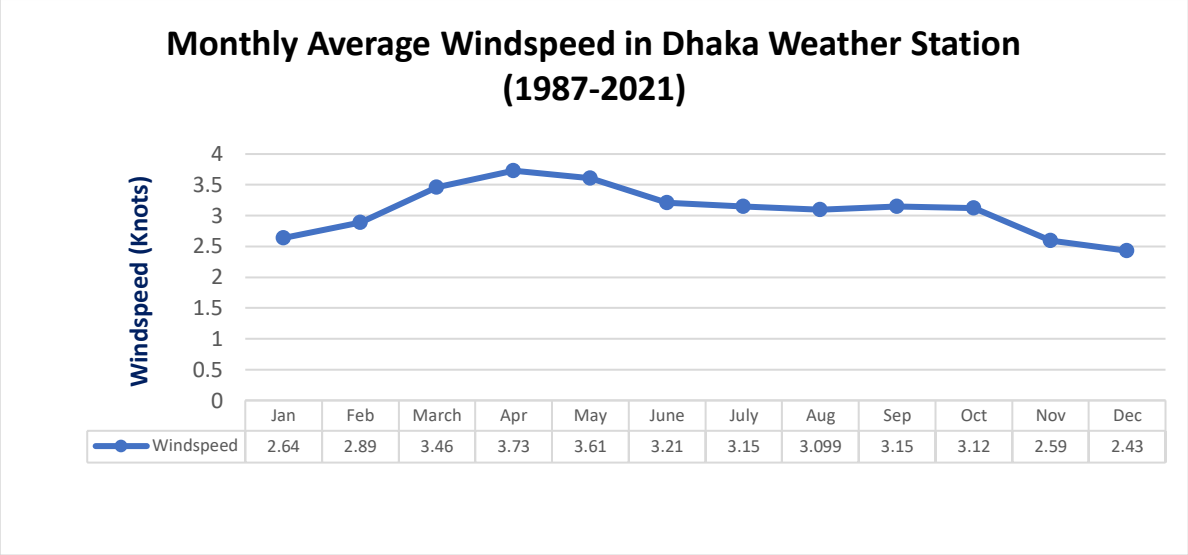
	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Rainfall	5.16	17.86	46.3	121.41	248.37	298.95	361.94	282.27	267.62	156.81	23.25	10.57

Source: Bangladesh Meteorological Department (BMD)

Figure 5-3: Average Monthly Rainfall of Dhaka

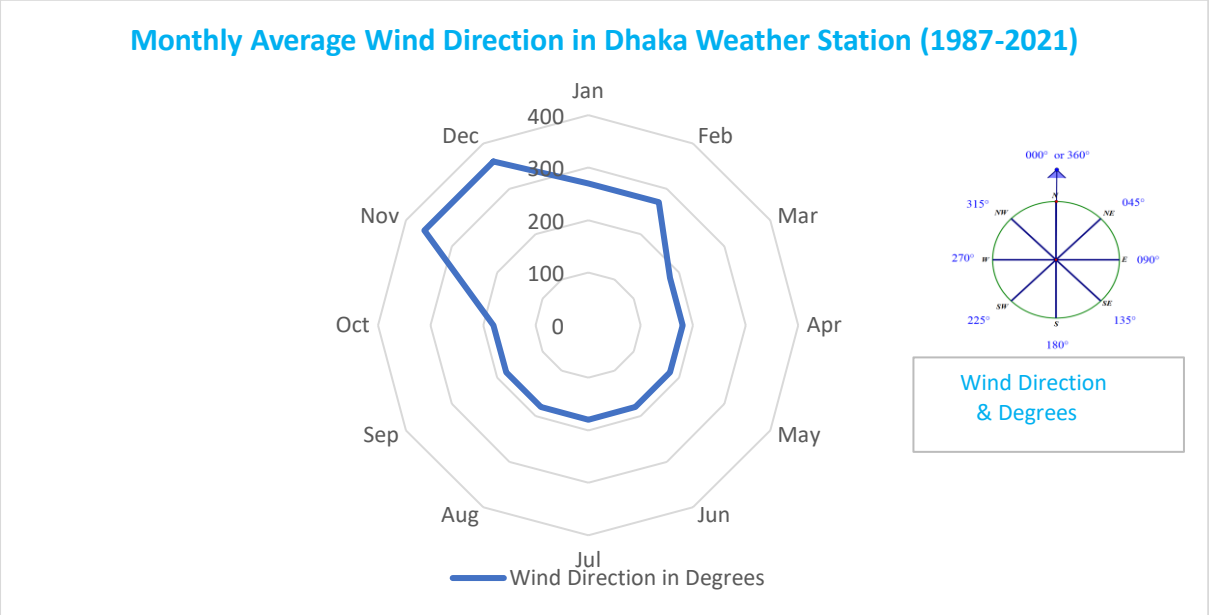
5.2.1.3 Wind

The statistical wind speed data (Figure 5.4) shows that average wind speed maximum value was 3.73 knots in April. The minimum wind speed value was 2.43 knots in the month of December in the area of Dhaka station. In the project areas the predominant wind flows from the northwest but with a high frequency of calm situations (Figure 5.5).



Source: Bangladesh Meteorological Department (BMD)

Figure 5-4: Average Monthly Wind Speed of Dhaka

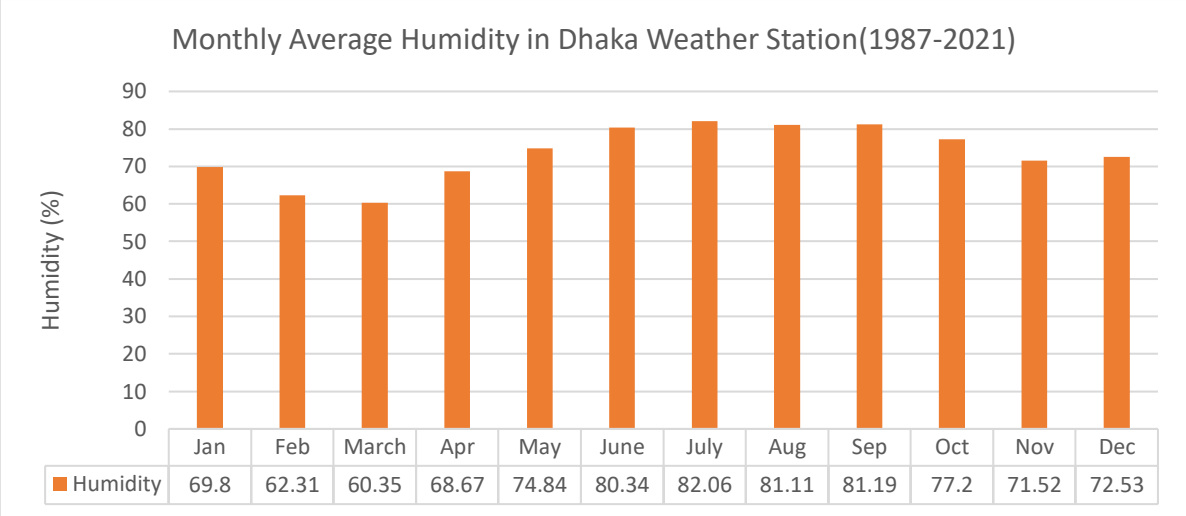


Source: Bangladesh Meteorological Department (BMD)

Figure 5-5: Wind Rose Diagram for Dhaka

5.2.1.4 Humidity

Humidity remains high in summer and comparatively low in winter season. The statistical data of humidity from 1989 to 2021 indicates that humidity in the Dhaka Station area maximized in June to September in the year which is ranges from 80% to 82%. On the other hand, humidity falls around 60% in February, March, and April during the winter season in the considered station area (Figure 5.6).



Source: Bangladesh Meteorological Department (BMD)

Figure 5-6: Average Monthly Relative Humidity of Dhaka

5.2.2 Agroecological Zone

According to the following figure 5-7, The project area, situated in the Middle Meghna River Floodplain and Old Brahmaputra Floodplain, encompasses an abandoned channel of the Brahmaputra River, positioned between Dhaka and Cumilla districts. This region, comprising old Brahmaputra chars within the Meghna River and adjacent mainland areas, features grey loam on ridges and grey to dark grey clays in basins. The prevailing soil type is non-calcareous grey floodplain soil, characterized by strongly acidic topsoil and slightly acidic to slightly alkaline subsoils. The overall fertility level is medium, with low nitrogen and organic matter content. Originating from Brahmaputra sediments before a river shift 200 years ago, the area exhibits irregular relief, particularly near historical and present river channels, with broad ridges and basins. The soil makeup includes silt loams to silty clay loams on ridges and clay in basins, with low organic matter on ridges and moderate content in basins, and a general low fertility level.

5.2.3 Topography

Although Bangladesh is a small country, it has considerable topographic diversity. It has three distinctive features: (i) a broad alluvial plain subject to frequent flooding, (ii) a slightly elevated relatively older plain, and (iii) a small hill region drained by flashy rivers. The project area has an elevation level of 3-10 m according to following figure 5-8.

5.2.4 Physiographic Features

Physiography is the description of the physical nature (form, substance, arrangement, changes) of objects, especially of natural features. The project area falls within distinct physiographic regions (Figure 5-9), notably the middle Meghna, encompassing the main channel upstream from its junction with the Dhaleshwari and Ganges to Bhairab Bazar. This floodplain, once part of the Brahmaputra, underwent a course change into the Jamuna two centuries ago, resulting in a low-lying landscape with broad islands and meandering channels. Predominantly composed of silty clays, Meghna sediments exhibit sandy Brahmaputra deposits on northern ridges. The extensive unit experiences deep seasonal flooding from the Meghna, submerging basin sites early and draining late. Characterized by an almost level relief with minimal elevation differences between ridges and basins, the southern part relies on a network of man-made canals for drainage due to sparse natural rivers and streams. While sediments are mainly deep and silty, some basin centers have a shallow clay layer. Rainwater-induced flooding is widespread, except in narrow floodplains alongside small rivers. The dual naming of the Brahmaputra acknowledges the comparatively recent Jamuna channel, formed in 1787 after a severe flood prompted a southward course change. The upliftment of Pleistocene blocks, Barind and Madhupur,

led to the creation of the Brahmaputra's new course, known as the great Jamuna, encompassing both left and right banks. The Brahmaputra-Jamuna floodplain further subdivides into the Bangali-Karatoya floodplain, Jamuna-Dhaleshwari floodplain, and diyaras and chars.

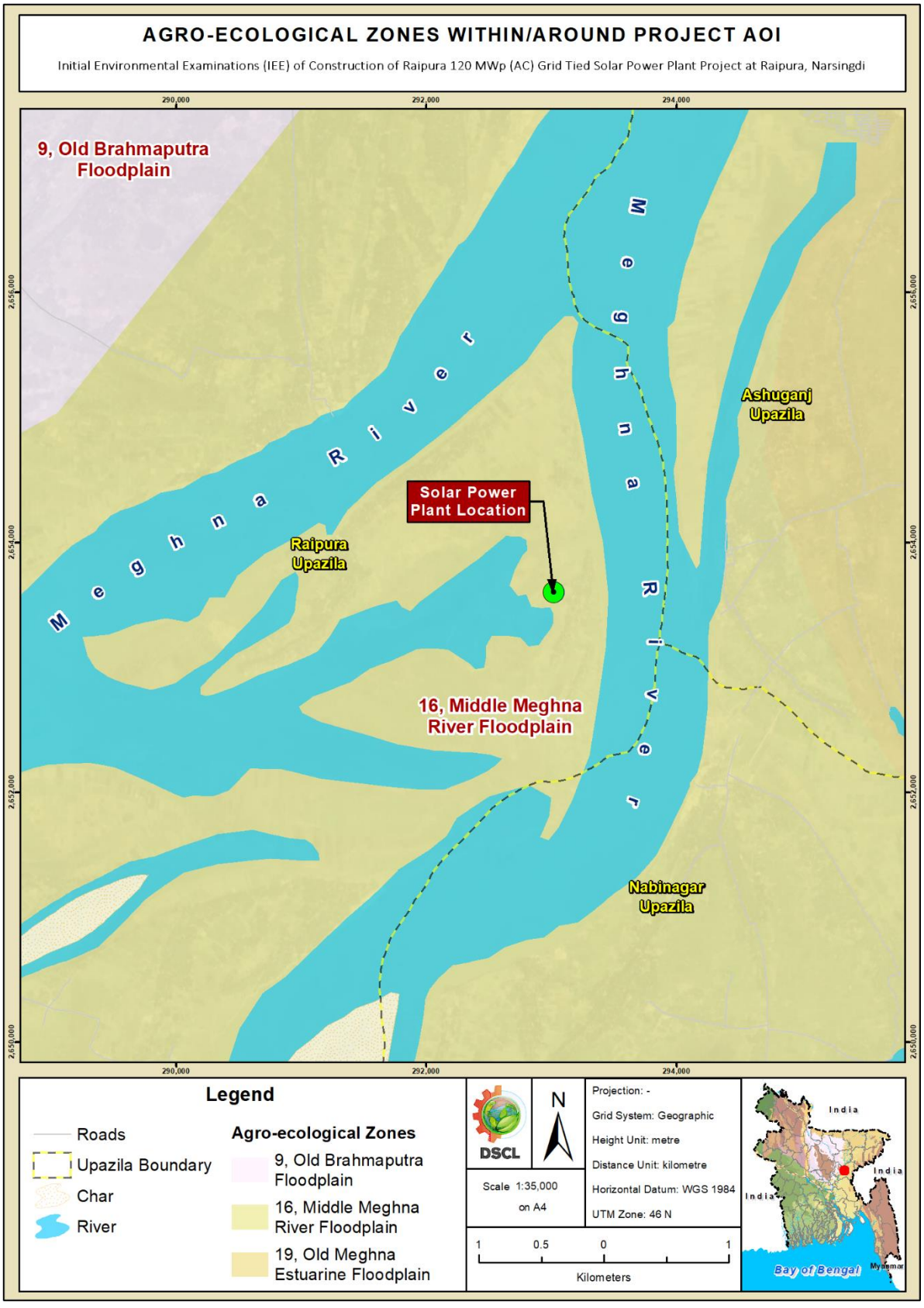


Figure 5-7: Agroecological Zone in and around the Proposed Proposed Project AOI

Figure 5-8: Topography with elevation Map in and around the Proposed Project AOI

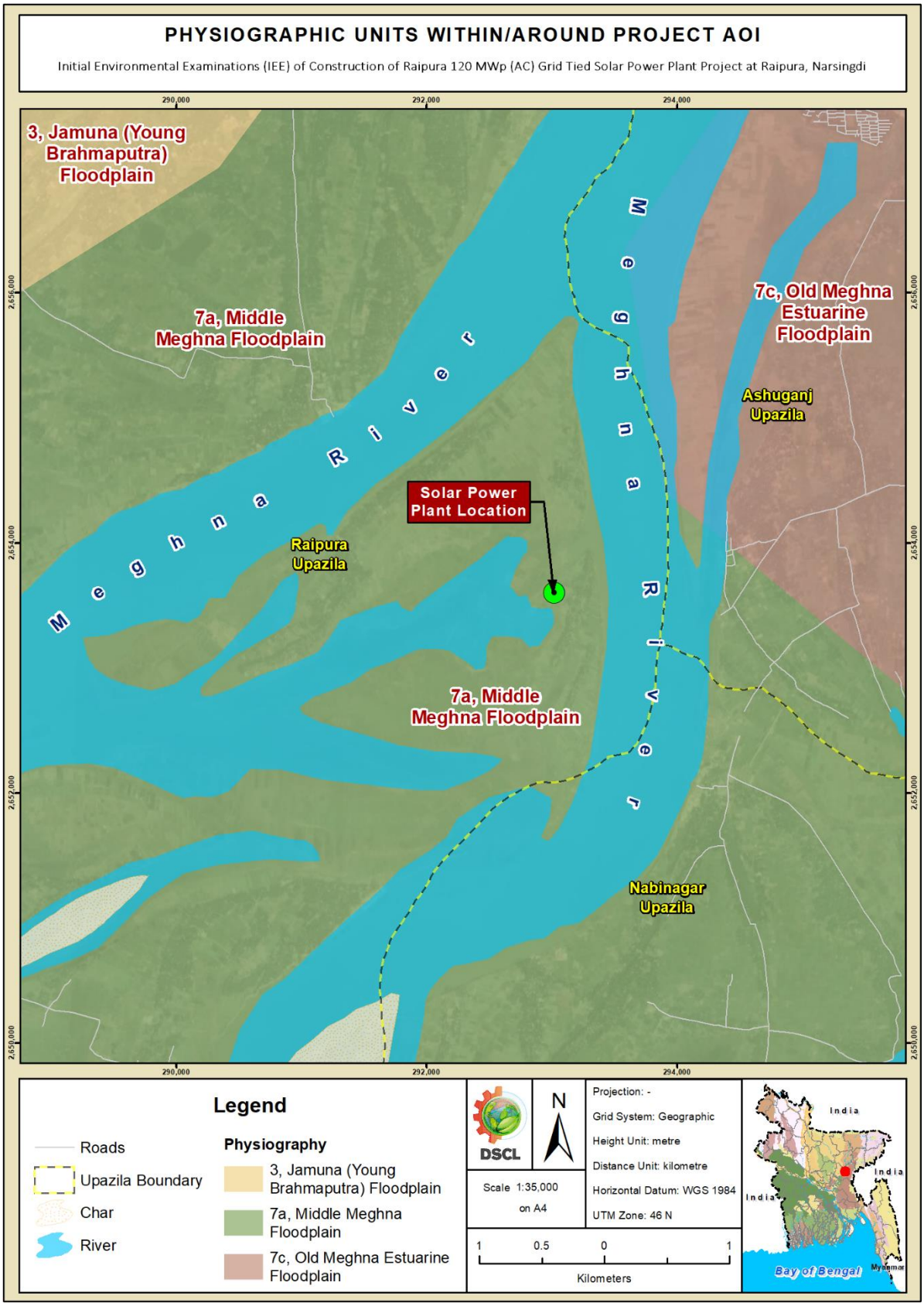


Figure 5-9: Physiographic Unit Map of the Proposed Project AOI

5.2.5 Geology

According to the following figure 5-10, the project area falls under Faridpur Trough geological zone. This is located in the southwestern part of Bangladesh, primarily extending through the Faridpur and Madaripur districts. It is situated within the larger Bengal Basin, which is a vast sedimentary basin covering parts of India and Bangladesh. This trough has been shaped by the subsidence and sedimentation processes associated with the Ganges-Brahmaputra Delta. It influences the sedimentation patterns of the Ganges and Brahmaputra rivers, which transport vast amounts of sediment and deposit them in the trough and the surrounding areas.

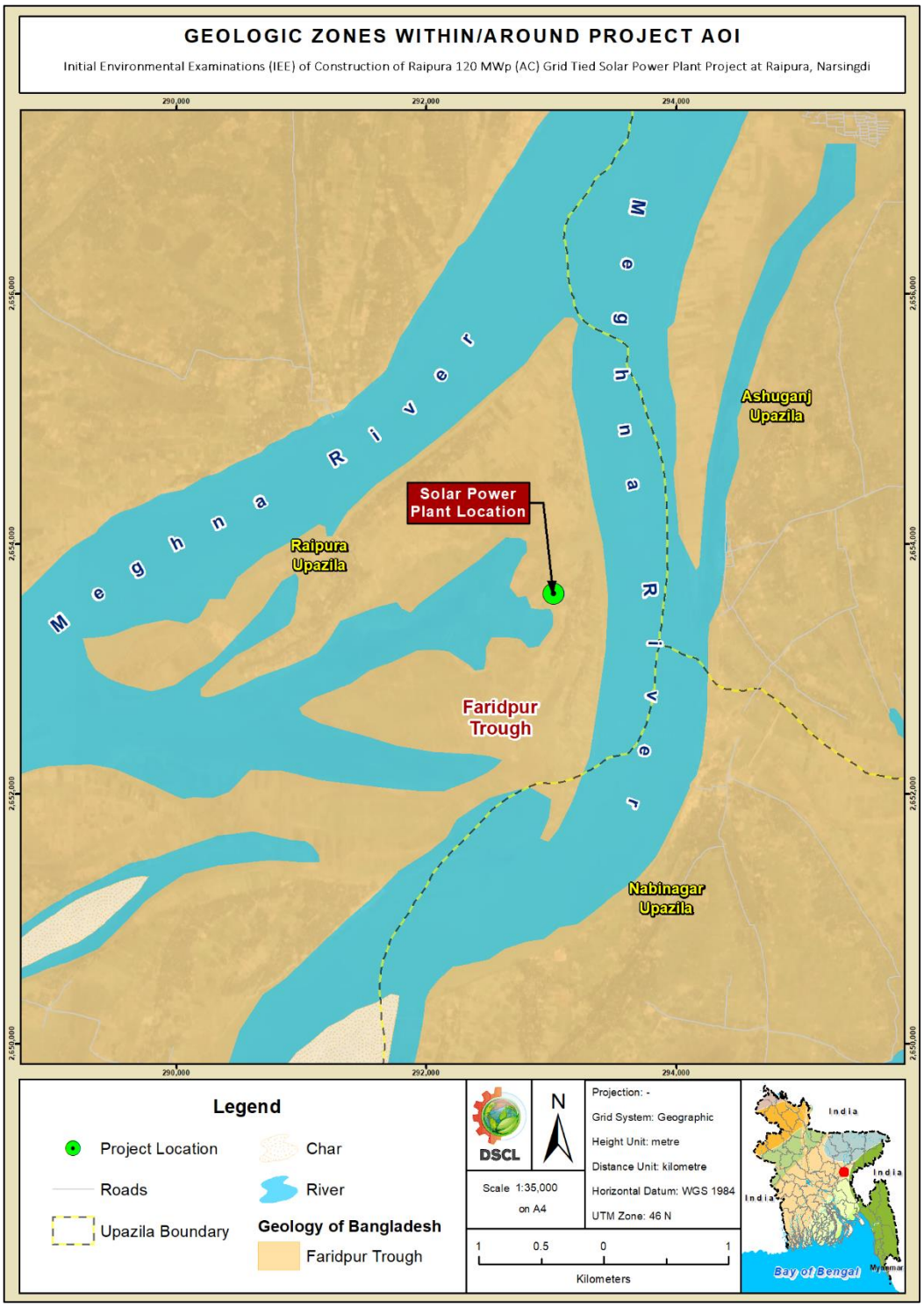


Figure 5-10: Geologic Zones within and around the Proposed Project Area

5.2.6 Soil Quality

5.2.6.1 Soil Type

According to the soil quality of the project area the soil types fall into non-calcareous and calcareous brown floodplain soil and non-calcareous alluvium soil by the following figure 5-11. Calcareous brown floodplain soil contains a significant amount of calcium carbonate (lime) throughout the soil profile. This calcium carbonate is often derived from parent material with a high calcium content or from groundwater leaching. Calcareous soils tend to have alkaline or high pH levels due to the presence of calcium carbonate. The pH can range from moderately alkaline to strongly alkaline. Non-calcareous brown floodplain soil lacks a significant presence of calcium carbonate. It is typically composed of minerals and organic matter. These soils do not pose the same lime-related concerns as calcareous soils, making them more versatile for different crops. Non-calcareous alluvium soil, also known as non-limestone alluvium soil, is a type of soil that does not contain a significant amount of calcium carbonate (lime) or other calcareous minerals. Alluvium soil is typically deposited by the action of water, such as rivers and streams, and it can vary in composition depending on the geological and environmental conditions of the region. It is characterized by its low to negligible levels of calcium carbonate and tends to be more acidic in nature compared to calcareous soils.

5.2.6.2 Soil Quality Measurement

To understand the soil quality status one (01) soil sample was collected from the project influenced location on 19 October 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 laboratory test results are given in Annex 2. The photographs of the testing are added in the following figure 5-12. Test Result of soil sampling analysis of project area is given at Table 5-1.

Inside project Area (SQ_APSCL_01)

Figure 5-11: Soil Sampling Collection at Project Influenced Areas

Table 5-1: Test Result of Soil Quality Analysis

Parameters	Unit	Soil Quality Test Result SQ_APSCL_01 23.980922° N 90.965837° E 19 October 2023	Dutch Standards for Soil*	Method of Analysis
Total Lead (Pb)	mg/kg	<5	85	Acid Digestion with ICP Analysis
Total Cadmium (Cd)	mg/kg	<0.5	0.8	
Total Chromium (Cr)	mg/kg	<5	100	
Total Zinc (Zn)	mg/kg	<27.5	140	

*Dutch Standards for Soil, 2004

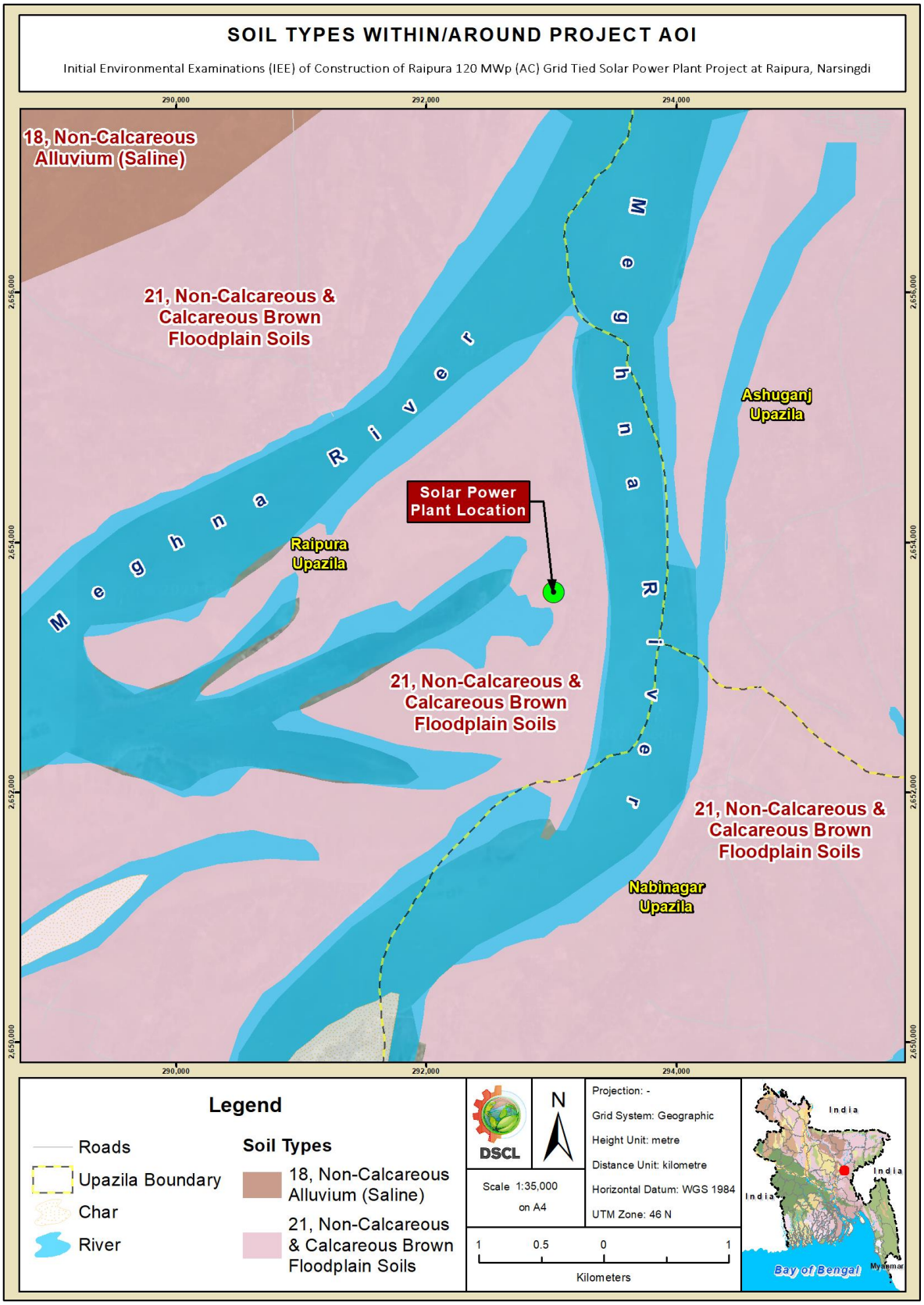


Figure 5-12: Soil types in/around the Proposed Project AOI

There is no Bangladesh regulation/standard for soil. In the absence of standard for soil in local or native 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. All Parameters analyzed in baseline quality of soil were observed to be well below the threshold limits as per the Dutch Standards.

5.2.7 Ambient Air Quality

Ambient air quality data at the project site was measured to verify the current quality of air. The main air pollutants in Bangladesh are nitrogen oxides (NOx), Sulphur dioxide (SO_2), PM_{10}, $PM_{2.5}$, Carbon Monoxide (CO). Most of the PM pollutants (greater than 80%) come from diesel-run vehicles. The air quality testing was performed at and around the three (03) project locations from 17 October 2023 to 19 October 2023. AEROQUAL Series 500 Portable air quality monitors were used for the measurement of particulate matter (PM_{10} and $PM_{2.5}$), SOx, NOx. Moreover, CO is measured by using the Lutron Air Quality Monitor Meter. The laboratory test result is given in Annex 2 and sampling activities in Annex 3. Results of the air quality monitored at the project location have been shown in Table 5-2 and 5.3.

Table 5-2: Test Results of Ambient Air Quality Monitoring

Parameter	Unit	AAQ_APSCL_01 86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi 23.980569˚ N 90.967328˚ E 17 October 2023	AAQ_APSCL_02 North side of the project Area, Chanpur, Raipura, Narsingdi 23.988628˚ N 90.965861˚ E 18 October 2023	AAQ_APSCL_03 Inside Project Area, Chanpur, Raipura, Narsingdi 23.978417˚ N 90.960581˚ E 19 October 2023	Bangladesh Standard**	Duration (Hours)	Method of Analysis
$PM_{2.5}$	µg/m^3	32.56	34.87	26.17	65	24	AEROQUAL series 500 portable air quality monitors
PM_{10}	µg/m^3	74.92	70.50	63.91	150	24	
SO_x	µg/m^3	12.31	17.79	9.12	80	24	
NO_X	µg/m^3	11.81	6.35	5.48	80	24	
CO*	PPM	2	1	1	5	8	Lutron AQ 9901
Weather Condition		Mostly Sunny	Sunny	Sunny	-		

Note: * CO concentrations and standards are 8-hourly only.

**The Bangladesh National Ambient Air Quality Standards have been obtained from the Air Pollution Control Rules, 2022, published on 26 July 2022 vide S.R.O. No. 255-Law/2022

Table 5-3: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(AAQ_APSCL_01)**	➢ Very low number of vehicle Movement was observed. ➢ People's movement was very low. ➢ A low amount of dust particles was seen. ➢ The weather was mostly sunny. Wind direction was from North-East to South-West. ➢ A moderate amount of vegetation cover was found.
North side of the project Area, Chanpur, Raipura, Narsingdi **(AAQ_APSCL_02)**	➢ Very low number of vehicle was moving. ➢ People movement was low. ➢ Visual dust particle was low. ➢ The weather was sunny. Wind direction was from North-West to South-East. ➢ High vegetation cover area has been found.
Inside Project Area, Chanpur, Raipura, Narsingdi	➢ Very Low number of vehicle movement has been seen. ➢ People movement was low.

Sample Location and ID	Sample Site Description
(AAQ_APSCL_03)	➢ Low amount of dust particles was seen. ➢ The weather was sunny. Wind direction was from North-East to South-West. ➢ No ongoing construction work has been observed. ➢ Moderate amount of vegetative land.

The result shows that the time weighted average value of the ambient air quality monitored inside the project location is within the limit for all the locations. According to Bangladesh Standard, the value of $PM_{2.5}$ and PM_{10}, CO, SO_x and NO_x are within the limit for all the locations. The quality of air quality is less degraded because of the very low vehicle movement along the project location alignment.

5.2.8 Noise Level Measurement

Noise Level Measurement was analyzed at project influenced area from 16 October 2023 to 19 October 2023 at three (03) locations. The calibrated Sound Level Meter set to A-weighting, fast response, and statistical analysis settings. The Sound Level Meter (SLM) was mounted on a tripod at a height of approximately 1.5m, facing in the direction of the apparent predominant noise source. The laboratory test result is given in Annex 1. Noise level data were taken during both daytime and nighttime and summarized in Table 5-4 and 5-5. Photographs of the noise level measurements are also attached in Annex 3.

Table 5-4: Results of Noise Level Measurements

Sampling Location and ID	Date	GPS Location	Land Use Category	Time		Noise Level (dBA)LA_{eq}		Bangladesh Standard (dBA)LA_{eq}	
				Day	Night	Day	Night	Day	Night
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(NM_APSCL_01)**	17 October 2023	23.98048˚ N 90.96695˚ E	Residential Area	01:00pm - 02:00pm	9:00pm - 10:00pm	52.38	40.80	55	45
North side of the project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_02)**	18 October 2023	23.98765˚ N 90.96670˚ E		10:00am - 11:00am	9:00pm - 10:00pm	51.72	43.54		
Inside Project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_03)**	19 October 2023	23.96116˚ N 89.15756˚ E	Mixed Area	10:30am - 11:30am	9:00pm - 10:00pm	55.31	48.75	60	50

Notes:
- Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)
- The sound level standards for the residential area are 55 dB(A) in the daytime and 45 at nighttime.
- The sound level standards for the mixed area are 60 dB(A) in the daytime and 50 dB(A) at nighttime.
- 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 5-5: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(NM_APSCL_01)**	➢ It was a residential area. ➢ Very low number of vehicle Movement was observed. ➢ People movement was low. ➢ Only boat's sound has been heard as it's situated beside the river. ➢ Two sensitive areas were present.

Sample Location and ID	Sample Site Description
North side of the project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_02)**	➢ It was a residential area. ➢ Very low number of vehicle was moving. ➢ People movement was low. ➢ Only boat's sound has been heard as it's situated beside the river. ➢ Sensitive area was found.
Inside Project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_03)**	➢ The land use category is considered a mixed zone, as both residential and agricultural areas have been observed. ➢ Very Low number of vehicle movement has been seen. ➢ People's movement was low. ➢ No construction work was noticed. ➢ No Sensitive area was found. ➢ No sound source is found except for a boat as this location was beside the river.

The result shows that time weighted average value of the sound monitored inside the project location area. The standard set for all locations is in standard range in daytime and nighttime for Bangladesh Standard. Vegetative land and some amount of residential area has been mostly seen in the project area. The noise level is within the limit may be due to the lower amount of traffic and people's movement both day and at night.

5.2.9 Water Resources and Hydrology

There is some residential area situated around the alignment of the project area. These are contributing to the pollution of the adjacent river and waterbodies. People throwing waste into the water bodies are also one of the main reasons for water pollution in the project surrounding area. According to the following map in figure 5-13, the main waterbody around the project area is Meghna River. The Meghna River, one of the major rivers in Bangladesh, plays a vital role in the country's hydrology and geography. Originating from the confluence of the Surma and Kushiyara rivers and finally mixing with the confluence of Ganges and Brahmaputra rivers, the Meghna flows through diverse landscapes, shaping the environment and supporting various ecosystems. Its extensive delta region is crucial for agriculture, providing fertile soil for crops. The river is a significant waterway for transportation, contributing to the economic activities of the region. However, the Meghna also presents challenges, such as seasonal flooding.

Figure 5-13: Waterbody in and around the Proposed Project AOI

Figure 5-14: Hydrological Networks within and around the Proposed Project AOI

5.2.9.1 Surface Water Quality

Surface water sample was collected from one (01) project influenced location on 19 October 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), Electrical Conductivity, Oxidation-Reduction Potential (ORP), Salinity and Dissolved Oxygen (DO) were tested on-site by portable meter and field kit. The samples have been sent to the DPHE for analysis of the remaining parameters. The laboratory test results are given in Annex 2. Test Result of surface water sampling analysis of project influenced area is given in Table 5-6. Photographs of the testing are shown in Annex 3.

Table 5-6: Test Result of Surface water Quality

Parameters	Unit	Concentration Present SW_APSCL_01 Meghna River, Near Chanpur, Raipura, Narsingdi 23.987818°N 90.967919°E 19 October, 2023	Standards for Inland SurfaceWater**	AnalysisMethod
Temperature*	°C	31.7	NYS	Multimeter
pH*	-	7.58	6-9	
Electrical Conductivity (EC)*	µS/cm	252	NYS	
Total Dissolved Solids (TDS)*	mg/L	141	1000	
Oxidation Reduction Potential (ORP)*	mg/L	-54.7	NYS	
Salinity*	mg/L	109	NYS	
Dissolved Oxygen (DO)*	mg/L	5.12	5 or more	DO Meter
Ammonium	mg/L	0.34	0.3	UV-Visible Spectrophotometer
Phosphate	mg/L	0.36	0.5	
TSS	mg/L	4	NYS	Gravimetric Method
Turbidity	mg/L	30.8	NYS	Turbidity 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; ** On-Site Test Result; NYS = Not Yet Standardized]*

Table 5-7: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
Meghna River, Near Chanpur Union Parishad, Raipura, Narsingdi. **(SW_APSCL_01)**	• Samples were collected from the Meghna River. • The sample was collected from a depth of approximately 6 inches. • Waste dumping hasn't been observed around the sampling location. • This river contains water throughout the year. • This Khal has been used by local people for bathing and washing purposes.

The surface water quality standard is not yet developed in the ECR 2023 except for a few parameters. The result shows that the value of the surface water monitored in specific locations exceeds Ammonium only. The rest of the values of other parameters were within the national standard.

5.2.9.2 Groundwater Quality

Groundwater sample is collected from the project influenced location on 19 October 2023 (Annex 3). 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 for analysis of the remaining parameters. The laboratory test results are given in Annex 2. Test Result of groundwater sampling analysis of project influenced area is given at Table 5-8 and 5-9.

Table 5-8: Test Results of Groundwater Quality

Parameters	Unit	GW_APSCL_01 86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi 23.980601^0 N 90.967302^0 E 86 No. Chanpur Govt. Primary High School	Standards for Potable Water**	Analysis Method
Temperature*	°C	28.3	20-30	Multimeter
pH*	-	6.86	6.5-8.5	
Electrical Conductivity (EC)*	µS/cm	604	NYS	
Total Dissolved Solids (TDS)*	mg/L	394	1000	
Oxidation Reduction Potential (ORP)*	mg/L	-14.1	NYS	
Salinity*	mg/L	298	NYS	
Dissolved Oxygen (DO)*	mg/L	5.2	5 or more	DO Meter
Total Coliform (TC)	N/100mL	0	0	Membrane Filtration Method
Faecal Coliform (FC)	N/100mL	0	0	
Total Suspended Solids (TSS)	mg/L	2	10	Gravimetric Method
Arsenic (As)	mg/L	0.003	0.05	AAS

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

Table 5-9: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Remarks
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(GW_ASPCL_01)**	• This tube well is about 50 feet deep which is established in 2001. • This tube well is mainly used for household, drinking, and washing purposes. • The nearby toilet with an adjacent septic tank is situated 25 feet away from sampling location. • Agricultural land is situated 40 feet away from this tube well.

From the above test results, it is found that all of the parameters are showing the results that were within the national standards for potable water.

5.2.10 Seismicity

On the basis of distribution of earthquake epicenters and morphotectonic behavior of different tectonic blocks the Bangladesh National Building Code (BNBC, 2020) which has divided our country into four (04) seismic zones and the project area falls under Zone-3 which indicates low risk zone. The map of the project seismic zones is given below in figure 5-15.

Figure 5-15: Seismic Zone around or within the Proposed Project AOI

5.2.11 Natural Hazards

Natural hazard of the project locations includes earthquake zone and the flooding conditions of that area. The details description is given below.

5.2.11.1 Flood

The study location area is also severe flood–prone areas where local people are vulnerable to repeated and multiple shocks to their lives, their settlements, and their livelihoods. As per residents opinions, varieties of crops and vegetables of the surrounding land have been damaged badly in untimely flash flood in Chanpur village. Being the low flood plain and river side area it goes under flooding. But the project will be constructed considering all these adverse situations with proper protecting measures and land filling.

5.2.11.2 Lightning

Chanpur is one the upazila in Bangladesh with a large variation in climate change specially temperature and rainfall. During social survey, local residents reported Chanpur and Lalpur village are going through a dangerous condition of Lightning Strike before.

5.2.11.3 River Erosion

Most of the areas in and around the project location are also facing massive river erosion as the project location is surrounded by the Meghna River. Low-lying areas and riverside villages are flooded most of the time and flood protection embankments are damaged due to this. But this project will be constructed in a stable area having all protection measures.

