

Environmental Impact Assessment (Draft)

February 2018

BAN: Rupsha 800 MW Combined Cycle Power Plant
Project

Volume 2
(Component 2 – Gas Supply to the Power Plant)

Prepared by North-West Power Generation Company Limited for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 14 February 2018)

Currency unit	–	taka (Tk)
Tk1.00	=	\$0.0120548
\$1.00	=	Tk82.96

ABBREVIATIONS

ADB	–	Asian Development Bank
CITES	–	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DoE	–	Department of Environment
EA	–	executing agency
ECA	–	Environment Conservation Act
ECC	–	Environmental Clearance Certificate
ECR	–	Environment Conservation Rules
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EMoP	–	Environmental Monitoring Plan
IEE	–	initial environmental examination
MoEF	–	Ministry of Environment and Forests
PMU	–	project management unit
RoW	–	right-of-way
SPS	–	Safeguard Policy Statement

WEIGHTS AND MEASURES

°C	–	degree Celsius
dB(A)	–	A-weighted decibel
ha	–	hectare
lac	–	100,000
ppm	–	parts per million
µg/m ³	–	microgram per cubic meter
m ²	–	square meter

GLOSSARY

Bangla	–	official language of Bangladesh
hydrostatic testing	–	process of filling a pipeline with water, or a mixture of water and ethylene glycol or methanol to test the structural integrity of the pipeline under pressure
khal	–	Bangla word for a small channel or canal
thana	–	sub-district level of government administration, comprising several unions under the district
union	–	smallest unit of local self-government comprising several villages

NOTE

In this report, "\$" refers to United States dollars.

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EXECUTIVE SUMMARY

Introduction

North-West Power Generation Company Limited (NWPGL), an enterprise of the Bangladesh Power Development Board (BPDB) has taken the initiative to enhance the power generation capacity of Bangladesh to address the growing demand for electricity. This initiative will involve the construction of a new Rupsha 800 MW Combined Cycle Power Plant (CCPP) in Khalishpur Upazila, Khulna District in the administrative division of South-Western Bangladesh. The Rupsha 800 MW CCPP will be designed to use natural gas as the main fuel and high speed diesel (HSD) as back-up fuel (about 500 hours maximum annually). The Government of Bangladesh (GoB) has applied for financing of this new power plant from the Asian Development Bank (ADB). The Islamic Development Bank (IsDB) is expected to co-finance about 20% of the total project cost.

Project Description

Key interrelated project components include: (i) the development and operation of the Rupsha 800 MW gas-fired CCPP (Component 1); (ii) the construction of a gas distribution pipeline and related network infrastructure ensuring reliable supply of fuel to the CCPP (Component 2); (iii) the construction of a power transmission interconnection facility to transfer the generated power to the national grid at the existing substation in Khulna (Component 3); and (iv) capacity strengthening of NWPGL (Component 4).

Component 2 will provide the infrastructure to supply natural gas to Rupsha 800 MW CCPP. Sundarban Gas Company Limited (SGCL) will deliver gas from the existing Khulna City Gate Station (CGS) in Arongghata to the Rupsha 800 MW CCPP in Khalishpur. A new 24-inch underground gas pipeline of about 10 km long will be installed from the Khulna CGS to the Rupsha 800 MW CCPP. A gas receiving and metering station (RMS) will be located at the Rupsha 800 MW CCPP. In addition, a new 20-inch underground distribution gas pipeline of about 2 km long will be branched off from the line from Khulna CGS to Rupsha 800 MW CCPP, to serve NWPGL's existing Khulna 225 MW CCPP.

Under the Bangladesh Oil, Gas and Mineral Corporation (Petrobangla), SGCL was established in 2009 by the GoB to manage the operations of the gas distribution networks within five districts: (i) Kustia, (ii) Jhenidah, (iii) Jessore, (iv) Khulna, and (v) Bagerhat including other 21 district towns of Khulna, Barisal and Dhaka Divisions. Petrobangla, the national gas utility and the single-buyer for the gas industry, will procure liquefied natural gas (LNG) from international sources and deliver regasified LNG to Khulna city gas station (CGS). The regional gas distribution company, SGCL will deliver gas from the existing Khulna CGS in Arongghata to the Rupsha power plant in Khalishpur.

The associated gas distribution pipeline network of the Khulna CGS of SGCL is included as Part C of the ongoing Loan 2622/2633-BAN: Natural Access Improvement Project (formerly Clean Fuel Development Project) funded by ADB with a total amount of \$537 million approved on 26 March 2010. Part C (Access Improvement in South Western Region) involved the construction of about 845 kilometer (km), 2 inch to 20 inch distribution pipelines in south western region comprising of the districts of Kushtia, Jhenidah, Jessore, Khulna and Bagerhat (including Mongla). As such, it was subject to ADB's environmental requirements. Also included in the loan is capacity building for SGCL.

NWPGCL will create a Project Management Unit (PMU) to manage the day-to-day implementation of the project and will have about 80 staff. NWPGCL will get the necessary technical support from SGCL for Component 2 and Power Grid Corporation of Bangladesh (PGCB) for Component 3. The project will have a high-level Project Steering Committee (PSC) consisting of members from various government departments, NWPGCL, PGCB and SGCL and act as overseer of the project. The steering committee will meet every quarter to monitor progress and will report to the GoB.

Environmental Requirements

National requirements. The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 and the Environment Conservation Rules (ECR) 1997. Under these regulations, except for Component 4, all the three components of the Project are “Red” category requiring an environmental clearance certificate (ECC). Securing the ECC involves two steps: (i) issuance of locational (or site) clearance certificate (SCC), and then (ii) the ECC. An initial environmental examination (IEE) is required for the SCC and an environmental impact assessment (EIA) is required for the ECC. The terms of reference (ToR) of the EIA for Component 2 was approved by the Department of Environment (DoE) on 3 November 2016 (see **Annex 1**). The approved NWPGCL has obtained exemptions for submitting an IEE required in obtaining the SCC for all the project components as follows:

- (1) Component 1 – 5 November 2017; DoE/Clearance/5584/2016/564
- (2) Component 2 – 5 November 2017; DoE/Clearance/5668/2016/563
- (3) Component 3 – 5 November 2017; DoE/Clearance/5669/2016/549

In August 2016, NWPGCL contracted the Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources, to prepare the EIAs for the three components.

ADB and IsDB requirements. The project is subject to the environmental requirements of both ADB and IsDB since NWPGCL is seeking their financial supports. The Safeguard Policy Statement (SPS) 2009 of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility. Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGCL for this project.

Under SPS 2009, projects are screened and categorized based on their potential environmental impacts. Following this screening procedure, the project is category A on environment which requires the preparation of an environmental impact assessment (EIA).¹ This EIA (Volume 2) covers the Component 2 of the project.

NWPGCL will be the executing agency of the project. On 17 October 2015, NWPGCL approved its Environmental, Health & Safety and Social Policy. NWPGCL is also certified in ISO 9001, ISO 14001. BS OSHAS 18001 valid until October 2019.

¹ Asian Development Bank Safeguard Policy Statement (SPS 2009), <https://www.adb.org/documents/safeguard-policy-statement>. (Accessed 23 November 2017)

Description of the Existing Environment

The description of the environment for Component 2 was based on the areas that will be traversed by the gas distribution pipeline route. Component 2 will cross five road crossings, three railway crossings and two river crossings along Mayur River in Khulna City.

Average yearly rainfall in the study area is 1,813 mm and is within seismic Zone which is considered as seismically quiet zone. The maximum temperature varies from 25.3°C to 34.9°C while the minimum temperature varies within the range of 12.2°C and 26.3°C.

The project area is mainly urban roads, modified semi-urban landscape where biological features are limited. Thus, floral and wildlife diversity is much less. However, there are planted vegetation along the Bastuhara roads and Khulna-Mongla highway to Arongghata. Most of the trees are newly planted and immature. The unused areas along the road were covered by common scattered planted tree, herbs and shrubs species. Common cultivated plants along the roadside are Rain Tree (*Samanea saman*), Mehogani (*Swietenia mahagoni*), Sugar Date Palm (*Phoenix sylvestris*), Banana (*Musa* sp.), Egyptian thorn (*Vachellia nilotica*), Horse radish tree (*Moringa oleifera*), Indian jujube (*Zizyphus mauritiana*), North Indian Rosewood (*Dalbergia sissoo*). No threatened plant species has been found along the gas pipeline route. Fauna that have been seen along the roadside is Golden Jackal, Grater bandicoot rat and Small Indian mongoose. Birds species seen in roadside trees are Black Drongo, Common Myna, Asian Pied Starling, Spotted Dove, Red-vented Bulbul, House Sparrow, Brahminy Kite, Long tailed shrike, House crow, Oriental Magpie Robin, etc. Garden lizard, toad and Indian cricket frog are commonly found along the road. No IUCN listed and rare fauna species are found within the project area.

Component 2 will mainly pass through non-agricultural land. Within the project area, only one acre land is cultivated for crop production and single Boro crop is produced during the dry season. The proposed pipeline route will cross one goldagher near the borrow pit at Toiyab Nagar KDA link road. Mayur River and a canal are not presently potential for fish habitat as the water quality has deteriorated due to discharge of wastewater from Khulna City.

The average household size is 4.1 and the male-female ratio is 109. Within the project area, the highest number of population (about 27 %) belongs to age group of 30 to 49 years while the lowest number (about 3%) belongs to 60 to 64 years age group. Literacy rate is 59% and employment rate is about 39.2%. About 35.1% of the population is engaged in household work while 25.1% are unemployed. Household income per month ranges from BDT 7,000 to BDT 29,000.

Anticipated Impacts and Mitigation Measures

The pipeline route will cause five road crossings, three railway crossings and two river crossings along Mayur River. Construction works along these crossing may have potential environmental impacts. Horizontal directional drilling (HDD) will be used in installing the pipeline in these crossings to minimize environmental impacts and disturbance to local people. Other potential environmental impacts during construction include increased level of noise and dusts, generation of waste from construction works, and clearing of 370 trees. Appropriate compensation will be given to privately-owned trees and budget estimates included in the Resettlement Plan for Component 2.

Prior to any civil works, the PMU will have an orientation briefing to the Engineering, Procurement, and Construction (EPC) Contractor and their workers about the environmental requirements by the DoE and ADB that need to be complied with, their roles and responsibility for compliance, record keeping and reporting, awareness on socially transmitted disease like HIV/AIDS to avoid the potential occurrence of this diseases in the construction site. The EPC Contractor will be required to prepare a Construction Management Plan (CMP) outlining their actions and measures to manage potential environmental impacts during construction phase. The CMP will be reviewed and approved by the PMU. As excavation works will be involved, a “chance find” procedures will guide workers in the event a physical cultural resource is affected.

The main sources of noise generation will include trenching, laying of pipe, grading, stringing, coating, etc. Movement of construction vehicles and material transport will also contribute to noise generation. Ambient air quality may be affected by dust generated from excavation, vehicular emissions, transport of construction materials, and other construction works like boring of road and railway. Noise generating activities during construction will be limited to daytime hours and will be stopped during school hours, madrasa and prayer time at mosques. Workers exposed to high ambient noise will be provided with ear muffs.

Construction activities such as excavation, laying and welding of pipes, mobilization of vehicles may pose occupational and community safety risks. A contingency fund will be made available by Component 2 to cover assistance in case of accidents involving workers and local people. To minimize occupational risks, the EPC Contractor will be required by PMU to provide workers with personal protective equipment (PPE), sanitary facilities, wash areas, and safe drinking water. The field construction camps will be provided with first aid kit, garbage bins, fire-fighting equipment and good housekeeping will be enforced at all times. Clear and visible safety and danger signs will be posted by the EPC Contractor at and around the field camps that may be enclosed (as needed) to contain dust levels and ambient noise level. PMU will regularly monitor compliance of the EPC Contractor.

To avoid traffic congestions which may inconvenience local residents particularly in areas that will be crossed by the gas pipeline, appropriate traffic signs will be posted and temporary pedestrian crossing will be installed to accommodate children, women, elderly, and persons with disability.

While areas that may be affected are mainly non-agricultural, about one acre agricultural land will lose about 1.8 tons of high yield variety (HYV) Boro rice production during construction phase. Production period of Boro rice is November to May. To avoid the loss, construction works in this agricultural area will avoid November to May. Also, trenching will affect *gher* along the Toiyab Nagar KDA road to Khulna City link road. It is estimated that the impact will be about 0.5 acre and a production loss estimated to be 147 kg of total impacted *gher* area.

Before commercial operation, Component 2 will be subjected to hydrostatic testing to check for leaks and strength. The hydrostatic testing plan, which will include disposal of used water, will be approved by PMU. Workers that will be involved in hydrostatic testing will be provided with appropriate safety gear and equipment. Used water will be checked for quality prior to discharge to ensure compliance with Schedule 10 of ECR 1997. Residents relatively near to the pipeline route will be informed of the schedule for hydrostatic testing.

Operation of Component 2 may pose occupational and public safety risks. A hazard risk assessment was conducted and an emergency preparedness plan is included. Part of continuing consultation will be a regular awareness campaign on disaster and emergency

preparedness. A communications strategy program will be done by NWPGL with technical guidance from a communications expert.

Clear and visible warning signs/markers following appropriate safety standards will be installed along the pipeline route to avoid accidental digging or exposure aboveground of the pipeline. The operation of the pipeline system will be monitored 24 hrs daily through the Supervisory Control and Data Acquisition (SCADA) which is equipped with an automatic shut off of gas flow in the event of pressure differential or leak.

NWPGL staff who will be involved in the operation of Component 2 will have the necessary experience and skills. At the same time, regular training on safety, disaster and emergency preparedness, and monitoring will be conducted to staff managing Component 2.

Analysis of Alternatives

A “no project” option means that the area along the proposed alignment of Component 2 will remain the same as the current condition. However, the supply of natural gas for the Rupsha 800 MW CCPP will not be provided and NWPGL will be compelled to use high speed diesel (HSD) as the primary fuel when a better and more environment-friendly fuel can be used.

“With project” evaluated three options and the selected pipeline route will result to less number of structures to be affected.

Information Disclosure, Consultation and Participation

A total of six consultation events were conducted from 12-14 June 2017 participated by 31 persons. These consultations were key informant interviews (KII) and informal interviews done in Arongghata, Ward No 9, and Ward No. 12 in the district of Khulna.

The people within the project area of Component 2 are aware of the project from other consultants who frequently visited the sites. They understood the potential project impacts and showed positive attitude and support towards the project. The RoW along the pipeline route is owned by the Government. Consultations will continue and a program for consultation will be finalized by NWPGL with support from the communication expert to ensure that stakeholders are consulted, as and when needed.

A project summary with details on grievance redress mechanism (GRM), and contact person in case of complaints will be prepared in both Bangla and English and will be made available at the field office of PMU in Khaliapur, Khulna and at the NWPGL office in Dhaka. More details on Component 2 will also be available from the EIA posted in the website of ADB.

Grievance Redress Mechanism

NWPGL currently manages grievance and/or complaints through the Grievance Redress System (GRS) which is required by the GoB and part of the mandatory Annual Performance Agreement (APA). This agreement will be signed and renewed annually between NWPGL and GoB.

To meet the requirements of SPS 2009, a GRM will be set up once ADB funding for Component 2 becomes effective. The GRM will provide three-tier entry points in grievance redress. Two grievance redress committees (GRCs) will be formed: (i) local grievance redress committee

(LGRC); and (ii) project grievance redress committee (PGRC). Grievances considered minor can be resolved onsite at the LGRC level within 7 days from receipt of complaint. Other complaints not resolved at the LGRC level will be forwarded to PGRC which will take two weeks (or 14 days) to resolve. Meetings of the LGRC will be held onsite (PMU office) and members may do site visits to check or verify the issue. Complainants will be informed of the status of resolution. The third tier entry point for grievance redress will be the appropriate rule of court.

Environmental Management Plan

The Corporate environmental staff of NWPGCL and the PMU will monitor the EPC Contractor on its compliance to the EMP. Environmental monitoring plans (EMoP) have been prepared. A total of Lac Tk 36 has been budgeted for the implementation of EMP and additional Lac Tk7.3 for monitoring. Environmental monitoring reports will be submitted by PMU to ADB semi-annually and these reports will be posted in the ADB website as required by SPS 2009 and PCP 2011.

Conclusion and Recommendation

The pipeline route in Component 2 was chosen with the least environmental impacts which can be mitigated by best available technology, compliance to design standards and specifications, applicable requirements of GoB and ADB. The EIA for Component 2 was prepared following the requirements of the DoE and ADB. An EMP and EMoP were included in the EIA with cost estimates.

The pipeline route will cause five road crossings, three railway crossings and two river crossings along Mayur River. HDD will be used in installing the pipeline in these crossings to minimize environmental impacts and disturbance to local people. Other potential environmental impacts during construction include increased level of noise and dusts, generation of waste from construction works, clearing of 370 trees, disturbance to local traffic at road and railway crossings, occupational and public safety risks. These temporary and of short duration impacts can be easily mitigated. Mitigation measures for these impacts are included in the EMP and the parameters for monitoring have been identified in the EMoP. Component 2 will be designed, constructed, supervised by technical consultants, and operated by experienced engineers, technical staff, and natural gas consultants.

This draft EIA will be disclosed in the ADB website in accordance with SPS 2009 and PCP 2011. Prior to construction works, all the relevant permits required for Component 2 will be obtained by NWPGCL.

1.0 INTRODUCTION

1. The Power System Master Plan 2016 recommends for diversification in the use of fuel for power generation such as domestic and imported coal and natural gas, oil, nuclear power, and renewable energy.² Consistent with this, the North-West Power Generation Company Limited (NWPGL), an enterprise of the Bangladesh Power Development Board (BPDB) has taken the initiative to enhance the power generation capacity of Bangladesh to address the growing demand for electricity. This initiative will involve the construction of a new Rupsha 800 MW Combined Cycle Power Plant (CCPP) in Khalishpur Upazila, Khulna District in the administrative division of South-Western Bangladesh. The Rupsha 800 MW CCPP will be designed to use natural gas as the main fuel and HSD as back-up fuel (about 500 hours maximum annually). The Government of Bangladesh (GoB) has applied for financing of this new power plant from the Asian Development Bank (ADB). The Islamic Development Bank (IsDB) is expected to co-finance about 20% of the total project cost.

2. The objectives of this initiative include the following:

- To contribute in meeting the demand for electricity and to increase reliability of supply by minimizing load-shedding;
- To support in achieving the vision of GoB, “Power to All by 2021;”
- To reduce the increasing gap between demand and supply of electricity throughout the country;
- To accelerate economic development by providing adequate and reliable power generation;
- To enhance the stability and reliability of the national grid system, and to reduce the systems loss by local generation; and
- To develop human resource through technology transfer.

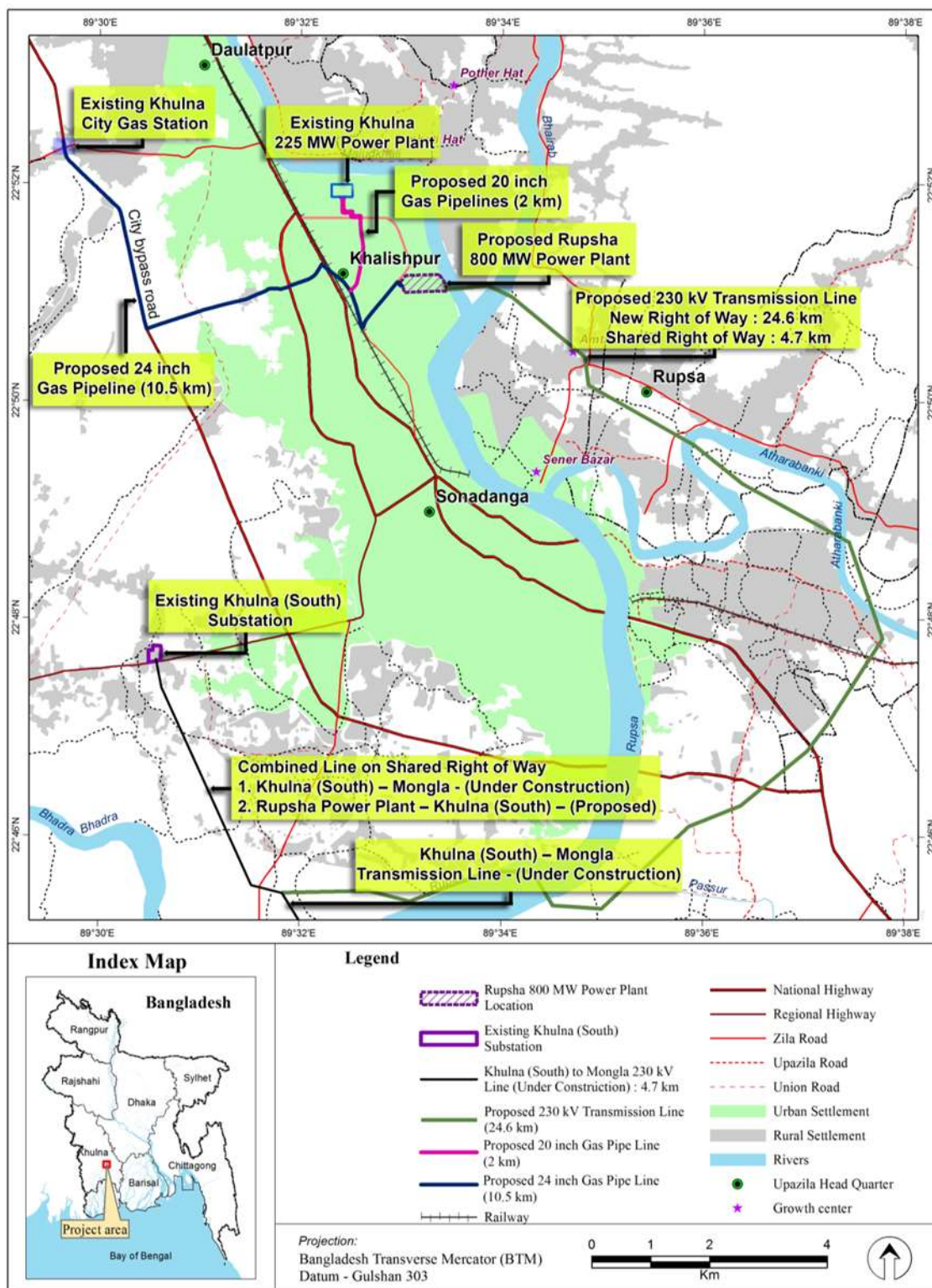
3. Overall, the goal is to improve the economic growth of Bangladesh by providing a reliable and stable power supply with this initiative.

1.1 Overview of the Project

4. The project targets strengthening energy security in Bangladesh. The country faces serious electricity shortages in the short- to medium-term and needs to secure cost-effective, new and diversified energy sources. Key interrelated project components include: (i) the development and operation of the Rupsha 800 MW gas-fired CCPP; (ii) the construction of a gas distribution pipeline and related network infrastructure ensuring reliable supply of fuel to the CCPP; (iii) the construction of a power transmission interconnection facility to transfer the generated power to the national grid at the existing substation in Khulna; and (iv) capacity strengthening of NWPGL. The project will establish the first ever power plant to use gas from the Bangladesh gas transmission network, where its gas supply would be attributed to LNG imported into Bangladesh. **Figure 1.1** shows the project.

² Ministry of Power, Energy and Mineral Resources, and Bangladesh Power Development Board. People's Republic of Bangladesh Power & Energy Sector Master Plan. [http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/\(E\)_FR_PSMP2016_Summary_revised.pdf](http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/(E)_FR_PSMP2016_Summary_revised.pdf). (Accessed 18 August 2017)

Figure 1.1: Location map



Component 1: Rupsha 800 MW CCPP

5. Rupsha 800 MW CCPP will be built in the (now abandoned) Khulna newsprint factory premises. The power plant will use combined cycle gas turbine technology, comprising two identical generating units, each nominally rated at 400 MW. Each combined cycle unit will consist of one gas turbine and one heat recovery steam generator (HRSG), forming a one-on-one configuration. At full capacity of 800 MW, the Rupsha power plant is capable of meeting 5% of the forecast peak demand of Bangladesh in year 2022. The cooling system will be closed-loop forced-draught cooling tower system that will require 2,010 m³/hour of water to be taken from the Bhairab River.

Component 2: Gas Supply to the Power Plant

6. Petrobangla, the national gas utility and the single-buyer for the gas industry, will procure liquefied natural gas (LNG) from international sources and deliver regasified LNG to Khulna city gas station (CGS). The regional gas distribution company, Sundarban Gas Company Limited (SGCL) will deliver gas from the existing Khulna CGS in Arongghata to the Rupsha power plant in Khalishpur. A new 24-inch (0.6 m) underground gas pipeline about 10 km long will be installed from Khulna CGS to the Rupsha 800 MW power plant. The gas receiving and metering station (RMS) will be located at the Rupsha power plant. In addition, a new 20-inch (0.5 m) underground gas pipeline 2 km long will be branched off from the line from Khulna CGS to Rupsha power plant, to serve NWPGL's existing Khulna 225 MW power plant. Owing to non-availability of gas, this 225 MW power plant is presently operating on diesel.

Component 3: Power Transmission Interconnection

7. Electricity generated in the Rupsha power plant will be stepped-up to the transmission voltage of 230 kilovolt (kV). A new 29 km transmission line will be built from Rupsha 800 MW CCPP to the existing Khulna South substation. The conductor to be used is twin-ACCC Hamburg³, and the line will have two circuits, each capable of transferring 1400 MW. The new transmission line will require three main river crossings and three minor river crossings, and would traverse for 29 km, mostly through rice fields. Upon reaching the existing Khulna South substation, the line will be terminated at two new line bays and termination equipment to be installed under the project. Thereafter, electricity produced at Rupsha power plant will flow into the 230 kV transmission network to serve the electricity demand in Khulna and elsewhere in the country.

Component 4: Capacity Strengthening of NWPGL

8. Strengthening institutional capacity has the following three major subcomponents: (i) improving project implementation, management, and construction supervision capabilities; (ii) establishing enterprise resource planning (ERP) system in NWPGL; and (iii) enhancing operation and maintenance practices through procurement and installation of modern and high technology universal power plant operations training simulator. Project management and construction supervision support will be provided for the development of Rupsha power plant. ERP system support includes both hardware and software for introducing computerized management system for NWPGL. The ERP system will substantially improve business process and NWPGL's efficiency and transparency by computerizing the Financial

³ Aluminium Conductor Composite Core (ACCC) Hamburg has a current carrying capability of 1440 ampere at 120°C.

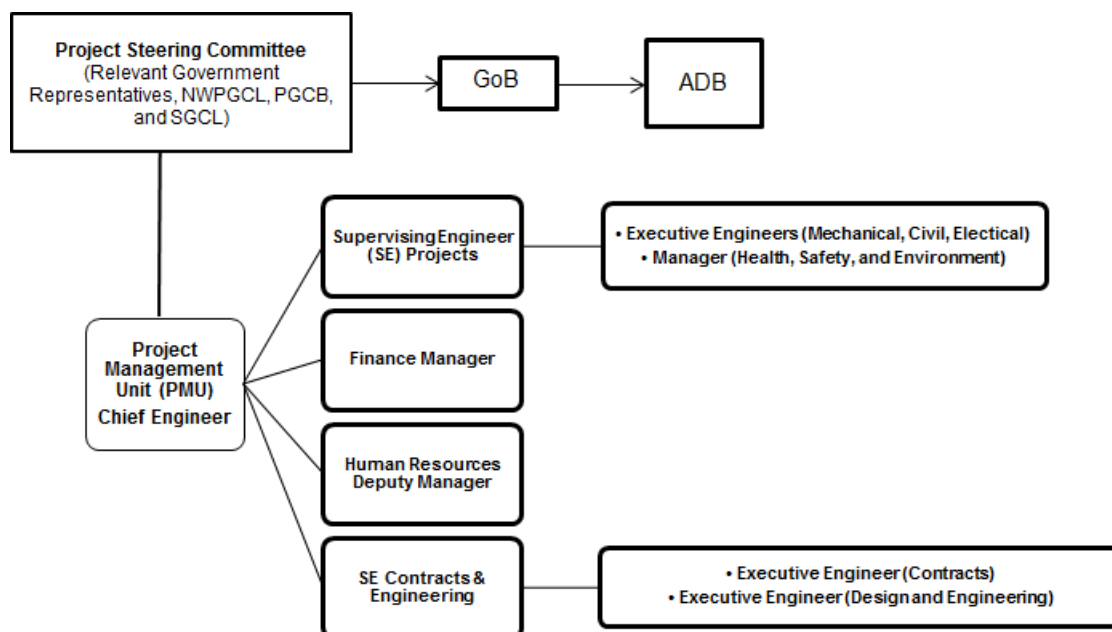
Accounting, Budgeting & Costing, Human Resource Management, Procurement Inventory, Planning and Monitoring, Operations & Maintenance and Project Management and Accounting.

1.2 Project Implementation Arrangements

9. Implementation supervision for the Rupsha 800 MW CCPP, power transmission, and gas distribution facilities will be carried out by the NWPGCL with assistance from a team of international and national implementation consultants. From time to time, assistance will be provided by the Power Grid Company of Bangladesh (PGCB) for Component 3, and the SGCL for Component 2 to ensure that coordination is achieved and implementation progresses smoothly. During construction, further assistance will be provided by SGCL and PGCB for approval of detailed design and drawings submitted by the contractors of Component 2 and Component 3, respectively. This arrangement has worked well for the Bheramara 360 MW CCPP project financed by the Japan International Cooperation Agency (JICA), which is very similar to the Rupsha 800 MW CCPP.

10. NWPGCL is currently setting up the project management unit (PMU) and so far, has assigned limited staff to it. The organogram (see **Figure 1.2**) prepared for the PMU shows the unit will have a compliment of 80 staff. It will be headed by a Chief Engineer, and will have 4 divisions, headed by: (i) Supervising Engineer (SE) Projects; (ii) Manager Finance; (iii) Deputy Manager Human Resources and (iv) SE Contracts & Engineering. SE Projects will have reporting to him, three Executive Engineers, (Mechanical, Civil, and Electrical) and Manager Health, Safety and Environment (HSE) while the SE Contracts& Engineering will have reporting to him Executive Engineer Contracts and Executive Engineer Design and Engineering. In addition, the project will have a high-level Project Steering Committee (PSC) consisting of members from various government departments, NWPGCL, PGCB and SGCL and act as overseer of the project. The steering committee will meet every quarter to monitor progress and will report to the GoB.

Figure 1.2: Project Implementation Arrangements



1.3 The Need for Environmental Assessment

11. The project is subject to the environmental requirements of GoB, ADB, and IsDB since the NWPGL is seeking the financial support of ADB and IsDB.

1.3.1 National Requirements

12. The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 and the Environment Conservation Rules (ECR) 1997. Under these regulations, all the three components of the Project are “Red” category requiring and environmental clearance certificate (ECC). Securing the ECC involves two steps: (i) issuance of locational (or site) clearance certificate (SCC), and then (ii) the ECC. An initial environmental examination (IEE) is required for the SCC and an environmental impact assessment (EIA) is required for the ECC. The terms of reference (TOR) of the EIA needs the approval of the Department of Environment (DoE). The DoE is the authority that regulates and enforces environmental management regulations to ensure that development projects are implemented sustainably, and to conserve and manage the environment in Bangladesh.

13. The ToR of the EIA for Component 2 was approved by the DoE on 3 November 2016. NWPGL has obtained exemptions for submitting an IEE in obtaining the SCC for all the project components as follows:

- (1) Component 1 – 5 November 2017; DoE/Clearance/5584/2016/564
- (2) Component 2 – 5 November 2017; DoE/Clearance/5668/2016/563
- (3) Component 3 – 5 November 2017; DoE/Clearance/5669/2016/549

14. Without the EIA approved by DoE, NWPGL cannot open line of credit in favor of importable machineries and cannot start any physical activities for the project. In 2016, NWPGL has engaged the Center for Environmental and Geographic Information Services (CEGIS) to prepare the EIAs of all the project components required by the DoE.

1.3.2 Environmental requirements of ADB and IsDB

15. The Safeguard Policy Statement 2009 (SPS 2009) of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. The IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility.⁴ Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGL for this project.

16. Under SPS 2009, projects that require funding from ADB will be subject to screening and categorization based on their potential environmental impacts. The project has four components: (i) Component 1 - Rupsha 800 MW CCPP, Component 2 – Gas Supply to the Power Plant, Component 3 – Power Transmission Interconnection, and Component 4 – Capacity Strengthening of NWPGL. Component 4 is not expected to have adverse

⁴ IsDB.Statement by Dr. Ahmad Mohamed Ali, President, IDB. United Nation’s Conference on Sustainable Development (Rio +20), 20-22 June 2012.
http://www.isdb.org/iri/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/About%20IDB/President%20IDB%20Group/PS_UN_ConferenceSustainableDevelopment_20June2012.pdf. (Accessed 6 December 2017)

environmental impacts. The project is category A on environment according to ADB's SPS 2009 which requires the preparation of an EIA.⁵

17. The EIA required by ADB was based on the findings of CEGIS and additional research for available secondary data to meet SPS 2009. Aside from the EIA, NWPGCL will provide ADB a copy of the ECC issued by the DoE for all the project components.

1.4 Structure of the Report

18. Following the requirements of SPS 2009, the environmental assessment for the project is presented as follows:

- 1) Volume 1 – EIA of Component 1;
- 2) Volume 2 – EIA of Component 2; and
- 3) Volume 3 – EIA of Component 3.

19. The EIAs of all the project components are based generally on the EIA format given in Annex to Appendix 1 of SPS 2009, pp41-43. This EIA covers Component 2 – Gas Supply to the Power Plant.

⁵ Asian Development Bank Safeguard Policy Statement (SPS 2009), <https://www.adb.org/documents/safeguard-policy-statement>.

2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 National environmental agency

20. The Ministry of Environment and Forests (MoEF) is the agency responsible for planning, promoting, coordinating and overseeing the implementation of programs and plans regarding environment and forestry. The MoEF deals with all national environmental matters and is responsible for the prevention and control of pollution, forestation and regeneration of degraded areas and protection of the environment, and in the framework of legislations. MoEF also undertakes surveys, impact assessment, pollution control, research, and collection and dissemination of environmental information, as well as environmental awareness among all sectors in Bangladesh.

21. Under the MoEF is the Department of Environment (DoE), which performs regulatory functions. DoE was created in 1989 as the primary government agency responsible for enforcing environmental management regulations to ensure sustainable development and to conserve and manage the environment. The DoE ensures the consistent application of environmental rules and regulations, and provides guidance, training and promotional campaign on improving environmental awareness.

2.2 National environmental regulations

22. The main environmental regulations in Bangladesh are the Environment Conservation Act (ECA) 1995 (amended 2000, 2002, 2007 and 2010) and Environment Conservation Rules (ECR) 1997. ECA 1995 provides the requirements on environmental protection, improvement of environmental standards, and control and abatement of environmental pollution. Through the ECA 1995, the DoE is mandated to undertake any activity needed to conserve and enhance the quality of environment and to control, prevent and mitigate pollution.

23. ECR 1997 provides for the declaration of ecologically-critical areas, categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects. Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc.; (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for the IEE and the EIA based on categories of industrial and other development interventions. ECA 1995 and ECR 1997 outline the regulatory mechanism to protect the environment in Bangladesh. Aside from ECA 1995 and ECR 1997, **Table 2.1** presents a summary of relevant environmental regulations.

Table 2.1: Relevant national environmental regulations

Regulation	Brief Description	Remarks
Environment Court Act 2000 (amended in 2002 and 2010)	This Act is under the Judiciary and MoEF to ensure the resolution of disputes on environmental and social damages resulting from any development activities. This Act also allows for the completion of environment-related legal proceedings effectively.	NWPGCL will ensure that all potential environmental complaints will be dealt with effectively at the project level through the Project Management Unit (PMU). SPS 2009 requires setting up of a grievance redress mechanism for projects known to cause potential environmental impacts.