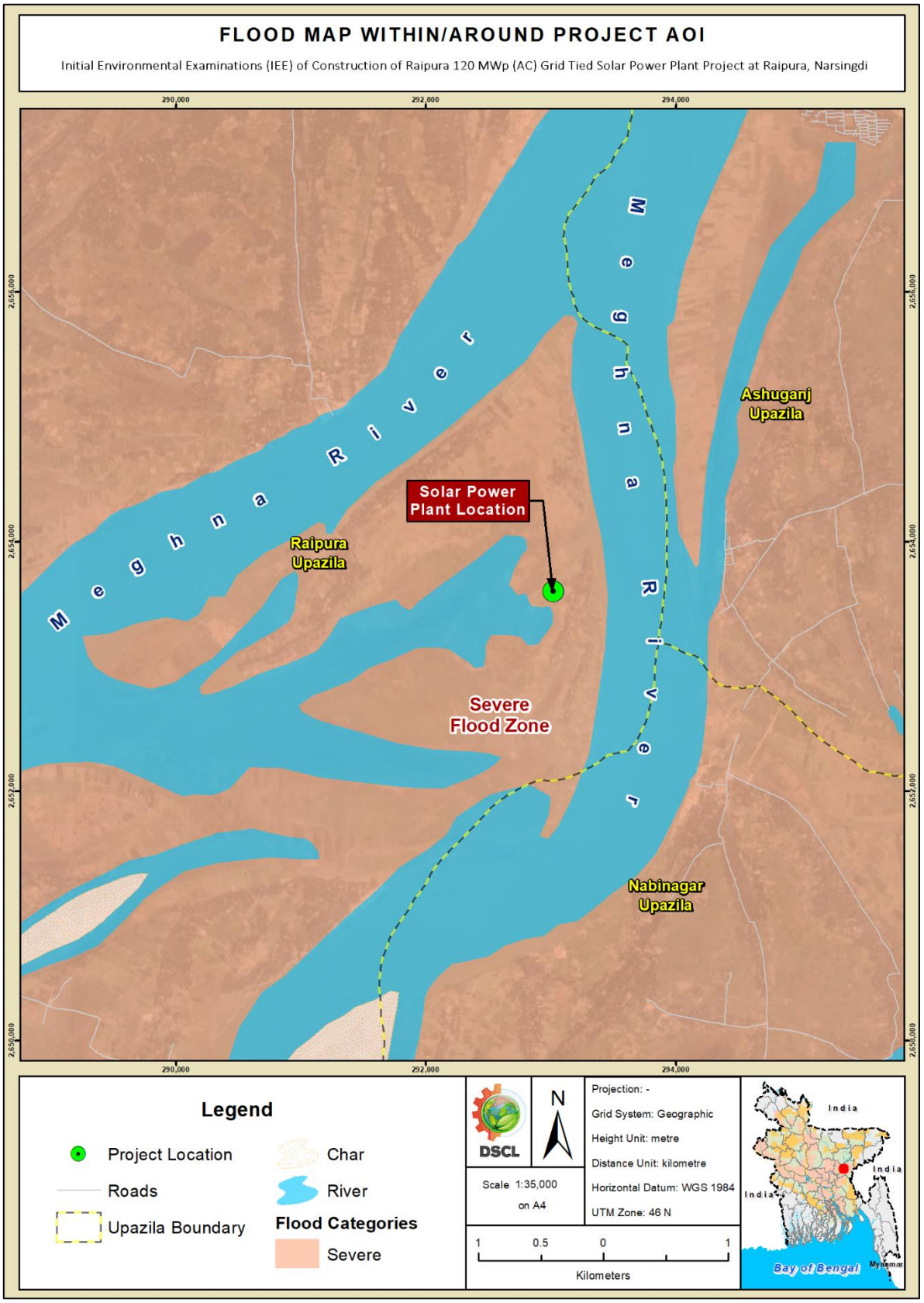


Figure 5-16: Flooding and Inundation Map around the project area

5.2.12 Important Environmental and Social Features

A number of important environmental and social features have been identified adjacent to the alignment of the project area. The lists are given below -

Sl. No	NAME	GPS	PICTURE
1.	86 No. Chanpur Govt. Primary High School	23.980510N 90.967262E	
2.	Eidgah Field near 86 No. Chanpur Govt. Primary High School	23.980455N 90.967050E	
3.	Mosque Near 86 No. Chanpur Govt. Primary High School	23.980382N 90.967832E	
4.	Graveyard near 86 No. Chanpur Govt. Primary High School	23.980522N 90.966985E	
5.	Chanpur Uttor Baitul Nur Jame Masjid	23.990571N 90.967245E	

Figure 5-17: Sensitive Locations around or within the Project

Figure 5-18: Environmental and Social Hotspots in and around the project area

5.3 Ecologically Critical Areas

An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be deemed Ecologically Critical Areas as a result of the Environmental Conservation Act. No ecologically critical areas are found in and around the project location. The ecologically critical areas such as Shitalakya River is 31.27km distance and Balu River is 52.59km distance which is shown in the following figure 5-19.

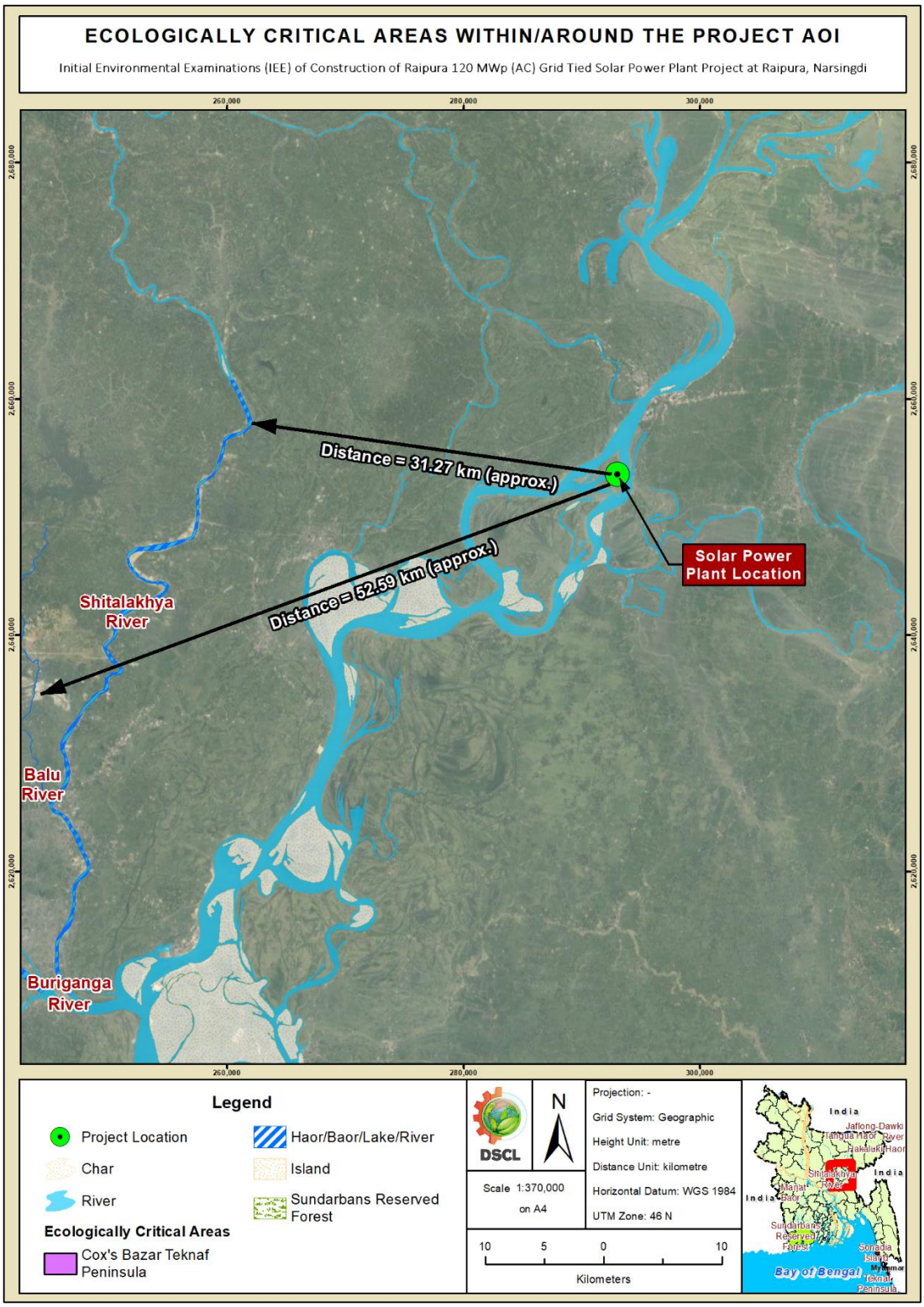


Figure 5-19: Ecologically Critical Areas in and around the Proposed Project AOI

5.4 Biological Environment

5.4.1 Bio-Ecological Zone

Bangladesh's ecosystems can be divided into two categories: (i) land-based ecosystems and (ii) aquatic ecosystems. Forest and hill ecosystems, agro-ecosystems, and homestead ecosystems are land-based, whereas seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats, chars, and marine are examples of aquatic ecosystems. Each of the ecosystems has many units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty-five bio-ecological zones. The project area falls into Brahmaputra-Jamuna Floodplain and Meghna Floodplain. Which is shown in the following figure 5-21.

5.4.1.1 Biodiversity of Flora and Fauna

The main objectives of the flora and fauna survey are:

- Using various conventional approaches, assess the status of important floral and faunal components of all terrestrial habitats (grassland, riverine land, agroecosystem, and homestead plantation) present in the Proposed Project AOI (containing the project site);
- Secondary data on the status of floral and faunal components and habitats are being collected and compiled from interested parties such as the Forest Service and others. Provide quantitative information on different floral and faunal components: using statistical analysis and deriving diversity indices.
- Identification and listing of floral and faunal species of conservation significant (rare, endangered and threatened – RET species and endemic species in accordance with International Union of Conservation for Nature - IUCN RED List) if any in the Proposed Project AOI;
- Assess the status of floral components (macro and microflora) of perennial aquatic habitats (lake, reservoirs/dams, and rivers) present in the Proposed Project AOI adopting standard techniques.
- Since some parts of the project location are wholly and intensively rural, much of the natural ecosystem remains intact. Herbs, shrubs, and trees are among the many types of vegetation. The project is not likely to harm terrestrial flora because its activities have been substantially similar to those in the area over the last few decades. The ecological survey was conducted in Transect walk along the project intervention area on sample basis.

a) Transect Walk

Alongside Transect line and gridding methods, surveyors performed transect walking to identify floral species. These random transect walks were done in-between the quadrat exercises.

Figure 5-20: Transect Walk along Project Location

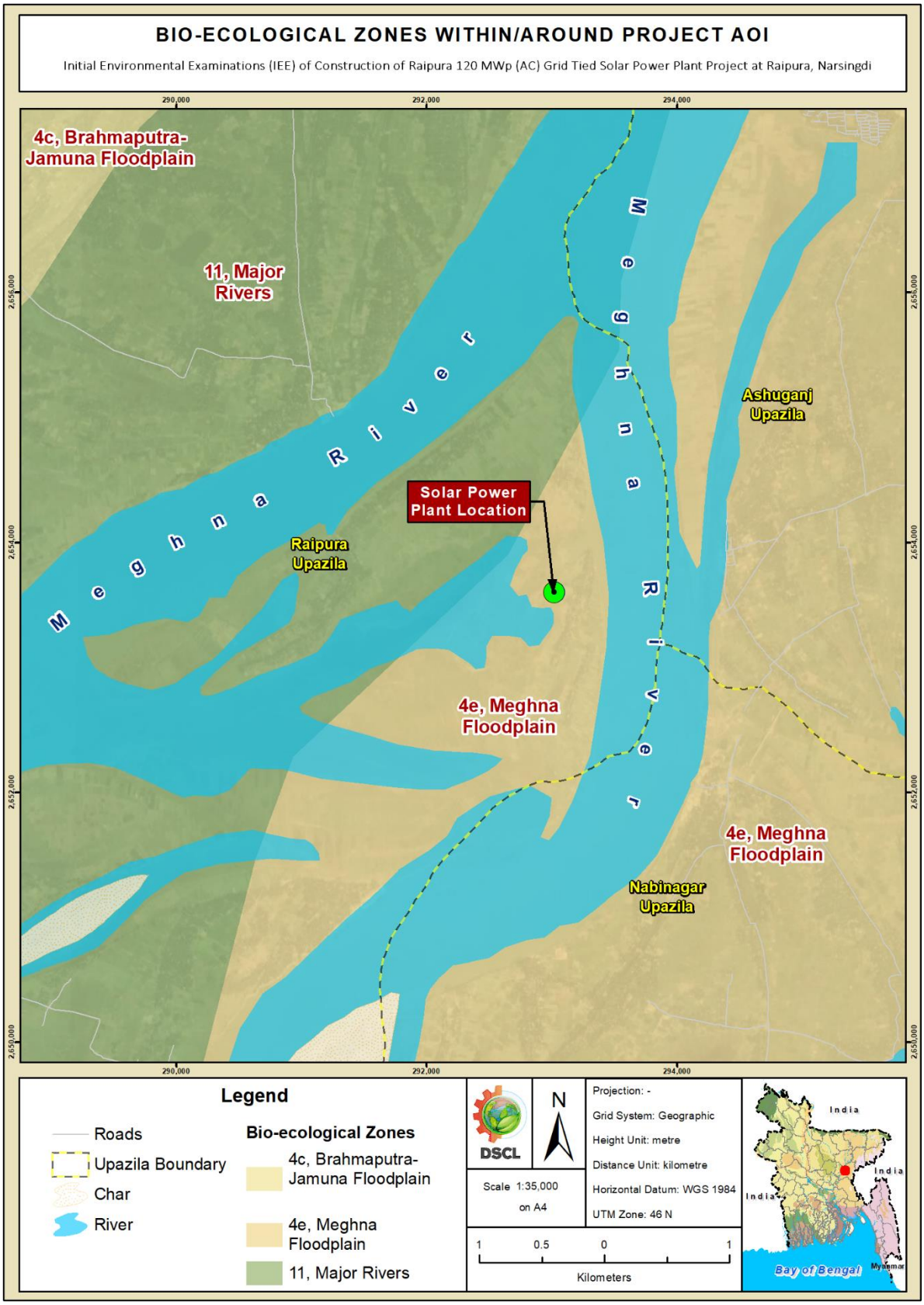


Figure 5-21: Bioecological Zones in and around the Proposed Project AOI

Quantitative plant surveys were conducted in two habitats to enumerate the vegetation occurring within the Proposed Project AOI. The proposed area mainly harbors naturalized shrubs, herbs, and grasses. The region is highly diversified in terms of vegetation. Since there is no single satisfactory

book of red lists in Bangladesh, we used the categories identified by various papers with references for threatened species listing. Below table presents the detailed information of the quadrat survey conducted in the field. The quadrats include Homestead, barren, riverine/aquatic vegetation, and agricultural vegetation.

Table 5-10: Detail Quadrat Information for Floral Survey

S/N	Location	Types of Habitats
1	Chanpur Union, Raipura Upazilla, Narsingdi Zilla, Bangladesh	Homestead, Agricultural, Barren, riverine/aquatic

Homestead Plantation

A list of plants (Table 5-11 & 5.12) found at homesteads of the project area is given in the table below and photographs in Annex 3-

Table 5-11: Common Plants Found in The Backyards of Homesteads of the Project Area

Bengali/ Local Name	Scientific name	Family	Uses/importance
Kola Gach	*Musa acuminata*	Musaceae	Fruit
Lau	*Lagenaria siceraria*	Cucurbits	Vegetable
Bel	*Aegle marmelos*	Rutaceae	Fruits, herbal medicine
Neem	*Azadirachta indica*	Meliaceae	Medicine, Wood
Kathal	*Artocarpus heterophyllus*	Moraceae	Fruit
Khejur	*Phoenix sylvestris*	Palmae	Juice, fruits, fuel, fence, Basket
Narikel	*Cocos nucifera*	Palmae	Fruits, drinks, fuel, fence, handicrafts
Peyara	*Psidium guajava*	Myrtaceae	Fruit
Mishti Kumra	*Cucurbita moschata*	Cucurbitaceae	Vegetable
Supari	*Areca catechu*	Palmae	Fruits, fuel, pole, window rod
Tetul	*Tamarindus indica*	Leguminosae	Fruits, medicine, timber, fuel

Table 5-12: List of Fauna Found in/around the Project Area

Scientific Name	Local Name	English	Types	Use	Type	IUCN Red Book Status	Type
Hibiscus rosa-sinesis	Joba	Chinese Rose	Flower-bearing tree	Flower	Indigenous	LC	Endemic
Syzygium jambos	Amruj	Rose Apple	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Azadirachta indica	Neem	Neem	Mdicinal	Medicinal	Indigenous	LC	Endemic
Neolamarckia cadamba	Kadam	Burflower-tree	Medicinal and Fuelwood	Medicinal and Fuelwood	Indigenous	LC	Endemic
Limonia acidissima	Bel	Wood-apple tree	Fruit	Food	Indigenous	LC	Endemic
Delonix regia	Krishnachura	Royal poinciana	Flower and Timber	Timber	Indigenous	LC	Endemic
Tectona grandis	Kathgaach	Wood Tree	Wood	Timber	Indigenous	LC	Endemic
Eucalyptus globulus	Eucalyptus	Bluegum	Wood	Timber	Indigenous	LC	Endemic
Ixora chinensis	pink Rongon	Ixora	Flower Bearing tree	Flower	Indigenous	LC	Endemic

Scientific Name	Local Name	English	Types	Use	Type	IUCN Red Book Status	Type
Wrightia antidysenterica	Shwet Dyuti	Coral Swirl	Flower Bearing tree	Flower	Indigenous	LC	Endemic
Eichhornia crassipes	Kochurip ana	Water Hyacinths	Aquatic plant		Indigenous	LC	Endemic
Benincasa hispida	Chal kumra	Ash gourd	Vegetables	Food	Indigenous	LC	Endemic
Saccharum Sponteneum	Kashful	Kans grass	Flower	Flower	Indigenous	LC	Endemic
Musa acuminata	Kola	Banana	Fruit-bearing tree	Food	Indigenous	LC	Endemic

*** Abbreviation:** LC = Least Concern

b) Fauna

Faunal studies were undertaken in the Proposed Project AOI by opportunistic search methods where habitats of the different faunal species were repeatedly visited twice to confirm their presence and usage. The focus was on the larger animals under threat of frequent urbanization and industrialization in the area. The target faunal species studied are Mammals, Avifauna, Reptiles, and Amphibians. Cows, goats, dogs, cats, mules are found in the study area during the visit. No wild fauna was found in the study area. Cow (*Bos Taurus*), Goat (*Capra aegagrus hircus*), Dogs (*Canis lupus familiaris*) were seen on the road (Table 5-13).

Table 5-13: List of Fauna found in/around the Proposed Project AOI and their Local IUCN Status

Scientific Name	Name	IUCN Redbook Status*
Equus Caballus	Horse	LC
Gallus gallus domesticus	Chicken	LC
Anatidae	Duck	LC
Bos Taurus	Cow	LC
Capra aegagrus hircus	Goat	LC
Canis lupus familiaris	Dog	LC
Ovis aries	Sheep	LC
Bubalus Bubalis	Buffalo	LC
Columbidae	Pigeon	LC

*** Abbreviation:** LC = Least Concern

c) Fish Survey

The survey was conducted for two (02) days in the adjacent fish markets. The two days were spent on reconnaissance surveys and primary survey purposes. During surveys, fishermen's interviews were also conducted to understand their perceptions and thoughts of fishing techniques, fish availability, and the correlation of fish caught with the environment. Interviews also covered environmental considerations, e.g., environmental changes over the past years and their correlation with a fish catch or migratory route.

Different fish species were observed and interviewed with fishers during the field survey during the fish market visit. Some figures are shown in Annex G. A complete list of fisheries found in the project area is listed in Table 5-14.

d) Endangered Species & Red Book Species

There are no biodiversity receptors of international, national, state, or district importance, including protected areas, key biodiversity areas, forest areas around the identified proposed sites or along the alignments. There are no locally threatened species found in the Proposed Project AOI.

Table 5-14: List of Fisheries Species found in the Proposed Project AOI and their Local IUCN Status

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*	Remarks
Ambassidae	*Parambassis ranga*	Indian glassy fish	Chanda	LC	-
Amblycipitidae	*Amblyceps mangois*	Indian Torrent catfish	Shing	LC	-
Anguillidae	*Anguilla bengalensis*	Indian longfin eel	Bain	VU	-
Anabantidae	*Anabas testudineus*	Climbing perch	Koi	LC	-
Bagridae	*Mystus tengara*	Indian catfish	Tengra	LC	-
	Sperata aor	long-whiskered catfish	Aair	VU	The status is old but at present these types are being cultured and become very common in and around the project area
	Rita rita	Rita	Ritha	LC	
Channidae	*Channa marulius*	Great snakehead	Gojar	EN	The status is old but at present these types are being cultured and become very common in and around the project area
	Channa striata	Snakehead murrel	Shol	LC	-
	Channa punctata	Spotted snakehead	Taki	LC	-
Cyprinidae	*Labeo bata*	Bata Labeo	Bata	LC	-
	Ctenopharyngodon idella	Grass carp	Grass carp	VU	The status is old but at present these types are being cultured and become very common in and around the project area
	Labeo calbasu	Black Rui	Kal Baush	DD	-
	Labeo catla	Indian carp	Katol	LC	-
	Hypophthalmichths molitrix	Common carp	Silver Carp	DD	-
	Puntius chola	Swamp barb	Puti	LC	-
	Labeo rohita	Ruhi	Rui	LC	-
	Puntius Sarana	Olive barb	Sorputi	LC	-
	Cirrhinus cirrhosus	Cauvery white carp	Mirka	LC	-
Notopteridae	*Notopterus chitala*	Chital	Humped Feather back	EN	The status is old but at present these types are being cultured and

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*	Remarks
					become very common in and around the project area
Siluridae	*Ompok pabo*	Pabda	Pabo Catfish	EN	The status is old but at present these types are being cultured and become very common in and around the project area
Pangasiidae	*Pangasius pangasius*	Pangas	River catfish	EN	The status is old but at present these types are being cultured and become very common in and around the project area
Latidae	*Lates calcarifer*	Barramundi	Coral	EN	The status is old but at present these types are being cultured and become very common in and around the project area
Cichlidae	*Oreochromis niloticus*	Tilapia	Telapia	LC	-
Penaeidae	*Fenneropenaeus indicus*	Prawn	Chingri	LC	-
Siluridae	*Wallago attu*	Helicopter Catfish	Boyal	LC	-

*** Abbreviation:** UC = Uncommon, VC = Very Common, C = Common, F = Few, O = Occasional, CR = Critically Endangered, EN = Endangered, Vu = Vulnerable, LC = Least Concern, DD = Data Deficient, M = Migratory, R = Resident, Bh = Bush, Op = Open place, Hh = Human habitation, Cl = Cultivated land, Tt = Tall tree, H = Hole, R = River, P = Pond, C = Canal, Dt = Ditch, We = Water edge.

5.5 Socio-Economic Environment

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. The following tools and techniques were used to collect the relevant data/information on the social and economic aspects of affected people:

- Literature review;
- Group discussion;
- Socio-economic survey, and
- Informal meeting with various professionals.

In addition, data obtained from secondary sources were considered along with the primary data/information gathered during the study.

Data on population, age/sex composition, household patterns, and sources of drinking water, sanitation facility etc. were enumerated based on the primary data collected during the survey.

5.5.1 Administrative Structures

The study area is in Chanpur Union of Raipura Upazila of Narsingdi district. It is on the bank of the Meghna River and has a population of about 23661. Raipura is the second largest upazila of Bangladesh in Narsingdi district. Located in the southeast It is bounded on the north by Belab Upazila, East Kishoreganj and Brahmanbaria Districts, on the south by Nabinagar and Bancharampur and Narsingdi Sadar Upazilas of Brahman-Baria District, on the west by Narsingdi Sadar and Shibpur Upazilas. Its total area is 312.6 sq km. Among them, reservoirs and rivers are 43.7 sq km. Demographic information of the project area is depicted in Table 5.15.

Table 5-15: Demographic information of the study area

Sl.	Population Characteristics		Narsingdi District	Raipura Upazila	Chanpur Union
01	Total Area (sq.km.)		1114	312.50	20.15
02	Sex Ratio	Total	2224944	535796	23661
		Male	1102943	258993	11424
		Female	1122001	276803	12237
03	Literacy Rate (%)	Average	49.60%	40.5%	25.8
		Male	50.56%		
		Female	48.66%		
04	School		773	199	1
	College		63	4	-
	Government Hospital		7	1	-
05	Religion	Muslim	2098829	515579	***
		Hindu	125769	20199	
		Others	346	18	
06	Major NGOs		Palash palli unnayan sangstha (pard)	BRAC	***
			Association for rural development (ard)	ASA	
			Chinishpur dipshikha mohila samity (cdms)	PROSHIKA	
			Poverty alleviation through participatory rural initiative (papri)	-	

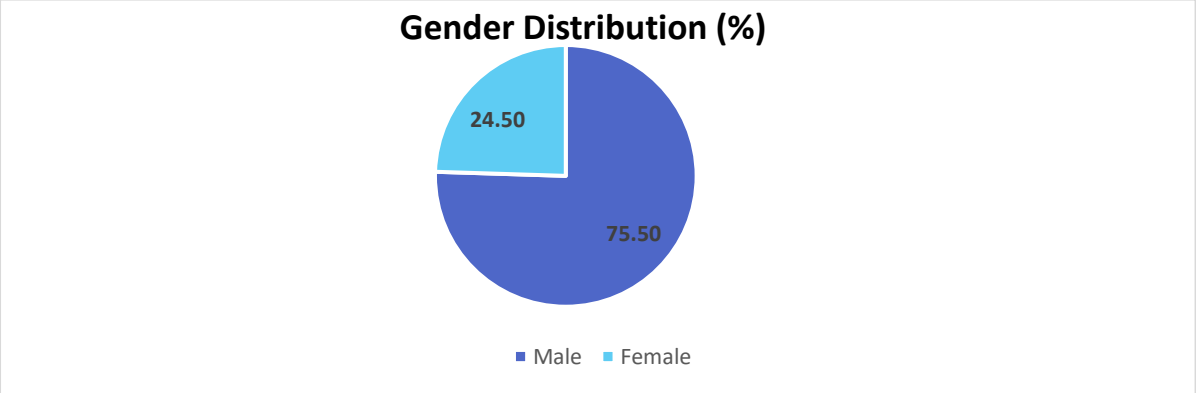
Data source: BBS 2011 & 2022; District Book 2011, and Wikipedia; ***No data available from secondary authentic sources.

5.5.2 Quality of Life Indicator

As a part of the social survey a total of 200 respondents were interviewed in Chanpur area (Union- Chanpur, Upazila- Raipura, Zilla- Narshindi). A questionnaire was developed in this regard before. The survey was conducted from the surrounding area to understand and assess the socio-economic conditions of the project area. Survey photographs are depicted in Annex 4 and questionnaire survey sheet in Annex 5.

5.5.2.1 Gender Distribution

The gender distribution of the respondents in the project area is represented in a column chart. It corresponds that only 24.50% female of the project area responded to the questions of the study whereas males were 75.50%.

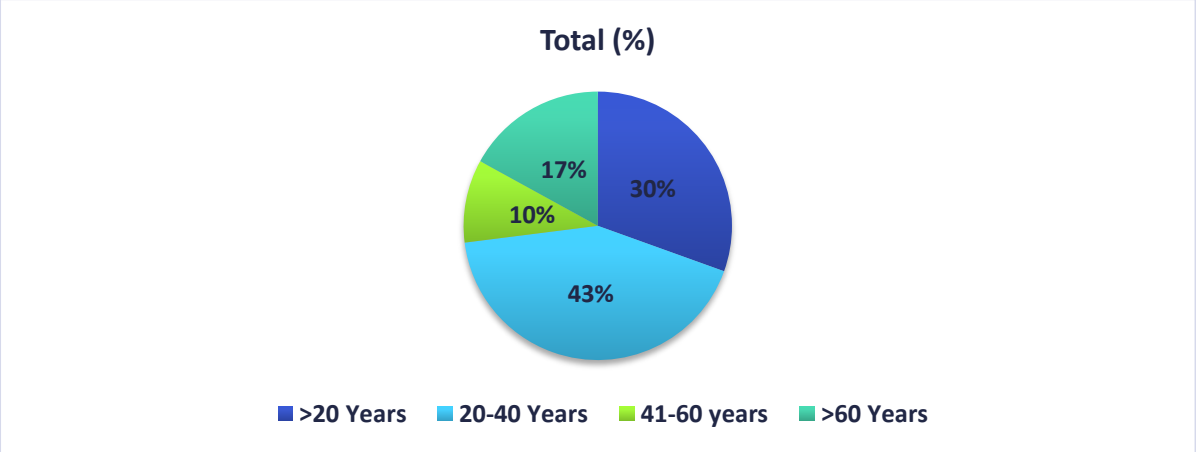


(Source: DSCL Census and SES survey, 2023)

Figure 5-22: Gender of the Respondents

5.5.2.2 Age

The age category of the project area is represented in a column chart. People between 20 to 40 years responded to the study most.

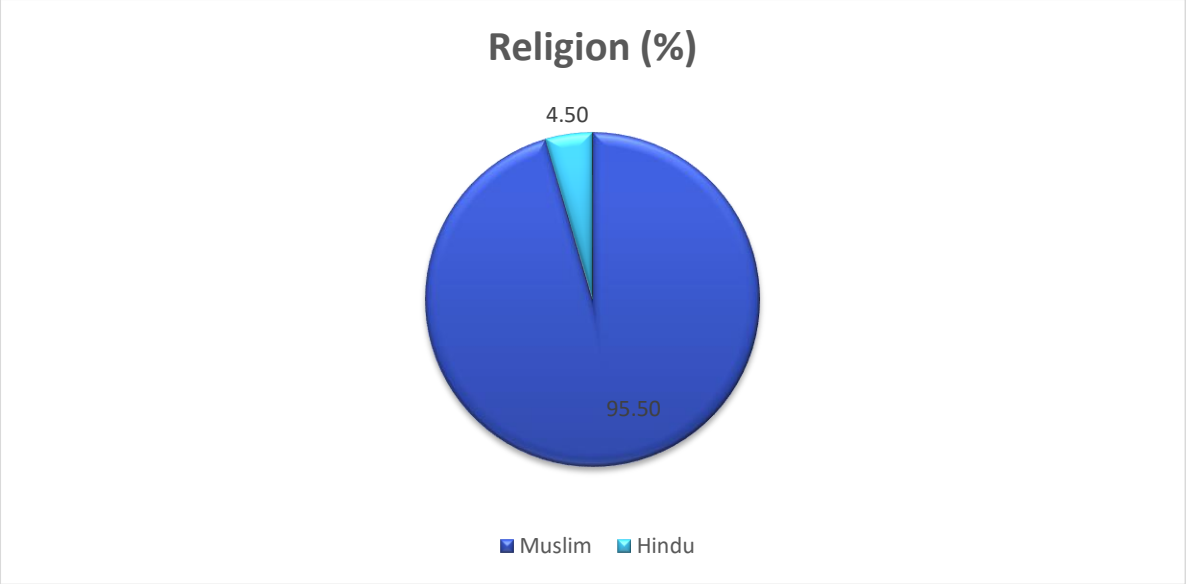


(Source: DSCL Census and SES survey, 2023)

Figure 5-23: Age of the Respondents

5.5.2.3 Religion

The following chart represents that most of the people of the project area are followed by Muslim religion (95.5%). Rest of the people are following Hindu religion. No other religious people have been found in the project area.

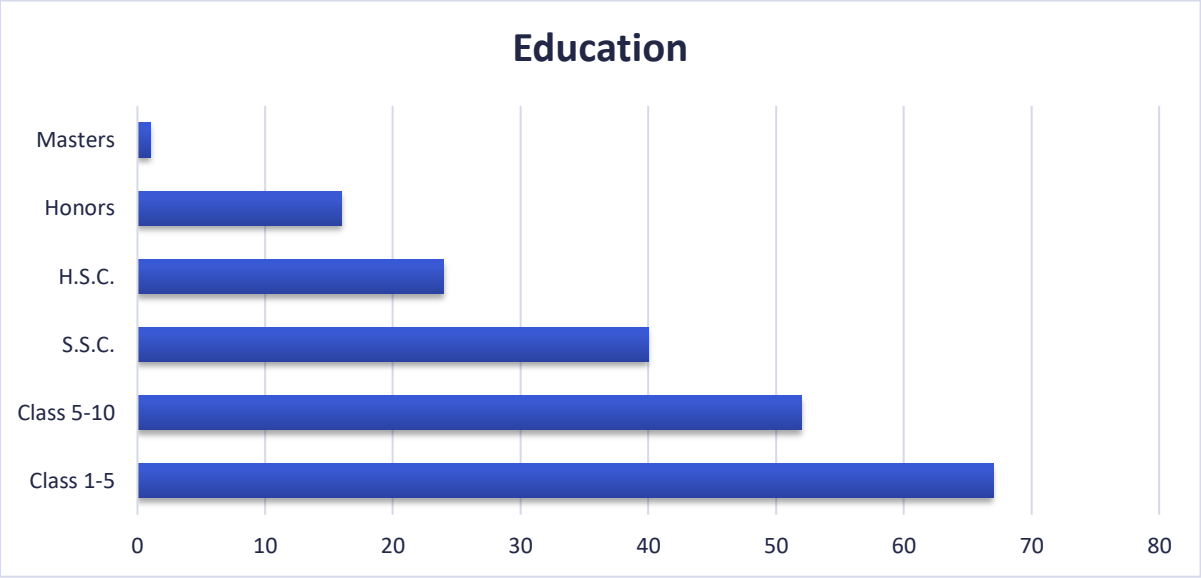


(Source: DSCL Census and SES survey, 2023)

Figure 5-24: Religion of the Respondents

5.5.2.4 Education

The following chart shows that the status of education level in the project area is similar to the national level. The rate of population with "<class 5" was 67%. The dropout rate continues to grow higher as it comes to higher studies.

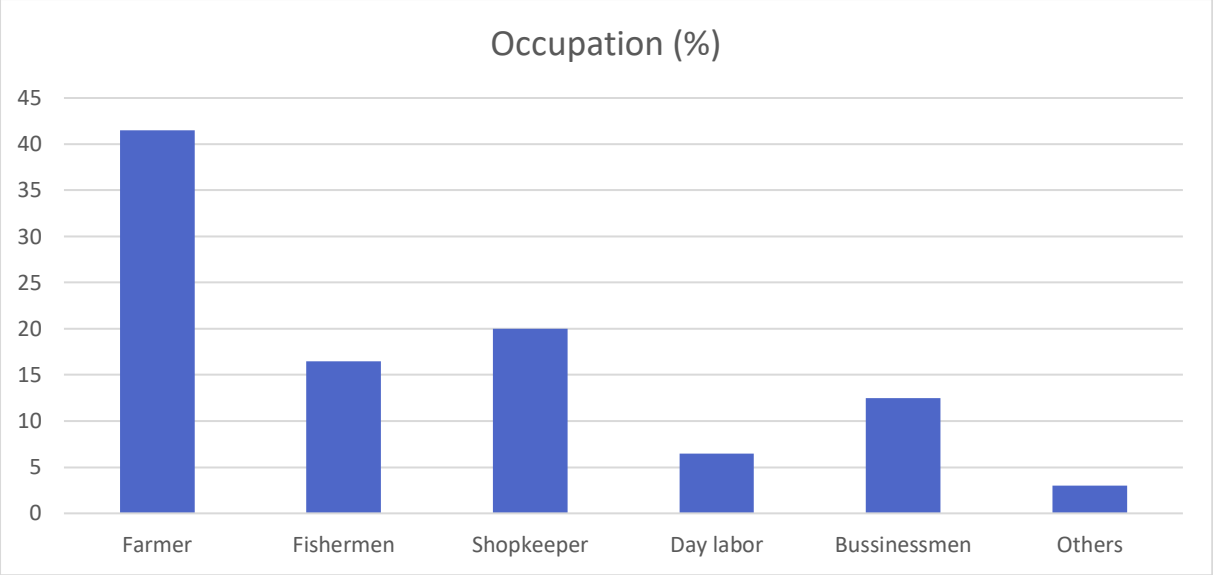


(Source: DSCL Census and SES survey, 2023)

Figure 5-25: Educational Profile of the Respondents

5.5.2.5 Occupation

This figure presents the distribution of total population of the project area; wherefrom is evident that about 41.50% respondents were farmer, 16.50% were fisherman, 20% were shopkeeper, 6.5% were day labor, 12.50% were Businessman and 3% were housewife.

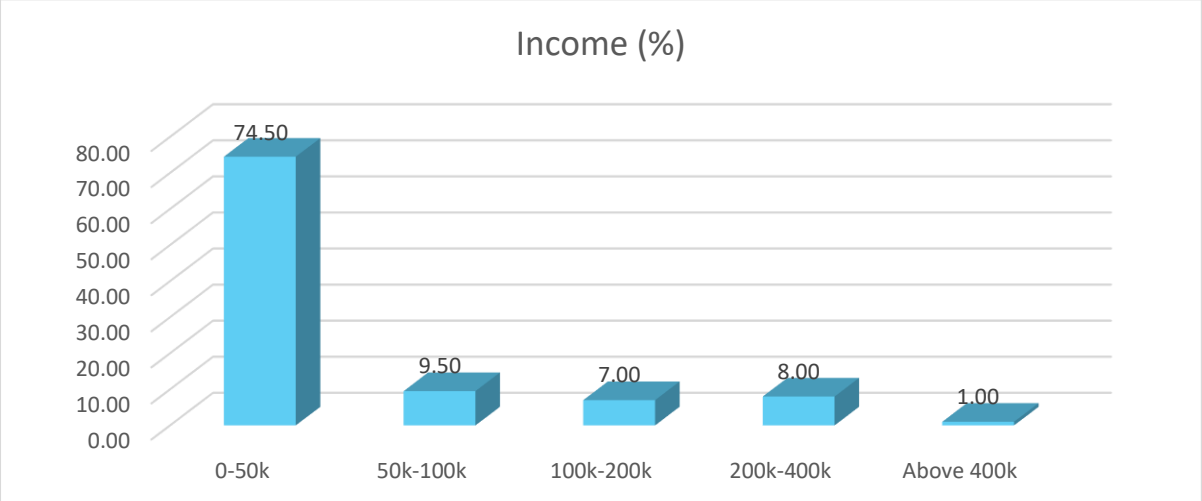


(Source: DSCL Census and SES survey, 2023)

Figure 5-26: Occupation of the Respondents

5.5.2.6 Income

As shown in figure 5-27, 74.50% of respondents reported their yearly income ranged between 0 to 50,000 BDT. While 9.5% of respondents are within the range of yearly income BDT 50,000 to 100,000. Only 7% and 8% reported their yearly income range was BDT 100,000 to 200,000 and BDT 200,000 to 400,000, accordingly.

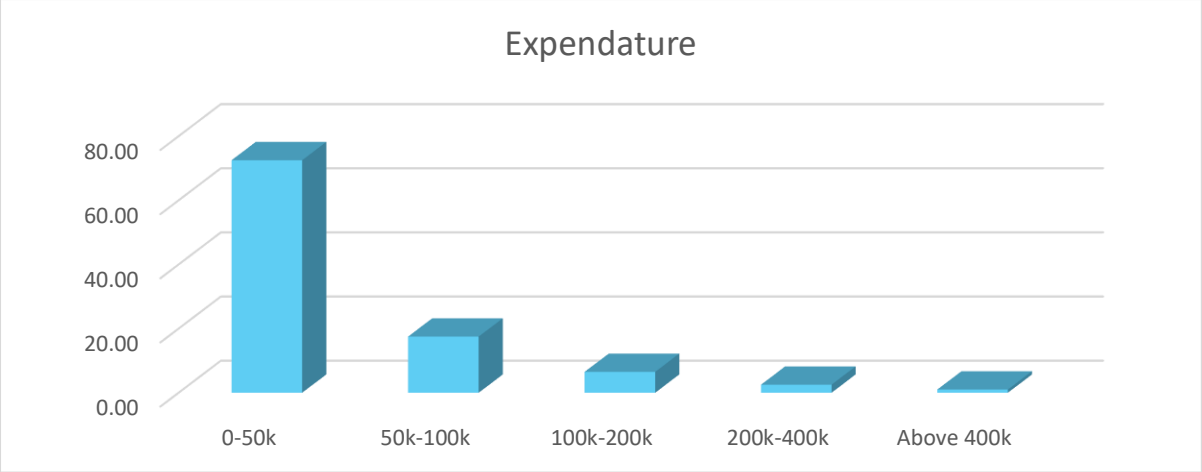


(Source: DSCL Census and SES survey, 2023)

Figure 5-27: Yearly Income of the Respondents

5.5.2.7 Expenditure

As shown in figure 5-28, 72.50% of respondents reported their yearly expenditure ranged between 0 to 50,000 BDT. While 17.50% respondents are within the range of yearly expenditure BDT 50,000 to 100,000 and 6.5% respondents are within the range of yearly expenditure BDT 100,000 to 200,000. Only 3.5% reported their yearly expenditure was more than BDT 200,000 to ≥400,000.

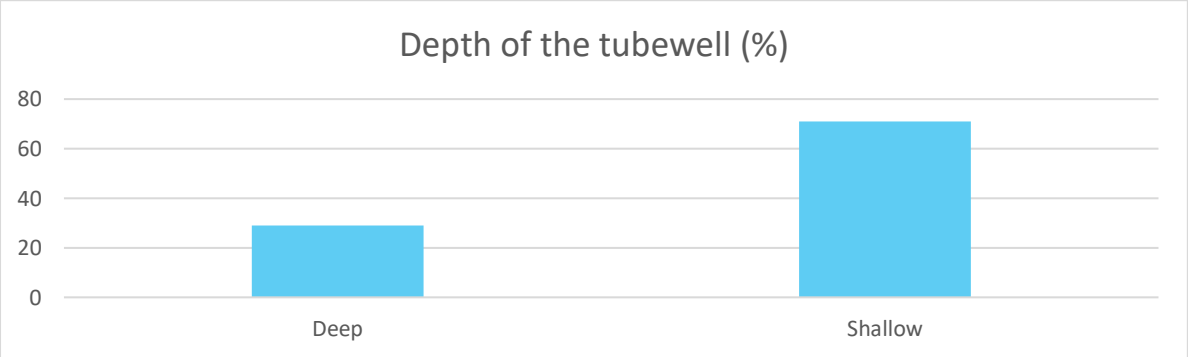


(Source: DSCL Census and SES survey, 2023)

Figure 5-28: Yearly expenditure of the Respondents

5.5.2.8 Depth of tube well

As shown in below figure, 29% tube well were deep and 71% tubewell were shallow in the project area.

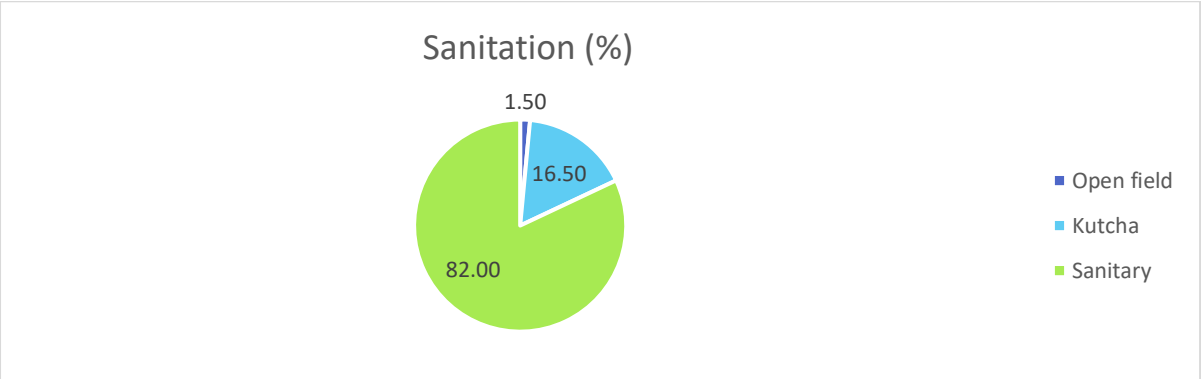


(Source: DSCL Census and SES survey, 2023)

Figure 5-29: Depth of tube well

5.5.2.9 Sanitation

According to figure 5-30, 82% respondents used sanitary toilet in the project area and 16.50% respondents used kutcha toilet in the project area.

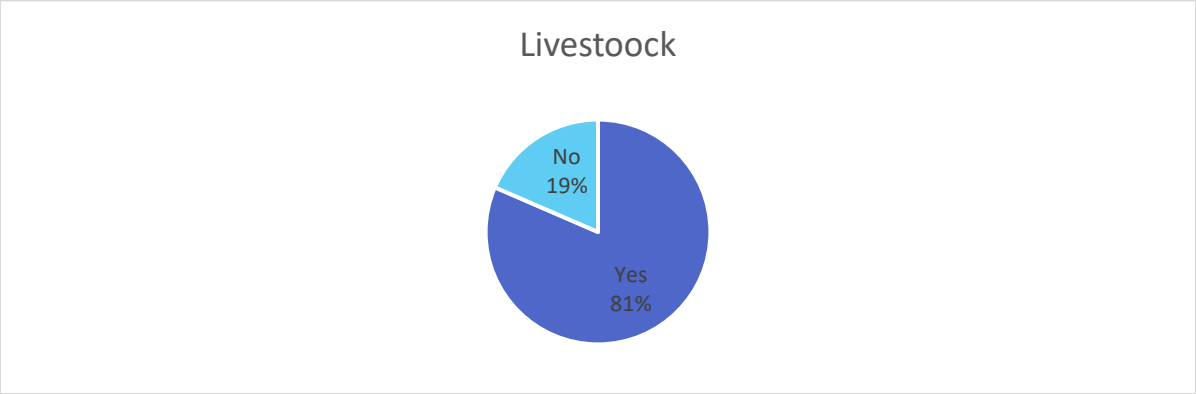


(Source: DSCL Census and SES survey, 2023)

Figure 5-30: Type of Toilet

5.5.2.10 Livestock

Almost 81% of households along the project area have livestock in their families. Livestock typically includes a variety of domesticated animals such as cows, goats, sheep, poultry, and occasionally water buffalo. Farmers in the area may engage in small-scale or backyard livestock farming, and the types of livestock kept can depend on factors such as land availability, climate, and individual preferences. Livestock farming often plays a significant role in the livelihoods of rural communities, contributing to both subsistence and income generation.



(Source: DSCL Census and SES survey, 2023)

Figure 5-31: Availability of livestock

5.5.2.11 Drinking Water Source

Almost 100% of households along the project collect drinking water from tube wells.

(Source: DSCL Census and SES survey, 2023)

Figure 5-32: Sources of drinking water

6 STAKEHOLDER ENGAGEMENT PLAN, KEY INFORMANT INTERVIEW AND FOCUS GROUP DISCUSSION

6.1 Introduction

Focus group discussions (FGD) are held as part of the stakeholder engagement process in collaboration with the project proponent. The process of FGD disclosure is one of the prerequisites of any development project's environmental safeguard aspect and, as such, is an integral part of the corresponding IEE process. Furthermore, it assists the project's proponent in obtaining the necessary public acceptance. It is essential that the communities as whole and individual members of the community are given every opportunity to express their views, concerns and worries in connection with the expected and projected environmental impacts and construction impacts for each of the proposed projects. The support of the community is a key indicator of the success of a project.

The project authority recognizes the importance of social and environmental factors in the successful implementation of the proposed project and intends to conduct a comprehensive process of public consultation and environmental investigation. The feedback from the consultation process will be used to shape the social and environmental programs. The project started with the beginning of a consultation process. The main goal was to give stakeholders the chance to share their opinions during project planning and decision-making processes while also keeping them informed about project proposals and developments.

The project's stakeholders, that included key informants, potentially impacted individuals, local community members, local officials, government organizations, and members of NGOs, participated in focus group discussions to achieve community involvement. A multidisciplinary team of social and environmental professionals ran the meetings. At meetings, Members of the Project team also described Project components, listened to suggestions, and responded to stakeholder questions to the best of their abilities. To maintain a consistent approach and to aid in the gathering of relevant data and information pertaining to each individual stakeholder, specific checklists were also developed.

6.2 Objectives

The overall objective of this public consultation is to define a program for stakeholder engagement, including public information disclosure and consultation, throughout the construction and operation of the proposed project. Public consultation is a useful tool for managing communications between the implementing agency, the supervision organization, and its stakeholders.

The Key Objectives can be summarized as follows:

- Identify key stakeholders that are affected, and/or able to influence the Project and its activities;
- Identify the most effective methods, timing and structures through which to share project information, and to ensure regular, accessible, transparent and appropriate consultation;
- Develops a stakeholder’s engagement process that provides stakeholders with an opportunity to engage in project planning and design and its implementation;
- Provide guidance for stakeholder engagement such that it meets the standards of national and international best practices;
- Define roles and responsibilities for the implementation of the project monitoring plan;

- Define reporting and monitoring measures to ensure the effectiveness of the plan and periodical reviews of the plan based on findings.

The consultation covers Project design, mitigation and monitoring measures, project-specific sharing of development benefits and opportunities, and implementation issues. During the Project's preparation and implementation, the funding agency expects the Client to engage in meaningful consultation with stakeholders.

6.3 Methodology for Stakeholder Consultation

As part of the IEE process, three (03) focus group discussions were organized and held to record the views and opinions of community members from October 23 to October 26, 2023. A range of stakeholder consultation and engagement methods have been used depending on the stakeholder type and the level of interest or concern. These consultation meetings were attended by elected representatives, local leaders, school teachers, religious leaders, students, painters, businessmen, service holders, drivers, and others. During the stakeholder consultations, social, environmental, and cross-cutting issues such as potential project impacts, activities on environmental and social parameters, identification of sensitive issues, risks, and potential threats from the project were discussed. The key methods used during these consultation sessions were:

- Focus Group discussions (FGD)- stakeholders were provided with a project briefing, given a chance to view posters, followed by a question-answer period;
- Face-to-face individual interview with Respectable Local Beneficiary Person Such as Union Parishad Chairman, ASPCL officials, Teacher & Imam.
- Letters/correspondence via regular mail and email.

Most of the public meetings were chaired by ASPCL Consultant, with both taking leading roles in the delivery of the government and agency positions. The approach undertaken for information disclosure and consultation involved the following key processes.

- Compile and analyze data from focus group discussions, interviews, and correspondence.
- Incorporate stakeholder feedback into the project plan and communicate changes.
- Implement a communication plan using various channels to keep stakeholders informed. Establish ongoing communication and engagement mechanisms with stakeholders.
- Address and resolve any outstanding issues or concerns raised during consultations.
- Implement a monitoring and evaluation system to assess communication effectiveness. Regularly produce and disseminate reports on project progress and challenges.
- Maintain transparent decision-making and accountability mechanisms.
- Acknowledge and celebrate project milestones with stakeholders.

6.3.1 Checklist Used for Public Consultation

A checklist devised by the consultants was used to enable participants to easily comprehend the issues, so that they could participate in the discussions more effectively and express their opinions and views objectively. This collaborative approach was well received by all participants.

- Location of consultation
- Name and occupation of participants
- Awareness of participants about the project
- Description of the project

- Benefits of the projects
- Impacts of the Project on social and environmental components
- Community concerns and perception of the Project
- Exception from the project
- Suggestions about the Project

6.4 Focus Group Discussions

A participatory approach was followed in conducting the Focus Group Discussion (FGD). Five focus group discussions (FGDs) and several informal discussions were also carried out during the public consultation process. Early in the Project, appropriate mechanisms will be established that incorporate local decision-making traditions to facilitate dialogue and develop consensus on identified issues.

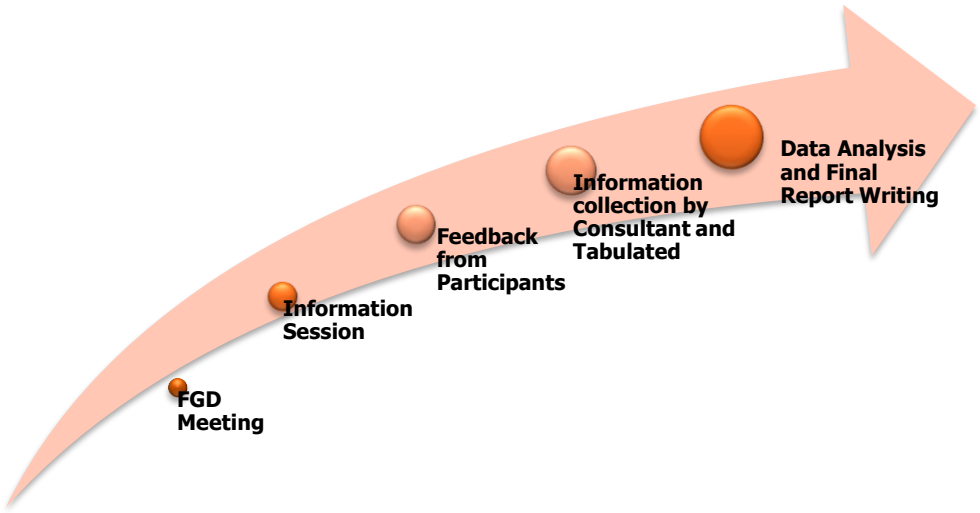


Figure 6-1: Approach of Focus Group Discussion (FGD)

6.4.1 Focus Group Discussion with the Local People

During the FGDs, the IEE team displayed maps of the project area, shared the initial concepts on proposed interventions, and facilitated the discussions to solicit responses from the participants. The stakeholders of the project were asked to share their needs, problems, possible sustainable solutions, and their views on the project interventions. The stakeholders' perceived views on important environmental and social components (IESCs) and the project's impacts on them, along with perceived benefits, risks, threats, and demand from the project were identified through these discussions. Due to the livelihood pattern, a huge number of participants were unable to attend the sessions. A total three (03) number of FGDs were conducted at the project area (Annex 3). Summary of comments from FGD with local people are in Table 6.2 whereas all description of those FGD is attached in Annex 4. This table indicates the date and place of the group discussion meetings including the number of participants present at each. Names of participants provided in annexures.

Table 6-1: Details of Public consultation and Focus Group Discussions

SI	Date	GPS Location	Location	Total Participants
1	16-10-2023	23.979704˚N, 90.967728˚E	Chanpur Bazar, Chanpur Union, Raipura, Narsingdi	10
2	17-10-2023	23.980569˚N, 90.967328˚E	Near Dokkhinghat, Chanpur Union, Raipura, Narsingdi	12

SI	Date	GPS Location	Location	Total Participants
3	18-10-2023	23.991609˚N, 90.967020˚E	1 No. Ward, North Chanpur, Chanpur Union, Raipura, Narsingdi	10

6.4.2 Overall Findings

The nature of the project was explained at the start of the FGDs, and the outcomes and potential impacts of the project interventions were discussed. Concerns were also raised about the climatic conditions in the project areas. The attendees were then asked for their thoughts and comments on the project, whether it is environmentally and socially viable during the construction and operational phases, and how it will affect their lives. Several people have spoken up, and they have all stated that they will support this project initiative because it will be helpful for their employment, economic development and benefits. The following are some of the most important issues and suggestions raised by the participants in Table 6-2. Details are attached in the Annexures 4.

Table 6-2: Issues Raised in FGD

Issue Discussed	Issue Raised	Comments/ Question from Local People	Suggestion
Impact of implementation of the project	Reduce unemployment	Will the solar power plant bring employment opportunities for our community?	Consultants noted the point of optimism. Labour should be taken from respective locality.
		How can we ensure that locals have access to these jobs?	
		After completion of Construction work, some people will be jobless as usual.	
	Access to Energy	How will the solar power plant improve our access to electricity?	The solar power plant aims to significantly enhance local electricity access, with a commitment to transparent benefit-sharing mechanisms ensuring direct and equitable advantages for the entire community. Local community and the country will get benefit from the grid power.
		what guarantees are there that the local community will get benefit?	
	Community development	We want to know more about the community development initiatives tied to the project. How will the benefits be distributed within our community?	We appreciate your concern. As part of Community development initiatives, we ensure job creation, skill-building programs, and infrastructure improvements, ensuring equitable distribution of benefits within the community.
	Social concern	Local people must face gathering in every place due to migrant workers, engineers	It seems to the survey team that problem is related to social issues.

Issue Discussed	Issue Raised	Comments/ Question from Local People	Suggestion
		and other officials. Moreover, due to migrant workers, pressure will be created on our local resources.	Project authorities are always aware of the negative impacts occurred by project influence, and we hope that they will try to take steps so that the contractor will arrange an awareness program during the construction period. They will make residential facilities and worker's camps in the project site that will control the mixing of people and keep the community safe from all kinds of incidents.
		Due to the coming of migrant labour, there would be a possibility to hamper social livelihood in the project area. Moreover, Local Women harassment could be happened by incoming migrant people.	
	Impact on Fish breeding and fish track or movement	How can we ensure the protection of our biodiversity?	Must avoid breeding season and breeding ground for project construction and operational activities.
	Waste Management	What measures are in place for proper waste disposal and management during construction and operation?	In response to waste disposal concerns, our project incorporates stringent waste management protocols, ensuring responsible disposal practices are followed throughout both the construction and operation phases. Moreover, appropriate sanitary system should be developed during project execution to protect air, water and soil from any kind of pollution.
	Crop damage	We depend on our land for agriculture. Can you provide assurances that the solar project won't negatively impact our crops and soil fertility?	We understand your concerns about public land use. The project will adhere to a timeline that minimizes disruption to cultivation activities, and we are open to discussing any specific arrangements that address community needs. The project will acquire sufficient land and will do all works in their land area to avoid any kind of disturbance to the concerned people and their land and other properties.
		In case of any damage to our crops during construction or operation, what provisions are there for compensation or support for affected farmers?	
		Moreover, if the construction materials and earthen materials of this project are stacked on public land for a long time, then it will pose a	

Issue Discussed	Issue Raised	Comments/ Question from Local People	Suggestion
		problem by preventing cultivation activity.	
	Pollution of air and surface water	If water is needed for the solar plant, how will this affect our local groundwater resources?	Monitoring should be adopted. Water will be sprayed on bare fields to suppress and control dust emission. Construction materials and sand will be transported with cover. Further these materials and sand pile will be covered at site to control dust emission.
		Construction activities often generate dust. How will you control dust to prevent it from affecting our crops?	
	Noise Pollution	We want to maintain the tranquillity of our community. How will the project address potential noise pollution during operation?	Appropriate noise mitigation measure will be adopted in construction site. Low noise level equipment will be used. Noisy work will be done at day time and will be avoided at night time.
	Erosion Control	This solar power plant is situated near riverbank. Given the proximity to rivers, what measures will be implemented to control erosion and prevent damage to riverbanks during construction & operation phase of this solar power plant?	If necessary, then project environmental experts will ensure erosion control measure for the ecological integrity of the project site. Proper engineering and environmental management system will be adopted to prevent erosion and to stabilize the area for the project and community safety.

The participants shared their positive opinion that the project's execution would not cause any environmental or social damage. Additionally, they stated that the project would open up new job opportunities and this project will be beneficial for the economy of the local community and as well as for the country.

6.5 Key Informant Interviews (KII)

Key informant interviews (KII) are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people- including stakeholders like community leaders, local government authority, professionals, and community residents - who have first-hand knowledge about the community. These community experts, with their particular knowledge and understanding, can provide insight into the nature of problems and give recommendations for solutions.

6.5.1 KII Methodology

Key Informants were interviewed as a part of KII under social survey. Experts from different offices of Raipura Upazila Parishads expressed their knowledge and thoughts to the survey team. These interviews are taken to equate here to in-depth, individual interviews which are either unstructured, structured, or more commonly semi-structured (set questions with scope for follow-ups and free discussion. The KII methodology consists of following points:

1. Identify & Selection of the type of interview (verbal, phone call, email)
2. Developing a tool for interviewing
    - Formal introduction to the key informant;
    - Major questions;
    - Follow up questions;
    - Closing questions;
    - Synopsis and Conclusion.
3. Determining documentation method
    - Taking notes;
    - Tape recording.
4. After collection and analyzation, compile & organize key informant interview data.

6.5.2 Major Findings from Key Informant Interviews (KII) with Stakeholders, community leaders and professionals

A total of Eight (08) Key Informant Interviewes (KII) related to proposed project has been carried out from 17 October 2023 to 18 October 2023. Interviewees are mainly Inspector from Narsingdi District Office of Department of Environment (DoE), Upazila Project Implementation Officer, Upazila Agriculture Officer, Upazila Livestock Officer, Senior Upazila Fisheries Officer, UP Chairman, member, Teachers, and Imam of the area. Community leaders, professionals, or residents with first-hand knowledge about the community were asked about their opinions on the project and its ecological, environmental and socio-economic impact. Their opinion and meeting summary are provided in the following sections (Annex 3). Detailed information and photographs of KII is given below-

Table 6-3: List of KIIs

SL. No.	Name of the Officer	Designation	Organization Name
1	Engr. Md. Borhan Uddin	Upazila Project Implementation Officer	Office of Upazila Implementation officer, Raipura Upazila, Narsingdi
2	Md. Mustafizur Rahman	Upazila Agriculture Officer	Office of Upazila Agriculture officer, Raipura Upazila, Narsingdi
3	Dr. Md. Azhar-Ul-Alam	Upazila Livestock Officer	Office of Upazila Livestock officer, Raipura Upazila, Narsingdi
4	Md. Habib Farhad Alam	Senior Upazila Fisheries Officer	Office of Upazila Fisheries Officer, Raipura Upazila, Narsingdi
5	Shomor krishno Das	Inspector	Depertment of Environment, Narsingdi.
6	Md. Jashim Mia	Member	Chanpur Union parishad
7	Md. Sohel Mia	Assistant Teacher	86 No. Chanpur Govt. Primary School
8	Bashirul Alam	Member	Chanpur Union Parishad

Consultants conducted Key Informant Interviews through some gradual stages like formulate study questions, preparing a short interview guide, selecting key informants, conducting interviews, taking adequate notes, analyzing interview data, and lastly checking for reliability and validity. Firstly, consultants started the discussion by stating a project description with specific objectives. They mentioned that Ashuganj Power Station Company Ltd. (an enterprise of Bangladesh Power Development Board) is the largest power-generating company in the country with an installed capacity of 1647 MW. The government of Bangladesh has directed all power generating companies to generate 10% of their total generation power from renewable energy sources, making APSCL's obligation to generate at least 165 MW of renewable energy-based electricity. APSCL has identified a potential land of 368 Acre at Raipura Upazilla in Narsingdi District of Bangladesh. The new solar power plant will help to cope with the increased demand for power supply. Major findings from the Key Informants are in the following table 6.4:

Table 6-4: Key findings of the Key Informant Interviews

Sl. No.	Upazila	Departments/Offices	Key Findings
1	Raipura Upazila	Office of Upazila Implementation officer, Raipura Upazila, Narsingdi	**Engr. Md. Borhan Uddin (Upazila Project Implementation Officer, Office of Upazila Implementation officer, Raipura Upazila, Narsingdi)** gave some information about the project area to the social survey team. Engr. Md. Borhan Uddin said that the river erosion is a big issue of the project area. Again, in monsoon season the area is badly affected by rising water level. During heavy rainfall temporary water logging can be a big issue in the project area.
2	Raipura Upazila	Office of Upazila Agriculture officer, Raipura Upazila, Narsingdi)	**Mr. Md. Mustafizur Rahman (Upazila Agriculture Officer, Office of Upazila Agriculture officer, Raipura Upazila, Narsingdi)** Proposed to take strategies for the preservation of important or endangered plant species in the project area. Moreover, he Suggested erosion control measures such as the use of vegetation cover or retaining walls to minimize soil loss, as this area has been located near riverbank. He also recommended the implementation of recycling and reusing practices to minimize the generation of construction waste. In the end, he said for planning construction and maintenance activities to coincide with non-critical periods for local agriculture, avoiding planting and harvesting seasons.

Sl. No.	Upazila	Departments/Offices	Key Findings
3	Raipura Upazila	Office of Upazila Livestock officer, Raipura Upazila, Narsingdi	**Dr. Md. Azhar-Ul-Alam (Upazila Livestock Officer, Office of Upazila Livestock officer, Raipura Upazila, Narsingdi)** emphasized to ensure that the solar power plant is located away from livestock habitats, grazing areas, and water sources to minimize disruption to normal livestock activities. Additionally, he suggested implementing appropriate fencing around the solar power plant to prevent livestock from entering restricted areas. Also recommend for ensuring that construction materials and equipment are stored in a way that minimizes the risk of harm to livestock. Furthermore, he suggested for providing fair compensation to livestock owners for any loss or damage to their animals or grazing lands due to the project activities.
4	Raipura Upazila	Office of Upazila Fisheries Officer, Raipura Upazila, Narsingdi	**Mr. Md. Habib Farhad Alam (Senior Upazila Fisheries Officer, Office of Upazila Fisheries Officer, Raipura Upazila, Narsingdi)** strongly propose to monitor and manage changes in water quality resulting from the construction and operation of the solar power plant. This includes controlling any potential runoff of pollutants into water bodies. Besides, he emphasized to ensure that the construction does not harm critical fish habitats such as breeding and feeding grounds. Recommend measures to protect these habitats, such as the installation of barriers or buffer zones. Moreover, he encouraged the adoption of an emergency response plan in case of any unforeseen events that could lead to environmental damage. This plan should include steps to mitigate the impact on fisheries and the surrounding environment In conclusion, he advocated for fair compensation for any loss of livelihood or adverse impact on fisheries.
5	Raipura Upazila	Department of Environment, Narsingdi	**Mr. Soumen Mitro (Inspector, Department of Environment, Narsingdi)** ensured that they would provide the necessary support for the progress of the work as and when required. Furthermore, he told the consultant team to submit the fom-3 with necessary document so that the DoE team can review it for approving the site clearance & environmental Clearance respectively.

Sl. No.	Upazila	Departments/Offices	Key Findings
6	Raipura Upazila	Chanpur Union parishad	**Mr. Jashim Mia (Member, Chanpur Union parishad)** raised questions about any potential resettlement plans for residents and how their needs will be addressed Additionally, Union Parishad member expressed opinions on how the solar power plant could contribute to the overall economic development of the area. Lastly, he discussed potential improvements or strains on local infrastructure, such as roads, schools, and healthcare facilities.
7	Raipura Upazila	86 No. Chanpur Govt. Primary School, Chanpur, Raipura, Narsingdi	**Mr. Md. Sohel Mia (Assistant Teacher, 86 No. Chanpur Govt. Primary School, Chanpur, Raipura, Narsingdi)** expressed concerns about potential disruptions to the local community during the construction phase, emphasizing the importance of clear communication and collaboration between the energy company and the community. Additionally, he requested for regular updates on construction progress and any potential disruptions to Madrasa's activities, so that scheduling adjustments can be made if necessary. Furthermore, he suggested that the project team consider hiring local labor to boost the community's economy. He added that this project will bring improvement in reducing loadshedding
8	Raipura Upazila	Chanpur Union parishad	**Mr. Bashirul Alam (Member, Chanpur Union Parishad)** raised concerns or suggestions regarding ensuring that the benefits of the solar power plant are accessible to the entire community. Additionally, he expressed concerns or support for safety measures in place for both workers and the community during different project phases. In the end, he advocated for transparency in project planning and implementation to build trust among community members.

6.6 Use of Consultation Results

Key issues and concerns identified through the consultation process, and the means by which they have been assessed and addressed in this IEE report is provided. These matters have also been translated into practical actions which are contained in the associated Environmental Management Plan (EMP).

7 ANTICIPATED IMPACTS & MITIGATION MEASURES

7.1 Environmental and Social Considerations

This chapter identifies and evaluates the potential environmental and social impacts of the proposed solar power project on the physical, social, and human environment within the area of influence of the proposed project. The likely impacts were assessed for all activities in the construction; installation, operation and maintenance, and decommissioning or dismantling phases of the project development.

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

Based on the characterization of the environment (*Description of the Environment*) conducted by the consultancy team, describing the physical, biological, socioeconomic, and archeological conditions of the zone of location of the Project, the potential impacts, as well as the environmental factors to be affected and the impacting activities to be performed in the stages of construction and operation of the Project have been determined. During the construction phase, the impacts may be regarded as temporary or short-term, while long-term impacts may be observed during the operation stage. The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever-increasing demand of Power and to bridge the Gap between demand and supply of Power.

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 35years)	Medium term lifespan of the project (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project Boundary	Specific location within project component or site boundaries with no detectable
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 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	Meets minimum national standard limits or international guidelines	Not applicable

Parameter	Major	Medium	Minor	Nominal
		one or more parameters		
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

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 7.2 above. A summary of the potential impacts of the project on the key environmental parameters and significance of these impacts are presented in Table 7.4, and 7.5 for different phases of this project; the potential impacts are discussed in the subsequent sections.

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

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 and

(iii) Impacts during operation phase.

(iv) 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. Impacts are described in the sections below.

7.5 Impacts of Solar Power Plant

7.5.1 Pre-Construction Phase

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

7.5.1.1 Land Acquisition/ Land Purchase

Impact:

The project area primarily consists of privately-owned Nul land (84.51%) and some Khas land (15.49%). The landowners are positive about acquisition of land. However, the project authority will buy the required private land from the respective owners with a win-win approach following government rules where both of them can be benefitted. As most of the land is barren land the landowners willingly agreed to sell them to the APSCL. APSCL will always ensure that nobody will lose their land or be adversely affected as a result of land acquisition. There will be no forceful attempt to purchase the land. As well as land purchase will be done in a win-win situation. The village chairmen and local elite persons will be consulted during the land reclamation process, and during the land purchase procedure. As a result each land seller will get direct benefit by project land purchase work.

Mitigation:

Administrative approval and no objection certificates (NOC) from respective departments has already done for land acquisition (Annex 1). Based on this, through negotiation, the contract details and amount to be paid for purchasing private land will be done. APSCL will pay advance through cheque to the seller and a land purchase intention deed (baina deed) will be prepared and registered with the local Land Office. This Baina deed will be valid for 3 months. Within 3 months, a sale deed will be prepared and registered with the Land Registration Office. During registration the remaining amount will be paid by cheque to the seller and the amount shall be transferred to the owners after verification of the ownership documents. APSCL will receive the sale deed from the Land Registration Office. This deed will be kept at the company's local office. Later the Land Dept. will update their records. From then on land belongs to the concerned authority.

7.5.1.2 Land Use / Landfilling

Impact

The Project site location does not conflict with any of the relevant governmental entities' formal planning context. Very few agricultural activities are being practiced there once in a year. In addition, the project site does not provide any major value to local communities. Therefore, there are no anticipated impacts during the planning phase of the Project. However, the project land is right now barren lands, with very little cultivation, mostly of spring harvestable. There will be some minor impacts due to landfilling: Pollution from overflow of filled earth (dredged materials); Erosion from the filled materials and side slope of filled lands.

Mitigation

The project developer is to take responsibility of minimizing environmental impact on the surroundings by following the project's Environmental Management Plan (EMP). For example, the developer should advise contractors to fence the proposed area so that the surrounding agricultural

land will not be disturbed. Since these activities are to be performed temporarily the minimum impact is expected to be acceptable. Landfilling for side slope of filled lands should be done only within the boundary line of the project to avoid damage to adjacent agricultural land, crops, trees, or any other properties. In case of damage by any construction activity, adequate compensation should be paid to the owner in time. But this will be completely mitigated by taking proper and preventive measures during land filling or land development. So, this minor impact will be reduced to no significant impact.

7.5.1.3 Flood Hazards

Impact

The project site is on low land, so there is a risk of flood hazards.

Mitigation

As per pre-feasibility report, a land development of approximately 3 meters or higher will be necessary to counteract potential flood levels before establishing the solar power plant. However, the exact amount of required land development can be assessed with accuracy after conducting a topographic survey. The solar mounting structure could be raised to a height above the maximum flood level. Channels need to be developed for proper drainage of water to the river.

7.5.2 Construction Phase

Environmental effects of the construction phase are expected to be temporary. Construction impacts are considered 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 EMP section. The following is a brief description of impacts envisaged during the construction phase.

7.5.2.1 Visual Amenity

Impact

The construction activities that are likely to create a visual intrusion and a disruption to aesthetics include: materials lay down, excavation, backfilling, and spoil.

The project site consists of areas that have no vegetative covers, and hence no trees or bushes will need to be removed as part of construction. In addition, there are some close communities such as some residences 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 contractor must be careful while doing construction works as though the adjacent agricultural practices and close communities do not hamper.

7.5.2.2 Water Resources

Impact

Surface water quality in the adjacent waterbodies might insignificantly degrade during construction 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 the construction work continues even in the monsoon when the flood occurrence is very high. There will have no major impacts on ground water quality due to the construction of solar power plant.

Mitigation

In order to minimize the adverse impact on water quality, the following mitigation measures are proposed:

- The contractor will dispose of the debris material in a planned manner to a designated disposal site in the project area.
- All reasonable measures will be taken to prevent the wastewater produced in construction from entering into creeks 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 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.
- The solar power plant project normally has no such types of heavy and massive construction works. So, finally it will not pollute water resources in the project area.

7.5.2.3 Noise

Impact

Construction activities for solar power plant will contribute to noise impacts. There are several noise generating activities such as opening access roads to construction personnel camp and facilities (if needed), earthworks, piling or foundation works, cutting, haulage activities, excavation, backfilling, and installation of PV panels, and other equipment within the facility in addition to noise sources generated from machinery and equipment on site.

The project site is far from any cultural or religious site but there are some residences and a primary school. These are the closest sensitive location to the project area. Hence, it can be said that 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:

- If noise levels were found to be excessive, construction activities should be stopped until adequate control measures are implemented;
- Apply adequate general noise suppressing 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.;
- Do the noisy work at day time and avoid it at night time; 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., Ear plug, Earmuffs).

7.5.2.4 Air Quality

Impact

The main impacts associated with construction activities will be:

1) **Dust generation:** resulting from earthworks such as leveling, grading, excavation works and movement of vehicles across dirt/unpaved roads, especially during windy conditions.
2) **Exhaust emissions:** Exhaust emissions of SO_2, NO_x, CO, CO_2, and PM1, $PM_{10,}$ $PM_{2.5}$ will be attributed predominantly to the operation of the construction plant and road vehicles such as movement of

vehicles during construction works. These emissions will be limited to the project area and are anticipated to be generated in small concentrations and dispersed rapidly within the area leading to an impact of low significance. This means that these effects are localized and temporary which implies that any deterioration in air quality at project location is unlikely to be significant and is expected to be transient.

Mitigation

The following identifies the mitigation measures to be applied by the Contractor during the construction phase (to prevent impacts caused by their construction activities and which are within their control) and which include:

- 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;
- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Bangladesh Codes to ensure that for activities associated with high dust levels, workers are equipped with proper Personal Protective Equipment (e.g., masks, eye goggles, breathing equipment, etc.);
- Apply basic dust control and suppression measures which could include:
- Regular watering of all active construction areas.
- Proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
- Proper management of stockpiles and excavated material (e.g., watering, containment, covering, bunding).
- Proper covering of vehicles transporting aggregates and fine materials
- Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issues to avoid unnecessary pollutant emissions.
- Cover the bare area with grass and plantation as much as practicable.

7.5.2.5 Soil

Impact

Construction activities are expected to result in significant soil loss. The excavation, leveling and other earthworks are the possible source to disturb the soil due to the removal of topsoil, which could trigger soil erosion process.

The other source of impact to soil is waste generation from construction material, accidental leakage of fuel, oil, or chemicals stored within a bounded area causing direct contamination of topsoil which may degrade lower layers of soil depending on the number of spills.

Mitigation

Spill response plan shall be in place by the contractor. It is anticipated that impacts to soil resulting from these activities will be likely, with a marginal consequence, yielding medium impact significance. Fuel and chemicals will be stored in proper place having spillage tray and secondary containment.

The filling material should be collected from the approved source dredging location with proper care or from private source with proper manner to ensure that no spillage will occur. Retention wall or waterproof boundary with plastic material should be constructed before the dredged material placement to prevent the spillage from site to adjacent agricultural land.

7.5.2.6 Terrestrial Ecology

Impact

The activities anticipated during the construction phase will include earthworks, excavations, grading, 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.

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

Mitigation

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

- Before construction commences, need to be careful about the presence of any key faunal species of importance (reptiles and mammals). If viable populations of such key species exist within the Project site, then let them to move another site without any disturbance and it should be relocated outside of construction active areas as much as practicable;
- Ensure that the fencing constructed for the Project site allows for the natural movement of small faunal species within the area. This could include for example a fence with an appropriate gap between the ground level and the first rail or strand (around 30cm);
- Implement proper management measures to prevent damage to the natural vegetation of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
  - Prohibit hunting at any time and under any condition by construction and operation workers onsite.
  - Ensure proper storage, collection, and disposal of waste streams generated.
  - 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.
  - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppression measures.

7.5.2.7 Waste Generation

Impact

Improper management of non-hazardous and hazardous waste generated during construction and operation may lead to impacts on air, soil, water, visual environment, in addition to health and safety of workers and other satkeholders. 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

All waste generated at the construction site will be managed as per the suggested waste management procedure in the IEE and Contractor's Waste Management procedures. Domestic wastewater generated at the site will be collected and managed by soak well and septic tanks.

7.5.2.8 Employment Opportunities

Impact

Positive benefits of the project may arise either from short-term job opportunities during construction, or from long-term job opportunities during operation. It is important that the construction and operation job be targeted to the local people within the project area where feasible.

Recommendation

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

7.5.2.9 Health and 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 even 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, emergency provisions and a rescue or evacuation plan in case of major accidents. The construction contractor and subcontractor should have insurance policy to provide compensation as per Bangladesh Labor Rules for any kind of incident, accident and casualty. For this site, both APSCL and EPC contractor will have site emergency ambulance and boat ambulance for all time. Both APSCL and EPC contractor will have HS&E team with sufficient skilled officers, supervisors and supporting staffs supported with all logistic supports and safety gears to ensure all safety measures for employees by conforming, enforcing and follow up all the works continuously.

Mitigation

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 are assessed and all prevention and mitigation measures are in place accordingly. All work will be done following respective Work Permit (PTW). The contractor shall ensure all workers during construction comply with safety procedures through training, daily toolbox talk, 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. Both APSCL and Construction contractor will have site emergency ambulance and boat ambulance for all time. Both APSCL and EPC contractor will have HS&E team with sufficient skilled officers, supervisors and supporting staffs supported with all logistic supports and safety gears to ensure all safety measures for employees by conforming, enforcing and follow up all the works continuously.

The project authority will have a Construction Environmental Action Plan (CEAP), which will, among others, delineate all work safety aspects that intends to apply and contractor will must follow it with

the suggested measures in the EMP part and IEE report. Focal points of the CEAP (HS&E Head of EPC Contractor) will relate to means, work permit (PTW), 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 if necessary.

7.5.2.10 Archaeology and Cultural Resources

Impact

The field visits were conducted at the project site, and it is found that there are some schools, colleges and madrasahs located near (approx. 200m away) the project area. Hence, it can be said that there will be some minor impacts 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 cultural sites.
- Do noisy work at day time and avoid it at night time.
- Ensure proper fencing with noise barrier in the construction site.

7.5.3 Operational 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 quality enhancement it would be necessary to implement the followings that are beyond the purview of this project.

7.5.3.1 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 far from any significant areas, nor residential dwellings, moreover, no potential visual disturbance to birds are expected given the fact, and as a result, there is no migratory birds flyway 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.

7.5.3.2 Water Resources

Impact

The surface water bodies may be affected and polluted due to uncontrolled release of contaminated stormwater/runoff from plant area. The pollutants associated with the plant activities include fuels and chemicals, wastes, heavy, corrosive products and suspended solids including insoluble heavy metals as colloidal materials from plant chemicals such as batteries etc.

Groundwater may be polluted due to infiltration of contaminated runoff chemical materials and sewage water. Additionally, the project may lead to faster infrastructure development near the project area. This will exert stress on the availability of groundwater in the project area.

To produce 120 MWp of electricity a total of 2,40,000 solar panels will be used, assuming each panel has a capacity of 650 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 of the Indian Council of Energy, Environment and Water that suggest using around 3 to 8 liters[1] of water per panel for cleaning solar panels.

Therefore, the total water demand for washing this panels will be (considering 5 liters per panel) –

Water Usage per Cleaning *= (2,40,000 panels × 5 liters/panel = 12,00,000 liters per cleaning (approx.)*

Approximately 12,00,000 liters per cleaning of water would be required for cleaning all the panels. Generally solar panels cleaning will be done once a month; therefore, the daily water consumption will be = *(12,00,000 / 30) liters/day.*

= 40,000 liters/day (approx.)

Mitigation

To meet the water demand, as per pre-feasibility study, groundwater will be used and water will be collected from deep well. As this area is adjacent to the Meghna River, there will be less impact on groundwater because of easy recharge of water table and aquifer. However, as per DPHE or WARPO guidelines an NOC might be required for groundwater consumption.

The following mitigation measures are proposed to attenuate water quality related impacts:

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

[1] https://renewablewatch.in/2020/12/03/waterless-way/

7.5.3.3 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 1-2 m); however, as distance increases, noise will be greatly reduced, not to mention that they do not generate noise during nighttime. Photovoltaic (PV) systems make no noise and cause no pollution in operation. Solar energy is clean, silent, and freely available.

Mitigation

These noise impacts are not considered to significantly harm animals nor cause impacts on a population level. The increased noise levels are considered occupational noise that requires occupational health and safety measures. The worker inside the project area should use earplug, earmuffs during the operation of diesel generator, noisy equipment or vehicles and any other noisy maintenance works.

7.5.3.4 Air Quality

Impact

No emissions are expected to be released during the operation phase, because solar PV power plants do not release greenhouse gases or any toxic pollutants during their operation. But dust emission can occur during the cleaning of dust of solar panels. As a result, no significant impacts on ambient air quality are anticipated during the operation phase.

It is worth mentioning that solar power plants have very low air emissions of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds, and the greenhouse gas like carbon dioxide during operations compared to fossil fuel power generation facilities, since solar power plants do not involve combustion processes. Dust emission may also occur from cleaning or housekeeping works, vehicle movement and from unpaved or bare fields and civil and other maintenance works.

Mitigation

APSCL, the project owner shall control emitted dust and gaseous pollutants from such operations through the proposed emission control procedures described in the Environmental Management Plan (EMP) included in this report. Washing of panels by water is preferable to brooming for dust cleaning of solar panels in this regard.

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 significant pollution in operation. PV panels should be cleaned and maintenance should be done regularly for make dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for proper management of PV panels or APSCL will do the proper management of it as per their policy to ensure no stress on the environment and community.

7.5.3.5 Soil

Impact

Soil impacts during operation phase are limited to accidental spillage of lubricant, fuel and other chemicals and e-waste 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. The surrounding lands will not be affected by operational works of this plant.

Mitigation

Through implanting spill response procedures, and proper storage and handling of any chemicals and oils 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.

7.5.3.6 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.

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.

7.5.3.7 Waste Generation

Impact

PV modules: PV modules may produce some solid and e-waste 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.

Waste water: Water consumption in PV panel cleaning operations can be a major operating cost over the lifetime of a solar panel installation. Control of water use is a key element to the economic viability and environmental stewardship of many PV installations.

Water requirement for cleaning panels (and its frequency) mainly depends on the cost and the environmental conditions of project area. In the dry and dusty season, the water requirement will be higher but during the monsoon the water consumption will be very minimum or no consumption.

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

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 with maintenance regularly to make dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for proper management of PV panels or APSCL will do the proper management of it as per their policy to ensure no stress on the environment and community.

Cleaning of solar panels will be conducted on an overcast day, early in the morning or in the evening. If the sun is heating 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 if possible.

7.5.3.8 Employment Opportunities

Impact

During the operation phase job opportunities will be created for executing the project activities. Local people can be involved in the project activities as per their skill.

Mitigation

During the recruitment of workers and other professionals, local poor and distressed people followed by project affected and poor women should be given priority as per their competence and skill. While recruiting and giving wage gender equity must be maintained. Being a government company, APSCL will follow and ensure the compliances here.

7.5.3.9 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.
- Hazard from Substation and Transmission line.

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.

Emergency Fire Hazard: Since this is a 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 in 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, this do not generally pose 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.

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.

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.