Regulation	Brief Description	Remarks
Bangladesh Water Act 2013	Makes provisions for integrated development, management, abstraction, distribution, use, protection and conservation of water resources	Component 2 will have two crossings at Mayur River. NWPGL will ensure that relevant provisions will be complied.
Vehicle Act 1927, the Motor Vehicles Ordinance 1983	These are under the Bangladesh Road Transport Authority (BRTA) which regulates vehicular emissions and noise including road safety.	This regulation will be complied with by vehicles that may be used during construction and operation of Component 2.
Factories Act 1965 and Bangladesh Labour 2006, Bangladesh Labor Act 2013	Regulations that aim to protect the interests and rights of the workers and to ensure their safety.	Workers recruited under Component 2 will be provided with personal protective equipment (if needed) and will comply with these regulations. No worker under 18 years old will be recruited.
The Forest Act 1927 (amended in 1982 and 1989)	This Act under the MoEF aims to protect the forest resources.	Component 2 will not traverse protected forest area or other forest type.
Telegraph Act 1885	Under the Ministry of Posts and Telecommunications, this provides power to the Telegraph Authority to alter position of gas or water pipes or drain (Sect. 14, a and b).	The route for Component 2 was selected considering this Act.
Electricity Act 1910	Relates to the supply and use of electrical energy, allows any person to secure a license to supply energy and to put down or place electrical supply lines for the transmission of energy. Sect 19(1) of the Act provides that the licensee, in the exercise of any of the powers conferred by or under this Act, will cause as little damage, detriment and inconvenience as may be, and will make full compensation for any damage, detriment or inconvenience caused by him or by any one employed by him.	Component 2 referred to the applicable provisions in this Act.
Gas Safety Rules 1991 (amended 2003)	Provides guidelines on the materials, design and construction of gas transmission and pipeline industry. This Safety Rules were based on the American National Standard Codes for Gas Transmission and Piping System.	NWPGL and SGCL will comply with these safety rules.
Bangladesh Gas Act 2010	Regulates the transmission, distribution, marketing, supply and storage of natural gas and liquid hydrocarbon	NWPGL and SGCL will comply with this Act.
Gas Distribution Rules (Industry) 2014	Provides guidance on gas distribution to industrial clients	NWPGL and SGCL will comply with the relevant provisions of this rules.
The Antiquities Act 1968 (amended 1976)	Regulation on the preservation and protection of antiquities.	NWPGL will have a "chance find" procedures.
Natural Water Bodies Protection Act 2000	According to this Act, the character of water bodies i.e. rivers, canals, tanks, or floodplains identified as water bodies in the master plans or in the master plans	Any part of Component 2 that will cross rivers, ponds, canals, and drainage channels will refer to this Act and will secure the required

Regulation	Brief Description	Remarks
	formulated under the laws establishing the municipalities in division and district towns shall not be changed without approval of concerned ministry. This Act is under the Rajdhani Unnayan Kartipakkha/Town Development Authority/Municipalities.	approval and clearances.
Wildlife (Protection and Safety) Act 2012	Provides for the conservation and safety of biodiversity, forest and wildlife of the country by repealing the existing law relating to conservation and management of wildlife of Bangladesh. Under this Act, hunting, trapping, killing of wildlife are strictly prohibited.	Component 2 will not affect areas of habitats known to host wildlife. Route is along urban areas.
The Protection and Conservation of Fish Act 1950 (amended 1973, 1982, 1995, 2002)	Provides for the requirements for the protection and conservation of fish. This Act defines fish as “all cartilaginous, bony fishes, prawn, shrimp, amphibians, tortoise, turtles, crustacean animals, molluscs, echinoderms and frogs at all stages in their life history.”	Component 2 will cross Mayur River twice and will ensure that no protected fish species under this Act will be destroyed or affected.

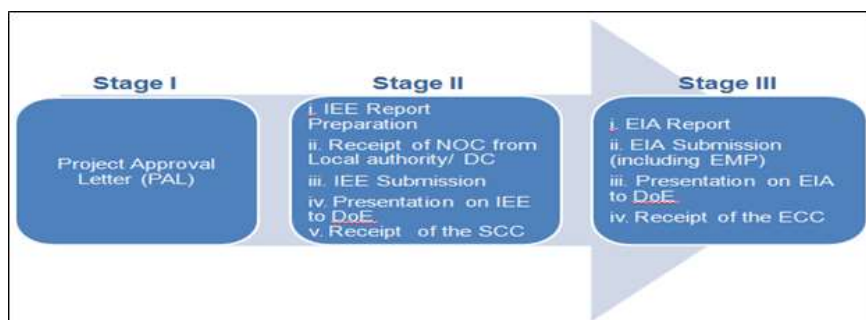
Source: ADB Consultant, November 2017

2.3 Overview of the environmental approval process

24. Section 12 of ECA 1995 provides that no industrial unit or project can be established or undertaken without securing an environmental clearance certificate (ECC) from the DoE. Following the requirements of ECR 1997, the DOE has classified various development interventions according to the potential adverse environmental impacts for the purpose of issuing the ECC. This classification includes: (i) green, (ii) orange-A, (iii) orange-B, and (iv) red. Green category refers to industries or projects considered to be relatively pollution-free, thus, no environmental study will be required while the Red category refers to industries/projects which may cause significant adverse environmental impacts and therefore, require an EIA.

25. For projects and industrial units classified as Orange-A, Orange-B, and Red (those that may have potential adverse environmental impacts), securing the ECC involves two steps: (i) issuance of site clearance certificate (SCC), and then (ii) the ECC.

26. SCC will be issued by the DoE upon approval of the IEE, receipt of the No Objection Certificate (NOC), which a “proof of authorization” to initiate a project, and the ToR of the EIA while the ECC will be issued upon the approval of the EIA. The project proponent cannot open line of credit in favor of importable machineries and cannot start any physical activities for the project without the EIA approved by the DoE. **Figure 2.1** shows the process of obtaining the ECC for Red category project.

Figure 2.1: Process of obtaining ECC

2.3.1 National environmental requirements for Component 2

27. According to ECR 1997, Component 2 is Red category requiring an SCC and an ECC. The NOC from the local government, Aviation Authority, and the Department of Forest have been obtained. On 5 November 2017, NWPGL has obtained exemption from the DoE for submitting an IEE and approval of the ToR of the EIA (DoE/Clearance/5668/2016/563).

2.4 Relevant International Environmental Agreements

28. **Table 2.2** lists the applicable international environmental agreements where Bangladesh is a signatory which can provide guidance during the implementation of Component 2.

Table 2.2: Relevant international environmental agreements

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972)	Defines and provides for the conservation of world's heritage by listing the natural and cultural sites whose value should be preserved.	3 November 1983	23 November 1972	Component 2 will have "chance find" procedures
Convention on Biological Diversity (1992)	A framework for biodiversity and requires signatories to develop national strategies (National Biodiversity Strategy and Action Plan) for the conservation and sustainable use of biological diversity.	3 May 1994	29 December 1993	Any replacement of cleared vegetation resulting from Component 2 will be consistent with the objectives and priorities of the current Action Plan.

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington 1973) – also known as CITES	Addresses the exploitation patterns and overharvesting that threaten species of flora and fauna. Under this Convention, the governments agree to restrict or regulate trade in species that are threatened by unsustainable patterns and to protect certain endangered species from overexploitation by means of a system of import/export permits.	20 November 1981	1 July 1975	Component 2 will ensure that it will not cause any harvesting and exploitation of wild flora and fauna during implementation.
Vienna Convention for the Protection of the Ozone Layer	A framework for efforts to protect the globe's ozone layer by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative or administrative measures against activities likely to have adverse effects on the ozone layer.	2 August 1990	22 March 1985	Component 2 will not use chemicals that can affect the ozone layer like methyl chloroform, a solvent generally used for industrial processes.
Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer)	Designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.	2 August 1990	1 January 1989	Component 2 will not use chemicals that can cause harm to the ozone layer.
Kyoto Protocol (1997)	Commits its Parties to set internationally-binding emission reduction targets.	22 October 2001	16 February 2005	Component 2 will ensure zero or minimal fugitive natural gas emissions.

International Environmental Agreement	Description	Date Ratified	Date Entered into Force	Comments
	This agreement is linked to the United Nations Framework Convention on Climate Change (UNFCCC).			
UNFCCC (1992)	This framework came into force on 21 March 1994 and aims to achieve stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level low enough to prevent dangerous anthropogenic interference with the climate system.	15 April 1994		Component 2 will ensure zero or minimal fugitive natural gas emissions.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)	Aims to reduce the amount of waste produced by signatories and regulate the international traffic in hazardous wastes.	1 April 1993	5 May 1992	Component 2 will ensure that disposal of chemicals used (if and when needed) will follow the instructions in the material data safety sheet.

Source: ADB Consultant, November 2017

2.5 Environmental requirements of ADB and IsDB

29. SPS 2009 of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. The IsDB is still in the process of preparing its Statement on Environmental and Social Safeguards Principles, and Commitments to Environmental and Social Responsibility.⁶ Given this, ADB and IsDB agreed to adopt SPS 2009 as the unified approach to documentation, consultation, and disclosure requirements to be complied by NWPGCL for this project.

2.5.1 ADB

30. SPS 2009 consists of three key safeguard areas, (i) environment, (ii) involuntary resettlement, and (iii) indigenous peoples; aims to avoid adverse project impacts to both the environment and the affected people; minimize, mitigate and/or compensate for adverse project impacts; and help Borrowers to strengthen their safeguard systems and to develop their capacity in managing the environmental and social risks.

⁶ IsDB.Statement by Dr. Ahmad Mohamed Ali, President, IDB. United Nation as Conference on Sustainable Development (Rio +20), 20-22 June 2012.
http://www.isdb.org/iri/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/About%20IDB/President%20IDB%20Group/PS_UN_ConferenceSustainableDevelopment_20June2012.pdf. (Accessed 6 December 2017)

31. During the project identification stage, ADB uses a categorization system to indicate the significance of potential environmental impacts and is determined by the category of its most environmentally-sensitive component, including direct, indirect, cumulative, and induced impacts within the project's area of influence. The project categorization system and the assessment required is described in **Table 2.3**.

Table 2.3: SPS 2009 environmental categorization

Category	Definition	Assessment Requirement
A	Likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.	Environmental impact assessment (EIA)
B	Likely to have adverse environmental impacts that are less adverse than those of Category A. Impacts are site-specific, few if any of them irreversible, and in most cases mitigation measures can be designed more readily than Category A.	Initial Environmental Examination (IEE)
C	Likely to have minimal or no adverse environmental impacts.	No environmental assessment is required but the environmental implications of the project will be reviewed.
FI	Project involves investment of ADB funds to or through a financial intermediary (FI).	FIs will be required to establish an environmental and social management commensurate with the nature and risks of the FI's likely future portfolio to be maintained as part of the FI's overall management system.

Source: ADB. Safeguard Policy Statement 2009, p. 19. <http://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>.

2.5.1.1 Environmental requirements of ADB for Component 2

32. Based on SPS 2009, Component 2 is category A given that it is an auxiliary part of the Rupsha 800 MW CCPP. The EIA of Component 2 is referred to in the overall project environmental assessment as Volume 2. This draft EIA was based on the findings of CEGIS and additional research for available secondary data to meet SPS 2009. Aside from this draft EIA, the NWPGL will provide ADB with a copy of the ECC issued by the DoE for Component 2.

2.5.1.2 Disclosure requirements

33. Aside from SPS 2009, the Public Communications Policy (PCP) 2011 provides for the requirements of disclosure for project information of projects and grants funded by ADB. Consistent with SPS 2009, PCP 2011 requires the disclosure of documents submitted by the borrower and/or client:

- (i) a draft EIA report for category A project, at least 120 days before Board consideration;

- (ii) a draft EARF, where applicable, before appraisal;⁷
- (iii) the final EIA or IEE, upon receipt by ADB;
- (iv) a new or updated EIA or IEE, and a corrective action plan, if any, prepared during project implementation, upon receipt by ADB; and,
- (v) the environmental monitoring reports, upon receipt by ADB.

34. To meet the disclosure requirements of ADB, the EIA of Component 2 will be disclosed to ADB website at least 120 days prior to Board consideration of the project by ADB Management.

2.5.2 IsDB

35. On 8 December 1974, the IsDB was created as an international financial institution in accordance with the Articles of Agreement signed and ratified by all member countries done in the City of Jeddah, Kingdom of Saudi Arabia.⁸ Consisting of 57 member countries in Africa, Asia, Europe, and Latin America, IsDB aims to foster the economic development and social progress in its member countries, and Muslim communities in non-member countries. Among others, IsDB is already a key player in the clean energy sector, with investments of around \$1 billion between 2010 and 2012.⁹ Since inception, IsDB has funded about \$2.75 billion in renewable energy projects and has allocated 6% of its operation to climate change mitigating projects.¹⁰

36. During the projects' appraisal/negotiations stage in the IsDB's project cycle, activities cover the review and assessment of the following major aspects of a project: technical, institutional, economic, financial, social, and environmental impact.

37. IsDB is ADB's third-largest multilateral partner for project cofinancing since December 2015 and has signed a framework cofinancing agreement in September 2008 and was extended until 2017.¹¹

2.6 Comparison of environmental safeguard principles between ADB and Bangladesh

38. **Table 2.4** presents a summary comparing the environmental safeguard principles of ADB and the Government of Bangladesh (GoB).

Table 2.4: Comparison of environmental safeguard principles

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
1	Use of screening process to determine the	Uses sector-specific rapid environmental assessment	• ECA 1995 and ECR 1997 set screening criteria to classify	No major gaps

⁷ If no further mission for appraisal is required, the document will be posted before the management review meeting or the first staff review meeting for sovereign projects, or before the final investment committee meeting for non-sovereign projects, as applicable (ADB procedures).

⁸ Islamic Development Bank, About IsDB.
<http://www.isdb.org/irj/portal/anonymous?NavigationTarget=navurl://24de0d5f10da906da85e96ac356b7af0>

⁹ UN Environment. UNEP and Islamic Development Bank Sign Agreement on Environmental Conservation. 20 January 2016. <http://web.unep.org/newscentre/unep-and-islamic-development-bank-sign-agreement-environmental-conservation>. (Accessed 6 December 2017)

¹⁰ IsDB. What do Islamic Bank Care About the Environment: Role of Islamic Development Bank in Financing Sustainable Development. 6 March 2017.

¹¹ Asian Development Bank-Islamic Development Bank Partnership and Cofinancing Guide. 2016

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
	appropriate environmental assessment	<p>checklist for screening and assigns categories based on potential impacts:</p> <ul style="list-style-type: none"> • A - EIA required (irreversible, diverse or unprecedented adverse environmental impacts) • B - IEE required • C - no environmental assessment required but a review of environmental implications • FI - ESMS required 	<p>industries/projects based on potential environmental impacts as follows:</p> <p>Green (pollution-free), Orange-A, Orange-B and Red (cause significant environmental impacts).</p> <p>The screening criteria is based on project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.</p>	
2	Conduct environmental assessment	<ul style="list-style-type: none"> • EIA and IEE - Identify potential impacts on physical, biological, physical cultural resources, and socioeconomic aspects in the context of project's area of influence (i.e., primary project site and facilities, and associated facilities) • ESMS for FIs 	<p><i>Industry/project category</i></p> <p><i>Green</i> - no environmental assessment required</p> <p><i>Orange A</i> - no IEE or EIA required but must provide process flow, lay-out showing effluent treatment plant, etc.</p> <p><i>Orange B</i> - IEE required</p> <p><i>Red</i> - both IEE and EIA are required</p>	No major gaps
3	Examine alternatives	<ul style="list-style-type: none"> • Analyze alternatives to the project's location, design, and technology • Document rationale for selecting the particular project location, design, and technology • Consider "no project" alternative 	<ul style="list-style-type: none"> • Regulations (i.e., ECA 1995 and ECR 1997) do not require specifically the identification and analysis of alternatives 	Not required by law but the ToR for EIA to be approved by the DoE now includes a discussion on analysis of alternatives.
4	Prepare an environmental management plan (EMP)	<ul style="list-style-type: none"> • EMP to include monitoring, budget and implementation arrangements 	<ul style="list-style-type: none"> • EMP and procedures for monitoring included in the IEE and EIA (i.e., Orange-A, Orange-B, and Red category projects) 	No major gaps
5	Carry out meaningful consultation	<ul style="list-style-type: none"> • Starts early and continues during implementation • Undertaken in an atmosphere free of intimidation • Gender inclusive and responsive • Tailored to the needs of vulnerable groups • Allows for the incorporation of all relevant views of stakeholders • Establish a grievance redress mechanism 	<ul style="list-style-type: none"> • Public consultation and participation are not mandatory based on ECA 1995 and ECR 1997 • Grievance redress mechanism is not mentioned in ECA 1995 and ECR 1997 • EIA format required by DoE includes stakeholders' consultation 	Approval of the ToR of EIA by DoE now includes consultation with stakeholders.
6	Timely disclosure of draft environmental assessment (including	<ul style="list-style-type: none"> • Draft EIA report posted on ADB website at least 120 days prior to Board consideration 	<ul style="list-style-type: none"> • No requirement for public disclosure of environmental reports but DoE posts the 	Still no requirement for public disclosure of environmental

SPS 2009			GoB	Gaps (if any)
No.	Principles	Delivery Process		
	the EMP)	<ul style="list-style-type: none"> • Draft EA/EARF prior to appraisal • Final or updated EIA/IEE upon receipt • Environmental monitoring report submitted by borrowers upon receipt 	Minutes of the Meeting on the application for environmental clearance certificate to its website, http://www.doe-bd.org/minutes.php	assessment
7	Implement EMP and monitor effectiveness	<ul style="list-style-type: none"> • Prepare monitoring reports on the progress of EMP • Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects • Prepare and implement corrective action plan if non-compliance is identified • Requires submission of quarterly, semi-annual, and annual reports to ADB for review 	<ul style="list-style-type: none"> • ECC is subject to annual renewal based on compliance of the conditions set by DoE 	No major gaps
8	Avoid areas of critical habitats (use of precautionary approach to the use, development and management of renewable natural resources)	Provides guidance on critical habitats	<ul style="list-style-type: none"> • ECA 1995 and ECR 1997 identifies ecologically-critical areas and the rules to protect them 	No major gaps
9	Use pollution prevention and control technologies and practices consistent with international good practices	<ul style="list-style-type: none"> • Refers to World Bank's Environmental Health and Safety (EHS) General Guidelines 2007 (or any update) • If national regulations differ, more stringent will be followed • If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification 	<ul style="list-style-type: none"> • Effluent standards, ambient and emission standards included in ECA 1995 and ECR 1997 • Ambient noise levels included in Noise Pollution Control Rules 2006 	No major gaps
10	Provide workers with safe and healthy working conditions	<ul style="list-style-type: none"> • Refers to WB EHS General Guidelines 2007 (or any update) 	<ul style="list-style-type: none"> • Occupational health and safety standards included in the Factories Act 1965, the Bangladesh Labour Law 2006, and the Bangladesh Labor Act 2013. 	No major gaps
11	Conserve physical cultural resources (PCR) and avoid destroying or damaging them	<ul style="list-style-type: none"> • Use of field-based surveys and experts in the assessment • Consult affected communities on PCR findings • Use chance find procedures for guidance 	<ul style="list-style-type: none"> • Preservation and protection of cultural resources are within the Antiquities Act 1968. 	No major gaps

3.0 DESCRIPTION OF THE PROJECT

3.1 Background

39. Component 2 of the Project will consist of the natural gas pipeline distribution from the existing Khulna Citygas Station (CGS) in Arongghata until the proposed 800 MW Rupsha Combined Cycle Power Plant in Khalispur. The Khulna CGS is operated and owned by the Sundarbans Gas Company Limited (SGCL).

40. Under the Bangladesh Oil, Gas and Mineral Corporation (Petrobangla), SGCL was established in 2009 by the GoB to manage the operations of the gas distribution networks within five districts: (i) Kustia, (ii) Jhenedah, (iii) Jessore, (iv) Khulna, and (v) Bagehat including other 21 district towns of Khulna, Barisal and Dhaka Divisions. **Figure 3.1** shows the franchise area of SGCL in the south western part of Bangladesh.

41. Petrobangla, the national gas utility and the single-buyer for the gas industry, will procure liquefied natural gas (LNG) from international sources and deliver regasified LNG to Khulna city gas station (CGS). The regional gas distribution company, SGCL will deliver gas from the existing Khulna CGS in Arongghata to the Rupsha power plant in Khalishpur. A new 24-inch (0.6 m) underground gas pipeline about 10 km long will be installed from Khulna CGS to the Rupsha 800 MW power plant. The gas receiving and metering station (RMS) will be located at the Rupsha power plant. In addition, a new 20-inch (0.5 m) underground gas pipeline 2 km long will be branched off from the line from Khulna CGS to Rupsha power plant, to serve NWPGCL's existing Khulna 225 MW CCPP.¹² Owing to non-availability of gas, this 225 MW power plant is presently operating on diesel. **Figure 3.2** shows the location of Component 2.

The existing associated gas distribution pipeline network of the Khulna CGS of SGCL is included as Part C of the ongoing Loan 2622/2633-BAN: Natural Access Improvement Project (formerly Clean Fuel Development Project) funded by ADB with a total amount of \$537 million approved on 26 March 2010. Part C (Access Improvement in South Western Region) involved the construction of about 845 kilometer (km), 2 inch to 20 inch distribution pipelines in south western region comprising of the districts of Kushtia, Jhenidah, Jessore, Khulna and Bagerhat (including Mongla). As such, it was subject to ADB's environmental requirements. Also included in the loan is capacity building for SGCL.

As of 2016, SGCL has about 3,076 domestic connections including commercial and industrial clients with two power plants.¹³ Safety features of SGCL operations include odorizer unit in distribution/district regulating station (DRS) to prevent accident from gas leakage along the distribution lines, a security map in all its establishments describing emergency routes and procedures, an emergency cell and security committee to handle disaster and emergency situation effectively, closed circuit camera to monitor activities in real time and metal halide explosion-proof emergency lighting installed in DRS, RMS and all other important areas of operation for better surveillance, and fire-fighting systems. These devices support the regular and manual ocular inspection of SGCL operations by designated technical staff.

42. Supply of natural gas will come from the regasified-LNG (R-LNG) and from domestic sources as follows:

¹² ADB. Loan 2966-BAN: Power System Expansion and Efficiency Improvement Investment Program – Tranche 1. December 2012.

¹³ Sundarban Gas Company Limited. Annual Report 2015-2016. <http://sgcl.org.bd/annual-report/>.

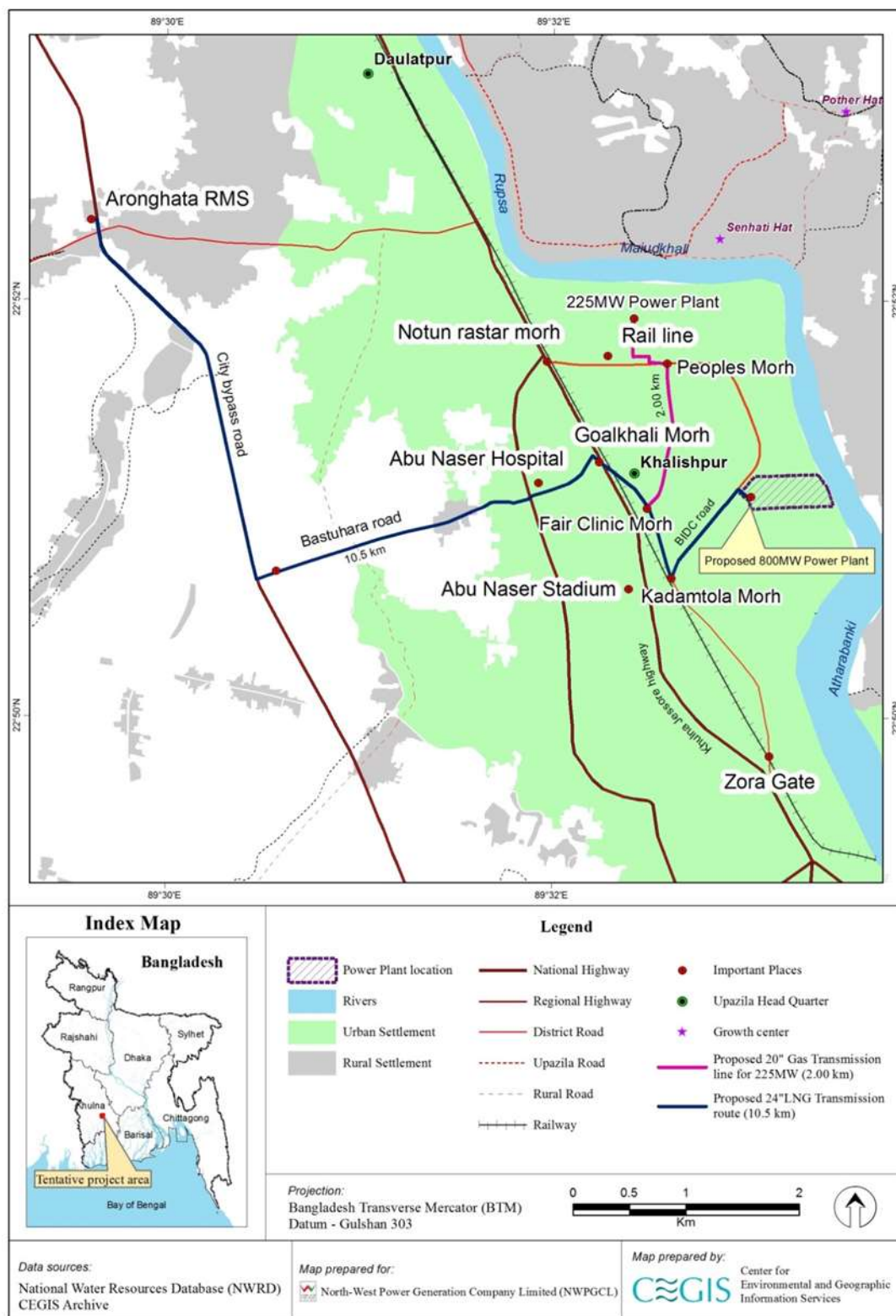
- FSRU Moheskhali - 500 MMSCFD of R-LNG will be made available by April 2018 developed by Excelerate Energy, USA-Bangladesh
- Summit LNG Terminal Company Limited – 500 MMSCFD R-LNG will be made available by October 2018
- GoB and RasGas (Qatar) has signed a deal in September 2017 for a 15-year LNG sales and purchase agreement to supply 1.8 million (M) tons LNG/year for 5 years and 2.5 M tons/year for the next 10 years
- According to Petrobangla, there will be additional supply (domestic) of 2,750 MMSCFD
- By 2021, Bangladesh Petroleum Exploration and Production Company Limited (BAPEX) will have 55 exploration wells and 31 development wells

These sources will provide adequate supply of natural gas.

Figure 3.1 Franchise Area of SGCL



Figure 3.2: Location Map



3.2 Features of Component 2

1. The gas distribution pipeline from Khulna CGS to Rupsha 800 MW CCPP will be about 10 km-long and will result to a total of three road crossings, two railway crossings, and two river crossing at different points in Mayur River. The gas distribution pipeline of Component 2 will have two parts:

3.2.1 Gas distribution pipeline route from Khulna CGS to Rupsha 800 MW CCPP

1. The gas distribution pipeline from Khulna CGS to Rupsha 800 MW CCPP will be about 10 km-long and will result to a total of three road crossings, two railway crossings, and two river crossing at different points in Mayur River.

3.2.2 Gas distribution pipeline route branched off from Khulna CGS to Rupsha 800 MW CCPP

2. The distribution gas pipeline route branched off from the Khulna CGS to Rupsha 800 MW CCPP will be about 2 km which will result to two road crossings, and one railway crossing.

3. The crossings of the gas distribution pipeline route on the road, railway and Mayur River are shown in **Figure 3.3**, **Figure 3.4** and **Figure 3.5**. **Table 3.1** gives the summary of the crossings while **Figure 3.6** shows the location of the crossings.

4. Aside from the gas distribution pipelines, there will be a pig launcher at Khulna CGS, another pig launcher at the branched off point of the 20-inch diameter gas distribution pipeline to the existing Khulna 225 MW CCPP, and a pig receiver at the Khulna 225 MW CCPP, and an RMS at Rupsha 800 MW CCPP.

Figure 3.3: Some road crossings along the gas pipeline route



Figure 3.4: Railway crossing at Goalkhali Bus Stand

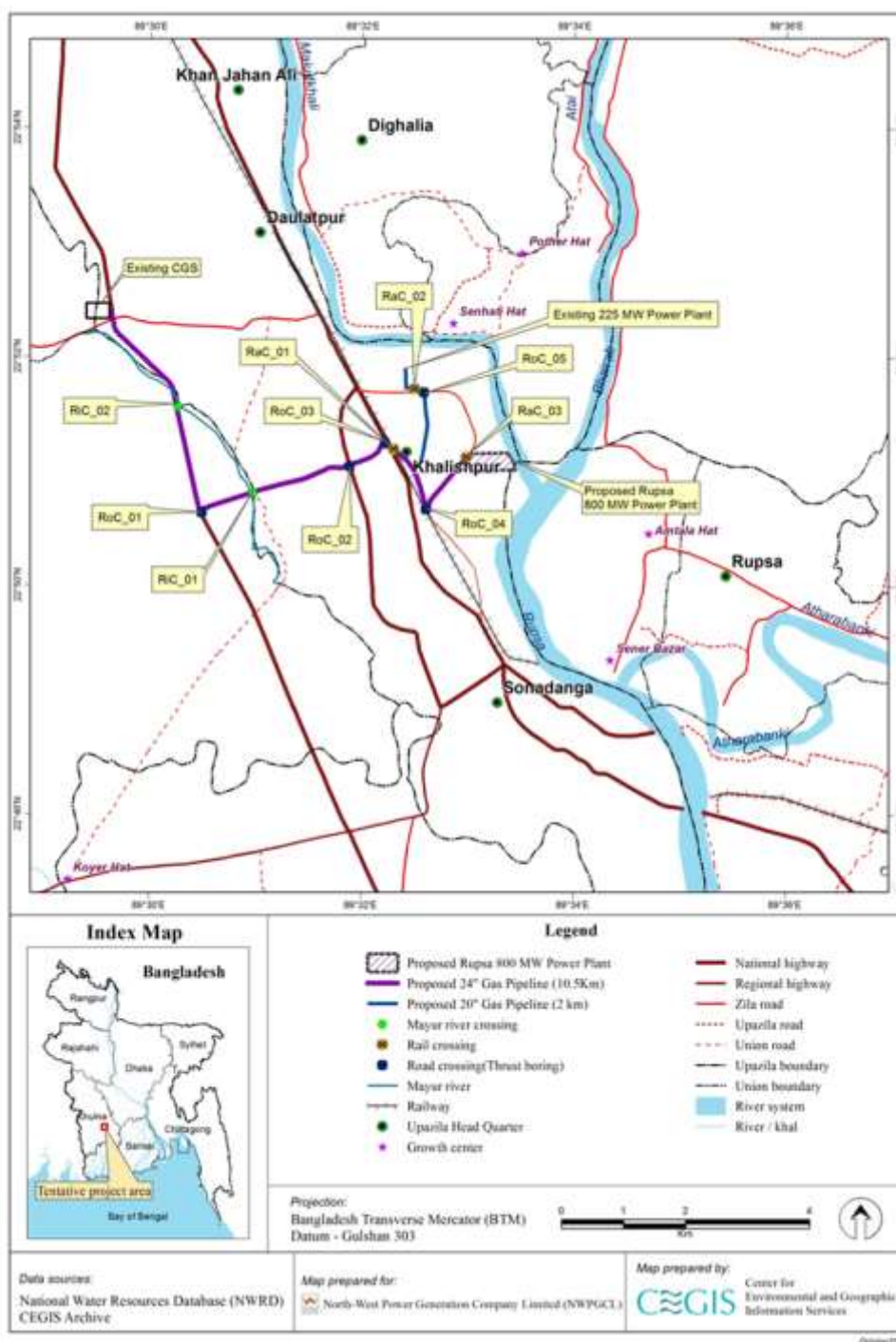


Figure 3.5: Crossing along Mayur River**Table 3.1: Summary of gas distribution line crossings**

Crossing	Pipeline Route	Reference in Figure 3.4	GPS Coordinates
Road	Khulna CGS –Rupsha 800 MW CCPP	RoC_01	N 22° 51' 42", E 89° 30' 04"
	Khulna CGS –Rupsha 800 MW CCPP	RoC_02	N 22° 51' 06", E 89° 31' 43"
	Khulna CGS – Khulna 225 MW CCPP	RoC_03	N 22° 51' 18", E 89° 32' 03"
	Khulna CGS – Rupsha 800 MW CCPP	RoC_04	N 22° 50' 43", E 89° 32' 27"
	Khulna CGS – Khulna 225 MW CCPP	RoC_05	N 22° 51' 45", E 89° 32' 26"
Mayur River	Khulna CGS – Rupsha 800 MW CCPP	RiC_01	N 22° 51' 42", E 89° 30' 04"
	Khulna CGS – Rupsha 800 MW CCPP	RiC_02	N 22° 50' 51", E 89° 30' 47"
Rail	Khulna CGS – Khulna 225 MW CCPP	RaC-1	N 22° 51' 12", E 89° 32' 11"
	Khulna CGS – Khulna 225 MW CCPP	RaC-2	N 22° 51' 46", E 89° 32' 20"
	Khulna CGS – Rupsha 800 MW CCPP	RaC-3	N 22° 51' 08", E 89° 32' 49"

Source: CEGIS Field visit, June 2017. Note: RaC - Rail Crossing, RiC - River Crossing, RoC - Road Crossing

Figure 3.6: Location of crossings



3.3 Project activities

5. Main activities include the following: (i) pipeline route survey, (ii) detailed drawing and design, (iii) procurement of materials, (iv) temporary storage and stockyard, (v) equipment and vehicle mobilization, (vi) pipeline construction, and (vii) pipeline testing and commissioning.

3.3.1 Pre-Construction Phase

6. The distribution gas pipeline route branched off from the Khulna CGS to Rupsha 800 MW CCPP will be about 2 km which will result to two road crossings, and one railway crossing. A summary of pre-construction activities in implementing Component 2 is given below.

Activities	Description
Pipeline route survey	Survey takes into consideration major factors such as access to the pipeline from the main road, river crossing, railroad and major road crossings. Other factors include presence of ecologically-sensitive areas and settlements. Component 2 will have a total of 5 road crossings, 2 river crossings and 3 railway crossings. The pipeline route will follow the existing road easements.
Detailed drawing and design	Pipeline construction must conform to Bangladesh Mineral Gas Safety Rules of 1991 (as amended in 2003) and other industry standards such as ASME B31.8 (Gas Transmission and Distribution Piping Systems) and relevant ASTM standards.
Procurement of materials	Required office furniture, machinery, accessories, pipeline materials, and other equipment will be purchased following the procurement guidelines of GoB and ADB.
Establish temporary storage and stockyard for materials and equipment	A space will be set up to keep the pipes, machinery, equipment and other support materials to facilitate construction activities.
Mobilization of equipment and vehicles	Vehicles, equipment and machinery will be inspected and assessed on their current condition to ensure that they are working properly before the start of construction phase. Periodic inspection will be undertaken to the construction vehicles, machinery, and equipment such as grader, dozer, side booms, trenching machine, excavators, welding machines, water pumps, dump trucks, crane, horizontal directional drilling (HDD) machine, tools, etc.

3.3.2 Construction Phase

7. At this stage, activities include site preparation, staking of the RoW, excavation, trenching, pipeline stringing, welding, back-filling, testing and commissioning, and clean-up. These major activities will be scheduled efficiently to ensure the completion of the total pipeline construction within the dry working season.

8. The Engineering, Procurement and Construction (EPC) Contractor will be selected following the guidelines and procedures of ADB and GoB. The Project Management Unit (PMU) will monitor the performance of the EPC Contractor and will supervise the overall implementation of Component 2. The labour force that will be recruited will consist of technical, skilled and unskilled workers and staff. NWPGL will require the EPC Contractor to give priority to local hiring.

9. **Main working camp.** This will be the construction office of the EPC Contractor which includes office accommodation, utilities, waste and sanitary facilities. Wastes that will be

generated from construction activities will be collected and disposed of in designated areas approved by the district administration of Khulna. PMU, NWPGL will monitor the management of the EPC Contractor.