Transmission Line: Workers specially engaged with the operation of transformers and other electrical equipment will be affected. Short circuits may occur if large trees come in contact with the substation conductor or transmission line cable during storm and as a result, accidents may occur. Even if birds, or any other avian species like bet, crow, pigeon etc., come in contact with substation conductor or transmission line cable and unexpected and natural event like lightning can also cause fire and explosion hazards here.

Mitigation

APSCL the project owner 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 and non-compliance events. Plantation will be done maintaining proper guidelines and right of way. Both vertically and horizontally at least 2.0 ft to 2.5 feet clearance or more as per standard will be maintained between transmission line cable and inner distribution line cable to avoid any short circuit and harm to bat, pigeon and avian species and subsequent fire or explosion hazard.

The Contractor, under the supervision of owner and 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 are assessed and all prevention and mitigation measures are in place accordingly. The contractor shall ensure all workers during construction comply with safety procedures through training, daily toolbox talk, awareness, monitoring 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.

7.5.4 Decommissioning Phase

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

7.5.4.1 Visual Amenity

Impact

During the dismantling of the solar power plant, removal of ancillary facilities, and the rehabilitation of the project area (if needed), visual intrusions will be likely.

Mitigation

Their consequence will be negligible due to 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.

7.5.4.2 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.

7.5.4.3 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

APSCL the project owner shall control emitted dust and gaseous pollutant from such operations through the proposed emission control procedures described in the Environmental Management Plan (EMP) included in this report.

7.5.4.4 Soil

Impact

During the decommissioning phase, the activities are anticipated to have a medium impact to soil. This is due to possible accidental leakage of fuel, oil, e-wastes 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, e-wastes and might be harmful for soil quality.

7.5.4.5 Terrestrial Ecology

Impact

The activities associated with decommissioning will involve dismantling of the solar power plant and removal of its facilities. This temporary phase could result in some additional noise and dust disturbances. These activities are not anticipated to harm any flora elements due to absence or scarcity of vegetative cover within and around project area, provided dust suppression measures and 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.

7.5.4.6 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, 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 wastes are the other waste besides 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. 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 ensures that potentially harmful materials are not released into the environment and reduces the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.

7.5.4.7 Employment Opportunities

Impact

Short-term job opportunities may arise during decommissioning; however, this can negatively affect temporary personnel at the solar power plant since the facility will cease its operations, therefore temporary staff may lose their jobs. But it will not create any problems to permanent employees.

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 according to their competency as much as practicable.

7.5.4.8 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

APSCL the project owner will ensure all health and safety measures are in place to prevent accidents and\or reduce the consequences of non-conformance events. APSCL shall ensure all prospect risks during decommissioning and dismantling phase are assessed and all safety, prevention and mitigations measures are in place accordingly.

7.6 Summary of Significant Impacts

Table 7.4 presents a summary of the anticipated impacts during the planning and construction, operation, and decommissioning phase of the Solar Power Plant Project.

Table 7-4: Summary of Anticipated Impacts for Solar Power Plant

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Planning and Construction Phase									
Landfilling/ Earthworks	Soil erosion from the fill material changes in existing landscape.	Short term	Local	Reversible	Certain	Medium	Severe	Moderate Negative	Low Negative
Flood Hazards	Project area is lowland, have risk of flood	A land development of approximately 3 meters or higher will be necessary to counteract potential flood levels before establishing the solar power plant. Drainage systems need to be developed for proper drainage of water to the river.							
Visual Amenity	The construction activities that are likely to create a visual intrusion and a disruption to aesthetics include: materials lay down, excavation, backfilling, and spoil.	Short term	Local	Reversible	Certain	Medium	Severe	Moderate Negative	Low Negative
Water Resources	Surface water quality in the adjacent rivers, channels, and ponds might insignificantly degrade during construction stage due to disposal of solid wastes, sewage effluent, and dredged materials, accidental spillage of petroleum products, cement, and noxious chemicals.	Could be long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	High Positive

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Noise	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Long term	Local	Reversible	Certain	Medium	Mild	Moderate Negative	Low Negative
Air Quality	Dust and exhaust emissions are likely to be generated by the construction equipment during the construction phase of the proposed solar plant. Motor vehicles that will be used to ferry construction materials would cause air quality impact by emitting pollutants through exhaust emissions.	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	High Positive
Soil	Construction activities are expected to result in significant soil loss. The excavation, leveling and other earthworks are the possible source to disturb the soil due to the removal of top soil, which could trigger soil erosion process.	Long term	Local	Reversible	Certain	Medium	Mild	Low Negative	High Positive

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Terrestrial Ecology	Construction activities could disturb existing habitats (flora, fauna, and avifauna) and any threatened or endangered species that 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
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
Employment Opportunities	Positive benefits of the project may arise either from short-term job opportunities during construction, or from long-term job opportunities during operation. It is important that construction and operation job to be targeted to the local people within the project area where feasible.	Short term	Local	Reversible	Likely	High	Severe	Low Negative	High Positive

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
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 even death due to accidents.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Archaeology and Cultural Resources	The field visits conducted at the project site and it is found that there are some schools, colleges, and madrasah located within 1km of the project area. Hence, it can be said that there will be some minor impacts from construction on these receptors	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Operation Phase									
Visual Amenity	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 interaction with surrounding landscape.	Long term	Local	Reversible	Likely	Medium	Low	Low Negative	Low Negative
Water Resources	Risk of soil, surface water and groundwater contamination	Long term	Local	Could be	Likely	Medium	Mild	Moderate Negative	Low negative

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	during the various operational activities from 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.			irreversible					
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
Air Quality	Solar power plants have very low air emissions of air pollutants such as dust, sulfur dioxide, nitrogen oxide, carbon monoxide, volatile organic compounds, and the greenhouse gas e.g. carbon dioxide during operations.	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	High Positive
Soil	Soil impacts during operation phase are limited to accidental	Long term	Local	Reversible	Certain	Medium	Mild	Low Negative	High Positive

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	spillage of lubricant, fuel and other chemicals, e-wastes 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.								
Terrestrial Ecology	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
Waste Generation	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.	Long term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Employment Opportunities	During the operation phase, job opportunities will be created for executing the project activities. Local people can be involved in the project activities as per their skill.	Short term	Local	Reversible	Certain	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Occupational and 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
Decommissioning Phase									
Visual Amenity	During the dismantling of the solar power plant, removal of ancillary facilities, and the rehabilitation of the project area (if needed), visual intrusions will be likely.	Long term	Local	Reversible	Likely	Medium	Low	Low 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
Air Quality	Dismantling/decommissioning activities will likely result in an increased level of dust and particulate matter emissions, gaseous emissions from vehicles that in turn will directly affect ambient air quality.	Short term	Local	Reversible	Certain	Medium	Low	Moderate Negative	Low Negative

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Soil	During the dismantling/decommissioning phase, the dismantling activities are anticipated to have an impact of medium significance to soil. This is due to possible accidental leakage of fuel, oil, or chemicals, e-wastes during demolition activities.	Long term	Local	Reversible	Certain	Medium	Mild	Low Negative	High Positive
Terrestrial Ecology	The activities associated with decommissioning will involve dismantling of the solar power plant and removal of its facilities. This temporary phase could result in some additional noise and dust disturbances.	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	Moderate Positive
Waste Generation	The most significant source of soil pollution is the damage of PV panels, inverters, e-wastes in case of major accidents. These contain chemicals, e-wastes and may be harmful for soil quality.	Long term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Employment Opportunities	Short-term job opportunities may arise during decommissioning; however, this can negatively	Short term	Local	Reversible	Certain	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impacts	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	impact temporary personnel at the solar power plant since the facility will cease its operations, therefore temporary staff may lose their jobs.								
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 even death due to accidents.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Traffic	The anticipated impacts during dismantling/decommissioning are similar to those for the construction phase, where the heavy machinery that transports disassembled parts of the solar power plant facility might be of more significance than normal vehicles and pickups.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative

8 CLIMATE CHANGE IMPACTS ASSESSMENT

8.1 Overview

Climate change is one of the significant factors considered in the Environmental/Ecological Assessment. Climate change assessment is done for the current assessment process with the objective to provide assurance that climate change implications are being appropriately considered in the design of the proposed project. The specific objectives are to:

- Support the project authority manage or reduce the potential risk posed by the impacts of climate change to the project and contribute to climate change action;
- Provide project managers of the co-financiers with information that will assist their broader climate change action; and
- Help decision makers to address climate change implications in a risk management context.

The current assessment is conducted climate change related investigation based on globally and nationally published climate change prediction reports focusing particularly on the variability of rainfall intensity, temperature changes, sea level rise. These variables are directly related to the functionality and durability of the proposed project.

To conduct the assessment literature review has been conducted available from different national climate change relevant agencies, such as Department of Disaster Management, Department of Environment and Bangladesh Meteorological Department. International and National Climate Change Communication reports, especially the 5th Intergovernmental Panel on Climate Change IPCC Assessment report has been reviewed for relevant major sources of information for impact and vulnerability projection on global and regional temperature, sea level rise, rainfall fluctuation and their impacts on proposed infrastructures. This climate change projection information will help in making the proposed project climate resilient.

8.2 Climate Change Impact Considerations

The impacts consideration assessed the hydro-meteorological parameters that are directly and indirectly exposed to climate change phenomenon for facilitating the detail design and environmental impact assessment process. Projecting the impact of global climate change on any infrastructure/related natural resources requires representation of climate processes on a variety of spatial scales, from global down to local level. In this regard, under the current scope of works, neither any climatic models nor any hydro-dynamic simulation was newly conducted; rather raw data available from different existing climate and hydro-metric observations and regional projections from different sources were used. The assessment provides some recommendation/potential solutions/mitigation for climate resilient structures based on the findings of the literature review.

8.2.1 Climate Projections: Temperature

The IPCC 5th assessment report (AR5) indicates that the global mean temperatures will continue to rise over the 21stcentury if greenhouse gas (GHG) emissions continue unabated. Global surface temperature change for the end of the 21stcentury is likely to exceed 2.5°C relative to 1986 to 2005 for all RCP (Representative Concentration Pathway) scenarios except RCP2.6, and warming will continue beyond 2100 under all RCP scenarios except RCP2.6. Table 8.1shows the projected change in global mean surface air temperature.

Table 8-1: Projected Change in Global Mean Surface Temperature (Likely Range)

Time Period (Base Year 1986 to 2005)	Temperature (°C)			
	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
2046-2065	0.4 to 1.6	0.9 to 2.0	0.8 to 1.8	1.4 to 2.6
2081-2100	0.3 to 1.7	1.1 to 2.6	1.4 to 3.1	2.6 to 4.8

On the other hand, for South Asia the report projections indicate that, compared to the average in the 20th century, average annual temperatures could rise by more than 2°C over land in most of South Asia by the mid-21st century and exceed 3°C, up to more than 6°C over high latitudes, by the late 21st century under a high-emissions scenario (RCP8.5); while under a low-emissions scenario (RCP 2.6) average temperatures could rise by less than 2°C in the 21st century, except at higher latitudes, which could be up to 3°C warmer.

Even though, IPCC assessment report does not provide any country level projections, under the Comprehensive Disaster Management Programme (CDMP II) of Department of Disaster Management (Ministry of Disaster Management & Relief) acclimate model PRECIS (Providing Regional Climates for Impacts Studies) is used to get climate change scenario for Bangladesh. Table 8.2 shows the projected temperature change for Bangladesh under CC scenario.

Table 8-2: Projected Temperature Change for Bangladesh under CC Scenario

Time Period	Temperature (°C)		
	Annual	Monsoon (Jun-Sep)	Winter (Dec-Feb)
(Base Year 1961-1990, Mean)	24.6	31.83	16.2
2071-2100	4.34	3.43	5.37
2011-2041	1.49	1.50	1.80

8.2.2 Climate Projections: Precipitation

AR5 reports that, in the long term, global precipitation will increase with increased global mean surface temperature. Global mean precipitation will increase at a rate per degree Celsius smaller than that of atmospheric water vapor. It will likely increase by 1 to 3% / °C for scenarios other than RCP2.6, for RCP2.6 the range increase will be 0.5 to 4% / °C at the end of the 21st century.

In the South Asian region AR5 projections indicate that under a high-emissions scenario more rainfall will be very likely at higher latitudes by the mid-21stcentury and over southern areas of the late 21st century. Under a low-emissions scenario, more rainfall at higher latitudes is likely by mid-century but no likely substantial changes in rainfall patterns at low latitudes. More frequent and heavy rainfall days are projected over parts of South Asia. (IPCC, 2007)

Analysis of past trend of rainfall by (CDMP II, 2013) study reveals that all-Bangladesh annual normal rainfall has not changed much in Bangladesh. For a period of 30 years (1980-2009), the annual normal rainfall is found to be 2,306 mm, such rainfalls were 2,298 and 2,314 mm during 1960-1989 and 1970-1999, respectively. On the other hand, Bangladesh normal rainfalls in different seasons show some mixed trend. Pre-monsoon (March-May) and post-monsoonal (October-November) normal rainfalls have increased and the monsoonal (June- September) normal rainfall has decreased over the three time periods (1960-89, 1970-99 & 1980-2009). The winter (December-February) normal rainfall has

increased in the last two periods compared to the first period. The change in projected precipitation for Bangladesh, as found by PRECIS run (CDMP II report) is presented in the following Table 8.3.

Table 8-3: Projected Precipitation Change for Bangladesh under CC Scenario

Time Period	Precipitation (mm/day)		
	Annual	Monsoon (Jun-Sep)	Winter (Dec-Feb)
(Base Year 1961-1990, Mean)	3.5	7.24	0.59
2071-2100	0.90	1.43	0.03
2011-2041	0.64	1.40	-0.05

8.2.3 Climate Projections: Sea Level Rise

AR5 predicted, it is very likely that the rate of global mean sea level rise during the 21st century will exceed the rate observed during 1971–2010 for all Representative Concentration Pathway (RCP) scenarios due to increases in ocean warming and loss of mass from glaciers and ice sheets Table 8.4.

Table 8-4: Global Mean Sea Level Rise (Values Shown as Median and Likely Range)

Time Period (Base Year 1986-2005)	Sea Level Rise (m)			
	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
2020	0.08 [0.06 to 0.10]	0.08 [0.06 to 0.10]	0.08 [0.06 to 0.10]	0.08 [0.06 to 0.11]
2050	0.22 [0.16 to 0.28]	0.23 [0.17 to 0.29]	0.22 [0.16 to 0.28]	0.25 [0.19 to 0.32]
2080	0.35 [0.24 to 0.48]	0.41 [0.28 to 0.54]	0.40 [0.28 to 0.53]	0.50 [0.37 to 0.67]
2100	0.44 [0.28 to 0.61]	0.53 [0.36 to 0.71]	0.55 [0.38 to 0.73]	0.74 [0.53 to 0.98]

It is very likely that in the 21st century and beyond, sea level change will have a strong regional pattern, with some places experiencing significant deviations of local and regional sea level change from the global mean change. However, no local level SLR data could be found for Bangladesh based on the AR_5 by the current assessment. The potential impact of SLR on the infrastructures of the proposed project described in the following section based on available literature.

8.3 Potential Climatic Impacts of the Project

The establishment of a 120 MW solar power plant in Chanpur Union, Raipura Upazila, Narshindi district of Bangladesh holds the promise of contributing significantly to the country's renewable energy capacity. However, a thorough climate impact assessment is essential to evaluate both positive and negative aspects and to implement effective mitigation measures.

8.3.1 Climate Change Action: Potential Carbon Emission Reduction through the Project

Potential carbon emission reduction from a 120 MW solar power plant establishment was calculated by estimating the amount of electricity generated by the solar plant and comparing it to the carbon emissions that would have occurred if the same amount of electricity were generated from conventional fossil fuel sources.

The general approach is to determine the carbon intensity of the electricity mix that the solar power plant is displacing. The carbon intensity is typically measured in grams of CO_2 emitted per kilowatt-hour (gCO_2/kWh) of electricity generated. Let's assume a hypothetical carbon intensity for

conventional fossil fuel-based electricity generation in Bangladesh, which might be around 600 gCO_2/kWh[2]. This is just an estimate, and actual values can vary. Therefore, the annual carbon emission reduction is -

At first, Electricity Generated (kWh/year) = Capacity (MW) × Capacity Factor × Hours in a Year

Here the common capacity factor for solar power plants (20%) is used.

Therefore,

Electricity Generated (kWh/year) = 120 MW × 0.20 × 8760 hours/year

≈ 210,240,000 kWh/year

Again, Carbon Emission Reduction ($kgCO_2$/year)

= (Electricity Generated (kWh/year)1000) × Carbon Intensity (gCO_2/kWh)

Using the assumed carbon intensity of 600g CO_2/kWh:

Carbon Emission Reduction ≈ (210,240,000 x 1000) × 600

≈ (1000 x 210,240,000) × 600

≈ 126,144,000 kg CO_2/year

Therefore, this 120 MW solar power plant project under these assumptions could potentially result in a reduction of approximately 1,26,144 metric tons of carbon dioxide emissions per year compared to conventional fossil fuel-based electricity generation.

8.3.2 Positive Aspects:

- **Renewable Energy Generation:** The solar power plant is a critical component of Bangladesh's efforts to transition to a more sustainable energy mix. By harnessing solar energy, the project contributes to the reduction of greenhouse gas emissions and dependence on non-renewable energy sources.
- **Reduced Greenhouse Gas Emissions:** Solar energy is inherently clean, emitting minimal greenhouse gases during electricity generation. This translates to a substantial reduction in the carbon footprint compared to conventional fossil fuel-based power plants.
- **Job Creation:** The construction and operation of the solar power plant will create employment opportunities for the local population as well as for other competent persons. Jobs may include roles in construction, maintenance, and operation of the facility, providing economic benefits to the community.
- **Local Economic Development:** The solar power plant has the potential to stimulate local economic development. Supporting businesses related to the solar industry, such as contractors, maintenance services and equipment suppliers, can create a ripple effect, fostering economic growth in the region.
- **Infrastructure Development:** The project's construction phase will necessitate the development or improvement of local infrastructure, such as roads and power transmission

[2] Abdallah, L., El-Shennawy, T. Evaluation of CO_2 emission from Egypt's future power plants. *Euro-Mediterr J Environ Integr* **5**, 49 (2020). https://doi.org/10.1007/s41207-020-00184-w

lines. This not only facilitates the project's implementation but also contributes to broader infrastructure enhancements in the region.

8.3.3 Negative Aspects:

- **Land Use and Habitat Disruption:** The installation of solar panels requires substantial land use, potentially leading to habitat disruption and fragmentation. Mitigation measures should focus on minimizing the impact on local ecosystems and biodiversity.
- **Water Consumption:** Depending on the technology employed, solar power plants may require water for cleaning purposes. In water-scarce regions, this can pose a challenge and necessitates the implementation of water-efficient technologies and recycling systems.
- **Chemical Use in Panel Production:** The manufacturing process of solar panels involves the use of certain chemicals. If not managed properly, these chemicals can lead to environmental pollution. Strict controls and regulations, along with proper disposal and recycling, are crucial mitigation measures.
- **Waste Generation:** Solar panels have a finite lifespan, and their disposal can generate electronic waste. A comprehensive waste management plan, including recycling options for decommissioned solar panels, is essential to prevent environmental contamination.
- **Visual Impact:** Some community members may perceive solar panels as visually intrusive, impacting the aesthetics of the local landscape. Visual screening and landscaping measures can be implemented to minimize the visual impact and integrate the project into the surroundings.

8.3.4 Mitigation Measures:

- Have to implement measures such as aforestation and habitat restoration to minimize habitat disruption and support local biodiversity.
- Implementation of water-efficient technologies for cleaning and cooling solar panels such as rainwater harvesting systems to reduce reliance on external water sources and establish recycling systems to minimize water consumption.
- Developing and implementing a comprehensive waste management plan for the entire lifecycle of solar panels. This includes proper disposal and recycling options for decommissioned panels, minimizing the environmental impact of electronic waste.
- Designing and implementing visual screening measures, such as landscaping and natural barriers, to minimize the visual impact of the solar power plant. Engage with the local community to incorporate their preferences and address concerns regarding aesthetics.
- Conducting extensive community consultations and awareness programs to address concerns and ensure the community's active participation in the project. This can include job training programs, facilitating local business opportunities, and addressing cultural or social considerations.
- Establishing a robust monitoring and evaluation system to track the environmental and social performance of the solar power plant. Implement adaptive management strategies, allowing for adjustments based on ongoing assessments and feedback from local stakeholders.

- Providing job training programs for local residents, enhancing their skills, and ensuring they can actively participate in the construction and operation works of the solar power plant. Promoting local sourcing of materials and services to further benefit the local economy.

9 DISASTER IMPACT ASSESSMENT

Disaster is another significant factor considered in the Environmental/Ecological Assessment in a disaster-prone country like Bangladesh. Disaster impact assessment is done to provide assurance that possible disaster and natural hazards are being appropriately considered in the design of the proposed project.

9.1 Objective

Disaster Impact Assessment has specific objectives such as:

- Identification of significant disasters that should be assessed for the project.
- Assessment of the significant impacts of considered disasters and suggesting general management and mitigation measures for the disasters.

9.2 Approach Methodology

The current assessment has conducted disaster related investigation based on globally and nationally published disaster related reports focusing particularly on flooding, waves, cyclones, tsunami and earthquakes. Literature review has been conducted available from different national climate change relevant agencies, such as Department of Disaster Management, Department of Environment, and Bangladesh Meteorological Department. This disaster impact projection information will help in making the proposed project climate resilient.

9.3 Disaster Impact Assessment Framework

In this section, a first draft of the framework for natural disasters impact evaluation is present. The objective of the framework relays on helping crisis managers to estimate disasters' impacts in different sectors.

Figure 9-1: Disaster Impact and Risk Management

9.4 Impact Analysis of the Project Area

Disasters mainly occur in this region from the event of natural hazards which are naturally occurring physical phenomena. They can be: Geophysical: (a hazard originating from solid earth such as earthquakes, landslides) Hydrological: caused by the occurrence, movement and distribution of water on earth (such as floods). Being in a low-lying area and beside the bank of the Meghna River the project area is most likely to cause flood almost every year. River erosion is another natural event that takes place in this region. As per the BNBC 2022, the project area also falls under the seismic zone-3 with a seismic co-efficient of 0.28g.

9.5 Assessment of Disaster of the Project

Planning Commissions and ADB (PC, 2018) have prepared a categorized chart comprising different types of hazards with respect to their hazard-prone districts:

Table 9-1: List of District and Respective Exposure to hazard types

Division	District	Potential Hazards	
Dhaka	1. Dhaka	F	C = Cyclone D = Drought Eq = Earthquake Er = Erosion F = Flood FF= Flash flood S = Salinity SLR = Sea-level Rise L = landslides SS = Strom Surge
	2. Faridpur	Er, F	
	3. Gazipur	F	
	4. Gopalganj	Er, F, S	
	5. Kishoreganj	Er, F, FF	
	6. Madaripur	Er, F	
	7. Manikganj	Er, F, Eq	
	8. Munshiganj	Er, F	
	9. Narayonganj	Er, F	
	10. Narsingdi	**F**	
	11. Rajbari	Er, F	
	12. Shariatpur	Er, F	
	13. Tangail	Er, F	

9.5.1 Flood Hazard

Bangladesh is one of the first line victims of ongoing and upcoming threats of climate change due to its geographical location, poverty and higher dependence on climate sensitive sectors like agriculture. The Merciless face of climate change and sea level rise reflects in the form of intense and frequent cyclone with tidal surge, subsequent flooding, salinity regression, extreme temperature, and precipitation along with local problems like river erosion, water logging and weak institutional framework poses the highest vulnerability in Bangladesh. Flooding is caused downstream from dams when reservoirs, which normally help to prevent downstream areas of rivers from flooding, are opened due to unusually high levels of precipitation to prevent the reservoir from overflowing the dam. A summary of year-wise percentage of areas inundated by flood is given in below Table 9.2.

Table 9-2: History of Flood Occurrences in Bangladesh

Year	Duration	Causes	AI (sq.km)/%	CD (million TK)	PA (million)	Deaths
1948-1953	**	**	**	**	**	**
1954	June and July	Flash Floods	36,920	1,200.00	30	112
1955	**	**	50,700	1,290.00	**	129
1956	**	**	35,620	900.00	**	**
1962	**	**	37,440	560.00	**	117
1963	**	**	43,180	580.00	**	**
1968	**	**	37,300	1,160.00	**	126
1970	August	Monsoon Rain	42,640	1,100.00	30	87
1971	April and July	Heavy Rain	36,475	**	**	120
1974	**	Monsoon Rain	52,720	28,490.00	30	1,987
1984	May	Heavy Rain	28,314	4,500.00	20	553
1987	July and Aug.	Monsoon Rain	57,491	35,000.00	30	1,657
1988	Aug. and Sep.	Monsoon Rain	89,970	100,000.00	47	2,379
1998	Aug. and Sep.	Monsoon Rain	100,000	120,000.00	55	1,050
1999	July and Sep.	Monsoon Rain	100,000	70400.00	30	918
2004	Aug. and Sep.	Monsoon Rain	58,000	200,000.00	36	750
2007	July and Sep.	Heavy Rain	32,000	72,535.00	16	3363
2008	September	**	3,394.13	**	1	7
2010	June	Floods and Landslides	**	**	**	56
2012	23 June	Floods and Landslides	230,000	**	5	139
2014	25 August	Heavy monsoon rains, river overflow	300	**	0.63 hh	9
2017	June and August	Heavy monsoon rains, river overflow	2.04%	**	6.77	115
2019	July and September	heavy rainfall	5320	**	20	30
2020	July and August	Heavy monsoon rains, river overflow	37%	**	30	251

Source: FFWC, 2021

N.B.: AI = Area Inundated, CD = Cost of Damage, PA = Population Affected; ** Indicates that data were not available; hh = households

Due to the location of Northwest Bangladesh, the situation in this area is deeply inter-related with Himalayan riverine systems and its tributaries and therefore many communities along the major rivers (Brahmaputra and Teesta) are at risk. It is expected that climate change induced alterations in temperature would affect the timing and rate of snow melt in the upper Himalayan reaches. Recent study shows that glaciers in the Himalaya are receding faster than in any other part of the world and, if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate (IPCC, 2007c). Four major floods occurred over a span of 17 years from 1987 to 2004. The number of deaths during monsoon floods, even during extraordinary events, is comparatively small. Floods occur in the month of Ashar to Ashwin. However, the severe damages took place in the month of Srabon and Vadro. The second places hazard, riverbank erosion happened at the same time. The agricultural drought occurs in the months of Kartik to Agrahayan during Aman cultivation and severely occurs in the month of Kartik. Pest infestation occurs in the month of Ashwin, Kartik and Agrahayan, during aman crop cultivation, when rainfall is rare. Cold wave is another problem that affects in the months of Poush and Magh; it has an effect on human health and rabi crops like potato and mustered. Active floodplains lie within and along the main river

channels. These are marginal environments for human occupancy and are highly vulnerable to floods and riverbank erosion. Stable floodplain land provides good crops in normal years, but kharif crops are vulnerable to untimely or unusually high floods.

The site is situated in the lowlands of the Meghna and Brahmaputra floodplains and is mostly fallow and barren land, except for a few elevated areas that may become submerged during monsoons or floods. The topography is not completely flat, but rather undulating and medium-high to low-flat, allowing for easy drainage of rain or flood water into adjacent rivers. Floods have a devastating impact on the displaced population. The majority of the people have been moving from one place to another. They tend to have experienced changes in their lifestyle with intensity and number of incidences of disaster events. It was clear that households cope differently when affected by this disaster. The communities should be encouraged to build houses using durable materials and away from the disaster-prone area as a way of coping with this disaster. A map is provided below that shows the magnitude of the flood impact in the project area.

Based on the data reviewed, it has been determined that the proposed area was affected by floods in 1988 and 1998. Additionally, the proposed project site is considered a normal flood-prone area, according to the flood-prone area map provided by the Water Development Board. According to the local people, some of the area of the site goes underwater in the rainy season. From Flood Forecasting and Warning Center (FFWC) of BWDB the nearest station of measurement is at Bhairab bazar Upper Meghna of Kishoreganj District. The Recorded Highest Water Level (RHWL) is 7.32 mMSL[2]. The topographic map of the site shows that the average elevation of site is around 5.0 mMSL[3]. Considering, the safety factor of 0.68 m the difference is around 3 mMSL. As the land in the proposed area is located in a low-lying area. there are two options that can be considered when implementation of the project:

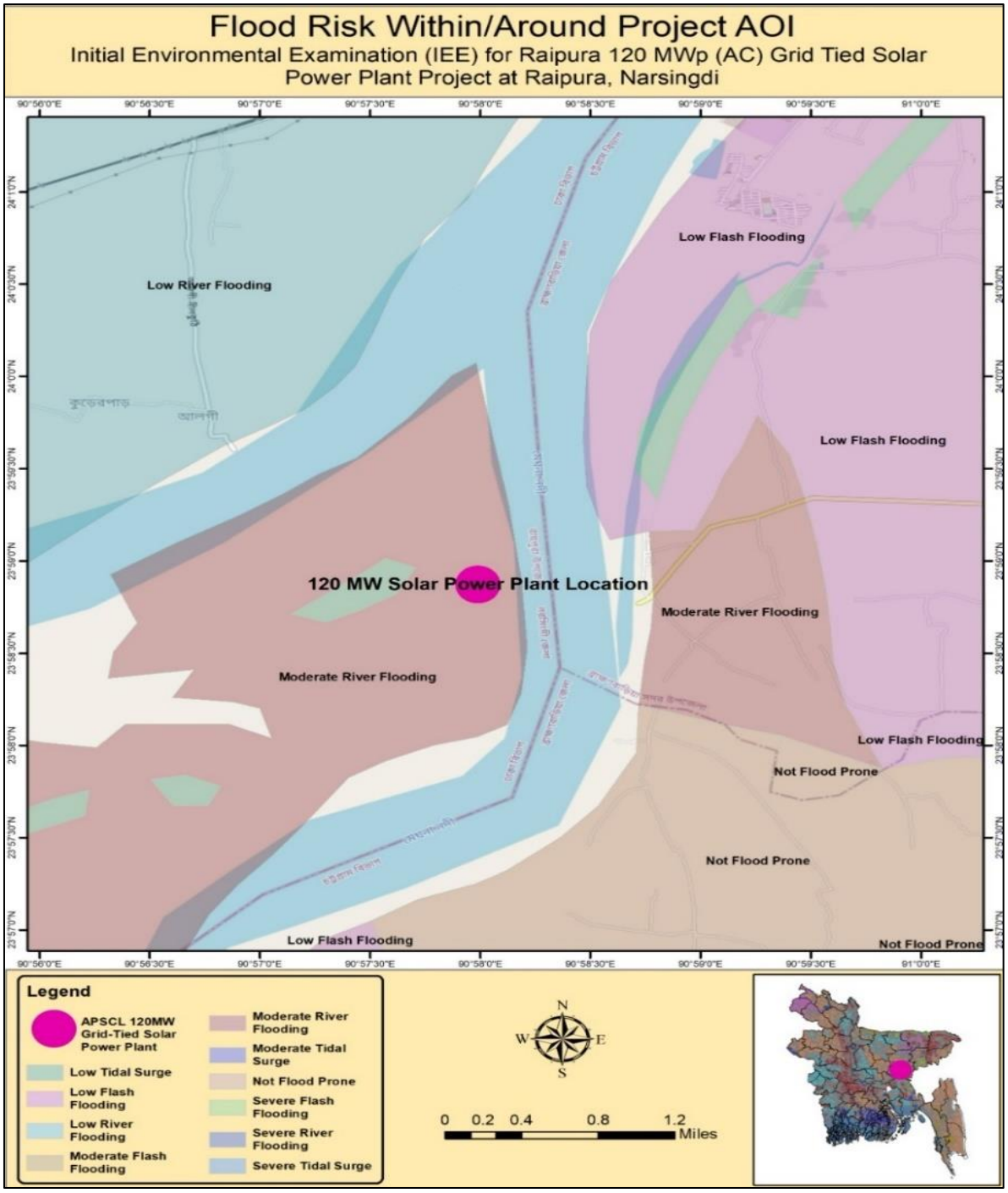


Figure 9-2: Flood Risk Map within Project Area

9.5.2 River Erosion

Riverbank erosion is in second place, not in terms of deaths, but in terms of the process of impoverishment and landlessness of the many people affected. According to the water development board, due to the flash flood incident in Meghna River, river erosion often occurs on the bank of Meghna, affecting the life and livelihood of these area dwellers, making many people landless. The site chosen for the project is located on a permanent char (River Delta) is surrounded by the Meghna and old Brahmaputra rivers on both sides and is composed of fluvial sediments and is a stable area, protected from river erosion.

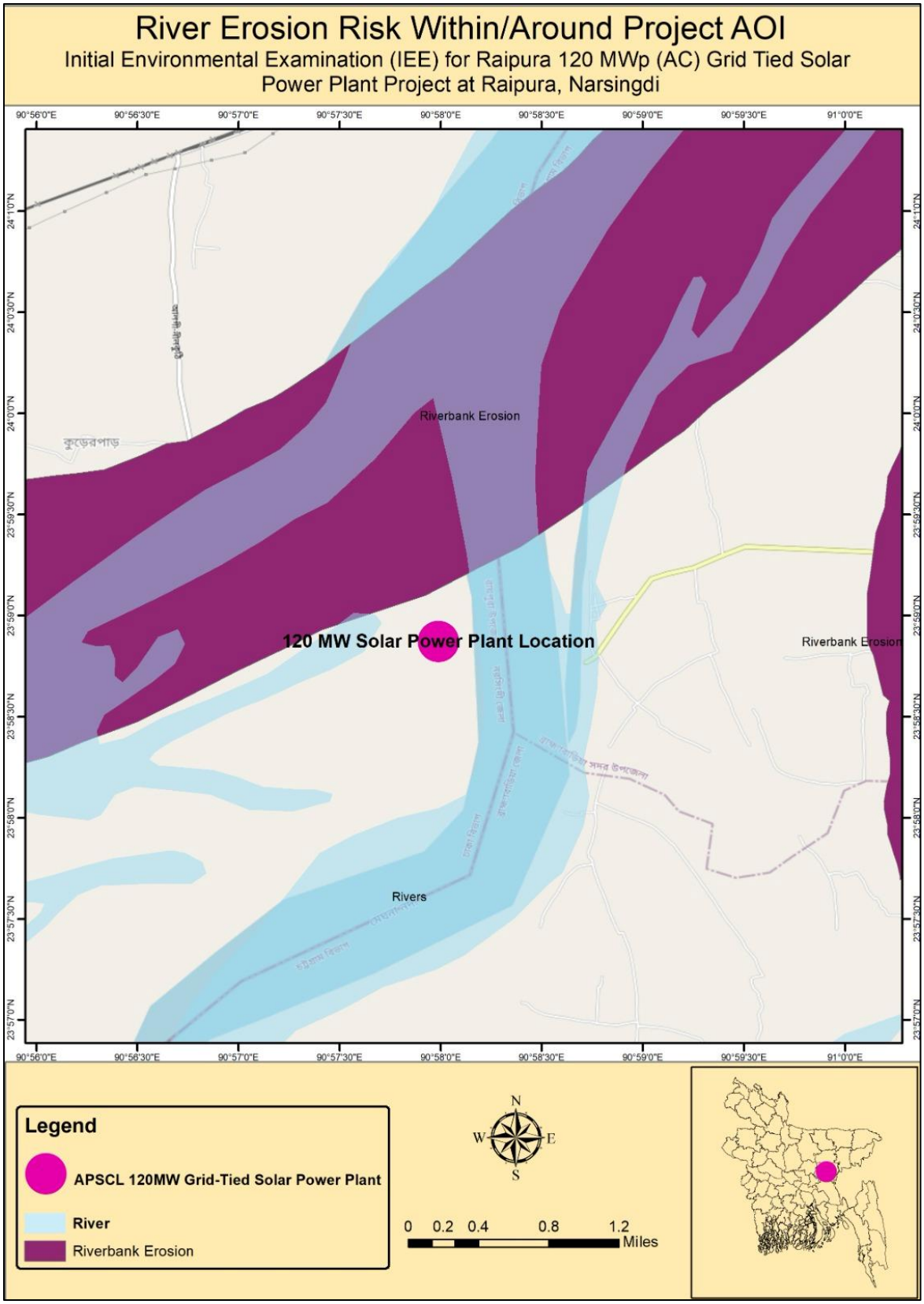


Figure 9-3: River Erosion Map within Project Area

9.5.3 Drought

Due to the scarcity of rainfall and unavailability of surface water in this region during the month of April to July, the project area under Narsingdi district faces drought almost every year. Practice to

withdraw groundwater is also sometimes impossible due to lower acquirer and fuel price increase. Thousands of hectors of sun-burnt cultivable lands develop cracks as soil moisture comes to the lowest level. Adequate Rainfall restores the drought situation in this region during monsoon season. Though the project area is adjacent to the river, both surface and groundwater withdrawn is very difficult for cultivation here due to increased fuel price and expenses. As a result drought occurs here almost every year and so on lands are barren here.

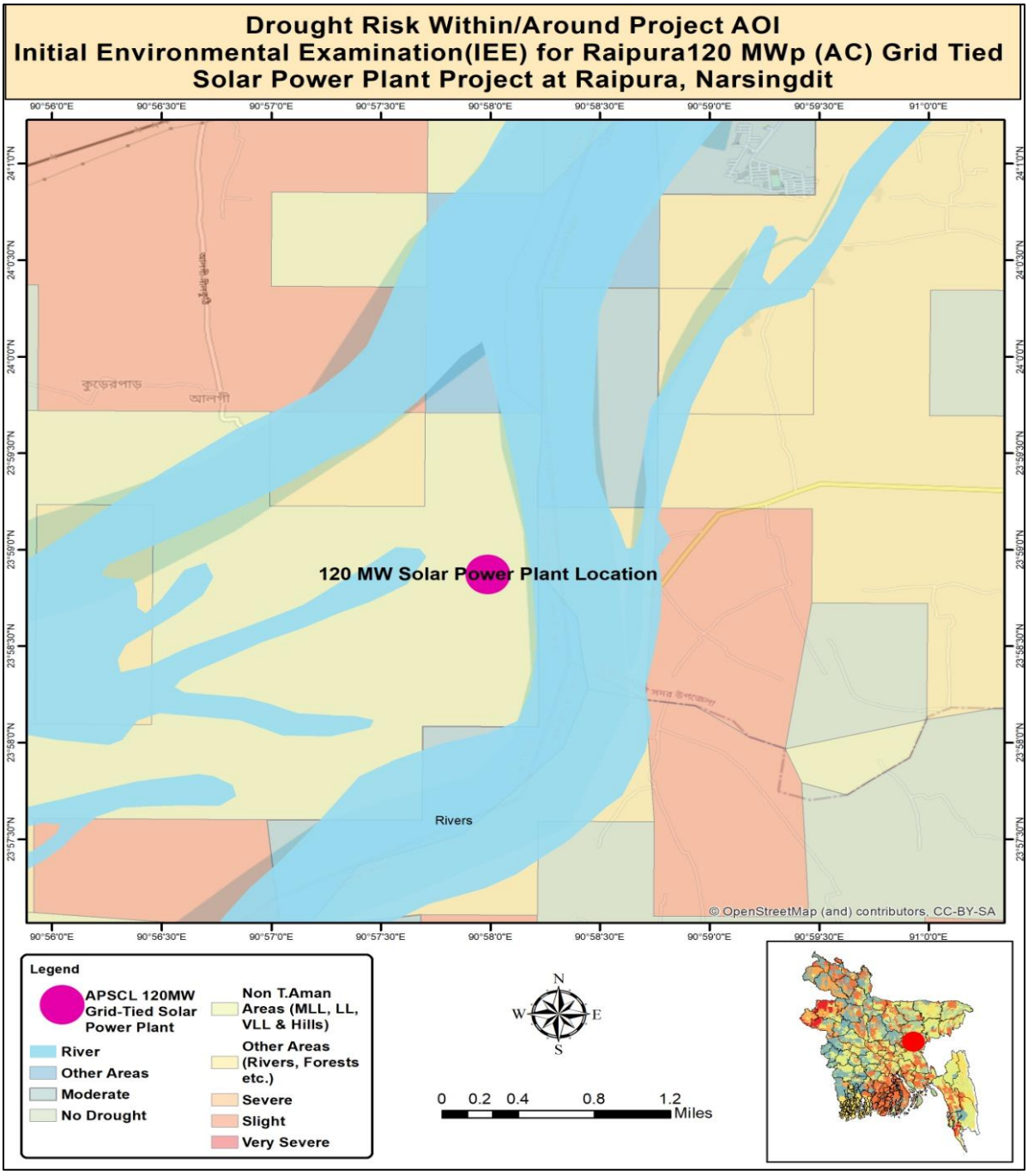


Figure 9-4: Drought Risk Map within Project Area

9.5.4 Earthquakes

Mega thrust faults occur at subduction zones, where Earth's tectonic plates are colliding with each other, and one plate is moving (or "subducting") under another. These faults produce the largest

earthquakes, reaching and even exceeding 9.0 magnitude, with recent examples being the 2011 Japan earthquake and tsunami, as well as the 2004 Banda Aceh earthquake and resulting Indian Ocean tsunami.

A vast majority of these mega thrust faults and their resulting earthquakes occur under the ocean, which is why they can unleash tsunamis. It is rare to find these types of faults under land, and even more rare - and potentially catastrophic - to have one directly underneath such a major population center. The study indicates that more than 140 million people live within 100 kilometers (60 miles) of this fault in Bangladesh, India, and Myanmar.