10. **Workers construction camps.** This will be field camps for workers working close to the road easement along the gas pipeline route and will be shifted depending on the expected completion of the work required. The field camps will be provided with sanitary facilities, water for general purpose washing, safe drinking water, electricity, first aid, etc. Given the scale of Component 2, (about 12 km-long gas distribution pipeline) and the location of the alignment (urban area), there may be less than 50 workers who will be staying in the field camps.

11. **Pipeline route and working areas.** The width of the pipeline trench for Component 2 is approximately 2m and depth of about 1.5 m from the top of the pipe along the route will be requisitioned as right-of-way (RoW) for construction of the pipeline. In general, the EPC Contractor shall clear and grub the RoW by removal of crop and vegetation. Trees will be avoided whenever possible. Debris shall be removed to the extreme edge of the RoW and disposed of properly so that these are not mixed with trench backfill material.

12. **Grading.** Where required, grading will be undertaken to have a reasonably level workspace during construction. Grading will be carried out also in areas where the pipeline route cuts across steep slopes to keep a gentler slope for pipe bending limitations.

13. **Pipe diameter factor.** Component 2 will use 24" diameter for the 10 km-long pipeline and 20" diameter for the 2 km-long pipeline. The larger the diameter of pipe, the greater width of RoW will be required. Large diameter pipe will require very accurate bends. The amounts of tough bends are usually kept to a minimum. Increasing the use of bends will increase the use of specialized heavy equipment like bending machine and crane/side boom.

14. **Trench depth factor.** The amount of soil excavated from the ditch to meet construction specifications is the main factor in determining the width of RoW with respect to ditch depth. Ditch depth will vary depending on the diameter and operating pressure of the pipeline and applicable codes and regulations.

15. **Stringing.** Stringing will be done through specialized trailers and equipment that haul and lift the pipe off the trailers and then place carefully onto the RoW that has been cleared and proper grading completed to ensure that the pipe or its coating are not damaged. GTCL will require the EPC Contractor to ensure that the pipe is strung properly at designated locations. Pipes shall be raised on sandbags.

16. **Coating of pipeline.** The pipeline will be protected from corrosion through barrier coating and cathodic protection system. The outer side will be coated to prevent moisture from coming into direct contact with steel that may cause corrosion. The 3-layer polyethylene (3LPE) coating is considered to be excellent in corrosion protection.

17. **River, railway, and road crossing.** Component 2 will involve two crossings of Mayur River at different points, a total of five road crossings, and three railway crossings (see **Table 3.1** and **Figure 3.4**). For crossings at Mayur River, HDD will be used and horizontal boring technique for road and railway crossings. These procedures help to minimize the environmental impact, disturbance and interference in traffic arteries. **Figure 3.7** shows the process of HDD. While drilling fluid components are generally not hazardous materials, excavation spoils may affect the quality of Mayur River (e.g., color, turbidity). HDD contractor will be required to

dispose of excess drilling fluid properly following Schedule 10, ECR 1997 and also to properly reinstate and protect the river banks from potential erosion.

Figure 3.7: HDD process



18. **Trenching.** The pipeline will have casing or cover whenever it crosses a highway, rail track, or water body. The minimum depth of cover shall be measured from the top of the pipe to the surface of the working grade. Crown materials along the surface of the ground level will not be considered as a part of the depth of cover. The depth will vary depending on the site condition and specifications by the design codes of practices. The trench shall be carefully cut so that the pipe is evenly bedded throughout its length with sufficient joint holes and trial holes made, where necessary. Trenching uses heavy equipment to give enough space for the pipeline to be moved over and lowered into place, and to protect from excavation damage.

Figure 3.8: Laying of Pipeline



19. **Lowering-in.** Prior to this, the trench is checked to make sure it is clean from any debris and other foreign material, and dewatered, if needed. Lowering-in will follow the applicable regulation and standards such as Bangladesh Natural Gas Safety Rules 1991,

ASTM, ASME, etc., and will commence right after the trench has been excavated. Lowering-in of pipeline will be undertaken and supervised by skilled operators and experienced engineers. The trench is then backfilled using the excavated material.

20. **Tying-in.** Separate welded joint sections of the pipeline shall be tied into a continuous system in such a manner that no stress will be introduced into the pipe as a consequence of the tying-in operation and duly certified for integrity upon Non-destructive Testing.

21. **Cathodic protection.** Cathodic protection test points shall be installed and connected to temporary cathodic protection facilities in accordance with the specification at the time of final operation of lowering or tying-in. The installation shall require inspection before backfilling is placed.

22. **Backfilling.** Before any backfilling is performed, the pipeline will be evenly bedded upon the bottom of the trench throughout its length and will be correctly positioned. Compaction of back filling material shall be performed by an approved method to prevent any subsequent subsidence.

23. **Re-instatement and clean-up.** As soon as the pipeline has been laid and backfilled, the road easement, RoW and work areas will be cleaned up to ensure that they are returned to their original condition (before the project) as much as possible.

24. **Placing route markers.** Reinforced concrete route markers will be placed on both sides of roads, rail, and river crossings with a specified maximum separation distance between markers. Specifications of other route markers along the pipe line will be also placed.

25. **Installing aerial marker.** There will be aerial markers at every horizontal bend and at intervals along the pipeline route based on design specifications and standards.

26. **Hydrostatic testing and dewatering.** Before commissioning of Component 2, it will be subjected to hydrostatic testing and dewatering (if needed). The entire length will be filled with water to carry out pressure test which will identify leaks and will ensure that it has adequate safety margin beyond the operating pressure. Wastewater from hydrostatic testing will be tested prior to discharge to ensure compliance with Schedule 10 (Rule 13) of ECR 1997. Hydrostatic testing Contractor will be required by NWPGCL to ensure proper discharge of wastewater.

27. **Commissioning.** After hydrostatic testing and dewatering, the pipeline will be cleaned and dried using mechanical tools (or pigs) moved through the pipeline with the aid of pressurized dry air. The pipeline will be dried to minimize internal corrosion. Once pipeline clean-up is complete, re-instatement/clean-up of RoW is done, installation of RoW markers and aerial markers are finished in accordance to design, standards, and procedures; and acceptable to the Quality Assurance Department, then NWPGCL will start the operation of the system with technical support from SGCL.

28. **Metering stations and other permanent above-ground facilities.** Small area of land will be required permanently to accommodate the metering stations, valves/stations, scraper facilities and to provide adequate pipeline clearance at the two river crossings in Mayur River. Construction activities for metering stations are similar to those employed for process plants, i.e., site preparation (grading, drainage construction, fencing, etc.) and plant construction/installation.

3.3.3 Operation and Maintenance Phase

29. After commissioning of the pipeline, it is ready to transport gas at a regulated pressure from Khulna CGS to the Rupsha 800 MW CCPP in Khalishpur and the existing Khulna 225 MW CCPP in Goalpara. The operation and maintenance of Component 2 will commence on the day it will be commissioned.

30. The Supervisory Control and Data Acquisition (SCADA) will monitor the gas distribution operations to ensure that there will be no pressure drop along the pipeline. The pipeline will operate at 300 psi with gas throughput of about 125 million cubic feet per day (MMCFD). Emergency maintenance engineers will be trained and will be immediately available to repair line breaks, leak clamping, replacement of section of pipes and other necessary repairs along the pipeline route.

31. Designated NWPGL staff will walk regularly along the route and will log down any noticeable changes on the RoW. The pipeline will be protected by impressed current cathodic protection system. The potential difference at the pipeline test poles will be monitored to ensure that cathodic protection is working all the time. Operation and maintenance activities will include:

- Removing and replacement of the length of the pipeline section, valves, meters, regulators, etc., on occasion for the purpose of inspection, repair, and maintenance.
- Regular overall repair and maintenance including workshops and vehicles.
- Pigging of pipe for cleaning purposes. This occurs on required basis. However, the waste disposal facilities should be maintained.
- Operation and maintenance of metering station at the Khulna CGS, the Khulna 225 MW CCPP, and the Rupsha 800 MW CCPP.
- Condensate will be generated at metering stations, which requires proper handling and storage. However, minimal condensate will be generated at different sources as SGCL generally transports drier and cleaner natural gas.

3.3.4 Waste and disposal activities

32. NWPGL, with technical support from SGCL, will adopt reduce, reuse, and recycle as strategy to minimize the generation of wastes during operation including maintenance of good housekeeping.

33. **Solid wastes.** These will include cleared vegetation, domestic wastes, scrap materials, welding torches, etc. Solid waste will be separated, identified, stored and disposed in designated areas. Plastic containers will be either returned to the suppliers or recycled.

34. **Chemicals.** All chemicals used during the operation of Component 2 will be listed, stored, and disposed of according to the material safety data sheet and the requirements for safe disposal procedures of GoB and ADB.

35. **Sewage water.** Black water will be discharged through toilets with septic tank facilities and will follow Schedule 9 of ECR 1997.

36. **Diesel/oil.** Oily wastes from machine workshops, equipment, repair of vehicles, etc., will be passed through an oil-water separator prior to disposal at designated sites.

37. **Gaseous emissions.** Vehicular emissions and dust from opened areas along the pipeline route will be generated during construction and installation of the pipeline system. During operation, vehicular emissions will be generated during inspection and maintenance along the pipeline route.

4.0 DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

4.1 Component 2 – Project's Area of Influence

38. The project area is the physical location of Component 2 (10 km of 24-in diameter gas line connecting from Khulna CGS, Arongghata to Rupsha 800 MW CCPP and also an off-take line of 2 km, 20-in diameter from the 10 km line at the point of Fair clinic morh/Modern morh to the existing Khulna 225 MW CCPP) and, receiving and metering station (RMS) of the project. The focus of the study will be limited to the area where the impacts of the activity will be directly felt. A 120m buffer along both sides (i.e. 60m+60m=120m) of the gas distribution pipeline has been considered for environmental analysis as area of influence and for the baseline study area.

4.2 Physical Environment

39. Physical environment includes natural environment i.e. air, noise, water, topography, built environment i.e. houses, roads, transport systems, buildings, infrastructure and the social and economic characteristics of the societies and communities in which we live. The baseline conditions of physical environment of the study area in terms of meteorology, geology, water resources and transportation are given in the following sections.

4.2.1 Seismicity

40. Bangladesh is one of the seismically active regions of the world, experiencing numerous earthquakes over the past 200 years. As per the updated seismic design provisions of Bangladesh National Building Code 1993, the study area falls under Zone I, which is considered as seismically quiet zone, with basic seismic zone coefficient of 0.075. **Figure 4.1** shows the earthquake zone map.

4.2.2 Meteorology

41. The data of all meteorological components were collected from Khulna BMD station as it is the only station nearest to the study area.

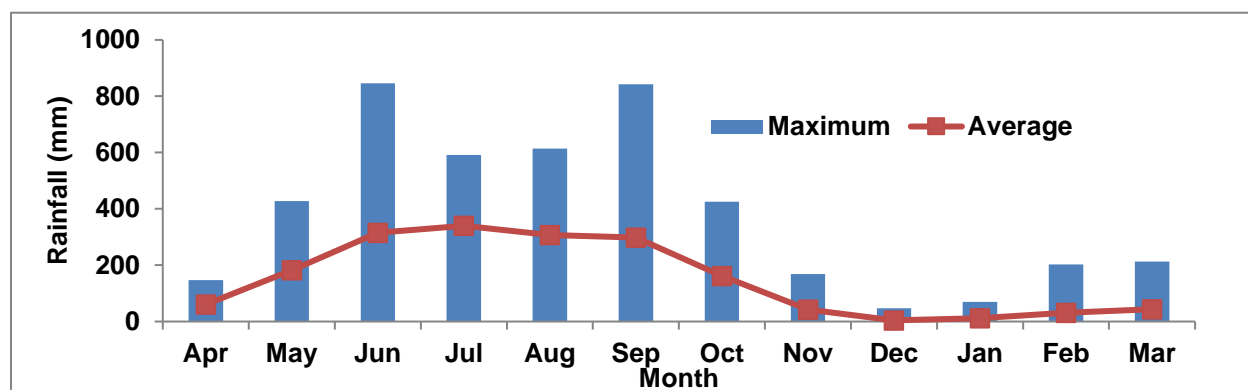
Rainfall

42. Rainfall data of 1984-2013 was analyzed to understand the baseline condition of the study area. Maximum rainfall was observed at 846mm. Heavy rainfall occurred between May to October. About 80-83% of the annual average rainfall occurred during this period. The average yearly rainfall is 1,813 mm. The monthly maximum and average rainfall of the area for the above period are shown in **Figure 4.2**.

Figure 4.1: Seismic Zonation Map of Bangladesh



Figure 4.2: Monthly Rainfall of Khulna BMD Station (1984-2013)

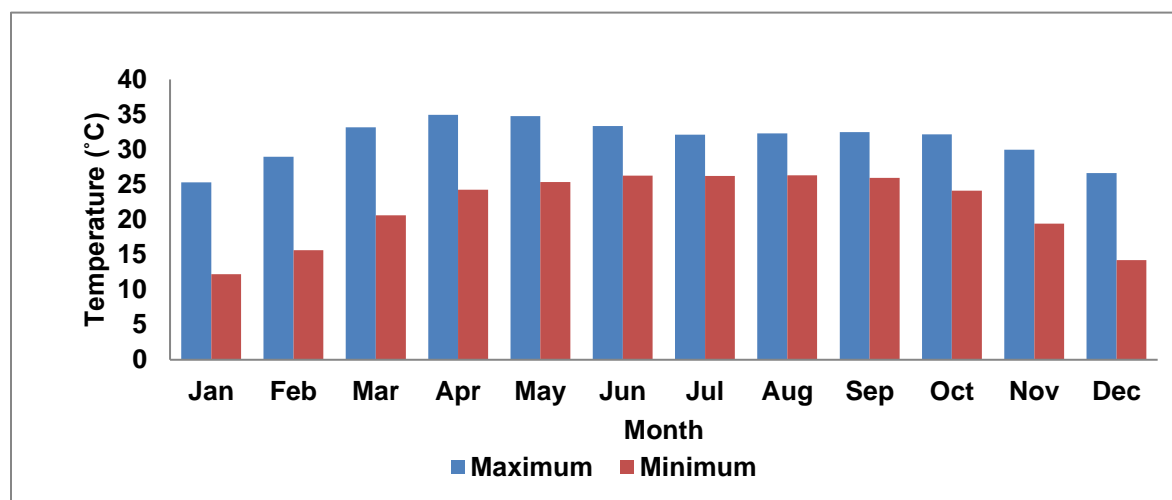


Source: BMD, Khulna

Temperature

43. The analysis of 30 years data during 1984-2013 shows that the maximum temperature in the project area varies from 25.3°C to 34.9°C while the minimum temperature varies within the range of 12.2°C and 26.3°C. The temperature rises during February to June and falls during December to February. The average of monthly maximum and minimum temperatures during this period is shown in **Figure 4.3**.

Figure 4.3: Monthly Temperature of Khulna BMD Station (1984-2013)

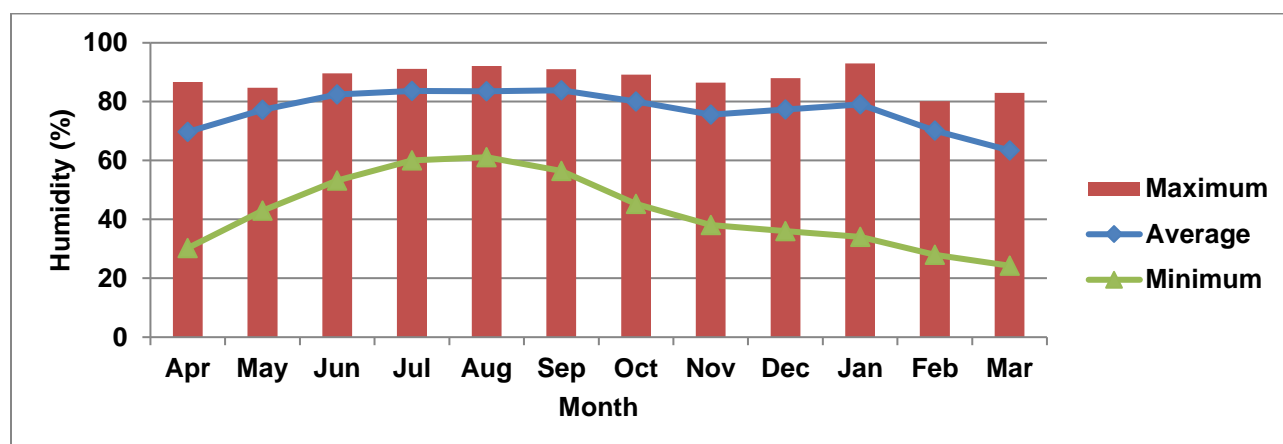


Source: BMD, Khulna

Humidity

44. The relative humidity data has been collected from 1984 to 2013. It shows that the monthly maximum relative humidity is 93% which occurs in January while the monthly minimum humidity is 25% observed in March. The monthly, maximum, minimum and average relative humidity is presented in **Figure 4.4**.

Figure 4.4: Monthly Humidity of Khulna BMD Station (1984-2013)

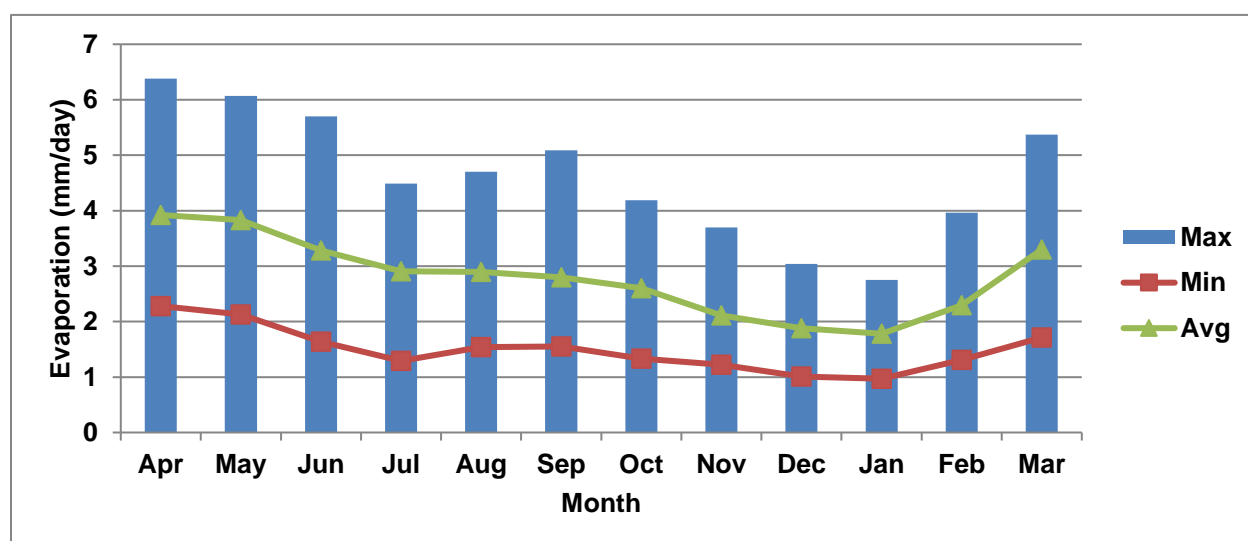


Source: BMD, Khulna

Evaporation

45. Available historical data on evaporation for the last 20 years 1992 to 2011 was collected and analyzed. It is observed that the monthly average evaporation rate varies from 1.78 to 3.92 mm/day. The monthly maximum, average and minimum evaporation rate is shown in **Figure 4.5**.

Figure 4.5: Monthly Evaporation of Khulna BMD Station (1992-2011)

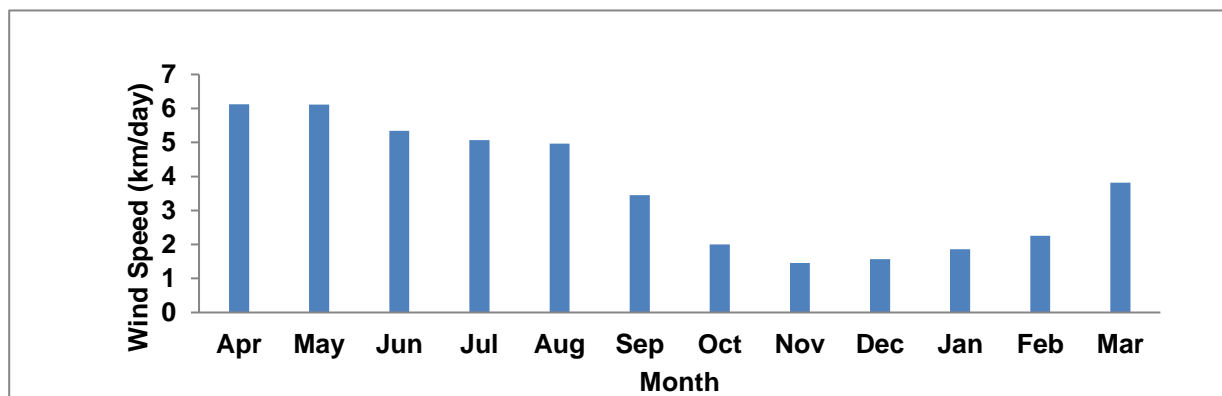


Source: BMD, Khulna

Windspeed

46. Wind speed data of last 30 years (1984 to 2013) was collected and analyzed. It shows that the monthly average windspeed varies from 1.5 to 6.1 km/day and the monthly maximum wind speed varies from 57 to 170 km/day. The average wind speed is shown in **Figure 4.6**.

Figure 4.6: Monthly Wind Speed of Khulna BMD Station (1984-2013)

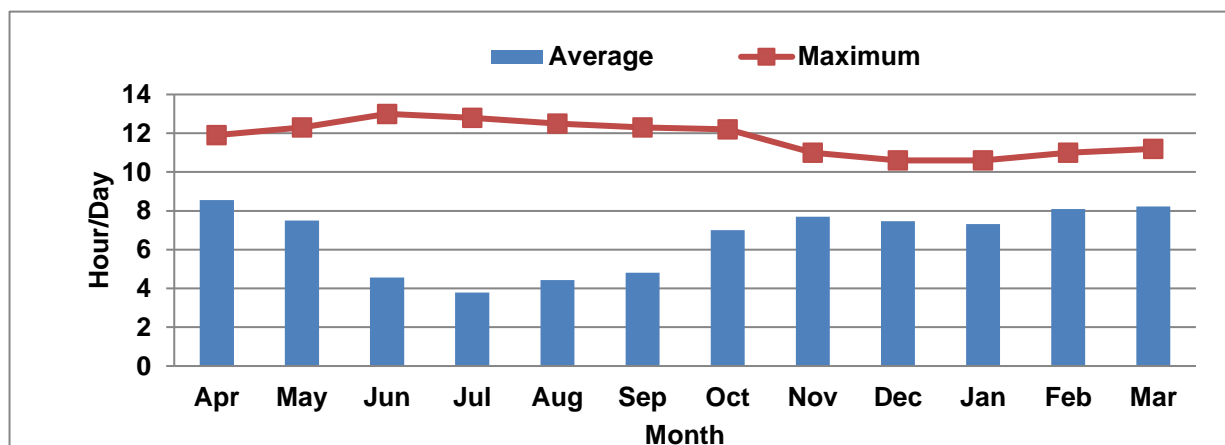


Source: BMD, Khulna

Sunshine Hour

47. The data of sunshine hours for the last 30 years (1984-2013) has been collected, analyzed and plotted (see **Figure 4.7**). The mean monthly values of sunshine hours vary from 4 to 9 hour/day while the maximum sunshine hour of 13 hr/day occurs in June.

Figure 4.7: Monthly Sunshine Hour of Khulna BMD Station (1984-2013)



Source: BMD, Khulna

Road and railway

48. The crossing roads are Bypass road, Bastuhara road, Refugee colony road, Goalkhali link road, BL College road, BIDC road, Aronghata mor, Outer Bypass and Khulna Jessore Highway (see **Figure 4.8**). The present road conditions are quite good except at some locations. Railway crossing will be beside the Golkhali Busstand.

Figure 4.8: Road network



4.2.3 Ambient Air Quality and Noise Level

Ambient Air Quality

49. The quality of air is mainly characterized by the presence of criteria pollutants. Major criteria pollutants are particulate matter (PM_{10} and $PM_{2.5}$), NO_2 , CO, SO_2 and Ozone (O_3). The DoE has set national ambient air quality standards for these pollutants in ECR 2005. These standards aim to protect against adverse human health impacts. One CAMS-9 (latitude 22.83 N, longitude 89.53 E) has been established in Khulna City to monitor the criteria pollutants. It is located in the Department of Social Forestry Office Campus at Baira, which is very much near to gas distribution line (**Figure 4.9**). Because of the topography of the city (flat) and good natural ventilation of the CAMS site representative air pollution levels of the city would be measured at this site. The location is relatively unaffected by nearby air pollution sources.

Figure 4.9: CAMS station in Khulna City

50. The sampler was placed on the flat roof of the CAMS housing. The roof height was 5 m above the ground and the intake nozzle of the sampler was located 1.8 m above the roof. Ambient air quality of Khulna city has been monitored for last four years. The results of 2013-2015 are shown in **Table 4.1** where the national air quality standard are also presented for comprehensive understanding and ready reference.

Table 4.1: Ambient air quality results at Khulna CAMS station

Criteria Pollutants	Standard Concentration (ECR 2005)		Result of 2013	Result of 2014	Result of 2015
	Period	$\mu\text{g} / \text{m}^3$	$\mu\text{g} / \text{m}^3$	$\mu\text{g} / \text{m}^3$	$\mu\text{g} / \text{m}^3$
Carbon Monoxide (CO)	8 Hr	10000 $\mu\text{g} / \text{m}^3$	1790	1020	550
	1 Hr	40000 $\mu\text{g} / \text{m}^3$	1590	860	460
Sulphur Dioxide (SO_2)	24 Hr	365 $\mu\text{g} / \text{m}^3$	16.7	12.1	31.4
Nitrogen Dioxide (NO_x)	24 Hr	-	27.07	DNA	122.76
Particulate Matter (PM_{10})	24 Hr	150 $\mu\text{g} / \text{m}^3$	132	219	93.5
Particulate Matter ($\text{PM}_{2.5}$)	24 Hr	65 $\mu\text{g} / \text{m}^3$	76.0	102	83.6

51. Initial assessment of the data shows that yearly average of 24-Hr PM concentration levels in both fractions ($\text{PM}_{2.5}$ and PM_{10}) in the Boyra CAMS monitoring sites (near to the gas distribution line) were high and $\text{PM}_{2.5}$ exceeded the Bangladesh National Ambient Air Quality Standards.

Ambient Noise Level

52. The study area will cross the national and regional roads and highways. Noise is generated in this area due to movement of vehicles like bus, micro, auto, van, motorbike, cycle which ply over the road all day long.

**Figure 4.10: Noise Level Measuring Location
(Navy School, Khulna)**



**Figure 4.11: Noise Level Measuring Location
(City Polytechnic Institute, Khulna)**



53. Noise Pollution Control Rules 2006 gives the limits based location sensitivity. Based on this rules, the study area falls under the commercial area. The noise level measured and the locaiton of noise level monitoring are shown in **Table 4.2** and **Figure 4.12**.

Table 4.2: Noise level at several locations

No.	Date and Time	Location	Coordinates	Day Time Monitoring Result	Noise Pollution Control Rules 2006 (Day)
				Leq (dBA)	Leq (dBA)
NL_01	12/06/17 1:20 pm	Bangladesh Navy School & College, Khulna	N 22° 51' 07" E 89° 31' 46"	69.5	70
NL_02	12/06/17 3:15 pm	Khulna City Polytecnic, BIDC	N 22° 50' 52" E 89° 32' 33"	68.5	70
NL_03	12/06/17 2:15 pm	Abu Naser Hospital, Khulna	N 22° 51' 08" E 89° 31' 48"	63	70

Source: Field visit, CEGIS, June 2017

54. Limited noise level measurements show that it is within the limits set by the Noise Pollution Control Rules 2006.

4.2.4 Water Resources

Flooding

55. Component 2 will follow the present regional and zonal road including Khulna bypass highway. These roads are free from river flooding. But during heavy moonsoon, roads get inundated due to poor drainage system.

Mayur River

56. Component 2 will cross the Mayur River at Bastuhara Bypass road. Mayur River is an important river situated in the western side of Khulna City. The length and width of the Mayur River is 11.5 km and 52 m wide. Water quality is poor due to wastewater and solid waste generated from the Sonadanga Kancha Bazar. The river originates from Rayer Mahal and falls in Rupsha River at Labonchora. It is almost a dead river. This river receives all types of municipal wastes through sewage outfall, which contains various organic and inorganic nutrient and other pollutants. Recently Khulna City Corporation has planned to develop a Linear Park on the bank of the river starting from Gollamari Bridge to Rayer Mahal surrounding Khulna University Campus on the east.

Figure 4.12 Mayur River crossing location



Surface water quality

57. Water sampling was conducted at Mayur River in November 2016 (dry season). **Figure 4.13** shows the sampling stations. A total of 21 different parameters were investigated. The parameters included temperature, turbidity, TSS, TDS, electrical conductivity (EC), pH, dissolved oxygen (DO), hardness, BOD, COD, boron, nitrate, sodium, calcium, chloride, ammonia, coliform (Faecal), lead, sulphate, salinity. The results are shown in **Table 4.3**.

Figure 4.13: Water quality and noise sampling map

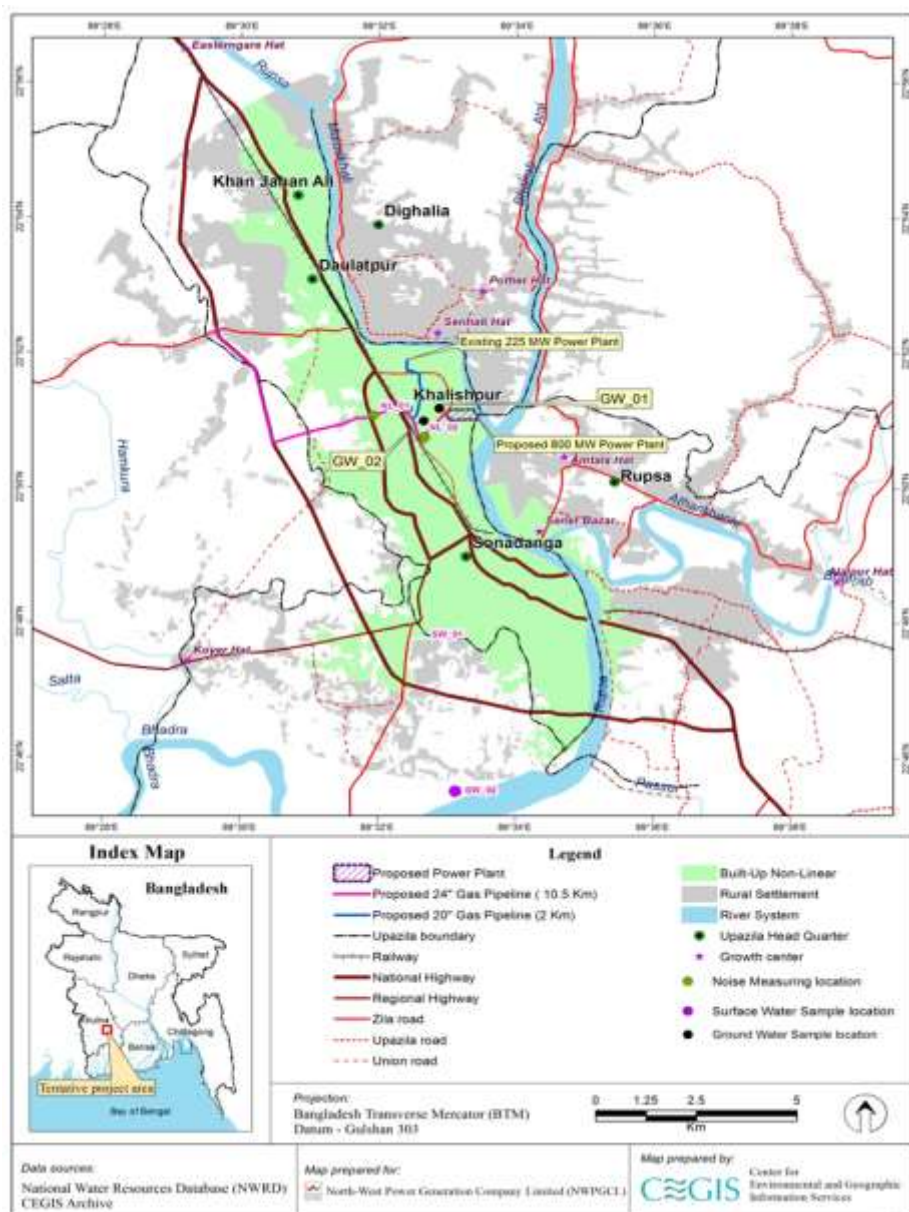


Table 4.3: Results of water quality, Mayur River

Name of Sample Locations and ID no	Lat (WGS 84)	Long (WGS84)	Parameter						
			Ammonia (mg/l)	Arsenic (mg/l)	BOD (mg/l)	Boron (mg/l)	Calcium (mg/l)	COD (mg/l)	Chloride (mg/l)
Buro Moulavir Darga (WL_01)	22°47' 48.00" N	89°32'35.5 2"E	0.78	0.002	4	0.21	165	16	242
10 Gate (WL_02)	22°45' 29.60" N	89°33'4.90 "E	0.61	0.001	1	<LOQ	138	4	194
ECR 1997 (assumed that river water usable for fisheries)	-	-	-	-	6	-	-	-	-
Name of Sample Locations and ID no	Lat (WGS 84)	Long (WGS84)	Parameter						
			Lead (mg/l)	Nitrate (mg/l)	pH	Salinity (%)	Sodium (mg/l)	Sulphate (mg/l)	Temperature (°C)
Buro Moulavir Darga (WL_01)	22°47' 48.00" N	89°32'35.5 2"E	0.01	0.39	7.2	0.66	178	3	24.9
10 Gate (WL_02)	22°45' 29.60" N	89°33'4.90 "E	0.004	3.11	7.1	0.46	129	15	24.7
ECR 1997 (assumed that river water usable for fisheries)					6.5-8.5				20-30
Name of Sample Locations and ID no	Lat (WGS 84)	Long (WGS84)	Parameter						
			Coliform (Faecal) N/100ml	DO (mg/l)	EC (µS/cm)	Hardness (mg/l)	TDS (mg/l)	TSS (mg/l)	Turbidity (NTU)
Buro Moulavir Darga (WL_01)	22°47' 48.00" N	89°32'35.5 2"E	182	6.21	1320	475	655	25	2.9
10 Gate (WL_02)	22°45' 29.60" N	89°33'4.90 "E	240	6.3	930	425	460	20	16.3
ECR 1997 (Schedule 3) (assumed that river water usable for fisheries)				5/higher					

Source: CEGIS field survey. November 2016

Groundwater

58. The Khulna Division, situated in Southwestern part of Bangladesh, lies on the Late Holocene Recent alluvium of the Ganges deltaic plain in the north and Ganges estuarine plain in the south. Lithologically, the area is composed of coarse to very fine sand, silt, silty clay and clay in various proportions up to a depth of 300m. The length of the pipeline would be about 10 km from the Khulna CGS and the RMS at the Rupsha 800 MW CCPP. The diameter of the pipeline will be 24 inches. The width of the trench will be about two meters. The pipeline will be laid in a trench to be excavated at a depth of about 1.5 m below ground surface. The groundwater table in the project area is about 40-60 ft below the surface. Thus, the trench for pipe laying is unlikely to interfere with groundwater and soil stability. **Table 4.4 and 4.5** presents the results of groundwater quality while **Figure 4.13** shows the sampling stations.

Table 4.4: Results of in-situ groundwater testing

Sample Source	Location of Sampling	pH	BOD ₅ at 20°C	EC (mS/cm)	TDS ppm	Salinity (ppt)	Temperature (°C)	Time
GW-01	Deep tube well of 400 ft depth	4.51	0.2	1260	630	2	27	16:45 pm
GW-02	Deep tube well of 500 ft depth	7.75	0.5	1570	780	2	26	12:30 pm
ECR 1997 (Schedule 3) (drinking water standards)		6.5-8.5	0.2		1000		20-30	

Source: CEGIS field study, 2016

Table 4.5: Results of groundwater chemical analysis

No.	Water Quality Parameters	Unit	Ground Water-01	Ground Water-02	Analysis Method	LOQ	ECR 1997 (mg/L) (drinking water standards)
1	Arsenic	Mg/L	0.001	0.001	AAS	0.001	0.05
2	Calcium	Mg/L	49.3	48.3	AAS	0.17	75
3	COD	Mg/L	4	4	CRM	-	4
4	Chloride	Mg/L	210	348	Titrimetric	-	150-600
5	Silica	Mg/L	33	42	UVS		-
6	Hardness	Mg/L	350	405	Titrimetric	-	200-500 (as CaCO ₃)
7	Iron	Mg/L	4.38	6.52	AAS	0.05	0.3-1.0
8	Lead	Mg/L	0.013	0.022	AAS	0.001	0.05
9	Nitrogen	Mg/L	1.6	1.1	UVS	0.10	1.0
10	Phosphate	Mg/L	1	0.50	UVS	0.98	6.0
11	Sulphate	Mg/L	3	2	UVS	1.0	400

Source: DHPE, 2016

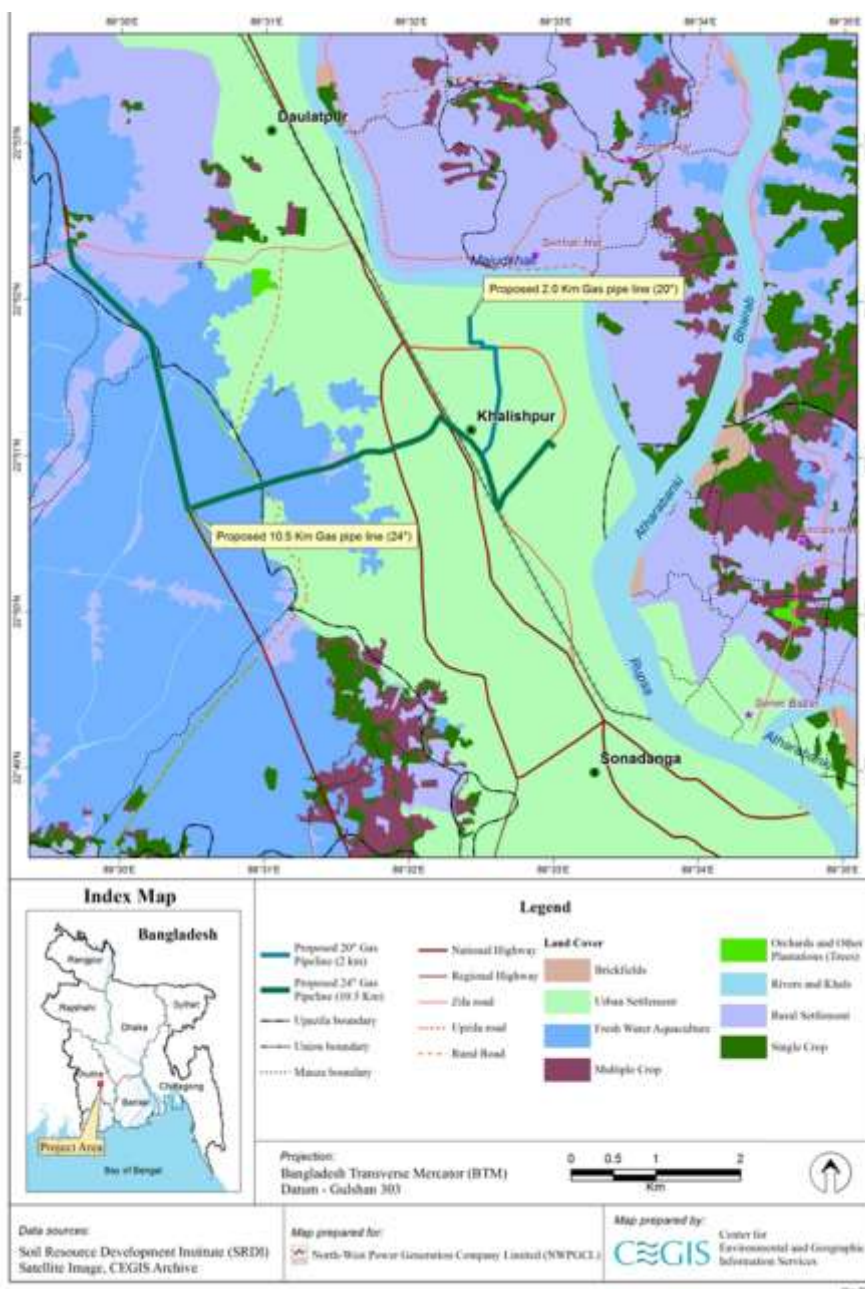
4.2.5 Land Resources

59. The RoW/road easement of the proposed gas distribution line has fallen under the Gopalganj-Khulna Beels (AEZ: 14) and High Ganges River Floodplain (AEZ: 11) based on FAO/UNDP, 1988 and is shown in **Figure 4.14**. The land type is medium high to medium low land and soil texture are clay and muck (pit soil). **Figure 4.15** shows the landuse of the study area.

Figure 4.14: Agro-ecological zones of the study area



Figure 4.15: Land use map of the study area



Soil Salinity

60. CEGIS field team collected three soil samples from RoW of the project area (Depth: 0-15cm). These soil samples were analyzed by Soil Resources Development Institute (SRDI), Dhaka.

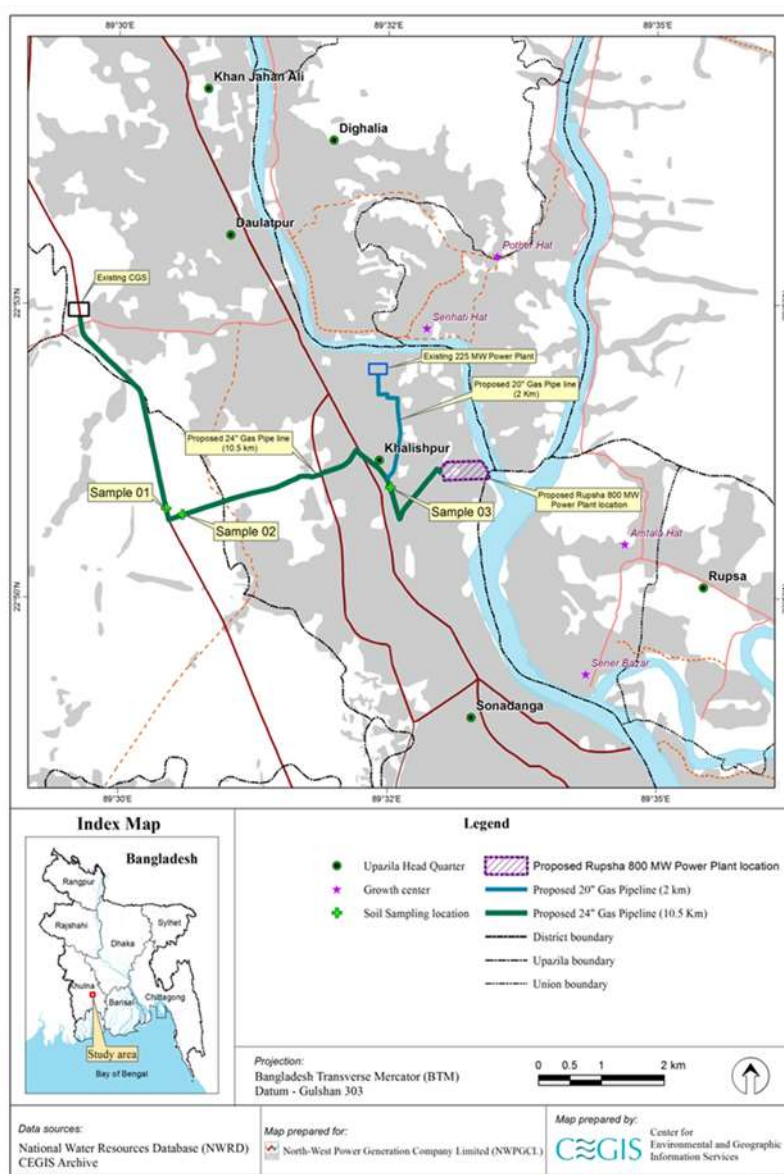
61. From the analyzed data, it is found that soil salinity of the Khalishpur, Khulna area is under S₁ soil salinity class (Non-saline).

62. The salinity status of Arongghata and Toiyabnagar was very slightly Saline with some slightly Saline (S_2). It might be due to the impact of polderization of the area. Polders protect saline water from regular inundation of tidal effect during dry seasons, when water salinity is very high. Details soil analysis data in respect to salinity is presented in **Table 4.6**.

Table 4.6: Soil salinity results

Sample ID	Sampling Location	GPS	Analyzed data result (ds/m)	Standard
Sample 01	Arongghata, Khulna (Road side slop)	N 22°50'48'' E 89°30'17''	5.65	S_2 (4.1-8.0)- Very slightly Saline with some slightly Saline
Sample 02	Toiyab Nagar, Khulna (Rice field)	N 22°50'45'' E 89°30'26''	5.45	S_2 (4.1-8.0)- Very slightly Saline with some slightly Saline
Sample 03	Khalishpur, Khulna (Road side vegetables cultivated area)	N 22°50'59'' E 89°32'22''	1.35	S_1 (Non Saline)

Figure 4.16: Map of soil sampling



Soil quality

63. Three soil samples were collected from the project study area during field visit of the study team from 13-14 June 2017 (see **Figure 4.16**). All these samples were analyzed at Soil Resources Development Institute (SRD) to assess the quality of the soil. It has been found that the pH of the soil is slightly alkaline. This condition is good for supporting plant growth. The micro nutrient concentration of the soil is sufficient, but macro nutrient was very low to optimum. Organic matter content was sufficient in rice field. It has been observed that trace element (Pb and Cd) concentration in soil samples was found to be higher than the average amount in soil (10 μ g/g for Pb and 0.06 μ g/g for Cd). It might be due to the vehicular movement of nearby roads and over application of fertilizer in crop fields. Detail soil analysis result is presented in **Table 4.7**.

Table 4.7: Results of soil analysis

Sample ID	Sampling Location	pH	OM (%)	Total N (%)	K (meq/100 g soil)	P (µg/g)	S (µg/g)	Fe (µg/g)	Cd (µg/g)	Pb (µg/g)
Sample 01	Arongghata, Khulna	8.0	0.94	0.047	0.22	0.31	224.15	121.66	0.0045	13.28
Sample 02	Toiyab Nagar, Khulna	7.5	5.58	0.280	0.36	0.53	131.81	11.68	0.1125	20.32
Sample 03	Khalishpur, Khulna	7.8	1.28	0.064	0.21	1.12	36.96	315.22	0.108	18.29

Land use

64. The gross study area is 337 acres, of which 336 acres (99.7%) are non-cultivated land including settlement, waterbodies and the rest 1 acre (0.3%) is cultivated land. Detailed land use of RoW of gas transmission pipe line is presented in **Table 4.8**.

Table 4.8: Land use of RoW

Land Use	Area (Acre)	Percentage (%)
Urban Settlement	165	49.1
Rural Settlement	24	7.1
Fresh Water Aquaculture (gher)	136	40.4
Orchards and Other Plantations (Trees)	8	2.4
Rivers and Khals	3	0.7
Agriculture land	1	0.3
Total	337	100.0

Source: CEGIS estimation from field information, June 2017 and Rapid Eye Image, 2012

4.2.6 Agriculture Resources

65. The RoW area is mainly non-agricultural land with a total area of about one acre of cultivated land. This land is cultivated for crop production and single Boro crop is produced during dry season. This crop is transplanted in December and harvested by early May. About 1.8 tons of HYV Boro rice is produced in the study area.

4.2.7 Fisheries Resources

66. During field visit it was observed that the gher owners encroached the borrow pit at Khulna City Bypass Road and merged with their respective ghers to cover more areas (see **Figure 4.17**). The pipeline will also cross Mayur River (near the Khulna city) and a natural canal which are not presently potential for fish habitat due to discharge of waste water from Khulna City causing poor quality of water (see **Figure 4.18**). The natural canal has also become a narrow channel due to siltation and encroachment for gher owners.

67. Two types of fish habitat e.g. (i) gher for culture fisheries and (ii) river and khal for open water fisheries were found in the study area. No floodplain and cultured pond was found within RoW of the proposed line.

68. The estimated total fish habitat in the study area is 139 acres, out of which culture fisheries (only gher) is 137.5 acres and capture fisheries (river and canal) is only 2 acres (**Table 4.9**). Golda with white fish gher is dominant which comprise 99% of total fish habitat and rest is capture fish habitat. Among the gher area only one acre of land is used for rice cum golda culture.

Figure 4.17: Borrow pit with gher near the Toiyab Nagar KDA linked road



Figure 4.18: Mayur River in the study area



Table 4.9: Fish habitat status and production across the RoW

No.	Fishery Category	Habitat Type	Area (acres)	Productivity (Kg/acre/year)	Total Production (kg)
1	Capture	River and canal	2	30 (all types of fishes)	60
	Sub-Total		2	-	60
2	Culture	Gherand pond	137	300 (golda with white fish)	41,100
	Sub-Total		139		41,100
	Grand Total				41,160

Sources: Field Survey, June 2017 and FRSS, 2016

69. Average fish production rate in river and khal is 30 kg/acre/year and gher is 300/kg/acre/year. The estimated total fish production of the study area is about 41,160 kg or 41.16 metric ton (MT). Most of the fish production (about 99.9%) comes from culture fisheries and very small amount from the capture fisheries. The reason for low production of capture fisheries is due to degradation of the river and canal habitats for discharges of waste water of Khulna city and siltation as reported by the local fishers and villagers.

70. The study area throughout the RoW of pipeline is poor in open water fish biodiversity. Local people reported that overall 10-15 fish species are found only in wet season in canal and Mayur River. Among these species, chingri (*Penaeus spp*), puti (*Puntius spp*), taki (*Channa punctatus*), shol (*Channa striatus*), tengra (*Mystus spp*), baim (*Mastacembelus pancalus*) and baila (*Glossogobius giuris*) are commonly found in the canal and river but their abundance is very low (**Figure 4.19**). Gher owners mostly concentrate in culture of golda (prawn) farming

which starts from May to September and continue until November depending on the availability of water in the gher. The Golder farmers follow improved extensive to semi-intensive systems along with freshwater fish which include Rui (*Labeo rohita*), Catla (*Catla catla*), Mirgel (*Cirrhinus cirrhosus*), puti (*Puntius gonionotus*), etc. Sometimes farmers also start rice cultivation in the gher and fresh water fish culture along with rice (**Figure 4.20**).

None of fish species that are found within the study area of the proposed gas pipeline is in the IUCN Red list and is shown in **Table 4.10**.

Table 4.10: Fish species in the study area

SI	Scientific Name	Local Name	Conservation status Bangladesh	IUCN conservation status
1	<i>Machrobrachium rosenbergii</i>	Prawn	NL	NL
2	<i>Peneus monodon</i>	Bagda	NL	NL
3	<i>Puntius sophore</i>	Punti	LC	LC
	<i>Channa punctatus</i>	Taki	LC	LC
4	<i>Channagachua</i>	Cheng	LC	LC
5	<i>Channa striatus</i>	Shol	LC	LC
6	<i>Mystus tengra</i>	Tengra	LC	LC
7	<i>Mastacembelus pancalus</i>	Striped Spiny Eel	LC	LC
8	<i>Glossogobius aureus</i>	Baila	LC	LC
9	<i>Labeo rohita</i>	Rui	LC	LC
10	<i>Catla catla</i>	Catla	LC	NE
11	<i>Cirrhinus cirrhosus</i>	Mirgel	NT	VU

LC = Least Concern; NE = Not Evaluated; NL = Not Listed in IUCN red list book; NT = Near Threatened; VU = Vulnerable.

Figure 4.19: Gher Fisheries (Golder)



Figure 4.20: Mixed catch of fish species



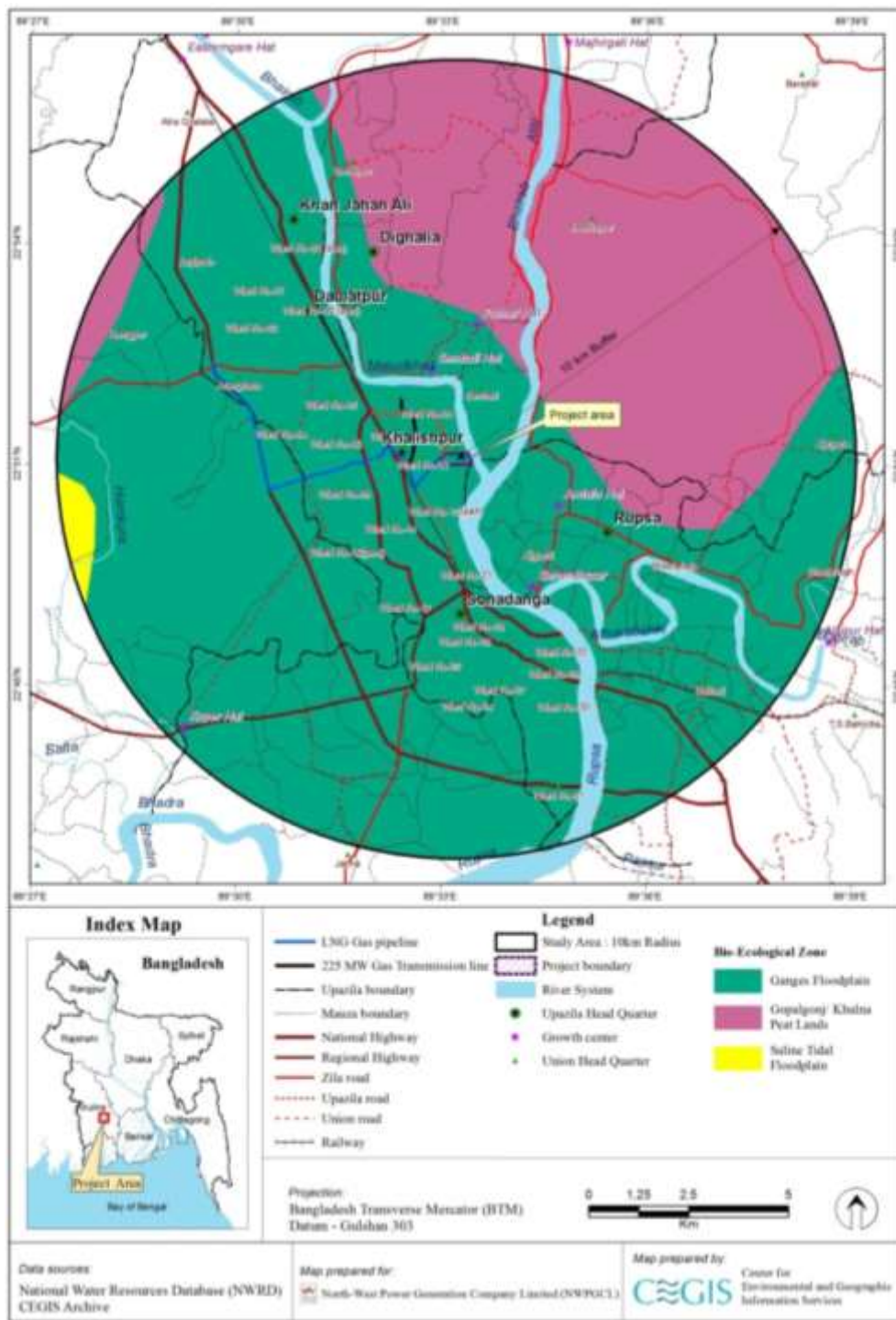
4.2.8 Biological Resources

Habitat characteristics of study area

Bio-Ecological Zone

71. IUCN has divided Bangladesh into 25 Bio-ecological Zones (Nishat et. al., 2002) with respect to physiographic units and biological diversity. Each of the bio-ecological zones represents overall ecological situation of an area of the country. The study area falls under the bio-ecological zones Ganges Floodplain (**Figure 4.21**). The area covered by bio-ecological zones is 337 acres or 100%.

Figure 4.21: Bio-ecological zone in Component 2



4.2.9 Ecosystem in the Study Area

Terrestrial Ecosystem

Roadside flora

72. Common cultivated plants along the road side are Rain Tree (*Samanea saman*), Mehogani (*Swietenia mahagoni*), Sugar Date Palm (*Phoenix sylvestris*), Banana (*Musa sp*), Egyptian thorn (*Vachellia nilotica*), Horse radish tree (*Moringa oleifera*), Indian jujube (*Zizyphus mauritiana*), Royal Poincian (*Delonix regia*), Spanish Cherry (*Mimusops elengi*), Coconut (*Cocos nucifera*), North Indian Rosewood (*Dalbergia sissoo*) (**Table 4.11**). The road sides are also covered with semi-spontaneous shrub and herb vegetation (**Figure 4.22**). The major shrub and herb species have been seen during the field visits are Glory bower (Bhant), Croton (Ban Tulshi), Bitter vine (Asma lata), Senna plant (Kolkasunda), minnie-root (patpati), ivy wood rose (halud kalmi), flannel weed (sida), dodder (swarnolata), crown flower (akando), Durba grasses hairy fig (dumur) and orange berry (daton). No threatened plant species has been found along the proposed alignment.

Figure 4.22: Roadside vegetation along the proposed alignment



Table 4.11: List of tree species diversity in study area

Scientific Name	Local Name	IUCN Global Status	IUCN National Status
<i>Acacia auriculiformis</i>	Akasmoni	Least Concern	Not Assessed
<i>Albizialebeck</i>	Sirish	Not Assessed	Not Assessed
<i>Albizia procera</i>	SadaKoroi	Not Assessed	Not Assessed
<i>Albizia richardiana</i>	Chambul	Not Assessed	Not Assessed
<i>Areca catechu</i>	Supari	Not Assessed	Not Assessed
<i>Artocarpus heterophyllus</i>	Kanthal	Not Assessed	Not Assessed
<i>Azadirachta indica</i>	Neem	Not Assessed	Not Assessed
<i>Boassus flabellifer</i>	Tal	Not Assessed	Not Assessed
<i>Cassia fistula</i>	Sonalu	Not Assessed	Not Assessed
<i>Cocos nucifera</i>	Narikel	Not Assessed	Not Assessed
<i>Corymbia citriodora</i>	Eucalyptus	Not Assessed	Not Assessed
<i>Dalbergia sissoo</i>	Sisoo	Not Assessed	Not Assessed
<i>Delonix regia</i>	Krisnachura	Least Concern	Not Assessed
<i>Erythrina indica</i>	Mandar	Not Assessed	Not Assessed
<i>Eucalyptus sp</i>	Eucalyptus	Not Assessed	Not Assessed
<i>Gmelina arborea</i>	Gamari	Not Assessed	Not Assessed
<i>Lenneacromandela</i>	Jiga	Not Assessed	Not Assessed
<i>Leucaena leucocephala</i>	Ipil	Not Assessed	Not Assessed
<i>Mangifera indica</i>	Aam	Not Assessed	Not Assessed
<i>Mimusops elengi</i>	Bakul	Not Assessed	Not Assessed
<i>Musa paradisiaca</i>	Kola	Not Assessed	Not Assessed
<i>Phoenix sylvestris</i>	Khejur	Not Assessed	Not Assessed
<i>Plumeria rubra</i>	Khatgolap	Not Assessed	Not Assessed
<i>Psidium guajava</i>	Peyara	Not Assessed	Not Assessed
<i>Rubus argutus</i>	Kalo Jam	Not Assessed	Not Assessed
<i>Samanea saman</i>	Raintree	Not Assessed	Not Assessed
<i>Samanea saman</i>	Raintree	Not Assessed	Not Assessed
<i>Swietenia mahagoni</i>	Mahogoni	Not Assessed	Not Assessed
<i>Tamarindus indica</i>	Tetul	Not Assessed	Not Assessed
<i>Tectona grandis</i>	Segun	Not Assessed	Not Assessed
<i>Trewia nudiflora</i>	Pitali	Not Assessed	Not Assessed
<i>Ziziphus mauritiana</i>	Kul	Not Assessed	Not Assessed

Roadside fauna

73. Fauna seen along the road side is Golden Jackal, Grater bandicoot rat and Small Indian mongoose. Birds species seen by the roadside trees are Black Drongo, Common Myna, Asian Pied Starling, Spotted Dove, Red-vented Bulbul, House Sparrow, Brahminy Kite, Long tailed shrike, House crow, Oriental Magpie Robin, etc. Common garden lizard, common Toad, and

Cricket frog are found along the roadside areas. No IUCN listed and rare fauna species has been found in the project area.

Wetland Ecosystem

Wetland flora

74. The proposed alignment is close to a few wetlands (**Figure 4.23**) along the Bastuhara and Khulna to Mongla highway. Plant species seen during the field visits are Water lily, Water hyacinth, *Polygonum barbatum*, *Trewia nudiflora*, *Barringtonia acutangula*, *Crataeva nurvala*, *Polygonum lanatum*, *Sagittaria sagittifolia*, *Commelina benghalensis*, and *Rumex dentate*, etc. Water lettuce (*Pistia strateotes*) is found in most of the ditches as well as ponds mixed with hyacinth.

Figure 4.23: Wetlands along in the project area



Wetland Fauna

75. Water birds are an important component of most wetland ecosystems, but no notable water bird was seen during the field survey. Wetland bird species seen and heard are Lesser Whistling Duck, Little cormorant, Indian pond heron, Bronzed winged Jacana, Common Kingfisher, White breasted Water Hen, etc. Bullfrogs (*Hoplobatrachus tigerinus*), Skipper Frog (*Euphlyctis cyanophlyctis*) were seen in water bodies. No threatened fauna species has been found in the study area.

4.3 Socio-economic Condition

4.3.1 Introduction

76. The socio-economic condition in the study area¹⁴ is presented in this section. Primary data was collected using Rapid Rural Appraisal (RRA), Key Informant Interview (KII), observation and informal consultations. Alongside, relevant secondary information including

¹⁴ Study area refers to the area that may be affected directly or indirectly by the project intervention. And project area means where proposed intervention will be implemented.

demographic profile, occupation and livelihood, standard of living, standard of education were compiled from the community series of the Population and Housing Census 2011 published by the Bangladesh Bureau of Statistics (BBS) in 2012.

4.3.2 Demographic Profile

77. **Area and Location.** Administratively the study area is under Khulna City Corporation except a portion of Gutudia union under Dumuria Upazila. Most of the wards (smallest administrative unit of City Corporation) are under Khalishpur Thana. Most of the study area covers Wards no. 7, 8, 9, 10, 12, 13 and 15 under Khalishpur Thana.

78. **Population.** The 3,771 households in the study area has a total population of 15,442 of which 8,114 (53%) is male and 7,324 (47%) is female. The female population is less in number than male population (**Table 4.12**). The male-female ratio is 115 which means there are 115 males per 100 females. This figure is higher than the national figure of 100.3 (BBS, 2012).

Table 4.12: Demographic data of the study area

Households	Population			Sex ratio
	Total	Male	Female	
3,771	15,442	8,114	7,324	115
	100 (%)	53 (%)	47 (%)	

Source: Population Census 2011, BBS, 2012

79. **Household size.** The average household size is 4.1 while the national average is 4.4 (BBS, 2012).

80. **Age structure.** The highest number of population (about 28 %) belongs to age group of 30 to 49 years while the lowest number (about 2%) belongs to 60 to 64 years age group. Age groups of 0-14 years is defined as children (28%), 15-24 years as early working age (21%), 25-59 years as prime working age (45%), above 60 and over as elderly people (6%). This classification is important as the size of young population (under age 15) would need more investment in education and health, while size of older populations (ages 65 and over) would need for more investment in the health sector. The workforce in the study area is 68% (people between the age 15 to 64 considered as working force according to ILO standard)

81. **Population migration.** Migration is common phenomena found in the study area. Permanent migration is negligible in both type of migration (In/Out migration). However, seasonal labor migration is also noticed. During the rainy season, they remain without work where they migrate temporarily to the other districts for livelihood. They mainly go to Dhaka, Sylhet and Mymensingh where they work as laborer, rickshaw puller, small scale businessman, etc.

Table 4.13: Migration status in the study area

Type of Migration	Labor Migration-Out		Labor Migration-In	
	Place of destination	% of total population	Place of origin	% of total population

Seasonal labour migration	Dhaka, Chittagong,	8%	Bagerhat, Gopalganj, Pirojpur, Barisal, Jhalokathi, Satkhira	15%
Permanent household migration	Dhaka, Chittagong,	2%	Bagerhat, Gopalganj, Pirojpur, Barisal, Jhalokathi, Satkhira	1%

Source: CEGIS fieldwork, 2016

4.3.3 Settlement and Housing

82. **Housing Condition.** Overall housing condition is moderate. The BBS (2011) data shows that on average 35% households are pucca, 27% households are kutcha, and 37% are semi pucca whereas the Jhupri house (1%) is very negligible.

4.3.4 Economy and Employment

126. **Employment status.** About 40.7% is employed in different sectors. About 33.5% of people are engaged in household work while about 25.3% of total population is not working.

127. **Occupational pattern.** Main occupation of total population is service (59%) in which 43% is male and 16% is female; about 17% people are engaged in agriculture while 24% of total population are engaged in industrial work.

83. **Labor availability and wage rate.** The wage rate varies between 400tk. to 500 tk/day (Table 4.14). A few migrant laborers stay in the study area almost all year round and return to their homes at the end of the year with all their income. Women participation in agricultural sector is negligible.

Table 4.14: Labor availability and wage rate in the study area

Type		Male			Female		
		Labor Availability	Average Wage tk/day		Labor Availability	Average Wage tk/day	
			Max.	Min.		Max.	Min.
Farming	Skilled	High	400	300	Nil	-	-
	Non-Skilled	High	350	300	Low	300	250
Non-Farming	Skilled	Medium	500	400	Low	400	300
	Non-Skilled	High	350	300	Medium	250	200

Source: CEGIS fieldwork, 2016

4.3.5 Utilities

84. **Drinking water facility.** According to the BBS 2012, collection of drinking water from tube well is predominant (92.6%) throughout the study area. About 7.2% households are dependent on tap water whereas only 0.2% household depends on other sources (pond, river and canal)

85. **Sanitation facility.** Until now, data show that about 15% of total population are using non-sanitary toilet. About 85% households have sanitary toilet facilities of which 43% are water-sealed and 42% are non-water-sealed. About 1% people are not using sanitary facility.

86. **Electricity.** About 93% of the households in the study area use electricity.

4.3.6 Community health and safety

87. **Community health.** Local people in the study area reported that the most prevalent diseases in the study area are diarrhea, typhoid, pneumonia, jaundice, skin diseases, etc. Children are mostly affected by water-borne diseases. Instant health facility is inadequate in nearby areas except the City corporation area. Hyper tension/high blood pressure is also increasing among the people. Disability is also found in the study area. Total disability is about 1.5%.

88. **Health services.** There is a 250-bed capacity health complex at Boyra. Patients from different districts go to Boyra for better medical treatment. There are number of private clinics in Khulna city where people can get better medical treatment.

89. **Availability of health services and facilities.** About 48% of patients go to trained physician as people have easy access to the trained physician in Khulna city. About 25% people in the study area go to paramedic doctor and about 22% patients go to quack doctors. Local people are nowadays much more aware about their health. They have eagerness to receive health treatment from trained physicians but all of them are not able to do that due to inadequate financial capability and availability of health facility.

90. **Literacy rate.** Literacy rate in the area is 71% where male accounts for 74% and female 68%

91. **Vulnerability to natural disaster.** Khulna is situated in the natural disaster-prone area. Local people opined that waterlogging, salinity intrusion, cyclone, surge, river erosion are the main natural disasters in the study area. These occur almost every year in this area.

92. **Safety nets.** Major social safety nets and poverty reduction programs in the area include the Vulnerable Group Development (VGD), Food/Taka for Work (F/TFW), Food for Education/Cash for Education, Rural Maintenance Program (RMP), Old Age Allowance, Freedom Fighter Allowance and Integrated Poverty Reduction Program. According to local people, these programs have created food security as well as social security among the targeted poor households and vulnerable communities. A number of local, national and international NGOs are working in the study area. The main activities of these NGOs are operating microcredit programs among the rural poor and landless women/men.

5.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Introduction

93. Important Environmental Components (IECs) that are likely to be impacted by Component 2 have been selected based on the rationale presented against each IEC and these are discussed in the following sections.

5.1.1 Selection of IECs and their Rationale

Table 5.1: IEC on physical environment

IECs	Rationale for selection
Noise Level	The noise level in the study area at present is a little higher (just below the limits) compared to the limits given in ECR 1997 and Noise Pollution Control Rules 2006. It is presumed that the noise level during the construction phase will increase further due to the use of construction equipment, vehicle movement, construction works and other activities during construction phase. Thus, may cause inconvenience to local residents adjacent to the pipeline route. Thus, noise is considered an IEC.
Air Quality	During construction phase, the potential for air quality being affected is limited to vehicular emissions and dust during earth-moving works. During operation, pipeline leaks and fugitive gas emissions may occur which can cause fire or explosion depending on the concentration of natural gas in air and may pose safety risks.
Traffic Congestion	The pipeline will be laid at one side of the road which is within 2.5m from the toe of the road. There are some places, where the homestead is just adjacent to the RoW. The earth excavated for laying pipe if dumped beside the road due to homestead on the other side may reduce the width of the road. This may hamper vehicular movement and mobility of local residents.
Drainage	The natural drainage system might be disrupted during the installation of gas distribution line, dumping of earthen materials adjacent to the RoW of trench.

Table 5.2: IEC on land and agricultural resources

IECs	Rationale for selection
Soil quality	During construction, soil along the pipeline route will be disturbed due to excavation for trenching, pipe-laying, and backfilling. These activities may affect soil quality.

Table 5.3: IECs on fisheries resources

IECs	Rationale for selection
Fish Habitat	The pipeline route will mainly pass through along the road, gher, and across a canal and the small Mayur River. Construction works may cause temporary loss of fish habitat. These activities may also deteriorate water quality of gher, canal and Mayur River. Thus, fish habitat has been considered an IEC.
Fish Production	Temporary loss of fish habitat due to construction activities may affect fish production.

Table 5.4: IECs on ecological resources

IECs	Rational for selection
Terrestrial vegetation	Implementation of Component 2 may cause damage and clearing of vegetation particularly along the roadside. Vegetation clearing may affect habitat quality

Table 5.5: IECs on socioeconomic components

IECs	Rationale
Traffic and mobility	Component 2 will affect five road crossings and three railway crossings. During construction phase all these roads will be disrupted temporarily which may affect traffic and mobility of people.
Temporary loss for small-scale business	No land acquisition is required but some temporary structures have been identified on the RoW. These structures sell goods like food, vegetables, etc.
Employment opportunities	Temporary employment opportunities may be created. During construction, employment opportunities for both skilled and unskilled labor may increase. Aside from creation of employment opportunities, there will be opportunities also for small-scale business to sell food to the workers or rental housing to workers.
Accident risks	Movement of construction vehicles, machineries and heavy equipment like excavators may pose safety risks to workers and the public.

5.2 Impact Assessment

94. Assessment of potential impacts were based on activities that will be involved in the implementation of Component 2, the existing environment, environmental sampling, and consultations.

5.2.1 Impact Screening

95. As part of the process, a screening matrix was used focusing on the potential environmental impacts during the design, construction and operation phases. The matrix examined the interaction of project activities with various important components of the environment. The potential impacts thus predicted were characterized as follows:

- Highly negative (adverse) impact;
- Moderately negative impact;
- Insignificant impact;
- Highly positive (beneficial) impact;
- Moderately positive impact

96. The environmental screening matrix is provided in **Table 5.6**. The negative impacts predicted in this manner are the 'unmitigated' impacts before any measures been taken. Appropriate mitigation measures have been recommended as part of this EIA, thus reducing the possibility and severity of the potential adverse impacts. The potential adverse impacts identified through this process are discussed in all the subsequent sections. The impact matrix is given in **Table 5.8**.