Bangladesh is situated in one of the most tectonically active regions in the world where three major plates meet (the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate). The project area is located over the Indian Plate, which is moving north. However, due to the location of relevant plates, fault lines and hinge zones, Bangladesh itself is divided into four seismic zones based on the ranges of the seismic coefficient (note: the seismic coefficient is a measure of how strong an earthquake has the potential to be based on a combination of the mass of the plate and the seismic forces acting on it, as well as how frequently these quakes are likely to occur). As per the seismic zone classifications of BNBC 2022, the project area falls under Zone-III means moderate seismic intensity. The seismic map is given in the baseline chapter; figure 5-19. Recent historical earthquake statistics are shown in Table 9-3 (Source: Bangladesh Meteorological Department).

Table 9-3: Historical major Earthquakes around Bangladesh

Sl. No.	Date (D/M/Y)	Lat (°N)	Long (°E)	Magnitude (Richter Scale)	Location of Epicenter
1	10-01-1869	24.79	93.17	7.5	Kachar, Assam, India
2	14-07-1885	24.70	89.55	7.0	Eastern Province, Nepal
3	12-06-1897	25.84	90.38	8.8	Shilang, Meghalaya, India
4	08-07-1918	24.16	91.75	7.6	Dauki, Meghalaya, India
5	02-07-1930	25.95	90.04	7.1	Dhubri, Assam, India
6	15-01-1934	26.60	86.8	8.3	Bihar-Nepal Border
7	23-10-1943	26.80	94.00	7.2	Assam, India
8	15-08-1950	28.79	95.62	8.6	Tibet, China
9	21-03-1954	25.86	94.00	7.2	Assam, India
10	08-07-1975	25.58	92.60	6.5	Assam, Sillon
11	06-08-1988	25.13	95.15	6.6	Manipur-Myanmar Border
12	21-11-1997	22.07	92.75	8.5	Arakan, Myanmar
13	11-08-2009	15.01	92.30	7.8	Andaman Islands

(Source: National Encyclopedia of Bangladesh, Banglapedia, CD Edition February 2006)

9.5.5 Water Logging

Likewise, many other rural village areas as well as char areas in Bangladesh, the project area is also subjected to temporary and seasonal waterlogging. As local people have their seasonal crops and vegetables (cucumber, peanuts, etc.) under cultivation in these areas, with short and long term continuous waterlogging, they face physical and economical loss associated with livelihood crisis on a specific session. The site is situated in the lowlands of the Meghna and Brahmaputra floodplains and is mostly fallow and barren land, except for a few elevated areas that may become submerged during monsoons or floods. The topography is not completely flat, but rather undulating and medium-high to low-flat, allowing for easy drainage of rain or flood water into adjacent rivers.

9.6 Emergency Response Plan (ERP)

9.6.1 Introduction

The initial response to an incident is a critical step in the overall emergency response. The responders often have minimal information and must make rapid decisions to ensure the safety of the public and the response teams themselves. As a rule, the initial response is guided by three priorities:

- People
- Property
- Environment

It is also important to remember that emergency responses must be adapted to individual circumstances and may require creative solutions to difficult problems. Further, to improve the response capabilities, cooperative arrangements and organizations must be established to provide the appropriate equipment and expertise.

The nature of emergency and hazardous situations may be of any of the following categories.

1) Emergency

- Fire
- Explosion
- Medical emergency
- Leaks and other releases of hazardous substances
- Spillage of toxic chemical, and electrocution

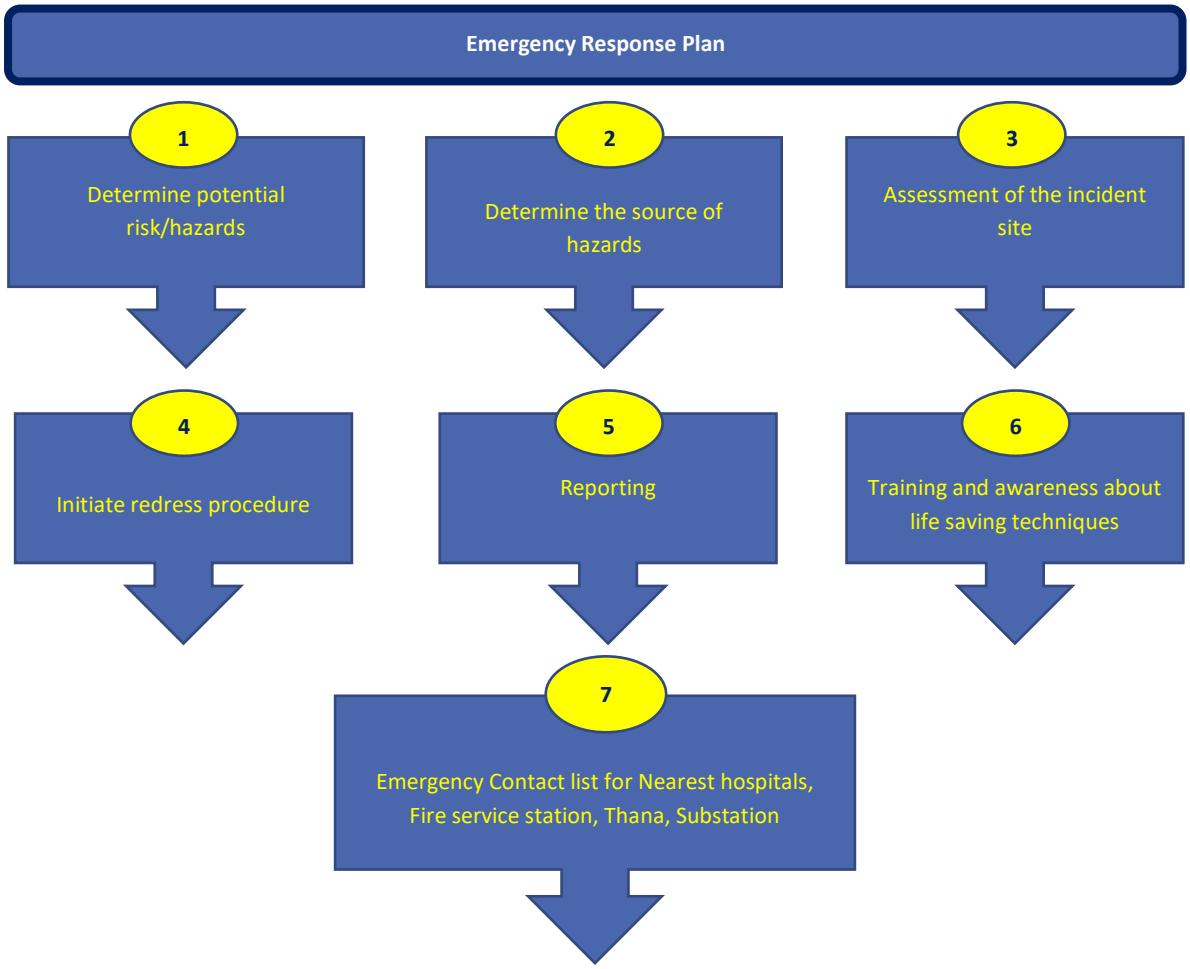


Figure 9-5: Framework for Emergency Response Plan

2) Natural disasters

- Flood
- Earthquake/cyclone
- Storm/ Typhoon/ Tornados, and
- Cloud burst lightning

3) External factors

- Food poisoning
- Sabotage, and
- War

The following framework should be followed in the project site in order to reduce risk and response in an emergency situation.

9.6.2 Seven steps in emergency response

Step-1

a) Determine the potential hazards and take appropriate action to identify the type and qualities of dangerous goods.

b) Determine potential hazards from local conditions such as inclement weather water bodies

Step-2

Determine the source/ cause of the event resulting to the emergency and prevent further losses.

Step-3

An assessment of the incident site for any further information on hazards or remedies.

Step-4

Initiate redress procedure.

Step-5

Report the incident procedures and any further assistance required etc. to the appropriate company, government and/or landowner.

Step-6

Create awareness and training programs for workers for emergency situations and life saving techniques.

Step-7

Collect information about the nearest hospitals, fire service, police station, substation for emergency situations. Make available the information on the project site via signboard, poster etc.

9.6.3 Emergency Response Planning

The objective of an Emergency Response Plan (ERP) is to describe the procedures to ensure the health and safety of staff.

Three levels of planning may be used depending on the particular circumstance, potential incidence rate and the location and number of residents living in the community/ locality in close proximity along the project sites. The scope of the ERP depends on the potential impact of the project activities, complexity of evacuation logistics and proximity to public facilities. A key feature of all plans is the Emergency Planning Zone which defines the area to be evacuated or protected in the event of an

emergency. Another fundamental requirement of Emergency Response Planning is that discussions occur with local residents and public within the Emergency Planning Zone and must include any pertinent health factors which must be considered.

The procedure should have an action plan to address the emergency. This includes defining the "Stages of Alert" that may be applicable for various aspects of the work.

Another essential component of an ERP is the responsibility of the emergency response personnel including off-site and on-site personnel, team coordinators, safety and evacuation personnel, monitoring crews, public relations and government personnel.

The roles and responsibilities for the various government departments are to be defined and coordinated within the plan should include the provision for the company/government to establish an on-site command post and a main control headquarter to provide advice.

9.6.3.1 Specialized equipment

All relevant emergency equipment should be maintained on site throughout the project. This includes items such as fire extinguishers, self-contained breathing apparatus and personal protective gear etc.

9.6.3.2 Training

In-house training programs should be held by the company and designated first responders to test their capabilities. Response teams have to be assembled both on a company and community cooperative basis to deal with potential emergency situations. A 2- days or need based training program that includes two or more field exercises would be effective for the attendees. Training should be regularly provided.

9.6.3.3 Safety orientation

Safety orientation is one of the most important aspects of any safety program. Employees and contractors must receive some level of basic training, specific to the facility and nature of the job. It must be ensured that appropriate orientation is given to all employees, contractors' sub-contractors and visitors.

The orientation should include:

- Company safety policy and procedures.
- Risk assessment and Specific job hazards.
- Safety precautions.
- Job responsibilities.
- Regulatory requirements.
- Company enforcement policy.
- Worker's right-to-know and authority to refuse unsafe work.
- Permit to Work (PTW).
- Environmental aspect and impact (EAI).
- Occupational health and safety.
- First aid.
- Fire safety.
- Emergency and drills.

9.6.3.4 Level of incidents

The affected area can be classified the following four classes in the event of a disaster at any Location within the workplace.

Level-I: Operator level

Level II: Local/community level

Level-Ill: Regional/National level

Level-IV: International level

Only Level-I and Level-II classes of incidents or accidents will be applicable within the proposed Solar Project.

Level-I, disasters may be the result of fires, explosions, oil spillages and spontaneous ignition of inflammable' materials. This may affect persons working in and around moving machinery, other plants and various sites which have been mentioned as potential hazard areas.

Level-II disasters may happen due to sabotage or complete failure of all automatic control/warning systems.

9.6.4 Incident/Accident Investigation and Reporting System

A routine system should be enforced to ensure that all accidents, incidents and near miss are investigated and reported to the plant head or Managing Director of APSCL in a specified format such as the following:

- Description of incident/accident.
- Immediate cause.
- Background on the factors that might have made the incident possible or root cause analysis.
- What form of energy release or toxic substance was involved?
- What was done to prevent accident (who responded and how)?
- What effect did it produce on the immediate and surrounding environment?
- What repercussions did the incident have?
- Cost estimates of damage done and repairs need.
- Preventive measures and recommendations to avoid repetition.

Registers of all incidents should be kept and should be analyzed on a regular basis (at least monthly) to identify trends or patterns in incident occurrence in particular cases. APSCL has its own format for reporting of accident/incident and near miss. It will be followed to identify the root cause and to prevent any kind of accident/incident.

10 CUMULATIVE AND INDUCED IMPACTS

10.1 General

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

The World Bank's "good practice handbook: cumulative impact assessment and management - guidance for the private sector in emerging markets (English)" proposes a six-step process to assist private sector companies in emerging markets identify cumulative impacts and guide them in the effective design and implementation of measures to manage such cumulative effects. This handbook is based on IFC's experience in applying its performance standards and is non-prescriptive in its approach. It should be used in conjunction with the Performance Standards, their guidance notes, and the World Bank Group environmental, health, and safety guidelines, which contain basic requirements and good international practices to be followed when designing, developing, and/or implementing projects. This document is not intended to duplicate requirements under the existing IFC sustainability framework. Its purpose is to provide practical guidance to companies investing in emerging markets to improve their understanding, assessment, and management of cumulative environmental and social impacts associated with their developments.

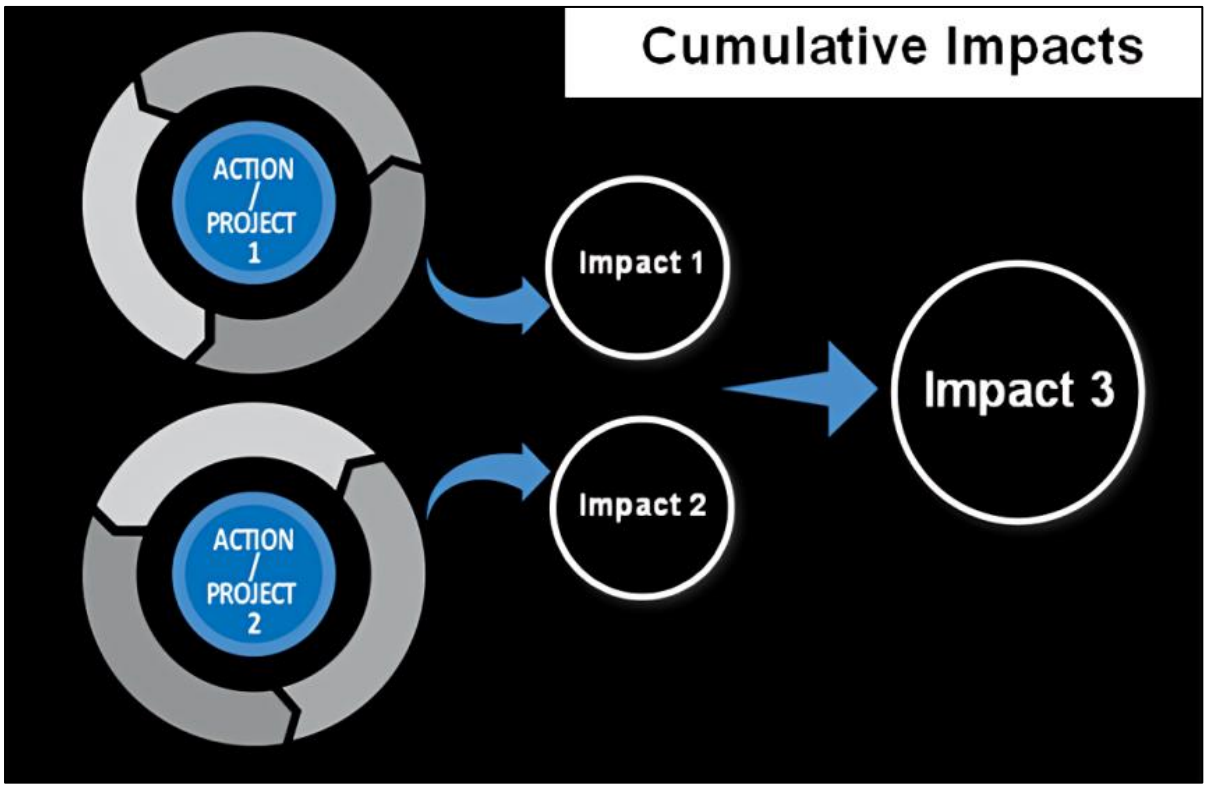


Figure 10-1: Cumulative Impact Assessment

The objective of the current cumulative impact assessment is to evaluate the combined effects of proposed developments along with the proposed project. The project adverse impacts have been broadly classified as impacts on land, structures (residential, commercial, residential cum commercial, and others) impacts on other immovable assets, impacts on other property assets, impact on

community property resources (religious structures, madrasah, school, passenger shelter, etc.), impacts on livelihood, etc.

10.2 Cumulative Negative Impacts and Mitigation Measures

10.2.1 Residual Impacts

After analysis of the air quality, the concentrations of CO, SO_2, NOx, PM_{10}, and $PM_{2.5}$ have been recorded. This project will contribute insignificantly of pollutants to the ambient environment.

From the cumulative impact assessment, it can be concluded that the proposed project will not contribute significantly during the initial stages.

10.2.1.1 Noise Level

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

10.2.1.1.1 Mitigation Measures

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

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

10.2.2 Cumulative Beneficial Impacts

The cumulative beneficial impact of the project will result in

- increased employment
- Reduce dependency on National electricity grid
- Sustainable use of natural resources

10.2.2.1 Employment

Employment opportunity will occur due to the project implementation and in the increased commercial and business activities induced with electricity supply.

10.2.2.2 Deterioration of Surface Water Quality

The proposed project will generate several types of wastes during their construction and O/M stages. Typical wastes are likely of solid and liquid that may further be classified as hazardous/toxic and non-hazardous/non-toxic. Disposal of these wastes without treatment

will contaminate the surface water surrounding the dumping sites. Contamination of surface water quality will have a potentially significant negative impact on the biological functions of surface water as well as fish/aquatic life resources therein.

10.2.2.3 Deterioration of Groundwater Quality

Deterioration in groundwater quality is likely to occur due to the dumping of untreated wastes. Leachate of wastes that contain hazardous elements will percolate soils reaching groundwater for contaminating the natural resources. Besides this if sewage water is not managed by soak pit and septic tank properly, it can contaminate ground water.

10.2.2.4 Wastes

Waste will be generated during the construction and O&M of the proposed project, and unless they are properly managed, they will have a severe impact on the environment. Particularly hazardous waste would affect the safety and health of the workers as well as contaminate soil and water at their dumping locations.

10.2.2.4.1 Mitigation Measures

The proposed project will not have any significant impact. Only some impacts may generate if there is any improper management of the project. So, proper management and monitoring and following the EMP during the project implementation will reduce the possibility of the induced impacts.

10.2.3 Summary of Cumulative Impacts

The types of environmental and social cumulative impacts with their magnitude of impacts are summarized in the table below:

Table 10-1: Summary of cumulative impacts and magnitude

Environmental and Social issues	Magnitude of Impacts						
	Positive Impact			No Impact	Negative Impact		
	Low	Moderate	High		Low	Moderate	High
Pre-Construction Stage							
Impact on air quality					√		
Quality of surface water						√	
Loss of agricultural land					√		
Impact on land resources					√		
Quality of Soil					√		
Impact on drainage				√			
Impact on eco-system					√		
Construction Stage							

Environmental and Social issues	Magnitude of Impacts						
	Positive Impact			No Impact	Negative Impact		
	Low	Moderate	High		Low	Moderate	High
Quality of Surface water						√	
Quality of Ground water						√	
Impact on air						√	
Quality of soil						√	
Drainage congestion				√			
Loss of aquatic biota					√		
Impact on noise						√	
Impact on agriculture				√			
Job opportunity		√					
Operation Stage							
Quality of air					√		
Quality of Surface Water					√		
Quality of Groundwater					√		
Noise level				√			
Soil quality				√			
Impact on climate change		√					
Loss of natural drainage				√			
Job opportunity	√						

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

11.1 Objectives

This Environmental Management Plan (EMP) 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 EMP are summarized below:

- Preventing or minimizing any adverse environmental, social and health impacts resulting from the project activities;
- Conducting all project activities in accordance with relevant Bangladesh Legislations and applicable ADB, World Bank guidelines, lender's requirements and other relevant conformances.
- Implementation of on-going environmental monitoring programs;
- Periodic review of the Environmental and Social Management programs to allow for iterative improvement;
- Ensure that all stakeholder concerns are addressed.

Overall, this EMP 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.

11.2 Environmental Management Plan (EMP)

On the basis of identification of the environmental and social impacts and recommended mitigation measures linked with the Solar Power Plant project activities, an EMP has been prepared which will be followed at the pre-construction, construction, operation, and decommissioning/dismantling stages. While preparing the EMP, medium and significant impacts are taken into consideration to recommend possible mitigation measures. As per suggested environmental monitoring schedule, framework and mitigation measures, EPC Contractor/Contractor and APSCL will must conduct all the required monitoring by independent environmental consultancy firm (3rd Party) and submit the report to DoE, district office regularly during the pre-construction, construction, operation, and decommissioning/dismantling stages. EPC Contractor/Construction Contractor will must conduct the environmental monitoring and reporting work as per the environmental monitoring plan suggested in the EMoP by independent environmental 3rd party during the project pre-construction and construction period as per direct guidelines and supervision of HS&E Manager/HS&E Divisional Head of APSCL and will submit the monthly report to Project Head of this project or to HS&E Division's Head of APSCL. During operation period (lifetime of the plant) and dismantling period, APSCL will must conduct the environmental monitoring and reporting work as per suggested plan in EMoP by independent environmental 3rd party. Finally project HS&E Officer of APSCL will and HS&E Manager/HS&E Division's Head of APSCL will monitor and supervise the 3rd party's monitoring work during all phases and submit the independent monthly monitoring report to DoE, District office regularly. Besides this, EPC Contractor/Construction Contractor and APSCL authority will must properly comply all the requirements of Site Clearance Certificate and Environmental Clearance Certificate issued for this plant from DoE.

Table 11-1: Environmental Management Plan (EMP) of Solar Power Plant

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Pre-construction Phase						
Land Use / Landfilling	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 APSCL.	▪ 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
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 APSCL.	-
Construction Phase						
Visual Amenity	Visual impacts from construction activities such as materials lay down, excavation, backfilling	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 APSCL.	▪ National Land use Policy, 2001 ▪ National Environmental Policy, 1992 ▪ National Environmental Management Action Plan, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
				▪ The fill material is maintained in a clean and tidy manner.		
Water Resources	Surface water quality in the adjacent rivers, channels and ponds might insignificantly degrade during construction 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 the construction work will continue 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 creeks 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 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.	Weekly	▪ Number of spills or incidents to be recorded during onsite audits. ▪ Training records of Personnel trained in spill response procedures must be filed	EPC Contractor. Supervision by APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995
Noise	Increased noise levels during to construction & machinery mobilization.	▪ The contractor shall use fine tuned heavy equipment, machinery having fitness test certificate, and fuels in compliance with national regulations. The contractor shall perform regular	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 APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ Noise Pollution Control Rules (2006)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		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.				
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 spray on an "as needs" basis. ▪ Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soil into trucks. ▪ 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. ▪ Covering the dusty construction materials and stockpiles properly. ▪ Transportation of construction materials by vehicles with cover.	Daily	▪ No visible dust plumes originating from construction sites. ▪ Regular machineries maintenance records. ▪ Water spray records.	EPC Contractor. Supervision by APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environmental Conservation Rules (ECR), 1997 ▪ Environment Court Act, 2000 ▪ Bangladesh Climate Change Strategy and Action Plan (2008)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Soil	Soil disturbance due to removal of topsoil, potential accidental spillage	▪ A spill prevention and response plan shall be prepared by the contractor in order to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary) to contain and clean up any contaminated soil. ▪ Construction of bunds around relevant work and storage areas. Bunds in areas of hazardous chemical storage (including temporary storage) should be lined to contain accidental spillage and minimize the potential for migration to the underlying soil. ▪ Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan and MSDS. ▪ Contractor shall ensure that a spill kit and adequate PPE is available at the site for emergency cleanup activities in case of chemical/oil spillage. ▪ To control soil erosion surface run-off should be collected from all paved working areas into retention ditches to restrict concentration of flows. ▪ Surrounding drainage networks will be prepared properly to prevent surface runoff and siltation	Weekly	▪ Number of spills or incidents to be recorded during onsite audits. ▪ Training records of Personnel trained in spill response procedures must be filed	EPC Contractor. Supervision by APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		in the neighboring areas and water bodies.				
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 and to prevent pollution.	Daily	N/A	EPC Contractor. Supervision by APSCL.	▪ 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	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) and having secondary	Daily	▪ Compliance with Waste management procedures. ▪ Current and Complete records of regular waste pickup and disposal.	EPC Contractor. Supervision by APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995 ▪ Environmental Conservation Rules (ECR), 1997

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		containment. 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 off regularly. ▪ Dispose of all waste in segregated dust bin. Finally dispose at designated dumping site for further proper management.				
Health and Safety risks	▪ Potential 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	▪ All construction equipment used for the execution of the project works shall be fit for purpose and carry valid inspection certificates and insurance requirements. ▪ 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.	Continuously	▪ Total Recordable Incidence Rate (TRIR). ▪ Lost Time Incidence Frequency. ▪ Fatal Accident Rate. ▪ Number of safety Training performed. ▪ Number of nonconformance events Reports. ▪ Medical Treatment Case (MTC). ▪ HSE Training Hours.	EPC Contractor. Supervision by APSCL.	▪ Bangladesh Labour Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	vibration, temporary or permanent hearing loss, heat stress, and dermatitis.	▪ Signpost any slippery areas, ensure proper footwear with a good grip is worn for personnel working within slippery areas. Provide sufficient warning signage to all respective areas. ▪ Avoid work at height where it is reasonably practicable to do so, e.g. by assembly at ground level. ▪ Prevent any person falling a distance liable to cause personal injury e.g., by using a scaffold platform with double guard-rail and toe boards; ▪ Arrest a fall with equipment to minimize the distance and consequences of a fall, e.g., safety nets, where work at height cannot be avoided or the fall prevented. ▪ Carry out fire risk assessment for the construction areas, 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 a 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.				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ Establish and communicate emergency response plan (ERP) 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 and drills to test the plan ▪ Ensure all plant machines and vehicles are regularly inspected, serviced and maintained; ensure all staff assigned are trained and competent to operate plant machines and vehicles. ▪ Ensure clear signage is in place, such as Warning of speed limits, obstructions, allowable widths/ heights...etc. ▪ Electrical equipment must be safe and properly maintained; work shall not be carried out on live systems. ▪ Only competent authorized persons shall carry out maintenance on electrical equipment, adequate Personal Protective Equipment (PPE) for electrical works must be provided to all personnel involved in the tasks.				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ The Lock-Out/Tag-Out (LOTO) system shall be implemented during any electrical works. ▪ Adequate number of full time HS&E Staff with supervisor and HS&E Officer will be deployed by EPC Contractor/Contractor that will monitor and supervise all works continuously and report it to HS&E manager/Division's head of APSCL and site HS&E Officer of APSCL. ▪ Adequate number of staff and first aiders shall be on site in accordance with Bangladesh Labor Law requirements. ▪ A 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. ▪ Emergency evacuation response shall be prepared by the contractor and relevant staff shall be trained through mock-up drills. ▪ Ensure all equipment is suitable for jobs (safety, size, power, efficiency, ergonomics, cost, user acceptability etc.), provide the lowest vibration tools that are suitable and can do the works. ▪ Ensure all tools and other work equipment are serviced and				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		maintained in accordance with maintenance schedules and manufacturer's instructions. ▪ Regular noise exposure assessments and noise level surveys of noisy areas, processes and equipment shall be carried out in order to form a basis for remedial actions when necessary. ▪ As far as reasonably practical, all steps to reduce noise exposure levels of employees by means other than that of personal protective equipment shall be taken, such as reducing exposure times, enclosures, silencers, machine covers, etc. ▪ Awareness training sessions should be established and provided to all personnel involved during the construction phase in order to highlight the heat related illnesses of working in hot conditions such as heat cramps, heat exhaustion, heat stroke, dehydration. Perform daily toolbox talk before the work starts. ▪ Ensure adequate quantities of safe drinking water are available at different locations within the site for all employees and workers. ▪ Provision of sunshades at different locations within the site.				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ Eliminate the risk of exposure whenever possible, provide proper PPE wherever necessary and ensure that there are satisfactory washing and changing facilities. ▪ Ensure that all workers exposed to a risk are aware of the possible dangers. They should be given thorough training in how to protect themselves and there should be effective supervision to ensure that the correct methods are being used. ▪ Provide sufficient number of male and female sanitary toilets and washrooms for all workers and employees both in project sites, offices and labor camps and residential areas. Keep sufficient number of sweepers/cleaners for continuous cleaning of the toilets and wash rooms with proper cleaning materials, safety gears and cleaners coverall. ▪ Provide sufficient number of hand wash basin with soap in the project site, offices and labor camps. Provide adequate number of eye wash points in the project site and storage areas. ▪ Will have furnished medical center with full time male and female doctors, nurses and				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		supporting staffs with ambulance and boat ambulance.				
Operation Phase (Lifetime of Plant)						
Visual Amenity	Potential glare from PV panels	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	APSCL.	▪ National Land use Policy, 2001 ▪ National Environmental Policy, 1992 ▪ National Environmental Management Action Plan, 1995
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	▪ 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	APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	flood occurrence is very high.					
Noise	Significant sound pollution from backup generator	▪ Establish the generator inside an insulated room and use noise reduction canopy and silencer to keep the environment free from sound pollution. ▪ Noise barrier should also be given around the generator room. ▪ The worker inside the project area should use earplug, earmuffs and required PPE during the operation of diesel generator and other noisy equipment.	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.	APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ Noise Pollution Control Rules, 2006
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 source of air pollutants. ▪ Replace the damaged and expired tools, equipment, PV panels and batteries as soon as it is notices.	Daily/as required.	▪ No visible dust plumes originating from project site. ▪ Regular machineries maintenance records.	APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environmental Conservation Rules (ECR), 1997 ▪ Environment Court Act, 2000 Bangladesh Climate Change Strategy and Action Plan (2008)
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. ▪ Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those	▪ Post rainfall Event ▪ Daily/Weekly/as required.	Maintain readily available records of all workers training on spill response procedures.	APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		chemicals to prevent their leakage and infiltration into the soil.				
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 and to prevent pollution. ▪ Make transmission and internal distribution line having both vertical and horizontal clearance at least of 2.0 ft to 2.5 ft between cables and as per standard to avoid short circuit by birds, bat or other avian species and to save them.	Weekly	No reported harm to birds.	APSCL.	▪ 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. ▪ Besides the wasted PV modules, few other solid wastes generated during the operational stage. These include end-of-life solar PV modules, electrical	▪ Proper Waste disposal and land filling sites are needed for plant site and residential sites for waste management in environmental friendly way to prevent any kind of pollution. ▪ A proper temporary storage facility is needed for the e-waste to avoid potential lead contamination. ▪ Collect the domestic sewage waste and external use water in soak pit and septic tanks to treat	Continuously	▪ Compliance with Waste management procedures. ▪ Current and Complete records of regular waste pickup and disposal.	APSCL.	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	wastes, metallic wastes and stationary wastes of office works etc.	according to the approved procedure. ▪ Dispose of all waste in segregated dust bin. Finally dispose at designated dumping site for further proper management.				
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 the 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.	▪ 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 the project site. ▪ Signpost any slippery areas, provide proper footwear during working within slippery areas. Provide Warning signage in all respective 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 hydrants, extinguishers should be located at identified fire	Continuously	▪ Total Recordable Incidence Rate (TRIR) ▪ Lost Time Incidence Frequency ▪ Number of safeties Training performed ▪ Number of nonconformance events.	Contractor during defect liability period. After that, APSCL.	▪ Bangladesh Labour Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	▪ 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.	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 Labor Law requirements. ▪ First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, medicine, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site. ▪ Will have dedicated HS&E division with adequate number of officer and supporting staff. ▪ Will have furnished medical center with full time male and female doctors, nurses and supporting staffs with and ambulance and boat ambulance.				
Dismantling/Decommissioning Phase						
▪ The solar power plant facility is considered a large-scale long-term investment that will contribute to economic benefits to the country through provision of power supply, designed in accordance with best practice, taking into account all relevant national and internal codes and legislation.						

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
▪ The design life of the facility will be approximately 20 years. Therefore, the post-design life is expected to involve rehabilitation, upgrading and modernization of the facility, with a possible expansion (retrofitting and addition of new technology). As a result, impacts from decommissioning are not expected to arise in the near future unless retrofitting and upgrading of the facility was not feasible. However, this IEE Study has considered potential decommissioning impacts in case there was a need for the facility to be dismantled and end operations. ▪ As can be noted from the impact assessment chapter 6, no impacts with high significance are anticipated to take place during decommissioning of the project since all facilities will be removed, solar power plant decommissioned, and PV panels will be dismantled and sent for recycling or disposal. ▪ The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. ▪ Therefore, to avoid repetition, please refer to Table 7.1 for detailed mitigation measures that overlap with decommissioning as well. ▪ 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. ▪ Proper dismantling/decommissioning and recycling of solar panels both ensure that potentially harmful materials are not released into the environment and reduce the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.					

11.3 Environmental Monitoring Plan (EMoP)

11.3.1 General

An Environmental Monitoring Plan (EMoP) is prepared to provide guidelines for environmental management plans during the pre-construction, construction, operation (plant lifetime) and decommissioning/dismantling phases of the solar mini grid Power Plant. The environmental components that will be monitored are those that will be positively or negatively affected, or expected to be affected, by construction, operation and dismantling activity. Environmental management is a sustainable way of planning, arranging, supervising, organizing, managing and developing the environment for the management 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 pre-construction, construction, full operation phase (plant life time) and dismantling phase for the proposed power plant project are listed in Table 11.2.

11.3.2 Objectives

The objective of environmental monitoring during the pre-construction, construction, full operation (plant life time) and decommissioning/dismantling 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 IEE;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the IEE;
- Ensure compliance with legal and community obligations including safety on construction and operational sites;
- Ensure the safe disposal of excess construction, operational and maintenance materials.
- Appraise the adequacy of the IEE with respect to the project's predicted long-term impacts on the physical, biological and socio-economic environment during pre-construction, construction, operation and decommissioning/dismantling phase;
- Implement all the suggested measures. Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- The EPC Contractor and APSCL will monitor monthly/regularly all the suggested parameters as per schedule/framework of Environmental Monitoring Plan by independent environmental firm (3rd Party) and will submit the monthly report to DoE district office, Narsingdi.

Table 11-2: Environmental Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
Pre-Construction Stage					
Ambient Air Quality	SO_2, NO_x, CO, $PM_{2.5}$, PM_{10}	Air quality standard by DoE, Bangladesh	Once/Month by 3rd Party	EPC Contractor	APSCL
Noise Level	At different locations	Noise Pollution Control Rules (2006)	Once/Month by 3rd Party	EPC Contractor	APSCL
Water Quality	**Surface water:** • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Suspended Solids (TSS) • Ammonium • Phosphate • Turbidity • Oil & Grease • Biochemical Oxygen Demand (BOD_5) • Chemical Oxygen Demand (COD) • Chromium (Total) • Cadmium (Cd) • Lead (Pb)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	EPC Contractor	APSCL
	Groundwater: • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	EPC Contractor	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Salinity • Total Coliform (TC) • Fecal Coliform (FC) • Total Suspended Solids (TSS) • Arsenic (As) • Iron (Fe) • Lead (Pb)				
	Drinking Water: • pH • Ammonia • Nitrate • Phosphate • Arsenic (As) • Iron (Fe) • Manganese (Mn) • Cadmium (Cd) • Chromium (Total) • Lead (Pb) • Total Coliform (TC) • Fecal Coliform (FC)	DoE/IFC/WHO	Once/Month by 3rd Party	EPC Contractor	APSCL
Construction Stage (Full Phase)					
Ambient Air Quality	SO_2, NO_x, CO, $PM_{2.5}$, PM_{10}	Air quality standard by DoE, Bangladesh	Once/Month by 3rd Party	EPC Contractor	APSCL
Noise Level	At different locations	Noise Pollution Control Rules (2006)	Once/Month by 3rd Party	EPC Contractor	APSCL
Water Quality	**Surface water:** • Temperature • pH • Electrical Conductivity (EC)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	EPC Contractor	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Suspended Solids (TSS) • Ammonium • Phosphate • Turbidity • Oil & Grease • Biochemical Oxygen Demand (BOD_5) • Chemical Oxygen Demand (COD) • Chromium (Total) • Cadmium (Cd) • Lead (Pb)				
	Groundwater: • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Coliform (TC) • Fecal Coliform (FC) • Total Suspended Solids (TSS) • Arsenic (As) • Iron (Fe) • Lead (Pb)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	EPC Contractor	APSCL
Water Quality	**Drinking Water:** • pH • Ammonia	DoE/IFC/WHO	Once/Month by 3rd Party	EPC Contractor	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Nitrate • Phosphate • Arsenic (As) • Iron (Fe) • Manganese (Mn) • Cadmium (Cd) • Chromium (Total) • Lead (Pb) • Total Coliform (TC) • Fecal Coliform (FC)				
Soil Pollution	**Analytical Monitoring:** ▪ Lead (Pb) ▪ Cadmium (Cd) ▪ Total Chromium (Cr) ▪ Oil & Grease **Visual Monitoring:** ▪ Check liquid waste is carried out by experienced personnel and in proper way. ▪ Careful and proper handling of oil and other hazardous liquids.	Analytical & Visual Monitoring	Analytical: Once/Six Month by 3rd Party. Visual: Regularly as required.	EPC Contractor	APSCL
Waste	▪ Check storage, transportation, disposal, handling of hazarders waste. ▪ Waste and effluents to be collected and disposed safely from camp to proper dumping site. ▪ Wastes and garbage from construction sites to be disposed safely to proper dumping site.	Visual Monitoring	Daily by Contractor. Once/Month by 3rd Party.	EPC Contractor	APSCL
Health and Safety	▪ Check quality of food and accommodation at construction camp. ▪ Check safe drinking water supply, cleanliness and hygiene of toilet at camp, construction of drain at camp	Monitoring	Daily by Contractor. Once/Month by 3rd Party.	EPC Contractor	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	site. ▪ Check safe drinking water supply, cleanliness and hygiene of toilet and drainage system at construction site. ▪ First Aid Box with required tools and medicines. ▪ Readiness and Fitness of site emergency ambulance and boat ambulance. ▪ 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. ▪ Check of personal protective equipment (PPE) for worker at the sites.				
Operation Stage (Plant Lifetime)					
Air Quality	SO_2, NO_x, CO, $PM_{2.5}$, PM_{10}	Air quality standard by DOE, Bangladesh	Once/Month by 3rd Party	APSCL	APSCL
Noise Level	At different locations	Noise Pollution Control Rules (2006)	Once/Month by 3rd Party	APSCL	APSCL
Water Quality	**Surface water:** • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Suspended Solids (TSS) • Ammonium • Phosphate • Turbidity • Oil & Grease	DOE, Bangladesh/IFC	Once/Month by 3rd Party	APSCL	DOE/IDCOL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Biochemical Oxygen Demand (BOD_5) • Chemical Oxygen Demand (COD) • Chromium (Total) • Cadmium (Cd) • Lead (Pb)				
	Groundwater: • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Coliform (TC) • Fecal Coliform (FC) • Total Suspended Solids (TSS) • Arsenic (As) • Iron (Fe) • Lead (Pb)	DOE, Bangladesh/IFC	Once/Month by 3rd Party	APSCL	APSCL
Water Quality	**Drinking Water:** • pH • Ammonia • Nitrate • Phosphate • Arsenic (As) • Iron (Fe) • Manganese (Mn) • Cadmium (Cd) • Chromium (Total) • Lead (Pb)	DoE/IFC/WHO	Once/Month by 3rd Party	APSCL	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Total Coliform (TC) • Fecal Coliform (FC)				
Accident and Public Safety	Record of incident, accidents, different level of disabilities/fatalities.	Non-Specific	Regularly/As required	APSCL	APSCL
Soil Quality	▪ Lead (Pb) ▪ Cadmium (Cd) ▪ Total Chromium (Cr) ▪ Oil & Grease	--	Once/Six Month by 3rd Party.	APSCL	APSCL
Dismantling/Decommissioning Stage					
Ambient Air Quality	SO_2, NO_x, CO, $PM_{2.5}$, PM_{10}	Air quality standard by DOE, Bangladesh	Once/Month by 3rd Party	APSCL	APSCL
Dust	Dust control	Air quality standard by DOE, Bangladesh	Daily	Contractor	APSCL
Noise Level	At different locations	Noise Pollution Control Rules (2006)	Once/Month by 3rd Party	APSCL	APSCL
Water Quality	**Surface water:** • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Suspended Solids (TSS) • Ammonium • Phosphate • Turbidity • Oil & Grease • Biochemical Oxygen Demand (BOD_5) • Chemical Oxygen Demand (COD)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	APSCL	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	• Chromium (Total) • Cadmium (Cd) • Lead (Pb)Iron (Fe)				
	Groundwater: • Temperature • pH • Electrical Conductivity (EC) • Total Dissolved Solids (TDS) • Dissolved Oxygen (DO) • Salinity • Total Coliform (TC) • Fecal Coliform (FC) • Total Suspended Solids (TSS) • Arsenic (As) • Iron (Fe) • Lead (Pb)	DoE, Bangladesh/IFC	Once/Month by 3rd Party	APSCL	APSCL
Water Quality	**Drinking Water:** • pH • Ammonia • Nitrate • Phosphate • Arsenic (As) • Iron (Fe) • Manganese (Mn) • Cadmium (Cd) • Chromium (Total) • Lead (Pb) • Total Coliform (TC) • Fecal Coliform (FC)	DoE/IFC/WHO	Once/Month by 3rd Party	APSCL	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
Soil Pollution	**Visual Monitoring:** ▪ Check liquid waste is carried out by experienced personnel and in proper way. ▪ Careful and proper handling of oil and other hazardous liquids. ▪ Careful and proper handling of PV panels and batteries.	Monitoring	Regularly as required.	Contractor	APSCL
Soil Quality	▪ Lead (Pb) ▪ Cadmium (Cd) ▪ Total Chromium (Cr) ▪ Oil & Grease	Monitoring	Once/Month by 3rd Party	APSCL	APSCL
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 and dismantling site to be disposed safely to proper dumping site. ▪ Damaged/obsolete PV panels and e-wastes that are not disposable to dumping site to be carried out and properly managed by Contractor by following DoE guidelines.	Monitoring	Daily	Contractor	APSCL
Health and Safety	▪ Check quality of food and accommodation at construction camp. ▪ Check safe drinking water supply, cleanliness and hygiene of toilet at camp, construction of drain at camp site. ▪ Check safe drinking water supply, cleanliness and hygiene of toilet and drainage system at dismantling site. ▪ First Aid Box with required tools and medicines.	Monitoring	Daily	Contractor	APSCL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/Month or Year	Responsibility	
				Implementation	Supervision
	▪ Readiness and Fitness of site emergency ambulance and boat ambulance. ▪ The heavy demolition material to handled and stored safely putting due care on public safety. ▪ Heavy materials at dismantling site to be stored and handled safely. ▪ Check of personal protective equipment (PPE) for worker at the sites.				