5.2.2 Impacts during pre-construction phase

97. Site development involves the following activities:

- Route survey and finalizing the alignment
- Land acquisition and requisition
- Obtaining site clearance from DoE
- Display of billboards to provide information about the project

5.2.2.1 Socio-economic Condition

Impacts

98. There is no need for land acquisition and requisition as the land affected by Component 2 is owned by GoB. During the field visits, 48 structures are along the pipeline route that will require relocation before the start of construction.

Mitigation

99. Affected persons will be given assistance for relocation of the temporary structures. Affected persons will be given at least one month before construction. Compensation and assistance will follow the requirements of GoB and ADB.

Residual Impacts

100. Level of impact significance will be moderate given the mitigation above.

5.2.3 Impacts during construction phase

101. Component 2 will involve the following tasks during construction phase:

- Equipment and vehicle movement
- Removal of vegetation (Plants, Trees)
- Trench excavation
- Stringing and welding of pipes, coating, and wrapping
- Laying of Pipes
- Backfilling
- Cleaning
- Pressure Testing
- Commissioning

102. Given that excavation will be involved within the 12 km of gas pipeline, **Annex 3** presents the procedures to be followed in the event of a “chance find” physical cultural resources during construction phase.

5.2.3.1 Ambient Noise Level

Impacts

103. The main sources of noise generation are trenching, laying of pipe, grading, stringing, coating, vehicle movement, etc. HDD along Mayur River and the five road crossings, and three rail crossings will also contribute to the increase in ambient noise level. This impact may cause inconvenience and annoyance to residents living close to the

pipeline route. The significance of this impact is considered moderate based on magnitude and receptor sensitivity.

Mitigation

104. Noise-generating construction activities will be limited to daytime only and will be stopped during the school hours (if close to a school), madrasa, prayer time at mosque. Equipment that generate high noise will be enclosed. Ear protection devices (muffs) will be provided to workers assigned to noise generating equipment, machineries, and activities. Orientation, labor training and awareness building programs will be undertaken at the construction sites. Unnecessary use of equipment and device that generate noise like whistle, bells, megaphone, etc., will be avoided. RMS and valves will be fenced and trees will be planted as safe distance to provide buffer.

Residual Impact

105. With mitigation, the level of significance of the impact is considered to be low.

5.2.3.2 Ambient Air Quality

Impact

106. Dust generation from excavated soil, vehicle movement, trenching works, boring of road and railway might impact ambient air quality. The significance of this impact is considered moderate based on magnitude and sensitivity.

Mitigation

107. Trucks/vehicles that deliver dust-generating materials to the construction site will be covered. Protective enclosures will be installed during welding operations and laying of pipe following the Bangladesh Natural Gas Safety Rules 1991. Water will be sprayed regularly in opened areas where dust is generated. Opened land areas and excavated soil dump will be covered during off working hours. Solid wastes generated by workers will be collected daily and transferred to designated bins provided by the EPC Contractor. Excavated earth will be backfilled and excess soil will be avoided.

Residual Impact

108. Once the potential increase in dust level is mitigated, the level of impact will be low.

5.2.3.3 Potential increase in vehicular traffic

Impact

109. Mobilization of equipment and machinery, construction material and manpower to the project area will result in additional traffic on roads. Also, construction works and site preparation may cause traffic congestion. Daily activities of local residents may be affected due to equipment and machinery movement. Mostly it will create problem in the roads and rail crossing points.

Mitigation

- Construction Management Plan, which will include traffic management, will be prepared by the EPC Contractor and approved by PMU.
- Mobilization activities will avoid peak hours during the day
- HDD will be used at crossings to minimize disturbance to local people

- Staff will be assigned to enforce traffic regulations and facilitate movement and avoid accidents.
- Clear and visible traffic signs will be posted to help in people and vehicle movement.
- Temporary pedestrian crossings will be provided (as needed) accommodating children, women, elderly, and persons with disability.
- Awareness program will be conducted to ensure the safety of local people.

Residual Impacts

110. With mitigation, the significance of the impact will be low.

5.2.3.4 Drainage System

Impact

- There will be a total of five road crossings along the pipeline route. Drainage may be obstructed during construction if the trench excavated soil is dumped beside the RoW or road easement and back-filling is not conducted properly.
- The significance of this potential unmitigated impact is considered low based on magnitude and receptor sensitivity.

Mitigation

- To the extent possible, installation of the gas distribution pipeline will be undertaken during the dry season.
- Backfilling of the trenches after pipe laying will be conducted right after and properly following the industry standards.
- Installation at river crossings along Mayur River will be done through HDD process to minimize environmental impacts. Re-vegetation or stabilization of the river banks will be done as soon as it is appropriate to do so.

Residual Impact

111. With the mitigation above, the level of significance of the impact will be negligible.

5.2.3.5 Soil quality deterioration

Impact

- During the installation of Component 2, soil in the RoW and road easement will be dug at a depth of about 1.5 m and a width of 2 m. After the pipe-laying, the trench will be backfilled with the same amount of soil excavated. During excavation, the topsoil and sub-soil may be disturbed and likely displaced. Waste generated may degrade the surrounding soils.
- Level of significance of this impact based on magnitude and receptor sensitivity is considered moderate.

Mitigation

- Excavated soil will be properly stacked for backfilling and covered during off-work hours.
- Loosened soil will be compacted to minimize wind erosion and dust generation.

- Waste generated will be properly collected and disposed of to minimize potential contamination of soil quality.

Residual Impacts

112. Implementing the mitigation measures, the level of impact significance will be very low.

5.2.3.6 Fish Habitat

Impact

113. Construction activities may potentially affect the *gher* along Toiyab Nagar KDA road to Khulna City link road. It was noted from the field visit that there are about 15 *ghers* (both *golda* and gold with white fish *gher*) that may be potentially affected temporarily. The estimated *gher* area that may be affected will be about 0.5 acre. Two locations along the Mayur River will be crossed by the pipeline route. Construction activities along these river points may affect the fish habitat on short duration and temporary. The surface water quality in Mayur River is not suitable for fish production due to water pollution for discharged wastewater from Khulna City. Trenching and backfilling in two river crossings may further affect the quality of Mayur River particularly turbidity and color. HDD will be used at two river crossings to minimize potential environmental impacts. Level of significance is considered low based on magnitude and receptor sensitivity.

Mitigation

114. Temporary bamboo fencing between the trench and *gher* area will be done to avoid disturbance of fish culture. Construction activities will be scheduled during the dry season (i.e., November to April) whenever possible as *Golda* is not cultured during this period.

Compensation

115. *Gher* owner will be compensated for any damage that will be incurred during construction.

Residual Impacts

116. With proper compensation, the level of significance of this impact will be negligible.

5.2.3.7 Fish production

Impact

- The construction of the 10km gas pipeline from Khulna CGS in Arongghata to Rupsha 800 MW CCPP in Khalispur may potentially cause reduction of fish production temporarily. The estimated loss from *gher* fisheries production is about 147 kg of total impacted *gher* area.
- The significance of this potential impact before mitigation is considered low based on magnitude and receptor sensitivity.

Mitigation

117. Construction of temporary bamboo fencing between trench and *gher* area to avoid disturbance of fish culture within the *gher*.

Compensation

118. Gher owner will be compensated and cost estimates are included in the Resettlement Plan.

Residual Impacts

119. Given that the impact is temporary, with proper compensation, the significance of the impact will be negligible.

5.2.3.8 Loss of terrestrial vegetation

Impacts

120. The pipeline route is generally following the existing road easement. Roadside lands are fallow and covered by seasonal undergrowth vegetation and planted tree species. Site preparation for workers' shed and material stockyard may cause damage to roadside vegetation. A total of 326 trees will be cut along the 10 km pipeline and 44 trees for the 2 km off-take pipeline (see **Table 5.7**).

Table 5.7: Details on trees affected

Name of trees	Type	Size of tree				Total
		Big	Medium	Small	Sapling	
10 km alignment						
Khejur	Fruit	5	2	12		19
Tal	Fruit			12		12
Mehgoni	Timber		8	43		51
Akashmoni	Timber			17	120	137
Babla	Timber			37		37
Bot	Timber		1			1
Raintree	Timber	1	6	1		8
Mahogoni	Timber	20	9	32		61
2km off-take gas line alignment						
Ata	Fruit			1		1
Bakul	Ornamental			2		2
Eucalyptus	Timber		1			1
Khatgolap	Ornamental		1			1
Krisnachura	Ornamental			4	2	6
Kul	Fruit			2		2
Mahogoni	Timber		6	5		11
Narikel	Fruit		2	1		3
Neem	Medicinal		1			1
Raintree	Timber		8	2		10
Sajna	Fruit		4			4
Sisoo	Timber			2		2
Total		26	49	173	122	370

Source: Census & IOL survey, CEGIS, 2017

121. Significance of this impact is considered moderate based on magnitude and receptor sensitivity.

Mitigation:

- Inform and coordinate with proper authorities like Department of Forest (DoF) about the need to cut about 370 trees due to the implementation of Component 2.
- Proper compensation to tree owners especially fruit trees will be provided.
- Tree plantation in areas identified by DoF or other relevant government agencies will be undertaken to offset the cut of trees.
- Choose areas that are not productive when selecting sites for labour shed and materials stockyard to minimize impacts on vegetation.
- Should fuel wood be needed by workers, this will be purchased in the local market. Unauthorized cutting of roadside trees for fuel will be prohibited.

Residual Impacts

122. With mitigation above, the level of significance of the impact will be low.

5.2.3.9 Employment opportunitiesImpact

123. Temporary employment opportunities will be created with the implementation of Component 2 during construction phase. There is adequate availability of local labour. Aside from employment opportunities, they may be potential for small-scale business opportunities by selling food to construction workers and rental housing.

Enhancement

- Provide employment for local community wherever possible.
- Local skilled labor will be given preference and local unskilled labor will be given priority for construction works
- EPC Contractor to target at least 30% local labor recruitment

5.3.4 Impacts during operation phase**5.3.4.1 Ambient air quality may be affected during maintenance**Impact

124. During maintenance and cleaning of the pipeline system, pigging will be undertaken. During pigging, some residual natural gas may be emitted. Also, as the pipeline system ages, fugitive natural gas emissions may occur. This occurrence will be temporary as continuous fugitive emissions would be safety risks. The significance of this potential unmitigated impact is considered moderate based on magnitude and receptor sensitivity.

Mitigation

- Pigging will be done by skilled workers and experienced staff to ensure that the procedure is done properly and safely.
- SCADA will monitor the operation of the gas distribution line 24 hours every day. An automatic valve shut off is included in the safety design. An odorant (normally "mercaptan" also used in liquefied petroleum gas) will be used to detect leaks.

- Distance between the valve stations will strictly follow the requirements of the Bangladesh Natural Gas Safety Rules 1991 and other international standards.

Residual Impacts

125. With proper safety measures, the significance level of the impact will be low.

5.3.4.2 Ambient noise level may increase during maintenance

Impact

- Valve stations and RMS may generate noise due to gas pressure. Local residents sensitive to ambient noise level may find the noise generated annoying and inconvenient. During pigging operation, ambient noise level may increase but this will be temporary and short duration.
- The significance of this potential unmitigated impact is considered as moderate based on magnitude and receptor sensitivity.

Mitigation

- Outer boundary of appropriate height will be installed in the valve station and RMS to contain the noise generated.
- Re-vegetation will be undertaken around the outer boundary to act as sound barrier.

Residual Impacts:

126. With mitigation, the level of significance will be low.

5.3.4.3 Occupational and public safety risks

Impact

127. Presence of the gas distribution pipeline system following the existing road easement may pose occupational and public safety risks. Identified risks are fire and explosion due to gas leaks along the pipeline.

Mitigation

- Pipeline will be designed and constructed following the Bangladesh Natural Gas Safety Rules 1991, ASTM, ASME and other international standards
- SCADA will monitor the pipeline operations 24 hours every day to detect any leaks. The pipeline system will be designed to have automatically valve shut off in case of leak.
- Clear and visible signs and danger warnings will be provided along the pipeline route.
- Appropriate and standard markers for gas distribution system will be installed.
- Contingency fund will be provided to address accidental issues.
- Periodic orientation on safety living near gas distribution pipeline system and emergency preparedness will be conducted by NWPGCL to neighboring residents.
- NWPGCL will have the necessary equipment, transport, and procedures in the unfortunate event of fire or explosion. Staff involved in the operation of the pipeline will have regular training.

Residual Impacts

128. With the above mitigation measures, residual impact will be moderate to low.

5.4 Hazard Identification and Risk Assessment

5.4.1 Introduction

129. Hazard is considered as those that can cause harm or has the potential to cause harm; whereas, risk is the likelihood of hazard being occurred and its severity. Thus a risk assessment is conducted, to carefully examine the potential hazards, how they occur and the measures to prevent such hazards. Mismanagement of one particular hazard can have consequences that simultaneously impact to a varying degree on several risk types.

130. A detailed assessment has been carried out as required by ECA 1995 and ECR 1997 of the DoE. This assessment identifies the potential hazards associated with natural gas distribution pipeline as in Component 2 so that these hazards can be avoided by incorporating safety plans in both planning and design process.

5.4.2 Hazard assessment process

131. The steps followed in this hazard and risk assessment are as follows:

- Identification of Hazards
- Cause Analysis
- Assessment of Frequency and Likelihood
- Risk Ranking, Recommended Actions and Safety Measures

The potential hazard points were identified to determine the causes and consequences (see **Table 5.8**).

Table 5.8 Potential hazard points identified for Component 2

Hazard classification	Hazard points
Mechanical	Clearing of standing installations in RoW, operation of laying equipment, welding equipment, etc.
	Valve and other pipeline components
	Construction sites
Fire and explosion	Gas pipeline (Stringing)
	Welding area
	Valve stations
	Pump stations
Methane gas leakage	Gas pipeline
	Valve stations
	Delivery stations
Failure mode hazard	Valve stations
	Gas pipeline
	Injection station/delivery station
	Final delivery station
Radiation Hazard	X-ray machine
Vehicular hazards	Motor vehicle and lorries, movement of vehicles

5.4.3 Identification of Hazards and Cause Analysis

132. Potential hazards are identified based on the different stages of the project phases, various location and project activities. Cause analysis is also conducted for potential hazards for each of the project activities. The potential hazards and risk during construction and operation stages are listed in **Table 5.9**.

Table 5.9: Hazard and Risk Assessment of Component 2

Location of hazard	Project Activities	Potential hazard	Cause Analysis	Consequences
Construction and Erection Stage				
Machineries, line pipe and other pipeline laying equipment.	<ul style="list-style-type: none"> Bringing in machines and equipment for site clearance activities Mobilizing line pipes, valves and other construction materials along the right of way 	<ul style="list-style-type: none"> Trips and falls Cuts and bruises 	<ul style="list-style-type: none"> Fatigue or prior sickness Mechanical failure Lack of safety training Not abiding to general health and safety and traffic rules 	<ul style="list-style-type: none"> Health injury Disability Life loss
Construction site	Land excavation	<ul style="list-style-type: none"> Inhalation of dust Sickness Accident (e.g. falling of machineries, equipment and debris) Cuts and bruises Trips and falls 	<ul style="list-style-type: none"> Fatigue or prior sickness Drinking from unsafe water (e.g. ponds, arsenic prone tube wells etc.) Mechanical failure (e.g. equipment failure etc.) Lack of safety training Not abiding to general health and safety rules 	<ul style="list-style-type: none"> Physical injury Disability Life loss
	Backfilling of the trench	<ul style="list-style-type: none"> Accidents Injuries from falls and slips Inhalation of dust Cuts and bruises 	<ul style="list-style-type: none"> Fatigue or prior sickness Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent entry of outside people) Not maintaining a designated place for backfilling storage Not maintaining enough lighting during the night 	<ul style="list-style-type: none"> Health injury Broken bones/Disability
	Occupational hazard	<ul style="list-style-type: none"> Cuts, bruises and burns Falls, slips and trips Confined space hazard Health injuries Sickness and illness Electrocution 	<ul style="list-style-type: none"> Lack of safety awareness Carelessness in maintaining safety protocols Use of faulty machineries and equipment Improper hygiene Not wearing appropriate PPEs Prior sickness or illness Heavy workload 	<ul style="list-style-type: none"> Health injuries (burns, anxiety, depression etc.) Disabilities Fatalities
Gas pipelines (Stringing)	Welding of pipelines	<ul style="list-style-type: none"> Burn damage Spread of fire Electrocution 	<ul style="list-style-type: none"> Lack of safety training whilst handling the equipment Carelessness in handling welding 	<ul style="list-style-type: none"> Injuries Fire burns Disability

Location of hazard	Project Activities	Potential hazard	Cause Analysis	Consequences
			machines <ul style="list-style-type: none"> Negligent towards the use of safety equipment (e.g. safety mask, gloves etc.) Selection of unskilled worker for welding works Not abiding to general health and safety rules 	
	<ul style="list-style-type: none"> X-ray scanning of pipelines 	<ul style="list-style-type: none"> Exposure to radiation 	<ul style="list-style-type: none"> Lack of safety training whilst handling the equipment Carelessness in handling the X-ray machine Negligent towards the use of proper safety equipment Not abiding to general health and safety rules 	<ul style="list-style-type: none"> Long term exposure leading to cancer, skin diseases and birth defects (in case of pregnant workers)
	<ul style="list-style-type: none"> Cleaning of pipelines with pressurized water 	<ul style="list-style-type: none"> Injuries from pressurized water Exposure to dirt and other muddy water 	<ul style="list-style-type: none"> Lack of communication Carelessness in dealing with pressurized water 	<ul style="list-style-type: none"> Health injury Broken bones/Disability
	<ul style="list-style-type: none"> Marking of the pipeline route after the pipes are put in its place 	<ul style="list-style-type: none"> Falls and trips Personal security (e.g. hijack, theft, kidnapping etc.) 	<ul style="list-style-type: none"> Traversing through a remote area alone Traversing through a remote area at night alone 	<ul style="list-style-type: none"> Possible fatal Injuries Loss of belongings Mental trauma Possible death
Motor vehicle and lorries	<ul style="list-style-type: none"> Transportation of machineries construction activities 	<ul style="list-style-type: none"> Noise generation Accident 	<ul style="list-style-type: none"> Noise generated from running engine, hydraulic horns and construction activities Mechanical failure of machines/lorries/other equipment 	<ul style="list-style-type: none"> Health injury (e.g. hearing loss, accidents etc.) Disability Fatality
Gas pipelines and safety valves	<ul style="list-style-type: none"> Installation of gas pipelines (laying) and safety valves 	<ul style="list-style-type: none"> Injury from falling pipes and debris 	<ul style="list-style-type: none"> Faulty safety harness of lorries, cranes and pulleys Mechanical failures Lack of proper safety training Not abiding to HSE rules 	<ul style="list-style-type: none"> Disability Life loss
Operation Stage				
<ul style="list-style-type: none"> Gas pipelines Valve station Pump station 	<ul style="list-style-type: none"> Gas leakage Thermal hazard Environmental hazard Mechanical hazard 	<ul style="list-style-type: none"> Asphyxiation Explosion Fire ball 	<ul style="list-style-type: none"> Faulty pipes Faulty connections Corrosion Induced stress Sabotage 	<ul style="list-style-type: none"> Life loss Damage to nearby buildings, houses and properties Damage to the environment and

Location of hazard	Project Activities	Potential hazard	Cause Analysis	Consequences
	<ul style="list-style-type: none"> Occupational activities Repair and Maintenance 	<ul style="list-style-type: none"> Occupational exposure to gas leaks and explosions Confined space hazard Electrocution 	<ul style="list-style-type: none"> Lack of Health and Safety Training Not abiding to HSE rules Not wearing appropriate PPEs Faulty pipes Faulty safety harness and masks Faulty connections Corrosion Induced stress Sabotage 	ecosystem <ul style="list-style-type: none"> Physical injury Loss of consciousness Life loss Damage to nearby buildings, houses and properties Damage to the environment and ecosystem

5.4.4 Assessment of Frequency and Likelihood

Hazard Consequence & Frequency Scales

133. The potential impacts of the project have been scaled and prioritized based on the magnitude of those potential impacts (consequence) and the likelihood of them occurring (frequency). The consequence of the said impacts are classified and illustrated in **Table 5.10**.

Table 5.10: Hazard Consequence Scale

Parameter	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
Duration of potential impact	Temporary with no detectable potential impact	Limited to construction period	Medium Term (1 to 2 years)	Long term (more than 2 years)	Permanent Damage
Spatial extent of the potential impact	Specific location within project component or site boundaries with no detectable potential impact	Within project boundary	Beyond immediate project components, site boundaries or local area	Widespread far beyond project boundaries with some community and wildlife habitat coverage	Beyond project boundaries extending to widespread communities and wildlife habitat
Reversibility of potential impacts	Baseline remains almost constant	Baseline returns naturally or with limited intervention and within a few months	Potential impact requires a year or so for recovering with some interventions to return to baseline	Potential impact is long-term, requiring considerable intervention to return to baseline	Potential impact is effectively permanent, with little to no chance of returning to baseline
Compliance to Legal Standards before Mitigation Measures	Complies with all minimum requirements only some improvement opportunities to strengthen good practices	Meets minimum national standard or limits or international guidelines	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Complies partially with limits given in national standards but breaches international lender guidelines	Completely breaches national standards and or international guidelines/ obligations
Extent of health injuries	Minor pain, scratch, discomfort requiring no medical attention	Health injuries can be cured with first aid and/or some medical attention	Health injury requires hospitalization; may require long term recuperation; may lead to long term absence from work	Health injury may lead to permanent disability; few fatalities of workers and or community people	Fatalities of workers more than 5 and or community people more than 2
Impact on wildlife	Minimal disturbance within	Disturbing habitat of wildlife	Disturbing habitat of wildlife causing	Impact leading to deaths of any	Impact may lead to deaths of 2 or more

Parameter	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
	compliance	causing discomfort	decrease of preys and forcing them to relocate	endangered species and decrease of their food source	endangered marine mammals and/or 5 of other endangered species

134. The criteria for determining the frequency of the potential hazard being occurred are outlined in **Table 5.11**.

Table 5.11: Criteria for determining frequency of the potential hazard

Frequency Scale Determination	Definition
1 (Rare)	Rare chance of occurrence, if not at all
2 (Low)	Very minimal chance of occurring
3 (Medium)	May occur considering if the conditions are abnormal or exceptional
4 (High)	Occurs more frequently and without any prior warnings
5 (Almost Certain)	Occurs under typical conditions

5.4.5 Developing Risk Matrix

135. Following the consequence and frequency scales, a risk matrix can be developed after analyzing the potential hazards for the Project. The table below (**Table 5.12**) shows the risk matrix for the potential hazards and how frequently they may occur. In **Table 5.13**, the risk evaluation based on the type of activities and potential hazards are shown.

Table 5.12: Risk matrix of potential hazards/impacts

Frequency (F) of Hazards ↓	Hazard Consequence (C) →				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Severe)
1 (Rare)	1	2	3	4	5
2 (Low)	2	4	6	8	10
3 (Medium)	3	6	9	12	15
4 (High)	4	8	12	16	20
5 (Almost Certain)	5	10	15	20	25

Color Legend:

Red (10-25)	≡ Top Priority	: Action with follow-up Verification & Validation by Authority needed before allowing work
Orange (10-14)	≡ High Priority	: Action needed under follow-up Supervision before allowing work
Yellow (5-9)	≡ Medium Priority	: Need maintaining with routine monitoring & reporting
Green (1-4)	≡ Low Priority	: Only for awareness; no Intervention Action needed to start work

136. The risk for the potential hazard/impact is evaluated based on the combination of the hazard consequence and their frequency (NHS, 2008). In order to calculate the potential risk, the frequency of impact is multiplied with consequences. E.g. Level 1 of frequency of an hazard (Rare) is multiplied with Level 1 of hazard consequence (insignificant) to give a total score of 1 ($1 \times 1 = 1$) and so on. In that regards, a score between 1 to 4 is considered low priority; a score between 5 to 9 is considered medium priority and; a score between 10 to 14 is considered high priority and; a score between 15 to 25 is considered top priority.

5.4.6 Risk Ranking, Recommended Actions and Safety Measures

137. Based on the hazard consequence and frequency scales in **Table 5.10** and **Table 5.11** potential risk of a particular hazard/impact is estimated and given a score. The score is given in terms of the presence and absence of safeguards. The final evaluation of the potential risks is determined based on combined score of hazard consequence and its frequency. The following table (**Table 5.13**) shows the risk evaluation (risk ranking) of the project activities and its subsequent hazards (both before and after implementing safety measures).

Table 5.13: Risk evaluation for construction and operation of Component 2

Hazard points	Project Activities	Potential hazard	Cause Analysis	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
Construction Stage										
Machineries, line pipe and other pipeline laying equipment.	<ul style="list-style-type: none"> Bringing in machines and equipment for site clearance activities Mobilizing line pipes, valves and other construction materials along the right of way 	<ul style="list-style-type: none"> Trips and falls Cuts and bruises 	<ul style="list-style-type: none"> Fatigue or prior sickness Mechanical failure Lack of safety training Not abiding to general health and safety and traffic rules 	3	2	6	<ul style="list-style-type: none"> Arranging toolbox meeting before going out for work Regular inspection and maintenance of equipment A thorough lorry driver selection process via interviews, checking whether they have the proper licenses and from past experiences Training of traffic rules and regulation, including maintaining vehicle speed limit for different categories of road after the selection process is complete Limiting movement of vehicles after sunset and before sunrise Regular health and safety training to all construction workers and lorry drivers, including the proper use of PPEs. 	2	1	2
Construction site	Land excavation	<ul style="list-style-type: none"> Inhalation of dust Sickness Accident (e.g. falling of machineries, equipment and debris) Cuts and bruises Trips and falls 	<ul style="list-style-type: none"> Fatigue or prior sickness Drinking from unsafe water (e.g. ponds, arsenic prone tube wells etc.) Mechanical failure (e.g. equipment failure etc.) Lack of safety training Not abiding to general health and safety rules 	3	2	6	<ul style="list-style-type: none"> Arranging toolbox meeting before going out for work (during each construction activities.). Provide each worker with a safety checklist and safety permit (based on their work) before starting work. Regular inspection and maintenance of equipment, machineries and especially, safety harness. Maintain a registry for any faulty equipment found; inform site contractors and have them replace those immediately. No work should be done until the faulty machineries are replaced and tested. Regular health and safety training and fire-fighting drills to all construction workers, including the proper use of PPEs during work. Enclosing the area with yellow barricade tape and restricting outside access to local people during the whole construction process. Spraying water on dust to minimize its spread via wind; put stockpile at a designated place and cover them with GI sheet; put up GI sheet fencing around the construction site. Maintenance of hygiene at construction site and providing appropriate training to workers in hygiene maintenance Supplying workers with safe drinking water Recording of any unusual activities and issuance of fines or suspensions if any rules are broken Maintenance of an accident registry book 	2	2	4
	Backfilling of the trench	<ul style="list-style-type: none"> Accidents Injuries from falls and slips Inhalation of dust Cuts and bruises 	<ul style="list-style-type: none"> Fatigue or prior sickness Lack of safety protocols (e.g. not putting up warning signs or enclosing the area to prevent entry of outside people) Not maintaining a designated 	3	3	9	<ul style="list-style-type: none"> Putting up appropriate florescent warning signs at construction site. Enclosing the area with yellow barricade tape and restricting outside access to local people during the whole construction process Maintenance of a designated area for storing the backfilling 	2	2	4

Hazard points	Project Activities	Potential hazard	Cause Analysis	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
			place for backfilling storage • Not maintaining enough lighting during the night				materials • Ensuring proper lighting during night time • Regular health and safety training to all construction workers, including the proper use of PPEs. • Maintenance of an accident registry book			
	Occupational hazard	<ul style="list-style-type: none"> Cuts, bruises and burns Falls, slips and trips Confined spaces hazard Health injuries Sickness and illness Electrocution 	<ul style="list-style-type: none"> Lack of safety awareness Carelessness in maintaining safety protocols Use of faulty machineries and equipment Not wearing appropriate PPEs Improper hygiene Prior sickness or illness Heavy workload 	3	3	9	<ul style="list-style-type: none"> Regular inspection and maintenance of equipments, machineries and vehicles. Raising awareness on occupational hazards. Arrange monthly health and safety training, electrical safety training and firefighting drills to all construction workers, including the proper use of PPEs during work. Training of traffic rules and regulation, including maintaining vehicle speed limit for different categories of road. Maintenance of hygiene at construction site and providing appropriate training to workers in hygiene maintenance Supplying workers with safe drinking water Monthly health checkup of workers for any sickness or illness. Provide treatment/consultation accordingly. In serious cases of injuries or sickness, an ambulance should be on standby for transporting them to nearby hospital. Work load should be managed effectively. Workers working every 2 hours should be given a mandatory 30 minutes break as stipulated in chapter 9 of Bangladesh Labour Rules, 2015¹⁵. Employment of child labour (children below the age of 18), pregnant women and elder citizens in hard labour and dangerous activities must be prohibited. All other facilities (toilet, canteen, overtime hours, leaves etc.) should be followed as stipulated in Labour Rules, 2015 Equipment, machineries and electric wires should be checked for current and voltage ratings. When using an extension cable, its wire rating should match with the equipment wire rating. Ensure the proper cathodic protection on pipelines as per standard procedure to prevent rusting Ensure proper connection of pipelines Inspect pipelines for cracks and faults. Make prompt repairs if found. Ensure regular communications with outside when entering underground. Use proper safety precautions (e.g. PPEs, oxygen masks etc.) when working at confined spaces 	2	2	4
Gas pipelines (Stringing)	Welding of pipelines	<ul style="list-style-type: none"> Burn damage Spread of fire Electrocution 	<ul style="list-style-type: none"> Lack of safety training whilst handling the equipment Carelessness in handling welding machines 	3	3	9	<ul style="list-style-type: none"> Careful selection of workers who have prior welding experience Inspection of welding machines and PPEs before starting work; change any faulty machines or PPEs if found. Equipment, machineries and electric wires should be checked 	2	2	4

¹⁵ Bangladesh Labour Rules (2015). Ministry of Labour and Employment. Retrieved from http://www.dpp.gov.bd/upload_file/gazettes/14079_83432.pdf.

Hazard points	Project Activities	Potential hazard	Cause Analysis	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
			<ul style="list-style-type: none"> Negligent towards the use of safety equipment (e.g. safety mask, gloves etc.) Selection of unskilled worker for welding works Not abiding to general health and safety rules 				for current and voltage ratings. When using an extension cable, its wire rating should match with the equipment wire rating. <ul style="list-style-type: none"> Proper earthing with machineries should be made. Maintenance of an accident registry book 			
	X-ray scanning of pipelines	Exposure to radiation	<ul style="list-style-type: none"> Lack of safety training whilst handling the equipment Carelessness in handling the X-ray machine Negligent towards the use of proper safety equipment Not abiding to general health and safety rules 	3	2	6	<ul style="list-style-type: none"> Prevent intruders from work site to protect them against welding radiation Protect integrity testers from exposure to X-ray. 	2	2	4
	Cleaning of pipelines with pressurized water	<ul style="list-style-type: none"> Injuries from pressurized water Exposure to dirt and other muddy water 	<ul style="list-style-type: none"> Lack of communication Carelessness in dealing with pressurized water 	3	3	9	<ul style="list-style-type: none"> Maintaining communication as to when to release water flow and when to stop water flow. Making sure the effluents are released as far away from locality as possible and at a designated site. Keeping an eye on the pressure gauge when releasing water; maintain pressure as required Report any structural damage to the pipelines immediately; stop water flow as soon as any structural damage is notified to prevent accidents Maintain a record of any incidents 	2	2	4
	Marking of the pipeline route after the pipes are put in its place	<ul style="list-style-type: none"> Falls and trips Personal security (e.g. hijack, theft, kidnapping etc.) 	Traversing through a remote area alone	3	3	9	<ul style="list-style-type: none"> Walking in numbers when traversing through a remote area; seeking the support from local security personnel to accompany them Travelling during daytime only. Keeping the phone numbers of the local police office and ambulance at speed dial 	2	2	4
Motor vehicle and lorries	<ul style="list-style-type: none"> Transportation of machineries construction activities 	<ul style="list-style-type: none"> Noise generation Accident 	<ul style="list-style-type: none"> Noise generated from running engine, hydraulic horns and construction activities Mechanical failure of machines/ lorries/other equipment 	3	2	6	<ul style="list-style-type: none"> Regular checking, servicing and maintenance of vehicle Periodic health checkup of lorry drivers and construction workers Maintaining traffic safety rules Maintain safe vehicle speed limit at the construction site. Proper traffic guidelines and regulations as per The Motor Vehicle Rules, 1984, should be ensured Switching off vehicles and machineries when not in use Using earmuffs to protect against loud noises (e.g. from hydraulic horns); if possible limit the usage of hydraulic horns during construction 	2	2	4
Gas pipelines and safety valves	Installation of gas pipelines (laying) and safety valves	Injury from falling pipes and debris	<ul style="list-style-type: none"> Faulty safety harness of lorries, cranes and pulleys Mechanical failures 	4	2	8	<ul style="list-style-type: none"> Arranging tool box meeting before going out for work Regular checking, servicing and maintenance of lorries, cranes and pulleys and their safety harness 	2	2	4

Hazard points	Project Activities	Potential hazard	Cause Analysis	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
			<ul style="list-style-type: none"> Lack of proper safety training Not abiding to HSE rules 				<ul style="list-style-type: none"> Regular health and safety training to all construction workers and lorry drivers, including the proper use of PPEs Putting up appropriate safety signs at construction site Recording of any unusual activities and issuance of fines or suspensions if any rules are broken Maintenance of an accident registry book. 			
Operation Phase										
<ul style="list-style-type: none"> Gas pipelines Valve station Pump station 	<ul style="list-style-type: none"> Gas leakage Thermal hazard Environmental hazard Mechanical hazard 	<ul style="list-style-type: none"> Asphyxiation Explosion Fire ball 	<ul style="list-style-type: none"> Faulty pipes Faulty connections Corrosion Induced stress Sabotage 	4	3	12	<ul style="list-style-type: none"> Arranging toolbox meeting before going out for work Inspection of the pipelines for leakage, corrosion etc. before installation Making sure the connections are made properly at each junction Covering the pipes with coatings/cathodic protection for corrosion protection Proper pipeline weighting to reduce buoyancy Periodic Inspection of pipelines for corrosion and leakage Setup of an automated monitoring system to monitor any changes to gas pressure at junctions/Metering stations Set up awareness programs to aware communities the dangers and hazards associated with gas transmission pipelines and motivating them to take an active part in prevention of any sabotage activities. Setup an on-site emergency response team to mobilize immediately to an emergency situation. This is to ensure minimum casualties. 	2	2	4
	<ul style="list-style-type: none"> Occupational activities Repair and Maintenance 	<ul style="list-style-type: none"> Occupational exposure to gas leaks and explosions Confined spaces Electrocution 	<ul style="list-style-type: none"> Lack of Health and Safety Training Not abiding to HSE rules Not wearing appropriate PPEs Faulty pipes Faulty safety harness and masks Faulty connections Corrosion Induced stress Sabotage 	4	3	12	<ul style="list-style-type: none"> Regular inspection and maintenance of equipments, machineries and vehicles. Raising awareness on occupational hazards and electric hazards. Arrange monthly health and safety training, electrical safety training and firefighting drills to all construction workers, including the proper use of PPEs during work. Training of traffic rules and regulation, including maintaining vehicle speed limit for different categories of road. In serious cases of injuries or sickness, an ambulance should be on standby for transporting them to nearby hospital. Work load should be managed effectively. Workers working every 2 hours should be given a mandatory 30 minutes break as stipulated in chapter 9 of Bangladesh Labour Rules, 2015. All other facilities (toilet, canteen, overtime hours, leaves etc.) should be followed as stipulated in Labour Rules, 2015 Equipments, machineries and electric wires should be checked for current and voltage ratings. When using an extension cable, its wire rating should match with the equipment wire rating. Ensure the proper cathodic protection on pipelines as per standard procedure to prevent rusting 	2	2	4

Hazard points	Project Activities	Potential hazard	Cause Analysis	Hazard Consequence (Before Safety Measures)	Hazard Frequency (Before Safety Measures)	Risk Ranking (Evaluation) (Before Safety Measures)	Suggested Safety measures (Risk Management Plan)	Hazard Consequence (After Safety Measures)	Hazard Frequency (After Safety Measures)	Risk Ranking (Evaluation) (After Safety Measures)
							<ul style="list-style-type: none">• Ensure proper connection of pipelines• Inspect pipelines for cracks and faults. Make prompt repairs if found.• Ensure regular communications with outside when entering underground.• Use proper safety precautions (e.g. PPEs, oxygen masks etc.) when working at confined spaces• Switch off power before doing any electrical maintenance work. Inform supervisor and respected machine operator before starting any electrical work. Inform them again after the electrical works are done.			

5.4.7 Emergency Response Plan

138. Emergency Response Plans are developed to address a range of plausible hazard scenarios that are unplanned and to emphasize the tasks required to respond to a physical event. The Emergency Response Plan for the proposed power plant and also associated gas pipeline has been developed listing various actions to be performed in a very short period of time in a predetermined sequence if it is to deal major and minor accidents effectively and efficiently. The primary objectives of the plan are:

- Providing clear lines of authority and communication during incident and crisis events
- Providing means by which trained people and resources are available to those managing the incident or crisis event
- Keeping the workplace safe and to achieve minimal incidents for health hazard; as well as keeping the impacts on the environment, materials, machineries and equipments from these unplanned events to a minimum.

139. Possible emergency events include:

- Fire and explosion;
- Immediate medical emergency due to injuries;
- Leakage of hazardous materials, such as, oil;
- Natural disaster; and
- Civil disturbance/terrorist activities

140. Emergency events are broken down to three level tiers; tier 1, 2 and 3. Tier 1 has the lowest threat level and Tier 3 has the highest threat level.

141. In the case of an emergency event, the Incident Response Team (IRT) at plant site would be mobilized with the Emergency Response Group (ERG) (Chaired by the Chief Engineer of NWPGL located at NWPGL head office in Uttara) coordinating and overseeing arrangements to ensure that the IRT meets its emergency management obligations. In the case of Tier 1 emergencies, the cases are escalated primarily to site specific IRTs only. Tier 2 involves ERG providing tactical response, support, assistance and advice to all incident and emergency situations at site/location and for providing operational response to any emergency situation which may occur in the affected (such as, fire, explosion, coal spillage and various social crisis). The Incident Management Team (IMT) (also located at NWPGL head office in Uttara) is activated in the case of Tier 3 incidents and responsible to define and control strategy for those incidents. The following table (**Table 5.14**) shows the emergency response escalation protocol for different levels of emergencies.

Table 5.14: Emergency Response Escalation Protocol

Impact/ Consequence	Health & Safety	Natural Environment	Reputation Government Community Media	Financial \$	Civil Unrest Hartals	Definition	Country Threat Level	Escalation ----->				Site specific IRT Members
								Operation Sites	Plant Manager	IRT	ERG Leader	
Tier 1	Minor injury – First Aid treatment.	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Incident reporting according to routine protocols.	Minimal impact to reputation.	Financial loss <\$50,000	Situation generally stable with some protests / Hartals against government	Incidents that are containable by the Operations' Site Incident Response Team (IRT)	Insignificant Low					Plant Manager other IRT members ERG - as required
Tier 2	Moderate injury- Medical Treatment, Lost Time injury	Impact on fauna, flora and/or habitat but no negative effects on ecosystem, may require immediate regulator notification.	Moderate to small impact on business reputation.	Financial loss >\$50,000	Security unrest appears to escalate to regular outburst - but authorities appear to be capable of maintaining control	Incidents that require Dhaka based ERG, governmental and regulatory support	Medium High	ERG	ERG Leader	Chief Engineer NWPGL activates Dhaka ERG	Inform Member- Generation	ERG Leader – Chief Engineer other ERG members ERG - activated for EHS / Security issues
Tier 3	Injury requiring ISOS activation. Permanent disabling injury and or long term off work and fatality.	Long term impact of regional significance on sensitive environmental features, likely to result in regulatory intervention/action	Significant impact on business reputation/ or international media exposure.	Financial loss greater than \$100,000.	Confirmed direct threat to foreign business interest or against expatriates Situation certain to escalate further beyond Government control	Incidents when there are multiple injuries or fatalities requiring IMT support and also international support, regulatory and public relations assistance.	High Extreme	IMT	IMT Leader activates IMT	Director Technical	Managing Director-NWPGCL IMT	IMT other IMT members IMT - activated

The Incident Response Team (IRT)

142. The Incident Response Team (IRT), based at plant location, is trained and responsible for dealing with all envisaged incidents and emergency situations which may occur at the location. Where additional support in the way of resources and advice may be required by the IRT at a remote location which will be requested through and provided by the Emergency Response Group (ERG) of Dhaka Office. On all occasions when an IRT is mobilized due to an incident or emergency situation, the ERG Manager must be notified immediately.

143. The IRT will be headed by the Plant OHSE Manager and will include senior staff from the Human Resources (HR), Health Safety Environment (HSE) and Logistics department within the plant.

The Emergency Response Group (ERG)

144. The Emergency Response Group (ERG) is based in the NWPGCL Head Office in Biddut Bhaban, Dhaka and will be chaired by the (Chief Engineer), who will also nominate an Emergency Response Coordinator to coordinate with representatives from various agencies and also senior staff from HR, Finance, HSE, Logistic, Security, IT, and public affairs department within NWPGCL. ERG will be responsible for providing tactical response, support, assistance and advice to all incident and emergency situations at site/location and will provide operational response to any emergency situation that may occur. The function of the ERG is to coordinate and oversee arrangements to ensure that the IRT meets its emergency management obligations. ERG should develop a plan, in consultation with the appointed OHSE Manager where it should describe how to handle both the "technical" crises e.g. fire, explosion, oil spill, and "social" crises e.g. illness, injury, kidnap, civil unrest. On all occasions that the ERG is mobilized due to an incident or emergency situation the Managing Director must be notified immediately.

The Incident Management Team (IMT)

145. The Incident Management Team (IMT) is the corporate body located in the NWPGCL headquarters in Biddut Bhaban, Dhaka, with the responsibility to define and control strategy for major incidents. A strategic response is defined as a situation arising from a single or multiple incidents or emergencies that escalate to a point beyond which significant damage to the Company's business could result in, including commercial and reputation damage, significant financial loss, shareholders' loss of confidence and damages resulting from litigation. When a potential strategic situation appears, the IMT will be mobilized to manage issues pertaining to the reputation and the continued commercial wellbeing of the Company. The IMT may however also be called upon to address some of the tactical roles that would normally be the responsibility of the ERG, for example, if the Dhaka Office were out of action or in the event of an evacuation from a country, which may equally limit the ERG's capability.

146. The IMT is chaired by the Managing Director of NWPGCL and includes high level representation from the Ministry of Power, Energy and Mineral Resources, Army, Police Department, Fire Department, District Commissioner's Office and the Disaster Management Bureau (DMB) of the Bangladesh Government.

5.4.8 Safety Training

147. In order to reduce the risks associated with accidents, internal and external threats, and natural disaster, a safety training program is essential for workers in plant operation and also associated gas pipeline. There should be regular training programs on safety for the workers to increase their awareness and also to reduce the risks. Provision of yearly professional training for health and safety, would enhance the effectiveness of safety. Safety training should be planned for the local people living around the project area so that they can be aware about the risk possessed by the project and can take appropriate preparedness (**Table 5.15**).

Table 5.15: Training schedule that may be adopted for safety

Target trainee	Training schedule
Worker	Four trainings per year
Professional	Two trainings per year
Local people	Two trainings per year
Drivers	Four trainings per year
Safety professional	Two trainings per year

148. In addition, there must be a discussion and awareness session for increasing awareness on safety in each and every kind of meeting. Tool box meeting and job safety analysis should be regularly practiced by the employee. Further details on the type of trainings to be provided will be discussed in the separate Emergency Response report.

5.4.9 OHS Training

149. The on-site OHSE Manager in conjunction with the (health and safety officer, environmental officer and relevant stakeholders/organization heads) will be responsible for the development of the OHS training plan. The (OHSE Manager) will be responsible for ensuring that the appropriate employees receive training required under the plan. The company's human resources representative will be responsible for ensuring that all employees receive introductory training on the OHS Management System.

5.4.10 Training Procedure

Task-Specific Training

150. A training program will need to be developed to ensure that employees are capable of accomplishing the tasks required to meet OHSE objectives and targets. The program will identify training topics, who should receive the training, when training should be given, and the training method. The program will also distinguish between training conducted to comply with OHS regulations and other trainings.

151. A training needs assessment for the employees should be made. The OHSE Manager will review past training and the nature of the employee's work. Based on this review, specific training requirements for each type of employee will be documented.

152. The OHSE Manager shall document the OHSE Training Program.

153. The training plan shall be implemented by the OHSE Manager. Upon completion of training by employees, the OHSE Manager shall make the Superintendent Engineer and Chief Engineer aware of the training completed. The OHSE Manager shall document the training completed form and Training Log.

154. Specific documentation pertaining to training received shall be maintained by the operational work areas for a minimum of two years, or as required by regulation.

155. Training effectiveness will be evaluated to ensure that the OHS Management System (MS) is being implemented effectively when changes are made to significant risks, objectives, targets or operational controls. Improvements to the training plan will be made accordingly.

General EMS Training

- All employees shall receive introductory training to make them aware of the OHS Management System.
- The human resources representative shall be responsible for coordinating the effort to assure that all new and existing employees have received suitable training.

5.4.11 Frequency of training

156. The training plan shall be updated whenever changes are made to the significant risks, objectives, targets, or operational controls. General OHS training shall be made available on a continual basis to ensure that new employees are made aware of the OHS MS.

Table 5.16: Draft OHSE Training Plan

Training Subject	Target Personnel
OHS Management System awareness	All staff members (including contractors)
Emergency response and management	IRT, ERG and IMT team
Handling, use & disposal of hazardous material	Workers with authorized access to hazardous material storage areas and required to use hazardous material during their works
Waste Management	All staff members
Defensive and Evasive training- Efficient & safe driving practices, including road & vehicle restrictions	Drivers & mobile plant operators
Actions to be taken in the event of major or minor pollution event at river/plant site	All staff
Use of flexible booms and surface skimmers in event of pollution event in water bodies	All crew members stationed at the Pollution Control Vessel
Pollution prevention: Best practice	All staffs
Health & Safety: Safe way to work & hazard awareness	All staff members
Health & Safety: Safe use of cranes and equipment	Operators of cranes & equipment
Front line leadership and project management training	Senior management of NWP GCL

Training Subject	Target Personnel
Health & Safety: Working at height	Crane operator
Health & Safety: Working near/on water	All staffs working on jetty strengthening and unloading coal from ship
Health & Safety: Use of PPE	All staff members
Emergency procedures and evacuation	All staffs
Fire fighting	All staffs
Health & Safety: Confined space entry	Designated workers
Health & Safety: Lifting and rigging	Crane operator and all riggers
Awareness raising on risks, prevention and available treatment of vector-borne diseases	All staffs
Cultural sensitivities of the local population	On induction of all non-local staff

5.4.12 Documenting and Reporting

157. Implementation status of the safety plans should be monitored and documented regularly. Monthly monitoring report should be prepared based on regular inspection and should be submitted to the Superintending Engineer of the Project. Any kind of incidents or even near misses should be documented and reported to the Superintending Engineer.

5.4.13 Occupational Health, Safety and Environment Team

158. There should be provision of Occupational Health, Safety and Environment Team with responsibility of implementation, inspection, documentation, and reporting of the safety plans. The team will also be responsible for implementing emergency plans under the Directorate of Environment, Health and Safety. The team should be a combination of multi-disciplinary professionals. The team composition could be as:

- Occupational Health, Safety and Environment Manager (Team Leader)
- Health and Safety Officer
- Environmental Officer
- Fire Safety Manager
- Chief Security Officer
- Security Officer
- Chief Medical Officer
- Medical Officer
- Rescue Officer

6.0 ANALYSIS OF ALTERNATIVES

159. Aside from economic, financial, safety and engineering factors, the potential environmental and social impacts have been carefully considered in selecting the best route for the gas distribution pipeline. Both the “no project” and “with project” options have been studied.

6.1 “No project” option

160. The “no project” option means that the area along the proposed alignment will remain the same as the current condition. However, the supply of natural gas for the Rupsha 800 MW Combined Cycle Power Plant (CCPP) will not be provided and NWPGL will be compelled to use HSD as the primary fuel when a better and more environment-friendly fuel can be used. A “no project” option will entail that the planned economic development and business opportunities within southwestern Bangladesh may not altogether happen due to lack of reliable power, and thus, will be an opportunity cost for GoB. **Table 6.1** presents a comparison of “with project” and “no project” options.

Table 6.1: Comparison of “with project” and “no project” options

Description	“With Project” Option	“No Project” Option
Supply of natural gas to the proposed 800 MW Rupsha CCPP	Provides a stable and reliable flow of natural gas for power generation	No additional power generation capacity
Economic development	More opportunities for southwestern part of Bangladesh as a result of reliable power supply	Minimal, if any, due to lack of reliable power supply
Potential impacts to ecologically-sensitive areas	No protected areas or national parks along the gas pipeline route. Associated potential impacts can be readily mitigated by adherence to applicable design standards and specifications, compliance to relevant regulations, and implementation of best practice engineering processes and procedures.	None
Potential impacts to terrestrial flora and fauna	Pipeline will be underground. The selected alignment will be along the easement of existing roads. The area is not known to host endangered or protected species of flora and fauna. No matured trees will be cleared.	None
Fugitive greenhouse gas (GHG) emissions	Pipeline design specifications and standards will ensure “no leak.” SCADA will monitor the operation of the pipeline at all	No GHG contribution

Description	“With Project” Option	“No Project” Option
	times.	
Disruption to local residents along the pipeline route	Potential impacts or disruption to daily activities will be minimal (i.e., temporary and short duration during construction/installation). Any disruption can be mitigated by proper construction planning and scheduling of activities.	None
Employment	Job opportunities will be created during project implementation.	None

6.2 “With project” options considered for the gas distribution pipeline routes

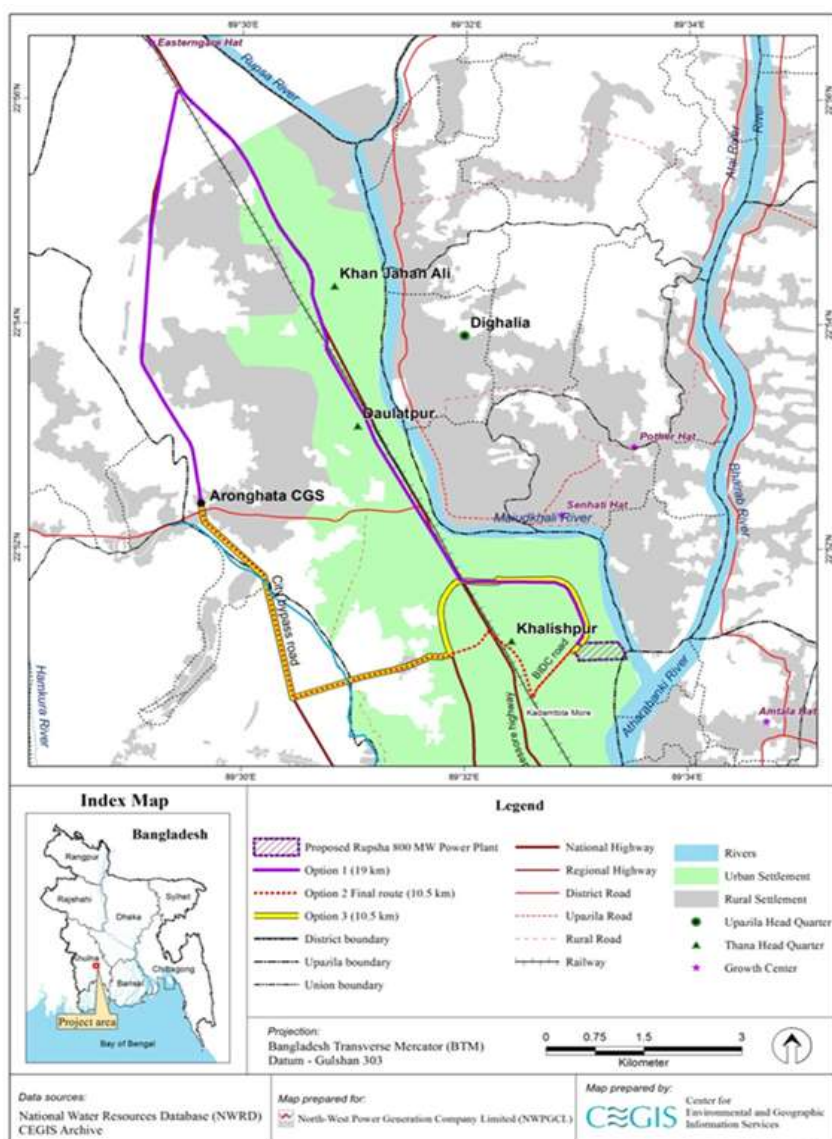
161. The required route will start from the existing Khulna City Gas Station (CGS) in Arongghata, Khulna until the proposed Rupsha 800 MW CCPP in Khalishpur, Khulna with offtake to the existing Khulna 225 MW CCPP in Goalpara. Three options have been carefully studied and these are given in **Table 6.2** and **Table 6.3**.

Table 6.2: Route options for the gas pipeline from Khulna CGS to Rupsha 800 MW CCPP

Description	Option 1	Option 2 (final option)	Option 3
Diameter of gas pipeline – 24 in			
Length, km	19.3	10	10
Number of bends	17	14	19
Number of structures to be disturbed	2,500	25	180
Major road crossing	5	3	3
Rail crossing	3	2	1
River crossing		2	

162. Based on the options given in **Table 6.2**, the best route will be Option 2 as this will incur the least disturbance to structures, road and railroad crossing, and number of bends along the pipeline. **Figure 6.1** presents the three route options considered.

Figure 6.1: Route options considered (24-in gas pipeline route)



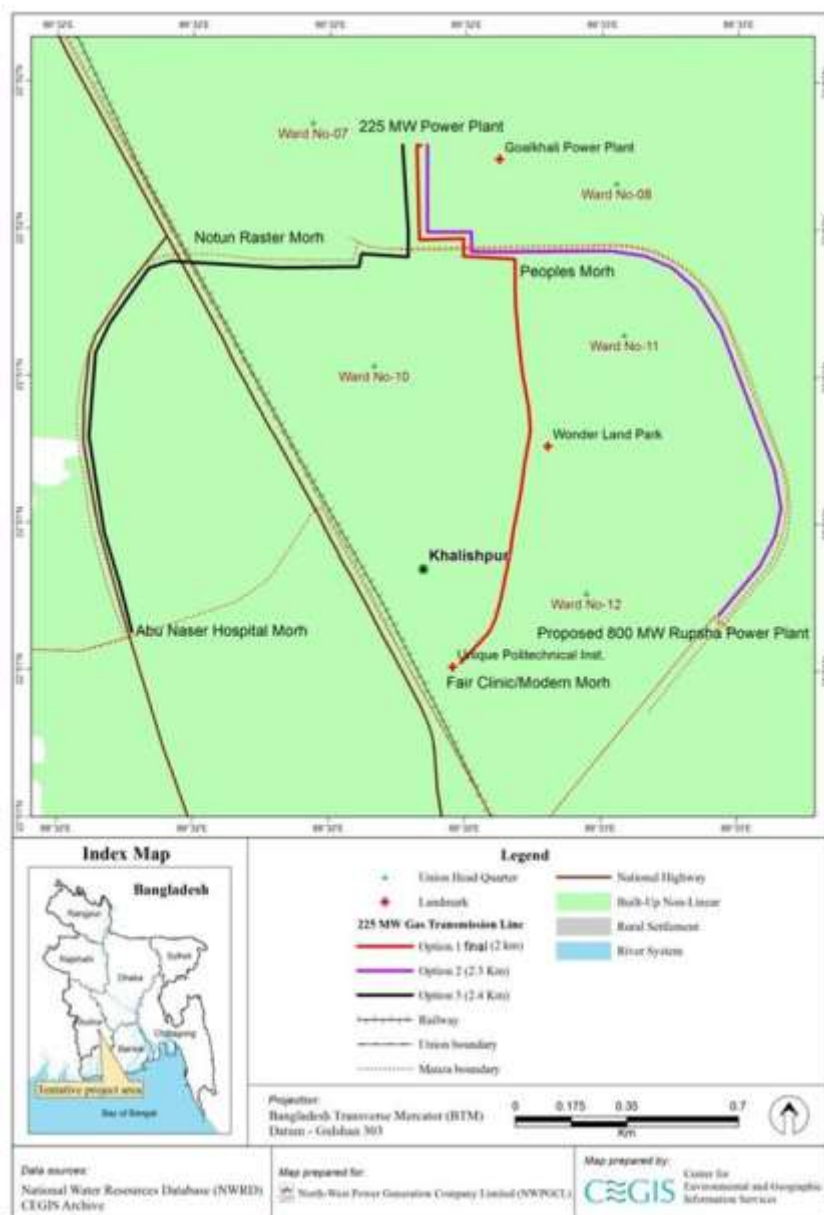
163. **Table 6.3** gives the options considered for the offtake gas pipeline route to the existing Khulna 225 MW CCPP while **Figure 6.2** shows the route options.

Table 6.3: Route options for the offtake gas pipeline to Khulna 225 MW CCP

Issues	Option 1 (final option)	Option 2	Option 3
Diameter of gas pipeline – 20 in			
Length, km	2	2.3	2.4
Number of bend	4	4	4
Number of structures to be disturbed	12	50	80
Major road crossing	2	0	1
Rail crossing	1	1	2

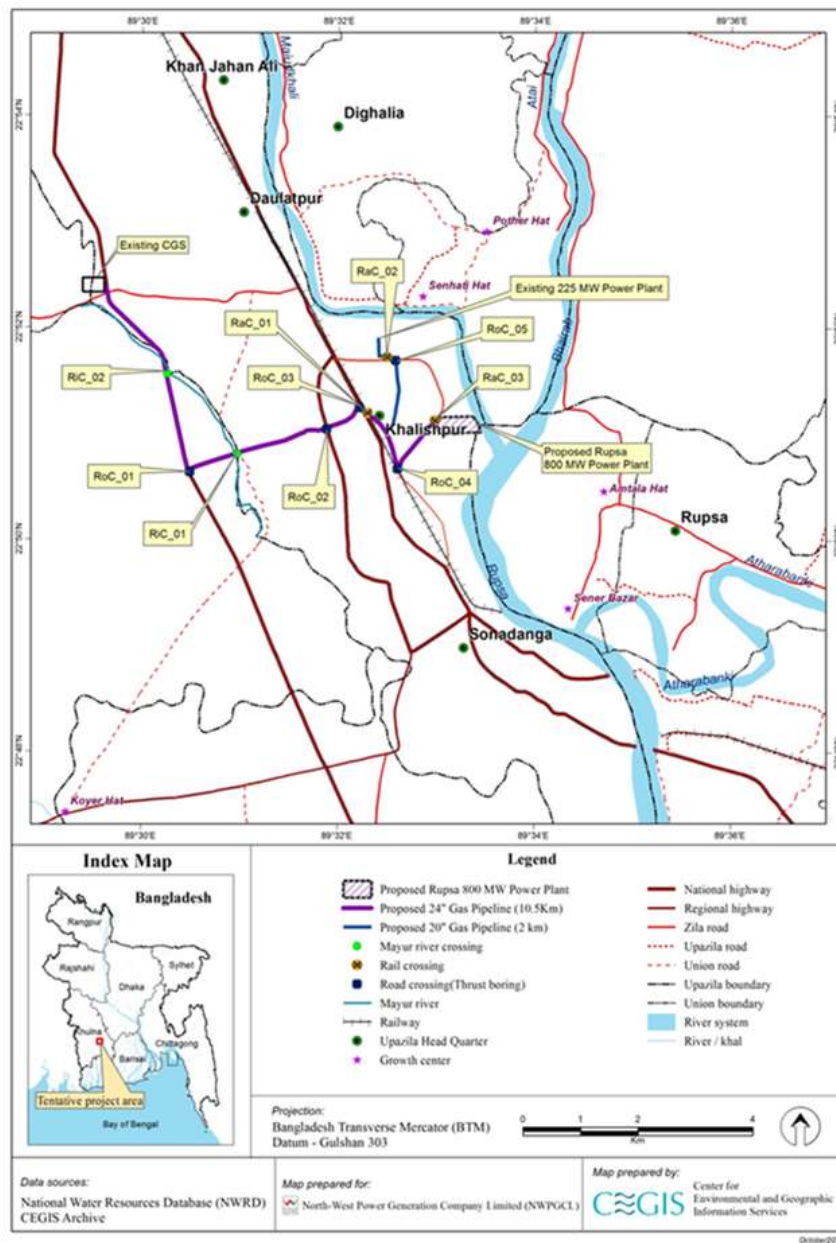
164. From the options considered, it shows that Option 1 is the best route as this will have the least disturbance.

Figure 6.2: Route options considered (20-in gas pipeline route)



165. From the options selected, Figure 6.3 shows the locations of the roads, rail, and river crossings.

Figure 6.3: Location of crossings



7.0 INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

7.1 Introduction

166. Consultations for Component 2 were conducted as part of the requirements of the DoE and ADB's SPS 2009. The main objective is to involve stakeholders throughout the project implementation and to know their concerns and perceptions about the project. Specific objectives of consultations include the following:

- a) To ensure peoples' participation in the proposed project;
- b) To inform key stakeholders about the project, its environmental implications within the project area, potential environmental impacts and mitigation measures, project benefits, and about the "cut-off date" for persons directly affected by the project;
- c) To determine the perceptions of the people about the project and share experiences of the participants on similar projects;
- d) To understand and create awareness of problems in the project area;
- e) To discuss and propose possible solutions to the problems identified;
- f) To describe the mechanism for handling potential grievance related to the project; and,
- g) To inform stakeholders on access to information about the project.

7.2 Approach and Methodology

167. Stakeholders were classified into primary and secondary stakeholders. These stakeholders are characterized as the following:

- a) Primary stakeholders

168. These are persons who will be along the right-of-way (RoW) of the pipeline route that may be directly affected during construction and operation phase. Primary stakeholders may be farmers, fishers, small business community, ambulant vendors as well as households to be displaced, women groups, and wage laborers.

- b) Secondary stakeholders

169. These are persons or organizations that will not be directly affected but may have interests that can contribute to the projector may affect decision-making in some areas. Secondary stakeholders may include relevant government agencies like Road Development Authority, Department of Environment, community-based organizations, NGOs, and other interested individuals or groups.

170. Component 2 will affect 37 structures along the pipeline route, will cross five roads, three railway points, and Mayur River in two locations.

171. Checklists were used to guide the consultations to ensure that the discussions are focused and relevant. A summary includes information about the project, proposed implementation schedule, and potential project impacts. Views and concerns of the participants were recorded and their questions were properly responded to by NWPGL and their consultants.

7.3 Consultations during the preparation of the EIA

172. A total of six consultation events were conducted from 12-14 June 2017 by the CEGIS, the consultant of NWPGL, and participated by 31 persons (see **Table 7.3**). These consultations were key informant interviews (KII) and informal interviews done in Arongghata, Ward No 9, and Ward No. 12 in the district of Khulna (see **Table 7.1** and **Figure 7.1**). In addition, final Public Consultation (workshop) including Public Disclosure was conducted on 21st October 2017, the details of which are attached in **Annex 2**. The meetings/discussions locations are presented in **Table 7.1** below:

Table 7.1: Location of consultations

District	Thana	Municipality/ Union	Type of Consultation	Venue	Date
Khulna	Daulatpur	Arongghata	KII	Arongghata Bypass	12/6/2017
	Khalishpur	Ward No. 9	KII	Beside Abu Naser Hospital	12/6/2017
	Khalishpur		KII	Refugee Colony road	13/6/2017
	Khalishpur	Ward No. 12	KII	BL College road	13/6/2017
	Sonadanga	-	KII	SGCL Office, Khulna	12/6/2017
	Khalishpur	Ward No. 12	Informal interview	Lebutola Point	14/6/2017
Khulna	Khalishpur	13 no. ward, Khulna City Corporation	Workshop	IEB conference room, Khalishpur	21/10/2017

7.4 People's perceptions of the Project

173. During these consultations, CEGIS discussed the project to the participants including those persons that will be directly affected. Apparently, the people within the project area are aware of the project from other consultants who frequently visited the sites. The participants showed positive attitude and support towards the project. The RoW along the pipeline route is owned by the Government. The people in the project area are aware of the probable project impacts. During the consultation, local people identified some issues as follows:

- 1) Provision of relocation notice before the start of construction activities
- 2) Consider providing the affected persons with at least three months to move their structures prior to construction
- 3) In case NWPGL would consider compensating encroachers for their structures, they requested to make the compensation procedure easy and on time
- 4) They requested to avoid religious structures. If it is unavoidable, then NWPGL needs to renovate those structures properly and within a shortest possible time.
- 5) To take extra care in managing spoils disposal
- 6) Construction activities should be undertaken during the dry season
- 7) Construction activities for road and rail crossing should be done within very short time and renovate it immediately to minimize local disturbance and reduce inconvenience to local people.

- 8) NWPGL to ensure that construction activities will not affect their daily life and livelihood.

174. The participants during consultations did not show negative attitude towards this project. A summary is given in **Table 7.2**. Participants are listed in **Table 7.3**.

Table 7.2: Summary of consultations

Issues Raised	Suggested Measures
<ul style="list-style-type: none"> • People will be in trouble if construction activities will start without any notice • Process for getting compensation is very complex • Accident risks to workers and children within the area • Crossing of gas pipeline to railway and roads may cause problems on transportation and communications during construction • Poor socioeconomic conditions of persons that may be affected • Construction activities during the monsoon season may cause inconvenience to affected people and road users • Poor spoils management may cause problems for the local people during construction 	<ul style="list-style-type: none"> • To inform affected people at least a month before construction • Provide guidelines for getting compensation to make it easier • Need contingency fund for affected neighboring people to address accidental issues during implementation period. • Provide clear and visible danger signs/posters to avoid accident at pipeline construction site. • Proper awareness program about accidents risks should be included for the neighboring people. • Construction activities on road and rail crossings should be done in the shortest possible time and renovation works done right after to minimize the inconveniences to the local residents. • Some informal settlers should be considered as vulnerable group. Compensation should be completed before the start of construction works. • Construction activities should be initiated and completed within the dry season. • Implement a good and effective spoils management system.

Table 7.3: List of the participants

No.	Name	Occupation	Address
1	Engr. AhsanulHaquePatoary	GM, SGCL	Sonadanga, Khulna
2	Engr. Moshir Rahman	NWPGCL official	Khalishpur, Khulna
3	AkramSarder Tulu	Agriculture	Bypass point, Khulna
4	Ishak Mollik	Agriculture	Bypass point, Khulna
5	Sheikh Bellal Hossain	Business	Bypass point, Khulna
6	Md. Roni Morol	Business	Arongghata
7	Md. Motlur Rahman	Business	Arongghata
8	Md. Azad Hossain	Business	Lebutola More
9	Ojifa Begum	Business	Lebutola More
10	Md. Jaber Ali	Business	Lebutola More
11	Monirul Islam	Business	Lebutola More

No.	Name	Occupation	Address
12	Rubel Hossain	Business	Goalkhali
13	Md. Kamal Sheikh	Business	Goalkhali
14	Hasina Begum	Business	Goalkhali
15	Md. Abdul Mannan	Business	Khalishpur
16	Md. Mujibur Rahman	Business	Khalishpur
17	Md. SamsulAlom	Business	Khalishpur
18	Md. Abdur Rashid	Business	Khalishpur
19	Md. Anowar Munshi	Business	Khalishpur (Kodomtola)
20	Md. Sattar Islam	Business	Khalishpur (Kodomtola)
21	Md. Rajon	Business	Khalishpur (Kodomtola)
22	Md. AbdurRohim	Business	Khalishpur (Kodomtola)
23	Nironjon	Business	Khalishpur (Kodomtola)
24	Md. Shorif	Business	Alomnagor
25	Md. Shekh Abdul Rashid	Business	Lebutola More
26	Md. Asadul	Business	Mohsin college gate
27	Md. Moinul Islam	Business	Khalishpurmeghamor
28	Md. Afsul	Business	Khalishpurmeghamor
29	Md. Idrish Ali	Business	Khalishpurmeghamor
30	Md. Salim Sheikh	Business	Khalishpurmeghamor
31	Md.Obydur Islam	Business	wonderland park

175. Consultations with stakeholders will continue during the implementation of Component 2, natural gas pipeline. A communication strategy plan will be prepared with the technical support of a Consultant. This will ensure that stakeholders are engaged, as and when needed.

176. A project summary will be posted in the website of NWPGL. In addition, a one-page flyer on project brief including details on grievance redress mechanism, and contact person in case of complaints and/or concerns will be prepared in Bangla and will be made available at the field office of PMU in Khaliaspur, Khulna and at the NWPGL office in Dhaka. More details on Component 2 will also be available from the EIA posted on the website of ADB.

Figure 7.1: Consultation sessions with stakeholders



KII with an owner of a structure that will be affected



KII with General Manager, Sundarban Gas Company Limited

8.0 GRIEVANCE REDRESS MECHANISM

8.1 Current system at NWPGCL

177. NWPGCL manages grievance and/or complaints through the Grievance Redress System (GRS) which is required by the GoB and part of the mandatory Annual Performance Agreement (APA). This agreement will be signed and renewed annually between NWPGCL and GoB.

178. GRS requires the NWPGCL to designate a staff as Focal Point whose name and contact details are disclosed at the website of NWPGCL. Compliance to the GRS is a Performance Indicator in the APA. NWPGCL has designated its Focal Point as required by GRS with the details disclosed in its website.

179. The GRS consists of specified roles, rules, and procedures for resolving complaints, grievances, disputes, or conflicts systematically. The objective is to provide an effective and objective way of lodging and resolving complaints on public service delivery.

8.2 Grievance system required by SPS 2009

180. A grievance redress mechanism (GRM) will be set up once ADB funding for Component 2 becomes effective. Similar to GRS, the GRM aims to provide stakeholders with a clear and simple way of filing a complaint on the environmental performance of Component 2. According to SPS 2009, the GRM will address complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to the affected persons at no costs and without retribution. Given these requirements, handling of potential complaints/grievance on the implementation of Component 2 will be as follows:

181. **Information disclosure.** NWPGCL will post signboards at the construction sites on the grievance mechanism including the details of the contact person who will take grievance. Details of the grievance mechanism together with the project brief will be posted in the website of NWPGCL.

182. **Procedure.** The GRM will provide three-tier entry points in grievance redress. Two grievance redress committees (GRCs) will be formed: (i) local grievance redress committee (LGRC); and (ii) project grievance redress committee (PGRC). Grievances considered minor such as increased dust level at the construction site and immediate vicinity can be resolved onsite at the LGRC level within 7 days from receipt of complaint. Other complaints not resolved at the LGRC level will be forwarded to PGRC which will take two weeks (or 14 days) to resolve. Meetings of the LGRC will be held onsite (PMU office) and members may do site visits to check or verify the issue. Complainants will be informed of the status of resolution.

183. **Composition.** NWPGCL will ensure the representation of women in the members of the GRCs.

- (a) **LGRC** – members will include (i) Deputy Manager/Executive Engineer (Environment) of PMU, (ii) Ward member, (iii) community representative, (iv) representative of women affected persons, and (v) EPC Contractor representative
- (b) **PGRC** – members will include (i) Project Director(PD), NWPGCL as the Chairperson, (ii) Environment staff of Project Management and Construction

(PMC) consultant, and (iii) representative of civil society nominated by PD with the help of PMC.