11.4 Environmental and Social Monitoring Budget

APSCL will must allocate environmental monitoring budget in the project cost for pre-construction and construction phase and continue it during operational and dismantling phase. The estimated budget for implementation of the mitigation and monitoring measures proposed in the EMoP is presented in Table 11.3. The costs will be added in the DPP or will be managed by APSCL as per their policy. The overall costs of the EMoP will comprise:

- Environmental monitoring through sample collection and analysis and reporting;
- Any remedial measures necessary to reduce or avoid environmental damages;
- Designing and implementing all mitigation and enhancement measures;

The total budget is estimated as **BDT 25,60,000.00 per year** for Pre-construction phase, **BDT 35,74,000.00 per year** for Construction phase, **BDT 25,90,000.00 per year** for Operation phase and **BDT 290,000.00 per month** for Dismantling phase. This estimate is calculated excluding VAT and AIT and it may vary with time. APSCL and Construction Contractor will allocate the sufficient budget to conduct the environmental monitoring as per their responsibility to comply the suggested monitoring requirements in below Table-11.3.

Table 11-3: Environmental Monitoring Budget for this Solar Power Plant Project

Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost (BDT)/Year
01	**Pre-construction Period**				
1.1	Landscape/Topography	Included in engineering cost			-
1.2	Labor Standard	Included in engineering cost			-
1.3	Capacity Enhancement	No.	100,000.00	1	100,000.00
1.4	Ambient Air	Monthly-1	35,000.00	12	420,000.00
1.5	Noise	Monthly-1	20,000.00	12	240,000.00
1.6	Surface Water	Monthly-1	50,000.00	12	600,000.00
1.7	Groundwater	Monthly-1	50,000.00	12	600,000.00
1.8	Drinking Water	Monthly-1	50,000.00	12	600,000.00
Subtotal (Pre-construction Period) Per Year					**25,60,000.00**
02	**Construction Period (Per Year)**				
2.1	Loss of Topsoil	--	--	--	--
2.2	Landscape/Topography	--	--	--	--
2.3	Ambient Air	Monthly-1	35,000.00	12	420,000.00
2.4	Noise	Monthly-1	20,000.00	12	240,000.00
2.5	Surface Water Quality	Monthly-1	50,000.00	12	600,000.00
2.6	Groundwater Quality	Monthly-1	50,000.00	12	600,000.00
2.7	Drinking Water Quality	Monthly-1	50,000.00	12	600,000.00
2.8	Soil Quality	Sixmonthly-1	35,000.00	2	70,000.00
2.9	Soil Erosion and Siltation	--	--	--	--

Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost (BDT)/Year
2.10	Drainage Congestion	--	--	--	--
2.11	Vegetation	--	--	--	--
2.12	Terrestrial Fauna	--	--	--	--
2.13	Aquatic Species	Monthly-1	30,000.00	12	360,000.00
2.14	Fisheries	--	--	--	--
2.15	Pollution from Wastes, Construction Waste Disposal (Wastewater, Oil, Hazardous Waste etc.)	Monthly-1	10,000.00	12	120,000.00
2.16	Construction Yards	--	--	--	--
2.17	Occupational Health and Safety (OHS)	Monthly-1	5000	12	60,000.00
2.18	Community Health and Safety	Monthly-1	5000	12	60,000.00
2.19	COVID-19 & other disease Measures	Monthly-1	5000	12	60,000.00
2.20	Traffic Congestion	Will be managed through existing TMP			
2.21	Income/Job Opportunities	--	--	--	--
2.22	Tree Plantation (plan required)	Number	300	400	120,000.00
2.23	Environmental Monitoring Report	Monthly Prepared by 3rd Party based on Monitoring			120,000.00
2.24	Water Spray for dust suppression	Daily to Monthly	12000	12	144,000.00
Subtotal (Construction Period) Per Year					**35,74,000.00**
03	**Operation Period for Plant Lifetime (Per Year)**				
3.1	Landscape/Topography	Included in engineering cost			-
3.2	Ambient Air Quality	Monthly-1	35,000.00	12	420,000.00
3.3	Noise	Monthly-1	25,000.00	12	300,000.00
3.4	Surface Water	Monthly-1	50,000.00	12	600,000.00
3.5	Groundwater	Monthly-1	50,000.00	12	600,000.00
3.6	Drinking Water	Monthly-1	50,000.00	12	600,000.00
3.7	Soil Quality	Sixmonthly-1	35,000.00	2	70,000.00
Subtotal (Operation Period) Per Year					**25,90,000.00**
04	**Dismantling Period**				
4.1	Ambient Air Quality	Monthly-1	40,000.00	1	40,000.00
4.2	Noise	Monthly-1	30,000.00	1	30,000.00

Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost (BDT)/Year
4.3	Surface Water	Monthly-1	60,000.00	1	60,000.00
4.4	Groundwater	Monthly-1	60,000.00	1	60,000.00
4.5	Drinking Water	Monthly-1	60,000.00	1	60,000.00
4.6	Soil Quality	Monthly-1	40,000.00	1	40,000.00
Subtotal (Dismantling Period) Per Month					**290,000.00**
SUMMARY OF THE BUDGET					
1.	**Pre-Construction Period (Per Year)**	**25,60,000.00**			
2.	**Construction Period (Per Year)**	**35,74,000.00**			
3.	**Operation Period (Per Year)**	**25,90,000.00**			
4.	**Dismantling Period (Per Month)**	**290,000.00**			

11.5 Institutional Arrangement

The Environmental and Social Cell of the project implementation unit (PIU) shall monitor the implementation of EMP properly. The roles and responsibilities of PIU and its consultants are presented in Table below-

Table 11-4: Organizational responsibilities

Organizations	Responsibilities
PIU/PMU/APSCL	• Ensure that all project activities are well-managed and coordinated. • Procurement of works and goods. • Recruitment and supervision of Construction Supervision Consultants (CSC). • Recruitment and supervision of external monitor and independent panel of experts. • Carry out environmental assessment. • All the actions related to ensure compliance with EMP as directed by PIU/PMU and preparatory studies based on the world bank and other Agency required.
E&S Cell within PIU/PMU	• Responsible for assisting PM and hiring of consultants to carry out any required environmental assessment work for subprojects and also for preparatory studies, reviewing consultant deliverables related to environmental assessment, reviewing bid documents for inclusion of EMP measures, supervising construction activities, producing periodic monitoring reports. • Ensuring inclusion of EMP in bidding documents. • Providing training on EMP principles and requirements to CSC, contractors, field staff, and others as needed to ensure effective implementation of EMP.

Organizations	Responsibilities
	• Supervising CSC for the implementation of EMP. • Closely coordinate with HS&E division of APSCL, other concerned agencies, local governments, and communities to support implementation of EMP. • Preparation of progress reports on implementation of EMP. • Ensure effective implementation of EMP components not directly tasked to the contractor including components dealing with indirect, induced, and cumulative effects, as well as operations and maintenance stage plans and measures. • Ensure compliance of the studies comply with DoE, World Bank, Lender and other agency requirements.
HS&E Officer and HS&E Manager of APSCL	• Project HS&E Officer of APSCL will be responsible for implementing standard environmental code of practices during operation and dismantling stage of this solar plant and will conduct monitoring and supervision as per guidance of HS&E Manager/Divisional head of APSCL. • Project HS&E Officer of APSCL will submit the monthly environmental monitoring report to DoE District Office, Narsingdi. • HS&E Manager/Divisional head of APSCL will be responsible for implementation, monitoring and supervision of mitigation and monitoring measures during pre-construction, construction, operation and dismantling stage as per Monitoring Plan and EMP. • HS&E Manager/Divisional head of APSCL will guide to EPC contractor to engage competent Environmental 3rd Party for environmental parameters monitoring and reporting as per the suggested monitoring plan. • HS&E Manager/Divisional head of APSCL will do monitoring and supervision of contractor's HS&E works and Environmental 3rd Party's monitoring work and reporting engaged by EPC Contractor during pre-construction and construction phase. • HS&E Manager/Divisional head of APSCL will review and accept the Environmental Monitoring report prepared by 3rd Party.
Construction Contractor	• Responsible for implementation of mitigation and monitoring measures by independent 3rd party proposed in the Monitoring Plan and EMP during the pre-construction and construction phases. • Prior to pre-construction phase, they will engage competent independent Environmental 3rd party for environmental monitoring as per direct guidelines and directions of HS&E Manager/HS&E Divisional Head of APSCL. • Prior to the pre-construction phase, the construction contractor will recruit an Environmental, Health and Safety (EHS) Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and maintain liaison with PIU. S/he will have adequate number of supervisor and staffs to support him/her for these tasks. He/She will always maintain liaison directly with project HS&E Officer and HS&E Manager/HS&E Divisional Head of APSCL and will report to him time to time.

12 GRIEVANCE REDRESS MECHANISM

12.1 General

The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall components/activities of the subproject itself during pre-construction, construction, operation and dismantling phase. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A Grievance Redress Mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns.

12.2 APSCL's Own Grievance System

Ongoing public involvement and input has been highlighted as essential to the execution of successful projects. As a result of this public participation during the initial stages of the project, major issues of grievance are not expected. During the construction and operational phase of the project, the complaints that may be anticipated are mostly related to noise, dust, soil pollution, water pollution and vibration of the engines. 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 Mechanism will be implemented during both the construction and operational period of the project to ensure that all complaints from local communities and stakeholders 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 and online system should be available. Confidentiality and privacy for complainants should be honored where this is seen as necessary or important. APSCL shall set up a grievance redress committee that will address any complaints during both the construction and operational period of the project.

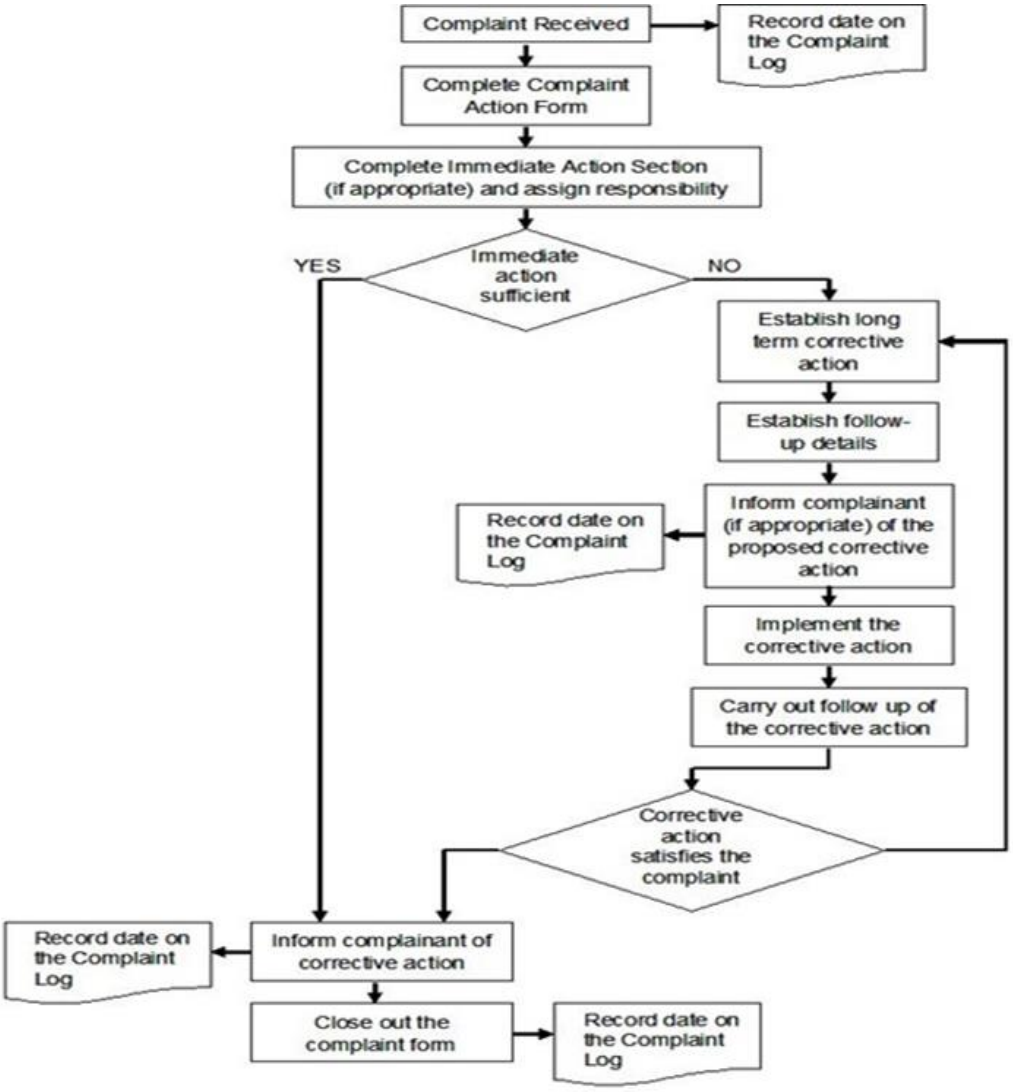


Figure 12-1: Flowchart of Complaints/Grievance Procedure

The representation in the committee makes project affected persons to have trust and build confidence in the system. The grievance redress committee reports its plan and activities to the Implementation committee. The following list presents the members of the committee in Table-12.1.

Table 12-1: Members of the Committee of Grievance Redress (GRC)

No.	Designation
1	Chief Engineer (O&M), APSCL
2	Project Director, 120 MW Solar Power Plant Project, APSCL
3	Manager (HRM), APSCL
4	Manager (HS&E), APSCL
5	Deputy Manager (Security & Discipline), APSCL

No.	Designation
6	**Assistant Manager (Security & Discipline), APSCL**

GRC will maintain a Complaints Database, which will contain all the information on complaints or grievances received from the communities or other stakeholders. This would include: the type of complaint, location, time, actions to address these complaints, and final outcome.

The procedures to be followed and adopted by the grievance redress should be transparent and simple to understand or uniform process for registering complaints provide project affected persons with free access to the procedures. The response time between activating the procedure and reaching a resolution should be as short as possible. An effective monitoring system will inform project management about the frequency and nature of grievances. GRC will arrange half yearly meetings where the activities and the outcomes/measures taken according to the Complaints Database are to be monitored and reviewed by third party consultant to ensure the required transparency. In addition to the above, if there are any grievances related to environmental management issues in the project area, the GRC will record these grievances and suggestions and pass it on to the relevant consultant for necessary action and follow-up.

GRC will be responsible to response for the grievances within a time limit. The initial movement to identify the causes should be taken within 48 hours. The GRC will not take more than two weeks to take the final initiative.

In case a dispute is not resolved by arbitrational tribunal, then if any of the Party disagrees, the aggrieved party has the right to appeal to the ordinary courts of law. However, the preferred option of dispute settlement ought to be the option of settling the dispute amicably because recourse to courts may take a very long time even years before a final decision is made and therefore, should not be the preferred option for both parties concerned. A grievance form is presented below and hard copies of both English and Bangla will be made available at the APSCL project office.

Beside this as per Labor Law 2018 and Clause no 81 of Labor Rules 2015, APSCL has an active 'Safety Committee' to address and solve the internal grievance regarding Health, Safety and Environmental issues. APSCL has established and published 'Citizen's Charter' System to address any grievance related to it and to rectify the problem rapidly by proper system. The web link of this is**: https://apscl.portal.gov.bd/site/view/citizen_charter/-**.

APSCL has also online Grievance Redress System. The useful links of these are: **http://apscl.gov.bd/site/page/929f626c-752c-4724-9680-845d0414883f/Process-Map & http://www.grs.gov.bd/** .

If anybody is affected by this solar power plant activities or any other power generating unit of APSCL can give complain here.

12.3 Proposed GRM System

The project proponent will make the public aware of the GRM through public awareness campaigns. The project information brochure will include information on the GRM and shall be widely disseminated throughout the project area by the Environmental Specialist/Engineer and other officials. Grievances can be filed in writing or by phone or by online with any member of the responsible team. Figure 12.2 represents how GRM will be implemented for the project.

First Tier of GRM: The Project Director (PD), shall be the designated person as the key specialist for grievance redress (1st tier). Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

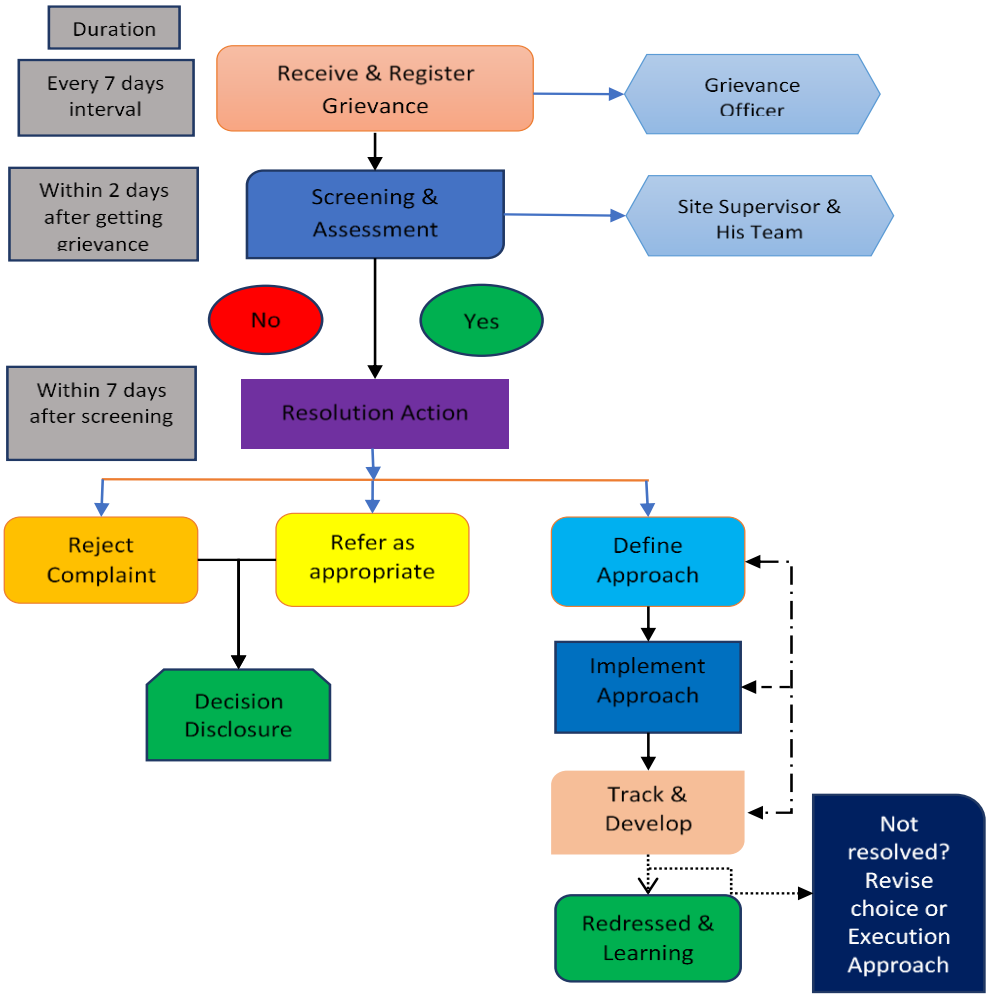


Figure 12-2: Proposed GRM for the Project

The updated register of grievances and complaints will be available to the public at the SEC office, construction site, and other key public offices along the project area. Should the grievance remain unresolved, it will be elevated to the second tier.

Second Tier of GRM: APSCL Solar Plant authority will activate the second tier of GRM by referring to the unresolved issue (with written documentation). The GRC shall be established by the responsible team for the project proponent before commencement of site work. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (iii) representative of the

affected persons; (iv) representative of the local Upazila parishad's office; and (v) representative of the Department of Environment (DOE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC. The PD, SEC will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued, and the decisions carried out.

Third Tier of GRM: In the event that a grievance cannot be resolved directly by the PIU (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city corporation authority. The grievance redress mechanism and procedure is depicted in Figure 12.2. The monitoring reports of the EMP shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

12.3.1 Construction Workers Grievance

At construction sites, work camps and on-the-job, laborers and other unskilled hired employees of the contractor have little recourse when either their living conditions are badly degraded, they are not paid according to agreement, or basics, such as safe drinking water, potable water are not supplied. Under this contract, as part of the written agreement with each hire, the contract or letter of assignment with the work will include the name and contact information for the worker to contact. The letter/agreement will contain a second statement indicating that the contractor will not penalize the worker for reporting a complaint and if that occurs, the contract will be levied a fine equal to the employees' contract duration from the time of the incident to the end of the contract period. That amount will be paid to the complainant. The contractor will provide a compliant box, sealed by the CSC, and collected by the CSC, thus allowing the construction worker to file complaints by going directly to the CSC.

13 ENVIRONMENTAL AND SOCIAL BENEFIT FROM THE PROJECT

13.1 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.

13.2 Emission Reduction

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 power plant generates electricity with no associated air pollution and GHG emissions. While solar energy systems emit some air pollutants, total air emissions are generally much lower than those of coal, oil and natural gas-fired power plants. In addition, solar energy requires essentially 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.

13.3 Energy and Climate Concern

The negative environmental impacts from generating electricity through conventional fossil fuel burning at thermal power plants are well known. This most importantly includes air pollutant emissions such as ozone depleting substances (ODS), sulfur dioxide (SO_2), Nitrogen Dioxide (NO_2), CO_2, CO, water vapor, particulate matter, and other gases that are the cause of some serious environmental concerns such as photochemical smog, acid rain, health effects, enhanced greenhouse effect, and many others.

In addition, the burning of fossil fuels results in carbon dioxide emissions; a primary greenhouse gas emitted through human activities that contributes to global warming. The main human activity that emits CO_2 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 (CO_2) over a 30-year lifetime.

13.4 Energy and Livelihood Concern

The belief that the provision of electricity in rural areas can bring about desired socio-economic changes (increased economic opportunities, improved health, and education facilities). First, it is argued that electrification only brings changes to resource-rich households, and second, that it drains the resource-scarce rural economy. However, changes in electrified areas might demonstrate some positive outcomes. In response to the availability of electricity, village people could find various productive uses for it.

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.

13.5 Energy and Economy Concern

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.

PV remains the most rapidly growing energy technology by a wide margin. Indeed, global PV installations for 2014 should reach at least 40,000 megawatts, expanding world PV capacity by another 30 percent. As concerns about climate change grow, solar PV has firmly established itself as an integral player in the transition from fossil fuels.

13.6 Improvement of Local Communities

The project will benefit the residents and economies of local communities near the project site. In addition to providing employment opportunities and improving the local economy, the project authority is committed to preserving the heritage and cultures of nearby villages. APSCL, the Project authority is committed to provide additional sustainable benefits, primarily for the local region affected by the project.

13.7 National Economic Benefits

The project will provide a significant boost to the national economy by eliminating the country's previous power deficit and significantly reducing the use of expensive and air-polluting fossil fuel-fired thermal power generation. The project will support economic growth and job creation as well as enhance the competitiveness of the local goods both regionally and internationally.

The project's principal macro benefits for Bangladesh include:

- New supply of clean, reliable energy.
- Lower electricity costs.
- Eliminate government subsidies for power production.
- Reduced electricity rationing.
- Increase in economic investment and national income.
- Reduced trade deficit and need to import gas and oil products.
- Support for rural electrification programs.

14 CONCLUSIONS AND RECOMMENDATIONS

14.1 Conclusions

According to the above analysis, it can be concluded 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 get benefit from this solar power plant project. Benefits in the project area will be insignificant except for some short terms' employment and business opportunities during the construction phase.

During the construction stage, there will be some negative impacts of the project and according to this study that will be managed and mitigated by following suggested measures. 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". 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.

14.2 Recommendations

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 EMP, its mitigation and monitoring programs, contained herewith shall be included within the Bidding documents for project works.

The construction contractor shall be responsible for the environmental parameters monitoring and implementation of the suggested requirements of the EMP of this report through his own Site Specific Environmental and Social Management Plan that will adopt all of the conditions of the EMP. This will ensure that all potential bidders are aware of the environmental requirements of the project and its associated health, safety and environmental monitoring, management and mitigation costs.

The EMP and all its requirements shall then be added to the construction contractor's contract, thereby making environmental parameters monitoring and implementation of the EMP as a legal requirement according to the contract. To ensure compliance with the EMP, prior to pre-construction phase the contractor should employ an independent environmental 3rd party for environmental parameters monitoring and reporting under the guidance and supervision of HS&E Manager/HS&E Divisional Head of APSCL throughout the project pre-construction and construction phase. APSCL authority will engage an independent environmental 3rd party for environmental parameters monitoring and reporting according to the suggested monitoring plan and framework of this report

during operation (plant lifetime) and dismantling phase of the plant. APSCL will submit all the monthly environmental monitoring report to DoE District office, Narsingdi. Both project construction contractor and APSCL will comply all the terms and conditions of site clearance certificate and environmental clearance certificate provided by DoE for this plant. Site Clearance certificate, Environmental Clearance Certificate, and others necessary documentation need to be updated and renewed as required. Ensuring strict adherence to environmental regulations and standards set by local and national authorities is recommended.

ANNEXURE

ANNEX 1: Administrative Approval & NOC from relevant departments and local authority

সংযুক্তি - ২১

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
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বিষয়: **"রায়পুরা ১২০ মেগাওয়াট গ্রিড টাইড সোলার পাওয়ার পাওয়ার প্ল্যান্ট" স্থাপনের লক্ষ্যে আশুগঞ্জ পাওয়ার ষ্টেশন কোম্পানী লিঃ (এপিএসসিএল) -এর অনুকূলে ৩৬৮ (তিনশত আটষট্টি) একর (কম / বেশী) জমি অধিগ্রহণের প্রশাসনিক অনুমোদন।**

সূত্র: এপিএসসিএল এর স্মারক নম্বর: ২৭.২৫.১২৩৩.৪৭১.৯৯.০০৯.১৯.১০, তারিখ: ০৮ মে ২০২২

উপর্যুক্ত বিষয় ও সূত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, আশুগঞ্জ পাওয়ার স্টেশন কোম্পানী লিঃ (এপিএসসিএল) কর্তৃক নরসিংদী জেলার রায়পুরা উপজেলাধীন চানপুর ইউনিয়নের মাঝেরচর মৌজায় ৩৬৮ (তিনশত আটষট্টি) একর (কম/বেশী) জমিতে রায়পুরা ১২০ মেগাওয়াট গ্রিড টাইড সোলার পাওয়ার প্ল্যান্ট স্থাপনের নিমিত্ত প্রাথমিকভাবে সম্ভাব্যতা যাচাই করা হয়েছে। উক্ত জমি অধিগ্রহণের জন্য প্রশাসনিক অনুমোদন প্রদানের জন্য অনুরোধ করা হয়েছে , যা বিদ্যুৎ বিভাগ কর্তৃক অনুমোদিত হয়েছে।

০২। এমতাবস্থায়, এপিএসসিএল কর্তৃক রায়পুরা ১২০ মেগাওয়াট গ্রিড টাইড সোলার পাওয়ার প্ল্যান্ট স্থাপনের জন্য নরসিংদী জেলার রায়পুরা উপজেলাধীন চানপুর ইউনিয়নের মাঝেরচর মৌজায় ৩৬৮ (তিনশত আটষট্টি) একর (কম/বেশী) জমি অধিগ্রহণের প্রশাসনিক অনুমোদন নির্দেশক্রমে জ্ঞাপন করা হলো।

১৭-৬-২০২২
মুহাম্মদ হাসনাত মোর্শেদ ভূঁইয়া
সিনিয়র সহকারী সচিব
ফোন: ২২৩৩৫৪৪০৯
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ব্যবস্থাপনা পরিচালক
আশুগঞ্জ পাওয়ার স্টেশন কোম্পানী লিঃ

স্মারক নম্বর: ২৭.০০.০০০০.০৯৬.১৪.০০৭.২২.৯২/১(৭) তারিখ: ৩ আষাঢ় ১৪২৯ / ১৭ জুন ২০২২

সদয় অবগতি ও কার্যার্থে প্রেরণ করা হল:

১) সচিব, ভূমি মন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা।
২) অতিরিক্ত সচিব, নবায়নযোগ্য জ্বালানি অনুবিভাগ, বিদ্যুৎ বিভাগ
৩) যুগ্মসচিব, নবায়নযোগ্য জ্বালানি অনুবিভাগ, বিদ্যুৎ বিভাগ
৪) জেলা প্রশাসক, জেলা প্রশাসকের কার্যালয়, নরসিংদী
৫) সচিবের একান্ত সচিব (অতিরিক্ত দায়িত্ব), সচিবের দপ্তর, বিদ্যুৎ বিভাগ
৬) মাননীয় প্রতিমন্ত্রীর একান্ত সচিব, প্রতিমন্ত্রীর দপ্তর , বিদ্যুৎ বিভাগ
৭) উপজেলা নির্বাহী অফিসার, উপজেলা নির্বাহী অফিসারের কার্যালয়,রায়পুরা,নরসিংদী

১৭-৬-২০২২
মুহাম্মদ হাসনাত মোর্শেদ ভূঁইয়া
সিনিয়র সহকারী সচিব

সংযুক্তি - ৩৬

শেখ হাসিনার বাংলাদেশ
পরিচ্ছন্ন পরিবেশ

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
ঢাকা অঞ্চল কার্যালয়
ই-১৬, আগারগাঁও, শেরে বাংলা নগর, ঢাকা-১২০৭।
www.doe.gov.bd

নং- ২২.০২.০০০০.১৩১.৯৯.০১৩.২২- ১৩১ তারিখ: ১১/০৪/২০২৩খ্রিঃ।

বিষয়: "রায়পুরা ১২০ মেগাওয়াট গ্রীড টাইড সোলার পাওয়ার প্ল্যান্ট" শিরর্ক প্রকল্প বাস্তবায়নের লক্ষ্যে নরসিংদী জেলার রায়পুরা উপজেলার চানপুর ইউনিয়নের মাঝেরচর মৌজায় বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ডের অধীন অশুগঞ্জ পাওয়ার স্টেশন কোম্পানি লিঃ (এশিএসসিএল) কর্তৃক ৩৬৮ (তিনশত আটষট্টি) একর (কম/বেশি) জমি অধিগ্রহণের অনাপত্তিপত্র।

সূত্র: আশুগঞ্জ পাওয়ার স্টেশন কোং লিঃ এর ২০/০৩/২০২৩ তারিখের পত্র।

উপর্যুক্ত বিষয় ও সূত্রের পরিপ্রেক্ষিতে জানানো যাচ্ছে যে, "রায়পুরা ১২০ মেগাওয়াট গ্রীড টাইড সোলার পাওয়ার প্ল্যান্ট" শিরর্ক প্রকল্প বাস্তবায়নের লক্ষ্যে অশুগঞ্জ পাওয়ার স্টেশন কোম্পানি লিঃ এর আবেদনের পরিপ্রেক্ষিতে নরসিংদী জেলার রায়পুরা উপজেলার চানপুর ইউনিয়নের মাঝেরচর মৌজায় ৩৬৮ (তিনশত আটষট্টি) একর (কম/বেশি) নাল, বোরো, হালট, বাড়ী শ্রেণীর জমি অধিগ্রহণের জন্য নিম্নবর্ণিত বিষয়াদি প্রতিপালনের শর্তে অত্র দপ্তর হতে নির্দেশক্রমে অনাপত্তিপত্র প্রদান করা হলোঃ

শর্তাবলীঃ

(ক) প্রকল্প এলাকায় অধিগ্রহণকৃত জলাশয় ভরাট করা যাবে না এবং বৃষ্টির পানি বা বন্যার পানির প্রবাহ বাধাগ্রস্থ করা যাবে না;

খ) বর্ণিত প্রকল্পের অনুকূলে পরিবেশ অধিদপ্তর হতে বিধি মোতাবেক পরিবেশগত ছাড়পত্র গ্রহণ করতে হবে। পরিবেশ সংরক্ষণ বিধিমালা, ২০২৩ এর তফসিল ১ অনুযায়ী প্রকল্পটি 'কমলা' শ্রেণিভুক্ত। এ শ্রেণির প্রকল্পের ক্ষেত্রে প্রথম পর্যায়ে অবস্থানগত ছাড়পত্র এবং পরবর্তীতে পরিবেশগত ছাড়পত্র গ্রহণ করতে হবে;

(গ) আলোচ্য প্রকল্পের কার্যক্রমের মাধ্যমে যাতে পারিপার্শ্বিক পরিবেশ (যথাঃ মাটি, পানি, বায়ু)-এর উপর কোন বিরূপ প্রভাব না পড়ে সে বিষয়ে যথোপযুক্ত ব্যবস্থা গ্রহণ করতে হবে এবং উৎপন্ন ই-বর্জ্য পরিবেশসম্মতভাবে অপসারণ করতে হবে;

(ঘ) প্রকল্পের কার্যক্রমের আওতায় পারিপার্শ্বিক জীববৈচিত্র্য ও বন/গাছপালা ক্ষতিগ্রস্থ করা যাবে না এবং প্রাকৃতিকভাবে সৃষ্ট জলাশয়, নর্দমা ও খাল ভরাট বা এর প্রবাহ কোনক্রমেই বিঘ্ন করা যাবে না;

(ঙ) প্রকল্পের যে কোন অবকাঠামো নির্মাণ কাজে ব্যবহৃত মালামাল যথাযথভাবে পরিবহন/ব্যবহার করতে হবে যাতে বায়ুদূষণের প্রতিরোধ করা যায়;

(চ) প্রকল্প বাস্তবায়নকালীন বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫, বায়ু দূষন নিয়ন্ত্রণ বিধিমালা, ২০২২, কঠিন বর্জ্য ব্যবস্থাপনা বিধিমালা, ২০২১ এবং শব্দ দূষন নিয়ন্ত্রণ বিধিমালা, ২০০৬ যথাযথভাবে পালন করতে হবে;

(ছ) এই অনাপত্তিপত্র ভূমির মালিকানা স্বত্ব নির্ধারণ করে না।

১১/৪/২৩

(সৈয়দ নজমুল আহসান)
পরিচালক
ফোন: ৮১৮১১০৩

তত্ত্বাবধায়ক প্রকৌশলী
পরিকল্পনা ও উন্নয়ন দপ্তর
আশুগঞ্জ পাওয়ার স্টেশন কোং লিঃ, নরসিংদী।

অনুলিপিঃ
১। উপপরিচালক, পরিবেশ অধিদপ্তর, নরসিংদী জেলা কার্যালয়, নরসিংদী।
২। সহকারী পরিচালক, মহাপরিচালক মহোদয়ের দপ্তর, পরিবেশ অধিদপ্তর, ঢাকা।

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সংযুক্তি - ৩৭

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
উপজেলা কৃষি অফিসারের কার্যালয়
রায়পুরা, নরসিংদী।

স্মারক নং-১২.১৮.৬৮৬৪.০৩৯.০২.২২.-১২০ তারিখ:২৭/০৩/২০২৩খ্রি.

বিষয়ঃ " রায়পুরা ১২০ মেগাওয়াট গ্রীড টাইড সোলার পাওয়ার প্ল্যান্ট প্রকল্প" স্থাপনের লক্ষ্যে রায়পুরা উপজেলায় চানপুর ইউনিয়নে মাঝেরচর মৌজার ভূমি অধিগ্রহন বিষয়ে মতামত প্রেরণ প্রসঙ্গে।

সূত্রঃ- তত্ত্বাবধায়ক প্রকৌশলী ,পরিকল্পনা ও উন্নয়ন দপ্তর, আশুগঞ্জ পাওয়ার স্টেশন কোঃ লিঃ মহোদয়ের দপ্তর স্মারক নং ২৭.২৫.১২৩৩.৪৭০.১৮ (৩).০০১.১৭.২৮ তারিখঃ ২০মার্চ -২০২৩ খ্রি. মোতাবেক।

উপর্যুক্ত বিষয় ও সূত্রের স্মারকের আলোকে মহোদয়ের অবগতি ও প্রয়োজনীয় ব্যবস্থা গ্রহনের জন্য জানানো যাচ্ছে যে " আশুগঞ্জ পাওয়ার স্টেশন কোঃ লিঃ (এপিএসসিএল) কর্তৃক রায়পুরা ১২০ মেগাওয়াট গ্রীড টাইড সোলার পাওয়ার প্ল্যান্ট প্রকল্প" স্থাপনের নিমিত্তে রায়পুরা উপজেলায় চানপুর ইউনিয়নের মাঝেরচর মৌজায় ৩৬৮.০০ (তিনশত আটষট্টি) একর জমি অধিগ্রহন কার্যক্রম পরিচালনার স্বার্থে একটি অনাপত্তি পত্র প্রদানের আবেদনের প্রেক্ষিতে সূত্রস্থ পত্রে উল্লেখিত মৌজাদ্বয়ের উক্ত দাগ সমূহের জমিগুলো নিম্নস্বাক্ষরকারীর পরিদর্শন হতে প্রাপ্ত তথ্যগুলো নিম্নোক্ত ছকে প্রদান করা হলো।

ক্রমিক নং	মৌজার নাম	জমি পরিমান (একরে)	জমি গুলো কৃষি জমি কি না	জমি কয় ফসলী	মন্তব্য
০১	মাঝের চর জেএল নং ৩০	৩৬৮.০০	কৃষি জমি	এক ফসলী	বালু চর হওয়ায় সেখানে সামান্য রবি শস্য চাষাবাদ হয়। অন্যান্য সময় পানিতে নিমজ্জিত থাকে।

সর্বমোট = ৩৬৮.০০ (তিনশত আটষট্টি একর মাত্র)

২৭.৩.২৩

(মোঃ মোস্তাফিজুর রহমান)
উপজেলা কৃষি অফিসার
রায়পুরা, নরসিংদী।

তত্ত্বাবধায়ক প্রকৌশলী ,
পরিকল্পনা ও উন্নয়ন দপ্তর,
আশুগঞ্জ পাওয়ার স্টেশন কোঃ লি
আশুগঞ্জ,ব্রাহ্মনবাড়িয়া- ৩৪০২।

অনুলিপি সদয় অবগতির জন্য:-
১। উপজেলা নির্বাহী অফিসার,রায়পুরা,নরসিংদী।
২। অফিস নথি।

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চাঁনপুর ইউনিয়ন পরিষদ

ডাকঘরঃসদাগরকান্দি,উপজেলাঃরায়পুরা,জেলাঃনরসিংদী।

স্মারক নং-চাঁন/ইউপি/রায়/নরসিংদী- ০৬/০১/২০২৪ ইং তারিখঃ ১৩/০১/২০২৪ ইং

"অবস্থানগত/ পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্র"