184. **Responsibilities.** GRCs will be expected to: (i) resolve grievances filed in writing or by phone to any member of the PMU, (ii) convene at least once a month to review grievances lodged (if any), (iii) record the grievances and resolve the issues within 15 days or a maximum of 30 days from the date the grievance was filed, and (iv) report to the complainant(s) the status of grievance resolution and the decisions made.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

185. The environmental management plan (EMP) covers measures that will be conducted in every phase of implementing Component 2 to ensure that adverse impacts are minimized and positive impacts enhanced. Aside from the mitigation measures, the EMP also includes the required monitoring and implementation arrangements with cost estimates.

9.1 Implementation Arrangements

186. NWPGCL has a total of six staff on environmental, chemical and safety managing the environment, health, and safety (EHS) concerns related to their operations. According to the Annual Report 2015-2016 of NWPGCL, additional eight staff will be recruited to enhance the technical capacity on EHS.

187. For the Rupsha 800 MW CCPP, NWPGCL will set up a PMU who will be responsible for project management and safeguards compliance monitoring of the EPC contractor during the construction stage. Component 2 will be managed and supervised also by the PMU. NWPGCL will require the EPC Contractor to recruit an environmental staff (or a Consultant) who will be primarily responsible for ensuring that the EMP is properly implemented during construction. This requirement for the EPC Contractor will be included in the Bidding documents. The Environmental staff (or consultant) of the EPC Contractor will coordinate and liaise with the PMU (NWPGCL) on compliance to ADB requirements, relevant government agencies and local authorities on clearances (as needed), and will prepare the environment section of the Project's Quarterly Progress Report (QPR) submitted by the EPC Contractor to the PMU. The environment section in the Project's QPR will be summarized by the PMU Environmental staff and submitted to ADB during construction phase as semi-annual environmental monitoring reports to ADB (see **Annex 4** for the format of environmental monitoring report). The semi-annual environmental monitoring reports are posted on ADB's website as required by SPS 2009 and PCP 2011. NWPGCL will submit the environmental monitoring reports starting from the date the loan becomes effective.

188. Should there be any change in the route of the gas distribution pipeline, length, and diameter of the pipe, or design of the gas distribution pipeline system, this EIA will be revised and/or updated and submitted to ADB prior to any construction works. The PMU Environmental staff together with NWPGCL Environmental staff will revise or update the EIA and submit to ADB for review. The revised and/or updated EIA of Component 2 will be re-posted on the ADB website to comply with the disclosure requirements of SPS 2009 and PCP 2011.

189. Before the start of any construction work, the PMU will inform the EPC Contractor on their responsibility to comply with the EMP and the requirements of DoE and ADB. The specific responsibilities of the EPC Contractor on the implementation and compliance to the EMP, environmental monitoring, and submission of environmental compliance status during the construction phase will be monitored by the PMU and the NWPGCL Corporate Environment staff (or Consultant).

190. During the operation phase, PMU will assign a staff (or Consultant) who will be responsible to handle the associated environmental issues and compliance to DoE and ADB's environmental requirements. Submission of environmental monitoring reports by NWPGCL to ADB during the operation phase will be annually. These environmental monitoring reports will be reviewed by ADB and will post them into their website as required by SPS 2009 and PCP 2011.

191. In case of non-compliance to any environmental covenant in the loan agreements, NWPGL will prepare a corrective action plan (CAP) describing the process and the time-bound actions that will be undertaken to ensure compliance. The CAP will be submitted to ADB for review and disclosure to ADB's website.

9.2 Mitigation Plan

192. **Table 9.1** presents the mitigation plan for various resources that may be affected by the implementation of Component 2.

Table 9.1: Mitigation Plan

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
Pre-Construction Phase					
Socio-economic Condition					
Employment	Temporary loss for small-scale business due to alignment of gas distribution pipeline.	Compensation to affected persons based on the requirements of GoB and ADB.	Cost included in the Resettlement Plan of Component 2.	PMU (NWPGCL)	GoB, NWPGCL (Corporate Office), ADB
Construction Phase					
Physical Environment					
Noise	Potential increase in ambient noise level due to construction activities, use of heavy equipment, and construction vehicles.	Noise-generating construction activities will be done only during daytime.	No cost involved	EPC Contractor	PMU
		Ambient noise limits set by Noise Pollution Control Rule 2006 will be complied.			
		Driving speed of construction vehicles will be monitored Unnecessary use of noise generating equipment and device such as whistle, megaphones, etc. will be avoided.	No cost involved		
		Noise-generating construction activities will be stopped during school hours, madrasa, and prayer time at mosque.	No cost involved		
		Noise-generating activities will be enclosed.	Included in project cost		
		Orientation, labor training and awareness building will be undertaken at the construction site to ensure that workers understand	5.0		

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
		compliance to environmental requirements of DoE and ADB.			
		A Construction Management Plan which includes a traffic management plan will be required from the EPC Contractor and approved by PMU.	3.0		
Air quality	Potential increase in dust level and vehicular emissions that may affect ambient air quality.	Temporary fencing and enclosures will be installed.	3.0	EPC Contractor	PMU
		Regular spraying of water to dust generating and opened areas.	1.5		
		Vehicles transporting dust-generating materials will be covered.	0.5		
		Road easement excavated will be covered with tarpaulin.	1.5		
		Stockyard will be covered properly during non-working period.			
Water Resources					
Creeks and small streams including Mayur River	Potential for congestion due to poor management of spoils during earth moving works Water may become turbid due to erosion of soil excavated.	To the extent possible, construction works will be schedule during the dry season.	No cost involved	EPC Contractor	PMU
		Backfilling of the trenches after the laying of the gas distribution pipeline will be conducted properly in the shortest possible time. Good housekeeping will be implemented at all times in construction sites. River banks will be stabilized as soon as it is ready.	Included in the project cost		
Agricultural Resources					
Agricultural land along the gas distribution pipeline route	Agricultural production and related impact on crop.	Agricultural land was avoided in the selection of the pipeline route. Excavated soils materials will be	No cost involved	EPC Contractor	PMU

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
		properly stacked for backfilling the trenches. Loose soil will be compacted to minimize erosion. Good housekeeping will be enforced at all times in the construction sites. Proper garbage bins will be provided at designated areas.			
Fisheries Resources					
Fish Production	Potential fragmentation and loss of fish pond Potential degradation of quality fish pond	Construction of temporary bamboo fencing between trench and gher area to avoid disturbance of fish culture.	1.0 (bamboo fencing including labour cost)	EPC Contractor	PMU
		To the extent possible, construction works will be done during dry season (i.e. November to April because Golda is not cultured during this period)	No cost involved	EPC Contractor	PMU
		The excavated earth should be backfilled after laying the pipe properly.	No cost involved	EPC Contractor	PMU
		Gher owner will be compensated properly and timely for standing crops (fish) as per the cost estimation in RP.	Cost estimates included in RP	PMU, NWPGCL (Environment Unit)	NWPGCL (Corporate Unit) and ADB
Ecological Resources					
Terrestrial vegetation	Vegetation clearing of privately-owned trees/vegetation along the pipeline route	Use barren or fallow land for storing materials and vehicle maneuvering area. Compensation will be provided to tree owners.	Compensation budget is included to RAP	NWPGCL (Environment Unit)	NWPGCL (Corporate Unit) and ADB

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
	Clearing of vegetation owned by Roads Authority along the road affected by the pipeline route.	Replanting of trees at designated areas identified in consultation with the DoE and Roads Authority.	4.0	NWPGCL (Environment Unit), PMU	NWPGCL (Corporate Unit)
Socio-economic Condition					
Traffic condition/mobility	Potential traffic congestion adjacent to the route of Component 2 as some portion will use the existing road easement.	Alternative arrangement to be implemented using Steele plate if required during construction works.	1.0 (for establishing temporary road)	EPC Contractor	PMU
		Clear and visible traffic and warning signs will be installed at the construction sites considering children, women, elderly and persons with disability.	1.0		
		Installation of temporary road crossings for children, women, elderly, and persons with disability disabled.			
		Traffic Management Plan will be prepared by the EPC Contractor and approved by the PMU.	1.0		
		HDD will be used at road, railway, and river crossings to ensure short duration disturbances and minimize traffic congestion.	Include in the Project Cost		
		Traffic enforcers will be assigned based on the Traffic Management Plan to avoid traffic congestion and inconvenience to local residents.	1.5		
Community safety	Risks of accident	Provision of contingency fund to address safety risks to affected neighboring people.	3.0	EPC Contractor	PMU
		Provision of appropriate safety and warning signs along the pipeline construction sites.	0.5		

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
		Conduct orientation and awareness program on safety and emergency preparedness to local residents along the pipeline route.			
Employment	Creation of employment opportunities.	Local skilled labor will be given preference and local unskilled labor will be given priority for construction works. To target at least 30% local labor recruitment.	NA	EPC Contractor	PMU
Operation Phase					
Physical Environment					
Surface water and groundwater quality.	Potential deterioration of water quality due to improper disposal of wastewater from pigging operations.	Personnel who will undertake pigging will have the required license and experience to do the work. Wastewater from pigging operations will be disposed of properly following the relevant water quality standards in ECR 1997. Disposal Plan should be developed after pigging operation. Pigging materials should be treated to meet the GoB requirement.	Included in the project cost.	Pigging Contractor (SGCL)	PMU
Occupational and public safety	Risks of fire and explosion due to gas leaks along the pipeline.	Pipeline will be designed and constructed following the Bangladesh Natural Gas Safety Rules 1991, ASTM, ASME and other international standards. SCADA will monitor the pipeline operations 24 hrs every day to detect any leaks. Valves will automatically	Included in the project cost.	SGCL	PMU in coordination with the Disaster Management Unit of GOB.

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
		<p>shut off in case of leak.</p> <p>Clear and visible signs and danger warnings will be provided along the pipeline route.</p> <p>Appropriate and standard markers for gas distribution system will be installed.</p>			
Terrestrial vegetation	Risk of damage of the saplings due to different causes.	<p>Regular monitoring the saplings.</p> <p>Re-plantation of the damaged saplings.</p>	1	SGCL / FD / RHD	PMU
Noise	Noise will be generated at the RMS point.	Appropriate like noise barrier to be installed to reduce noise level.	0.5	SGCL	PMU
Decommissioning Phase/Site Closure					
Wastes	Generation of wastes from decommissioning activities such as construction debris, waste materials, used equipment & temporary structures.	<p>Develop a detail decommissioning plan by the proponent.</p> <p>All of the demolished materials, sewage and other hazardous waste to be disposed as per ECR, 1997 and IFC standard as appropriate.</p> <p>Stabilization of all project sites.</p> <p>Spoil heaps will be stabilized and re-vegetated.</p> <p>Care will be taken to ensure all the sites are properly restored and effectively reestablished.</p> <p>During site closure, GoB and ADB Guidelines will be followed.</p>	5.0	Contractor (SGCL)	PMU

Environmental Component	Environmental Impacts	Mitigation Measures	Cost (Lac Tk.)	Institutional Responsibilities	
				Implementation	Supervision
Socio-economic Condition					
Occupational and public safety	Risks of accident	Develop a detail decommissioning plan by the proponent. Contingency fund will be provided to cover the cost in the event of accident.	2.0	Contractor (SGCL)	PMU
Total EMP cost			36.0		

9.3 Monitoring Plan

193. The following **Table 9.2** present the different monitoring plans that will be implemented during construction and operation phase. Results from the implementation of these plans will be included in the environmental monitoring reports to be submitted to ADB.

Table 9.2: Monitoring Plan and related Tentative Cost

Indicator	Locations	Frequency	Monitoring Agency	Monitoring Responsibility	Monitoring Cost (in BDT Lakh)
Construction Phase					
Air Quality	Along the gas distribution line	Queerly (8 hrs in three sensitive locations)	EPC Contractor	PMU	3.0
Noise level	Along the gas distribution line and near the important institutions like schools, community hospitals, mosques, etc.	Weekly	EPC Contractor	PMU	1.0
Traffic Congestion	Toiyobnagar Mor, Notun Bazaar-Boyra Bazaar Mor, Khulna-Jessore Highway and BIDD Road.	Daily (Observation)	EPC Contractor	PMU	0.5
Soil Quality Nitrogen (N), Phosphorous (P), Potassium (K), Iron (Fe), lead (Pb), Mercury (Hg), Cupper (Cu)	Selected sites along the pipeline route (e.g., near agricultural land), valves and metering stations.	Once in two locations	EPC Contractor	PMU	0.3
Fish Production of the fish pond/gher	Along pipeline route where gher has been crossed.	Quarterly consultation with the fish farmer.	EPC Contractor	PMU	0.5
Cut off trees and Plantation	Along pipeline route	As needed during clearing.	EPC Contractor	PMU	0.5
Safety and health condition of workers, project personnel and surrounding people	Along pipeline route	Weekly	EPC Contractor	NWPGCL (Corporate Unit)	1.0
Overall sanitation and drinking water	Along pipeline route	Weekly	EPC Contractor	NWPGCL (Corporate Unit)	0.5

Indicator	Locations	Frequency	Monitoring Agency	Monitoring Responsibility	Monitoring Cost (in BDT Lakh)
facilities					
Operation Phase					
Noise	Receptors like settlements, schools, mosques, and community hospitals near or adjacent to valves and RMS	Once a month	SGCL	PMU	Project Cost
Vegetation growth	Gas pipelines alignment	Half yearly (5 years)	SGCL	PMU	Project Cost
Occupational and public safety	Along pipeline route	Quarterly	SGCL	NWPGCL (Corporate Unit)	Project Cost
Total Monitoring Cost					7.3

10.0 CONCLUSION AND RECOMMENDATION

194. Component 2 is an integral part of Rupsha 800 MW CCPP which will address one of the recommendations of the Power System Master Plan 2016 to diversity the use of fuel for power generation. Implementation of Component 2 will enhance the power generation capacity of Bangladesh to address the growing demand for electricity.

195. Component 2 is the gas distribution pipeline route system consisting of about 10 km, 24" diameter pipeline and 2 km, 20" diameter pipeline from the existing Khulna CGS in Arongghata to Rupsha 800 MW CCPP and branch off from the 24" diameter pipeline to the existing Khulna 225 MW CCPP.

196. The EIA for Component 2 was prepared following the requirements of the DoE and ADB. The pipeline route will cause five road crossings, three railway crossings and two river crossings along Mayur River. HDD will be used in installing the pipeline in these crossings to minimize environmental impacts and disturbance to local people. Other potential environmental impacts during construction include increased level of noise and dusts, generation of waste from construction works, clearing of 370 trees, disturbance to local traffic at road and railway crossings, occupational and public safety risks. These temporary and of short duration impacts can be easily mitigated. Mitigation measures for these impacts are included in the EMP and the parameters for monitoring have been identified in the environmental monitoring plan. Component 2 will be designed, constructed, supervised by technical consultants, and operated by experienced engineers, technical staff, and natural gas consultants.

197. Stakeholders were consulted during the preparation of the EIA in June and October 2017. People within the pipeline route generally supported the implementation of Component 2 in anticipation of employment opportunities but concerned about the process of compensation. A GRM will be set up by PMU consistent with the requirements of GoB and ADB. A project brief in English and in Bangla with details on the GRM will be made available at the NWPGL office in Khulna and in Dhaka. Consultations will continue in varying degrees throughout the project's lifecycle. Awareness and information campaign on safety of living near gas pipeline systems will be conducted by NWPGL in consultation to the public.

198. This draft EIA will be disclosed at the ADB website in accordance with SPS 2009 and PCP 2011. Prior to construction works all the relevant permits required for Component 2 will be obtained by NWPGL.

Annex 1

ToR of EIA for Component 2 Approved by DoE

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Sher-e-Bangla Nagar, Dhaka-1207
www.doe.gov.bd

Memo No: DoE/Clearance/5668/2016/ 477

Date: 03/11/2016

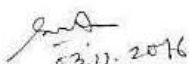
Subject: Exemption from Initial Environmental Examination (IEE) and Approval of Terms of Reference (ToR) for Environmental Impact Assessment (EIA) in favor of Construction of Gas Transmission Pipelines under Proposed Khulna LNG Based 750-850 MW Combined Cycle Power Plant Project at Khalishpur, Khulna .

Ref : Your application on 08.09.2016.

With reference to your letter dated 08.09.2016 for the subject mentioned above, the Department of Environment hereby gives exemption from IEE and approval of ToR for Environmental Impact Assessment (EIA) in favour of Construction of Gas Transmission Pipelines under Proposed Khulna LNG Based 750-850 MW Combined Cycle Power Plant at Khalishpur, Khulna subject to fulfilling the following terms and conditions.

- I. The Project Authority shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of the said Project in accordance with the TOR submitted to the DOE and additional suggestions provided herein.
- II. The EIA report should be prepared in accordance with following indicative outlines:
 - A. Executive summary
 - B. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
 - C. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)
 - D. The Project (Location detail and concise description of the project/interventions and relevant activities)
 - E. Baseline Environmental Condition should include, inter alia, following:
 - Physical Environment: Geology, Topology, Geomorphology, Soils, Meteorology, Hydrology, Seabed Morphology and Seismic activity
 - Biological Environment: Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora & Fauna
 - Environment Quality: Air, Water, Soil and Sediment Quality and Noise
 - F. Socio-economic environment should include, inter alia, following:
 - Population: Demographic profile and ethnic composition
 - Settlement and housing
 - Traffic and transport
 - Public utilities: water supply, sanitation and solid waste
 - Economy and employment: employment structure and cultural issues in employment
 - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors

- G. Identification and Evaluation of Potential Impacts (identification and assessment positive and negative impacts likely to result from the proposed project)
 - H. Management Plan/Procedures:
For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures and those which are immitigable, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures.
An outline of the Environmental Management Plan shall be developed for the project.
In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).
 - I. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
 - J. Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
 - K. Conclusion and Recommendations
- III. Without approval of EIA report by the Department of Environment, The Project Authority shall not be able to open L/C in favor of importable machineries.
 - IV. Without obtaining Environmental Clearance, The Project Authority shall not start operation of the project.
 - V. The The project authority shall submit the EIA report along with the filled-in application for Environmental Clearance in prescribed form, the feasibility study report, the applicable Environmental Clearance fee in a treasury chalan, the applicable 15% VAT on clearance fee in a separate treasury chalan, the No Objection Certificate (NOC) from local authority, NOC from Forest Department (if it is required in case of cutting any forested plant, private or public) and NOC from other relevant agencies for operational activity etc. to the Khulna Divisional Office of DOE in Khulna with a copy to the Head Office of DOE in Dhaka.


 03.11.2016
 (Syed Nazmul Ahsan)
 Director (Environmental Clearance, c.c)
 Phone # 02-8181673

Project Director

Khulna LNG Based 750-850 MW
 Combined Cycle Power Plant Construction Project
 North-West Power Generation Company Ltd.
 Bidyut Bhaban (Level-14)
 1, Abdul Gani Road, Dhaka-1000.

Copy Forwarded to :

- 1) Private Secretary to the Hon'ble Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
- 2) Director, Department of Environment, Khulna Divisional Office, Khulna.
- 3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Annex 2

Public Disclosure Meeting

Introduction

The Center for Environmental and Geographic Information Services (CEGIS) organized a public disclosure meeting on behalf of Northwest Power Generation Company Limited (NWPGL), for exposure of the proposed “Rupsha 800MW combined cycle power plant Project” at the conference room of Khulna Engineers Institute at Khalishpur, Khulna on 21 October 2017.

Objectives

The overall objective of the consultation was to explore the peoples’ perception and attitudes towards the proposed project and to provide informations regarding the findings of EIA study. The specific objectives were to:

- Aware the local people about the proposed project;
- Sharing the information to the participants about EIA and RP findings;
- Explore the problems of the study area;
- Share experiences of the participants over the years;
- Unveil the potential negative or positive impacts of the proposed project;
- Outline potential mitigation measures for negative impacts and enhancement measures for the positive impacts; and
- Ensure the peoples’ participation in the proposed project.

Approaches of the Public Disclosure Meeting

The main purpose of the PDM was to disclose the findings of EIA and RP study to the key stakeholders and take suggestions/opinions from them. To serve that purpose it was mandatory to gather key stakeholders at a certain venue.

Identification of Stakeholders

Stakeholders included all those who would affect and/or would be affected by policies, decisions or actions within a particular system. Stakeholders included groups of people, organizations, institutions and sometimes-even individuals. Stakeholders can be divided into primary and secondary stakeholder categories.

Primary Stakeholders

Primary stakeholders are people who would be directly benefited or impacted by a certain project intervention. In case of the proposed project, the primary stakeholders include the people whose land will be affected and who are living within the project area.

Secondary Stakeholders

This category of secondary stakeholders pertains to those who may not be directly impacted but have interest to contribute in the study, play a role in implementation at some stage, or decision making on project aspects. In this project, secondary stakeholders include PDB, Local Government Institutions (LGIs), local public representatives, other relevant government agencies, academia, journalists, NGOs and general public at large.

Time, Date and Venue Selection

Venue, date and time of meeting was selected in consultation with the local administration, local government, local people, the project proponent and the consultant. The local people and local government selected an agreed venue e.g. Khulna Engineers Institute at Khalishpur, having easy accessibility and which is likely to be neutral. Date and time was also finalized in the similar way considering availability of the participants, ensuring the maximum participation and compliance with the other arrangement.

Enlisting and Invitation

A comprehensive list of potential stakeholders was prepared through the consultation. This list was intended to cover all sorts of interest groups, occupational groups, socially acceptable and knowledgeable peoples.

Table A.1: Invitation list of consultation meetings

SL. NO	Organization/Persons	No. of invitations
1.	Representative of Government Institutions (DC, DoE, Forest etc.)	21
2.	Representatives Khulna City Corporation	03
3.	Academia/School (Teacher, Managing committee and Students)	07
4.	Project proponent	05
5.	Representative of NGOs	02
6.	Representative of Journalists	03
7.	Representative of Fisherman community	05
8.	Representative of Affected parsons of Gas Transmission line	03
9.	Representative of Affected parsons of Overhead Transmission line	03
10.	Political leader	03
11.	Local elite persons	15
Total		70

To make the meeting successful and to ensure maximum participation, an advertisement was published in the local daily newspaper.



Consultation Instrument

Checklist: A comprehensive checklist and questionnaire covering all possible issues to be addressed was prepared through consultation with the multidisciplinary study team. This checklist was used in the meeting to unveil peoples' perception and opinion along with suggestions

Attendance list: An inventory of the participants was maintained in attendance sheet containing contact number. Camera: For visualizing the participants, photographs were taken using camera. These photos are presented in this chapter. Photos of the meeting participants are presented at the end of this chapter.

Consultation Participants

The main participants of the consultation meetings included public representative of Government Institutions, Khulna City Corporation, Academia/School representative, Project proponent, NGOs, Journalists, Fisherman community, Affected persons of Gas Transmission line, Affected persons of Overhead Transmission line, Political leader Local elite persons, of the nearby "Rupsha 800MW combined cycle power plant Project" areas. A total of 64 participants attended these consultations in which 52 is male and rest of female.

The stakeholders have right to know about the activities, pattern and impacts of the project. In doing so, a brief description on project was distributed to each participant:

নর্থওয়েস্ট পাওয়ার জেনারেশন কোম্পানী কর্তৃক অত্র এলাকায় গৃহীত খুলনা ৮০০ মেগাওয়াট গ্যাস ও তেল ভিত্তিক কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র এবং সংশ্লিষ্ট উপাদান সমূহের তথ্য, খুলনা

✓ সভার মূল উদ্দেশ্য

- আজকের সভার মূল উদ্দেশ্য হচ্ছে প্রস্তাবিত ২ X ৮০০ (৮০০) মেগাওয়াট গ্যাস ও তেল ভিত্তিক বিদ্যুৎ প্রকল্প ও অত্র প্রকল্প সংশ্লিষ্ট উপাদান সমূহ স্থাপিত হলে প্রকল্প সংলগ্ন এলাকায় কী ধরনের পরিবেশগত ও আর্থ-সামাজিক প্রভাব পড়তে পারে এ সম্বন্ধে এলাকার জনগোষ্ঠীর মতামত গ্রহণ করা।
- একই সাথে প্রকল্প নকশা ও নির্মাণ পর্যায়ে জনগণের প্রতিক্রিয়া নেওয়া যাতে প্রকল্প বাস্তবায়নে তাদের আকাঙ্ক্ষার প্রতিফলন ঘটে।

✓ প্রস্তাবিত প্রকল্প ও সংশ্লিষ্ট বিষয়াদি

- বাংলাদেশ সরকার ক্রমবর্ধমান বিদ্যুতের চাহিদা পূরণের লক্ষ্যে একটি মহাপরিকল্পনা, *Power System Master Plan* গণ্যন করে, যার মূল প্রতিপাদ্য বিষয় হচ্ছে:

- জ্বালানীর বহুমুখীকরণ যেমন: গ্যাস, এলএনজি, কয়লা, এইচএসডি, ফার্বেস অয়েল নবায়নযোগ্য জ্বালানি ইত্যাদি।
- জ্বালানীর উৎস সনাক্তকরণ ও এর সর্বোত্তম ব্যবহার নিশ্চিত করণ।
- জ্বালানী উৎসের ও সরবরাহের সুবিধাদির ভিত্তিতে বিদ্যুৎ প্রকল্প নির্মাণের স্থান নির্ধারণ।
- বিদ্যুতের ক্রমবর্ধমান চাহিদার উপর ভিত্তি করে উৎপাদন ক্ষমতা বৃদ্ধি করা, যা জাতীয় বিদ্যুৎ গ্রীডের মাধ্যমে নিরবিচ্ছিন্নভাবে বিদ্যুৎ সরবরাহ করতে পারবে।

- রূপকল্প-২০২১ অনুযায়ী 'পাওয়ার সিস্টেম মাস্টার প্লান, '২০১০ ও ২০১৬' এর আলোকে দেশের সর্বত্রের বিদ্যুৎ পৌঁছে দেয়ার লক্ষ্যে নর্থ-ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লি: (NWPGL) খুলনা জেলায় গ্যাস ও তেল ভিত্তিক বিদ্যুৎ প্রকল্প নির্মাণ করে ১০০০ মেগাওয়াটের অধিক বিদ্যুৎ উৎপাদনের লক্ষ্য নির্ধারণ করেছে।

✓ পরিবেশগত ও আর্থ-সামাজিক প্রভাব বিশ্লেষণ সংক্রান্ত তথ্য সংগ্রহ ও প্রয়োজনীয় পরীক্ষানিরীক্ষা

- *CEGIS* এই প্রকল্পটির পরিবেশগত ও আর্থ-সামাজিক প্রভাব বিশ্লেষণে দায়িত্বপ্রাপ্ত হয়ে বিভিন্ন পর্যায়ে এলাকার জনগণের সাথে এই বিষয়ে আলোচনা করে পরিবেশ ও আর্থ-সামাজিক প্রেক্ষাপটের বর্তমান অবস্থা বিশ্লেষণ করার চেষ্টা করেছে এবং পর্যবেক্ষণ করার জন্য সংশ্লিষ্ট অফিসগুলো থেকেও তথ্য সংগ্রহ করে, যেমন:

- কৃষি অফিস থেকে ফসল, ফসলী জমি ও সেচ সংক্রান্ত তথ্য।
- মৎস্য অফিস থেকে মাছ ও মাছের আধার সংক্রান্ত তথ্য।
- ইউনিয়ন পরিষদ থেকে সামাজিক ও অর্থনৈতিক বিষয়াদি সংক্রান্ত বিভিন্ন তথ্য।
- বিভিন্ন প্রকার শিল্প থেকে নির্গত দূষণ সম্পর্কিত তথ্য সংগ্রহ।

- প্রকল্প এলাকার বিভিন্ন বৈশিষ্ট্য সঠিকভাবে বিশ্লেষণ করার নিমিত্তে নিম্নলিখিত পরীক্ষা-নিরীক্ষা করা হয়:

- ভূ-তাত্ত্বিক জরিপ যার মাধ্যমে প্রকল্প এলাকার মাটি ও ভূ-গর্ভস্থ পানি সম্বন্ধে ধারণা পাওয়া।
- বন্যার পানির সর্বোচ্চ উচ্চতার বিষয়টি বিশ্লেষণ করে কতটুকু মাটি ভরাট করতে হবে তা জানা।
- পানির গুণাগুণ বোঝার জন্য ভূ-গর্ভস্থ ও ভূ-পরিষ্ক পানি পরীক্ষা-নিরীক্ষা করা হয়।
- বায়ুর দূষণ মাত্রা বোঝার জন্য বায়ু পরীক্ষা-নিরীক্ষা করা হয়।
- শব্দ দূষণ মাত্রা বোঝার জন্য শব্দ দূষণ যন্ত্র ব্যবহার করা এবং প্রাক্ট থেকে ৫০০ মি. চারপাশে শব্দ দূষণ পরিমাপক যন্ত্রের মাধ্যমে শব্দের তীব্রতা মাপা হয়।

- পরিবেশগত ও সামাজিক প্রভাব বিশ্লেষণের জন্য প্রাক্টকে কেন্দ্র করে চারপাশে ১০ কি.মি এলাকা পর্যবেক্ষণ করা হয়েছে।

✓ পরিবেশগত ও আর্থসামাজিক প্রভাব বিশ্লেষণ - প্রকল্প বাস্তবায়ন পরবর্তী অবস্থা বিশ্লেষণ (পরিবেশগত প্রভাব বিশ্লেষণ)

■ ৮০০ মেগাওয়াট গ্যাস ও তেল ডিভিকবিদ্যুৎ প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- বিভিন্ন সংবেদনশীল এলাকায় বায়ু দূষণের মাত্রা মাপা হয়েছে এবং বায়ু দূষণের ক্ষেত্রে ক্যান্সার মত রোগের মাধ্যমে CO₂, SO_x, NO_x বিশ্লেষণ করে দেখা গেছে উল্লিখিত দূষণের মাত্রা বাংলাদেশ ও আন্তর্জাতিক গ্রহনযোগ্য সীমার নীচে আছে।
- শব্দ দূষণের মাত্রা উল্লিখিত শব্দ দূষণ নিয়ন্ত্রন বিধি-২০০৬ এর গ্রহনযোগ্য সীমার নীচে থাকবে।
- মেশিন চালুকালে ডু-কম্পনের মাত্রা সহনশীল পর্যায়ে থাকবে।
- প্রকল্প চালু করার সময় কুদ্বিহ্ন টাওয়ার এর জন্য ভৈরব নদ থেকে একাধীন ৬০,০০০ ঘন মিটার পানি উত্তোলন করা হবে এবং পরবর্তীতে প্রকল্প চালু অবস্থায় ভৈরব নদ থেকে প্রতি ঘণ্টায় ২১০ ঘন মিটার পানি উত্তোলন করা হবে যা খুবই কম এবং চলমান নদী প্রবাহের মাত্র ০.১২%।
- ভূ-গর্ভস্থ পানিদূষণের মাত্রা বর্তমানে উল্লিখিত ইসিআর- ১৯৯৭ এর গ্রহনযোগ্য সীমার নীচে থাকবে।
- বিন্দুয়ৎ কেন্দ্র থেকে নির্গমিত সকল তরল পদার্থ পরিশোধিত করে গ্রহনযোগ্য সীমার মধ্যে রাখতে হবে নচেৎ পরিবেশ বিপন্ন হবে।
- কৃষিক্ষেত্রে পানির কোন সংকট হবে না এবং মাছ চাষের উপর কোন বিরূপ প্রভাব পড়বে না।
- ২১৫ টি গাছের উপর প্রভাব পড়বে যা আইউসিএন এর লাল তালিকা বহির্ভূত।

■ গ্যাস পাইপলাইন প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- উল্লিখিত গ্যাস পাইপলাইন প্রকল্প বাস্তবায়নের ফলে বায়ু দূষণ, শব্দ দূষণ, বর্জ্য দূষণ, পানি দূষণ অথবা সংশ্লিষ্ট এলাকায় পানির কোন অভাব দেখা দেবে না। এছাড়া উক্ত প্রকল্পের কারণে কৃষি জমি ও মাছ চাষ প্রকল্পের কোন ক্ষতি হবে না। তবে ১০.৫০ কিমি পাইপলাইনের জন্য কিছু গাছের উপর প্রভাব পড়বে যা বাংলাদেশ সরকার উল্লিখিত সিটিউল বহির্ভূত। উদ্বেগ্য, উক্ত প্রকল্পের কারণে কোন গ্রাণি বা সর্বভাষে পরিবেশের উপর তাৎপর্যপূর্ণ কোন প্রভাব পড়বে না।

■ ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়ন পরবর্তী পরিবেশগত প্রভাব বিশ্লেষণ

- উল্লিখিত ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়নের ফলে বায়ু দূষণ, শব্দ দূষণ, বর্জ্য দূষণ, পানি দূষণ অথবা পানির কোন অভাব দেখা দেবে না। উক্ত ২৯ কিমি ২৩০ কেভি লাইন কোন গ্রাণি, কৃষি জমি এবং নদীসহ সার্বিকভাবে পরিবেশের উপর তাৎপর্যপূর্ণ কোন প্রভাব ফেলবে না।

✓ পরিবেশগত ও আর্থসামাজিক প্রভাব বিশ্লেষণ - প্রকল্প বাস্তবায়ন পরবর্তী অবস্থা বিশ্লেষণ (আর্থসামাজিক প্রভাব বিশ্লেষণ)

- গ্যাস ও তেল ডিভিক ৮০০ মেগাওয়াট কন্সট্রাক্ট সাইকেল বিদ্যুৎ প্রকল্প স্থাপনের জন্য খুলনা সরকারি নিউজব্রিট মিলের পরিত্যক্ত ৫০ একর জমি নেয়া হয়েছে। উক্ত এলাকায় পরিত্যক্ত মিলের ০৫টি পরিবার স্থানান্তরিত হওয়ার কারণে অর্থনৈতিকভাবে প্রভাবিত হবে। অত্র প্রস্তাবিত প্রকল্প এলাকায় কোন আদিবাসি ও বৃকিপূর্ণ পরিবার নেই।
- অত্র প্রস্তাবিত ৮০০ মেগাওয়াট বিদ্যুৎ প্রকল্প এলাকায় বর্তমানে অবস্থিত ০১ টি বালক উচ্চ বিদ্যালয় ও ০১ টি বালিকা উচ্চ বিদ্যালয় স্থানান্তরিত করা হবে। ২১৫ টি গাছ ক্ষতিগ্রস্ত হবে।
- গ্যাস ট্রান্সমিশন লাইন (১০.৫০ কিমি) মূলত রাজ্য সংলগ্ন সড়ক ও জনপথের জমির উপর স্থাপিত হবে। এ ক্ষেত্রে মুচি সহ মোট ২৪ টি ক্ষুদ্র ব্যবসায়িক নিকটবর্তী পরিত্যক্ত জায়গায় স্থানান্তরিত করা হবে এবং ৩২৬ টি গাছ ক্ষতিগ্রস্ত হবে। ২ কিমি পাইপ লাইনের ক্ষেত্রে রাজ্যের পাশের ০৯ টি ক্ষুদ্র দোকান ব্যবসায়ী নিকটবর্তী স্থানে স্থানান্তরিত হবে ও ৪০ টি গাছ ক্ষতিগ্রস্ত হবে। উদ্বেগ্য কোন স্থাপনা ক্ষতিগ্রস্ত হবে না।
- ২৯ কিমি ওভারহেড ট্রান্সমিশন লাইন প্রকল্প কৃষি জমি, নদী এবং কিছু বাড়ী, সামাজিক প্রতিষ্ঠানের উপর নিয়ে যাবে তবে কোন প্রত্নতাত্ত্বিক এবং ঐতিহাসিক স্থাপনার উপর নিয়ে যাবে না। উল্লিখিত প্রকল্পের আওতায় টাওয়ার স্থাপনের ফলে ০৭ টি পরিবার স্থায়ীভাবে ক্ষতিগ্রস্ত হবে যার মধ্যে ০৫ টি পরিবারের বসতবাড়ীও ক্ষতিগ্রস্ত হবে এবং ক্ষতিগ্রস্তদের মধ্যে ০২ টি পরিবার বৃকিপূর্ণ। এছাড়া উক্ত প্রকল্পের কারণে শস্য ও ০১ টি মাছের খের সাময়িকভাবে ক্ষতিগ্রস্ত হবে।

✓ পরিবেশগত প্রশমন ব্যবস্থা

■ বায়ু দূষণ মোকাবেলায় করণীয়:

- Advance Dry Low NOx Burner যা বায়ুর একরকম দূষণ (NOx)-কে নিয়ন্ত্রণ করবে।
- প্রাক্ট এলাকার চতুর্দিকে ও খোলা যায়গায় সবুজ বেটনী তৈরীর ব্যবস্থা রাখা হয়েছে যা বায়ু দূষণের প্রভাবকে নিয়ন্ত্রণ করবে।
- প্রধান ও বাইপাস চিমনির উচ্চতা যথাক্রমে ন্যূনতম ৬০ মি. ও ৫০ মি. হতে হবে যাতে প্রাক্ট নিয়ন্ত্রিত ধোঁয়া আকাশে মিলিয়ে যায় এবং পরিবেশের উপর ক্ষতিকর প্রভাব না ফেলে।

■ পানি দূষণ মোকাবেলায় করণীয় :

- কুলিং টাওয়ারের কারণে কোন প্রকার গরম পানি নদীতে পড়বে না।
- প্রাক্ট হতে নির্গত পানি যথাযথ পরীক্ষা-নিরীক্ষার পর পূর্ণ-ব্যবহার করা হবে; যা পরিবেশের উপর কোন ক্ষতিকর প্রভাব ফেলবে না।
- তেল ও গ্রীজ পানি থেকে আলাদা করণের জন্য সেন্ট্রিফিউগাল যন্ত্রের ব্যবহারের ব্যবস্থা রাখা হয়েছে। আলাদাকৃত তেল এলাকার ডেভলপের কাছে বিক্রি করা হবে।
- বিদ্যুৎকেন্দ্রে থেকে নিষ্কাশিত তরল; আধুনিক বর্জ্য ব্যবস্থাপনার (ETP) মাধ্যমে পরিশুদ্ধ করা হবে। ফলে নদীর মাছ ও পানির তেমন কোন ক্ষতি হবে না।
- প্রদূষিত বিদ্যুৎকেন্দ্রে পর্যায়নির্মাণন ব্যবস্থাপনারও সুবিধা থাকবে।

■ পানি উত্তোলন সীমিতকরণ ব্যবস্থা:

- প্রকল্প চালু অবস্থায় ভৈরব নদ থেকে প্রতি ঘণ্টায় ২১০ ঘন মিটার পানি উত্তোলন করা হবে যা খুবই কম এবং চলমান নদী প্রবাহের মাত্র ০.১২%।
- উদ্ভূত, সঠ অনুসারে প্রকল্প চালু রাখার জন্য কখনই ডু-গর্ভস্থ পানি উত্তোলন করা হবে না।
- উক্ত বিদ্যুৎ কেন্দ্রে বসবাসকৃত জনসাধারণের খাবার পানির জন্য খুলনা ওয়াশো কড়ক পাইপ লাইন দ্বারা সরবরাহকৃত পানি ব্যবহার করা হবে।

■ শব্দ দূষণ মোকাবেলায় করণীয়:

- আধুনিক প্রযুক্তি সঞ্চিত মেশিনারী স্থাপন করা।
- ঘূর্ণন মেশিনারীর জন্য শব্দ দূষণ প্রতিরোধী হুড বা ঢাকনার ব্যবস্থা করা।
- প্রাক্ট এলাকার চতুর্দিকে ও খোলা যায়গায় সবুজ বেটনী তৈরীর ব্যবস্থা রাখা হয়েছে যা শব্দ দূষণের প্রভাবকে নিয়ন্ত্রণ করবে।
- শব্দ দূষণ কমানোর জন্য প্রয়োজ্য স্থানে স্তর ভিত্তিক দেশীয় জাতের গাছ লাগানো।
- ঘূর্ণন মেশিনারীর ভিতরে যারা কাজ করবে তাদেরকে অবশ্যই পিপিই (PPE) যেমন: ইয়ার প্রাণ, মাফলার ইত্যাদি পরতে হবে।
- ধোঁয়া বের হওয়ার পথে চিমনিতে সাইল্যান্সার লাগানো।
- শব্দ প্রশমনীয় দেয়াল নির্মাণ করা।

■ কম্পন মোকাবেলায় করণীয়:

- সীম (প্রট ১/১০০০ ইঞ্চি) প্রযুক্তির ব্যবহার করা।

■ পরিবেশ ও জলজ প্রাণি ব্যবস্থাপনায় করণীয়:

- প্রদূষিত ৮০০ মেগাওয়াট বিদ্যুৎ কেন্দ্রে হতে নির্গমিত সকল তরল বর্জ্য ও পর্যায়নির্মাণন যথাক্রমে ইটিপি (ETP) ও এসটিপি (STP) এর মাধ্যমে পরিশোধিত করে ফেখাপড়ক বাংলাদেশ বিধি ও আইএফসি (IFC) গাইডলাইনের গ্রহণযোগ্য সীমার মধ্যে রাখা হবে যাতে ডলফিন সহ পরিবেশ ও জীববৈচিত্র্য দূষণের প্রভাব মুক্ত থাকে।

- গ্যাস লাইন ও OHT line এর ক্ষেত্রে প্রকল্প এলাকার কর্মচারীদের বাসস্থানের পর্যায়ক্রমিক পরিবেশবাহনের মাধ্যমে বাংলাদেশ বিধির (ECR,1997) গ্রহণযোগ্য সীমার মধ্যে রাখা হবে।
- অত্র প্রকল্প চালু অবস্থায় EMP সংশ্লিষ্ট পর্যবেক্ষণ ব্যবস্থা নিয়মিত বলবৎ থাকবে এবং উক্ত পর্যবেক্ষণ এর আওতায় প্রকল্প এলাকার পরিবেশ ও জীববৈচিত্র (ডলফিন সহ) এর উপর নিরীক্ষা করা হবে এবং প্রয়োজনীয় প্রশমন পরিকল্পনা অনুযায়ী ব্যবস্থা নেয়া হবে।

✓ আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা

- ৮০০ মেগাওয়াট বিন্দু প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা
 - অত্র প্রকল্পটি বাস্তবায়নের জন্য উদ্ভিষিত খুলনা সরকারি নিউক্লিয়ার মিলের পরিত্যক্ত ৫০ একর জমি সরকারি প্রথা অনুসারে নির্ধারিত মূল্য পরিশোধ সাপেক্ষে নর্থ ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লিঃ এর অনুকূলে বরাদ্দ দেয়া হয়েছে।
 - অত্র প্রদত্ত প্রকল্প এলাকার উদ্ভিষিত ০২ টি বিন্দু (০১ টি বালক ও ০১ টি বালিকা) পরিত্যক্ত পেপার মিলের অবশিষ্ট (৩৭.৬০ একর) জমির উপর পুনর্নির্মিত হবে যা পাওয়ার প্রাক্টের সীমানার বাইরে অবস্থিত। এবং উক্ত বিন্দু দ্বারা দুটিতে উন্নতমানের পাকা ইমারতসহ প্রয়োজনীয় আধুনিক সুযোগ সুবিধা যথা; কম্পিউটার ল্যাব, বিজ্ঞানাগার, পাঠাগার, খেলার মাঠ, সুপেয় পানি, সৌচাগার, ইত্যাদির সুব্যবস্থা থাকবে।
 - উক্ত এলাকায় পরিত্যক্ত মিলের ০৫টি স্থানান্তরিত পরিবারকে নর্থ ওয়েস্ট পাওয়ার জেনারেশন কোম্পানী লিঃ কর্তৃক ক্ষতিপূরণ দেয়া হবে।
 - উক্ত প্রকল্প এলাকা সংলগ্ন মসজিদ ও কবরস্থানের সংস্কার করা হবে এবং প্রকল্পসহ সর্বসাধারণের ব্যবহারের জন্য ব্যবস্থা থাকবে।
- গ্যাস পাইপলাইন প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা
 - গ্যাস ট্রান্সমিশন লাইন (১০.৫০ কিমি) মূলত সড়ক ও জনপথের জমির উপর অনুমতি সাপেক্ষে স্থাপিত হবে। উক্ত প্রকল্পে মুচি সহ মোট ২৪ টি ক্ষুদ্র ব্যবসায়িকে অর্থনৈতিক ক্ষতির জন্য ক্ষতিপূরণ প্রদান করা হবে। এছাড়া ৩২৬ টি গাছের ক্ষতিপূরণ প্রদান করা হবে। উল্লেখ্য, ২ কিমি পাইপ লাইনের ক্ষেত্রে রাস্তার পাশের ০৯ টি ক্ষুদ্র দোকান ব্যবসায়ীকে অর্থনৈতিক ক্ষতিপূরণ ও ৪০ টি গাছের জন্য ক্ষতিপূরণ দেয়া হবে।
- ওভারহেড ট্রান্সমিশন লাইন প্রকল্প বাস্তবায়ন পরবর্তী আর্থসামাজিক সম্পর্কীয় প্রশমনব্যবস্থা
 - অত্র প্রকল্পের আওতায় টাওয়ার স্থাপনের ফলে ০৭ টি পরিবারকে ক্ষতিপূরণ দেয়া হবে যারা স্থায়ীভাবে ক্ষতিগ্রস্ত হবে এবং এদের মধ্যে ০২টি পরিবার কৃষিপূর্ণ। এছাড়া উক্ত প্রকল্পের কারণে শস্য ও ০১ টি মাছের ঘেরের সাময়িকভাবে ক্ষতির ক্ষতিপূরণ দেয়া হবে।

সারসংক্ষেপ

- ❖ প্রকল্পের পরিবেশগত প্রভাব প্রশমনের সুপারিশসমূহ যথাযথভাবে বাস্তবায়ন করা।
- ❖ প্রকল্পের আর্থ-সামাজিক সুপারিশসমূহ, সরকারি ও উল্লেখযোগ্য উদাহরণ/অনুশীলন বাস্তবায়ন করা।
- ❖ যথাযথভাবে পরিবেশগত নিরীক্ষণ কার্যক্রম পরিচালনা করা এবং প্রয়োজনীয় পদক্ষেপ গ্রহণ করা।
- ❖ আর্থ-সামাজিক বিষয় সংক্রান্ত অভিযোগ ও অসন্তুষ্ট সিপিবিদ্ধ করা ও তা প্রশমনের ব্যবস্থা নেয়া।
- ❖ আমরা প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক বিষয়ের উপর আপনার সুচিন্তিত মতামত/মন্তব্য গ্রহণ করবো যা EIA প্রতিবেদনে সিপিবিদ্ধ করা হবে।
- ❖ অত্র প্রকল্প চলাকালীন ইএমপি (EMP) সংশ্লিষ্ট বিষয়ের সার্বক্ষণিক পর্যবেক্ষণ ব্যবস্থা বলবৎ থাকবে এবং ডলফিন সহ পরিবেশ ও জীববৈচিত্রের জন্য প্রয়োজনীয় টেকসই রক্ষণাবেক্ষণ পরিকল্পনা করা হবে।

Findings from the Public Disclosure Meeting

The Chief Guest of the Public Disclosure Meeting was Muhammad Moniruzzaman Moni, Mayor khulna City Corporation. The program was presided over by S.M Kurshid Ahmed Tona counselor, 13 no. ward, Khulna City Corporation, Md. Mofazzol Hossain Sarkar, Chief Engineer, Goalpara Power Station, Md. Shahidul Morsalin Joarder, Chief Engineer, NWPGL. Different government officials, Ward Counselors from different unions, NGO representatives, Journalists, political leader, freedom fighter, UP members, farmers and fishermen from the study area were present in the meeting. Mr. Md. Sharif Hossain Sourav from CEGIS started the meeting with an introductory speech. Dr. Kazi Md Noor Newaz, Advisor and Team leader of the study team, CEGIS, made a power point presentation of the key report of the project. A brief description about the project was delivered by Mr. Hasmot Ali, Executive Engineer, NWPGL.

Following the presentation, all the participants took part in an open discussion. They made various types of comments after the presentation of Dr. Kazi Md Noor Newaz. Their comments are given below:

The people's opinions and queries shared in the open discussion are given below:

Issues raised by the participants	Feedback from the NWPGL and CEGIS
Modern technology should be adopted.	<p>Latest available technology will be adopted for the proposed power plant to reduce air emission, noise level and water extraction within appropriate GOB and IFC acceptable limit and some of the specific options are as follows:</p> <ul style="list-style-type: none"> - To control SO_x, NO_x, latest technology will be applied. - Noise and vibration level will be within acceptable limit of GOB and IFC guidelines as appropriate during project implementation period. - The height of the chimney will be 60 meter and bypass chimney will be 50 meter height - Closed cycle cooling tower which require minimum water - No extraction of ground water for plant operation - Water will be extracted from Bhairab River as a source of surface water. And only 0.12 % of the total discharge of the Bhairab river will be extracted per hour for operation of the proposed power plant. - ETP will be installed to treat and keep all discharges from the proposed power plant within acceptable limit of GOB and IFC as appropriate. - STP will be installed to treat and keep all sewage discharges within acceptable limit of GOB and IFC as appropriate. - Govt. policy and SPS (2009) will be

	applied during project implementation period as required.
Local experts like experienced university (Khulna University) teacher should be taken part of the power Plant intervention.	It is suggested that relevant teachers from Khulna University may discuss with local NWPGL relevant technical staff and share their opinions to include in the documents. If necessary, the Khulna University staff may also contact with CEGIS or get access in the document while it will be posted in the web site by ADB and Proponent.
All the mitigation measures must be materialized.	All the development work will be monitored from the construction phase.
The study may be carefully reviewed to focus for people and gain optimum target.	<ul style="list-style-type: none"> - Construction phase to power plant will be monitored step by step. - All the steps will be taken to obtain optimum goal.
Health safety and security should be established all around the project.	<ul style="list-style-type: none"> - All the safety measures will be ensured following GOB and ADB/IFC guidelines. The labours will be trained. - awareness programme will be taken. - Fast aid box and trained Physician will be ensured. - Appropriate PPE for workers and staff
All machinery should be modernized	
The location of the schools (both Boys and Girls) shall be fixed as early as possible	<ul style="list-style-type: none"> - Currently schools (Boys and Girls) are risky for the students and needs to be shifted as early as possible. - The locations of both Schools shall be fixed based on considering environmental and social issues before submission of the final report to ADB and GOB. - Two modern multi-storeyed schools buildings will be established with modern school furniture. - Two school buses (a bus per school) and laboratory with modern instruments, furniture will be bought. - A solar panel will be installed to support during load- shedding of electricity if it occurs. - a play ground (bigger one than the existing one) facility for the students will be ensured. - The schools will be established completely before shifting. The school building construction will begin according to the newsprint authority and BCIC. - A clinic with ambulance service will be established.

	<ul style="list-style-type: none"> - ensuring safe drinking water, there will be a proper system of water purification. - ADB and NWPGL will implement it.
The mosque should be renovated and developed	The mosque will be modernized and reformed. Graveyard of martyrs will be well decorated with proper respect.
Fisherman livelihood will be at the risk and disrupted. They need to migrate for better livelihood	<ul style="list-style-type: none"> - We (NWPGL assigned CEGIS) have made a study in buffer zone considering 10 km and found no impact on river ecology. - No impact will be found on the Bhoirab and Atai River.
Rehabilitation programme should be introduced for the affected fisherman	Such type of programme will not be needed.
All the Newsprint mill security guard should be employed in the New Power plant	<ul style="list-style-type: none"> - Newsprint mill has another place, factory with machinery and administrative office. All the security guard will be employed by the Khulna newsprint mill authority in other place. - If we (NWPGL) have the opportunities of employing the security guard, we would take necessary action regarding the point. - In regard to the permanent employment in power plant, Bangladesh service rule will be followed.
The environmental impact must be addressed with care to protect fish and biodiversity	IUCN recommendations on biodiversity and related management will be followed for dolphin management and future monitoring activities as well. In this regard, we (NWPGL) have to wait up to that level for future plan for Bio-diversity management.
Is there any experience of NWPGL regarding this type of project in Bangladesh?	NWPGL is an experienced and reputed company to the related field and related type of gas based power plant. It has already implemented some project like this. Even in Goalpara, they have a power plant (225 MW).
Technical issues are not clearly understood. Is there any video document of power plant having gas based technology? if yes, please show us.	There are video documentaries regarding the gas based power plant. But due to inaccessibility we cannot show the video filming. It can be watched from internet.
Is there any plan of government for providing electricity for all houses?	Government already has a vision to provide electricity to every home within 2021 (Vision 2021).

The people showed nothing negative towards the project, but they urged to maintain all the environmental, social and safety issues during construction and production as well.

Concluding Remarks

The answers to all questions were given by the relevant project personnel following the open discussion session. Then Mr. Md. Shahidul Morsalin Joarder, Chief Engineer and Project Director NWPGL expressed his opinion about the project. Then the president of this assembly Mr. S.M Khurshid Ahmed Tona counselor, 13 no. ward, Khulna City Corporation concluded the PDM by thanking all the participants.

Photographs of the PCM



Photograph 5:



Photograph 6:



Photograph 7:



Photograph 8:



Photograph 9:



Photograph 10:



Photograph 11:



Photograph 12:



List of participants of PCM conducted on 21st October 2017:

খুলনা ৮০০ মেগাওয়াট কন্ডাইড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা				
স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।				
তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ				
সময়ঃ সকাল ১১:০০				
ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
১.	শ্রীযুক্ত মনিরুজ্জামান মনি	মিঃ মনিরুজ্জামান মনি	udayan21@yahoo.com	
২.	মুসব্ব্বাহ মুহাম্মদ আলী	কাস্টমার-২৩ ফেজিলিগঞ্জ	০১৭১১-৩০৯০২২	
৩.	মিঃ মোহাম্মদ হোসেন সহকারী	প্রধান প্রকৌশলী ফিউচার	০১৭১১-৪২২ ৪৭০	
৪.	আব্দুর রহিম	প্রধান প্রকৌশলী ২৩পাওয়ে	০১৭১১-৬৩০০২১	
৫.	মিঃ মোহাম্মদ হোসেন	উপ প্রকৌশলী ২৩পাওয়ে	০১৭৩০-০৬৬৭৮৭	
৬.	Shanitul Islam	Consultant/ADB	0178580756	
৭.	Ruby D CORRO ARICO	ADB - ENVIRONMENT CONSULTANT	—	
৮.	Shamouddin Ahmed	ADB - Consultant (Gas Sector Specialist)	shamof.hed@gmail.com	
৯.	Mazmun Nahar	ADB BRM	nnahar@adb.org	
১০.	মিঃ মোহাম্মদ হোসেন	মহাপ্রকৌশলী ২৩পাওয়ে	০১৭১১-৩০৯০২২	
১১.	মিঃ মোহাম্মদ হোসেন	২৩পাওয়ে	০১৩৩৩৪৭৪৭২	
১২.	মিঃ মিলন	২৩পাওয়ে	০১৬৩৫-২৫০২৪৮	
১৩.				
১৪.	Aziz Yusupov	Energy Spec. ADB	ayusupov@adb.org	
১৫.	Md. Shahidul Morsalin Joarder	প্রকল্প পরিচালক, (মহাপ্রকৌশলী)	pd.lng.martgell@gmail.com ০১৭৩০০৬৬৭৮৫	

খুলনা ৮০০ মেগাওয়াট কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
১৬.	Syed Imdad Hossain	Manager, GTCL Arongghatta, KH	Gossain.unimelb @gmail.com 01709639723	
১৭.	Engr. Nizam Uddin	Manager, SCL	uddinengr@gmail.com 01711049978	
১৮.	Abdullah-Al-Mamun	Asst. Teacher 01710027985	dua_mamun @yahoo.com	
১৯.		Asst. Press	01718444611	
২০.	Mashuda Parveen	Manager (EHS) (Indo) NWPGL	farwin@nwpgl.org bd 01777736469	 21.10.17
২১.	Mr. Jamal Uddin	AM (EHS) NWPGL	jamalenv466@ gmail.com	 21.10.17.
২২.	Mr. HASMAT ALI	XA NWPGL	hasmat@nwpgl .org.bd	 21.10.17
২৩.	Zamir Alam Khan	General Secre- tary AL-13		 21.10.17
২৪.	Mr. Zakiur Hossain	13, No. Ward Office	01712179692	
২৫.	ডোঃ শিমস	১৬ নং ওয়ার্ড	০২৬০২-২৫০২৮৪	
২৬.	ডোঃ জিয়াউর রহমান	১৬ নং ওয়ার্ড	০১৩৩৩৪৫৪৭২	
২৭.	মহাশয়	মহাশয়	০২০১০১০১০১০	
২৮.	মোঃ কফিল হুসাইন	১৬ নং ওয়ার্ড	০১৬১৬২২৩৩২	
২৯.	আশিক আল রাজা	১৬ নং ওয়ার্ড	০১৩১৬০৬০৪৭	
৩০.	ডাঃ মমতাজ হুসাইন	চকরিয়া ৬ নং ওয়ার্ড	০১২৬২৩১০০৮	

খুলনা ৮০০ মেগাওয়াট কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইপটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
৩১.	মুহুম্মদ দাস	চন্দ্রনগর, ৬ নং ওয়ার্ড		মুহুম্মদ
৩২.	মিত্র দাস	চন্দ্রনগর, ৬ নং ওয়ার্ড		মিত্র
৩৩.	জাটান বিজয়	চন্দ্রনগর, ৬ নং ওয়ার্ড		জাটান বিজয়
৩৪.	বাসুদেব	১৬ ৩২৮৫		বাসুদেব
৩৫.	শ্রীঃ হিঙ্গু ফুলজার	২০ নং জোয়ার, চন্দ্রনগর		
৩৬.	শ্রীঃ দেবদাস কলিতা	তরুণগড়, চন্দ্রনগর		শ্রীঃ দেবদাস
৩৭.	জ্যোতিষজ্ঞানন্দ	১০ নং ওয়ার্ড, চন্দ্রনগর		
৩৮.	শ্রীঃ মাহবুবুল হক			
৩৯.	শ্রীঃ মাহবুবুল হক	কে.এন.এম ০১৭/১৭/১০৭৭		
৪০.	গাহিনী খাতুন	সুপার মার্কেট, কে.এন.এম ২০ নং ওয়ার্ড	০১৭১৪৮১১০০৮	গাহিনী ২১.১০.২০১৭
৪১.	অপর্ণা রায়	অহকারাশিমুখ, কে.এন.এম ২০ নং ওয়ার্ড	০১৭২৭৭০৬৪৪১	অপর্ণা ২১.১০.১৭
৪২.	মুস্তা	জিলাখাতি নতুন, কে.এন.এম ২০ নং ওয়ার্ড	০১৭৪২৫৫০৩৫৩	Mukta
৪৩.	সকিনুর	জিলাখাতি নতুন, কে.এন.এম ২০ নং ওয়ার্ড	০১৭১৬৫৬১৭৫১	Sakinur
৪৪.	নুসরাত জাহান পুতুল	জিলাখাতি নতুন, কে.এন.এম ২০ নং ওয়ার্ড	০১৭৭৪৭৪৭৩১২	Putul
৪৫.	নুপুর	জিলাখাতি নতুন, কে.এন.এম ২০ নং ওয়ার্ড	০১৭৩৫২৭৬৪৬	Nupur

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নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইন্সটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১:০০

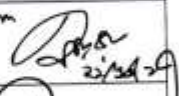
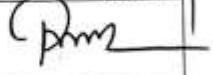
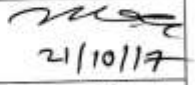

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৪৬.	শ্রী. এ. জামিল হোসেন	কম্পিউটার	০১৭৩০-৮৮২২ ৪৯	[Signature]
৪৭.	শ্রী. জাহাঙ্গীর	কম্পিউটার	০১৭৩৭৭৪৭৫৫	[Signature]
৪৮.	শ্রী. মাহমুদ	কম্পিউটার	০১৭১২-৮৮৭৭৫	[Signature]
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৫১.	শ্রী. মাহমুদ হোসেন	কম্পিউটার	০১৭৫৪৪৪৩৫০	[Signature]
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৫৩.	ইমতিয়াজ হোসেন	কম্পিউটার	০১৭৭৭৭ ৩৬৭৮	[Signature]
৫৪.	শ্রী. মাহমুদ হোসেন	কম্পিউটার	০১৭৪৮১৫৭৭১০	[Signature]
৫৫.	Rashid Jones	ADB-CAJUNAR	-	[Signature]
৫৬.	Yoojung Jang	ADB-HQ	Yjang@adb.org	[Signature]
৫৭.	ZHAOJING MU	ADB	zhaojingmu@adb.org	[Signature]
৫৮.	SM Faruk Ahmed	BUSINESS	০১৭১৫০০১১০৬	[Signature]
৫৯.	শ্রী. মাহমুদ হোসেন	কম্পিউটার	০১৭২১৩০৭৬৭	[Signature]
৬০.	শ্রী. মাহমুদ হোসেন	কম্পিউটার	০১৭১৬-১৫৩৬৩৩	[Signature]

খুলনা ৮০০ মেগাওয়াট কম্বাইন্ড সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ
নিরূপণ বিষয়ক মতবিনিময় সভা উপস্থিতির তালিকা

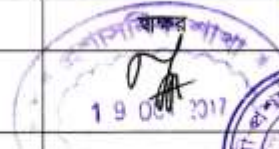

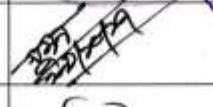



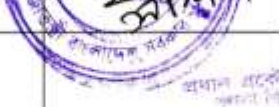

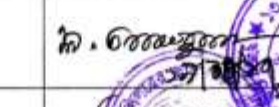



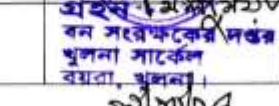
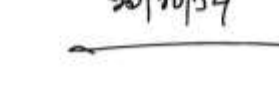
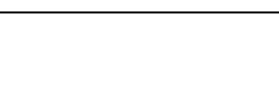
স্থানঃ সম্মেলন কক্ষ, ইঞ্জিনিয়ার্স ইনস্টিটিউট ইসটিটিউট, খালিশপুর, খুলনা।

তারিখঃ ২১ অক্টোবর, ২০১৭ খ্রিঃ

সময়ঃ সকাল ১১ টা

ক্রমিক নং	নাম	পদবী/ঠিকানা	ইমেইল ও মোবাইল নং	স্বাক্ষর
৬১.	মুহাম্মদ আবদুল করিম	সহকারী প্রকৌশলী ডিই প্রকৌশলী	mazimur@cegusbd.com ০১৭১৩৪৬৫৫২৩	
৬২.	এনজি এদ্রিসুল ইসলাম	Electrical Engg CEGIS	০১৭১০-৫৬৪০৬৬	
৬৩.	ড. জাহাঙ্গীর নেওয়াজ	Advisor, CEGIS	nuhammad@cegusbd.com	
৬৪.	Md. Hasan	Asstt. IES KLN-	০১৫৫৪৩৪৪৩	
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৭৫.				

List of invited Government officials with their acknowledgement

খুলনা ৮০০ মেগাওয়াট কন্সট্রাক্ট সাইকেল বিদ্যুৎ কেন্দ্র প্রকল্পের পরিবেশগত ও আর্থ-সামাজিক প্রভাব নিরূপণ বিষয়ক মতবিনিময় সভা মতবিনিময় সভার আপত্তন পত্রের প্রাপ্তি স্বীকার			
ক্রমিক নং	নাম/পদবী	মোবাইল নং ও ইমেইল	স্বাক্ষর
১.	মেয়র, খুলনা সিটি কর্পোরেশন, খুলনা		
২.	জেলা প্রশাসক, খুলনা।		
৩.	পুলিশ কমিশনার, ডিএমপি, খুলনা		
৪.	জেনারেল ম্যানেজার, সুন্দরবন গ্যাস কোম্পানি লিঃ, খুলনা		
৫.	ম্যানেজিং ডিরেক্টর, খুলনা ওয়াসাএবং চেয়ারম্যান, আইইবি, খুলনা		
৬.	ব্যবস্থাপনা পরিচালক, খুলনা নিউজপ্রিন্ট মিলস্ লিঃ খুলনা		
৭.	পরিচালক, পরিবেশ অধিদপ্তর, খুলনা		
৮.	প্রধান প্রকৌশলী, খুলনা বিদ্যুৎকেন্দ্র, বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড (বিপিডিবি), খুলনা		
৯.	প্লান্ট ম্যানেজার, খুলনা ২২৫ মেঃঃঃ সিসিপিপি, এনড্রিউপিজিসিএল, খুলনা		
১০.	এস এম খুরশিদ আহমেদ (টোনা) কাউন্সিলর, ওয়ার্ড-১০, খুলনা সিটি কর্পোরেশন, খুলনা		
১১.	মোঃ সাহিদুর রহমান কাউন্সিলর, ওয়ার্ড-০৮, খুলনা সিটি কর্পোরেশন, খুলনা		
১২.	সভাপতি, খুলনা প্রেসক্লাব, খুলনা		
১৩.	সম্পাদক, খুলনা প্রেসক্লাব, খুলনা		
১৪.	নির্বাহী প্রকৌশলী, বাংলাদেশ পানি উন্নয়ন বোর্ড, খুলনা		
১৫.	বন সংরক্ষক, খুলনা সার্কেল		

ক্রমিক নং	নাম/পদবী	মোবাইল নং ও ইমেইল	
১৬.	বিভাগীয় বন কর্মকর্তা, বন্য প্রাণী ব্যবস্থাপনা ও প্রকৃতি সংরক্ষণ বিভাগ, খুলনা		
১৭.	জেলা মৎস্য কর্মকর্তা, খুলনা	০১৭১২০৬৬২১৬	
১৮.	উপ পরিচালক, বাংলাদেশ কৃষি সম্প্রসারণ অধিদফতর, খুলনা		
১৯.	নির্বাহী প্রকৌশলী, গনপূর্ত বিভাগ, -২ খুলনা	/	
২০.	নির্বাহী প্রকৌশলী, সড়ক ও জনপদ বিভাগ, খুলনা		✓
২১.	নির্বাহী প্রকৌশলী, বাংলাদেশ কৃষি উন্নয়ন কর্পোরেশন, খুলনা		✓
২২.	ভারপ্রাপ্ত কর্মকর্তা, খালিশপুর থানা, খুলনা		
২৩.	প্রধান শিক্ষক, খুলনা নিউজপ্রিন্ট মিলস্ ফুল, খুলনা	০১১৮৮২২০০৮	
২৪.	ইমাম, খুলনা নিউজপ্রিন্ট মিলস্ মসজিদ, খুলনা		✓
২৫.	Mr. Masud Hossain,	০১৭১১ ৩৩২৬৩৫	✓
২৬.	Mr. Masud Hossain	০১৭১২-৫১৫৭৫১	✓
২৭.	Mr. Masud Hossain -	০১৭১২ ২৭১৬১২	
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Annex 3

“Chance Find” Procedures for Physical Cultural Resources

1.0 Introduction

These procedures describe the measures to be undertaken if an accidental discovery or chance find, or an encounter with a physical cultural resource (PCR) occurred during the construction phase. The chance find procedures will be finalized as Physical Cultural Resources Plan (PCRP) by NWPGL and the EPC Contractor, in consultation with the Department of Archaeology (DOA) or the Ministry of Cultural Affairs to ensure compliance to The Antiquities Act 1968 (amended 1976), National Cultural Policy 2006, and applicable regulations. The PCRP will be included in the Construction Management Plan that will be required from the EPC Contractor. The objectives of these procedures are to identify and promote the preservation, protection, and recording of any PCR that may be discovered or exposed during excavation other earthmoving works and ground alteration along the 12 km gas distribution pipeline route from the Khulna CGS to Rupsha 800 MW CCPP and the existing Khulna 225 MW CCPP.

2.0 Orientation and/or Briefing of Workers

The EPC Contractor, with technical support from the DOA or Ministry of Cultural Affairs and PMU, NWPGL will conduct an orientation or training for all workers, particularly those who will be involved in earth movements and excavation on how to recognize artifacts that they may potentially encounter or discover. The EPC Contractor will be responsible for creating awareness to construction personnel on the ADB requirements for any unanticipated impacts such as discovery of a physical cultural resource.

An archeological map of Bangladesh (if available) will be obtained from the DOA or other relevant sources to examine if there are potential "hot spots" within the project area. This map will be part of the references on-site to guide the construction supervision staff in determining the potential "hot spots."

3.0 Procedures

3.1 General

In case a PCR was encountered during excavation, construction activities including traffic within a 30.5-meter radius in the area will be stopped immediately by the EPC Contractor. The discovery will be reported by the site engineer or representative from the EPC Contractor to PMU, NWPGL environment staff (or Consultant). The site or area discovered will be marked or demarcated using a global positioning system (GPS) unit to determine the exact coordinates and photographs will be taken. The construction supervision staff of the EPC Contractor and PMU, NWPGL site engineer/staff will secure the site to prevent damage, loss or pilferage of removable objects. Site Engineer of PMU, NWPGL or designated staff will be responsible for coordinating with DOA.

If the encounter involves removable items, a security person will be posted until the representative of DOA or Ministry of Cultural Affairs arrives to assess and determine its value. The DOA staff will be responsible in determining the appropriate course of action. Further excavation or earth moving works may be conducted at the distance and demarcation area recommended by the DOA staff.

If the chance find will have significant cultural value, this may entail consequent changes in the lay-out particularly if the discovery is considered or assessed as remains of cultural or archeological importance that is not removable.

EPC Contractor will not be entitled for compensation due to work stoppage as a result of the discovery and its associated subsequent actions.

3.2 Assessment and Recovery

Appropriate heavy equipment such as wheel loader will be made available to recover the excavated material from the excavation site to allow the geologist onsite or the DOA staff to inspect, recover or conduct sampling. A safe storage area will be provided to protect the discovered object. If the chance find is part of a large artifact, deposit or structure, the inspection or recording will include photography and video on an "as-is, where is" manner. The exact location will be recorded using a GPS unit.

3.3 Resumption of Work

The Contractor can continue with excavation and construction works within the affected area after the DOA staff has given clearance. All the discovered objects of value will be given to the Government.

4.0 Reporting

The EPC Contractor will prepare a "Chance Find" Report within a week showing the date and time of discovery, specific location, description of the PCR, and interim protection measures implemented. This Report will be submitted to PMU, NWPGCL who will provide it to the DOA or Ministry of Cultural Affairs. The chance find including measures on how it was dealt with will be included in the EMoP submitted to ADB.

Annex 4
Format of Environmental Monitoring Report

Environmental Monitoring Report

{Annual/Semestral} Report
{Month Year}

BAN: Rupsha 800 MW Combined Cycle Power Plant Project

Prepared by the North-West Power Generation Company Limited for the Asian Development
Bank

CURRENCY EQUIVALENTS

(as of {Day Month Year})

{The date of the currency equivalents must be within 2 months from the date on the cover.}

Currency unit	–	{currency name in lowercase (Symbol)}
{Symbol}1.00	=	\${ }
\$1.00	=	{Symbol_____}

ABBREVIATIONS

{AAA}	–	{spell out (capitalize only proper names)}
{BBB}	–	{spell out}
{CCC}	–	{spell out}

WEIGHTS AND MEASURES

{symbol 1 (full name 1)}	–	{Definition 1}
{symbol 2 (full name 2)}	–	{Definition 2}
{symbol 3 (full name 3)}	–	{Definition 3}

GLOSSARY

{Term 1}	–	{Definition 1}
{Term 2}	–	{Definition 2}
{Term 3}	–	{Definition 3}

NOTE

In this report, "\$" refers to US dollars.

This environmental monitoring report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

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2.1 Environmental Conservation Rules 1997	
3.0 Compliance to Relevant Environmental Requirements from the ADB Loan Agreement	
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4.0 Compliance to Environmental Management Plan	
(Refer to the EMP of the Project)	
5.0 Safeguards Monitoring Results and Unanticipated Impacts	
(Refer to the Environmental Monitoring Plan and document any exceedence to environmental standards (if any), or any unanticipated impact not included in the EMP and any correction action/measures taken)	
6.0 Implementation of Grievance Redress Mechanism and Complaints Received from Stakeholders	
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