০১) আবেদন কারীর নাম ঃ জনাব মোঃশাহ আলম খান

০২) পিতার নাম ঃ মোঃ আবুল হাসেম খান

০৩) আবেদন কারীর ঠিকানা ঃ ব্যবস্থাপনা পরিচালক

আশুগঞ্জ পাওয়ার স্টেশন কোম্পানীলিঃ(এপিএসসিএল), আশুগঞ্জ, ব্রাহ্মানবাড়ীয়া- ৩৪০২

০৪) কারখানা/ প্রকল্পের অবস্থানগতঠিকানা ঃ রায়পুরা, নরসিংদী

০৫) কারখানা/ প্রকল্পেরতফসিল ঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমিরধরণ	মোট জমির পরিমাণ
১	২	৩	৪	৫	৬	৭
নরসিংদী	রায়পুরা	মাঝের চর	৮১,১৮৭,১০৮,১৬৫,৩৮,৫৪৫,৫৬১,৪০৩,২৩১,৩৮,৪৬৬,৮৪,৮৪,২১১,৪২৭,৩৮০,১৪৮,১৫৩,২১১,৩০৯,৪৭,৪৭,৪৭,৪৭,৪৭,৪০৩,১,৩৪২,২৪০,১,১,১,১,২৪১,১৭৮,১৭৮,৪৭৪,৫৪২,৩৫২,৬৭,১৯১,১,১,৩৯৭,৩৯৭,১৭৮,২০৪,২৪১,১৭৮,৫০১,৪৭৪,১,১,১,১,১,৩২৯,৫৪,৫৪,৩৮৩,৩৮৩,৫৯১,১৫৩,৪৪৪,৫৩৩,৬০২,৫১৩,২১৪,৫৫৭,২৮৮,৫৬৬,৪৯৩,১১০,৩৮০,১৪৮,৩৮৮,৩৩,৬২,১,১,৪৬৬,৩৬৬,৪৫১,১৪৮,৫৯৮,৫৯৮,৪২৮,১১৩,১৮৬,৬০,৪৪৪,২৩১,১,১,২১১,৪৩৩,৫১০,২০৫,২০৫,২৪৬,৩০৯,৫১০,৫৭০,৩৬৬,১৮৭,৫৪,৩৪৮,৫১৩,৫৩৯,৩০৯,২৪৬,২৪৬,৩০৯,১,৩০৯,৪১৯,৫১৩,১৮৭,৩৩৬,৫৪৬,৫৬১,৪,৫৪৬,৫৯১,৫৪৬,১৬৫,১,৫০৯,৫১৪,২৮০,৪৩৫,৪৪০,৬,৩৬০,৪২০,৫৯৮,৫৫৭,৫৮৯,৫৩৪,৪৩৫,৪,৫৯১,৩৩০,৩৩০,৪০৩,৫৬৩,৯৯,৫৯১,৫৯৩,৫৩৪,৫,১১৭,৪২৮,২৭৬,৫৯৩,৪২৮,৪৫৭,৪২৮,৪৫৭,১২৩,১২৩,৪৫৭,৫০৮,৪৮১,৪৫৭,২১৭,৪২৬,৩৯১,৪৪৮,৪৪৭,৫৬,৪৩০,২৮৩,২৮৩,২৮৩,৩৭৯,১০০,৩৭৯,২৮৩,১৭৫,৩০৩,৩০২,১,৫৫৫,২৯২,১৭৬,৩০৩,১৪৪,১,৩১৮,৩৯০,৫৭,৫৫৫,৫৩৮,৫৫৫,৫৩৪,১৫১,৫৫৫,১৮৬,৫৩৮,১,১,১,১,৪২০,৪৮৬,১,১,১,১,১,১,১,১,৬০৪,৪৮,৫৬৩,৫৭,২১৬,৩৭৯,১১৮,৪৯৭,১৬০,৪৮২,৭,৫০৭,২৬৭,২৯৯,১০৩,৪৯৭,৪৯৭,২১২,২১৯,২৯৯,২৬৭,৪২৬,৫৭,৫৭,৫৭,৫৭,৫৭,৪৭১,৫৭,৪৭১,৪৭১,৪৪৭,১২২,২১৭,১২২,৪৫৭,৪৭১,২১০,২১০,৪৯৭,৫৭,৩০২,৭৩,১৭৫,৩৭৯,৩৭৯,১০০,১৫৯,২৮৩,১০০,২৮৩,৫২,৫৭৫,৪২৮,৪২৮,৩৩৩,৫৭৫,৩৪৪,৪৫,৫৯৬,৫৬৯,৩৬১,৩৭৯,৫৭,১১৬,৮,৩৩৮,৫৭৬,১১৩,১,৩৭৭,৩৭৭,৩৩৮,	১০৭৫,১০৭৬,১০৮০,১০৮১,১০৮৬,১০৮৭,১০৮৮,১০৮৯,১০৯০,১০৯১,১০৯২,১০৯৩,১০৯৪,১০৯৫,১০৯৬,১০৯৭,১০৯৮,১০৯৯,১১০০,১১০১,১১০২,১১০৩,১১০৪,১১০৫,১১০৬,১১২৪,১১২৫,১১২৬,১১২৭,১১২৮,১১২৯,১১৩০,১১৩১,১১৩২,১১৩৩,১১৩৪,১১৩৫,১১৩৬,১১৩৭,১১৩৮,১১৩৯,১১৪০,১১৪১,১১৪২,১১৪৩,১১৪৪,১১৪৫,১১৪৬,১১৪৭,১১৪৮,১১৪৯,১১৫০,১১৫১,১১৫২,১১৫৩,১১৫৪,১১৫৫,১১৫৬,১১৫৭,১১৫৮,১১৫৯,১১৬০,১১৬১,১১৬৬,১১৬৭,১১৬৮,১১৭০,১১৭১,১১৭২,১১৭৩,১১৭৪,১১৭৫,১১৭৬,১১৭৭,১১৭৮,১১৭৯,১১৮০,১১৮১,১১৮২,১১৮৩,১১৮৪,১১৮৫,১১৮৬,১১৮৭,১১৮৮,১১৮৯,১১৯০,১১৯১,১১৯২,১১৯৩,১১৯৪,১১৯৫,১১৯৬,১১৯৭,১১৯৮,১১৯৯,১২০০,১২০১,১২০২,১২০৩,১২০৪,১২০৫,১২০৬,১২০৭,১২০৮,১২০৯,১২১০,১২১১,২৫৮৫,২৫৮৬,২৫৮৭,২৫৮৮,২৫৮৯,২৫৯০,২৬০২,২৬০৪,২৬০৫,২৬০৬,২৬০৭,২৬০৮,২৬০৯,২৬১০,২৬১১,২৬১২,২৬১৩,২৬১৪,২৬১৫,২৬১৬,২৬১৭,২৬১৮,২৬১৯,২৬২০,২৬২১,২৬২২,২৬২৩,২৬২৪,২৬২৫,২৬২৬,২৬২৯,২৬৩০,২৬৩১,২৬৩২,২৬৩৩,২৬৩৫,২৬৩৬,২৬৩৭,২৬৩৯,২৬৪০,২৬৪১,২৬৪২,২৬৪৩,২৬৪৪,২৭৪৬,৩৫০১,৩৫০২,৩৫০৩,৩৫০৪,৩৫০৫,৩৫০৬,৩৫০৭,৩৫০৮,৩৫০৯,৩৫১০,৩৫১১,৩৫১২,৩৫১৩,৩৫১৪,৩৫১৫,৩৫১৬,৩৫১৭,৩৫১৮,৩৫১৯,৩৫২০,৩৫২১,৩৫২২,৩৫২৩,৩৫২৪,৩৫২৫,৩৫২৬,৩৫২৭,৩৫২৮,৩৫২৯,৩৫৩০,৩৫৩১,৩৫৩২,৩৫৩৩,৩৫৩৪,৩৫৩৫,৩৫৩৬,৩৫৩৭,৩৫৩৮,৩৫৩৯,৩৫৪০,৩৫৪১,৩৫৪২,৩৫৪৩,৩৫৪৪,৩৫৪৫,৩৫৪৬,৩৫৪৭,৩৫৪৮,৩৫৪৯,৩৫৫০,৩৫৫১,৩৫৫২,৩৫৫৩,৩৫৫৪,৩৫৫৫,৩৫৫৬,৩৫৫৭,৩৫৫৮,৩৫৫৯,৩৫৬০,৩৫৬১,৩৫৬২,৩৫৬৩,৩৫৬৬,৩৫৬৭,৩৫৬৮,৩৫৬৯,৩৫৭০,৩৫৭১,৩৫৭২,৩৫৭৩,৩৫৭৪,৩৫৭৫,৩৫৭৬,৩৫৭৭,৩৫৭৮,৩৫৭৯,৩৫৮০,৩৫৮১,৩৫৮২,৩৫৮৩,৩৫৮৪,৩৫৮৫,৩৫৮৬,৩৫৮৭,৩৫৮৮,৩৫৮৯,৩৫৯০,৩৫৯১,৩৫৯২,৩৫৯৩,৩৫৯৪,৩৫৯৫,৩৫৯৬,৩৫৯৭,৩৫৯৮,৩৫৯৯,৩৬০০,৩৬০১,৩৬০২,৩৬০৩,৩৬০	নাল, বোরো, ছুট, লায়েক পতিত,	৩৬৮ একর

			৫৬৩,১৩৬,৫৭৩,৫৬৩,৫০৩,৩৭৭,৩৭৭,৫৭৮,৩৩৮,১৮১,৪০৭,২৬৭,৭০,৫৭৬,৭০,১০৩,১০৩,৫৮২,৫৮২,৩২৭,৩২৭,৩২৭,১৫,৩২৭,১৫,৩২৭,৩২৭,১১৭,১২৩,২৯৮,২৬০,৩৬৮,১১৭,৫৬৩,৩৯০,৫৬৩,১২৩,৩২৭,৩২৭,১৫,৩২৭,২১,২১,৪০৭,৪৯৬,৫৬৩,১৩৫,৩২৬,৩৩২,৫৬৩,৫৭৬,৪৪৫,৫৭৮,২৪,১৩৫,১৫০,৪৮২,৫৭৮,১২২,৫৩৬,১১৩,৪৪৯,৫৩২,২৬৬,২৬৬,৫৮১,৩৭৯,১০০,৪৭৭,৫৮২,২৮৩,৪৪৯,৫০৫,৪৯৬,৯৯,৩৭৭,৩৭৭,১১৩,৪৪৯,১৫,৩২৭,৩২৭,৩২৭,১৩৫,১১৩,৩৭৭,৫৯২,১২৫,২৫৮,৩৫৬,৫৭৬,৫২১,২৯৭,২৪,৫৩৫,৩৬৮,২৮১,৩৪৯,৫৩৫,৫৪৯,১১৪,১১৪,৫৮২,২১,২১,৪৯৬,৪৮২,২২৬,১২২,২৫১,৫৮৯,২০৯,৩২৭,৩২৭,২৪২,২৮১,৩৪৯,১৬০,১৬০,৩২৭,২৪,৩২৭,৩২৭,১৫,৩২৭,১৬১,১৮৩,১১৩,৪৪৯,২০১,৩৭৯,১০০,৪২৬,১০৭,১০৭,১০৭,৪৭১,১০৭,৩৯১,৪২৬,৪৮৩,৩৫৫,৪২৬,২১৭,১২২,৩৪৯,৪৮২,১১৬,২১৭,১২২,৪২৬,৪৪৭,৩৯১,৪৮১,৪২৮,৮,৪২৮,৫৪৯,৫৪৯,১২৫,২২৮,২১,২৩,১২২,৪২৫,২০৮,৪২৮,৪২৮,৮,৪২৮,৪২৮,৯৬,৯৬,১১১,৪২৮,৮,৪২৮,৫৬,৪৯৭,৪৯৭,৬০০,৫৪৯,৩৭৪,৩৭৪,৩৩৮,২২,২২,২২,২২,২২৪,১০৭,২৬০,৪৪৩,১,১,৫৪৯,৫৪৯,২৪,২৫৮,১৩৯,১২২,৩১৬,৩১৬,৪২৮,৪২৮,৪২৮,২১৩,২৪,২৪,২৩,২৪,২৩,৪৯১,১,৪৮২,৪৮২,৪৮২,৪৮২,৪৬,৪৮২,৫৬৩,২৪৭,২৪৭,৩৬৮,৩৭৭,১,৪৫৭,৫৪৯,৫০৮,৩৭৯,১০০,২৪,৫৯৬,৫৬৯,১১৬,৩৭৯,২১৭,৪৪৭,১২২,৩৯১,৫৫,১৩৪,১৩৪,১৩৪,২৯৬,১০১,১,১০১,১৮২,১৩৪,ছুট,২৭,২৭,২৭,১,১,১,৫৯৬,৫৬৯,৩৪৪,১,৩৪৪,৫৬৯,৫৯৬,৩৩৮,৪৫৭,৩৭৩,৩৭৩,৩৪৪,৫৯৬,৫৬৯,১২২,৪২৬,৫২,৪২৩,১০১,১৮৩,১০৭,৫২১,২৯৭,১২৫,১২৫,১২২,১৮১,৪৪২,১৮৩,৫৮২,২৫১,২৯৭,৫২১,৩৮৬,৩৭৯,১,৩৫৬,৫৫,২২১,১৮৩,২৮১,৩৩৮,৪৫৭,৩৭৭,৩৬৮,২৪,২৮১,২৪,৪৯৬,৪৯৬,১,২৫১,৫৮২,৩৭৭,৩৭৭,২৪,৫৭,২২১,৫৩৮	৪,৩৬০৫,৩৬০৬,৩৬১০,৩৬১১,৩৬১২,৩৬১৩,৩৬১৪,৩৬১৫,৩৬১৬,৩৬১৭,৩৬১৮,৩৬১৯,৩৬২০,৩৬২১,৩৬২২,৩৬২৩,৩৬২৪,৩৬২৫,৩৬২৬,৩৬২৭,৩৬২৮,৩৬২৯,৩৬৩০,৩৬৩১,৩৬৩২,৩৬৩৩,৩৬৩৪,৩৬৩৫,৩৬৩৬,৩৬৩৭,৩৬৩৮,৩৬৩৯,৩৬৪০,৩৬৪১,৩৬৪২,৩৬৪৩,৩৬৪৪,৩৬৪৫,৩৬৪৬,৩৬৪৭,৩৬৪৮,৩৬৪৯,৩৬৫০,৩৬৫১,৩৬৫২,৩৬৫৩,৩৬৫৪,৩৬৫৫,৩৬৫৬,৩৬৫৮,৩৬৫৯,৩৬৬০,৩৬৬১,৩৬৬২,৩৬৬৩,৩৬৬৪,৩৬৬৫,৩৬৬৬,৩৬৬৭,৩৬৬৮,৩৬৬৯,৩৬৭০,৩৬৭১,৩৬৭২,৩৬৭৩,৩৬৭৪,৩৬৭৫,৩৬৭৬,৩৬৭৭,৩৬৭৮,৩৬৭৯,৩৬৮০,৩৬৮১,৩৬৮২,৩৬৮৩,৩৬৮৪,৩৬৮৫,৩৬৮৬,৩৬৮৭,৩৬৮৮,৩৬৮৯,৩৬৯০,৩৬৯১,৩৬৯২,৩৬৯৩,৩৬৯৪,৩৬৯৫,৩৬৯৬,৩৬৯৭,৩৬৯৮,৩৬৯৯,৩৭০০,৩৭০১,৩৭০২,৩৭০৩,৩৭০৪,৩৭০৫,৩৭০৬,৩৭০৭,৩৭০৮,৩৭০৯,৩৭১০,৩৭১১,৩৭১২,৩৭১৩,৩৭১৪,৩৭১৫,৩৭১৬,৩৭১৭,৩৭১৮,৩৭১৯,৩৭২০,৩৭২১,৩৭২২,৩৭২৩,৩৭২৪,৩৭২৫,৩৭২৬,৩৭২৭,৩৭২৮,৩৭২৯,৩৭৩০,৩৭৩১,৩৭৫১,৩৭৫২,৩৭৫৩,৩৭৫৪,৩৭৫৫,৩৭৫৬,৩৭৫৭,৩৭৫৮,৩৭৫৯,৩৭৬০,৩৭৬১,৩৭৬২,৩৭৬৩,৩৭৬৪,৩৭৬৫,৩৭৬৬,৩৭৬৭,৩৭৬৮,৩৭৬৯,৩৭৭০,৩৭৭১,৩৭৭২,৩৭৭৩,৩৯০৫,৩৯০৬,৩৯০৭,৩৯৩০,৩৯৩১,৩৯৩২,৩৯৫৪,৩৯৫৫,৩৯৫৬,৩৯৫৭,৩৯৫৮,৩৯৫৯,৩৯৬০,৩৯৬১,৩৯৬২,৩৯৬৩,৩৯৬৪,৩৯৬৫,৩৯৬৬,৩৯৬৭,৩৯৬৮,৩৯৬৯,৩৯৭০,৩৯৭১,৩৯৭২,৩৯৭৩,৩৯৭৪,৩৯৭৫,৩৯৭৬,৩৯৭৭,৩৯৭৮,৩৯৭৯,৩৯৮০,৩৯৮১,৩৯৮২,৩৯৮৩,৩৯৮৪,৩৯৮৫,৩৯৮৬,৩৯৮৭,৩৯৮৮,৩৯৮৯,৩৯৯০,৩৯৯১,৩৯৯২,৩৯৯৩,৩৯৯৪,৩৯৯৫,৩৯৯৬,৩৯৯৭,৩৯৯৮,৩৯৯৯,৪০০০,৪০০১,৪০০২,৪০০৩,৪০০৪,৪০০৫,৪০০৬,৪০০৭,৪০০৮,৪০০৯,৪০১০,৪০১১,৪০১২,৪০১৩,৪০১৪,৪০১৫,৪০১৬,৪০১৭,৪০১৮,৪০১৯,৪০২০,৪০২১,৪০২২,৪০২৩,৪০২৪,৪০২৫,৪০২৬,৪০২৭,৪০২৮,৪০২৯,৪০৩০,৪০৩১,৪০৩২,৪০৩৩,৪০৩৪,৪০৩৫,৪০৩৬,৪০৩৭,৪০৩৮,৪০৩৯,৪০৪০,৪০৪১,৪০৪২,৪০৪৩,৪০৪৪,৪০৪৫,৪০৪৬,৪০৪৭,৪০৪৮,৪০৪৯,৪০৫০,৪০৫১,৪০৫২,৪০৫৩,৪০৫৪,৪০৫৫,৪০৫৬,৪০৫৭,৪০৫৮,৪০৫৯,৪০৬০,৪০৬১,৪০৬২,৪০৬৩,৪০৬৪,৪০৬৫,৪০৬৬,৪০৬৭,৪০৬৮,৪০৬৯,৪০৭০,৪০৭১,৪০৭২,৪০৭৩,৪০৭৪,৪০৭৫,৪০৭৬,৪০৭৭,৪০৭৮,৪০৭৯,৪০৮০,৪০৮১,৪০৮২,৪০৮৩,৪০৮৪,৪০৮৫,৪০৮৬,৪০৮৭,৪০৮৮,৪০৮৯,৪০৯০,৪০৯১,৪০৯২,৪০৯৩,৪০৯৪,৪০৯৫,৪০৯৬,৪০৯৭,৪০৯৯,৪১০০,৪১০৩,৪১০৪,৪১০৫,৪১১৪		
		চাঁনপুর দিয়ারা	১,৩৫,৭০,৭০,৪৭,১৪৭,১৩,১২৭,৪৩,৪০,১২৬,১২৬,১,১,৬,১৬,১৫,১৭,১৮,২৮,১,৫৯,১৭,১৪২,৩৩,২৪,২৪,২৪,২৪,২৬,৬০,৪৯,৪৯,৬০,২৬,৫৯,১৭,৮২,৮২,৫৯,১,১৭,৩২,৩২,৯৭,১০৫,১,১২৫,১০৪,৪,১০৯,৮৩,৮২,১০৯,১২৪,১৪১,৫৬,৫৬,৮৩,৬৯,৬৯,৬৯,১,১,৬৯,১২৫,২১,২২,৫৯,৩৩,৩২,২৮,৮৭,১০৬,১০৯,৫৩,৭১,৭১,৭১,১৩২,৬৬,১০,১০,১,১,১০,১০,১২৫,৪৪,১৯,১৯,৬১,৮২,৮৪,১,১১১,১২৩,৪,১,১৩০,১৩০,১,১২০,১০০,১০,৮৭,১,১,১৪৩,১,১,১৩০,৪৩,৪৩,১০৫,৫৫,৫৫,৪৮,৪৮,৫৫,১,১,৭৫,১৪,১৪,৫৫,১,১৪,১৪,১৪,১,১,৪১,৪১,৬৮,৬৮,১,১,১০৩,১০৩,৩৪,২২,১২০,৪,১২০,৭৭,৭৭,৪৮,২৩,১,১,৩,৭৫,৫৪,৭৯,৭৮,৬৬,১৯,২৩,২৪,৪৮,৫৫,৫৫,৫৫,১১২,১১২,১১২,১১২,১,১০৯,১০৯,৮২,৮২,৮২,৮২,৬১,৬১,৬১,৬৬,১২৫	১,২,৩,৪,৫,৬,৭,৮,৯,১০,১১,১২,১৩,১৪,১৫,১৬,১৭,১৮,১৯,২০,২১,২২,২৩,২৪,২৫,২৬,২৭,২৮,২৯,৩০,৩১,৩২,৩৩,৩৪,৩৫,৩৬,৩৭,৩৮,৩৯,৪০,৪১,৪২,৪৩,৪৪,৪৫,৪৬,৪৭,৪৮,৪৯,৫০,৫১,৫২,৫৩,৫৪,৫৫,৫৬,৫৭,৫৮,৫৯,৬০,৬১,৬২,৬৩,৬৪,৬৫,৬৬,৬৭,৬৮,৬৯,৭০,৭১,৭২,৭৩,৭৫,৭৬,৭৭,৭৮,৭৯,৮০,৮১,৮২,৮৩,৮৪,৮৫,৮৬,৮৭,৮৮,৮৯,৯০,৯১,৯২,৯৩,৯৪,৯৫,৯৬,৯৭,৯৮,৯৯,১০০,১২০,১২২,১২৩,১৩৫,১৩৬,১৩৭,১৪৮,১৪৯,১৫২,১৫৩,১৫৪,১৫৫,১৫৬,১৫৭,২১১,২১২,২১৩,২১৪,২১৫,২১৬,২১৭,২১৮,৪৮৮,৪৮৯,৪৯০,৪৯১,৪৯২,৪৯৩,৪৯৪,৪৯৫,৪৯৬,৪৯৭,৪৯৮,৪৯৯,৫০০,৫০১,৫০২,৫০৩,৫০৪,৫০৫,৫০৬,৫০৭,৫০৮,৫০৯,৫১০,৫১৩,৫১৪,৫১৭,৫১৯,৫২১,৫২২,৫২৩,৫২৪,৫২৫,৫২৬,৫২৭,৫২৮,৫২৯,৫৩০,৫৩১,৫৩২,৫৩৩,৫৩৪,৫৩৭,৫৩৮,৫৪০,৫৪১,৫৪২,৫৪৩,৫৪৪,৫৪৫,৫৪৬,৫৪৭,৫৪৮,৫৪৯,৫৫০,৫৫১,৫৫২,৫৫৩,৫৫৪,৫৫৫,৫৫৬,৫৫৭		

		কাটুয়ার	১,১৭৮,১৭৮,১,১,১৪৮,১৪৩,১,৭,১,১,১,১,১,১,১,১,১,১,১,৪০,১,১২২,১২২,১,১,১,১,৫০,৯০,১২২,৫০,৯০,১২২,১৫৬,১৫৬,১,১,১৭২,৪৯,১,১,৪৯,১২২,১৭০,১,১,১৩৬,২৭,১,১,১৬৩,১,১,১,৮৯,৯১,১,১,১,৩৩,১৪১,১,১,১১৮,১১৮,১,১৫১,১,৩৩,১৫১,২২,৬৫,১,১,১,১৪৩,১৪৩,১৪৩,১৪৩,১৪৩,৮৯,৯১,১৪২,১৫৩,১৫৩,১৪৯,১৩৫,১৪,২৯,১২৪,২৯,১২৪,১,১,১,১৪১,১৪১,১৭৪,১,১,১,১,১,২০,১,১,১,১,১,৩৩,১৬৬,৫৮,১৬৩,১৪১,১৮১,১,১৮১,৯৯,৭৫,১,৮৯,১৪২,২০,২০,১,১,১৩১,১,৭৬,১,১,৩১,৪,১,১২,১,৫৪,৫৪,৫৪,৫৪,২০,২০,২০,২০,২০,২০,১,৫৪,১৩২,১৩২,১৩২,২০,১৮২,১,৬৬,১৪,১৩৫,১৩৫,১৩৫,১৩৫,১,১৫৩,১২৫,৩৫,৪৩,১,১,৫৭,৫৭,৭৪,১,৪০,৪০,১,১,২০,২০,২০,২০,২০,২০,২০,১,১৮,৪১,৪১,১,৯১,১,১৬৩,১,১৩৬,১৩৬,১২৩,১,১,১৫৬,১,১৬৬,১৪৬,১১,১৭২,১০৮,৪৭,১৩৫,১,৭৩,৭৩,১৫৬,১০২,১,১,১০,৮৩,১৪৯,১,৪৩,৪২,৮৪,৫৫,২০,৭৭,৫৩,৮১,২৪,১,১,১	৩৯৩,৩৯৪,৩৯৫,৩৯৬,৩৯৭,৩৯৮,৩৯৯,৪০০,৪০১,৪০২,৪০৩,৪০৪,৪০৫,৪০৬,৪০৭,৪০৮,৪০৯,৪১০,৪১১,৪১২,৪১৩,৪১৪,৪১৫,৪১৬,৪১৭,৪১৮,৪১৯,৪২০,৪২১,৪২২,৪২৩,৪২৪,৪২৫,৪২৬,৪২৭,৪২৮,৪২৯,৪৩০,৪৩১,৪৩২,৪৩৩,৪৩৪,৪৩৫,৪৩৬,৪৩৭,৪৩৮,৪৩৯,৪৪০,৪৪১,৪৪২,৪৪৩,৪৪৪,৪৪৫,৪৪৬,৪৪৭,৪৪৮,৪৪৯,৪৫০,৪৫১,৪৫২,৪৫৩,৪৫৪,৪৫৫,৪৫৬,৪৫৭,৪৫৮,৪৫৯,৪৬০,৫৬১,৫৬২,৪৬৩,৪৬৪,৪৬৫,৪৬৬,৪৬৭,৪৬৮,৪৬৯,৪৭০,৪৭১,৪৭২,৪৭৩,৪৭৪,৪৭৫,৪৭৬,৪৭৭,৪৭৮,৪৭৯,৪৮০,৪৮১,৪৮২,৪৮৮,৪৮৪,৪৮৫,৪৮৬,৪৮৭,৪৮৮,৪৮৯,৪৯০,৪৯১,৪৯২,৪৯৩,৪৯৪,৪৯৫,৪৯৬,৪৯৭,৪৯৮,৪৯৯,৫০০,৫০১,৫০২,৫০৩,৫০৪,৫০৫,৫০৬,৫০৭,৫০৮,৫০৯,৫১০,৫১১,৫১২,৫১৩,৫১৪,৫১৫,৫১৬,৫১৭,৫১৮,৫১৯,৫২০,৫২১,৫২২,৫২৩,৫২৪,৫২৫,৫২৬,৫২৭,৫২৮,৫২৯,৫৩০,৫৩১,৫৩২,৫৩৩,৫৩৫,৫৩৬,৫৩৭,৫৩৮,৫৩৯,৫৪০,৫৪১,৫৪২,৫৪৩,৫৪৪,৫৪৫,৫৪৬,৫৪৭,৫৪৮,৫৪৯,৫৫০,৫৫১,৫৫২,৫৫৩,৫৫৪,৫৫৫,৫৫৬,৫৫৭,৫৫৮,৫৫৯,৫৬০,৫৬১,৫৬২,৫৬৩,৫৬৪,৫৬৫,৫৬৬,৫৬৭,৫৬৮,৫৬৯,৫৭০,৫৭১,৫৭২,৫৭৩,৫৭৪,৫৭৫,৫৭৬,৫৭৭,৫৭৮,৫৭৯,৫৮০,৫৮১,৫৮২,৫৮৩,৫৮৪,৫৮৫,৫৮৬,৫৮৭,৭৬০,৭৬১,৭৬২,৭৬৩,৭৬৪,৭৬৫,৭৬৬,৭৬৭,৭৬৮,৭৬৯,৭৭০,৭৭১,৮৭০,৮৭১,৮৮৫,৮৮৬,৮৮৭,৮৯১,৮৯২,৮৯৫,৮৯৬,৮৯৯,৯০০,৯০৩,৯৩৫,৯৩৯,৯৪০		

০৬) কারখানা/ প্রকল্পের উৎপাদিত/ উৎপাদিতব্য পণ্যেও নাম ঃ বিদ্যুৎ

উপরোক্ত তথ্যাদিও আলোকে (কারখানা/ প্রকল্পেরনাম) আশুগঞ্জ পাওয়ার স্টেশন কোম্পানীলিঃ (এপিএসসিএল) এর **রায়পুরা ১২০ মেগাওয়াট (এসি) পিকগ্রীড টাইড সোলার** পাওয়ার পল্যান্ট প্রকল্প-কে নিম্নবর্তী শর্ত সাপেক্ষে অনাপত্তি পত্র প্রদান করা হলো।

শর্তাবলীঃ-

১) প্রকল্প/ কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথ ভাবে অনুসরণ করতে হবে।

২) পরিবেশ অধিদপ্তর হতে বিধিদ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহণ করতে হবে।

৩) কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।

৪) উপযুক্ত অগ্নিনির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নি কান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরী নির্গমন ব্যবস্থা থাকতে হবে।

৫) বায়ু ও শব্দ দূষণ করা যাবেনা।

৬) কারখানা/ প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইওে নির্গমন করা যাবেনা।উপরোক্ত যে কোনশর্ত লংঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/ প্রকল্পের বিরুদ্ধে আইনানুগব্যবস্থা নেয়া যাবে।

তারিখঃ ১৮/০১/২৪

স্থানীয় কর্তৃপক্ষের স্বাক্ষর ও সীল

মোঃ মোমেন সরকার
চেয়ারম্যান
চাঁনপুর ইউনিয়ন পরিষদ
রায়পুরা, নরসিংদী।

ANNEX 2: Environmental Parameter Quality Test

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DSCL Environmental Laboratory

Name of the Project	Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi.
Description of sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	17 to 19 October 2023

Test Result of Ambient Air Quality Analysis

Parameter	Unit	AAQ_APSCL_01 86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi 23.980569° N 90.967328° E 17 October 2023	AAQ_APSCL_02 North side of the project Area, Chanpur, Raipura, Narsingdi 23.988628° N 90.965861° E 18 October 2023	AAQ_APSCL_03 Inside Project Area, Chanpur, Raipura, Narsingdi 23.978417° N 90.960581° E 19 October 2023	Bangladesh Standard*	Duration (Hours)	Method of Analysis
$PM_{2.5}$	µg/m³	32.56	34.87	26.17	65	24	AEROQUAL series 500 portable air quality monitors
PM_{10}	µg/m³	74.92	70.50	63.91	150	24	
SO_x	µg/m³	12.31	17.79	9.12	80	24	
NO_x	µg/m³	11.81	6.35	5.48	80	24	
CO	PPM	2	1	1	5	8	Lutron AQ 9901
Weather Condition		Mostly Sunny	Sunny	Sunny	-		

Note:
** The Bangladesh National Ambient Air Quality Standards have been obtained from the Air Pollution Control Rules,2022, vide S.R.O. No, 255-Law 26 July 2022.*

Description of the surrounding Environment

Sample Location and ID	Sample Site Description
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(AAQ_APSCL_01)**	➢ Very low amount of vehicle Movement was observed. ➢ People's movement was very low. ➢ A low amount of dust particles was seen. ➢ The weather was mostly sunny. ➢ A moderate amount of vegetation cover was found.
North side of the project Area, Chanpur, Raipura, Narsingdi **(AAQ_APSCL_02)**	➢ Very low amount of vehicle was moving. ➢ People movement was low. ➢ Visual dust particle was low. ➢ The weather was sunny. ➢ High vegetation cover area has been found.
Inside Project Area, Chanpur, Raipura, Narsingdi **(AAQ_APSCL_03)**	➢ Very Low amount of vehicle movement has been seen. ➢ People movement was low. ➢ Low amount of dust particles was seen. ➢ The weather was sunny. ➢ No ongoing construction work has been observed. ➢ Moderate amount of vegetative land.

Development Solutions Consultant Limited ★ DSCL ★

Test Performed by:
Md. Fojlur Rahman Abir
Assistant Manager

Checked by:
Pinon Nath
Deputy Manager

Approved By:
Saiful Islam Imran
Manager (Environment & Social)

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ISO 9001:2015
ISO 14001:2015
ISO 45001:2018

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Name of the Project	Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi.
Description of sample	Noise Level Monitoring
Sample Collector	Collected by DSCL Personnel
Sampling Date	17-19 October 2023

Test Results of Noise Monitoring

Sampling Location and ID	Date	GPS Location	Land Use Category	Time		Noise Level (dBA)LA_{eq}		Bangladesh Standard (dBA)LA_{eq}	
				Day	Night	Day	Night	Day	Night
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(NM_APSCL_01)**	17 October 2023	23.98048°N 90.96695°E	Residential Area	01:00pm - 02:00pm	9:00pm - 10:00pm	52.38	40.80	55	45
North side of the project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_02)**	18 October 2023	23.98765°N 90.96670°E		10:00am - 11:00am	9:00pm - 10:00pm	51.72	43.54		
Inside Project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_03)**	19 October 2023	23.96116°N 89.15756°E	Mixed Area	10:30am - 11:30am	9:00pm - 10:00pm	55.31	48.75	60	50

Notes:
- Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)
- The sound level standards for the residential area are 55 at daytime and 45 at night time.
- The sound level standards for the mixed area are 60 at daytime and 50 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

Description of Surrounding Environment

Sample Location and ID	Sample Site Description
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(NM_APSCL_01)**	➢ It was a residential area. ➢ Very low amount of vehicle Movement was observed. ➢ People movement was low. ➢ Only boat's sound has been heard as it's situated beside the river. ➢ Two sensitive areas were present.
North side of the project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_02)**	➢ It was a residential area. ➢ Very low amount of vehicle was moving. ➢ People movement was low. ➢ Only boat's sound has been heard as it's situated beside the river. ➢ Sensitive area was found.
Inside Project Area, Chanpur, Raipura, Narsingdi **(NM_APSCL_03)**	➢ The land use category is considered a mixed zone, as both residential and agricultural areas have been observed ➢ Very Low amount of vehicle movement has been seen. ➢ People movement was low. ➢ No construction work was noticed. ➢ No Sensitive area was found. ➢ No sound source is found except for a boat as this location was beside the river.

Test Performed by:
Md. Fojlur Rahman Abir
Assistant Manager

Checked by:
Pinon Nath
Deputy Manager

Approved By:
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Manager (Environment & Social)

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ISO 9001:2015
ISO 14001:2015
ISO 45001:2018

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Name of the Project	Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi.
Description of Sample	Surface Water Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	19 October 2023

On-site Surface Water Quality Test

Parameters	Unit	SW_APSCL_01 Meghna River, Near Chanpur, Raipura, Narsingdi. 23.987818° N 90.967919° E 19 October 2023	Standards for Inland Surface Water* (Best fishing practice)	Analysis Method
pH	-	7.58	6-9	Multimeter
Temperature	°C	31.7	NYS	
Total Dissolved Solids (TDS)	mg/L	141	1000	
Electric Conductivity (EC)	µS/cm	252	NYS	
Oxidation-Reduction Potential (ORP)	mg/L	-54.7	NYS	
Salinity	mg/L	109	NYS	
Dissolved Oxygen (DO)	mg/L	5.12	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
Meghna River, Near Chanpur Union Parishad, Raipura, Narsingdi. **(SW_APSCL_01)**	• Sample was collected from the Meghna River. • The sample was collected from a depth of approximately 6 inches. • Waste dumping hasn't been observed around the sampling location. • This river contains water throughout the year. • This Khal has been used by local people for bathing and washing purposes.

Development Solutions Consultant Limited ★ DSCL ★

Test Performed By
Md. Fojlur Rahman Abir
Assistant Manager

Checked By
Pinon Nath
Deputy Manager

Approved By
Saiful Islam Imran
Manager (Environment & Social)

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

IAF IAS ACCREDITED BQSR ISO 9001:2015 ISO 45001:2018

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi.
Description of Sample	Groundwater Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	19 October 2023

On-site Groundwater Quality Test

Parameters	Unit	GW_ASPCL_01 86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi 23.980601°N 90.967302°E 19 October 2023	Standards for Potable Water*	Analysis Method
pH	-	6.86	6.5-8.5	Multimeter
Electric Conductivity (EC)	µS/cm	604	NYS	
Total Dissolved Solids (TDS)	mg/L	394	1000	
Salinity	mg/L	298	NYS	
Oxidation-reduction potential (ORP)	mV	-14.1	NYS	
Temperature	°C	28.3	20-30	
Dissolved Oxygen (DO)	mg/L	5.2	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
86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi **(GW_ASPCL_01)**	• This tube well is about 50 feet deep which is established in 2001. • This tube well is mainly used for household, drinking and washing purposes. • The nearby toilet with an adjacent septic tank is situated 25 feet away from sampling location. • Agricultural land is situated 40 feet away from this tube well.

Development Solutions Consultant Limited ★ DSCL ★

Test Performed By
Md. Fojlur Rahman Abir
Assistant Manager

Checked By
Pinon Nath
Deputy Manager

Approved By
Saiful Islam Imran
Manager (Environment & Social)

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

IAF BQSR IAS ACCREDITED ISO 9001:2015 ISO 45001:2018

Government of the People's Republic of Bangladesh
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: 503/ CC, DPHE, CL, Dhaka

Date: 07-11-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023110021	Sample Receiving date: 22-10-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 22-10-2023	Sample Source: Ground Water
Sent by:Sadia Sabrin ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Brahmanbaria, Upa:Ashuganj
Care Taker: DSCL (Sample ID : GW_APSCL_01)	Union:, Vill.:Chanpur Govt. Primary School
Sample Collection date:	Date of Testing: 22/10/2023-05/11/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Coliform (Faecal)	0	0	N/100ml	MFM	-
3	Coliform (Total)	0	0	N/100ml	MFM	-
4	Total Suspended Solid (TSS)	10	2	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, MFM-Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 07.11.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/11/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.11.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

Government of the People's Republic of Bangladesh
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: 503/ CC, DPHE, CL, Dhaka

Date: 07-11-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023110020	Sample Receiving date: 22-10-2023
Ref. Memo No: DSCL/2023/Nill & Dated: 22-10-2023	Sample Source: Surface Water
Sent by:Sadia Sabrin ,Deputy Manager , DSCL, Mirpur DOHS, Dhaka.	Dist:Brahmanbaria, Upa:Ashuganj
Care Taker: DSCL (Sample ID : SW_APSCL_01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 22/10/2023-05/11/2023

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	Phosphate	6.0	0.36	mg/L	UVS	0.10
3	Total Suspended Solid (TSS)	10	4	mg/L	Gravimetric Method	-
4	Turbidity	10	30.8	NTU	Turbidity Meter	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, MFM-Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 07.11.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/11/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.11.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

TEST REPORT NO: 1002105509 **Oct.30,2023**

UL ORDER NO: 15024071

Page : 1 of 4

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Oct.23 – 30, 2023
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	SADIA SABRIN		

Sample Description:	SOIL SAMPLES
Testing Protocol:	Self-Reference
Project Name:	Ashuganj Solar Power Plant Project
Sample ID:	SQ_APSCL_01
Source:	Soil Sample from the site
Location:	Inside Project Area
No. of Sample	1 Sample

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	SOIL SAMPLE	SQ_APSCL_01

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

TEST REPORT NO: 1002105509 **Oct.30,2023**

UL ORDER NO: 15024071

Page : 2 of 4

TEST	Sample ID
	001
Total Lead (Pb)	NC
Total Cadmium (Cd)	NC
Total Chromium (Cr)	NC
Total Zinc (Zn)	NC

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

TEST REPORT NO: 1002105509 **Oct.30,2023**

UL ORDER NO: 15024071

(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_APSCL_01	Lead (Pb)	7439-92-1	5	<5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(02) 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_APSCL_01	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(03) 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_APSCL_01	Chromium (Cr)	7440-47-3	5	<5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(04) 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_APSCL_01	Zinc (Zn)	7440-66-6	10	27.5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

UL VS Bangladesh Ltd
The Pearl Trade Center (5th,14th&15th floor), Cha- 90/3, Progoti Sharani, North Badda, Dhaka 1212, Bangladesh.
M: +88-01730087201, 01730087200 for CS Hotline & +8801730317241 for sample pick / Web: www.ul.com

ANNEX 3: Photographs of Environmental Quality Testing and Survey Activities

86 No. Chanpur Govt. Primary High School (AAQ_APSCL_01)

North side of the project Area, Chanpur, Ashuganj (AAQ_APSCL_02)

Inside Project Area (AAQ_APSCL_03)

Figure A: Air Quality Monitoring

86 No. Chanpur Govt. Primary High School (NM_ASPCL_01)

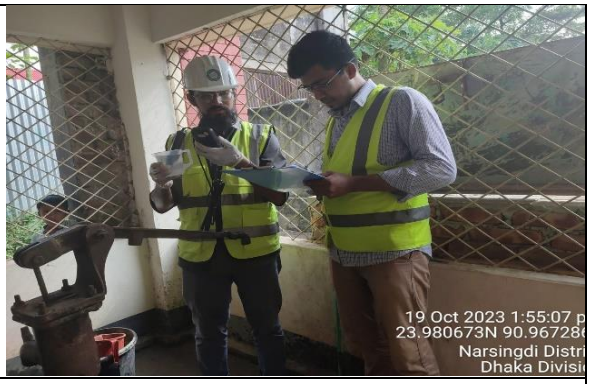
North side of the project Area, Chanpur, Ashuganj (NM_ASPCL_02)

Inside Project Area (NM_ASPCL_03)

Figure B: Noise Level Measurement

Meghna River, Near Chanpur, Raipura, Narsingdi (SW_ASPCL_01)

Figure C: Surface Water Sampling from Project Influenced Location



86 No. Chanpur Govt. Primary High School, Chanpur, Raipura, Narsingdi(GW_APSCL_01)

Figure D: Ground Water Sampling from Project Influenced Location

Mangoe Tree

Papaya

Jujube

Bean

(Source: DSCL Survey Team 2022)

Figure E: Commonly Found Plants in the Project Area

Duck

Cow

Frog

Goat

Dog

Hen

Duck

Pigeon

(Source: Survey Team 2023)

Figure F: Commonly found Fauna in the Project Area

Figure G: Fisheries Survey within the Project

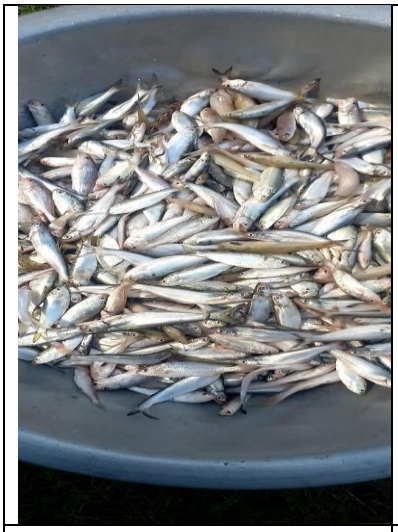
		
Puti and Mixed Fish	Hilsha, Boal	Kachki Fish
		
Prawn and Mixed Fish	Mixed Carp	Hisha Fish

Figure H: Different Types of Fishes Observed in the Proposed Project AOI


16 Oct 2023 4:29:15 p
23.979912N 90.96767
Index number:


16 Oct 2023 4:17:06 p
23.979667N 90.96779
Brahmanbaria Distri
Chittagong Divisi
Index number:


16 Oct 2023 14:06
23.983062N 90.97952
Ashuganj, Brahmanbaria Distri
Banglade


16 Oct 2023 3:51:45 pm
23.979994N 90.96761
Unnamed Road
Brahmanbaria District
Chittagong Division
Index number: 10


16 Oct 2023 1:50:54 p
23.9796743N 90.9677902
Index number:
Google


16 Oct 2023 14:02:3
23.990564N 90.9687
Begomabad, Narsingdi District
Bangladesh


17 Oct 2023 17:08:
23.977055N 90.96782
Narsingdi Distri
Banglade
Altitude:-65.2
Speed:1.5km


17 Oct 2023 16:34:5
23.978267N 90.96717
Narsingdi District
Bangladesh
Altitude:-52.5m
Speed:0.0km/

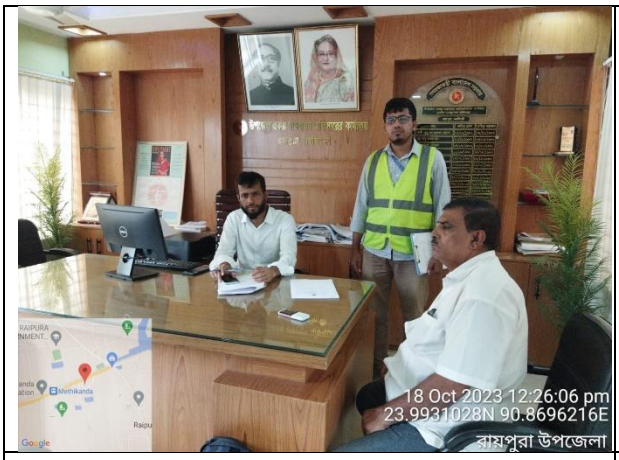
Figure I: Social Survey Conduction

FGD_01 (Chanpur Bazar, Chanpur Union, Raipura, Narsingdi)

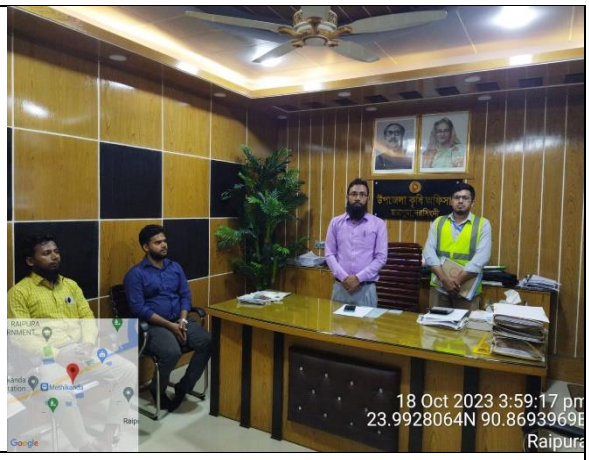
FGD_02 (Near Dokkhinghat, Chanpur Union, Raipura, Narsingdi)

FGD_03 (1 No. Ward, North Chanpur, Chanpur Union, Raipura, Narsingdi)

Figure J: Public consultation and FGD in the project location



Engr. Md. Borhan Uddin,Project Implementation Officer, Office of Upazila Implementation officer, Raipura Upazila, Narsingdi



Md. Mustafizur Rahman, Upazila Agriculture Officer, Office of Upazila Agriculture officer, Raipura Upazila, Narsingdi

	
Dr. Md. Azhar-Ul-Alam, Upazila Livestock Officer, Office of Upazila Livestock officer, Raipura Upazila, Narsingdi	Md. Habib Farhad Alam, Senior Upazila Fisheries Officer, Office of Upazila Fisheries Officer, Raipura Upazila, Narsingdi
	
Shomor krishno Das, Inspector, DoE, Narsingdi.	Md. Jashim Mia, Member, Chanpur Union parishad
	
Md. Sohel Mia, Assistant Teacher, 86 No. Chanpur Govt. Primary School, Chanpur, Raipura, Narsingdi	Bashirul Alam, Member, Chanpur Union Parishad

Figure K: Pictures of KIIs

ANNEX 4: Details of Public Consultation Meetings

Focus Group Discussion-01

Date: 16 October 2023 **Location:** Chanpur Bazar, Chanpur Union, Raipura, Narsingdi

Time: 02.10 pm **GPS Location:** 23.979704˚N, 90.967728˚E

Sl. No	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
1	Mr. Fojlur Rahman Abir (Facilitator) thanks all participants those attended this meeting. This Solar Power Plant will be constructed by the Ashuganj Power Station Company Ltd. (APSCL). Ashuganj Power Station Company Ltd. (an enterprise of Bangladesh Power Development Board) is the largest power-generating company in the country with an installed capacity of 1647 MW. Honorable Prime Minister has directed all power generating companies to generate 10% of their total generation power from renewable energy sources, making APSCL's obligation to generate at least 165 MW of renewable energy-based electricity. APSCL has identified a potential land of 368 Acre at Raipura Upazilla in Narsingdi District of Bangladesh. The new solar power plant will help to cope with the increased demand of power supply. Now we are conducting the consultations as part of the project preparation in your area. By this meeting, overall impact of the project on the people will be assessed. Based on the assessment, an environmental assessment will be prepared to mitigate negative impacts. People will face several problems due to this project. Consequently, people may suffer. Additionally, the construction activities will create several environmental pollutions that may affect the local ecology. Therefore, I am here to learn about your problems and how to solve the problem that may occur from project activities. The location is almost finalized by a team of ASPCL professionals based		

Sl. No	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
	on engineering point of view. However, people's opinion will be taken into account. People's opinion will be brought into the notice of the project authority for further consideration.		
2	Do you know about this project? If yes, what are they?	Most of the Participants know about the project work except two persons in that session of Chanpur Bazar, Chanpur Union, Raipura, Narsingdi. **Farid (Service holder):** Yes, I heard about the project some days before. **Md. Saiful Islam (Service holder):** Yes, first we heard from our politicians and some elite people. After attending this meeting, we would know much about that project. **Md. Billal Miah (Farmer):** No, I didn't hear about the project before. **Bashir Ahmed (Businessman):** Yes, first we heard from our Local leaders and religious institutions. We want to know more about the community development initiatives tied to the project. How will the benefits be distributed within our community?	We appreciate your concern. As part of Community development initiatives, we ensure job creation, skill-building programs, and infrastructure improvements, ensuring equitable distribution of benefits within the community
3	Do you have electricity in your house?	**Md. Saiful Islam (Service holder):** I have an electricity Connection in my house. **Md. Billal Miah (Farmer):** I have a solar panel in my house.	Noted down
4	What kind of facility will you expect after implementing the project?	**Mujibur Rahman (Day Labor):** I Hope, this project task generates job opportunities for local employees. This project will change our economic condition. **Md. Billal Miah (Farmer):** We expect for improving access to electricity for local residents. **Farid (Service holder):** We also hope for improvements in local infrastructure, such as better roads, electricity access, and overall enhanced community facilities resulting from the project	The survey team will inform the expected facility of local people & suggest project authority for giving the best possible opportunities to local people.
5	What kind of problem do you think that your surrounding environment (soil, water, noise, air etc.) might face for this project?	**Bashir Ahmed (Businessman):** Construction activities can result in the release of sediments, pollutants, and chemicals into nearby water bodies. This can affect water quality, potentially harming fisheries and impacting the availability of clean water for local communities. How can	The survey team will inform Project authority to analyze the environmental management system's mitigating action to mitigate the issues. Additionally, fisheries breeding season and

Sl. No	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
		we ensure the protection of our biodiversity? **Farid (Service holder):** Construction sites can be noisy, and the noise generated during solar power plant construction can disturb local residents. **Md. Saiful Islam (Service holder):** Construction activities often generate dust, emissions, and other pollutants that can degrade air quality in the vicinity.	breeding ground will be avoided for this project
6	Will the project affect your social and economic sector? If yes, how?	**Bashir Ahmed (Businessman):** There would be a scope of work for increasing their monthly income for working on the project work. It will help our economic development and better communication. People can work here during the Construction period. **Md. Billal Miah (Farmer):** There would be an opportunity to enhance peoples' income due to the project's influence, **Mujibur Rahman (Day Labor):** Social livelihood would be better due to the project's influence. **Farid (Service holder):** Population would be increased, and livelihood areas could be compromised due to the project's influence. **Md. Faruk Ahmed (Imam):** More migrant labour would come due to starting project work, and some social impact will occur during construction time. **Fojlu Mia (Farmer):** Woman harassment could occur during the construction stage.	Good Observation.
7	Is wildlife (birds, snakes, crabs, foxes, etc.) available in the area? If yes, mention their name. Among them which are endangered?	**Md. Billal Miah (Farmer):** The habitat and lifestyles of animals and birds could be hampered due to project work. During the construction period, birds and wild animals will go far due to various pollution impacts. **Md. Saiful Islam (Service holder):** There were some birds and animals in the project area before. Those are not seen now. **Bashir Ahmed (Businessman):** Due to any pollution from construction work, there would be a possibility of damaging flora and fauna life and habitat.	The survey team will inform the project authority to take proper action to address this problem and solve the problem with the Environmental Baseline.

Sl. No	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
8	Is any Sensitive Area (School, College, Madrasa, Church, Mosque) located nearby the construction area of the project? If yes, where & how far from the project?	**Md. Billal Miah (Farmer):** No sensitive area exists in our locality. **Farid (Service holder):** sensitive area exists in our locality **Mujibur Rahman (Day Labor):** I think, if there is any sensitive area, the project implementation process won't be passed by the government.	Okay
9	Are you in favor of this project? Why?	**Md. Saiful Islam (Service holder):** Yes, we are in favor of this project. This project will aid our economic development & solve our load shedding issues. **Farid (Service holder):** This project would be a milestone for this community. Income-generating activities would be increased. Moreover, social lifestyles could be good after the implementation of the project.	The survey team will appreciate your opinion on behalf of ASPCL. Thank you

Consultancy Services for Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi

List of Participants for Focus Group Discussion

Address চানপুর ব্যবসায়ী স্কুলের সামনে চানপুর বাজার, চানপুর ইউনিয়ন, রায়পুরা, নরসিংদী

GPS Location 23°57'04" 90°56'28"

Date 16-10-26 **Time** 2:20 pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
১.	ফরিদ	৬২	চাকরী	01770243469	
২.	নজরুল	৫৫	কৃষি	-	নজরুল ইসলাম
৩	মো: কামাল	৬৫	কৃষি	-	কামাল
৪.	ক কামরুন নিয়া	৪০	কৃষি	-	
৫.	মফিজুর রহমান	৩৮	ব্যবসা	01855847396	
৬.	মো: বিল্লাল মিয়া	২৮	Farmer	01928124649	বিল্লাল
৭	মো: আবু তাহের	৬০	Imam	01XX834210	আবু তাহের
৮	কবির আহমেদ	৬৭	Businessman	01319640196	কবির আহমেদ
৯	মো: সাইফুল ইসলাম	৫১	Bda company	01852198024	সাইফুল ইসলাম
১০	Iskandar	55	Worker, Private company	01XX547036	ইস্কান্দার

Facilitated By Md. Fojlur Rahman Abir

Signature Abir

Focus Group Discussion - 02

Date: 17 October 2023 **Location:** Near Dokkhinghat, Chanpur Union, Raipura, Narsing

Time: 05.56 pm **GPS Location:** 23.980569˚N, 90.967328˚E

Sl. No.	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
1	**Mr. Fojlur Rahman Abir (Facilitator)** thanks all participants those attended this meeting. This Solar Power Plant will be constructed by the Ashuganj Power Station Company Ltd. (APSCL). Ashuganj Power Station Company Ltd. (an enterprise of Bangladesh Power Development Board) is the largest power-generating company in the country with an installed capacity of 1647 MW. Honorable Prime Minister has directed all power generating companies to generate 10% of their total generation power from renewable energy sources, making APSCL's obligation to generate at least 165 MW of renewable energy-based electricity. APSCL has identified a potential land of 368 Acre at Raipura Upazilla in Narsingdi District of Bangladesh. The new solar power plant will help to cope with the increased demand of power supply. Now we are conducting the consultations as part of the project preparation in your area. By this meeting, overall impact of the project on the people will be assessed. Based on the assessment, an environmental assessment will be prepared to mitigate negative impacts. People will face several problems due to this project. Consequently, people may suffer. Additionally, the construction activities will create several environmental pollutions that may affect the local ecology. Therefore, I am here to learn about your problems and how to solve the problem that may occur from project activities. The location is almost finalized by a team of ASPCL professionals based on engineering point of view.		

Sl. No.	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
	However, people's opinion will be taken into account. People's opinion will be brought into the notice of the project authority for further consideration.		
2	Do you know about this project? If yes, what are they?	**Gofur Munshi (Shop keeper):** Yes, first we heard from our local Elite Persons and Govt. officials. After attending this meeting, we would know much about that project. **Shopon Miah (Farmer):** No, I didn't hear about the issue.	Thank you for providing your perspectives on the project. It's valuable to gather insights from individuals with various backgrounds.
3	Do you have electricity in your house?	**Miraj Ali (Farmer):** Yes, I have an electricity connection in my home. **Gofur Munshi (Shop keeper):** Almost most of the presented people have an electric connection in their house.	Noted down
4	What kind of facility will you expect after implementing the project?	**Ataur (Farmer):** As this solar power plant will supply electricity, we will expect that load shedding will reduce. **Shopon Miah (Farmer):** We will expect enough electricity connection in all houses in this locality. **Miraj Ali (Farmer):** Hope, we will get electricity at a low cost rather than the present condition.	The survey team will inform the expected facility of local people & suggest project authority for giving the best possible opportunities to local people.
5	Any air pollution due to the project activities? If yes, how to mitigate?	**Shopon Miah (Farmer):** There is a possibility of air pollution during construction period. **Tanim Sikder (Student):** If air pollution occurs due to this solar power plant project, what measures will be taken to minimize the impact on air quality? **Miraj Ali (Farmer):** Construction activities often generate dust. How will you control dust to prevent it from affecting our crops?	Your opinion will be provided to ASPCL so that they will take initiative to mitigate the air pollution in during the project intervention.
6	Any soil pollution due to the project activities? If yes, how to mitigate?	**Shopon Miah (Farmer):** If the construction materials and earthen materials of this project are stacked on public land for a long time, then it will pose a problem by preventing cultivation activity. **Gofur Munshi (Shop keeper):** No likelihood of soil pollution is there. But if any polluted waste from construction activity could dump on our land, it may create impact on our crop's productivity	Valid concerns. It's essential to address potential impacts on both public land and private property to ensure a smooth coexistence with local activities. Collaboration and proper waste management can mitigate these issues.

Sl. No.	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
		Haris Mia (Farmer): What measures are in place for proper waste disposal during construction and operation?	
7	Will the project affect your social and economic sector? If yes, how?	**Gofur Munshi (Shop keeper):** Yes, I think so. it will help our economic development regionally as well as nationally and communication and networking would be enriched. People can work here during the Construction period. **Miraj Ali (Farmer):** Yes, I also think so. New job opportunities would be raised. **Shopon Miah (Farmer):** Due to the coming of migrant labour, there would be a possibility to hamper social livelihood in the project area **Tanim Sikder (Student):** Overpopulation would be seen in the project area. The price hike would be seen in the locality. New job opportunities could be generated also.	The survey team will inform the project authority to conduct different activities to lessen the negative impacts and mitigate the social problems following the social parameters and social management system.
8	What kind of other problem do you people think that you might face for this project?	**Gofur Munshi (Shop keeper):** If the project authority won't follow management rules appropriately, then some problems could have appeared. **Shopon Miah (Farmer):** If project authority does anything without maintaining law, that might be harmful for local people **Ataur (Farmer):** We depend on our land for agriculture. Can you provide assurances that the solar project won't negatively impact our crops and soil fertility? **Miraj Ali (Farmer):** In case of any damage to our crops during construction or operation, what provisions are there for compensation or support for affected farmers?	We understand your concerns about public land use. The project will adhere to a timeline that minimizes disruption to cultivation activities, and we are open to discussing any specific arrangements that address community needs.
9	Is wildlife (birds, snakes, crabs, foxes, etc.) available in the area? If yes, mention their name. Among them which are endangered?	**Shopon Miah (Farmer):** Animal habitats and lifestyles would be hampered sometimes. **Dulal Mia (Farmer):** Nowadays birds and foxes are not seen as much as in past days. **Gofur Munshi (Shop keeper):** I think that as construction creates noise &	The survey team will inform the project authority to take a proper Environmental management plan to solve the problem.

Sl. No.	Information/ Questions from the project team	Important Questions/ Reply/Comments of the Participants	Remarks
		vibration, construction work could affect animal life.	
10	Is any Sensitive Area (School, College, Madrasa, Church, Mosque) located nearby the construction area of the project? If yes, where & how far from the project?	**Dulal Mia (Farmer):** No sensitive area exists in our locality. So, this question is not applicable in our locality. **Shopon Miah (Farmer):** No sensitive area exists in our locality.	Okay.
11	Are you in favour of this project? Why?	**Gofur Munshi (Shop keeper):** Yes, we are in favour of this project. This project will aid our economic development. **Dulal Mia (Farmer):** Yes. I support if everyone support.	Your opinion will be greatly appreciated by ASPCL.

Consultancy Services for Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi

List of Participants for Focus Group Discussion

Address Near Dokkhinghat Chanpur Union, Raipura, Narsingdi.

GPS Location 23.980569 90.96x328

Date 17/10/2023 **Time** 05:56 PM

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
1	Haris Mia		Farmer	017x834216	
2	Dulal Mia		Farmer	–	দুলাল
3	Ataur		Farmer	01726 866287	Ataur
4	Amin Hossain		Farmer	–	আমিন
5	Golap Mia		Farmer	01760831231	গোলাপ
6	Minaj Ali		Farmer	01756 467946	
7	Shopon Miah		Farmer	01794351009	
8	Grofur Munshi		Shopkeeper	–	গফুর
9	Tanim Shikder		Student	–	Tanim Sikdar
10	Monju		Day-labour	–	মনজু
11	Jahangir		Boatman	01983879326	
12	Mohashin		Day-labour	–	

Facilitated By Md. Fojlur Rahman Abir

Signature

Focus Group Discussion - 03

Date: 18 October 2023 **Location:** 1 No. Ward, North Chanpur, Chanpur Union, Raipura, Narsingdi

Time: 12.00 pm **GPS Location:** 23.991609˚N, 90.967020˚E

Sl No	Information/ Questions from project team	Questions/ Reply/Comments of the Participants	Remarks
1	Mr. Fojlur Rahman Abir (Facilitator) thanks all participants those attended this meeting. This Solar Power Plant will be constructed by the Ashuganj Power Station Company Ltd. (APSCL). Ashuganj Power Station Company Ltd. (an enterprise of Bangladesh Power Development Board) is the largest power-generating company in the country with an installed capacity of 1647 MW. Honorable Prime Minister has directed all power generating companies to generate 10% of their total generation power from renewable energy sources, making APSCL's obligation to generate at least 165 MW of renewable energy-based electricity. APSCL has identified a potential land of 368 Acre at Raipura Upazilla in Narsingdi District of Bangladesh. The new solar power plant will help to cope with the increased demand of power supply. Now we are conducting the consultations as part of the project preparation in your area. By this meeting, overall impact of the project on the people will be assessed. Based on the assessment, an environmental assessment will be prepared to mitigate negative impacts. People will face several problems due to this project. Consequently, people may suffer. Additionally, the construction activities will create several environmental pollutions that may affect the local ecology. Therefore, I am here to learn about your problems and how to solve the problem that may occur from project activities. The location is almost finalized by a team of ASPCL professionals based on engineering point of view. However, people's opinion will be taken into account. People's opinion will be brought into the notice of the project authority for further consideration.		
2	Do you know about this project? If yes, what are they?	Most of the Participants didn't know about the project work in that session of 1 No. Ward, North Chanpur, Chanpur Union, Raipura, Narsingdi. **Shahidul (Businessman):** No, we are not aware of the project work.	Thank you for sharing your feedback. We'll work on improving awareness.

Sl No	Information/ Questions from project team	Questions/ Reply/Comments of the Participants	Remarks
		Abdul Aziz: No, we are not aware of the project work. **Md. Shohag (Mason):** No, we are not aware of the project work.	
3	Do you have electricity in your house?	**Mizanur Rahman (Student):** Yes, I have a solar panel in my house **Abdul Aziz:** Yes, I have electricity from DESCO in my house.	Noted down
4	What kind of facility will you expect after implementing the project?	**Rohis Mia (Farmer):** I will expect an electricity connection at a low price in every house. **Abdul Aziz:** I will expect that this project may take employees from us. **Shahidul (Businessman):** Hope, Maintenance of surrounding Road facilities will be increased with this project.	Noted down.
5	Any air pollution due to the project activities? If yes, how to mitigate?	**Abdul Aziz:** We have not that much of idea regarding air pollution due to this solar power plant project. **Rohis Mia (Farmer):** Some air pollution may occur by construction Vehicle.	Thank you. The survey team will inform ASPCL so that if the project were implemented, ASPCL will take step by contractor to mitigate the air pollution.
6	Any impact on local soil and noise due to the project activities? If yes, how to mitigate	**Md. Shohag (Mason):** Some noise impact will be found during construction time. Construction vehicle will create noise. **Shahidul (Businessman):** Construction vibration and noise may affect people from adjacent area of project location. Sound pollution during construction period should be minimized. **Iliyas (Farmer):** If construction waste is dumped into farmland, It would be a problem for us.	ASPCL will be informed about those issues and will suggest them to look up for solutions about this problem.
7	What kind of problem do you think that you might face for this project?	**Shahidul (Businessman):** If construction work won't finish within project schedule, then this could pose a problem for us **Rajib (Businessman):** Various factors, such as adverse weather conditions, unforeseen site conditions, or labor issues, can contribute to construction delays. Delays can have cascading effects on the overall project which could pose a problem for us too. **Iliyas (Farmer):** Acquiring the necessary land and rights-of-way for the project can be a complex process, involving negotiations with	Project Authority is always aware of the negative impacts occurred by project influence and the survey team hopes that they will try to take a step so that the contractor will do work in accordance with the Environmental and Social Baseline.

Sl No	Information/ Questions from project team	Questions/ Reply/Comments of the Participants	Remarks
		property owners. This vould also pose a problem for us	
8	Will the project affect your social and economic sector? If yes, how?	**Md. Shohag (Mason):** If the project authority gives us a job, then we can be able to improve our lives economically. **Shahidul (Businessman):** This project will contribute to the local and regional economies. The lifestyle of our people would be better and developed. **Iliyas (Farmer):** I think, overcrowding will increase in every place due to migrant workers **Rajib (Businessman):** People could get a chance to work in the project area. Their income would be greater than now.	The survey team will inform Project Authority to conduct different activities to lessen the negative impacts and mitigate the social problems following the social parameters and social management system.
9	Is wildlife (birds, snakes, crabs, foxes, etc.) available in the area? If yes, mention their name. Among them which are endangered?	**Md. Shohag (Mason):** The habitat of the birds could be damaged. **Mizanur Rahman (Student):** No idea about that.	The survey team will inform project authority to take proper action to address this problem and solve the problem.
10	Is any Sensitive Area (School, College, Madrasa, Church, Mosque) located nearby the construction area of the project? If yes, where & how far from the project?	**Md. Shohag (Mason):** No sensitive area exists in our locality. **Iliyas (Farmer):** No, school & college are situated at a long distance from this area.	Okay. Noted down
11	Are you in favour of this project? Why?	**Iliyas (Farmer):** If this project gives us a good thing, then we support it obviously. **Rajib (Businessman):** I may support this electricity generating project. However, this solar power plant is situated near riverbank. Given the proximity to rivers, what measures will be implemented to control erosion and prevent damage to riverbanks during construction & operation phase of this solar power plant?	Your opinion will be greatly appreciated by APSCL. Moreover, we are working on a transparent on our project activity. If necessary, then our environmental experts will ensure erosion control measure for the ecological integrity of the project site

Consultancy Services for Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi

List of Participants for Focus Group Discussion

Address ৯নং ওয়ার্ড উত্তর চানপুর,

GPS Location ২৩.৯৯০১১৬৯ , ৯০.৯৬৭০৬৭

Date ২৮/০৯/২০২৩ **Time** ১২:০০ pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
০১	আব্দুল আজিজ	৮০	—		
০২	রশিদ মিয়া	৬৫	কৃষক	01929504907	রশিদ
০৩	রাজিব	২৫	ব্যবসায়ী	01330082111	রাজিব
০৪	শহিদুল	২৬	ব্যবসায়ী	—	শহিদুল
০৫	ইলিয়াস	[illegible]৫	কৃষক	0193693358	ইলিয়াস
০৬	ববিতা	28	গৃহিণী	—	ববিতা
০৭	হনুফা	৫৫	গৃহিণী	—	হনুফা
০৮	মিজানুর রহমান	২১	ছাত্র	01315377505	মিজান
০৯	মো: মোস্তাক	22	রাজমিস্ত্রী	01314334081	মোস্তাক
১০	আমজাদ	৭০	—		

Facilitated By Tamanna

Signature [signature]

ANNEX 5: Questionnaire for socio-economic survey

Consultancy Services for Construction of Raipura 120 MWp (AC) Grid Tied Solar Power Plant Project at Raipura, Narsingdi

প্রকল্প এলাকার মধ্যে অবস্থিত ব্যক্তিবর্গের আর্থ সামাজিক জরীপ

(Interviewers: নিচের অংশটি উত্তরদাতার কাছে পরিস্কারভাবে বর্ণনা করুন এবং তার অনুমতি নিয়ে আরম্ভ করুন।)

[উত্তরদাতার অনুমতি সাপেক্ষে তথ্য নেয়া শুরু করুন]

সাক্ষাৎকার গ্রহনের তারিখ ঃ					সাক্ষাৎকার শুরুর সময় ঃ			
	দিন	মাস	বছর			ঘন্টা	মিনিট	
সাক্ষাৎকার গ্রহনকারীর নাম ঃ					কোড ঃ			
উত্তরদাতার নাম (খানা প্রধান/বয়স্ক/জ্ঞানী ব্যক্তি) ঃ								
গ্রামের/ ওয়ার্ডের নাম ও কোড ঃ								
বিস্তারিত ঠিকানা ঃ	ওয়ার্ড ঃ -- -- -- -- -- - ইউনিয়ন ঃ -- -- -- -- -- -- -- -- -- থানা/উপজেলাঃ -- -- -- -- -- -- -- -- -- -- জেলাঃ -- -- -- -- -- -- -- ---- -- বিস্তারিত ঃ --							
উত্তরদাতার মোবাইল নাম্বার:	**[1]**					**[2]**		
উত্তরদাতা এই এলাকায় কত বছর ধরে বসবাস করছেন? [সব সময় বসবাস করে থাকলে 95 লিখুন]								
উত্তরদাতার লিঙ্গঃ	1= পুরুষ ; 2= নারী							
উত্তরদাতার বয়স								
শিক্ষাগত যোগ্যতা	1= ভর্তি হয়নি/কখনও স্কুলে যায়নি; 2 = ভর্তি এবং নিয়মিত; 3 = ভর্তি কিন্তু অনিয়মিত (এক মাসে 10 দিনের কম); 4= ভর্তির অপেক্ষায়; 5= ড্রপ আউট; 6= পড়াশুনা শেষ							
উত্তরদাতার পেশা	কৃষক = 1, শিক্ষক = 2, প্রবাসী = 3, পরিষেবা = 4, গৃহিণী = 5, জেলে = 6, ব্যবসা = 7, দিনমজুর = 8, ড্রাইভার = 9, রাজমিস্ত্রি = 10, ছুতার = 11, বেকার = 12, দর্জি = 13, ডাক্তার = 14, অন্যান্য চিকিৎসক = 15, বোটম্যান = 16, ছাত্র = 17, রিকশা/ভ্যান চালক = 18, (অন্যান্য হলে উল্লেখ করুন ___________)							

Page 1 of 5

1. Poverty Status

ক্রম.	প্রশ্ন	কোড	কোডের তালিকা
	1	2	3
01.	এই খানার সদস্যরা কি ধরনের পায়খানা ব্যবহার করেন?		1= খোলা মাঠ, 2= কাঁচা 3= স্যানিটারি
02.	আপনার খানার কোনো সদস্য কি দিনমজুরির সাথে যুক্ত?		1= হ্যাঁ 2= না
03.	আপনার খানার ৬ থেকে ১৭ বছর বয়সের সকল শিশু কি স্কুলে যায়?		1= হ্যঁ 2= না 99= প্রযোজ্য নয়
04.	আপনার খানায় কি বিদ্যুৎ সংযোগ আছে?		1= হ্যাঁ 2= না
05.	আপনার খানায় কি নিজস্ব কোনো গবাদি পশু আছে?		
06.	আপনার খানায় কি কোনো আলাদা রান্নাঘর আছে?		
07.	আপনাদের খানার খাবার পানির প্রধান উৎস কি?		1= সাপ্লাই/ পাইপের পানি (বাড়িতে) 2= সাপ্লাই/ পাইপের পানি (বাড়ির বাইরে) 3= সরকারি কল 4= ঝর্ণা 5= নলকূপ 6= পুকুর/নদী/খাল 7= কুয়া/ কূপ অন্যান্য (নিদিষ্ট করুন)
08.	আপনাদের খানার জ্বালানীর প্রধান উৎস কি?		1 = লাকড়ি/ কাঠ/ খড়ি 2 = কয়লা 3= পাতা, খড়, ঘুটে ইত্যাদি 4 = গ্যাস/ বায়োগ্যাস/ এলপিজি 5 = কেরোসিন 6= বিদ্যুৎ অন্যান্য (নিদিষ্ট করুন)
09.	বিগত ১২ মাসে এ অবস্থার কেমন পরিবর্তন হয়েছে?		1= উন্নতি হয়েছে, 2= অবনতি হয়েছে 3= একই রকম আছে
10.	বিগত ১২ মসের গড় আয় বিবেচনা করলে একটি সাধারন মাসে আপনার খানার মোট আয় কত?		
11.	বিগত ১২ মসের গড় ব্যয় বিবেচনা করলে একটি সাধারন মাসে আপনার খানার মোট ব্যয় কত?		

2. Health Status

স্বাস্থ্যসেবা প্রদানকারী প্রতিষ্ঠানের নাম	আছে কিনা? 1= হ্যাঁ 2= না 3= জানি না	দূরত্ব (কিমি :)	সেবা নেয়া হয় কিনা? 1= হ্যাঁ 2= না 3= প্রয়োজন নেই	যাতায়াতের বাহন/ মাধ্যম (সর্বাধিক ব্যবহৃত)	যাতায়াত খরচ (সর্বাধিক ব্যবহৃত)
কমিউনিটি হেলথ ক্লিনিক					
ইউনিয়ন পর্যায়ে হেলথ কমপ্লেক্স					
নগর মাতৃসদন কেন্দ্র *(ম্যাটারনিটি ক্লিনিক)*					
উপজেলা স্বাস্থ্যকেন্দ্র					
সদর হাসপাতাল					
এনজিও পরিচালিত স্বাস্থ্যকেন্দ্র					

স্বাস্থ্যসেবা প্রদানকারী প্রতিষ্ঠানের নাম	আছে কিনা? 1= হ্যাঁ 2= না 3= জানি না	দূরত্ব (কিমি :)	সেবা নেয়া হয় কিনা? 1= হ্যাঁ 2= না 3= প্রয়োজন নেই	যাতায়াতের বাহন/ মাধ্যম (সর্বাধিক ব্যবহৃত)	যাতায়াত খরচ (সর্বাধিক ব্যবহৃত)
বেসরকারী হাসপাতাল					
দক্ষ বেসরকারী চিকিৎক					
হাঁতুড়ে ডাক্তার					
অন্যান্য (উল্লেখ করুন)					

যাতায়াত ব্যবস্থা:
1=পায়ে হেঁটে, 2=সাইকেল, 3=রিকশা, 4=ভ্যান, 5=অটো-ভ্যান, 6=বাস, 7=ট্রেন, অন্যান্য (উল্লেখ করুন)

3. Eviction Threat

ক্রম	প্রশ্ন	কোড		কোড লিখুন
1	বর্তমানে আপনি যেখানে বসবাস করছেন সেখান থেকে বাসস্থান পরিবর্তনের চিন্তা-ভাবনা আছে কি?	1= হ্যাঁ 2= না [না হলে প্রশ্ন নং 3 এ যান]		
2	বাসস্থান পরিবর্তনের পরিকল্পনা থাকলে কেন পরিবর্তন করবেন? (প্রধান দুইটি কারণ আনুন)	01 = বন্যা 02 = সাইক্লোন/টর্নেডো 03 = নদী-ভাঙ্গন 04 = অতিবৃষ্টি 05 = অতিরিক্ত গরম 06 = অতিরিক্ত ঠান্ডা 07 = জলাবদ্ধতা 08 = ভূমিকম্প 09 = ভূমিধ্বস/ হঠাৎ বন্যা 10 = ধূলিঝড় 11 = অগ্নিসংযোগ 12 = খরা 13 = শুকনো মৌসুমে পানি স্বল্পতা 14 = অপেক্ষাকৃত ভালো জীবন-যাপন	15 = অন্যদের সাথে ঝগড়া বা সংঘর্ষ 16 = শিক্ষা 17 = উচ্ছেদ হওয়া/ আশংকা 18 = বাবা-মায়ের/ স্বামীর সাথে ঝগড়া 19 = ভাড়া বেশি/বৃদ্ধির কারনে 20 = ব্যবসায় ক্ষতি হওয়ার কারনে 21 = আয়- রোজগার/রুজির কারনে 22 = স্বামীর অসুস্থতা/মৃত্যুর কারনে 23 = চাকুরীর কারনে/বদলী 24= ক্ষমতাশালীদের প্রভাবের জন্য 25= বাচ্চার ভবিষ্যত চিন্তা করে 26= বাবা-মার সাথে এসেছে অন্যান্য (উল্লেখ করুন)	
3	প্রকল্পের কারণে যদি আপনার বসতভিটা/ জমির ক্ষতি হয় তাহলে এই ব্যাপারটিকে আপনি কিভাবে দেখেন/দেখবেন? *(একাধিক উত্তর আসতে পারে)*	1= আয় কমে যাবে 2= জমি/ বাড়ি/ অবকাঠামো হারাতে হবে বা ক্ষতিগ্রস্থ হবে 3= খরচ/ ব্যয় বৃদ্ধি	4= আর্থিক ক্ষতি হবে 5= কিছুই করার নেই অন্যান্য (উল্লেখ করুন)-	

ক্রম	প্রশ্ন	কোড	কোড লিখুন
4	প্রকল্পের কারণে যদি আপনাকে অন্যত্র সরে যেতে হয় তাহলে নতুন এলাকায় স্থানান্তরিত হওয়ার ক্ষেত্রে আপনাকে কি ধরণের চ্যালেঞ্জের সম্মুখীন হতে হবে বলে মনে করেন? *(একাধিক উত্তর আসতে পারে)*	1= খরচ/ ব্যয় বৃদ্ধি 2= নতুন জমি/ বাড়ি/ দোকান পেতে সমস্যা 3= নতুন জমি/ বাড়ি/ দোকান করা সময়সাপেক্ষ 4= নতুন পরিবেশের সাথে খাপ খাওয়ানো সমস্যা 5= আয় কমে যাবে 6= মানসিকভাবে ক্ষতিগ্রস্থ হওয়া 7= বাসা ভাড়া করে থাকা 8= সমস্যা হবে না অন্যান্য (উল্লেখ করুন)-	

4. General Opinion

ক্রম	প্রশ্ন	কোড	কোড লিখুন
1.	আপনার খানা কত বছর ধরে এই এলাকা/ কমিউনিটিতে বসবাস করছেন? **(উত্তরদাতা যত বছর ধরে কমিউনিটিতে বসবাস করছেন সেই সময় বছরে লিখুন)**		
2.	প্রকল্প এলাকায় কি কোনো কবরস্থান/ শ্মশ্মান/ সৎকার করার জায়গা পড়েছে? ***(না হলে ৫নং প্রশ্নে যান)***	**1** = হ্যাঁ **2** = না	
3.	যদি থাকে, কতগুলো?		
4.	কবরস্থান/ শ্মশ্মান বা সৎকার করার জায়গাগুলোর অবস্থান উল্লেখ করুন:		
5.	প্রকল্প এলাকায় কোনো ঐতিহাসিক/ দর্শনীয় / সাংস্কৃতিকভাবে গুরুত্বপূর্ণ স্থান আছে? ***(না হলে ৭ নং প্রশ্নে যান)***	**1** = হ্যাঁ **2** = না	
6.	যদি থাকে, তাহলে সেই স্থানগুলোর নাম, অবস্থান এবং প্রকৃতি সম্পর্কে বলুন।		
7.	প্রকল্প এলাকায় জমি ব্যবহারের উপর কোনো ধরনের বাধ্যবাধকতা আছে? ***(না হলে ১৪ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না	
8.	যদি থাকে, তাহলে কি ধরনের বাঁধা?		
9.	আপনি কি মনে করেন যে, প্রকল্পে নির্মাণ কাজের স্বার্থে যে কাঁচামাল এবং অন্যান্য উপকরণ ব্যবহার করা হবে সেগুলো সর্বোচ্চ উপযোগীতা মাথায় রেখে ব্যবহার করা হবে?	1 = হ্যাঁ 2 = না 3= জানিনা	
10.	এগুলো ব্যবহারের ক্ষেত্রে প্রকল্পের নির্দিষ্ট বর্জ্য ব্যবস্থাপনা থাকবে/ থাকা উচিৎ? ***(না হলে, ১২ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না	
11.	যদি বর্জ্য ব্যবস্থাপনা থাকে, তাহলে সঠিক বর্জ্য ব্যবস্থাপনা করার জন্য আপনার পরামর্শ কি?		
12.	প্রকল্প এলাকায় কোনো ক্ষুদ্র নৃ-গোষ্ঠীর বসবাস আছে?	1 = হ্যাঁ 2 = না 3= জানিনা	
13.	বসবাসকারী ক্ষুদ্র নৃ-গোষ্ঠীর নাম কি?		

ক্রম	প্রশ্ন	কোড	কোড লিখুন
14.	আপনি কি মনে করেন, প্রকল্প দ্বারা কোনো ক্ষুদ্র নৃ-গোষ্ঠীর ক্ষতি হবার সম্ভাবনা আছে?	1 = হ্যাঁ 2 = না	
15.	কমিউনিটি থেকে কেউ কি প্রকল্পের কাজে শ্রমিক হিসেবে যুক্ত হতে চাইবে বলে মনে করেন?	1 = হ্যাঁ 2 = না	
16.	আপনি কি মনে করেন, প্রকল্প এলাকার আওতাধীন কোনো বাজার ক্ষতিগ্রস্থ হবে? ***(না হলে, ১৮ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না	
17.	যদি হ্যা হয়, কোন বাজার ক্ষতিগ্রস্থ হবে বলে আপনি মনে করেন? *(বাজারের নাম লিখুন)*		
18.	আপনি কি মনে করেন, প্রকল্পের কারণে কোনো স্কুল/ কলেজ / মাদ্রাসা ক্ষতিগ্রস্থ হবে? ***(না হলে, ২০ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না	
19.	যদি হ্যা হয়, তাহলে কোন স্কুল/ কলেজ / মাদ্রাসা ক্ষতিগ্রস্থ হবে বলে আপনি মনে করেন? *(স্কুল/ কলেজ / মাদ্রাসার নাম লিখুন)*		
20.	প্রকল্প এলাকায় কোনো মসজিদ/মন্দির/গীর্জা/উপাসনালয় ক্ষতিগ্রস্থ হবে বলে আপনি মনে করেন?	**1** = হ্যাঁ **2** = না	
21.	যদি হ্যা হয়, তাহলে তাদের অবস্থান উল্লেখ করুন:		
22.	প্রকল্প এলাকায় অবস্থিত কোনো পুকুর/ জলাশয় আছে কী?	**1** = হ্যাঁ **2** = না	
23.	যদি থাকে, তাহলে কোন তাদের অবস্থান উল্লেখ করুন:		
24.	আপনাদের এলাকায় স্থাপিত টিউবওয়েলগুলোর গভীরতা কেমন?	**1** = গভীর **2** = অগভীর	
25.	গণপরিবহনে যাতায়াতের সময় মানুষ প্রধানত নারীরা নিরাপদ বোধ করেন কিনা?	**1** = হ্যাঁ **2** = না	
26.	প্রকল্প এলাকায় হয়রানির শিকার কোনো রেকর্ড আছে কিনা?	**1** = হ্যাঁ **2** = না	
27	প্রকল্প এলাকায় সরকারি/বেসরকারি এইঠ পরিষেবা কেন্দ্রের উপস্থিতি দেখা যায়?	**1** = হ্যাঁ **2** = না	
28.	এই এলাকায় এমন কোনো প্রাণী/মাছ/পাখি আছে যা, ১০ বছর পূর্বেও দেখা যেত কিন্তু বর্তমানে খুবই কম দেখা যায় বা প্রায় নেই বললেই চলে?	**1** = হ্যাঁ **2** = না	
29.	'হ্যাঁ' হলে, তাদের নাম উল্লেখ করুন:		

ANNEX 6: Grievance Record Form

	ASHUGANJ POWER STATION COMPANY LIMITED	**Document No.** SF-OHS-22
		Revision No.: 00
	FORM	**Effective Date:** 14 Mar. 15
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EXTERNAL/INTERNAL COMPLAIN LOG

Month: Year:

Sl. No.	Date	Complained by (Name, Address, Tel, Email) & Medium of Complain (Online/Email/Box/Hand to Hand)	Received by	Complain in Details	Day & time of incident	Root cause of the incident	Corrective Action	Decision taken by	Action taken on

Recorded By: Checked & Approved By:

Name & Designation: Name & Designation:

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EXTERNAL/INTERNAL GRIEVANCE COMMUNICATION RECORD

Month: Year:

Sl. No.	Date	Received From & Medium of Receipt (Online/Email/Box/Hand to Hand)	Subject	Necessity of Reply	Findings on the Subject	Action Required	Responsibility	Action Completed on	Action Communicated on	Remarks

Recorded By: Checked & Approved By:

Name & Designation: Name & Designation: