

**Preparatory Survey on
The Natural Gas Efficiency Project in
The People's Republic of Bangladesh**

**FINAL REPORT
APPENDIX (2/2)**

March 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

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**Ministry of Power, Energy and Mineral Resources
The People's Republic of Bangladesh**

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FINAL REPORT OF EIA UPDATA STUDY

ON

DHANUA-ELENGA GAS TRANSMISSION PIPELINE

PROJECT OF GTCL



ORIENTAL CONSULTANTS Co., LTD., JAPAN

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**EIA UPDATE STUDY ON DHANUA - ELENGA AND WEST BANK OF
JAMUNA BRIDGE - NALKA GAS TRANSMISSION PIPELINE PROJECTS OF GTCL**
Component-1: Dhanua-Elega Sector Gas Transmission Pipeline of 52 km in Length and 30" in Diameter



FINAL REPORT

MARCH 2014

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Final Report of EIA Update Study on Dhanua-Elenga Gas Transmission Pipeline Project of GTCL

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ABBREVIATION & GLOSSARY

ADB	Asian Development Bank
ADP	Annual Development Program
AER	Agro-Ecological Region
AEZ	Agro-ecological Zone
AQM	Air Quality Management
ARAP	Abbreviated Resettlement Action Plan
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advance Studies
BETS	Bangladesh Engineering and Technological Services Ltd.
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BPI	Bangladesh Petroleum Institute
BWDB	Bangladesh Water Development Board
CBE	Community Based Entrepreneurs
CCL	Cash Compensation Under Law
CDC	Community Development Council
CG	Construction Grant
CGS	City Gate Station
CNG	Compressed Natural Gas
CSMC	Construction Supervision and Monitoring Consultant
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DGM	Deputy General Manager
DOE	Department of Environment
DOF	Department of Fisheries
DPP	Development Project Proforma
DTW	Deep Tube Well
ECA	Ecologically Critical Area
ECA	Environmental Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules

EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering Procurement and Construction
EPZ	Export Processing Zone
EQS	Environmental Quality Standards
ERP	Emergency Response Plan
ESMS	Environmental Safety Management System
FGD	Focus Group Discussion
GIS	Geographic Information System
GOB	Government of Bangladesh
GM	General Manager
GPS	Global Positioning System
GRC	Grievance Redress Committee
GTCL	Gas Transmission Company Limited
HDD	Horizontal Directional Drilling
IEC	Important Environmental Component
IEB	Institute of Engineers Bangladesh
IEE	Initial Environmental Examination
ISBB	Industrial Safety Board of Bangladesh
IUCN	International Union for Conservation of Nature and Natural Resources or the World Conservation Union
JICA	Japan International Cooperation Agency
KII	Key Informant Interview
LGED	Local Government Engineering Department
M-D-E-EBJB	Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge
MMCFD	Millions of Cubic Feet per Day
MSDS	Material Safety Data Sheet
NDT	Non Destructive Testing
NGO	Non-governmental Organization
NWMP	National Water Management Plan
PAP	Project Affected Person
PCP	Project Concept Paper

PMU	Project Management Unit
PPE	Personal Protective Equipment
RHD	Roads and Highway Department
ROW	Right of Way
RU-GTCL	Resettlement Unit-Gas Transmission Company Limited
SDC	Study and Design Consultant
SRDI	Soil Resource Development Institute
TG	Transfer Grant
TOR	Terms of Reference
UNDP	United Nations Development Program

Adverse impact: An impact that is considered undesirable

Ambient air: Surrounding air

Aquatic: Growing or living in or near water

Bangla: Bengali language

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

Bazar: Market

Beel: A "back swamp" or depression. It can be either perennial or seasonal.

Beneficial impacts: Impacts, which are considered to be desirable and useful.

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

Char: Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion

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

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

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

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

Environmental impact assessment (EIA)/Environmental assessment: The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from a proposed development and its reasonable alternatives. It is sometimes known as environmental assessment.

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

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

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

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

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

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

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

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

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

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

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

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

Khal: Small Channel, Canal.

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

Mauza: A Bengali word for the smallest government administrative area corresponding to a village revenue unit.

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

Negative Impact: negative change from the existing situation due to the project.

Public involvement/Public consultation: A range of techniques that can be used to inform, consult or interact with stakeholders affected/to be affected by a proposal.

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

Stakeholders: Those who may be potentially affected by a proposal e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or take an interest in it.

Taka: Bangladeshi currency.

Terrestrial: Living on land.

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

Union: Smallest unit of local self government comprising several villages.

Upazila: *Sub-district*. Upazila introduced in 1982.

Zila: Bengali word of District.

EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) report covers the construction and operation of the proposed 30" dia 52 km Gas Transmission Pipeline from Dhanua-Elenga. The project is under taken with a view to delivering gas through this pipeline which would eventually contribute to national gas grid and thus help significantly in narrowing the existing production-evacuation gap.

The volume of approximately 500 mmscfd gas as planned to be flowing through this pipeline would also tremendously help in overcoming the current crisis of same in the different industrial, commercial and domestic sectors including power plants and fertilizer factories downstream of the producing gas fields of the north-eastern region of the country.

The project is being financed by GTCL through utilization of different development funds. It is expected that implementation of this pipeline project will play an important role for the development of national economy.

The results of the EIA are based on information that was readily available from the documentations and maps of the project and the reports on the proposed right of way (ROW) provided by GTCL, reports on similar pipelines, interviews with the stakeholders, Key Important informants (KII), and personnel involved in the construction of such other high pressure gas transmission pipeline. The result and recommendation from the DOE on the approved TOR of EIA and a detail field survey of the proposed project area where all the physical, biological and socio-economic existing features have been assessed in detail and recorded have also been the basis of delivering the results of this EIA.

Pipeline construction and operation, in general, has temporary environmental impacts compared to other industrial projects. An environmental management plan is presented which indicates management action for the implementation of mitigation measures and the use of best management practices and mitigation procedures and controls which will have minimum adverse impacts on the environment. Overall long term environmental impacts, in fact, will be beneficial in the context of different technical and socio-economic considerations.

The most important measure to achieve a good level of environmental acceptability for the project is adherence to the national and international best practices in design and construction with due observance of rules regulations and standards. Accordingly route selections have been given high importance and avoidance of environmentally sensitive location has been an integral part of the process. Particular attention should now be given to arriving at a fair and equitable level of compensation for farmers, residents and other individuals affected by land and structures etc. to be taken and / or damaged/ dislocated in executing the project.

Any potential negative socio-economic impact will be temporary and minor in nature. Positive impacts on the other hand will include availability of less expensive and cleaner burning fuel, temporary employment for the local population and potential business opportunities. Mitigation measures include providing temporary housing, eating and sanitary facilities for the construction crew to prevent overtaxing the local infrastructure.

Land use impact will be temporary and minor with the implementation of proper mitigation techniques. 102 hectares of temporary ROW will be required for working space. Compensation has to be paid to the owners for their crop loss. Another 41.69 hectares of permanent parcels of land will be acquired for pipeline, valve, controlling stations and the scraper trap installations and to provide adequate spaces for the ancillary facilities. Water body and trees etc. elsewhere along the route, will be either avoided as far as practicable or protected by using appropriate construction techniques as far as possible. Most farmlands acquired by GTCL could be cultivated with crop restriction and GTCL usually does not discourage such controlled farming of cultivable lands. But the significant permanent land of GTCL acquired for installation of Valve station, City Gate Station (CGS) etc. shall be out of the public use for farming.

Soil erosion and fertility impact will be temporary and minor with due reinstatement and bank protection measures as well as implementation of planned mitigation methods and procedures. Soil fertility will be preserved by segregating the 30 cm topsoil layer from common fill material during trenching, and ensuring that the fertile soil is replaced on the top of the trench during backfilling operations. The soil erosion mitigation plan would include particular measures for conserving soil during river and stream crossings, during trenching activities and when discharging water and /or sediment during directional drilling, thrust boring, hydrostatic testing, pigging and dewatering etc.

Air quality impact appears to be negligible and less significant mitigation measure is necessary. Similarly noise and vibration impacts will be insignificant too. However efforts would be continued to keep and operate the machinery and equipments in good order to generate less noise and to control emission and dust particles. Surface and ground water quality impact will be temporary and minor with implementation of suggested mitigation methods and procedures. Sediment loading of water bodies is mitigated by controlling soil erosion. Soil erosion will be minimized by implementing the soil erosion plan. This is further assisted by the planned pipeline related construction works in dry season only.

Contamination of surface and ground water from sanitary solid waste will be minimized by implementation of the waste disposal plan. Ground water used for potable water by the construction crew will be tested to ensure that, it meets the minimum environmental standards of Bangladesh for safe drinking water.

Fish and wildlife impact would be quite temporary and minor with adequate mitigation measures. Natural fish production would be protected by controlling water pollution caused due to sanitary and solid waste, oil and grease, paints and other chemicals and sediments. Plans for mitigating the impacts of these pollutions are included in oil spill plan, waste disposal plan, soil erosion and fertility control plans.

Impact on wild life is insignificant but the construction force will be prohibited from hunting and further degradation of this limited resource. Except for a number of mosque, temples, graves and graveyards along the route, hardly any historical or archaeological sites have been identified. Use of the protective measures will preserve such mosques, temples, graves and graveyards too so that these are not directly affected.

Any environmental impact associated with the project activity is likely to have only a very minimal effect in any particular location and its social or biological community. Unlike many other operations, no large quantities of hazardous chemicals will be used. Therefore, potentially toxic discharges and emissions will not be a threat to the environment. Further, most adverse impacts can be offset by good environmental management practices.

Some reasonable expectations, views and opinion of stakeholders, important key informants and experienced personnel involved in the construction of such high pressure gas transmission pipeline have been included in findings. There were 10 focus group discussions that were conducted in several locations of the project and its adjacent areas. It has been revealed from these meetings and surveys that the majority of the people are in the mean time aware about the project activities. Though there were expression of some reservations, most of the villagers, peoples of the localities along the route welcomed the project as it will support a national benefit as well as create new jobs and business opportunities to the local people.

It is expected that GTCL and its contractors will ensure a smooth, environmentally compatible and socially acceptable execution of the project and will comply with national regulations and operational

requirements. GTCL will perform as a responsible neighbor to the surrounding establishments and local people and discharge their corporate social responsibilities with due diligence as well.

In view of the forgoing considerations, it is expected that the present EIA Report will be approved by the Department of Environment and necessary Environmental Clearances would be issued in favor of safe and environment-friendly execution and operation of this priority project of national importance.

CHAPTER-1 INTRODUCTION

1.1 Background

To supplement the existing gas deficit in Gazipur, Tangail and Mymensingh areas and to expand National Gas Transmission Network system for equitable regional distribution of gas at designated pressure, GTCL has considered construction of Dhanua-Elenga is to be anticipated.

1.2 Brief Description of the Assignment

Dauna–Elenga sector gas transmission pipeline is 52 km in length and 30 inch in diameter. This sector is a sub-component of the originally ADB planned project of “Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge Gas Transmission Pipeline Project” which had in detail EIA study in 2005. As such the work requirement is the update of the available EIA report (2005) for the relevant 52 km sector of Dhauna-Elenga and hence to formulate updated EIA report.

1.3 Purpose of the Project

Objective of the EIA Study is to formulate relevant updated EIA reports on a draft basis for the construction of gas transmission pipelines selected for potential JICA finance. GTCL will be the executing agency of the project. The draft update EIA report will be formulated as appropriate so as to meet the requirement of environmental clearance of DOE of Bangladesh and also to conform to the guidelines for environmental and social considerations of JICA (2010).

1.4 Scope of the Present Study

The scoping of an EIA study is the process of short-listing those aspects of the environment which are relevant in the context of the proposed development. Scoping involved making an initial assessment of the nature of impacts which the project may have, and selecting for further study those aspects of the environment which might be affected by these impacts.

Three phases of project implementation are recognized as significant in terms of environmental impacts namely pre-construction, construction and post construction (operation and maintenance). The approach followed in this EIA is to consider the potential impacts of each component by the aforementioned phases of the development activity.

The EIA will identify potential impacts of the proposed project activity on environment, following DOE and JICA guidelines. The available EIA report of 2005 will also be used as a basis to prepare the Environmental Management Plan (EMP) to render or offset adverse impacts. The EMP shall also include Environmental Monitoring Plan and institutional arrangement for future monitoring.

1.5 Methodology

The report is prepared on the basis of the information of the project activities supplied by the project proponent (GTCL) and JICA Study Team. The consultant’s multidisciplinary team of experts made further site visits. The interaction between the project activity and the significant environmental component was made on the basis of a checklist. This checklist was prepared following the DOE guidelines, different gas development projects and the consultant’s experience on similar projects. Environmental and socio-economic data from different sources (BBS, DOE, Department of Meteorology, Agro-Climatic Survey of Bangladesh etc. and other EIA reports) of the proposed project area were collected to prepare baseline environmental and socio-economic profile. The contents of the report are as per the DOE and JICA guidelines.

1.6 EIA Team

BETS study team has formed a multidisciplinary team of EIA experts of having experience of conducting Environmental Impact Assessment of the similar projects. The list of the core EIA team members is given below:

Name	Position
1. Md. Delawar Bakth	Team Leader/ Energy and Environment Expert
2. Dr. Md. Mohsinuzzaman Chowdhury	Biologist
3. Zahidul Islam Miah	Water Quality Specialist
4. Md. Nurul Alam Siddique	Environmental Engineer
5. A K M Fazlul Hoque Majumder	Social Expert
6. Humayun Kabir	ARAP Expert
7. Md. Mahidur Rahman Khan	GIS Specialist
8. Mir Towfiq Hussain	Field Coordinator

1.7 Limitation

Limitation confronted in the EIA study included the following:

- The field study/data collection of the project was hindered for the political unrest of the country

1.8 Acknowledgement

The EIA report is prepared basically with the support from GTCL, JICA Study Team and also from various government agencies including Bangladesh Meteorological Department (BMD), Soil Resource Development Institute (SRDI), Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), Department of Explosives, Department of Environment (DOE), Department of Agriculture Extension (DAE), etc. The project proponent was extremely positive in providing necessary information, documents and guidance during the undertaking and preparation of the Report.

CHAPTER-2 LEGISLATIVE, REGULATORY AND POLICY CONSIDERATIONS

2.1 Introduction

In any country, development projects are governed by some legal and/or institutional requirements. So, assessment of relevant policy, strategy and regulatory issues are very important for any project proponent or developer before they actually execute a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. The following sections review the relevant National legislative, regulatory and policy requirements along with some international ones.

Any Gas Exploration, Production, Transmission and Distribution Company are expected to conduct its operations in compliance with local, national and international legislation. In other words, the proposed project will be executed and operated in accordance with Bangladesh legislations and international agreements to which Bangladesh is a party.

2.2 Legal and Regulatory Framework

2.2.1 The EIA and Planning Process

2.2.1.1 Environmental Impact Assessment (EIA) Process

The policy and legal consideration in the EIA process will be the same and in addition some standards and guidelines of Environment Conservation Rules (ECR) of 1997 will be elaborated i.e. at present there are environmental standards in operation in Bangladesh as promulgated under the ECR of 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges including vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding.

2.2.1.2 Planning Process

EIA is the standard report / format for following up the rules and regulations in the planning process. The GTCL should comply with the policy and legal considerations.

2.2.2 Environmental Agencies

There are a number of agencies and organizations relevant to the environmental considerations/concerns in Bangladesh. Following sub-sections present a precise description of such organizations.

2.2.2.1 Ministry of Forest and Environment (MoFE)

The Ministry of Environment and Forest (MoEF) is the key government institution in Bangladesh for matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEF was created in 1989 and is presently a permanent member of the Executive Committee of the National Economic Council. This group is the major decision-making body for economic policy and is also responsible for approving public investment projects. The MoEF oversees the activities of the following agencies:

- Department of Environment (DOE);
- Department of Forest (DoF);
- Forest Industries Development Corporation;
- Bangladesh Forest Research Institute and Institute of Forestry;
- Forestry Division of the Bangladesh Agricultural Research Council and
- National Herbarium.

Of the above agencies precise description of the first two departments including other pertinent ones are presented below as considered relevant.

2.2.2.2 Department of Environment (DoE)

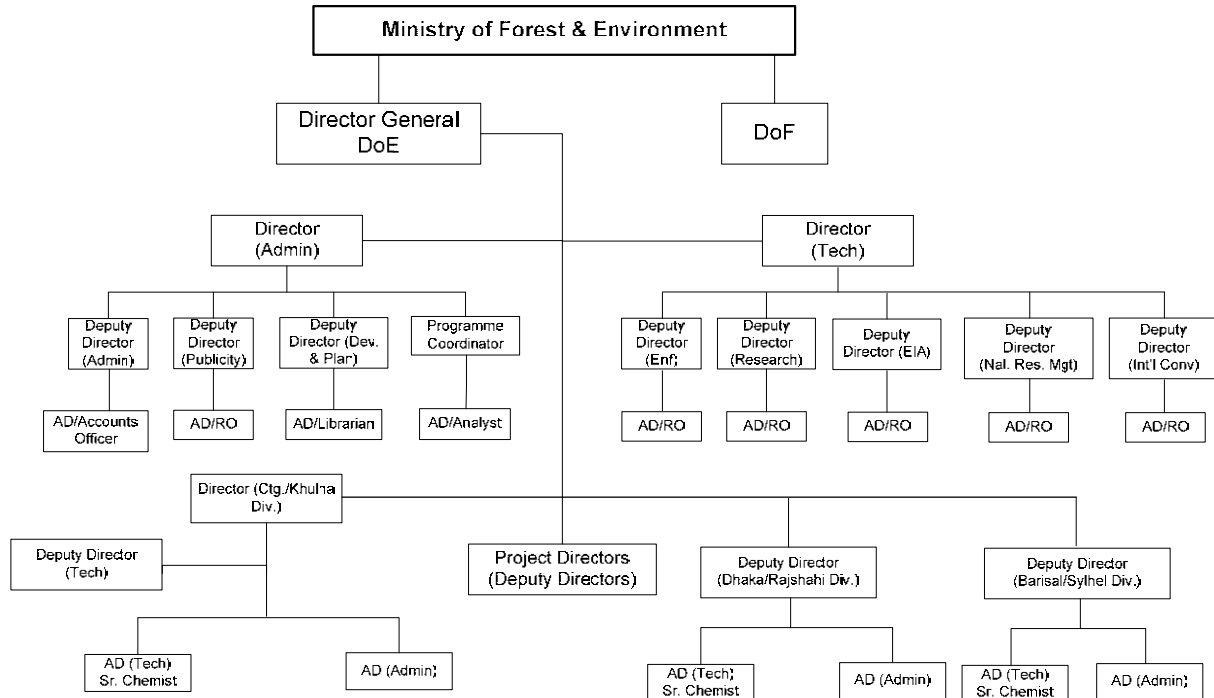
The Department of Environment (DoE), established in 1989 under the jurisdiction of the MoEF, is the executing agency for planning and implementing environmental issues including, but not limited to, the following activities:

- Reviewing environmental impact assessments and issuing environmental clearance where appropriate;
- Implementing environmental monitoring programs and enforcement measures;
- Developing and maintaining environmental data bases, and
- Coordinating international events with the MoEF (e.g., representing Bangladesh in international seminars, workshops, etc).

The DoE is headed by a Director General (DG) who is supported by a team of Directors, Deputy Directors, Assistant Directors, Engineers, and other technical staff (e.g. chemists and laboratory technicians). The DoE has regional offices, monitoring stations and several laboratories. Figure-2.2-1 shows the Organizational Set-up of DoE.

2.2.2.3 Department of Forest (DoF)

The Department of Forest (DoF), under the Ministry of Environment and Forest, is responsible for protection and management of the Reserve Forests in the country. The department manpower extends down to Union levels in areas where reserve forest exists. Officers of the DoF are responsible for protection of wildlife in these forest areas.



Source: MOEF AD: Asstt. Director. RO: Research Officer

Figure-2.2-1: The Organizational Set-up of DoE

2.3 Relevant National Policies amid Legislation

The key pieces of policy and legislation which apply to such project execution program are described in the following sections.

2.3.1 National Conservation Strategy (NCS) 1992

National Conservation Strategy was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle; however the final approval of the document is yet to be made by the officials of the government.

For sustainable development in the energy sector, the strategy document offered various recommendations but none was there concerning the present specific pipeline project execution program or related matter.

For the 'Energy and Minerals' sector, the relevant strategy recommendations are:

- ✓ To use the minimum possible area of land in exploration sites;
- ✓ Rehabilitate sites when abandoned;
- ✓ To take precautionary measures against Environmental Pollution from liquid effluent, condensate recovery and dehydration plants; and
- ✓ Technology assessment for selection of appropriate technology

2.3.2 National Environmental Management Plan (NEMAP) 1995

The National Environmental Management Action Plan (NEMAP) is a wide ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements for a period during 1995 to 2005 and set out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

NEMAP has the broad objectives of:

- ✓ Identification of key environmental issues affecting Bangladesh;
- ✓ Identification of actions necessary to halt or reduce the rate of environmental degradation;
- ✓ Improvement of the natural and built environment;
- ✓ Conservation of habitats and biodiversity;
- ✓ Promotion of sustainable development; and
- ✓ Improvement in the quality of life of the people.

One of the key issues in NEMAP regarding the energy sector has been that "energy conservation awareness is generally low throughout the country". NEMAP did not recognize mineral resources as an important sector and there is no separate discussion on this.

2.3.3 Forest Policy (1994)

The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation Program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

Amendments of the existing laws (acts, rules and regulations) relating to the forestry sector and creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties and Protocols (ICTPs).

2.3.4 The Bangladesh Forest Act 1927

The Forestry Act of 1927 provides for reserving forests over which the government has an acquired property right. This act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest.

Other Forest Acts

The Supplementary Rules of 1959 empower the concerned governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of wetlands in Bangladesh.

2.3.5 Industrial Policy (1999)

The National Industrial Policy, 1999 aims to ensure a high rate of investment by the public and private sectors, a strong productive sector, direct foreign investment, development of labour intensive industries, introduction of new appropriate technology, women's participation, development of small and cottage industries, entrepreneurship development, high growth of export, infrastructure development and environmentally sound industrial development.

WTO guidelines have been proposed to be followed in the Industry Policy. Following the guidelines may result in conflicts with intellectual property rights. Guidelines for mitigating such possible conflicts are absent in the policy document. No specific guidelines are given for sustainable extraction and utilization of raw materials for different industries.

One of the 17 objectives of the policy (Section 2.12; Chapter II) is "To ensure a process of industrialization which is environmentally sound and consistent with the resource endowment of the country". However, none of the 24 strategies of the policy relate to the environment.

2.3.6 National Water Policy (1999)

The National Water Policy of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

The water policy, however, fails to address issues like consequences of trans-boundary water disputes and watershed management.

2.3.7 National Tourism Policy (1992)

One of the aims of the policy statement is "Development of tourism resources of the country and their maintenance". Two special sections of the policy focus on 'archaeological and historical sites' and 'conservation of wildlife'.

2.3.8 Energy Policy (1995)

The National Energy Policy provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sound sustainable energy development programs. The Policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.

One of the seven objectives (Section 1.2) addresses the environment and states, "(vi) to ensure environmentally sound sustainable energy development Programs causing minimum damage to the environment".

Seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present project:

- Environmental impact assessment should be made mandatory and should constitute an integral part of any new energy development project;
- Use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation.

2.3.9 Petroleum Policy (1993)

The Petroleum Policy has the primary objective of promoting, monitoring, and regulating all activities in the oil and gas sector in relation to exploration, development, refining, marketing and export. The Petroleum Policy mentions the need to "promote Environmental Impact Assessment" in the oil and gas sector and to formulate various laws, rules and policies for fostering safety and environmental protection. The Petroleum Policy further states that private companies, in consultation with the Ministry of Power, Energy and Mineral Resources and Petrobangla, are to contribute towards improving the state of the environment in their area(s) of operation.

The Petroleum Policy is now an integral part of the Energy Policy.

2.3.10 Bangladesh Gas Act 2010

Bangladesh Gas Act 2010 has been published in the Gazette of 19 July, 2010. This act has been passed in the parliament as 40th Act of 2010 to frame different rules for transmission, distribution, marketing, storage and delivery of natural gas and associated liquid Hydro carbon. This has covered appropriate use of same including relevant other issues. Ch-6 of this act has retained provisions of punishment and penalties up to 5 years or fine or both for theft and violations of different rules and regulations, contracts and agreements in consumption and business of Natural Gas, Condensates, CNG and LPG etc.

2.3.11 Petroleum Act (1974)

The Bangladesh Petroleum Act is enabling legislation which allows the Bangladesh Government to enter into all aspects of petroleum exploration, development, exploitation, processing, refining and marketing. In addition, the Government is authorized to enter into Petroleum Agreement(s) with any person(s) for the purpose of petroleum operations. The duties of such person(s) are:

- To ensure that petroleum operation is carried out in a proper and workman like manner and in accordance with good oil field practice.
- To carry out petroleum operation in any area in a manner that does not interfere with navigation, fishing and conservation of resources.
- To consider the factors connected with the ecology and environment.

Clause 6(2) of the Act sets out certain details related to environment and safety:

“In particular, and without prejudice to the generality of the foregoing provision, a person engaged in any petroleum operations shall, in carrying out such operations in any area:

- Control the flow and prevent the waste or escape’ in the area, of petroleum or water;
- Prevent the escape in that area of any mixture of water or drilling fluid with petroleum or any other matter;
- Prevent damage to petroleum-bearing strata in any area, whether adjacent to that area or not; and
- Keep separate any petroleum pool discovered in the area.”

2.3.12 Environmental Policy (1992)

Bangladesh National Environmental Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. The Environment Policy provides the broader framework of sustainable development in the country. It also states that all major undertakings, which will have a bearing on the environment, (including setting up of an industrial establishment) must undertake an IEE / EIA before they initiate the project.

The Environment Policy delineates the Department of Environment (DoE), as the approving agency for all such IEE / EIA’s to be undertaken in the country.

Policies of fifteen sectors are described in the Policy. Under the Energy and Fuel sector, the use of fuel that has the least environmental impact is encouraged in Section 3.4.1. Conservation of fossil fuel is stressed in Section 3.4.5 and the need for conducting EIA’s before implementation of projects for fuel and mineral resources is stressed in Section 3.4.6.

Under the Environmental Action Plan Section of the Policy and sub-section ‘Fuel and Energy’, it is suggested that:

- The use of gas, coal, kerosene and petrol as fuel will be expanded in the rural areas, so that fuel wood, agricultural residues, and cow dung is conserved. This will help the use of agricultural residues, and cow dung etc. as manure; and
- Appropriate measures will be taken to ensure that extraction; distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem.
Section 3.7 "Forest, Wildlife and Biodiversity" requires:
 - Conserve Wildlife and Biodiversity, strengthen related research and help dissemination and exchange of knowledge in these areas; and
 - Conserve and develop wetlands and protection of migratory birds.

2.3.13 Bangladesh Wildlife Preservation Act, 1973 (Amended in 1974)

The Bangladesh Wildlife (Preservation) Act of 1973 provides for the preservation, conservation and management of wildlife in Bangladesh. The earlier laws on wildlife preservation, namely, the Elephant Preservation Act 1879, the Wild Bird and Animals Protection Act 1912, and the Rhinoceros Preservation Act 1932 have been repealed and their provisions have been suitably incorporated in this law.

This Act encompasses a range of different activities including hunting and fishing although the provisions of greatest significance relate to the establishment of National Parks, Wildlife Sanctuaries and Game Reserves by the MoEF. Such designations have enormous significance for the types of developments that may take place.

This legislation does not provide scope for creation of a strong organization, which can adopt appropriate measures to protect wildlife. The importance of wildlife could have been highlighted in the

legislation, which it does not do. Punitive provisions are not readily usable. The types of endangered and ecologically valuable animals/birds could have been highlighted in the legislation. It should have asked for active participation and specific action from local administration to protect wildlife. It also does not prescribe seasons when certain animal/birds cannot be hunted or captured.

An executive order issued in June 1998, in relation to the Bangladesh Wildlife Preservation Order of 1973 has imposed a ban for the next five years on hunting of any form of wildlife.

2.3.14 Environmental Conservation Act (1995, Amended in 2000 & 2002)

The Bangladesh Environment Conservation Act of 1995 (ECA '95) is currently the main legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has repealed the Environment Pollution Control Ordinance of 1977.

The main objectives of ECA '95 are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The Department of Environment (DOE) executes the Act under the leadership of the Director General (DG).

Bangladesh Environmental Conservation Act (Amendment 2000)

This amendment of the Act focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Bangladesh Environmental Conservation Act (Amendment 2002)

This amendment of the Act elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

Bangladesh Environmental Conservation Act 2010

This amendment of ECA '95 has been published on 5 October, 2010 as Bangladesh Environmental Conservation Act, 2010. This is available in Bengali version and has references to the ECA'95 and

the aforesaid other amendments. Some changes and inclusions has been made in different clauses particularly in defining the Ecologically Critical Area, framing certain rules and conditions in cutting and/or razing hills, handling disposal of hazardous wastes, managing ship breaking industries & wetlands, fixing responsibilities of environmental and safety management, obligations of obtaining and issuance of environmental clearance certificates and imposing penalties for violations including but not limited to filing cases for compensations, fixing fees and framing different rules under this Act.

2.3.15 Environmental Conservation Rules (1997)

These are the first set of rules, promulgated under the Environmental Conservation Act of 1995 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003). The Environment Conservation Rules of 1997 has provided 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 IEE/ EIA's according to categories of industrial and other development interventions.

The Rules are not explicit for various oil and gas exploration interventions. Rather, this is covered under the broader heading of "exploration, extraction and distribution of mineral resources" under the Red Category Projects.

The proposed project, according to the DOE, is considered under the Red category of the Environmental Conservation Rules, 1997 (Item 65: Exploration, extraction and distribution of mineral resources) [Page 3122 of the Bangladesh Gazette of 28 August 1997].

2.3.16 Mineral Gas Safety Rules 1991 (Amendment 2003)

This document is derived mainly from the American Society of Mechanical Engineers (ASME), American National Standard Institute (ANSI) and British Standards (BS), codes and practices etc. and Petroleum Act, 1934. These Rules deal with the materials, design and construction of gas pipelines, pipeline crossings of railways, testing and commissioning, protection against corrosion, pipeline operation and maintenance, storage and distribution, and reporting of accidents. The Rules are quite prescriptive, and include stipulations as to the separation distances between pipelines and the public properties and thoroughfare. The provisions of the rules have been updated through amendment in 2003.

2.3.17 Explosives Act, 1884

As per section 4 of the legislation,

"(1) "explosive" includes-

- (a) means, gun powder, nitro-glycerine, dynamite, gun-cotton, blasting powders, fulminate of mercury or of other metals, cooled fires and every other substance, whether similar to those above-mentioned or not, used or manufactured with a view to produce a practical effect by explosion, or a pyrotechnic effect; and
- (b) includes fog-signals, fireworks, fuses, rockets, percussion-caps, detonators, cartridges, ammunitions of all descriptions, and every adaptation or preparation of an explosive as above defined;
- (3) "vessel" includes every ship, boat and other vessel used in navigation, whether propelled by oars or otherwise;

- (4) “carriage” includes any carriage, wagon, cart, truck, vehicle or other means of conveying goods, or passengers by land, in whatever manner the same may be propelled: .
- (6) “import” means to bring into (Bangladesh) by sea or land.”

Section 6 of the Act provides punishment for contravening notifications issued under the provisions of this law, which may extend to imprisonment of ten years with or without fine amounting to fifty thousand taka. Section 8 provides for punishment for failing to notify the Chief Inspector of Explosives in Bangladesh and also to the Officer-in-Charge of the nearest Police Station in case of an accident due to explosion of any explosives either during manufacturing, possession, usage or carriage. The punishment extends to three months of imprisonment and to a fine of up to five thousand taka.

Under the provisions of Explosives Rules, 2003 (rules made under the provision of section 5 of the Explosives Act, 1884), GTCL will be required to obtain licenses for explosive related activities i.e. import, transport and possession and for such GTCL will apply for a license to import explosives from the Chief Controller of Imports and Exports with the clearance from the Chief Inspector of Department of Explosives. Application for transport and possession must be sought from the Chief Inspector of Department of Explosives.

2.3.18 Explosives Substances Act, 1908

In this statute in section 2 an “explosive substance” has been defined as follows –2. In this Act the expression “explosive substance” shall be deemed to include any materials for making any explosive substance; also any apparatus, machine implement or material used, or intended to be used, or adapted for causing, or aiding in causing, any explosion in or with any explosive substance; also any part of any such apparatus, machine or implement.”

Section 3 provides for maximum punishment of a life jail term for causing any explosion “...unlawfully and maliciously...to endanger life to cause serious injury to property...”, however, this statute does not come within the purview of this project as there will be no unlawful or malicious intention whatsoever.

2.3.19 Compliance with Bangladesh Labour Act, 2006

GTCL will employ workers in the field for the purposes of the construction works and as such must comply with the Bangladesh Labour Act, 2006. In this statute definition of labour is provided in section 2, whilst classification of a labour is entailed in section 4(1). Every labourer must be provided with a contract and an identification card (section 5). Whilst child labour is clearly defined in section 34, the nature of the activities will inherently exclude any child (section 40) or women labourers (section 45). Compliance to health and safety is provided in Chapters V (sections 51-60) and VI (sections 61-78), and special provisions regarding health and safety are provided in chapter VII (sections 79-85).

With regard to welfare of the labourers, chapter VIII states that first aid materials (section 89) are mandatory.

Regarding working hours for the laborers, chapter IX sections 101 & 102 and section 105-108 (overtime) are required to be followed. Payment of wages of the laborers is provided for in Chapter X (section 120-123 and 137 must be looked at specifically). Compensation for accidents during work (Chapter XII) is contained in sections 150-153 and 155. Schedule IV provides specific mention of laborers engaged in handling explosives and working in mines.

2.3.20 East Bengal Protection and Conservation of Fish Act (1950)

The East-Bengal Protection and Fish Conservation Act of 1950, as amended by the Protection and Conservation of Fish (Amendment) Ordinance of 1982 and the Protection and Conservation of Fish (Amendment) Act of 1995, provides provisions for the protection and conservation of fish in inland waters of Bangladesh. This is relatively unspecific and simply provides a means by which the Government may introduce rules to protect those inland waters not in private ownership.

This is framework legislation with rule making powers. Among others, some of these rules may:

Prohibit the destruction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, by trade effluent or otherwise.

2.3.21 The Protection and Conservation of Fish Rules (1985)

These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that "No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters". Section 6 of the Rules states that "No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters".

2.3.22 The Penal Code (1860)

[Chapter XIV of offences affective Public health, safety, convenience, decency and morals]

The Bangladesh Penal Code of 1860 has some valid provisions related to pollution management, environmental protection and protection of health and safety. Some of these are: Article 277: Falling Water or Public Spring or Reservoir; Article 278: Making Atmosphere Noxious to Health; Article 284: Negligent Conduct with Respect to Poisonous Substance; Article 285: Negligent Conduct with Respect to Fire or Combustible Matter; and Article 286: Negligent Conduct with Respect to Explosive Substance.

2.3.23 Acquisition and Requisition of Immovable Property Ordinance (ARIPO 1982)

This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property.

The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors.

The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women & squatters and such other vulnerable groups are yet to be framed.

The amendments, which has been made to the ARIPO in 1993 has increased the amount of the premium (to reflect market or replacement values) for compulsory acquisition from 25 to 50% on the assessed value of the property. The 1994 amendment provides provision for payment of crop compensation to tenants. The ARIPO does not cover compensation for loss of wage income; it also doesn't cover losses of non-titled persons (squatters, encroachers, etc) aside from crop losses to tenants.

The policy framework and entitlements for the Projects are all based on this national law called Acquisition and Requisition of Immovable Property Ordinance of 1982.

For the purpose of acquisition and requisition of immovable properties in Bangladesh, the government, taking into consideration all previous Acts, Rules, Ordinances etc., have prepared 'Acquisition of Immovable Properties Manual-1997'. This manual guides all acquisition and requisition of immovable properties, for all related purposes whatsoever as well as payment of compensation for all sorts of losses.

2.4 Environmental Requirements for the Project

To execute any project under Red Category should adopt a policy of compliance with all the requirements for environmental permission and clearance, regardless of whether GTCL might otherwise is able to obtain exemptions from some or all of the rules.

In this case, it is necessary for the GTCL to obtain both site clearance and environmental clearance for this pipeline project. Since necessary exemption from submitting IEE for site clearance has already been obtained, this EIA report should be submitted with due coverage of the emergency response plan and the key map of the pipelines along with the list of documents required accompanying the application for environmental clearance for the pipeline project.

No Objection Certificate (NOC) is a prerequisite document for submitting EIA report to DOE under Form-3 of the application Format and for this GTCL has to collect NOC from the thirteen union Parishad chairman offices of the thirteen (13) unions through which the pipelines would pass. The list of these thirteen unions of the project area is given in Table: 3.2-1 of Chapter-3 of this report. GTCL will have to submit this EIA report with local authority clearances i.e. NOCs so collected for obtaining the ECC from DOE.

It has also to ensure compliance with the Bangladesh Labor Law 2006 policy. The Labor Law encompasses the related occupational health and safety obligations and focus on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation.

2.5 Reference to pre-set criteria such as Protected Areas, sites of Bangladesh

Classification of Protected areas and environmentally-controlled areas in Bangladesh are shown in Table-2.5-1. Those areas are declared as National Park, Wildlife Sanctuary, Game Reserve, Botanical gardens and Eco-parks under the Wildlife (Preservation) Order, Reserved Forests and Protected Forests under the Forest Act and Ecologically Critical Areas (ECA) notified under the Environmental Conservation Act.

Table 2.5-1 Classification of Protected area, environmentally controlled area

Classification		Competent Authority	Governing law
A	National Parks	Department of Forest	Wildlife (Preservation) Order
B	Wildlife Sanctuaries		
C	Game Reserves		

Classification		Competent Authority	Governing law
D	Botanical Gardens, Eco-parks		Forest Act
E	Reserved Forests, Protected Forests		
F	Ecologically Critical Areas	Department of Environment	Environmental Conservation Act

(Source: Power System Master Plan 2010)

There are fifteen National parks, thirteen wildlife sanctuaries, five botanical gardens and eco-parks in Bangladesh notified under the Wildlife (Preservation) Order, having total area of 2,702.2 km². List of Protected areas and environmentally-controlled areas declared under the Wildlife (Preservation) Order are shown in Table-2.5-2. The Dhanua-Elenga project area is out of the protected area and environmentally controlled/critical area of Bangladesh, so none of the area will be affected by the project interventions.

There are nine ECA, and the total area is 8,063.2 km² excluding the Gulshan-Banani-Baridhara Lake in Dhaka. Table-2.5-3 shows a list of ECA designated under the Environmental Conservation Act. The Environmental Conservation Act has provision for ECA declarations by the Director General of the Department of Environment in cases where ecosystem or biodiversity of area is considered to be threatened to reach a critical state. Along with the ECA declaration, each ECA has notification declared in which specific activities to be restricted in that ECA is specified.

Table 2.5-2 List of Protected area, environmentally controlled area

Item	No	Name	Place	Size (km2)
A	1	Bhawal National Park	Gazipur	50.2
	2	Modhupur National Park	Tangail/ Mymensingh	84.4
	3	Ramsagar National Park	Dinajpur	0.3
	4	Himchari National Park	Cox's Bazar	17.3
	5	Lawachara National Park	Moulavibazar	12.5
	6	Kaptai National Park	Chittagong Hill Tracts	54.6
	7	Nijhum Dweep National Park	Noakhali	163.5
	8	Medha Kachhapia National Park	Cox's Bazar	4.0
	9	Satchari National Park	Habigonj	2.4
	10	Khadim Nagar National Park	Sylhet	6.8
	11	Baraiyadhala National Park	Chittagong	29.3
	12	Kuakata National Park	Patuakhali	16.1
	13	Nababgonj National Park	Dinajpur	5.2
	14	Shingra National Park	Dinajpur	3.1
	15	Kadigarh National Park	Mymensingh	3.4
B	1	Rema-Kalenga Wildlife Sanctuary	Hobigonj	18.0
	2	Char Kukri-Mukri Wildlife Sanctuary	Bhola	0.4
	3	Sundarban (East) Wildlife Sanctuary	Bagerhat	312.3
	4	Sundarban (West) Wildlife Sanctuary	Satkhira	715.0
	5	Sundarban (South) Wildlife Sanctuary	Khulna	369.7
	6	Pablakhali Wildlife Sanctuary	Chittagong Hill Tracts	420.9
	7	Chunati Wildlife Sanctuary	Chittagong	77.6
	8	Fashiakhali Wildlife Sanctuary	Cox's Bazar	32.2
	9	Dudh Pukuria-Dhopachari Wildlife Sanctuary	Chittagong	47.2
	10	Hazarikhil Wildlife Sanctuary	Chittagong	29.1
	11	Sangu Wildlife Sanctuary	Bandarban	57.6
	12	Teknaf Wildlife Sanctuary	Cox's Bazar	116.2
	13	Tengragiri Wildlife Sanctuary	Barguna	40.5
D	1	National Botanical Garden	Dhaka	0.8
	2	Baldha Garden	Dhaka	-
	3	Madhabkunda Eco-Park	Moulavibazar	2.7
	4	Sitakunda Botanical Garden and Eco-park	Chittagong	8.1
	5	Dulahazara Safari Parks	Cox's Bazar	6.0

(Source: <http://www.bforest.gov.bd/conservation.php>, accessed January 2011)

Table 2.5-3 List of Environmental Critical Areas

Item	No	Name	Place	Size (km2)
F	1	The Sundarbans	Bagerhat, Khulna, Satkhira	7,620.3
	2	Cox's Bazar (Teknaf, Sea beach)	Cox's Bazar	104.7
	3	St. Martin Island	Cox's Bazar	5.9
	4	Sonadia Island	Cox's Bazar	49.2
	5	Hakaluki Haor	Moulavi Bazar	183.8
	6	Tanguar Haor	Sumamganj	97.3
	7	Marjat Baor	Jhinaidha	2
	8	Gulshan-Banani-Baridhara Lake	Dhaka	-
	9	Rivers (Buriganga, Turag, Sitalakhya and Balu) around Dhaka city	Dhaka	-

(Source: Biodiversity National Assessment and Program of Action 2020, DOE Bangladesh, 2010)

2.6 Environmental Quality Standards

Environmental quality standards for surface water quality, air quality, noise, odor, sewerage, discharge, industrial effluents and industrial project emissions for Bangladesh are furnished in the following Tables.

Table-2.6-1 (A) Standards for Inland Surface Water

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

Source: Schedule-3, Rule 12, Environment Conservation Rules of 1997

Notes:

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

Table-2.6-1 (B) Standards for drinking water

Sl. No.	Parameter	Unit	Standard
1	Aluminum	mg/l	0.2
2	Ammonia (NH3)	"	0.5
3	Arsenic	"	0.05
4	Barium	"	0.01
5	Benzene	"	0.01
6	BOD5 20°C	"	0.2
7	Boron	"	1.0
8	Cadmium	"	0.005
9	Calcium	"	75
10	Chloride	"	150-600*
11	Chlorinated Alkanes	"	
	Carbontetrachloride	"	0.01
	1,1 Dichloroethylene	"	0.001
	1,2 Dichloroethylene	"	0.03
	Tetrachloroethylene	"	0.03
	Trichloroethylene	"	0.09
12	Carbontetrachloride	"	0.01
	1,1 Dichloroethylene	"	0.001
	1, 2 Dichloroethylene	"	0.03
13	Chlorine (Residual)	"	0.2
14	Chloroform	"	0.09
15	Chromium (Hexavalent)	"	0.05

Sl. No.	Parameter	Unit	Standard
16	Chromium (Total)	"	0.05
17	COD	"	4
18	Coliform (Fecal)	n/100 ml	0
19	Coliform (Total)	n/100 ml	0
20	Color	Hazen unit	15
21	Copper	mg/l	1
22	Cyanide	"	0.1
23	Detergents	"	0.2
24	DO	"	6
25	Fluoride	"	1
26	Hardness (as CaCO ₃)	"	200-500
27	Iron	"	0.3-1.0
28	Kjeldhl Nitrogen (total)	"	1
29	Lead	"	0.05
30	Magnesium	"	30-35
31	Manganese	"	0.1
32	Mercury	"	0.001
33	Nickel	"	0.1
34	Nitrate	"	10
35	Nitrite	"	<1
36	Odor	"	Odorless
37	Oil and grease	"	0.01
38	pH	"	6.5-8.5
39	Phenolic compounds	"	0.002
40	Phosphate	"	6
41	Phosphorus	"	0
42	Potassium	"	12
43	Radioactive materials (gross alpha activity)	Bq/l	0.01
44	Radioactive materials (gross beta activity)	Bq/l	0.1
45	Selenium	mg/l	0.01
46	Silver	"	0.02
47	Sodium	"	200
48	Suspended particulate matters	"	10
49	Sulfide	"	0
50	Sulfate	"	400
51	Total dissolved solids	"	10000
52	Temperature	°C	20-30
53	Tin	mg/l	2
54	Turbidity	JTU	10
55	Zinc	mg/l	5

Source: Schedule-3, Rule 12, Environment Conservation Rules of 1997

Table-2.6-2: Bangladesh Standards for Ambient Air Quality (All values in micrograms per cubic meters)

Sl. No.	Area	Suspended Particulate Matters(SPM)	Sulfur Dioxide (SO ₂)	Carbon Dioxide CO ₂	Oxides Nitrogen (NO _x)
1	Industrial and mixed	500	120	5000	100
2	Commercial and mixed	400	100	5000	100
3	Residential and rural	200	80	2000	80
4	Sensitive	100	30	1000	30

Source: Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Page 3123, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali)

Note:

- Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions
- Any industrial unit located not at a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category "Residential and Rural" and 'Sensitive'.
- Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

Table-2.6-3: Bangladesh Standards for Noise

Sl. No.	Area Category	Standard Values (all values in dBA)	
		Day	Night
1	Silent Zone	45	30
2	Residential area	50	40
3	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Source: Schedule 4, Rule-12, Environment Conservation Rules, 1997 (Page 3127, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali)

Note:

1. Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 pm to 6 am
3. Silent zones are areas up to a radius of 100 meter around hospitals, educational institutes or special establishments declared or to be declared as such by the Government. Use of vehicular horn, other signals and loudspeakers is prohibited in silent zones.

Table-2.6-4: Bangladesh Standards for Odor

Parameters	Unit	Values
Acetaldehyde	PPM	0.5-5.0
Ammonia	PPM	1.0-5.0
Hydrogen Sulfide	PPM	0.02-0.2
Methyl Disulfide	PPM	0.009-0.1
Methyl Mercaptan	PPM	0.02-0.2
Methyl Sulfide	PPM	0.01-0.2
Styrene	PPM	0.4-2.0
Trimethylamine	PPM	0.005-0.07

Source: Schedule-8, Rule-12, Environment Conservation Rules, 1997. (Page 3130, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali version)

Note:

1. Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters):
 $Q = 0.108 \times H e^2 C_m$
 Where Q - gas emission rate (Nm³/hour)
 He - effective height of the outlet (m)
 Cm - above mentioned standard (PPM)
2. Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Table-2.6-5: Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	25
Suspended Solid (SS)	mg/l	100
Temperature	°C	30
Coli forms	number/100ml	1000

Source: Schedule-9, Rule-12, Environment Conservation Rules, 1997. (Page 3131, Bangladesh Gazette, 28 August 1997), (own authentic translation from original Bengali)

Note:

1. These standards are applicable for discharge into surface and inland water bodies.
2. Chlorination is to be done before Final discharge.

Table-2.6-6: Bangladesh Standards for Industrial Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
1	Ammonical nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD at 20°C	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as Hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µmhos/cm	1200	1200	1200
14	Total dissolved solids	mg/l	2100	2100	2100
15	Fluoride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total Kjeldahl Nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet set	10
24	Oil and grease	mg/l	10	20	10
25	Phenol compounds (as CeHsOH)	mg/l	1.0	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	to be specified by Bangladesh Atomic Energy Commission)			
28	PH	-	6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total dissolved solids	mg/l	2100	2100	2100
32	Temperature	°C (summer)	40	40	40
		°C (winter)	45	45	45
33	Suspended solids	mg/l	150	500	200
34	Cyanide	mg/l	0.1	2.0	0.2

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3132-3134, Bangladesh Gazette, 28 August 1997), (own authentic translation from original Bengali version)

Note:

- These standards will be applicable for all industries other than those which are specified under 'industrial sector specific standards'.
- These standards will have to be compiled from the moment of trial production in case of industries and from the moment of the very beginning in case of projects.
- These standards will have to be met at any point of time and any sampling. In case of need for ambient environment condition, these standards may be made stringent.
- Inland surface water will include drains, ponds, tanks, water bodies, ditches, canals, rivers, streams and estuaries.
- Public sewer means leading to full fledged joint treatment facility comprising primary and secondary treatment.
- Land for irrigation means organized irrigation of selected crops on adequate land determined on the basis of quantum and characteristics of waste water.

Table-2.6-7: Bangladesh Standards for Industrial Project Emissions

Sl. No	Parameters	Values (in mg/Nm ³)
1	Particulates (ka) Power station of capacity of 200 MW or more (kha) Power station of capacity less than 200 MW	150 350
2	Chlorine	150
3	Hydrochloric acid vapor and mist	350
4	Total fluoride (as F)	25
5	Sulfuric acid mist	50
6	Lead particulates	50
7	Mercury particulates	10
8	Sulfur dioxide (ka) Sulfuric acid production (DCDA * process) (kha) Sulfuric acid production (SCSA * process) (*DCDA: Double conversion, double absorption, SCSA; Single conversion single absorption)Lowest height of stack for sulfur dioxide dispersion: (ka) Coal based power plant 500 MW or more 200 MW - 500 MW Less than 200 MW (kha) Boiler Steam per hour- up to 15 tons Steam per hour - more than 15 tons (Q=SO ₂ emission in kg/hour)	kg/ton acid 4 100 275m 220m 14(Q)03 11m 14(Q)03
9	Oxides of nitrogen (ka) Nitric acid production (kha) Gas based power stations 500 MW or more 200 - 500 MW Less than 200 MW (Ga) Metallurgical oven	3 kg/ton acid 50 ppm 50 ppm 40 ppm 30 ppm 200 ppm
10	Kiln soot and dust (ka) Blast furnace (kha) Brick kiln (Ga) Coke oven (Gha) Limekiln	Mg/Nm-1 500 1000 500 250

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3135-3136, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali).

2.7 International Treaties and Conventions

Bangladesh already had accessed to, ratified or signed a number of major international treaties, conventions and protocols related to environment protection and conservation of natural resources which shall have to be complied with during implementation of any project. The Environment related International conventions, protocols, treaties signed/ratified by Bangladesh are listed below:

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
01.	International Plant Protection Convention (Rome, 1951.)		01.09.78	
02.	International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.)		28.12.81 (entry into force)	
03.	Plant Protection Agreement for the South East		04.12.74 (AC)	

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
	Asia and Pacific Region (as amended) (Rome, 1956.)		(entry into force)	
04.	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (Moscow, 1963.)	13.03.85		
05.	Treaty on Principles governing the Activities of States in the Exploration and use of outer Space Including the Moon and Other Celestial Bodies (London, Moscow, Washington, 1967.)		14.01.86 (AC)	
06.	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)		04.02.82 (entry into force)	
07.	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").		20.04.92 (ratified)	
08.	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons, and on Their Destruction (London, Moscow, Washington, 1972.)		13.03.85	
09.	Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972.)		03.08.83 (Accepted) 03.11.83 (ratified)	
10.	Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention")	20.11.81	18.02.82	
11.	United Nations Convention on the Law of the Sea (Montego Bay, 1982.)		10.12.82	
12.	Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)		02.08.90 (AC) 31.10.90 (entry into force)	
13.	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)		02.08.90 31.10.90 (AC) (entry into force)	
13a.	London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)		18.03.94 (AC) 16.06.94 (entry into force)	
13b.	Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992		27.11.2000 (AT) 26.2.2001 (Entry into force)	
13c.	Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997		27.7.2001 (Accepted) 26.10.2001 (Entry into force)	
14.	Convention on Early Notification of a Nuclear Accident (Vienna, 1986.) 07.01.88 (ratified)		07.02.88 (entry into force)	
15.	Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency (Vienna, 1986.)		07.01.88 (ratified) 07.02.88 (entry into force)	
16.	Agreement on the Network of Aquaculture Centers in Asia and the Pacific (Bangkok, 1988.)		15.05.90 (ratified)	
17.	Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989.)		01.04.93 (AC)	
18.	International Convention on Oil Pollution	30.11.90		In the

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
	Preparedness, Response and Cooperation (London, 1990.)			process of ratification
19.	United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92	15.04.94	
20.	Convention on Biological Diversity, (Rio De Janeiro, 1992.)	05.06.92	03.05.94	
21.	International Convention to Combat Desertification, (Paris 1994.)	14.10.94	26.01.1996 (Ratification) 26.12.1996 (entry into force)	
22.	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)		03.10.79 (AC) (entry into force)	
23.	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994.)	28.07.96		
24.	Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (New York, 1995.)	04.12.95		
25.	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Paris, 1993.)	14.01.93		
26.	United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Paris, 1994.)	14.10.94	26.01.96	
27.	Convention on Nuclear Safety (Vienna, 1994.)	21.09.95	21.09.95 (AT)	
28.	Cartagena protocol on Bio-safety to the Convention on Biological Diversity	24.5.2000	05.05.2004 (AC)	
29.	Convention on persistent Organic Pollutants, Stockholm	23.5.2001	12 March 2007	
30.	Kyoto protocol to the United Nations Framework Convention on Climate Change		21.8.2001 (AC) 11.12.1997 (AD)	
Source: "Multilateral Environmental Agreements in force in Bangladesh" Department of Environment (DOE), Bangladesh				

The relevant environment related conventions, protocols and treaties are briefly presented below.

2.7.1 International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969))

The main objective of this convention is to take action to prevent pollution of the sea by oil discharged from ships. This Convention applies to all ships, except tankers of under 150 tons gross tonnage and other ships of under 500 tons gross tonnage, registered in the territory of, or having the nationality of, a party. Naval ships and ships engaged in whaling are also excepted (art. 2). Discharges are prohibited, except when a ship is proceeding en route or when the instantaneous rate of discharge does not exceed 60 liters per mile. The prohibition is not applicable when the following conditions are

satisfied: in the case of a ship - the oil content of the discharge is less than 100 parts per million parts of the mixture, or the discharge is made as far as practicable from land; in the case of a tanker - the total quantity of oil discharged on a ballast voyage does not exceed one fifteen-thousandth of the total cargo-carrying capacity, or the tanker is more than 50 miles from the nearest land (art. 3); Exceptions to article 3 are provided in cases of necessity to secure safety of ships, save life or prevent damage to cargo, or where leakage is unavoidable and all measures have been taken to minimize it (art. 4). Ships are to be fitted within 12 months to prevent escape of oil into the bilges (art. 7). Parties undertake to provide appropriate facilities at ports and oil-loading terminals (art. 8). All ships covered by the Convention are to carry an oil record book in a form specified in the annex, to be completed whenever certain operations take place (art. 9). Parties agree to send texts of laws, decrees, orders and regulations giving effect to the Convention to the United Nations.

2.7.2 Rio Declaration

The 1992 United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

2.7.3 Convention on Biological Diversity, Rio de Janeiro, (1992)

The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 05 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

The Contracting Parties of the Convention have committed to:

- Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and
- Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account.

Obligation has been placed on State parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 4).

2.7.4 Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971)

This convention is also known as the Ramsar Convention. It was adopted 02 February, 1971 and entered into force on 21 December, 1975. Bangladesh has ratified the Convention 20 April, 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 127 Parties with 1085 wetland sites designated as 'Wetlands of International Importance'.

This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance", the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves.

Bangladesh has two Ramsar sites- Parts of Sunderban Reserved Forest (Southwest of Bangladesh) and Tanguar Haor (Northeast of Bangladesh). Both the Ramsar sites are located far away from this proposed project area. (Source: <http://www.ramsar.org/>)

2.7.5 United Nations Convention on the Law of the Sea, Montego Bay, (1982)

This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

Main objectives of the convention are:

- To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and
- To establish basic environmental protection principles and rules on global and regional co-operation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to all sources of marine pollution.

2.7.6 Others (Convention and Agreements)

The following conventions and agreements may include provisions relevant to different aspects of oil and gas operations for environmental management, nature protection, and biodiversity conservation:

- Convention relative to the Preservation of Fauna and Flora in their Natural State 1933;
- International Convention for the Protection of Birds, Paris, 1950;
- International Plant Protection Convention, Rome. 1951;
- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972: This convention has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (Popularly known as CITES): This provides a framework for addressing over harvesting and exploitation patterns which threaten plant and animal species. Under CITES, governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns; and

Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988): This provides a framework for agreements between countries important to the migration of species that are threatened.

2.8 Compliance with International Guidelines and Standards

Under the study health and safety guidelines of few development agencies will be reviewed. This will include "JICA Guidelines for Environment and Social Consideration" (April, 2010), World Bank Operational Directives (OD-4.00, Annex-A), "Environmental, Health, and Safety Guidelines of the International Finance Corporation Guideline (IFC/EHS Guideline)".

2.8.1 Compliance with JICA Guidelines for Environment and Social Consideration (April 2010)

JICA, which is responsible for Official Development Assistance (ODA), plays a key role in contributing to sustainable development in developing countries. The inclusion of environmental and social costs in development costs and the social and institutional framework that makes such inclusion possible are crucial for sustainable development. Internalization and an institutional framework are requirements for measures regarding environmental and social considerations, and JICA is required to have suitable consideration for environmental and social impacts.

The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

2.8.2 Compliance with World Bank EA process

The WB introduced the Operational directive on Environmental Assessment (OD-4.00, Annex-A) in October 1989. This comprehensive and detailed new policy mandated an environmental assessment for all projects that may have significant impacts on the environment. After two years of the Bank experience with environmental assessments, the operational directive was revised to broaden its scope and applicability. Recognizing that the projects aimed at achieving environmental objectives could sometimes have negative and unanticipated effects, the new revised guideline OD.4.01 was introduced which incorporates a new system of classifying projects according to the nature and extent of their environmental impact. The Bank uses the following three categories to signal the appropriate level of EIA for any given project.

Category A: If the project is likely to have significant adverse impacts that are sensitive, diverse or unprecedented, or that affect an area broader than the sites or facilities subject to the physical area. EA for category A projects examines a project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" condition) and recommends any measures needed to prevent, minimize, mitigate or compensate for adverse impacts and improve environmental performance. For Category A projects, the borrower is responsible for preparing an EIA report that includes an environmental management plan and a monitoring plan.

Category B: A proposed project falls under Category B if its potential adverse environmental impact on human populations or environmentally important areas including wetlands, forests, grasslands and other natural habitats are less adverse than that of Category A projects. The scope of EIA for Category B projects may vary from project to project, but it is narrower than that of Category A.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

2.8.3 IFC/EHS Guideline

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice, as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement.

2.9 Compliance with EIA Guidelines of DOE

The DOE has issued EIA Guidelines for Industries (this document was released in December 1997) and addresses the IEE and EIA for several industrial sectors and activities. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DOE guidelines. Figure-2.2 shows the application procedure for obtaining site/environmental clearance.

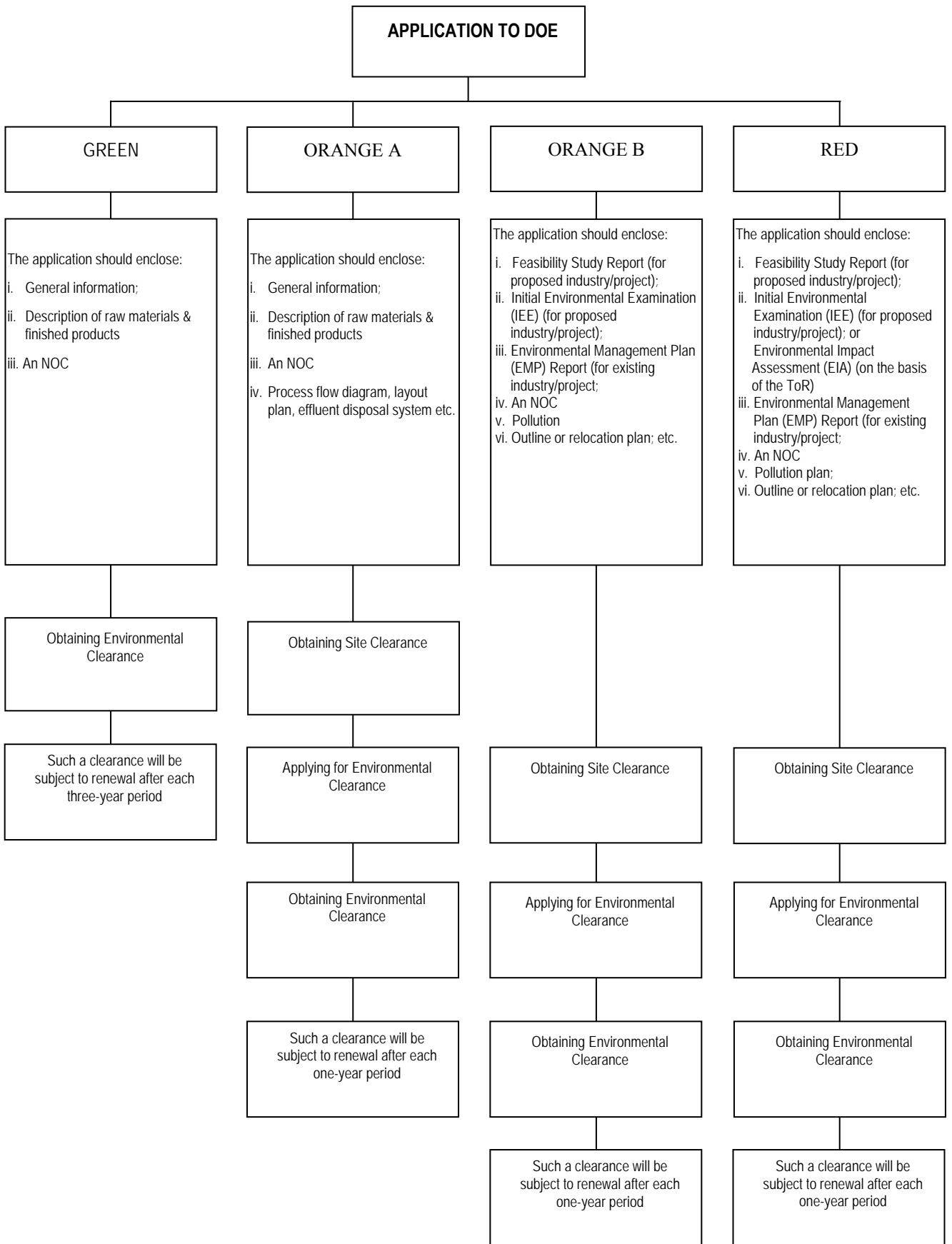


Figure-2.9-1: Steps Involved in Environmental Clearance Following DOE Guidelines

CHAPTER-3 PROJECT DESCRIPTION

3.1 General

Gas Transmission Company Limited (GTCL) has proposed to construct Dhanua-Elenga 30 inch 52kms high pressure gas transmission pipeline, in place mostly parallel to the M-D-E-EBJB pipeline. The route of the pipeline would mostly follow the same route as used in available M-D-E-EBJB pipeline. The route assumed for the 2005 EIA studies has been reviewed recently (September 2013) by GTCL to confirm its suitability under present condition with focus on any possible minimization of resettlement requirement. As the result of review realignment of the originally planned ROW (2005) in some places along the initial 32 km sector of the ROW located between Dhanua and Sulgrampur was made so as to minimize resettlement requirement.

3.1.1 Project Category

As per the criteria of DOE, the gas transmission pipeline falls under the Red Category and the same requires Environmental Impact Assessment (EIA). Though the project has some environmental impact but of lesser degree as will be revealed from the successive chapters.

3.1.2 Project Justification

The implementation of the proposed project will extend the additional supply of natural gas and thereby reducing Bangladesh's dependence on imported fuel.

3.2 Project Location

The proposed routing for the high-pressure gas transmission pipeline from Dhanua-Elenga falls into three districts, four thanas, thirteen unions and forty mouzas. Key route map of the project area is shown in Figure-3.2-1. The details of the administrative units are tabulated in Table-3.2-1.

Table-3.2-1: Location of Dhanua-Elenga Gas Transmission Pipeline Project

Sl. No.	District	Thana	Union	Mouza
1	Gazipur	Sreepur	Gazipur	Gazipur
2	Gazipur	Sreepur	Gazipur	Sailat
3	Gazipur	Sreepur	Gazipur	Banshbari
4	Gazipur	Sreepur	Gazipur	Dhanua
5	Gazipur	Sreepur	Maona	Maona
6	Gazipur	Sreepur	Telihati	Mulaid
7	Mymensingh	Bhaluka	Kachina	Kachina
8	Tangail	Sakhipur	Baheratail	Ghateshwari
9	Tangail	Kalihati	Kok Dahara	Mahish Jora
10	Tangail	Kalihati	Sahadebpur	Pathanda
11	Tangail	Kalihati	Nagbari	Pakutia
12	Tangail	Kalihati	Sahadebpur	Terki
13	Tangail	Kalihati	Kok Dahara	Badda
14	Tangail	Kalihati	Nagbari	Nagbari
15	Tangail	Kalihati	Kok Dahara	Baldhi
16	Tangail	Kalihati	Bangra	Rajabari
17	Tangail	Kalihati	Kok Dahara	Kok Dahara

Sl. No.	District	Thana	Union	Mouza
18	Tangail	Kalihati	Sahadebpur	Patita Para
19	Tangail	Kalihati	Sahadebpur	Dimukha
20	Tangail	Kalihati	Balla	Balla
21	Tangail	Kalihati	Kok Dahara	Dattagram
22	Tangail	Kalihati	Sahadebpur	Mundail
23	Tangail	Sakhipur	Baheratail	Dabail
24	Tangail	Sakhipur	Baheratail	Gohailbari
25	Tangail	Sakhipur	Baheratail	Jogir Kopha
26	Tangail	Kalihati	Elenga	Masinda
27	Tangail	Kalihati	Balla	Singair
28	Tangail	Kalihati	Nagbari	Khigati
29	Tangail	Kalihati	Kok Dahara	Banira
30	Tangail	Sakhipur	Gazaria	Mocharia Pathar
31	Tangail	Sakhipur	Gazaria	Gazaria Kirtankhola
32	Tangail	Sakhipur	Gazaria	Garh Gobindapur
33	Tangail	Sakhipur	Gazaria	Sakhipur
34	Tangail	Sakhipur	Gazaria	Silimpur
35	Tangail	Sakhipur	Baheratail	Betua
36	Tangail	Sakhipur	Baheratail	Salgrampur
37	Tangail	Sakhipur	Jadabpur	Kalidas
38	Tangail	Sakhipur	Gazaria	Chhota Mausea
39	Tangail	Sakhipur	Gazaria	Pratima Banki
40	Tangail	Sakhipur	Jadabpur	Kalmegha

Mouza map of the proposed Transmission pipeline is shown in Figure-3.2-2.

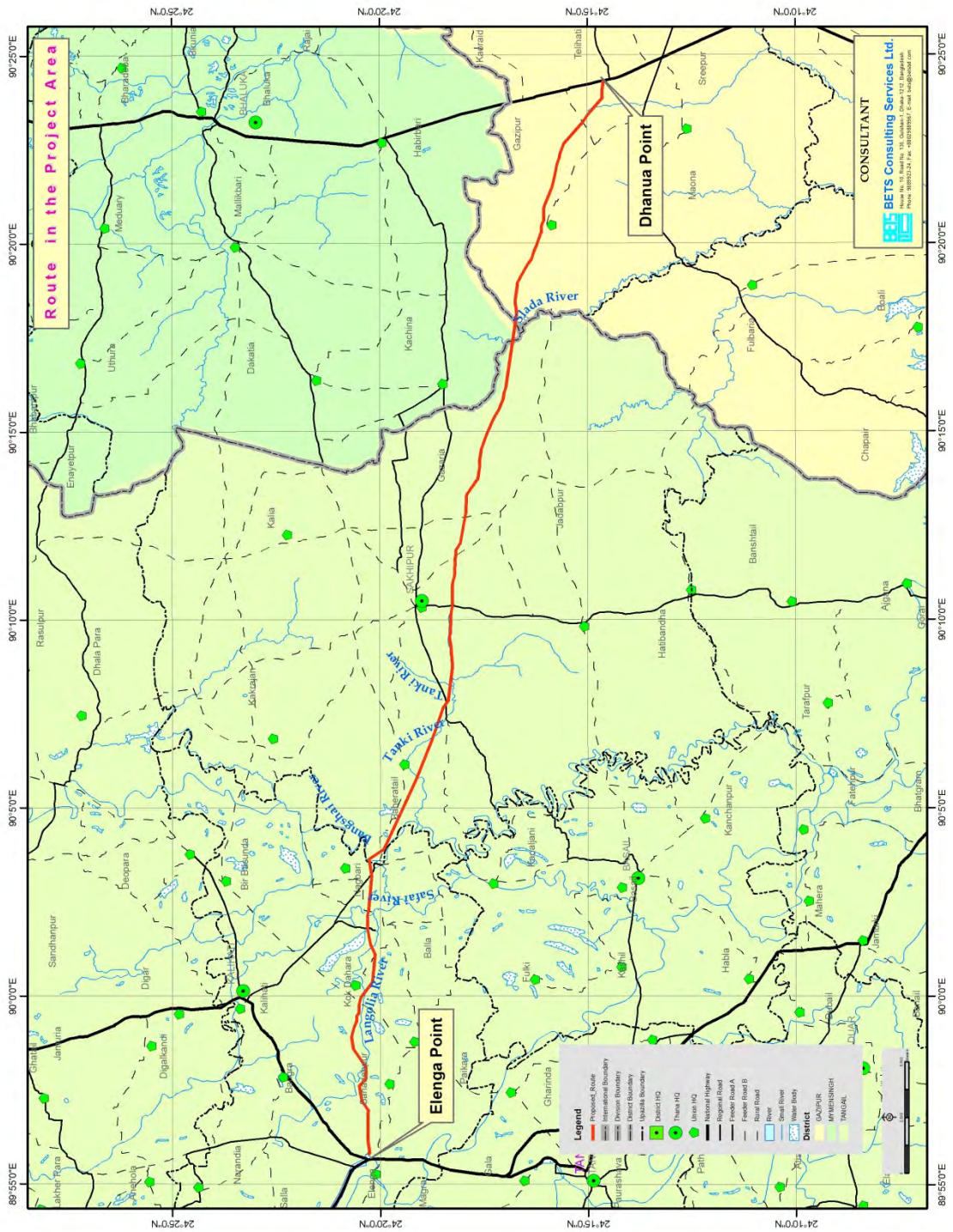


Figure 3.2-1: Key Route Map of the Project Area

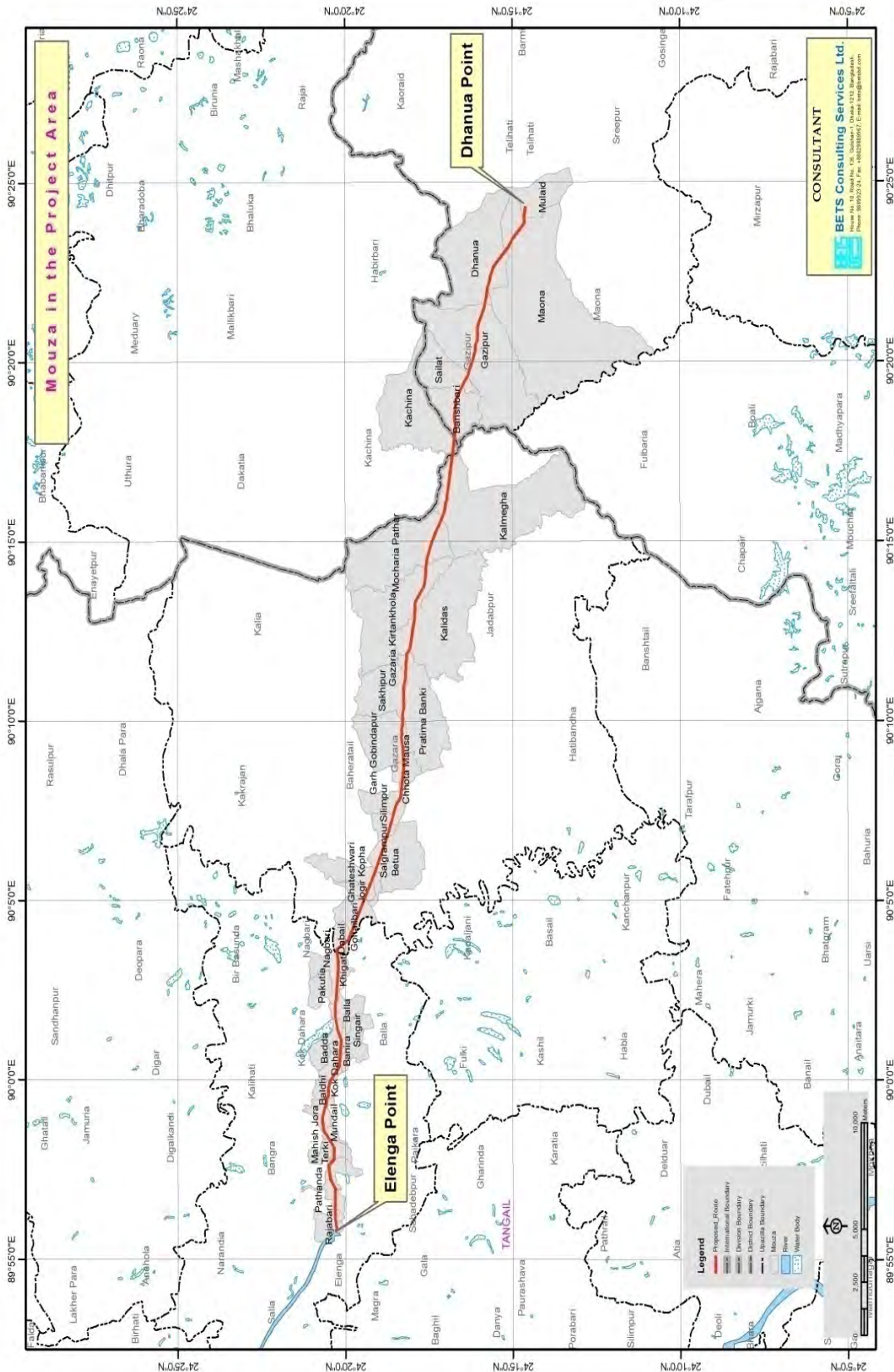


Figure 3.2-2: Mouza Map of the Project Area

3.3 Physical Components of the Project

The physical components of the project are:

- I. 52km 30 inch, 1130 psig Dhanua-Elenga high pressure pipeline construction
- II. Salda, Tanki-1, Tanki-2, Bangshai, Safai and Langolia river crossing through Horizontal Directional Drilling (HDD)
- III. Five major and fifteen minor Road Crossing along the route
- IV. One rail crossing along the route at the Rajabari point
- V. Hook-up of the proposed pipeline by hot tapping with
 - Two interface metering station
 - Two valve station
 - Seven intake/off-take nozzle

3.4 Access to the Project Area

The proposed Dhanua-Elenga high-pressure pipeline will pass across the Tongi-Mymensingh and Tongi-Tangail Highway. Besides these Highways a good number of cross road network exists in the project area. Construction materials would be transported from the Highway through these existing access roads at different sites of the project area. Imported materials may be transported at project site through Dhaka-Chittagong Highway or through railway.

Figure-3.4-1 shows the communication network map, the probable access roads to the ROW for transportation of construction materials, pipeline and other related equipments.

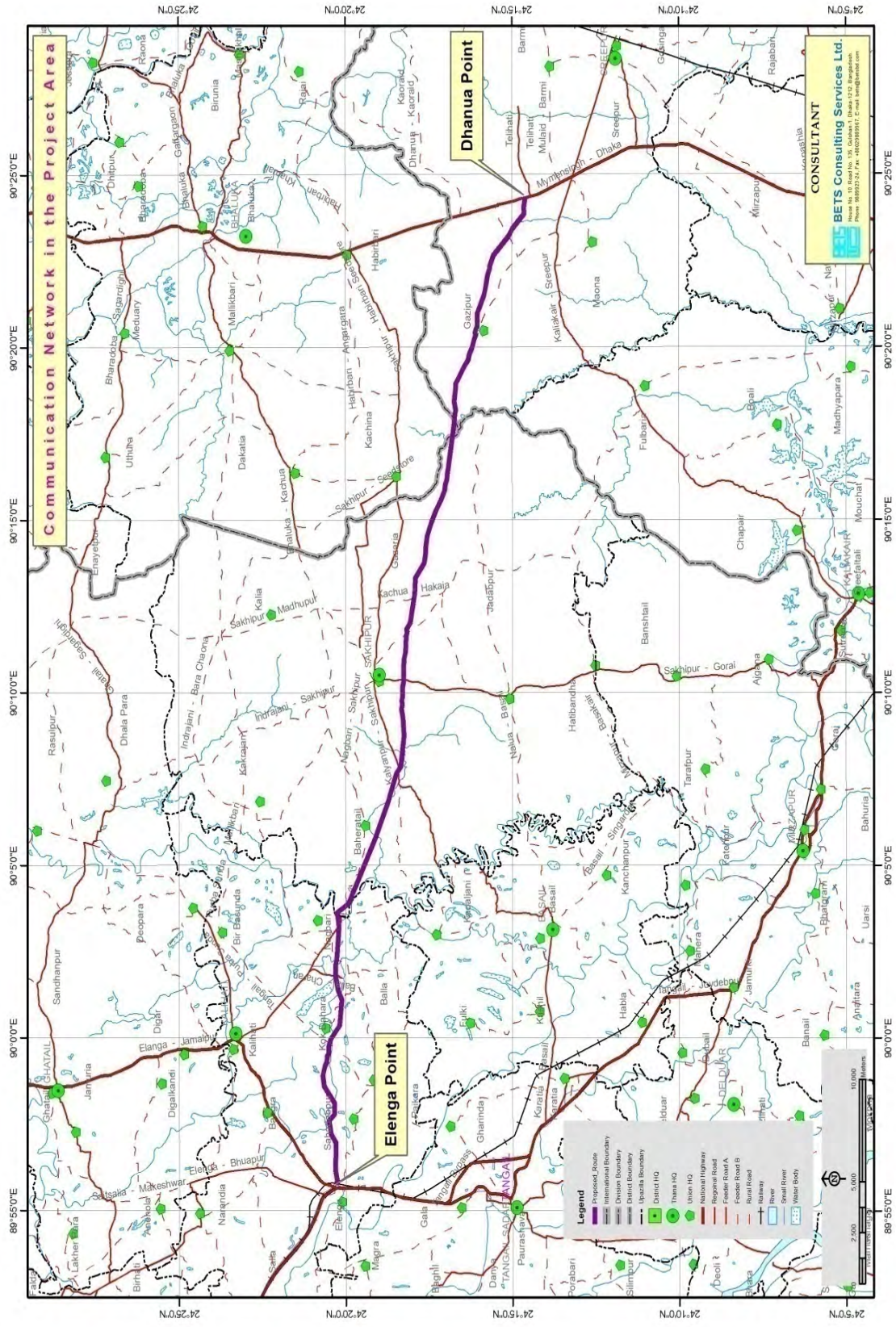


Figure 3.4-1: Communication Network Map of the Project Area

3.5 Basic data including requirements of land

The basic data of the project are furnished in Table-3.5-1.

Table-3.5-1: Basic Data of the Project

Sl. No.	Item		Description
1.	Name of the Project		Dhanua-Elenga Gas Transmission Pipeline
2.	Executing Agency		Gas Transmission Company Limited (GTCL)
3.	Project Location		This 52km Dhanua-Elenga high-pressure pipeline will pass through Gazipur, Mymensingh and Tangail districts.
4.	Length of Transmission loop line in		52kms
5.	Size (Diameter)		30 inch
6.	Gas Transmission pressure at gas supply capacity		Monohordi valve station 840 psig and at valve station East Bank of Jamuna 750 psig
7.	Physical work	a) Survey	Pipeline route survey: EIA and Resettlement Plan
		b) Pipeline Construction	Construction of 30 inch, 52kms, 1130 psig High pressure transmission pipeline, pigging, Hydro-testing and commissioning.
		c) River Crossing	Salda, Tanki-1, Tanki-2, Bangshai, Safai and Langolia River crossing through Horizontal Directional Drilling (HDD)
		Road/Rail Crossing	Five highway and one railway crossing
8.	Land Requirement	a) Acquisition	41.69 hectares for loopline, laying and valve station, scrapper trap and CP station
		b) Requisition	102 hectares for providing working area during pipe laying works and other construction works
9.	Civil Construction	a) Office space	Already exist
		b) Residential area	130 sqm at Dhanua
		c) Other construction	Not Required
10.	Procurement	a) Equipment and Machinery	Line pipe, scrapper trap, valves, fittings, bends, coating & wrapping materials, CP materials etc.
		b) Transport	Jeep 2 nos. & Micro 2 nos.
11.	Manpower	a) Implementation period	27 nos. (both D-E and WBJB-Nalka Project)
		b) Operation period	60 nos. (both D-E and WBJB-Nalka Project)
12.	Project cost		Tk 93,397.54 lakh (USD 116.75 m) (both D-E and WBJB-Nalka Project)
13.	Project Implementation Period		July 2014 to December 2017 (both D-E and WBJB-Nalka Project)

Source: Draft DPP of GTCL

3.6 Description of Valve Station along Pipeline Route

The proposed routing for the new pipeline from Dhanua to Elenga valve station falls into three districts namely Gazipur, Mymensingh & Tangail and four thanas.

Though the proposed pipeline will be constructed parallel to the existing M-D-E-EBJB pipeline wherever possible, the new line will not be always in the same ROW of the existing pipeline. In finalizing the route of the pipeline, features of particular sensitivity (such as graveyards, mosque and temple) have already been identified and the right of way has been diverted away from them including most of the homesteads of the villages. Starting from Dhanua valve station, the proposed pipeline will cross a number of rivers/khals, wetland (beel/khal) and a number of ponds.

3.7 Analysis of Suitability of Alternative Routes

To minimize adverse impacts on the environment, the identification of a suitable route for gas transmission pipeline is very important. Two options for the pipeline route have been developed. Factors which were taken into account include:

- Length of the Route
- Minimal Highway Crossing

- Avoid Rural road crossing as much as possible
- Avoid Rivers crossing as much as possible
- Minimal obstruction to habitation
- Avoid large trees and tree plantations as much as possible
- Avoid water bodies and / swampy areas as much as possible
- Avoid homestead, schools, grave yard, mosque, church/ temple, cremation yards etc. and
- Avoid environmental sensitive areas, historic and archaeological sites as much as possible.

Apart from the above factors, the following considerations were made during the route selection process:

- **Route Selection:**
The critical and attentive issues for selection of a route for pipeline are:
Selection of route avoiding the following twelve (12) Ecologically Critical Areas: **Human Settlements**, Forest Sanctuaries, National Parks, Game Reserves, Mangroves, Forest Areas, Wetlands, Wildlife Habitats, Archaeological Sites, Ancient Monument Sites, Biodiversity Areas and Similar Other Areas.
- **Preference of Non-productive Land:**
The non-productive land as an alternative just near the proposed agriculture land is preferable for environmental soundness.

A comparative integrated (technical, social, economical and environmental) analysis has been performed to reach the conclusion which route option with alternatives shall be selected.

Two route alternatives were conducted, one is the 2005 route as planned by the previous ADBs project (Alternative-1), other one is rerouting as much as practical to minimize resettlement and also straitening as much as possible to minimize any additional increase in overall length of the pipeline (Alternative-2).

The route alternatives are shown in **Figure-3.7-1**. Considering the raw information based on the field investigations (physically, survey drawing or satellite image observation etc.), consultation with the different stakeholders and focusing on the minimum resettlement population, it is clear that the Alternative-2 is better than the Alternative-1 and selected for the project. The details of the comparison of the two alternatives are described in **Table-3.7-1**.

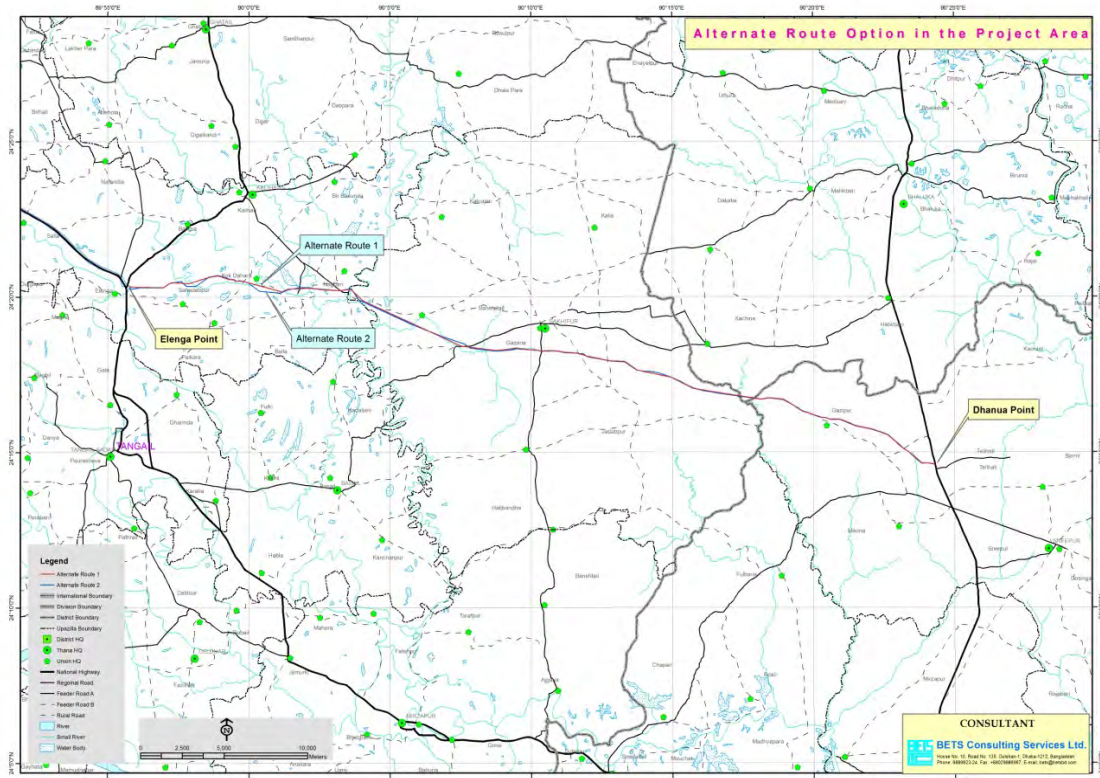


Figure-3.7-1: Alternative Route Option of the Project

Table-3.7-1: Alternative Route Option Analysis

Analyses Parameter	Alternative-1 (ADB Route of 2005)	Alternative-2 (Rerouting to minimize Resettlement and Straitening)
Current status of Route	<ol style="list-style-type: none"> 1. Comparatively significant Homestead on the route 2. Insignificant Fisheries on the route 3. Insignificant Agricultural land on the route 4. River Crossing (Five) 5. Road Crossing (Five) 6. One Rail Crossing 	<ol style="list-style-type: none"> 1. Comparatively insignificant Homestead on the route 2. Insignificant Fisheries on the route 3. Agricultural land on the route is a bit more than the Alternative-1. 4. River Crossing (Six) 5. Road Crossing (Five) 6. One Rail Crossing
Technical	<ol style="list-style-type: none"> 1. Route length:52 km 2. Pipeline Construction: difficult as the significant homesteads are observed 3. Accessibility (Access to the route for construction work): Difficult 4. Soil Condition of the route is good 5. No hill cutting is required 	<ol style="list-style-type: none"> 1. Route length: 51.681km, this is less than the Alternative-1. 2. Pipeline Construction: Comparatively easy 3. Accessibility (Access to the route for construction work): Comparatively easy 4. Soil Condition of the route is good 5. No hill cutting is required
Social	<ol style="list-style-type: none"> 1. Resettlement Population: 194 Households (HH) i.e. around 1000 PAPs are found on this route. Maximum Resettlement is required in comparison of the Alternative-2. 2. Relocation/Loss of shelter/Loss of asset/Loss of income sources e.g., shops, agricultural, small industry is maximum on this route 3. No Indigenous people/Indigenous Ethnic Minorities/Tribal groups are affected 4. Project does not affect any cultural property i.e. Graveyard/Mosque/Temple/Pagoda /Church/Archeological/Paleontological/Historic/Others 	<ol style="list-style-type: none"> 1. Resettlement Population: 25Households i.e. around 121 PAPs are found on this route. Minimum Resettlement is required in comparison of the Alternative-1. 2. Relocation/Loss of shelter/Loss of asset/Loss of income sources e.g., shops, agricultural, small industry is minimum on this route 3. No Indigenous people/Indigenous Ethnic Minorities/Tribal groups are affected 4. Project does not affect any cultural property i.e. Graveyard/Mosque/Temple/Pagoda/Church/Archeological/Paleontological/Historic/Others

Analyses Parameter	Alternative-1 (ADB Route of 2005)	Alternative-2 (Rerouting to minimize Resettlement and Straightening)
Environmental	<ol style="list-style-type: none"> 1. Loss of productive land is comparatively less than Alternative-2. 2. Loss of Agri. Yields is comparatively less than Alternative-2. 3. Increase of Agri. Yields: Indirectly positive, the availability of fuel will help to generate electricity for irrigation as well as increase of Agri. Yields. 4. Cumulative and long-term effect: Insignificant 5. Loss of Forest: Insignificant 6. Loss of indigenous species: Insignificant 7. Loss of Biodiversity: Insignificant 	<ol style="list-style-type: none"> 1. Loss of productive land is more in comparison of the alternative-1. 2. Loss of Agri. Yields is comparatively maximum than the alternative-1. 3. Increase of Agri. Yields: Indirectly positive, the availability of fuel will help to generate electricity for irrigation as well as increase of Agri. Yields. 4. Cumulative and long-term effect: insignificant 5. Loss of Forest: Insignificant 6. Loss of indigenous species: Insignificant 7. Loss of Biodiversity: Insignificant

3.8 Description of Pipeline Construction, Metering Stations and Other Facilities

The design and construction of pipeline to meet local condition is of most important. Key activities during pre-construction phase of pipelines must conform to the Bangladesh Mineral gas safety rules of 1991 amended up to 2003. Pipelines are buried and the clearance from the crown of the pipeline to the surface is minimum 90 cm. All sections of the pipeline must be pigged; therefore, adequate provision has to be kept for this purpose while designing the pipeline system.

➤ **Pipeline Route Selection**

In drawing a tentative route, a number of factors are taken into consideration such as access to the pipeline from the main road and avoidance of river crossing, railway crossings and major road crossings as much as possible. The pipeline selector has to carry out a series of consultations with involved agencies such as district authority. Once the tentative pipeline route is selected, a detailed survey work is carried out along the entire right of way.

➤ **Impact Prediction**

Impacts of the pipeline on infrastructure, human and ecological systems are a critical aspect of pipeline route selection and construction.

➤ **Miscellaneous Factors to be considered in Pipeline Construction**

- Temporary Storage and Stack Yard
- Fire Fighting
- Equipment and Vehicle Mobilization
- Construction of Temporary Access Roads

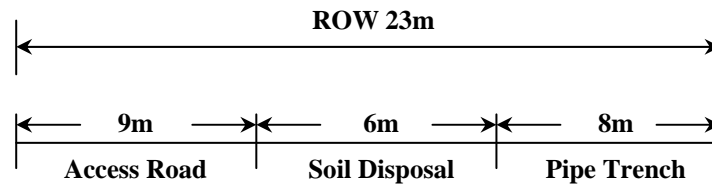
3.9 Key activities during construction phase

In consideration of the basic data of the project as shown in **Table 3.5-1**, the key activities involve survey, pipeline constructions, special crossings & civil construction etc. for the 52km high pressure pipelines from Dhanua-Elenga. The salient features of these activities are highlighted below in the context of environmental considerations:

- *Setting up Pipeline Route and Working Areas*-The width of the normal right of way is 23 meters, but where the right of way passes through farm yards, drainage ditches, etc., then only that amount of right of way necessary for actual movement of equipments, pipeline construction and trenching etc. should be utilized.
- *Fences and Gates for Temporary Crossings*- It is essential to demarcate the crossing areas of roads and other special areas. Prior to other construction operations, substantial gates or gaps in all fences must be installed which intersect the right of way to permit passage of construction equipment along the right of way.
- *Grading*- The purpose of grading is to provide adequate right of way access and ditch-line preparation to complete construction. Attempts should be made to lay the

pipeline in areas which will minimize grading, thus reducing environmental impacts.

The ROW of the pipe alignment is shown in the sketch below:



The contractor shall prepare the construction working area on the ROW sufficient in width to run the vehicles and for construction of pipelines in accordance with project alignment drawings and specification and good pipeline practice. In doing this, interest of the land owners should be given priority and shall cause a minimum inconvenience and damage. For cultivable land, the top soil strip shall be stripped and set separate to prevent contamination. All existing access, drainage and irrigation system shall be maintained across agricultural land.

- *Route Selection*- Selection of the route has been made so that it provides a “path of least resistance” and ensures the most practical locations. Consideration of good pipeline practices and potential environmental impacts should now be taken in to account.
- *Survey*- Fine-tune the right of way onsite to minimize grading by avoiding previously undetected problem areas.
- *Inspection*- Provide guidance for the Contractor- for quality works keeping good communication at each step of activities.
- *Width of Right-of-Way*-Determine optimum width of right-of-way for the pipeline and its ancillary facilities at different locations.
- *Pipe Diameter Factor*-The larger the diameter of pipe, the greater right of way width is required. Large diameter pipe will not “rope” into the ditch, thus requiring very accurate bends. However, the pipeline of this project being 30" in diameter and there would be no variation in the width of ROW.
- *Ditch Depth Factor*-The amount of soil excavated from the ditch to meet the construction specifications is the main factor in determining the width of right of way with respect to ditch depth.
- *Stringing*-Pipes should be strung only on the right of way which has been cleared and where necessary grading has been completed. Pipe should be strung to facilitate for proper progress of the subsequent activities viz. welding, coating, wrapping, laying etc.
- *Welding*- All pipe joints must be welded in accordance with the proper specification. The welded pipes and joints shall undergo non-destructive testing (NDT) to ensure proper quality of the pipeline joints and necessary repair & replacement of the defective ones as required.
- *Coating and Wrapping of Pipeline*-The pipeline should be of 3 layer polyethylene (PE) coating. Except for Horizontal Directional Drilled crossings all pipelines at river crossings shall be pre-coated with CWC over PE coating.
- *Horizontal Directional Drilling*-All care should be taken to see that Horizontal Directional Drilling is performed to cross the rivers at proper alignment and depth below the river bed. The banks of the rivers should be properly re-instated and protected from subsequent erosion. The pipeline crossing section should be properly hydro-tested before tie-in.
- *Lowering*-In-Commencement of the laying work shall take place as soon as possible after the trench has been excavated and the NDT and Holiday Detection (HD) are completed. In this operation, special care shall be taken to ensure that the pipe coating sustains no damage and that the pipe is not laid in tension. Any damage to the pipe coating during the lowering operation shall be repaired before back-filling commences.
- *Tieing*-In-Separate welded sections of the pipeline shall be tied-in to a continuous system in such a manner that no stress will be introduced into the pipe as a consequence of the tie-in operation.

- *Protection against Trench Collapse:* Maintaining a slope along the trench by cutting back at the trench walls to an angle where it is unlikely that the soil will shift. Shoring the sides of an excavation using timber, mechanical or hydraulic systems, or using a trench box to protect workers inside a trench. The box is moved along as the trench progresses, with workers required to be outside of the trench while the trench box is being moved.
- *Cathodic Protection-Cathodic protection test points shall be installed and connected to temporary cathodic protection facilities in accordance with the specification as the final operation of lowering or tying-in. The installation shall require inspection before back-fill is placed.*
- *Back-filling-*Before any back-filling is started, it must be assured that the pipeline is evenly bedded upon the bottom of the trench throughout its length, in its correct position and is not riding upon any stones, rock or other material which may be harmful to the pipe or the coating. When back-filling in progress, no rocks, hard clods or other hard objects shall be permitted to fall on the coated pipe. Compaction of back-filling by an approved method shall be such as to prevent any subsequent settlement.
- *Reinstatement and Clean-Up-*As soon as the pipe has been laid and back-filling in the right of way is completed, all working areas should be cleaned up to ensure that they are returned to their original status as much as possible.
- *Route Markers*
 - Route Marker-Reinforced cement concrete posts (route markers) shall be installed except at aerial marker locations, on both sides of road, river and canal crossings and at interval along the pipeline route with a maximum separation distance of 0.2 km between markers.
 - Aerial Marker-Aerial markers shall be installed at every horizontal bend and at intervals along the pipeline route with a maximum separation distance of 1.6 km between the aerial markers.

Pipeline Cleaning, Pigging, Hydrostatic Testing and commissioning

It is required to carry out hydrostatic strength and leakage tests and drying before the pipeline is accepted for mechanical completion and commissioning. Necessary pigging, purging and dewatering are essential activities for final commissioning of the pipeline sections.

Commissioning

All installation facilities shall be purged with Nitrogen prior to commissioning and provision shall also be made for Nitrogen to be used in the pipeline commissioning phase. Upon completion of the commissioning and appropriate reinstatement and clean up of the ROW including installation of ROW markers and aerial markers in accordance with the program and procedures, to the satisfaction of the engineer, the pipeline system will be taken over for operation by the company.

Metering Stations and Other Permanent Above-ground Facilities

Small permanent parcels of land are required for metering stations, valves/stations, scraper facilities and to provide adequate pipeline clearance at major river crossing. 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 (including the guide lines for scrapers trap stations and river crossing operation).

Scraper Traps

- **Purpose**
To clean or internally inspect a pipeline without interrupting fluid flow.
- **Location**
Scraper or pig launching traps are located at the start of the pipeline with receiving

traps located at the downstream end. Intermediate launching and receiving facilities are generally installed:

- Where the pipeline length from the nearest launcher exceeds the recommended maximum travel distance of the pig or scraper being used.
- At compressor stations.

➤ **Components**

The following are main components required for scraper trap facilities:

- ❖ Receiver or launcher barrel complete with:
 - Quick-opening closure
 - Barrel Blow-down
 - Barrel drains on receivers.
- ❖ Various valves to alter fluid flow through the assembly.
- ❖ Kicker lines to initiate pig travel or to draw the pig into the barrel.
- ❖ Trap isolation valve.
- ❖ Assemblies bypass flow line.
- ❖ Pig passage indicator.

Valve Assemblies

1) Block Valves

i. Purpose

Block valve assemblies are used to isolate sections of mainline or a long lateral if a line break occurs or when maintenance in a section of the line is necessary.

ii. Required Components

The following are the main components required for a block valve assembly:

- ❖ A gate or ball valve the size of the mainline.
- ❖ Two blows downs, either remote from or directly connected to the mainline, interconnected for equalizing the pressure on both sides of the block valve.
- ❖ A riser on each side of the block valve to provide a power supply for a hydraulic/ pneumatic operator, or for taking fluid samples, connecting pressure gauges or performing flow tests.

iii. Block Valve Location

- Code requirements for maximum block valve spacing vary with Class Location as follows:

<u>Class Location</u>	<u>ASME B31.8</u>	<u>CAN/CSA Z184</u>
1	32 km	None (32 km norm)
2	24 km	25 km
3	16 km	13 km
4	8 km	8 km

- Ease of access and site conditions should always be evaluated when selecting a location for a valve assembly.

2) Side Valves

a. Purpose

- The side valve assembly is required to isolate the lateral from the mainline in situations where a line break may occur or when maintenance of the lateral may be necessary.
- The check valve in the assembly is to prevent reverse flow, or flow from the mainline up the inflowing lateral when the pressure in the lateral is less than that in the mainline. Check valves are not required on sales (off-take) laterals.

b. Required Components

A side valve assembly consists of the following components:

- A gate or ball valve the size of the lateral.
- A check valve and bypass line (receipt laterals).
- A blow down with appropriate valving.
- A flange and insulation set to separate the lateral electrically from the mainline.

- Test leads from the mainline and the lateral.

c. Location

These assemblies are located on the lateral immediately adjacent to the mainline.

3) River Crossings

- Geometry and location of crossings
- Scour considerations
- Depth of burial
- Sag bend location
- Environmental considerations
- Timing of Construction
- Bank stabilization methods
- Buoyancy control methods
- Construction techniques
- Warning signs

Pipeline/ Metering Station Operations

Many activities are associated with operation of gas transmission and distribution pipelines and metering stations. Some of these are:

- Removing and replacement of the length of the pipeline section, valves, meters, regulators etc on occasions for the purposes of inspection, repair & maintenance.
- Repair and maintenance activity
- Pigging of pipe for cleaning purposes. This occurs on an infrequent basis. Significant waste is generated that requires proper disposal.
- Operation and maintenance of metering station. Often includes workshop and vehicle maintenance activities.
- Some hazardous materials (paints, thinners, POL, odorant) are generated.
- Condensate is generated at metering stations which requires proper handling and storage.

3.10 Work Schedule

This project is scheduled to start from July 2014 and will be completed in June 2017. After completion of the project work, GTCL will be able to supply 500 MMSCFD gas for each five year through this line keeping the pressure at 1130 psig in Dhanua valve station and 1000 psig at valve station Elenga respectively. This loop-line will meet the present and future gas demand of Titas Gas and Paschimanchal Franchise Areas. The work schedule of the project is shown in bar chart diagram **3.10-1**.

3.11 Investment cost and funding arrangement

The proposal of proposed 30" dia X 66km (52km D-E + 14km WBJB-Nalka) X 1000psig transmission pipeline project is envisaged for implementation with the following investment cost (Lakh Tk.):

Local Currency (LC)	Tk. 46735.53	USD 58.42 M
Foreign Exchange (FE)	Tk. 46662.01	USD 58.33 M
Total	Tk. 93397.54	USD 116.75 M

Source: Draft DPP of GTCL



Figure: 3.10-1 Tentative Schedule of the Dhanua-Elenga and West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline Project

CHAPTER-4 BASELINES/EXISTING ENVIRONMENT

4.1 Introduction

There are two principal objectives in examining and defining the existing environment in an EIA study:

- To recognize potential environmental impacts of the project and enable mitigation measures to be identified.
- To provide a baseline against which environmental conditions in the future may be measured, to assist in identifying changes which might be attributable to the project and equally to document conditions which were either existing or developing before the introduction of the project and not due to the project.

Detail environmental features of 52km Dhanua-Elenga loop-line route have been recorded through field study and secondary data and report reviewing.

For EIA study the emphasis is given on the environmental features that are of particular significance to the present project. Considerations are given to both the environment and ancillary area that seems to be affected.

4.2 Study Area

The following districts, thanas, unions and the numbers of villages fall within the project area. Detailed location of the project area is shown in Table-4.2-1.

Table-4.2-1: Project Area

Project	District	Thana	Union	No. of Mouza	
Dhanua-Elenga-loop-line	Gazipur	Sreepur	Gazipur	4	
			Maona	1	
			Telihati	1	
	Mymensingh	Bhaluka	Kachina	1	
	Tangail	Kalihati	Kok Dahara	6	
			Sahadebpur	4	
			Nagbari	3	
			Bangra	1	
			Balla	2	
			Elenga	1	
			Sakhipur	Gazaria	7
				Baheratail	6
				Jadabpur	2

The study area is almost entirely agricultural consisting of small plots for raising crops and vegetated areas used for grazing farm animals. Low marshy lands are used for cultivation of paddy. The communities also support fish cultivation in small man made ponds. Individual farming homesteads exist adjacent to the route. The areas adjacent to thanas contain most of the homes and business that support the agricultural effort. Public and private sparse forest exists along about 30Kms on both sides of the proposed pipeline route near Dhanua.

The wetlands on the project area are important habitats for a large number of species. It is suspected that a good number of wetlands are drying up due in part to drainage irrigation and flood controls.

4.3 Physical Environment

Dhanua-Elenga loopline route traverses the Brahmaputra Flood Plain and the Young meander flood plain (usually called the Jamuna Flood Plain), comprises irregular pattern of rides and basins with areas of more irregular low laying areas with internal rivers and channels.

Here in Bangladesh earthquake occurrence is rare but the flooding is regarded as a yearly natural hazard. The rivers and waterways slowly shift over the years and can thereby create stability problems for pipeline and its facility locations.

4.3.1 Geology

Bangladesh is a riverine country and the geology of Bangladesh is affected by its location. It is the eastern two-thirds of the Ganges and Brahmaputra river delta plain stretching to the north from the Bay of Bengal. There are two smaller areas of higher jungle composed of old alluvium called the Madhupur tract and the Barind Tract.

The rivers are the most significant feature of Bangladesh geology as they constantly change course, sometimes rapidly, so that topological features of Bangladesh are ever changing. The route area is mostly open flat low-lying agricultural land. There are six rivers i.e. Salda, Tanki-1, Tanki-2, Bangshi, Safai and Langolia are being crossed by the alignment of the proposed loopline project. Except a major waterway i.e. Langolia canal which will be crossed in three points by the proposed pipeline many minor waterways i.e. canals, drains are in and around the project area.

The downward twisting of the basement rocks under central and southern Bangladesh result from the pressure of sediments that have been accumulating since the Cretaceous period, mostly a large quantity of carbonate. In the Late Eocene epoch the conditions in the Bay of Bengal changed and these deposits ceased. The pipeline route traverse through two type of geology:

- Alluvial Silt and Clay
- Madhupur Clay Residuum

Figure 4.3-1 shows the geology of the project area.



Figure 4.3-1 Geology of the Project Area

4.3.2 Topology

The topology of the project area is more or less plain field all along the route. Gazipur and a part of Tangail area are comparatively high land i.e. maximum around 23m elevation with respect to the Public Works Department (PWD) datum which was noted from the topographic survey. The area is relatively high and cannot hold waters during monsoon. Some waters are retained by raising "bandhs" around fields. The area spreads over Modhupur Garh in Tangail and Mymensingh district, Bhaol's Garh in Gazipur. Figure-4.3-2 shows the topology of the project area.

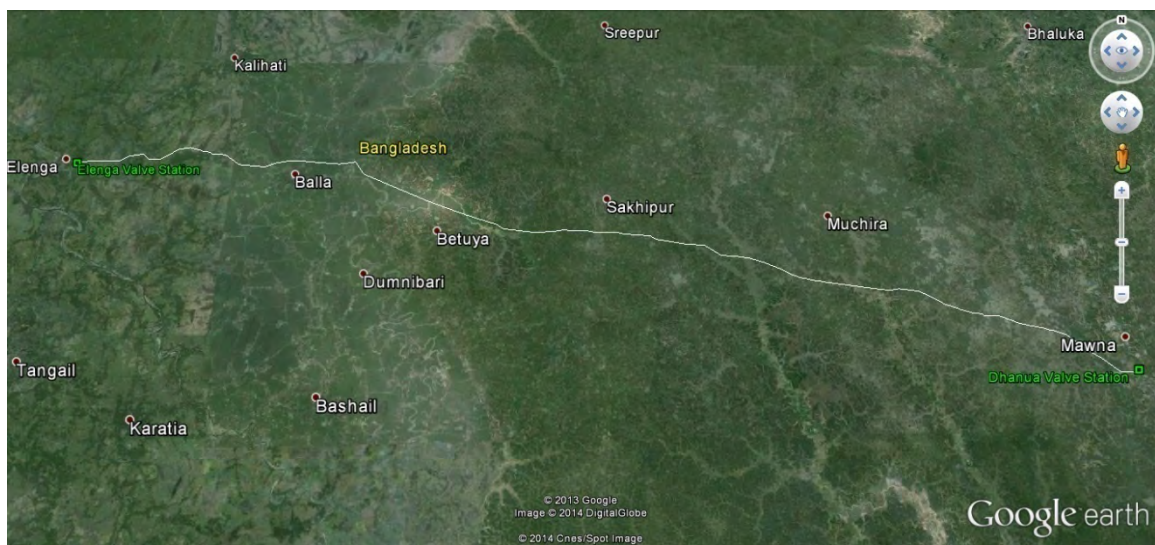


Figure-4.3-2 Topology of the Project Area

4.3.3 Ground water

Bangladesh is located over a subsiding basin of tectonic origin with a great thickness of sedimentary strata. This is an unconsolidated alluvial deposit of Recent to sub-Recent age overlying marine sediments. The recent delta and alluvial plains of the Ganges, Brahmaputra and the Meghna Rivers constitute the upper formation. The near surface Quaternary alluvium contains good aquifer characteristics (transmission and storage coefficients). The project areas ground water characteristics are good and its groundwater storage reservoir has three divisions; upper clay and silt layer, a middle composite aquifer (fine to very fine sand) and a main aquifer consisting of medium to coarse sand.

4.3.4 Land Conditions (Topography)

The distribution of land levels in relation to seasonal flooding i.e. depth of flooding are the following types:

- i. Highland (H): land which is above normal flood-level.
- ii. Medium Highland (MH): land which is normally flooded about 90 cm deep during the flood season.
- iii. Medium Lowland (ML): Land which is normally flooded between 90 cm. and 180 cm. deep during the flood season.
- iv. Lowland (L): land which is normally flooded between 180 and 300 cm deep during the flood season.
- v. Very Lowland (VL): land which is normally flooded deeper than 300 cm during the flood season.

Project area falls in the High Land, Medium High Land and Medium Low Land where the agricultural activities are mostly taken care of. Major portion of the project area is in high land and the remaining portion of the project area covers evenly with the Medium high land and medium low land. Figure-4.3-3 shows the land type of the project area.

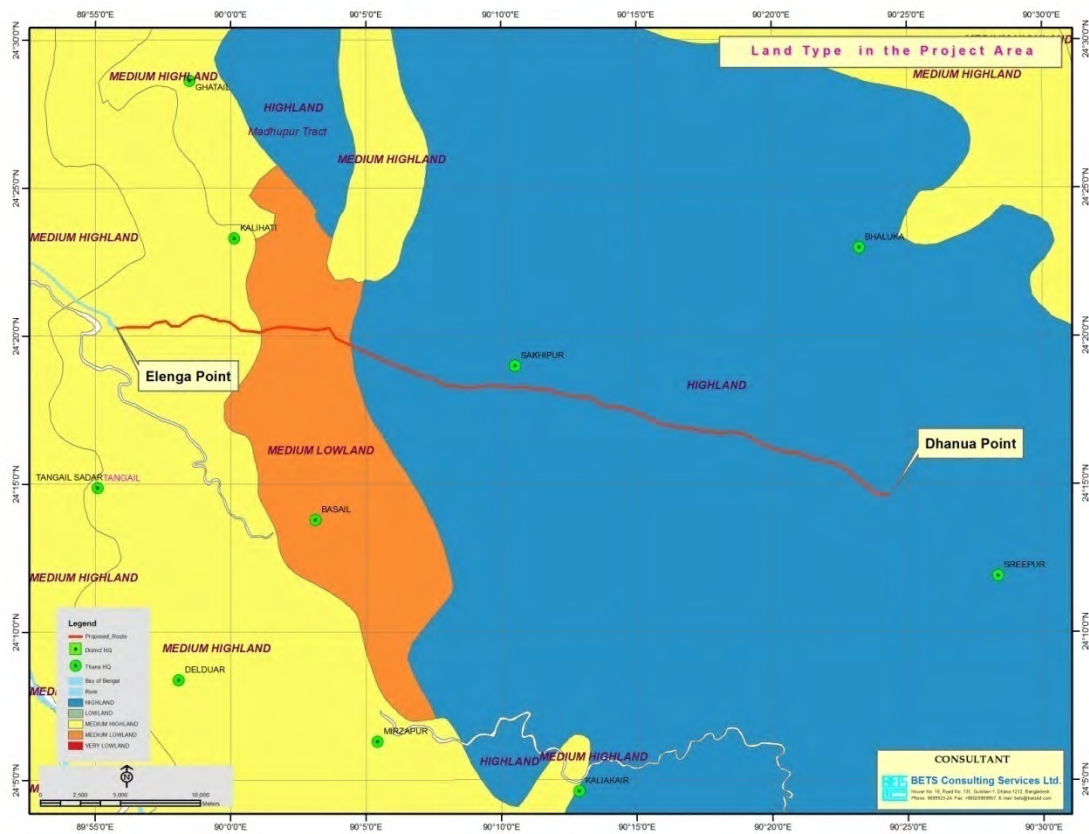


Figure: 4.3-3 Land Type of the Project Area

4.3.5 Soil

As a flood basin in the confluence of the Brahmaputra and Meghna rivers, the area is subjected to periodic flooding and sediment deposition, which adds fertility for crop production. However, soil fertility is rapidly depleted by up to three planting per year and application of fertilizer is required to provide necessary crop nutrition's. The government of Bangladesh identified declining soil fertility as a serious national problem in their 1992 Draft Environment Policy.

Food and Agricultural Organization (FAO) conducted a number of surveys in the sixties and developed a detailed soil classification of Bangladesh which is now used for various purposes. The FAO classification presents a series of 28 general soil classes of Bangladesh. The project survey area falls in the following soil tract group:

- Non-calcareous Alluvium
- Grey Floodplain soils
- Madhupur Tract Soils
- Non-calcareous Dark Grey Floodpalin Soils

4.3.6 Riverbed Morphology

The term river morphology used to describe the shapes of river channels and how they change over time. The morphology of a river channel is a function of a number of processes and environmental conditions, including the composition and erodibility of the bed and banks (e.g., sand, clay, bedrock); vegetation and the rate of plant growth; the availability of sediment; the size and composition of the sediment moving through the channel; the rate of sediment transport through the channel and the rate of deposition on the floodplain, banks, bars, and bed; and regional aggradations or degradation due to subsidence or uplift.

Bangshi River is familiar as Banshi or Bangshi, an important tributary of the Dhaleshwari river. It originates from the foot of the Madhupur Tract. The river flows through the eastern part of Mymensingh district and travels southwards to fall into the Dhaleshwari after entering Dhaka district near the junction of savar and kaliakair upazilas. In its northern reaches the river joins with the Old Brahmaputra and ultimately turns into an offshoot of the Old Brahmaputra. Length of the river is 238 km. Its peak flow is 1,000 cumec and the minimum flow is only 5 cumec at mirzapur. It is navigable only in the monsoon season. It is observed from the historical data and field observation that the six rivers of the project area are almost not navigable in the dry season. Some of the rivers became narrow and locally known as Khal (canal). Figure-4.3-4 shows the river system map of the project area.

The actual (as per Route Survey Data of GTCL) widths of the rivers are listed below:

Sl. No.	River Name	Width (m)
1	Salda	11.29
2	Tanki-1	27.07
3	Tanki-2	25.96
4	Bangshi	65.64
5	Safai	15.61
6	Langolia	45.61

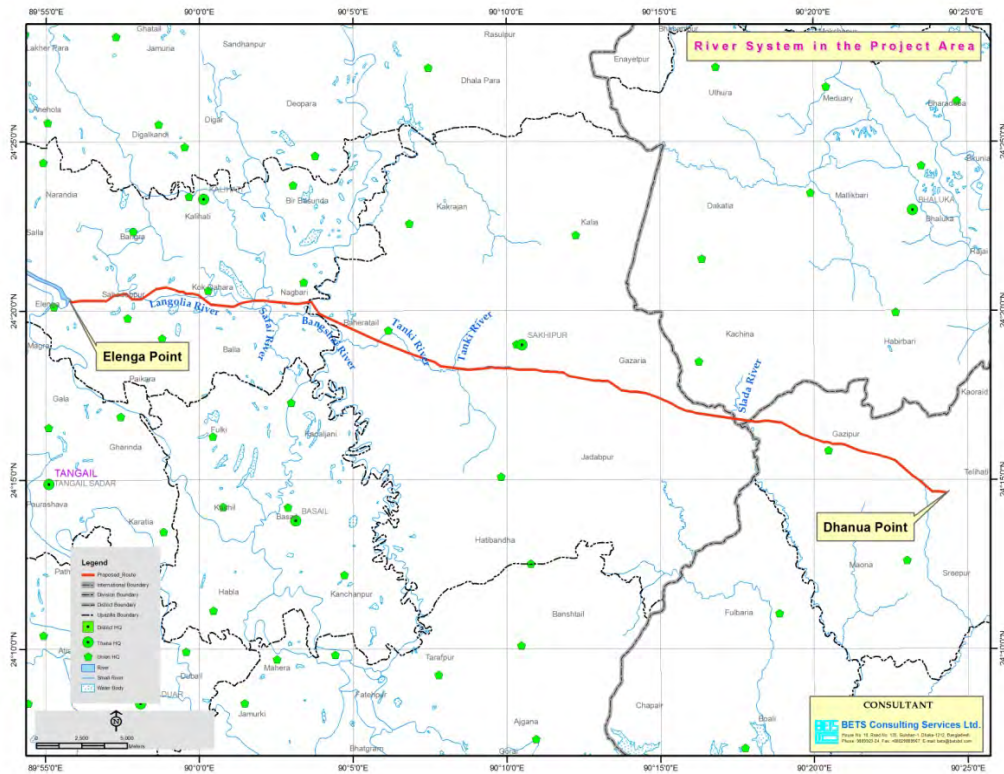


Figure-4.3-4 River System of the Project Area

4.3.7 Seismic Activity

The project area falls within earthquake Zone-II of the seismic-zoning map of Bangladesh. The probable maximum intensity predicted for this zone is 6.0 to 6.5, with a seismic coefficient of 0.05-0.04 (Geological survey of Bangladesh; pers. Comm., 1979). The country is divided into three Seismic Zones with respect to the ranges of seismic co-efficient where the Zone-I is the most severe and Zone-III.

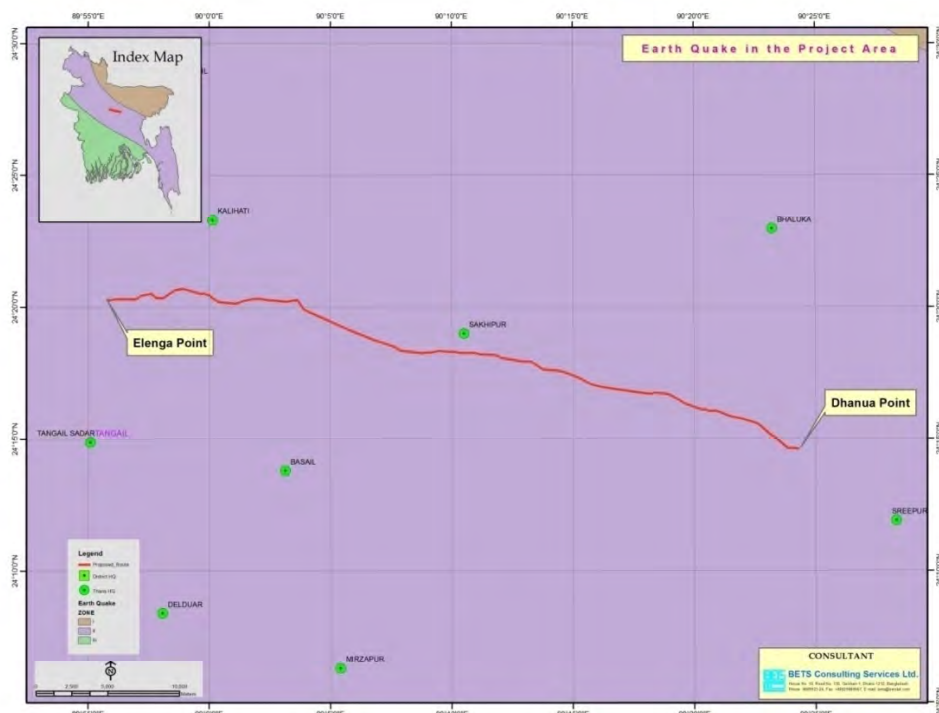


Figure-4.3-5 Seismic Zoning Map of the Project Area

4.3.8 Geomorphology

The project area falls in the active Brahmaputra-Jamuna Floodplain, Madhupur Tract, Old Brahmaputra Floodplain and Young Brahmaputra and Jamuna Floodplain. Due to the uplift of the two large Pleistocene blocks of the Barind and Madhupur, the zone of subsidence between them was turned into a rift valley and became the new course of the Brahmaputra as the great Jamuna. Both the left and right banks of the river are included in this sub-region. The Brahmaputra-Jamuna floodplain could be subdivided into the Bangali-Karatoya floodplain, the Jamuna-Dhaleshwari floodplain and diyaras and chars. Madhupur Tract a large upland area in the central part of Bangladesh. The southern part of this tract is known in Bangla as Bhawal Garh and the northern part as Madhupur Garh. Geologically it is a terrace from one to ten meters above the adjacent floodplains. Though in its present form it is of Pleistocene age its origin may be in the late Miocene, when the bengal basin was being filled in rapidly. The total extent of this Tract is 4,244 sq km. Figure-4.3-6 shows the geomorphology of the project area.

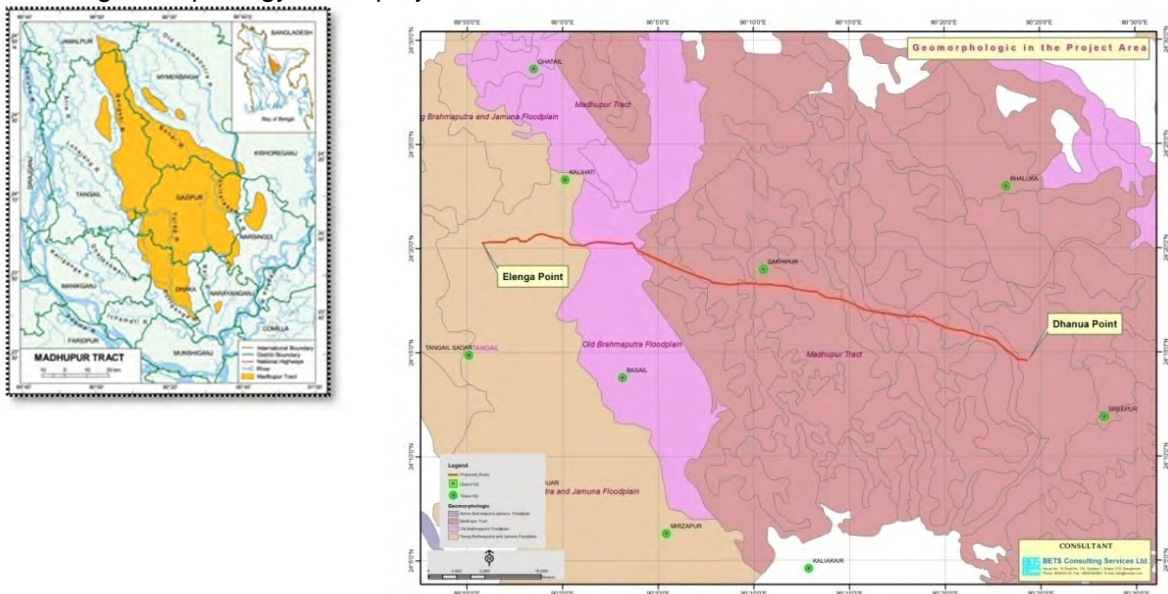


Figure-4.3-6 Geomorphological Map of the Project Area

4.3.9 Meteorology

The region has a tropical climate with three main seasons – the hot and humid summer, the rainy season and the mild and relatively dry winter. The climate of Bangladesh exhibits pronounced seasonal variability associated with monsoon winds-predominantly from the southwest during summer, from the northeast during winter and light and variable during spring and autumn.

Climatic data for the project area was obtained from the meteorological station located in Dhaka, Tangail and Mymensingh and maintained by the Bangladesh Meteorological Department (BMD). Meteorological data collected include temperature, humidity and rainfall. Summarized meteorological data are listed below.

Temperature

The average minimum temperature in Bangladesh lies within November to February which varies generally from 6.2°C to 13.4°C while the maximum temperature is seen in May which is around 39.5°C.

Table-4.3-1 Climatic data of the year 2012 in the project Area

Stations	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Minimum Temperature (°C)													
Mymensingh		12.43	13.93	19.18	22.07	24.34	25.57	26.49	26.74	26.33	23.00	16.95	13.15
Dhaka		14.49	16.00	22.13	23.74	25.76	26.91	26.65	26.59	26.77	24.28	19.14	14.54
Tangail		12.22	13.25	19.03	22.79	24.68	26.18	26.27	26.35	26.01	22.99	17.44	12.90
Maximum Temperature (°C)													
Mymensingh		21.96	25.35	29.75	31.61	31.09	31.63	31.02	30.79	30.86	30.12	26.68	22.17
Dhaka		22.13	25.55	29.82	31.69	31.16	31.70	31.08	30.84	30.95	30.24	26.85	22.36
Tangail		21.78	25.09	29.51	31.28	30.87	31.35	30.87	30.65	30.69	30.00	26.48	21.96

Source: Bangladesh Meteorological Department

Humidity

As seen from meteorological data the average yearly humidity in the region varied from 79% to 84% depicted data of the last ten years. In general, the relative humidity of the study area is the lowest in January to April and from May there is a steady increase until November and then December decrease is observed down to January again.

Table-4.3-2 Monthly Average Relative Humidity 2012 by Station (%)

Stations	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Mymensingh	79	71	73	80	77	85	86	85	85	82	81	88
Dhaka	66	52	57	69	70	77	79	78	79	71	68	77
Tangail	79	69	65	73	75	83	84	84	85	80	79	85

Source: Bangladesh Meteorological Department

Rainfall

The maximum annual rainfall in the last ten year the project area is about 2885mm. In Rabi season (November-February), Pre-monsoon season (March-May) and in Monsoon season (June-October) maximum rainfall are about 30 mm, 100 mm and 148 mm respectively.

Table-4.3-3 Monthly Rainfall of 2012 by Station (mm)

Stations	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Mymensingh	18	0	1	202	85	241	409	238	221	45	19	0
Dhaka	10	1	37	269	137	175	226	282	81	38	68	5
Tangail	10	0	2	106	171	246	241	204	319	75	94	1

Source: Bangladesh Meteorological Department

Table-4.3-4: Climatic Data of the Project Area

Meteorological Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dhaka Station										
Max. Temp (°C)	30.22	30.51	30.83	31.28	30.5	30.5	31.61	31.9	30.5	30.83
Min. Temp (°C)	21.76	21.94	22.37	22.43	21.7	22.7	22.5	22.8	21.9	22.25
Rainfall (mm)	1693	2347	2637	1919	2885	2385	1930	1523	1776	1329
Humidity (%)	73.67	72.67	72.83	71.42	73.17	73.42	70.25	70.42	70.92	70.25
Mymensingh Station										
Max. Temp (°C)	29.30	29.56	29.71	30.16	29.50	29.60	30.48	30.70	29.60	29.71
Min. Temp (°C)	20.89	20.94	21.10	21.27	20.80	21.60	21.20	21.30	20.80	20.84
Rainfall (mm)	1734	3193	2672	1961	2782	2239	1662	2095	2147	1479
Humidity (%)	81.42	82.00	82.00	83.58	82.92	83.33	82.00	81.92	81.33	81.00
Tangail Station										

Meteorological Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Max. Temp (°C)	30.22	30.62	30.92	31.2	30.4	30.4	31.48	31.9	30.5	30.74
Min. Temp (°C)	20.79	20.83	21.16	21.16	20.7	21.6	21	21.2	20.7	20.84
Rainfall (mm)	-	2005	1953	2325	2258	1856	1391	1750	1839	1469
Humidity (%)	80.333	79.417	79.583	79.417	79.417	80	78.167	78.917	79.583	78.417

Source: Bangladesh Meteorological Department

Solar Radiation

Solar radiation design heat flux in Bangladesh is 5 kWh / m².

Winds

Winds around the project area can reach from min 9 km/h (Winter Season) to max 100 km/h (Summer Season).

4.3.10 Hydrology Conditions (Surface and Ground Water Hydrology)

Surface Water: Bangladesh is the world's largest delta and also the land of many water bodies. Water dominates life, people and economy of Bangladesh. Water is the most important re-source of Bangladesh and the basis of its agricultural productivity. But excess of water is the cause of floods, the greatest natural hazard of Bangladesh. The developmental needs have changed the pattern of water use, given rise to conflict of interests, incorporated new technologies and have raised major environmental concerns. The different aquatic ecosystems have their own characteristics and their production patterns. The interaction between water resources, their uses and developmental needs raises many environmental concerns. Main rivers of the project area are the Slada, Tanki-1, Tanki-2, Bangshi, Safai & Langolia River. Most of the rivers are not navigable in the dry season but the Bangshai and Safai carry some water which

Ground Water: The ground water table fluctuation of the project area indicates the recharge and discharge to the ground water reservoir. The highest ground water occurs during the month of August-September when the aquifer recharges fully and the lowest ground water table occurs during April-May due to natural discharge and ground water use for domestic and irrigation purposes.

4.3.11 Existing Surface Water

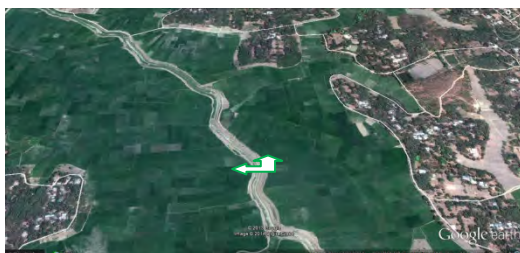
There are eight (8) canals and six (6) rivers crossing all along the pipeline route of the project. Major existing surface water satellite images of the project area are shown in the Figure -4.3-7.



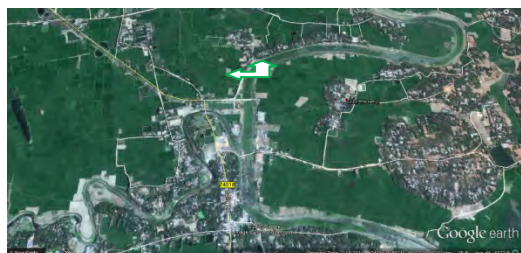
Salda River



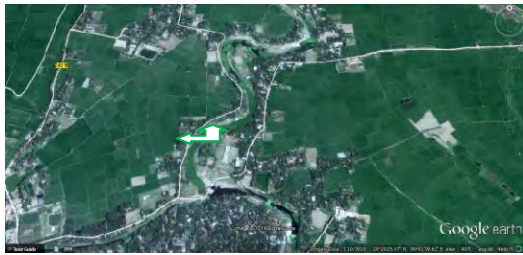
Tanki-1 River



Tanki-2 River



Bangshi River



Safai River



Langolia River



Langolia Canal

Figure-4.3-7 Major Existing Surface Water Satellite Images of the Project Area

4.4 Environmental Quality

Environmental quality is a set of properties and characteristics of the environment, either generalized or local, as they impinge on human beings and other organisms. It is a measure of the condition of an environment relative to the requirements of one or more species and or to any human need or purpose.

Environmental quality is a general term which can refer to varied characteristics that relate to the natural environment as well as the built environment, such as air and water purity or pollution, noise and the potential effects which such characteristics may have on physical and mental health caused by human activities. In this project study air, water, soil, noise and sediment quality are taken into consideration which are describing in details below.

4.4.1 Ambient Air Quality

There is no official secondary air quality data for the project area due to the non-availability of a regular air quality-monitoring program. However, the prevailing conditions are generally typical of rural Bangladesh, which implies generally good conditions, with the exception of towns, industrial pockets and areas immediately adjacent to roads. These may experience increased pollution from vehicular sources and dust. The principal source of pollutants in the region is from vehicular traffic.

4.4.2 Water Quality

Surface Water: Six rivers in the project area were closely observed and two water samples from each river were collected for laboratory testing. Onsite test of the rivers and some canals are also made. The surface water quality testing and sampling was conducted in winter/ dry season. In this season the flow of water in the rivers was in such a minimum level that for this the BOD levels of the water sample slightly exceeded the ECR'97 standards. Out of the six rivers, BOD of the Tanki-2

seems too high. This is because there was no flow of water in the river at the time of onsite testing and sampling. Figure-4.4-1 shows the stagnant surface water of the Tanki-2 River.



Figure-4.4-1 Stagnant Surface Water of the Tanki-2 River

Location of surface water sampling and its water quality results of the project area are listed below:



Salda River Location and Surface Water Quality Test Result

Sampling Date: 29th November 2013

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°16'40"N 90°17'26"E	24°16'41"N 90°17'26"E
1	Temperature	°C	-	25	25
2	pH	-	6.5-8.5	7.5	7.5
3	DO	mg/l	5 or more	5.1	5.1
4	E.C	(µs/cm)	-	0	0
5	TDS	(mg/l)	-	420	60

Laboratory Test Result

1	Total Alkalinity	mg/l	-	20	20
---	------------------	------	---	----	----

	as CaCO ₃				
2	COD	mg/l	-	24	24
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	6	8
4	Chloride	mg/l	600	11	12
5	Total Suspended Solids (TSS)	mg/l	-	94	88
6	Oil & Grease	mg/l	-	0.45	0.39



Tanki-1 River Location and Surface Water Quality Test Result

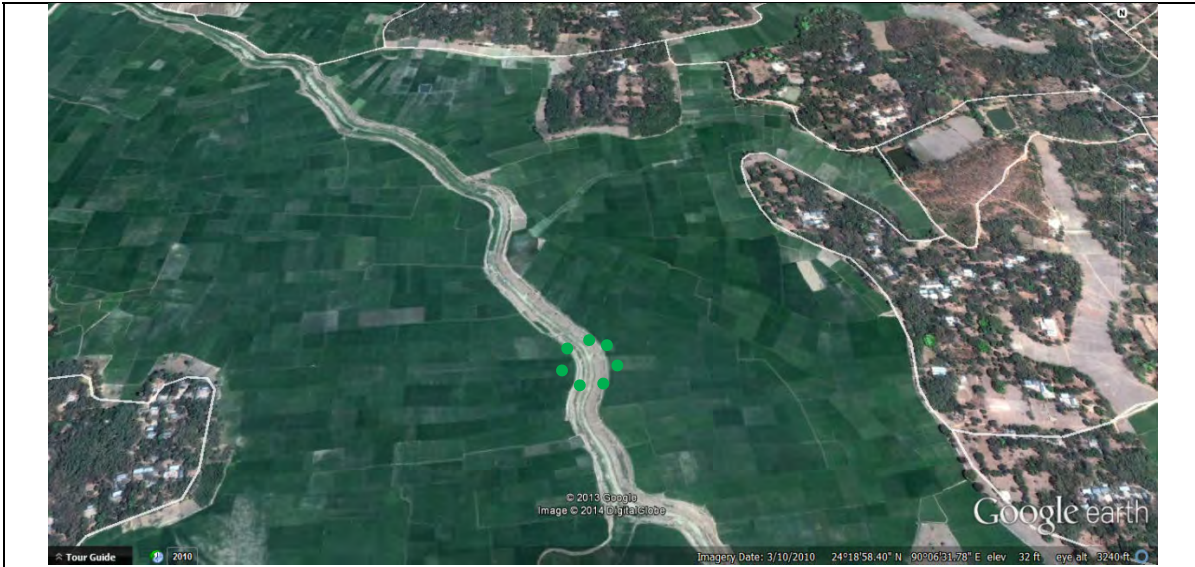
Sampling Date: 29th November 2013

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°18'23"N 90°07'18"E	24°18'23"N 90°07'18"E
1	Temperature	°C	-	23	23
2	pH	-	6.5-8.5	7.4	7.4
3	DO	mg/l	5 or more	6	5.9
4	E.C	(µs/cm)	-	0	0
5	TDS	(mg/l)	-	80	110

Laboratory Test Result

1	Total Alkalinity as CaCO ₃	mg/l	-	22	22
2	COD	mg/l	-	20	20
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	5	10
4	Chloride	mg/l	600	14	12
5	Total Suspended Solids (TSS)	mg/l	-	100	98
6	Oil & Grease	mg/l	-	0.35	0.33



Tanki-2 River Location and Surface Water Quality Test Result

Sampling Date: 29th November 2013

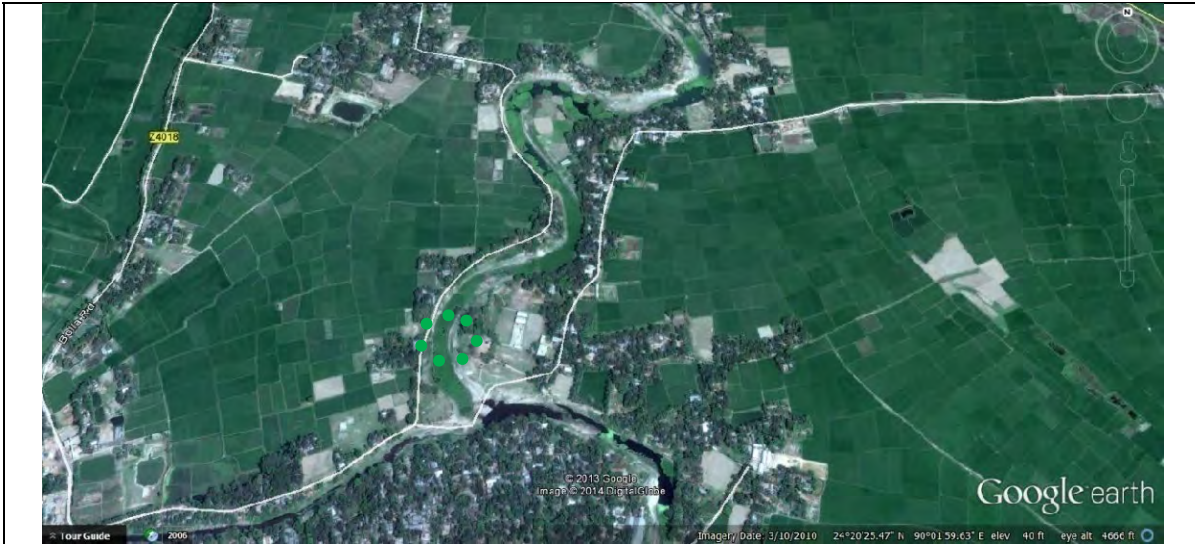
Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°18'54"N 90°06'35"E	24°18'54"N 90°06'35"E
1	Temperature	°C	-	22	22
2	pH	-	6.5-8.5	7.1	7.1
3	DO	mg/l	5 or more	5.4	5.3
4	E.C	(µs/cm)	-	0	0
5	TDS	(mg/l)	-	50	60

Laboratory Test Result

1	Total Alkalinity as CaCO ₃	mg/l	-	12	12
2	COD	mg/l	-	56	56
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	16	20
4	Chloride	mg/l	600	19	16
5	Total Suspended Solids (TSS)	mg/l	-	956	916
6	Oil & Grease	mg/l	-	0.52	0.56





Safai River Location and Surface Water Quality Test Result

Sampling Date: 05th December 2013

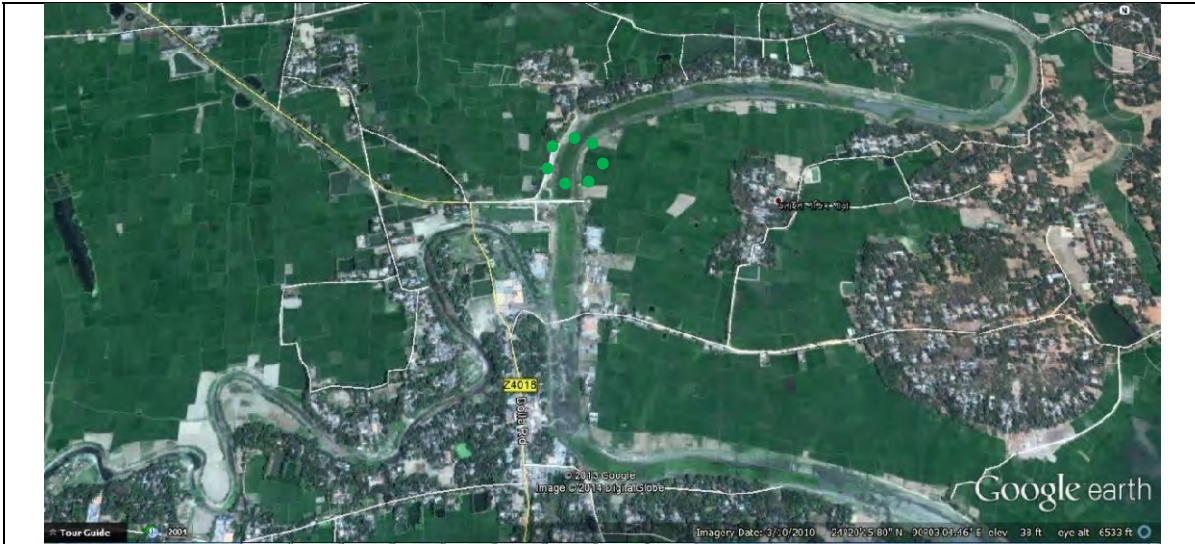
Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°20'13"N 90°01'57"E	24°20'12"N 90°01'56"E
1	Temperature	°C	-	24	24
2	pH	-	6.5-8.5	7.6	7.7
3	DO	mg/l	5 or more	5	6.0
4	E.C	(µs/cm)	-	0.3	0.3
5	TDS	(mg/l)	-	160	200

Laboratory Test Result

1	Total Alkalinity as CaCO ₃	mg/l	-	145	145
2	COD	mg/l	-	20	20
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	7	4
4	Chloride	mg/l	600	11	14
5	Total Suspended Solids (TSS)	mg/l	-	25	51
6	Oil & Grease	mg/l	-	0.25	0.23





Bangshi River Location and Surface Water Quality Test Result

Sampling Date: 05th December 2013

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°20'17"N 90°03'25"E	24°20'17"N 90°03'23"E
1	Temperature	°C	-	25	25
2	pH	-	6.5-8.5	7.3	7.4
3	DO	mg/l	5 or more	6.0	4.9
4	E.C	(µs/cm)	-	0.2	0.2
5	TDS	(mg/l)	-	100	130

Laboratory Test Result

1	Total Alkalinity as CaCO ₃	mg/l	-	145	150
2	COD	mg/l	-	24	24
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	7	11
4	Chloride	mg/l	600	19	15
5	Total Suspended Solids (TSS)	mg/l	-	38	35
6	Oil & Grease	mg/l	-	0.24	0.28





Langolia River Location and Surface Water Quality Test Result

Sampling Date: 15th January 2014

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Left Bank	Right Bank
				24°20'34"N 89°59'05"E	24°20'34"N 89°59'06"E
1	Temperature	°C	-	23	23
2	pH	-	6.5-8.5	7.8	7.8
3	DO	mg/l	5 or more	5.8	6.2
4	E.C	(µs/cm)	-	0.2	0.2
5	TDS	(mg/l)	-	140	140

Laboratory Test Result

1	Total Alkalinity as CaCO ₃	mg/l	-	109	111
2	COD	mg/l	-	28	24
3	BOD ₅	mg/l	≤6(Fisheries) ≤10(Irrigation)	10	8
4	Chloride	mg/l	600	9	8
5	Total Suspended Solids (TSS)	mg/l	-	12	7
6	Oil & Grease	mg/l	-	0.23	0.20





Langolia Canal Location and Surface Water Quality Test Result

Sampling Date: 5th December 2013

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	Point-1		Point-2		Point-3	
				Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank
				24°20'32"N 89°59'23"E	24°20'32"N 89°59'22"E	24°20'31"N 89°59'29"E	24°20'31"N 89°59'30"E	24°20'22"N 89°57'46"E	24°20'22"N 89°57'46"E
1	Temperature	°C	-	22	22	22	22.5	22	22
2	pH	-	6.5-8.5	7.6	7.7	7.5	7.6	7.3	7.5
3	DO	mg/l	5 or more	5	5.3	6	6.2	3.2	3
4	E.C	(µs/cm)	-	0.2	0.2	0.2	0.2	0.2	0.2
5	TDS	(mg/l)	-	130	140	110	130	125	130

Ground Water: Ground water quality of the project area is quite good. Most of the people use the Shallow Tube-well (STW) for their drinking purposes.

4.4.3 Soil Quality

The land use pattern of the country is influenced by agro ecology, soil physiographic and climatic factors. According to the variations of all these factors and agricultural potential, the total land area has been classified into thirty agro ecological zones which are grouped into twenty major physiographic units. The project area falls into the Old Brahmaputra Flood Plain and Modhupur Tract. The soil of the project area is acidic silt loamy to clayey and the organic content is medium to low. The soil quality of the project area is listed below in Table-4.4-1.

Table-4.4-1: Soil Quality of the Project area.

Sl. No.	Agro-Ecological Zone (AEZ)	Soil Parameter	Soil Quality based on Land Type		
			High	Medium High	Medium Low
1	Old Brahmaputra Flood Plain	Texture	Silt-Loam	Loamy	Clayey
		pH	5.1-5.6	5.1-5.6	5.1-5.6
		Organic Matter Status= 0.m	Low	Medium	Medium
2	Modhupur Tract	Texture	Loamy	Loamy	-
		pH	4.8-5.5	4.8-5.5	-
		Organic Matter Status= 0.m	Low	Low	-

4.4.4 Noise Level

Yet another serious threat to the quality of the environment is noise pollution. High-intensity sound, such as that emitted by machines used for excavating earth and welding pipes, for long periods of

time is disturbing and potentially damaging to nearby human populations and wildlife. When continued for long periods of time it can also permanently damage the hearing of workers engaged in the area. While 50 dB (decibels) creates severe discomfort, 85dB is usually considered as the critical level for ear damage. The Environmental Quality Standards for Bangladesh (DOE, 1997) have set noise guidelines for industrial sites in Bangladesh. According to this standard, noise level should not exceed 75dB in the daytime and 70dB at night. Table-4.4-2 presents noise level standards of Bangladesh. The data show that for sensitive areas like hospitals and schools the ambient noise level is much higher than the allowable limits.

Table-4.4-2: Bangladesh Standard of Noise Level

Sl. No.	Area Category	Standards Values(all values in dBA)	
		Day	Night
1	Silent zone	45	30
2	Residential area	50	40
3	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Source: Schedule 4, Rule-12, Environment Conservation Rules 1997

Note:

1. Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 p.m. to 6 a.m.

4.5 Biological Environment

Every species of the floral and faunal diversity of the project area play an important role in its natural community and ecosystem and removal of that species is likely to have adverse impact. Bio- habitant of the study area may be divided into major types viz. terrestrial and wetland habitat.

4.5.1 Terrestrial Habitats

Terrestrial Fauna:

Total thirty nine (39) species of terrestrial fauna were identified during reconnaissance field visit which are very common all over the country. Of the total fauna five (5) species of amphibian, eight (8) species of reptiles, seven (7) species of mammals and 19 (nineteen) species of birds.

Table-4.5-1 Terrestrial Fauna List

Sl. No.	Local Name	Scientific Name	Status
Terrestrial Fauna Amphibian			
1	Kuno Bang	<i>Bufo melanostictus</i>	Common
2	Geso Bang	<i>Rhacophorus maximus</i>	F. Common
3	Ballon Frog	<i>Uperonon globulus</i>	-
4	Jhi Jhi Bang	<i>Rana timnocharis</i>	-
5	Sona Bang	<i>Rana tigruna</i>	Rare
Terrestrial Fauna Reptiles			
1	Dhura Shap	<i>Amphiesma stolata</i>	Common
2	Matik Shap	<i>Atrium schistosum</i>	Common
3	Tiktiki	<i>Hemidactylus brooke</i>	Common
4	Kari Katta	<i>Kachugotectum</i>	Common
5	Daraish Shap	<i>Ptyas mucosus</i>	Common
6	Gokhra	<i>Naja lutra</i>	F. Common
7	Kassap	<i>Chitra idica</i>	Rare
8	Gui Shap	<i>Varanus nubulosus</i>	Rare
Terrestrial Fauna Mammals			
1	Badur	<i>Pteropus giganteus</i>	Common
2	Idur	<i>Mus musculus</i>	Common
3	Shial	<i>Vulpes bengalensis</i>	Common

Sl. No.	Local Name	Scientific Name	Status
4	Chika	<i>Pipistrellus.sp</i>	Common
5	Bagdash	<i>Viverra zibetha</i>	F. Common
6	Khekshial	<i>Canes aureas</i>	F. Common
7	Begi	<i>Herpestes</i>	Rare
Terrestrial Fauna Birds			
1	Choroi	<i>Passer domesticus</i>	Common
2	Doyel	<i>Opsychus sularis</i>	Common
3	Bulbuli	<i>Spizixos canifreons</i>	Common
4	Bagari	<i>Emberiza spodocephala</i>	Common
5	Ghughu	<i>Streptapelia Orientalis</i>	Common
6	Shalik	<i>Stuma contra</i>	Common
7	Kak	<i>Carvus splendens</i>	Common
8	Bok	<i>Ardea alba</i>	Common
9	Kokil	<i>Eudynamus scolopacea</i>	F. Common
10	Tuntuni	<i>Orthotomus sutorius</i>	F. Common
11	Chil	<i>Milvus migrans</i>	F. Common
12	Machranga	<i>Helcyon smyrrensis</i>	F. Common
13	Tota	<i>Psittacula alezandari</i>	F. Common
14	Tia	<i>Psittacula Krameri</i>	F. Common
15	Badur	<i>Pteropus giganteus</i>	F. Common
16	Pecha	<i>Tyto alba</i>	Rare
17	Halud pakhi	<i>Oriolus xanthornus</i>	Rare
18	Shakun	<i>Gyps bengalensis</i>	Rare
19	Katthokra	<i>Picus canus</i>	Rare

Source: Field Observation

Endangered and threatened Species

The reconnaissance survey shows that five species were in Endangered and five species were in threatened. Out of recorded thirty nine terrestrial fauna of the project area, classified endangered and threatened species of different categories are shown in tabular form below. This project will not hamper the endangered species of the project area.

Table-4.5-2 Endangered and threatened fauna list

Sl. No.	Local Name	Scientific Name	Status
Amphibian			
1	Jhi Jhi Bang	<i>Rana Limnocharis</i>	Endangered
2	Sona Bang	<i>Rana tigrina</i>	Threatened
Reptiles			
1	Gokhra	<i>Naja lutra</i>	Endangered
2	Gui Shap	<i>Varanus flevescens</i>	Threatened
Mammals			
1	Khekshial	<i>Vulpes bengalensis</i>	Endangered
2	Khatash	<i>Viverricula indica</i>	Threatened
Birds			
1	Mach Ranga	<i>Helcyon smyrrensis</i>	Endangered
2	Halud Pakhi	<i>Oriolus xanthornus</i>	Endangered
3	Pecha	<i>Tyto alba</i>	Threatened
4	Kath Thokra	<i>Picus canus</i>	Threatened

Source: Field Observation

Terrestrial Natural Flora

Total 36 (thirty six) terrestrial flora species were recorded during reconnaissance field visit in the project area. The major habitat patterns of the project were the agricultural fields, homesteads, roadside and open land. Flora identified through interview were classified under three categories as stated below:

- ✓ Terrestrial Natural flora

- ✓ Terrestrial planted flora and
- ✓ Medicinal flora

The recorded terrestrial floras from field area under each category have been listed below.

Table-4.5-3 Terrestrial Flora

Sl. No.	Local Name	Scientific Name	Status
Natural Flora			
1	Boiraj	<i>Anesoptera scaphula (Roxb)</i>	Common
2	Jam	<i>Syzygium spp</i>	Common
3	Bansh	<i>Bambusa spp</i>	Common
4	Am	<i>Melia agedaroch</i>	Common
5	Korroi	<i>Albizia procera benth</i>	Common
6	Kadam	<i>Anthocephalus chinensis</i>	Common
7	Sitki	<i>Phyllanthus reticulates</i>	Common
8	Borroi	<i>Zizyphus mauritiana</i>	Common
9	Peyara	<i>Psidium guajava</i>	Common
10	Kalagas	<i>Musa spp</i>	Common
11	Shimul	<i>Bombax cetha</i>	F. Common
12	Tetul	<i>Tamarindus indicus L.</i>	F. Common
13	Dumur	<i>Ficus hispida L.f</i>	F. Common
14	Shora	<i>Streblus asper (Lower)</i>	F. Common
15	Jika	<i>Lannea Koromandelica</i>	F. Common
16	Tal	<i>Botshddud flabellifra L.</i>	Rare
17	Hizal	<i>Borringtomia racemosa</i>	Rare
18	Nim	<i>Acadirachta indica</i>	Rare
Planted Flora			
1	Amgas	<i>Melia agedarach</i>	Common
2	Kathal	<i>Artocarpus heterophutlus</i>	Common
3	Supari	<i>Areca catechu</i>	Common
Planted Flora			
4	Kadam	<i>Anthocephalus chinensis rich</i>	Common
5	Satni	<i>Alstonia acholaris Br.</i>	Common
6	Kalagas	<i>Mysa spp.</i>	Common
7	Lebu	<i>Citrus aurantifolia</i>	F. Common
8	Peara	<i>Psidium guajava</i>	F. Common
9	Narikel	<i>Cocos nucifera</i>	F. Common
10	Jampbura	<i>Citrus grandis</i>	F. Common
11	Tetul	<i>Tamarindus indicus</i>	Rare
12	Jalpai	<i>Elacocarps roustus</i>	Rare
13	Tal	<i>Borrasus flabellifera L</i>	Rare
Herbal/ Medicinal Flora			
1	Akhanda	<i>Calotropis gigantea</i>	Common
2	Bashok	<i>Adhtoda vasica nees</i>	Common
3	Tulshipata	<i>Ocimum americanun L.</i>	Common
4	Dumur	<i>Ficus hispida L.F.</i>	Common
5	Nim	<i>Acadirachta indica</i>	Common

Source: Field Observation

Endangered and threatened Terrestrial Natural Flora

Two endangered and two threatened species were found in the project area out of the studied 36 (thirty six) species.

Table-4.5-4 Endangered and threatened flora list

Sl. No.	Local Name	Scientific Name	Status
1	Tal	<i>Borrasus flabellifera L.</i>	Endangered
2	Tetul	<i>Tamarindus indicus L.</i>	Endangered
3	Tezpatha	<i>Cinnamomum tamala (Nees)</i>	Threatened
4	Jambura	<i>Citrus grandis</i>	Threatened

Source: Field Observation

4.5.2 Aquatic life and Fisheries Aquatic Fauna

Total six (6) aquatic fauna species were recorded from the project area. These aquatic faunas directly depend on the availability of water bodies. Most of the water bodies were intensively exploited and habitat was highly disturbed by human intervention. Aquatic fauna are listed in the tabular form below:

Table-4.5-5 Aquatic Fauna

SI. No.	Local Name	Scientific Name	Status
1	Kakra	<i>Seylla serratta</i>	Common
2	Shamuk	<i>Anastemus oscitans</i>	Common
3	Bang	<i>Bufo melanostictus</i>	Common
4	Guishap	<i>Varanus bengalensis</i>	F. Common
5	Dhora Shap	<i>Xencehrophis piscator</i>	F. Common
6	Kachim	<i>Trionyx gangeticus</i>	F. Common

Source: Field Observation

Endangered and Threatened Aquatic Fauna

One endangered and one threatened aquatic fauna out of six species were observed in the project area. They are listed below:

Table-4.5-6 Endangered and Threatened Aquatic Fauna

SI. No.	Local Name	Scientific Name	Status
1	Gui Shap	<i>Varanus bel/ ngalensis</i>	Endangered
2	Kachim	<i>Trionyx gangeticus</i>	Threatened

Source: Field Observation

Aquatic Flora

Total eight (8) aquatic floras were recorded from the project area. In a tabular form these are listed below:

Table-4.5-7 Aquatic Flora

SI. No.	Local Name	Scientific Name	Status
1	Dholkalmi	<i>Ipomoea fistulosa</i>	Common
2	Muthagas	<i>Cyperus spp</i>	Common
3	Kachuripana	<i>Elchhornis</i>	Common
4	Sheola	<i>Biysca octandra</i>	Common
5	Ghagra	<i>Xanthium indicum</i>	Common
6	Khudi Kachuripana	<i>Lemna Spp</i>	F. Common
7	Hizal	<i>Baringtonia acutangula</i>	F. Common
8	Kalmi	<i>Ipomoea albo L.</i>	F. Common

Source: Field Observation

Endangered and Threatened Species

One endangered and one threatened aquatic flora out of six species was observed in the project area. They are listed below:

Table-4.5-8 Endangered and Threatened Aquatic Flora

SI. No.	Local Name	Scientific Name	Status
1	Jal Padma	<i>Nelumbo nucifera gaertn</i>	Endangered
2	Sheorah	<i>Streblus asper lour</i>	Threatened

Source: Field Observation

Fisheries:

Considering the fish sanctuary and fish production of the country the project area are not so important like other region. Tangail and Mymnsingh districts are more important than of Gazipur district as they

have important rivers and fish cultivation points as well. The following fishes are common in the inland surface water of the project area.

Tangail District:

- Megarasbora elanga (*Bengala Elanga*)
- Catfish/ Bane-hara (*Hara jerdoni*)

Mymensingh District:

- Boal (*Acanthocobitis Botia*)
- Bata/Bangna (*Barilius Bendelisis*)
- Utii (*Chagunius chagunio*)
- Bhangna (*Labeo dero*)
- Kuli/Bhut bele (*Raiamas bola*)
- Gong tengra (*Gogangra viridescens*)
- Bane-har (*Hara jerdoni*)

Some common fishes of the project area are listed below:

- Mola (*Amblypharyngodon mola*)
- Tilapia (*Oreochromis mossambicus*)
- Phopa chanda (*Pseudambassis baculis*)
- Chenua (*Sisor rabdophorus*)
- Pangasius (*Pangasianodon hypophthalmus*)
- Arwari (*Hemibagrus menoda*)
- Puiya (*Lepidocephalichthys berdmorei*)
- Putitor mohashoul (*Tor putitora*)
- Ghora chela (*Securricula gora*)
- Chela (*Salmostoma acinaces*)
- Darkina (*Rasbora daniconius*)
- Mola punti (*Puntius guganio*)
- Gilipunti (*Puntius gelius*)
- Black Carp (*Mylopharyngodon piceus*)
- Koi (*Cyprinus carpio*)
- Engraulidae (*Setipinna taty*)
- Broadhead Catfish *Clarias gariepinus*
- Tiashol (*Channa barca*)
- Katol (*Catla Catla*)
- Rajputi (*Barbonymus Gonionotus*)

4.5.3 Biodiversity/Environmentally Sensitive Areas

The Bangladesh Environment Conservation Act, 1995 includes provision for Ecologically Sensitive Area (ESA) declarations by the director general of the Department of the Environment in certain cases where the ecosystem is considered to be in danger of reaching a critical state. If the government is satisfied that due to the degradation of the environment, the ecosystem of any area has reached or is danger of reaching a critical state, the government may, by notification in the official gazette, declare that area an ESA. The government shall specify, through the notification provided in sub-clause (1) or by separate notification, which of the operations or processes cannot be initiated or continued in the ESA. Our project area is out of the designated ESA of Bangladesh. The gas pipeline in future will not affect the ESA.

Table 4.5-9: Ecologically Sensitive Areas

Sl. No.	Name	Districts	Area (Ha)
1	The Sundarbans	Bagerhat, Khulna, Satkhira	762,034
2	Cox's Bazar (Teknaf, Sea beach)	Cox's Bazar	10,465
3	St. Martin Island	Cox's Bazar	590

Sl. No.	Name	Districts	Area (Ha)
4	Sonadia Island	Cox's Bazar	4,916
5	Hakaluki Haor	Maulavi Bazar	18,383
6	Tanguar Haor	Sunamganj	9,727
7	Marjat Baor	Jhinaidha	200
8	Gulshan-Banani-Baridhara Lake	Dhaka	n.a

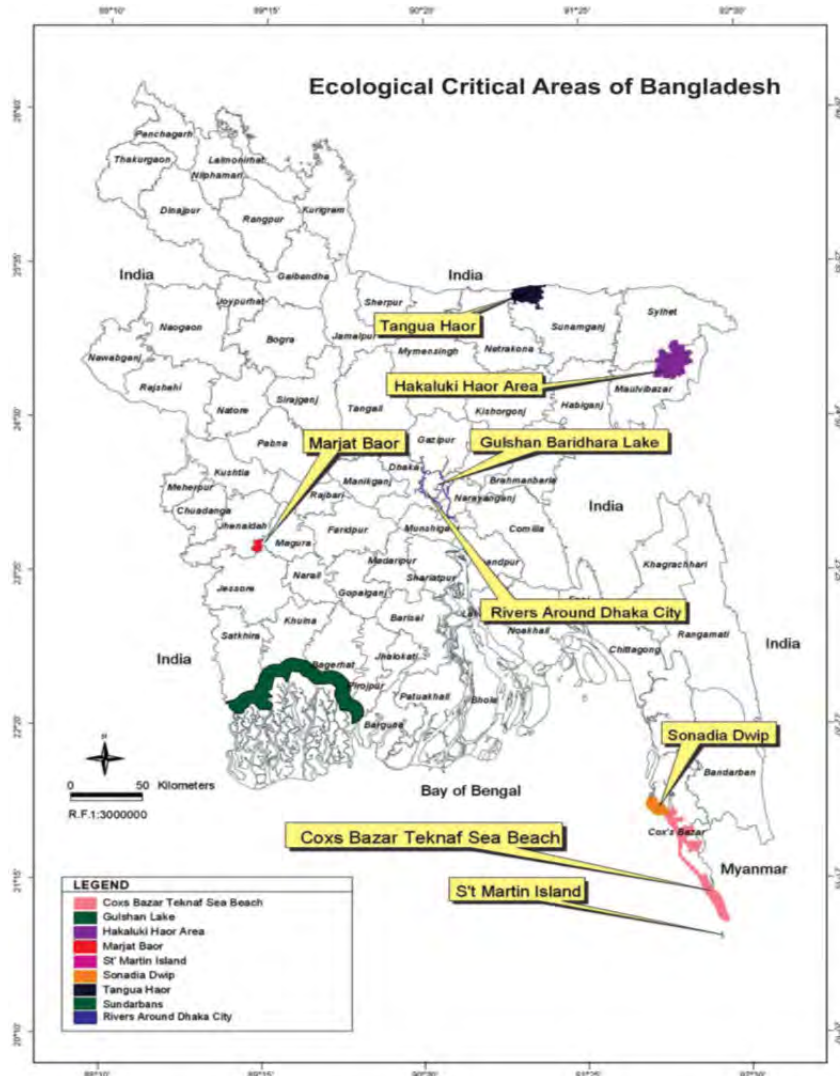


Figure-4.5-1 Ecologically Critical/Sensitive Areas of Bangladesh

4.6 Natural Hazards and Risks

Natural Hazard is any natural event which has an adverse socio-economic impact on the human being. Alternatively, an extreme natural event, such as a cyclone, an earthquake or a flood, that is not caused by human beings. These are naturally occurring phenomena that only become hazardous due to the intervention of human infrastructure. The vulnerability of human infrastructure to destruction (risk) by a disaster is also an important factor in understanding natural hazards. The distribution and impact of natural hazards is unequal with greatest loss of life and property in the developing part of the world. This is not because of greater hazard frequency but simply because of greater vulnerability. In the table-4.6-1 more than hundred years' disaster, events, and affected information are listed below.

Table-4.6-1 EM-DAT Information 1907 to 2004

Disaster	# of Events	Total Killed	Avg. # Killed	Total Affected	Avg. # Affected
Cyclone	137	614,112	4,483	63,817,281	465,820
Drought	5	18	4	25,002,000	5,000,400

Disaster	# of Events	Total Killed	Avg. # Killed	Total Affected	Avg. # Affected
Earthquake	6	34	6	19,125	3,188
Flood	64	50,310	786	369,678,156	5,776,221
Volcano	-	-	-	-	-

Source: Centre for hazard and Risk Research, Bangladesh, 2011

The hotspots maps of **Centre for Hazard and Risk Research** indicate that cyclones and floods pose the greatest risk to Bangladesh on a country level. Sub-nationally, the northern and eastern regions of the country are susceptible to earthquakes while the southeast is particularly vulnerable to all five hazards. Lastly, the combined multi-hazard maps (Figure-4.6-1) for mortality and GDP show that Bangladesh ranks in the top 3 deciles of risk when compared to the rest of the world. Figure-4.6-2 shows the mortality and GDP deciles of Bangladesh.

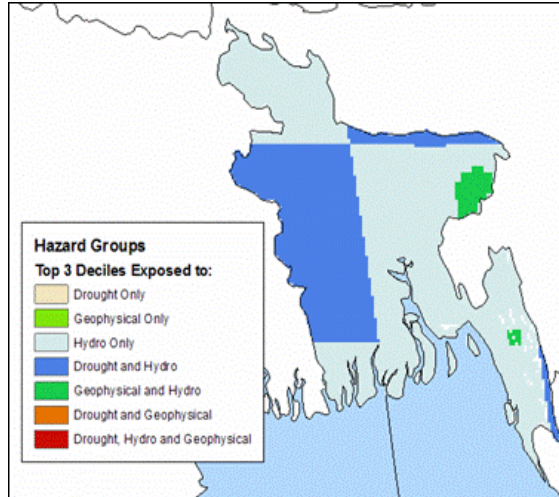


Figure-4.6-1 Multi-Hazard Disaster Risk Hotspots by Hazard Groups (Top Three Deciles)

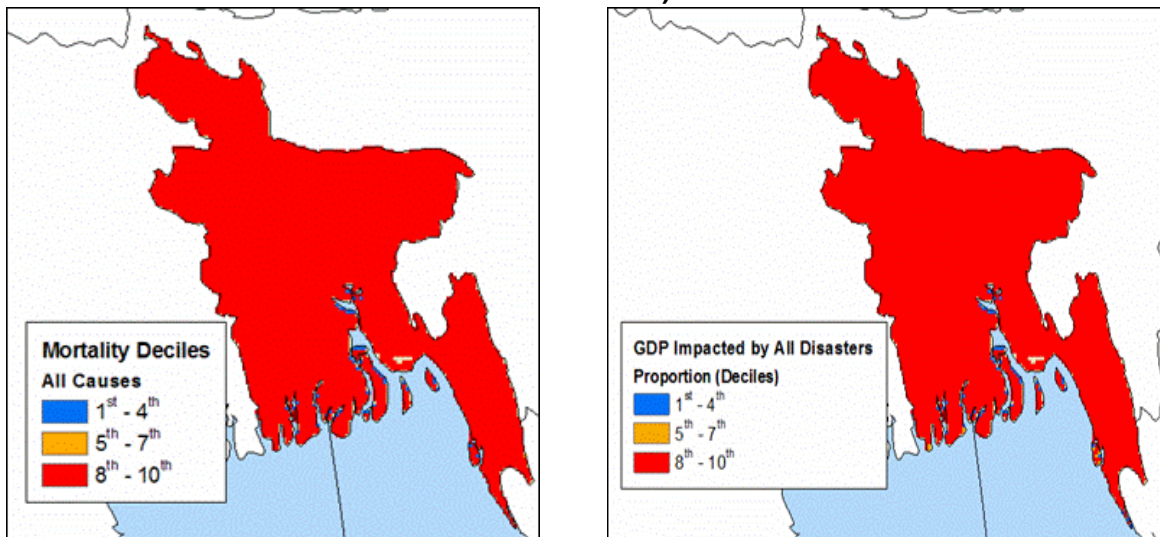


Figure-4.6-2 Multi-Hazard Disaster Risk Hotspots

(All Hazards combined and weighted by Mortality and Proportion of GDP Impacted)

Source: Centre for Hazard and Risk Research, Bangladesh, 2011

4.6.1 Flooding

Bangladesh is one of the world’s most densely populated country and one of the most susceptible countries to flood disasters. It also has one of the three most powerful rivers passing though it Ganges, Meghna and Brahmaputra. About one half of the land area in Bangladesh is at an elevation of less than 8 meters above sea level. Up to 30% of the country has been covered with flood

waters. In 1991 more 200,000 deaths resulted from flooding and associated tropical cyclones. Causes of flood are shown in the **Figure-4.6-3** and **Figure-4.6-4**.

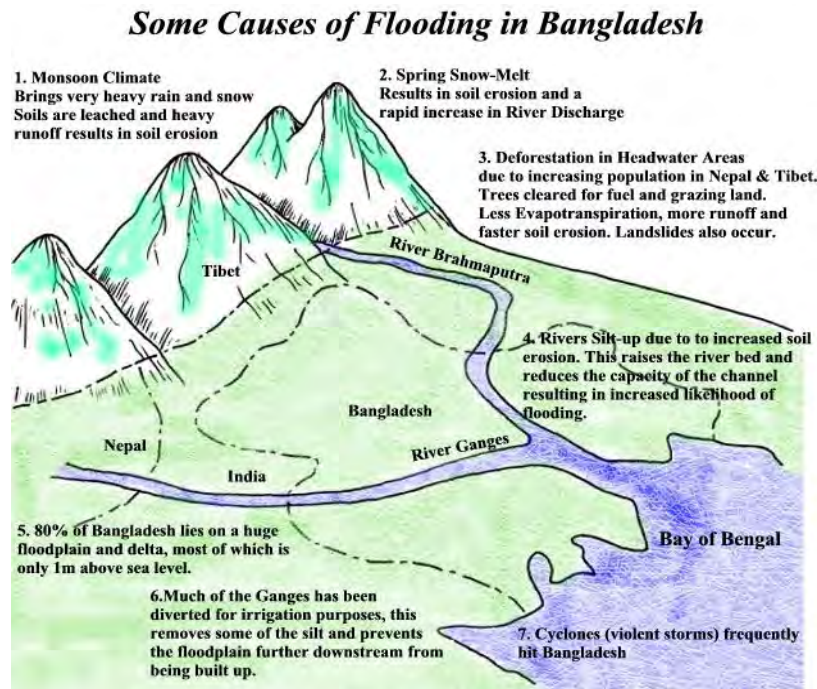


Figure-4.6-3 Causes of flooding in Bangladesh

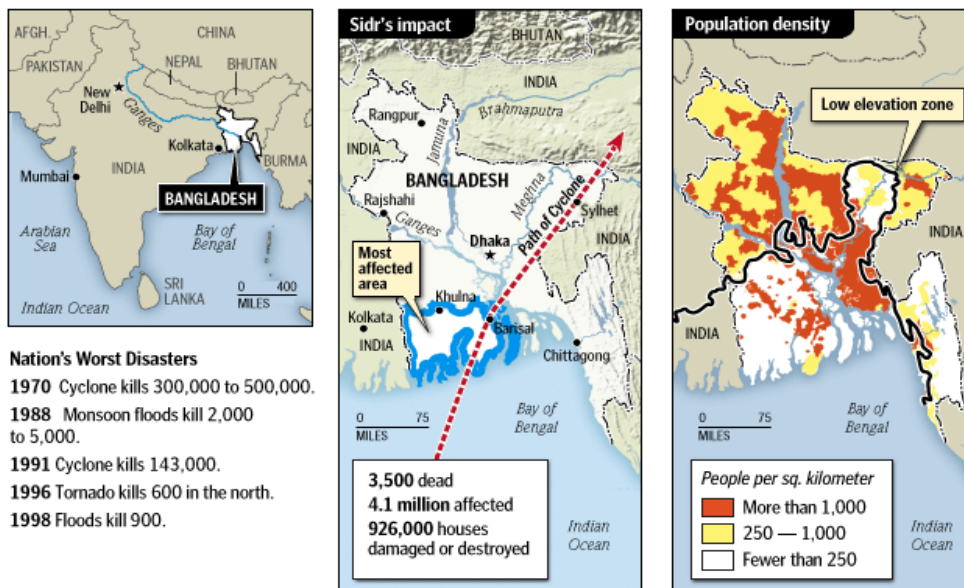


Figure-4.6-4 Flood Disaster in Bangladesh

Source: Centre for Hazard and Risk Research, Bangladesh, 2011

4.6.2 Seismic Effects

Bangladesh is located close to the plate boundary between the northward moving Indian plate and the Eurasian plate. During 1869-1930, five earthquakes with magnitude $M \geq 7$ have affected parts of Bangladesh. Two of them had their epicentres inside Bangladesh. Repeat of similar earthquakes which appears to be quite likely can now cause great devastation due to the rapid growth of densely populated urban areas with construction lacking quality as well as earthquake resistant design. Even moderate earthquakes close to the urban cities may cause great havoc. In rural areas of high seismic risk, highly vulnerable mud-walled houses are quite common. During the last seven or eight years, the occurrence and damage caused by some earthquakes (magnitude between 4 and 6) in the south-eastern part of the country inside the country or near the country's border, has raised the level of awareness among the general people and the government as well.

4.6.3 Cyclones and Storms

Cyclone is a tropical storm or atmospheric turbulence involving circular motion of winds, occurs in Bangladesh as a natural hazard. The tropics can be regarded as the region lying between 30°N latitude and 30°S latitude. All the tropical seas of the earth with the exception of the south Atlantic and southeast Pacific give birth to deadly atmospheric phenomena known as tropical cyclones. On an average, 80 tropical cyclones are formed every year all over the globe.

The project area is out of the tropical storm considering the previous history of the cyclone. **Figure 4.6-5** shows the cyclonic storm track where clearly revealed the project area cyclonic storm risk. In 1991 and 1996 the project area was under the disaster of cyclone and the table-4.6-2 below shows the major Cyclonic Storms disaster in the Project Area.

Table-4.6-2 Major Cyclonic Storms disaster in the Project Area

Date of Occurrence	Place of Occurrence	Area of Devastation (Sq. km.)	Duration of Storm (Minutes)	Maximum Wind Speed (Km/hr.)	People killed	Number of Injured
05-07-91	Gazipur	-	Several minutes	298	46	400
13-05-96	Tangail	16 Unions of 6 Thanas	05-08	320-400	570	30,000

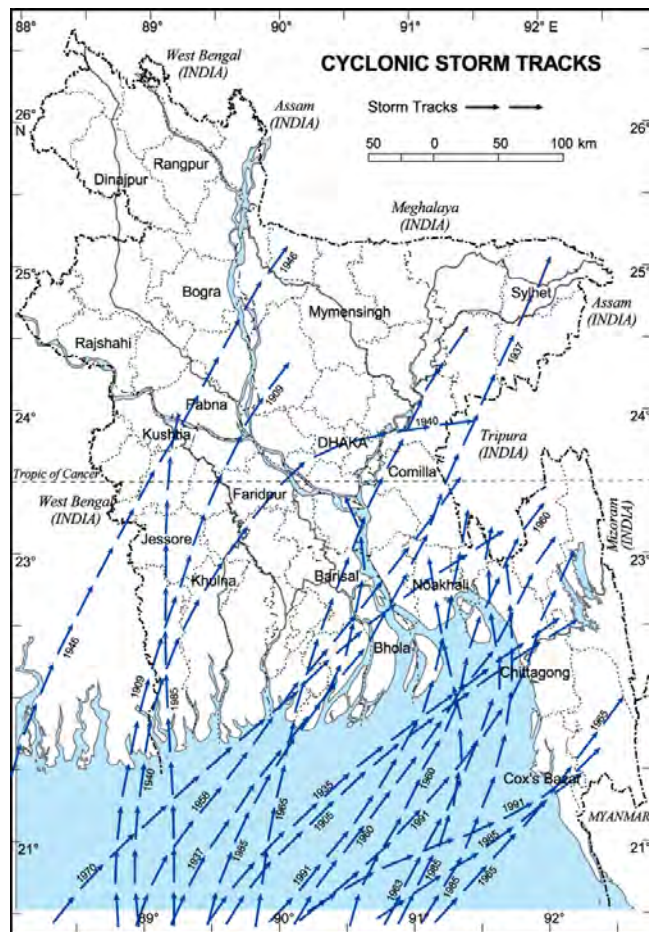


Figure-4.6-5 Project area Cyclonic Significance

Source: National Encyclopedia of Bangladesh, 2003

4.6.4 Erosion

The deltaic coastline of Bangladesh can be recognised as consisting of two basic physiographic units: the inactive or abandoned Ganges tidal plain and the active Meghna deltaic plain. While the Ganges tidal plain is relatively old, the Meghna deltaic plain is geologically very young. The Meghna deltaic plain extends from the Chittagong coast in the east to Tentulia Channel in the west. The erosion-accretion processes take place much more within this part. Broad map comparisons indicate that the delta of the Ganges-Brahmaputra Rivers has not grown significantly toward the sea over last two centuries. The project area is not significantly affected by erosion like other area of Bangladesh.

4.7 Socio-economic Environment

4.7.1 Population: Demographic profile of the Project Area

A complete sample census survey was made with 150 questionnaires to get the social information of the project affected peoples (PAPs). Parallel to this survey, 102 non-project affected persons questionnaire survey was made for understanding the socio-economic status of the project area. An exclusive ARAP report is prepared for identifying the affected household (HH) structures, community based entrepreneurs (CBEs) and land losers of the project. One third of all land loser affected were interviewed by random selection of which 114 PAPs are permanent land loser and 36 are temporary land losers. Of structure loser project affected household, full structure loss is 12 including 3CBEs and partial structure loss is 16 of living structure losers, total structure loss 28 (25 is living structure loser and 3 CBEs). Average household size of the project area is 4.5. The respondent of the questionnaires were 100% Muslim and married as well.

The details of the social information of the project area are listed in the Tables below.

Table-4.7-1: Household (HH) Size of the Project Area

Gender	Family members	%
Male	249	54
Female	213	46
Total	462	100
Average HH size= 4.5		

Table-4.7-2 Age Structure of the Project Area

Age	No. (Persons)	%
0-5	24	5
6-7	14	3
8-18	122	27
19-30	100	22
31-45	121	27
46-60	54	12
61+	19	4
Total	454	100

Table-4.7-3 Educational Status of the Project Area

Class Attended	No. of Respondent	%
Child under 4 years	51	11
Illiterate	18	4
Only read and write	0	0
Class 1 to class 5	7	2

Class Attended	No. of Respondent	%
Class 6 to 10	43	10
SSC/equivalent	14	3
HSC/equivalent	136	30
Degree/graduate	69	15
Masters/Honors	41	9
Others	72	16
Total	451	100

4.7.2 Settlement and Housing

Peoples of the project area mostly use the Tin structures i.e. roof and wall are made of tin and other metal sheets. Concrete brick made structures of the project area are 35-40%.

4.7.3 Traffic and Transport

The traffic and transport facilities of the project area are described in upazila wise below.

- Sreepur:
 - Communication facilities Roads: Pucca 80 km, semi pucca 20 km and mud road 800 km.
 - Traditional transport: Extinct and nearly extinct transports Palanquin, boat, bullock cart.
- Bhaluka:
 - Communication facilities Roads: Pucca 40 km, semi pucca 30 km and mud road 1113 km; waterways 17 nautical mile (during the rainy season).
 - Traditional transport: Palanquin (extinct), bullock cart (nearly extinct), boat.
- Kalihati:
 - Communication facilities Roads: Pucca 42.65 km, semi pucca 4.50 km, mud road 305.30 km; railways 12.8 km.
 - Traditional transport: Palanquin (extinct), horse carriage and bullock cart (nearly extinct), boat.
- Sakhipur:
 - Communication facilities Roads: Pucca 21 km and mud road 1178 km.
 - Traditional transport palanquin, horse carriage and bullock cart. These means of transport are either extinct or nearly extinct.

4.7.4 Public utilities: Water supply

Project area peoples are dependent on the ground water supply. 95% of the project peoples are using the STW & DTW. Water Supply facilities of the project area are listed below.

Table-4.7-4 Water Supply facilities of the project area

Type of use	Drinking (no)	%	Cooking (no)	%	Bathing (no)	%	Cattle/goat washing (no)	%
STW	26	25	26	25	26	25	27	26
DTW	71	70	72	71	72	71	70	69
Water supply	4	4	3	3	3	3	4	4
Well	1	1	1	1	1	1	1	1
Pond		0		0		0		0
Canal/River		0		0		0		0
Total	102	100	102	100	102	100	102	100

Note: STW-Shallow Tube-well; DTW-Deep Tube-well

4.7.5 Economy and employment: employment structure and cultural issue in employment

Project area is dominated by middle class people. Around 66% people are in the middle class as per survey data. Project area people are mostly in agriculture profession. Employment structure of the project area is listed below.

Table-4.7.5 Economy of the Affected Households

PAPs	No.	%
Ultra Poor	4	4
Poor	27	27
Middle class	65	66
Rich	3	3
Total	99	100

Table-4.7-6 Occupation of the Project Area

Occupation	Primary Occupation (No.)	%	Secondary Occupation (No.)	%
Farmer	41	9.7	7	29.2
Fisherman	2	0.5	0	0.0
Agriculture	14	3.3	0	0.0
Non agriculture Labor	3	0.7	0	0.0
Service	17	4.0	1	4.2
Small business	57	13.5	6	25.0
Household work	120	28.5	1	4.2
Student	138	32.8	2	8.3
Child	13	3.1	0	0.0
Retired/handicapped		0.0	0	0.0
Unemployed	4	1.0	7	29.2
Service in Abroad	8	1.9	0	0.0
Others	4	1.0	0	0.0
Total	421	100.0	24	100.0

Table-4.7-7 Employment Structure of the Project Area

Type	Respondent	Value (tk)
Agriculture	46	55070
Trade/business/industry	33	111061
Wage	16	39750
Rent	24	187250
Organizational work	14	258214
Government activities	0	0
Cleaning/collecting	0	0
Miscellaneous	9	162278

4.7.6 Fisheries: Fishing activities, Fishing communities, Commercial important species, fishing resources, commercial factors

The fisheries resources of Bangladesh are among the richest in the world. The contribution of this sub-sector under the agricultural sector in terms of GDP is 10.33%, which is 3.3% of the total GDP (Bangladesh economic review, 1998). During 1996-97, total fish production both inland and marine

was 1.373 MMT and the target for 1997-98 has been fixed as 1.491 MMT. Contribution of marine fisheries was 28.46% of the total production in 1996-97, which reveals that the inland fisheries production is still much higher than the marine fisheries production. This sub-sector provides an estimated 2 millions people comprises of full time fishermen, small fish traders, fish transporters, packers etc. Out of these 2 millions people 1.276 millions are engaged exclusively in fishing activities as prime source of income and hence termed as fulltime fishermen. Out of these fulltime fishermen, 40.43% are engaged in marine fisheries activities. In and around the project area there are six numbers of rivers and eight canals which are directly crossed by the pipeline route and many other small pockets of water bodies are available. In the rainy season the fishing activities are mostly common. More on some sort of fish cultivation are also observed during the field survey. Fish culture details of the project area are listed in the table below.

Table-4.7-8 Fish Culture of the Project Area

Fish name	Quantities (kg)	Price (Tk./Kg)
Karfu	250	22500
katla	220	22000
Talapia	200	19000
Ruhi	1500	180000
Pangas	120	13200

CHAPTER-5 IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS

5.1 General Overview of Environmental Impacts

An environmental impact is defined as any change to an existing condition of the environment. Findings of the assessment are presented according to site preparation, construction and operation phases. The impacts will be determined as significant, positive or negative, direct or indirect, long term or short term.

The potential environmental impacts of the proposed project have been assessed by using checklists. Checklists are comprehensive lists of environmental effects and impacts indicator designed to simulate and analyze to think broadly about possible consequence of contemplated actions. **Annex-1** represents the checklist developed for the proposed pipeline project. In the checklist, actions that may affect at the various stages of the project activities are listed and the confirmations of the environmental considerations for this project are recorded.

5.2 Identification of Impacts

Table-5.2-1 shows the scoping of the project considering various project activities, impact evaluation of in different stages of the project.

In reviewing impacts, the following issues are generally addressed:

- Air Quality;
- Noise and Vibration;
- Waste
- Soil
- Climate Change Factor
- Topography
- Geology
- Hydrology
- Ecosystem
- Biodiversity
- Protected areas
- Areas of environmental /ecological significance
- Local Economy
- Resettlement
- Indigenous people
- Cultural Heritage
- Health and Safety

5.2-1 Environmental Scoping for Dhanua-Elenga Pipeline Project

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
Environment quality and pollution control	Air quality	B-	D	During construction, air pollutants are expected from land clearance, movement of heavy equipment and trucks, which would generate mostly dust and to some extent exhaust gaseous emission (CO, NO _x , SO _x , and others). During O&M, no significant air pollutant emission is expected since pipeline is laid underground and conveys compressed natural gas.
	Water quality	B-	D	Potential rivers water quality deterioration while HDD construction/installation works across the six rivers i.e. Bangshai, Salda, Safai, Tanki-1, Tanki-2 & Langolia and finally the pipeline crossing at three points of Langolia canal could occur. However, no long-term adverse effects on water quality is anticipated during the project operational stage since the pipeline is laid underground and will not affect any water body.
	Noise/vibration	B-	D	Noise and vibration during construction/installation of pipeline is a critical aspect and could not be entirely eliminated. Still, work prone to potentially high noise/vibration shall be scheduled for day-time only. As also noted above, since the pipeline is laid underground there is no potential noise/vibration issue is involved during operation stage of the project.
	Waste	B-	B-/D	Waste generation during construction activities include excess borrow pit soil due to pipeline trench back-filling following pipe laying, sanitary and solid waste generation due to working personnel and other construction related works. Waste generated during operation of the pipeline is pigging waste that has already been generated consequent to the existing gas transmission pipelines of more than 1000 km in length. As such this pipeline with length of only 52 km will result only in marginal increase in pigging waste generation. Still, pigging waste management is a long-term requirement. These wastes due to construction and operation have to be managed properly with a good and effective waste management system.
	Soil	B-	D	Trenching and subsequent back-filling following pipeline work has potential to affect agricultural fertility of excavated land area. However, long-term adverse effects on soil fertility due to underground (laid) pipeline is regarded as not that significant.
	Climate change Factors	D	D	Natural gas results in less CO ₂ emissions in comparison to other liquid petroleum sources. Still, in overall, any such beneficial effects on overall climate change factors is regarded as not that significant when this project effect is

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
				individually taken into account.
Natural Environment	Topography	D	D	The project is not that large-scale to significantly affect topography that is also evident from already laid and operational gas transmission pipelines of more than 1000 km in length.
	Geology	D	D	Similar to the topography case of above potential adverse effects on geology is regarded as not that significant.
	Hydrology	D	D	Similar to the topography case of above potential adverse effects on hydrology is regarded as not that significant.
	Ecosystem	D	D	The project is not expected to affect the ecosystem since there is no important ecosystem that would be affected by the installation of the pipeline that will be laid underground basically in-parallel/near-by already existing underground pipeline.
	Biodiversity	D	D	Any potential adverse effect on biodiversity due to linear trenching and backfilling following pipe laying is regarded as only marginal and not that significant considering the highly anthropogenic influenced nature of the project affected area. In the operation stage since land is restored to original state as the pipeline is laid underground there would be no adverse effect on biodiversity.
	Protected areas	D	D	There are no protected areas located in and around the vicinity of the planned ROW of pipeline route and hence there is no adverse effect.
	Areas of environmental /ecological significance	D	D	There are no environmentally or ecologically significant, critical or vulnerable areas located in and around the vicinity of the planned ROW of the pipeline route, condition similar to the case of protected area of above.
Social Environment	Local Economy	B+	B+	Implementation of the project involving very significant demand for even unskilled labor for trenching and backfilling work has potential for local employment opportunity during construction stage of the project thereby contributing to local economy. This is also possible to some extent during the operation stage as well for maintenance of facilities such as valve stations and also for patrolling work to ensure the integrity and protection of ROW (of the newly laid underground pipeline).
	Resettlement	B-	D	Even with all efforts to minimize resettlement requirement with rerouting of the ROW to avoid residential areas to the extent possible some small-scale resettlement requirement is regarded as inevitable. In this respect, due compensation, living assistance, job training and other support system conforming to internationally accepted policies of WB (OP 4.12) shall be used as the mechanism both for execution and subsequent

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
				monitoring of resettlement activities. Since resettlement and its monitoring is relatively short-term activity and hence no long-term adverse effect to correspond to the operation of the pipeline system is anticipated.
	Indigenous people	D	D	There are no indigenous people living in and around the vicinity of the ROW of the planned pipeline route. So no adverse effect is anticipated.
	Cultural Heritage	D	D	There are no cultural heritage sites located in and around the vicinity of the ROW of the planned pipeline route. So no adverse effect is anticipated.
	Health and Safety	B-	D	Health and safety of construction personnel is very important aspect in the construction management by contractor. Instilling due awareness among migrant workers on the dangers of communicable diseases and the importance in respecting the customs and traditions of village people is the most significant social aspect to be addressed by the construction contractor. Full commitment and adherence to the concept of "Safety First" in the conduct of all construction related activities by the construction contractor is necessary for enhanced safety of construction work force. No significant safety issue is anticipated consequent to the operation of the underground gas transmission pipeline with due adherence to safety guidelines of GTCL (having more than 20-year operational experience in gas transmission pipelines).

Legend:

A+/- : Significant positive/negative impact is expected

B+/- : Positive/negative impact is expected

C+/- : Extent of positive impact/extent of negative impact is unknown (needs further investigation and clarification or whether the impact can be clarified as the ESC Study progresses)

D : No significant impact is expected or no impact at all is expected

5.3 Preconstruction Phase

The construction of 30 inch 52 km Dhanua-Elenga gas transmission loopline will require acquisition and requisition of land for two purposes (a) for pipeline laying and (b) for post construction maintenance and inspection.

An additional 102 hectares of temporary ROW will be required for working space along ROW of 41.69 hectares required to be acquisitioned for the project.

Disturbance of Population

The route for this 30 inch new loop line has been finally determined so that, the loop line will be routed parallel to the existing Monohordi-Dhanua-Elenga East Bank of Jamuna Bridge (M-D-E-EBJB) pipeline.

Disturbance of Communication and Utilities

As continuous linear structures, pipeline has to cross all intersecting linear features along the route. Thus roads, rivers, canals, migration channels, water pipelines, electricity and telephone cables are potentially at risk of disturbance as a result of pipeline routing. Areas of land can be rendered unusable through loss of access as a result of an insensitive pipeline routing.

5.4 Construction Phase

The implementation of Dhanua-Elenga loop line project will require acquisition and requisition of land for two specific purposes a) A temporary requisition of land up to a total of 102 hectares along the loop line as right-of-way (ROW) for the construction of the pipeline b) A total of 41.69 hectares of land will be acquired for pipeline laying and construction of other surface facilities. GTCL has prepared a schedule of plots required for acquisition and requisition purposes. The landowners are to be paid for acquisition of the land and for compensation due to crops loss.

Labor Market Impact and Income Generation

The pipeline and facility construction activities will entail direct employment of local manpower by the contractor and the Supervision Team. The local manpower will be primarily employed as drivers and unskilled labor. Patrolmen will be hired locally.

The indirect effects of the construction activities will affect local tradesmen and landowners who can sell food and other commodities to the construction and Inspection Teams.

Soil Erosion and Fertility

Potential impacts to soils include compaction, erosion and loss of fertility. The proposed pipeline route will be affected by grading and construction, resulting in various degrees of compaction.

Road access is located at the ends of the pipeline route and at two-three locations along the route. Therefore the construction contractor will have to deploy more equipment along the right of way of (ROW) approx 10-15 km. Experience from previous pipeline construction works under similar soil conditions in Bangladesh recall that compaction has limited affect on agricultural capability after reinstatement of the ROW.

The impact will be minimized in the long term if construction and reclamation procedures are performed according to strict soil protection guidelines.

Mixing of topsoil and horizons can occur during trenching and back filling. Mixing of sub-soil with the cultivation layer would result in a negative effect considering that the majority of the project area is used for agricultural purposes.

Trenching and subsequent backfilling will subject soil to potential erosion. The erosion potential is greatest during the rainy season and when flooding is prevalent. Trenching and backfilling also subjects topsoil to potential mixing with less fertile lower layer soil resulting in loss of fertility.

There are few access roads to the pipeline route. Construction materials and manpower must be transported to worksites by trucks and other vehicles via ROW Vehicular traffic create ruts, destroys vegetation and compact soils. Rutting and destruction of vegetation increases the potential for erosion.

With proper mitigation techniques, construction of the pipeline is considered to have a minor impact on soil fertility and erosion.

Soil Erosion and Fertility Control Plan

Construction activities shall be conducted so as to minimize soil erosion, loss of soil fertility and sedimentation of water bodies. Grading shall be limited as much as possible to minimize disturbing vegetated areas and subject them to potential erosion. Contractor shall install erosion controls on all disturbed critical areas. A critical area is any area subject to erosion due to slope angle, and areas impacted by large flows such as river/stream banks, a discharged hydrostatic pressure water and slurry from directional drilling under river bottoms. For this project, all soils are considered highly erodible.

General Trenching and Backfilling Activities

Trenches shall be backfilled as soon as possible to minimize erosion potential. Spoil piles shall not be placed on slopes greater than 5% or adjacent to water bodies where they may be washed away by high water or run-off. The upper 30 cm fertile soil level shall be conserved by segregating fertile spoil piles from common fill spoil piles. The soil is highly erodible in areas where vegetation has been disturbed. Disturbed slopes greater than 30 percent shall be stabilized with sand bags, slopes between 5 and 30 percent seeded and stabilized with jute mats anchored with stakes.

Storm water and ground water pumped from trenches and hydrostatic pressure water drained from the pipeline shall be released under controlled conditions. Discharged water shall be directed to vegetate areas to minimize erosion and filter out sediment. The discharge flow shall be controlled to prevent washout of the vegetation and subsequent erosion.

River Crossing

Minimum clearance maintained between the bored hole and river bottom during directional drilling activities shall be seven meters. The location of the drilling head shall be monitored at all times and corrective measures implemented when this clearance is less than specified.

Trenching and backfilling operations at stream crossings shall be conducted during the dry season when river elevations and flow are at their lowest. Work shall be scheduled so that trenching and backfilling is completed in the shortest possible time. Spoil shall be placed on a level surface high enough to prevent washout in the event the river level rises. The contractor shall provide drains protected with silt fences, jute mats or sand bags if necessary to trap sediment and drain excess water from the spoil area while minimizing erosion.

Surface Water

Surface water may be adversely impacted by contaminated storm water runoff from maintenance areas. Oil, grease, chemicals, paints and solvents used in the construction activities may be the sources of this storm water contamination. Implementing the oil spill plan will reduce the risk of contamination by chemicals, paints and oil and grease etc.

Trenching and back filling at river and stream crossing will increase sediment loads to those water bodies. This impact will be minimized by using conservative construction crossing procedures and adequately stabilizing the banks disturbed by construction activities. The river/stream crossing plan will minimize soil erosion and sediment loading of the watercourse.

Drilling fluids used for directional drilling under the Rivers may not contain chemical additives; but drilling slurry returned to shore could add sediment to the river and cause bank erosion; if allowed to drain uncontrolled to the watercourse. Erosion from construction areas may be carried by storm water runoff to surface water and increase sediment loading on that water body.

Improperly handled sanitary waste generated by the construction force may be carried by storm water runoff to contaminate nearby surface waters, if not properly treated and handled. Use of sanitary latrines and adequate treatment facilities as detailed in the waste disposal section will eliminate this possibility.

Ground Water

Ground water may be adversely impacted by percolation of contaminants from maintenance areas polluted with oil, grease, or chemicals. Spills and leaks of chemicals, paints and solvents used in the construction activities may also be a source of ground water contamination. Contaminates from improperly handled sanitary waste generated by the construction force may percolate to ground water if not properly contained and treated.

Shallow ground water, brought to the surface through tube-wells may be used as drinking water by the construction force. Lack of proper sanitary facilities for the local population may result in to contamination of this water supply as has been the case in other similar areas.

5.5 Operation Phase

Loss of Use of Land

Potential environmental impacts from the operation of pipeline are limited to the loss of utility of land along the pipeline alignment due to the requirement for a ROW for patrolmen to patrol the line, and for operations personnel to gain access to valve stations.

A specified safety zone in either side of the pipeline is required under the Bangladesh Mineral, gas safety rules to be kept free of residences.

CHAPTER-6 ENVIRONMENTAL MANAGEMENT AND MITIGATION PLAN / PROCEDURES

6.1 Introduction

In the context of a project, environmental management is concerned with the implementation of the measures necessary to minimize or offset adverse impacts and to enhance beneficial impacts. The prime function of EIA is to provide a basis for shaping the project so that overall environmental performance is enhanced this cannot be achieved. Unless the mitigation and benefit enhancement measures identified in the project EIA are fully implemented.

In order to be effective, environmental management must be fully integrated with the overall project management effort, which itself should aim at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions efficiently throughout its life.

At this stage of Dhanua-Elenga loopline project, the environmental management plan has been prepared in outline only, as many important elements of the project are yet to be fully defined. However, the plan indicated in the following sections indicates the broad approach which should be adopted. The plan should be expanded during the detailed design stage when more information is available, and a fully detailed environmental management plan should be prepared at that time.

The identified mitigation measures are means of reducing the potential impacts of the project to the residual levels. The task of management is to ensure that the mitigation is carried out and the targets (assessed residual impacts) are met surpassed. The Environmental Management System (EMS) is the set of procedures, which should allow the management team to achieve this objective. The EMS is not, however, a substitute for management, which still needs to be exercised, in the environmental dimension of the project just as much as in any other dimension, such as the financial, or personnel aspects.

6.2 Mitigation Measures of Project Impacts

6.2.1 Preconstruction Phase

During the pre-construction phase of the project, the critical activities of route selection and preliminary design will be taking place. Land acquisition and requisition will be initiated and specifications and contract documents will be prepared as well. The responsibility for delivery of those mitigation measures identified in this EIA as related to the design and the operation of the project, and those associated with site selection, will be with GTCL directly.

Prior to contractor mobilization and the commencement of construction, environmental management will cover six principal groups of activities:

- Review of EIA and identification of additional mitigation/enhancement measures as necessary for all subprojects.
- Supervision of a detailed environmental survey of the pipeline route, to provide information to the design process and to assemble baseline data.
- Preparation of a comprehensive Environmental Management Plan for the project which provides for the implementation of mitigation measures identified in the EIA and subsequent reviews.
- Preparation of detailed designs which give due consideration to minimization of adverse impacts and benefit enhancement.
- Preparation of tender and construction contract documentation which contains appropriate clauses to allow control of impacts arising from construction activities.
- Preparation of a Resettlement Action Plan (RAP), or more correctly, a Land Acquisition Plan

(LAP), since no major resettlement is anticipated.

- Acquisition of land and property to accommodate the proposed works

Responsibility for reviewing of EIA, preparation of the EMP, detailed design and the preparation of tender and contract documentation lies with the planning division of GTCL. Overall responsibility for environmental management in these respects will lie with GTCL management.

The planning division of GTCL will be responsible for preparing site plans showing the extent of land which will have to be acquired in order to accommodate the project works, together with an estimate of land and property acquisition costs, for inclusion in the project budget. Land ownership is registered on Mouza maps (land registry maps) and regulated by the District Commissioners.

Land requisition is regulated by the Board of Land Administration as per Immovable Property Ordinance of 1982. Land values are generally registered at one-half value to avoid taxes, which has caused great concern and hardship to property owners in past acquisition negotiations (Stone & Webster, 1993). An NGO/consultant, appointed by GTCL will prepare the LAP, which will be consistent with current Bangladesh legislation and the requirements of the ADB.

The assessment of compensation for land and property should involve a Joint On-Site Inventory and Verification Team (JIV) consisting of the representatives of the Deputy Commissioner (DC), GTCL and the Project Implementation Office (PIO). The Ministry of Lands will also have to approve the final land acquisition plans.

6.2.2 Construction Phase

Implementation of mitigation measures for the construction phase should be achieved in the following manner. The EIA and the GTCL environmental management plan for the project should be issued to tenderers as part of the tender documents. Tenderers should be asked to submit a Contractor's Environmental Management Plan for their site operations which addresses the issues identified in the EIA, and show how they propose to implement the mitigation measures identified therein. The contractor's EMP should address the following issues:

- Waste management (including spoil)
- Surface and groundwater management
- Traffic management
- Noise management (working hours etc)

Environmental management during the construction phase is essentially concerned with controlling impacts, which could result from the activities of the contractor, through enforcement of those contract clauses, which relate to environmental protection. It is important to recognize that the clauses relating to control of construction impacts will not themselves have any effect unless they are fully implemented and enforced.

Primary responsibility for construction supervision and contract management will lie with the Engineer, as defined in the construction contract. This person will be appointed by and from GTCL, and will have overall responsibility for environmental management during the construction phase. It is anticipated that the Engineer will be assisted in construction supervision by staff from consultants, and that day-to-day responsibilities for site supervision, including environmental management aspects, will lie with the Engineer's Representative, who will have specific powers and responsibilities delegated to him by the Engineer.

It is recommended that a full/part-time local Environmental Specialist should be appointed as a member of the construction supervision team. He would visit all sites on a regular basis and generally provide advice and assistance in relation to all aspects of environmental management during the

construction period. He should encourage work crews to be aware of possible environmental issues which they may encounter during their work, as these may not always be expected even when prior investigation and survey has been carried out.

6.2.3 Operation Phase

Some of the impacts which are expected to occur during the operational phase are essentially related to the design of the project, and in this respect the principal environmental management functions are the responsibility of the design consultants. Matter relating to safety and risk management, will be the responsibility of the local authorities concerned.

Matters relating to routine and periodic maintenance will be the responsibility of GTCL, and environmental management responsibilities will also lie with this body. It is therefore recommended that GTCL would

- Upgrade emergency response system with due input to their stock of their equipments, tools and PPE.
- Revisit their policy statement and personnel awareness program to commensurate with the diversified project components in their ongoing and upcoming project implementation plans.
- Strengthen their capacity of manpower and technology through continuous professional development plans for their designated officials responsible for taking care of HSE issues of the company in general and particularly for this project.

Environmental Impact Mitigation/Management Plan of Dhanua-Elenga Project is shown in **Table-6.2-1**.

Table-6.2-1: Environmental Impact Mitigation/Management Plan of Dhanua-Elenga Project

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
Preconstruction					
1.1	Involuntary Resettlement - Households and people are influenced	<ul style="list-style-type: none"> • Proper resettlement action Plan (RAP) • Provide adequate compensation in time to PAPs 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Replacement value of land: 1,149,230,000
1.2	Local Economies such as Employment, livelihood etc. - Shop owners, employees, cultivators, properties and plantation owners are influenced	<ul style="list-style-type: none"> • All direct income loss must be adequately compensated within the RAP • Income loss can be mitigated by providing alternative job opportunities for PAPs. • Arrangement of skill development training • Micro credit support for SME 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Training Cost: 5,000,000 Revolving Fund for Microcredit: 10,000,000 One time cash grant for Income Losers: 4,500,000
1.3	Land use and utilization of local resources - Cultivable lands area and three small poultry farms structure, house structures are affected - Loss of Trees (private and Government forest trees)	<ul style="list-style-type: none"> • Cultivable land area which will be temporarily occupied during construction, will be restored to original state and returned to the land owner after construction • Proper compensation shall be made for the affected structures, trees • Tree plantation cost shall be provided to the private/government organizations to minimize the loss of trees 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Compensation for affected structure: 10,630,000 Budget for requisition land and Standing Crop: 23,438,126 Compensation for trees: 17,307,000 Compensation for Business Losses: 4,800,000
1.4	Social institutions such as Social infrastructures and decision-making institutions - Social institutions are affected by relocation	<ul style="list-style-type: none"> • Proper resettlement action Plan (RAP) • Provide adequate compensation in time to Social Institutions 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall project formation cost
1.5	Poor, indigenous people or ethnic minority - Livelihood of poor or female headed households are affected	<ul style="list-style-type: none"> • Prepare RAP involving the following measures <ul style="list-style-type: none"> - Define the displaced persons and criteria for determining their eligibility for compensation - Establish external monitoring committee consists of the third party • Proponent will improve the surface water condition and also will make available the groundwater for the poor 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall project formation and administration cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
1.6	Mal-distribution of benefits and damages - Displaced people may be suffered at pipeline route sites	people. • Prepare RAP involving the following measures - Assessed compensation will base on the market price - Payment will be carried out before resettlement • Establish external monitoring committee consisting of a third party	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall project formation and administration cost
2. Construction					
2.1	Involuntary Resettlement - Households and people are influenced	• Prepare Resettlement Action Plan (RAP) • Provide adequate compensation and assistance in time to PAPs	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall administration cost
2.2	Local Economies such as Employment, livelihood etc. - Shop owners, employees, cultivators, properties and plantation owners are influenced	• All direct income loss must be adequately compensated within the RAP • Income loss can be mitigated by providing alternative job opportunities for PAPs.	RAP Implementing Agency	GTCL and External Monitoring Agency	Included in overall administration cost
2.3	Land use and utilization of local resources - Cultivable lands area and a small poultry farm structure, house structures are affected	• Cultivable land area which will be tentatively occupied during construction, will be restored to original state and returned to the land owner after construction • For cultivable land areas during land clearance for trench excavation and related works fertile top soil shall be retrieved and stored separately and reused after trench backfilling as final cover so that soil fertility is duly restored • Proper compensation shall be made for the affected structures	Contractor/ RAP Implementing Agency (RU-GTCL)	GTCL, Supervising consultant and External Monitoring Agency	Included in overall administration and construction cost
2.4	Social institutions such as Social infrastructures and decision-making institutions - Social institutions are affected by relocation and noise	• Proper resettlement action Plan (RAP) • Provide adequate compensation in time to PAPs • Periodical maintenance of construction vehicles • Installation of sound insulation	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall administration cost
2.5	Existing social infrastructures and Services - Social service utilities are located underground in the affected area	• Proper detailed design is going to be done and the utilities line will be diverted before starting the construction activity.	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall administration cost
2.6	Poor, indigenous people or ethnic	• Prepare RAP involving the following measures	RAP	GTCL and External Monitoring Agency	Included in overall administration cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
	minority - Livelihood of poor or female headed households are affected	<ul style="list-style-type: none"> - Define the displaced persons and criteria for determining their eligibility for compensation - Establish external monitoring committee consists of the third party • For poor people, proponent activities improving surface water condition, making groundwater available and enhancing their job skill shall be implemented 	Implementing Agency (RU-GTCL)	Monitoring Agency	administration cost
2.7	Mal-distribution of benefits and damages - Displaced people may be suffered at pipeline route sites	<ul style="list-style-type: none"> • Prepare RAP involving the following measures <ul style="list-style-type: none"> - Assessed compensation will base on the market price - Payment will be carried out before resettlement • Establish external monitoring committee consists of the third party 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall administration cost
2.8	Local conflicts of interest - candidates of construction workers may have some conflicts between communities	<ul style="list-style-type: none"> • Clear information about the needs of labor (number and qualification) should be provided with local people. • The job skills and the priority for the affected people shall be taken into account and the workers can be chosen. 	RAP Implementing Agency (RU-GTCL)	GTCL and External Monitoring Agency	Included in overall administration cost
2.9	Accident - Construction workers can have harmful and critical troubles and injuries	<ul style="list-style-type: none"> • Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.10	HIV/AIDS - Transmission of disease by inflow of migrant workers	<ul style="list-style-type: none"> • An HIV-AIDS awareness campaign via approved service provider shall be implemented 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.11	Gender - Salary gap between genders	<ul style="list-style-type: none"> • Monitoring of payment to workers by the contractor shall be implemented not to allow payment gaps between male and female. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.12	Children's right - A bunch of children come and work in construction site	<ul style="list-style-type: none"> • Regular monitoring of sites to guide contractors and their related firms to discourage child labor. • When the child labor will be detected, necessary and decisive actions to the violating firms are implemented. • Some assistance for parents of working child. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.13	Flora and Fauna - Loss of Species diversity, Damage to habitat, Loss of species due to disposal of petroleum oil lubricants and toxic refuse	<ul style="list-style-type: none"> • Any illegal discharge of waste water, leaked oil shall be prohibited • Construction development area shall be fixed, not to develop or cut trees out of project area • Night lightning in construction should be restricted to 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
2.14	<p>Air Pollution</p> <ul style="list-style-type: none"> - Dust rising from unpaved road, emission of Greenhouse gas, heat emission and others during construction 	<p>the construction site.</p> <ul style="list-style-type: none"> • Quick recovery of the backfilled trenches in rainy season which will follow the reemergence of vegetation by rain • Good maintenance and operation of equipment and vehicles • Use environmentally-friendly material • Spraying water to suppress the dust rising • Cover the loaded vehicles with tarpaulin to prevent the load materials from being blown. • Good maintenance of material • Monitoring and regular meeting for air quality 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
2.15	<p>Water Pollution</p> <ul style="list-style-type: none"> - Construction sludge, mud water from earthwork, domestic waste liquid from worker's camp, and oil leaking from construction vessel 	<ul style="list-style-type: none"> • Generated construction sludge is to be treated by silt basin and remaining sludge is disposed at designated dumping site • Drilling fluid used will be managed through bioremediation and applied to irrigable land • Turbid water from construction work area is treated in silt basin for satisfying water quality standard and drain away to the nearest drainage or river • Domestic water is treated by septic tank for satisfying water quality standard and drain away to the nearest drainage or river. • Water quality including contents of arsenic will be checked before using groundwater as potable water for construction workers. • Waste oil shall be stored without leaking before legal disposal process. • Re-fuelling place to equipment/ vehicles shall be concreted floor • Fuel and oil shall be stored at concrete floored tank surrounded with concrete fence • Equipment and vehicles are properly maintained not to cause leaking of fuel onto ground surface. Inspection sheet of maintenance record shall be submitted regularly • Batteries containing liquid inside shall be kept on 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
		<p>impervious place to prevent battery liquid that contains hazardous heavy metals leaks and percolate into sub-ground</p> <ul style="list-style-type: none"> To be on the safe side, study on groundwater will be implemented by the consultant during detailed design stage in order not to cause adverse impact on surrounding wells. Preparation of a waste management plan to achieve reuse, reclamation and recycling of materials. 			
2.16	<p>Soil erosion</p> <ul style="list-style-type: none"> Practical construction period selection, washed off excavated soil 	<ul style="list-style-type: none"> Construction work shall be carried out in dry season (practical only in dry season for pipe laying work) only. Emphasize due construction planning with the intention that the trench portion excavated will be fully completed and backfilled with pipe laid underground within the dry-season so that the topography is fully restored to original condition. No excess excavated soil mount is left behind to be washed off during rains (erosion soil runoff mitigation). 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.17	<p>Soil pollution</p> <ul style="list-style-type: none"> leakage of oil, and borrow can contaminate soil 	<ul style="list-style-type: none"> Disposal at designated dumping site Soil quality testing Disposal of waste oil without leakage Refueling place having concreted floor Preserved in the tank surrounded with concrete fence Equipment and vehicles are properly maintained Batteries containing liquid inside shall be kept on impervious place 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
2.18	<p>Waste</p> <ul style="list-style-type: none"> Generation of construction sludge and domestic waste 	<ul style="list-style-type: none"> Minimize volume to use silt basin before disposing Segregate waste to minimize waste material Disposed in designated dumping site instructed by the section handling waste Recycled as possible with consideration of soil property. 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
2.19	<p>Transportation of Material, Equipment, Pipes etc.</p>	<ul style="list-style-type: none"> Minimize interference to regular traffic Effective measures to be taken to minimize dispersion of dust (in case of dust prone material excess soil transport) 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
2.20	<p>Noise and Vibrations</p> <ul style="list-style-type: none"> Noise and vibration from 	<ul style="list-style-type: none"> Periodical maintenance of construction vehicles Installation of sound insulation cover on boundary near 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
2.21	<p>construction machines and vehicles</p> <p>Offensive Odor</p> <ul style="list-style-type: none"> - Open burning of construction waste, improper treatment of human liquid waste, exhausted smoke from heavy equipment etc. 	<p>residential area</p> <ul style="list-style-type: none"> • Prohibition of open burning • Proper treatment of camp waste • Proper maintenance of heavy equipment. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.22	<p>Bottom sediment</p> <ul style="list-style-type: none"> - Waste dumped into rivers can contaminate river bed 	<ul style="list-style-type: none"> • Construction contractor will be obliged to no dumping of waste into the river 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.23	<p>Construction Safety Measures</p>	<ul style="list-style-type: none"> • Employees shall be provided with appropriate training on different topics • Employees shall be provided with appropriate PPE's(safety shoe, safety Helmet, safety goggles, hand gloves, ear plug, etc) • Employees shall be provided with appropriate first aid facility and Health surveillance. • Medical tie up shall be established with ambulance facility. • Drinking water with healthy food shall be supplied at site with suitable dining area. • Toilet/mobile toilet shall be arranged. • Suitable lifting equipments and tools & tackles shall be arranged. • Proper supervision shall be arranged at each location of sites. • Environmental parameters test shall be conducted on frequent interval. • Motivational HSE programs shall be arranged for the promotion of health & safety. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.24	<p>Emergency Response Plan</p>	<ul style="list-style-type: none"> • Emergency response team • First aid facilities at sites and camp • 24 Hours Hospital tie-ups with ambulance facility. • Training facility for how to response in any emergency. • Mock drill exercise to response during any real emergency. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost (BDT)
2.25	Occupational Health and Safety	<ul style="list-style-type: none"> • Ensure that where it is possible for a worker to fall through a vertical distance, the worker is protected from the falling by <ul style="list-style-type: none"> - A guard rail around the work area - A safe net; or - A fall arresting device • Protection against collapse • Wearing proper clothing • Eye protection • Foot protection • Respiratory protective equipment • Safety for Building and equipment • Precautions in case of fire • Fencing of machinery • Any dust or fumes or other Impurities likely to be injurious to the workers effective measure shall be taken to prevent its accumulation and its inhalation by workers • The hydro test water will be diluted prior to discharge. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
2.26	Hydrostatic test water not treated with biocides, corrosion inhibitor and oxygen scavengers		Contractor	GTCL/Supervising Consultant	Included in overall construction cost
3. Operation					
3.1	Pigging Waste <ul style="list-style-type: none"> - Pipe cleaning waste (pigging grit – scale, rust, or other foreign material) 	<ul style="list-style-type: none"> • Pigging waste is assessed as containing mostly silt material by GTCL and currently it is buried underground as government approved disposal method. 	GTCL	GTCL/Petro Bangla	Included in overall operational cost
3.2	Operational Safety	<ul style="list-style-type: none"> • It is recommended that GTCL will continue to follow the gas safety rules and its updates in timely manner 	GTCL	GTCL/Petro Bangla	Included in overall operational cost
3.3	Emergency Response System	<ul style="list-style-type: none"> • It is recommended that GTCL will equip its personnel with due awareness training, appropriate PPE and Safety guidelines to respond Emergency situations. 	GTCL	GTCL/Petro Bangla	Included in overall operational cost

6.3 Implementation of the Environmental Management and Mitigation Plan

6.3.1 Organizational Management Aspects

Executive responsibility for project management commonly involves a number of organizations, each with specific responsibilities for particular aspects during the pre-construction, construction and operation & maintenance phases. Following accumulation of the database of environmental measurements, the management measures with regard to controlling the potential impacts that could occur during different phases of the project should indicate responsibilities for the various actions concerned.

The environmental management team should, therefore, detail the management actions required with fixation of specific individual responsibilities for these actions particularly in respect of Policy and leadership for continuous improvement through, training and orientation, fulfilling the regulatory requirements in environment, safety and health. The responsibilities would also include risk management and ensuring emergency preparedness and response, incident reporting & investigation and maintaining harmonious community relations.

Environment and Safety (EAS) Management System Process

Besides defining management's requirements regarding EAS, the GTCL ESMS establishes the processes to apply the system to their operations. These processes include steps to clarify accountability. These steps are listed as follows:

Specific Activities and Responsibilities

1. The first step is to clearly assign responsibility to meet each EAS requirement at all levels of the GTCL. This process begins at the top of management and continues down through each level of the organization, so that until each affected person understands his/her EAS responsibility. Managers and supervisors of the Technical Support Staff at every level of the project execution would review each of the project activity performed by themselves, by their contractors including the contractor and then would make his choice(s) of remedial action.
2. This process will continue in GTCL until all procedures have an assigned responsible person who will assure that the procedure is implemented. In many cases, several people will be accountable for implementation of a procedure. For example, at the pipeline construction sites and at supporting field camps more than one person would be responsible for fulfilling the procedure regarding correct waste management.

Implement the System

In the implementation step, all of those responsible for implementing each EAS procedure will develop the approach and the systems needed for procedure implementation. Clearly defined roles and responsibilities are critical, along with the necessary training, to support implementation.

The institutional arrangement designed for EMP of the Dhanua-Elenga Gas Transmission Pipeline project has been shown in **Figure-6.3-1** reflecting the inter-linkages between GTCL Technical Staff, the Contractor and the Environmental Specialist of the client/contractor so far as implementation, supervision and monitoring of the EAS issues are concerned.

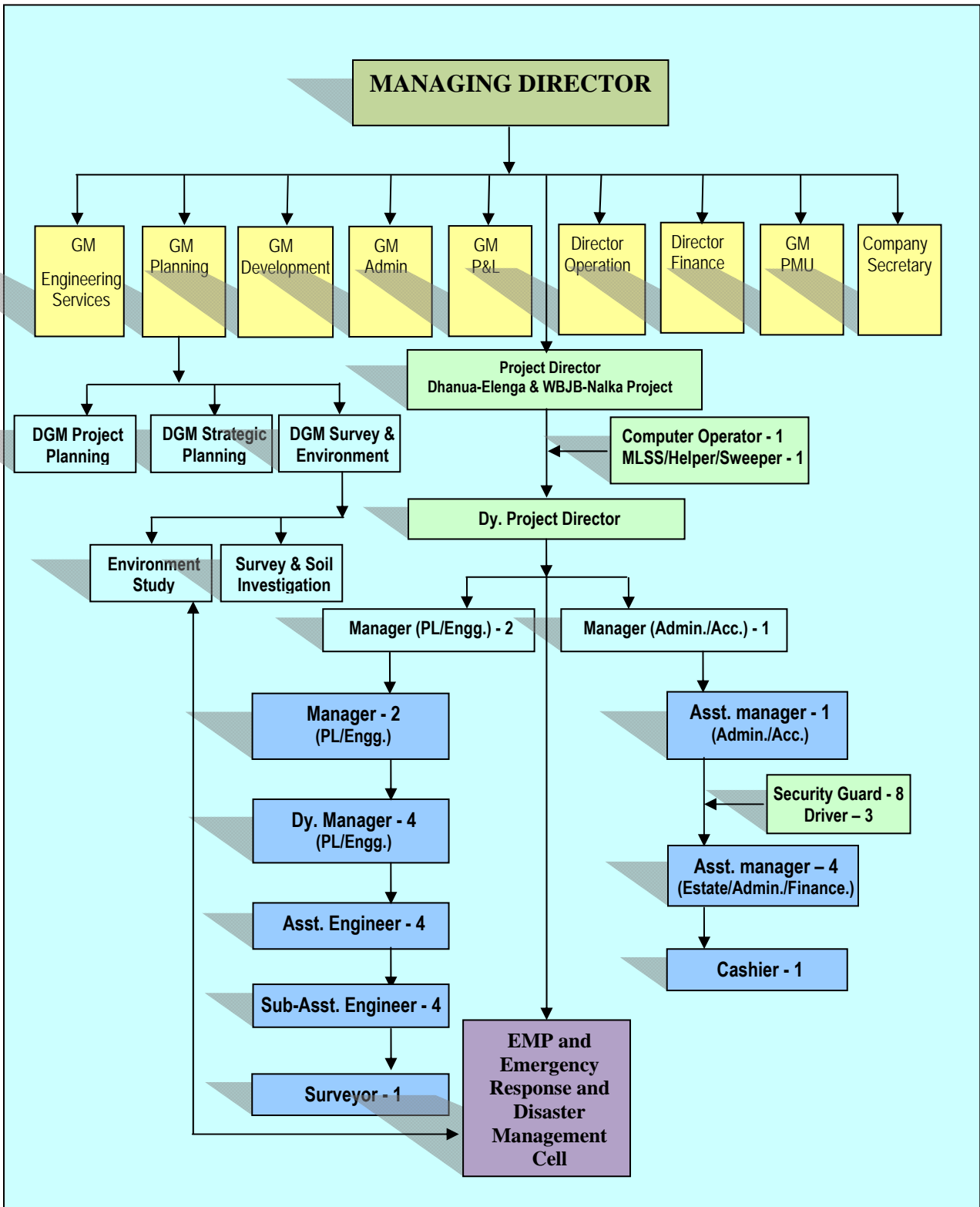


Figure-6.3-1: Existing and Project Implementation Organizational Set-up of GTCL

6.4 Emergency Response Plan and disaster management plan

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

- People
- Property
- Environment

Keeping these priorities in mind, the six steps described below constitute most of the emergency response phases. It is important to realize that although the six discrete steps have been identified several of the steps may be activated simultaneously.

The emergency procedures identify 'who does what and when' in the event of an emergency. Responsibility for who is in charge and their coordination of emergency actions shall have to be identified. The following are important events that require emergency procedures at any given time or may be occurring all at once.

It is also important to remember that emergency response must be adapted to individual circumstances and may require inventive, adaptive or creative solutions to difficult problems with very little time for planning or debate. Further, to improve the response capabilities, cooperative arrangements and organizations must be established for providing the appropriate equipment and expertise.

Nature of Emergency & Hazardous Situations may be of any or all of the following categories:

I. Emergency

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

II. Natural Disasters

- Flood,
- Earthquake/ cyclone,
- Storm/ typhoon/ tornados, and
- Cloud burst lightning.

III. External Factors

- Food poisoning / water poisoning,
- Sabotage, and
- War.

Six Steps in Emergency Response

Step-1: Determine the potential hazards associated with the incident, substance or circumstances and take appropriate action. Identify the type and qualities of dangerous goods involved and any known associated hazards. Determine potential hazards stemming from local conditions such as inclement weather, contaminated water bodies etc and ensure that the initial response team is aware of these conditions.

Step- 2: Determine the source / cause of event resulting to emergency and prevent further losses.

Step- 3: Conduct assessment of the incident site for further information on hazards or remedies.

Step- 4: Initiate redress procedures.

Step- 5: Report the incidence, its nature, cause, impact, applied redress procedures and any further assistance required etc. to concerned officials of GTCL, any other concerned agencies of the government and / or land owner / neighborhood community.

Step- 6: Take appropriate steps with respect to hazards to wildlife, other resources and addressing public and media concerns and issues, as applicable. Response priorities are to protect human lives, property and the environment in and around the project sites.

6.4.1 Emergency Response Plan of Construction Stage

The purpose of an Emergency Response Plan (ERP) is to describe the procedures to ensure the health and safety of staff and the public in the event of any incident. Although Emergency Response Plans for gas pipelines have a different scope than those of other facilities, the purpose and key elements of the plans are similar.

Three levels of planning (reduced, normal and special) may be used depending on the particular circumstance, potential incidence rate and the location and number of residents living in the community/locality in close proximity along the project sites.

The scope of the ERP is also dependant on the potential impact of the project activities, complexity of evacuation logistics and proximity to public facilities. A key feature of all plans is the designation of an Emergency Planning Zone which defines the area to be evacuated or protected in the event of an emergency.

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

The contents of a plan must include a definition of “an Emergency” and an action plan to address that emergency. This includes defining the “Stages of Alert” that may be applicable for various aspects of the work. This is important since it requires good coordination between aspects such as welding, testing, commissioning and Tie-in etc. Each action plan defines what level of evacuation should be occurring, who should be notified, what monitoring should be done and when emergency response teams are notified.

Another essential component of an ERP is the definition of responsibilities of the emergency response personnel including: off-site and on-site personnel, team coordinators, safety and evacuation personnel, monitoring crews, public relations and government personnel. Evacuation procedures, evacuation centers, communication systems equipment lists and post emergency procedures must also be defined.

The roles and responsibilities for the various government departments are to be defined and coordinated within the plan which should include the provision for the company/government to establish an on-site command post and a main control headquarters to provide advice to affected persons, Union Parishad (councils), local administrations, fire brigade and the media.

To ensure preparedness, there should be provision for testing the response and usefulness of the planned emergency response exercises. These exercises usually involve the company and contractor personnel as well as various government organizations and the community leaderships that would be involved in actual emergency incidents.

6.4.2 Assessment of Environmental Risks and Potential Hazards for Various Scenarios of Chemical Emergency during Pipeline Operation

Environmental risks and potential hazards for various scenarios of chemical emergency during pipeline operation generates from inappropriate handling, use, transportation, storage and disposal of hazardous chemicals. Hazardous materials are classified as those that present an excessive risk to property, the environment or human health due to their physical and / or chemical characteristics. The materials classified as Hazardous include:

- Explosives;
- Compressed gases, including toxic or flammable gases;
- Flammable solids;
- Oxidizing substances;
- Radioactive material;
- Toxic and infectious substances; and
- Corrosive substances etc.

6.4.2.1 General Approach to Risk Assessment

The objective of any chemical hazard management plan is to ensure safety for both the local community and the environment in general. So, any plan would aim to reduce risks of emergencies related to hazardous material use, handling, storage or disposal.

The principal approach to risk assessment is obviously based on the postulation of:

- a certain probability of major accidents occurring at a specific site and
- an estimate of potential damage to the population and the environment around the site

Probability of risk within any identification framework for various scenarios of chemical emergency during pipeline operation is usually derived from statistical data. The probability of a major accident depends on the failure ratio of technical installations, the frequency of hazardous goods transports etc. The damage assessment depends on various factors such as amounts of chemicals stored or transported, dispersion distances for different chemical substances, toxic properties of chemical substances, population density, etc.

The resulting risk is presented as an expectation value (mathematically a multiplication of probability and damage) or as a cumulative risk curve. These calculations are carried out separately for human and environmental damages and for all relevant risk sources.

The employment of Geographic Information Systems (GIS) methods allows one to visualize the risk levels and to assign them to specific geographical areas. Furthermore, GIS facilitates the interpretation of data and of the final results. The accumulated risk layers lead to interesting, sometimes surprising results, because several minor events accumulated at the same geographical site might result in a significant total risk.

In the foregoing context, anticipated major risk assessment problem to be faced by GTCL may include the possible increase in conflicts between risk-inducing activities and land-use planning, more intensely used emerging built-up areas and increasing redevelopment of sub-urban sites close to its pipeline system into areas of industrial and mixed use ones, producing new risk exposure situations.

6.4.2.2 Chemical Hazards

Some of the major and potential issues causing most of the chemical emergencies during pipeline operation may be listed as follows:

- Oxygen Deficiency
- Combustibility
- Flammability
- Flash Point
- Gas / Vapor Explosions
- Corrosiveness and
- Reactivity

Usually any hazardous situation related to fires and explosions involves.

- a. Physical destruction due to shock waves, heat and flying objects
- b. Initiation of secondary fires or creation of flammable conditions
- c. Release of toxic and corrosive compounds into the surrounding environment.
- d. BLEVE - The build-up of internal pressure in combination with a weakened containing shell (or tank) can result in an instantaneous release and ignition of vapor, known as a BLEVE (an acronym for Boiling Liquid Expanding Vapor Explosion). A BLEVE' results when a flammable liquid is rapidly heated to relatively high temperatures above its boiling point.

The possibilities cannot be ruled out about GTCL being subjected to any one or more of the cause and effect of the foregoing potential chemical hazards at any time of its activities during construction, testing, commissioning, operation & maintenance of the Dhanua-Elenga high pressure gas transmission system.

6.5 Occupational Health amid Safety Management Plan

In work places, good industrial practice will be maintained during construction and operation by the contractor and EMU, GTCL respectively. During construction phase, the contractor will follow their own corporate Occupation Health and Safety (OHS) procedures, that procedures will be produced to the GTCL prior to the construction work.

The state of art OHS practice will be followed by the contractor, in case of any lapses in definition and understanding of the environmental parameters and tests, the Engineering Procurement Construction contractor will be obliged to follow the Bangladesh EHS policy.

OHS committee will monitor and train the workers. Weekly / fortnightly training will be conducted to aware the workers under the contractors obligation. The cost regarding those activities will be borne by the executors. Regular Tool Box safety meetings at the beginning of each day's work should be encouraged.

6.5.1 General Requirements

Bangladesh Labor Law encompasses the related occupational health and safety obligations under the Labor Law 2006. This law has focused on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation. The salient features of the general requirements for the workers' health and safety stated in the referred law is presented in **Table-6.5-1** This law is commonly followed in Bangladesh by the employers, and there are punitive provisions to in case of non-compliance to same.

6.5.2 Workplace Environmental Quality

The proposed gas pipeline and plants project has two main phases-(i) the construction of infrastructure, installation and commissioning of the pipeline and the plants & equipment, (ii) operation of the pipeline system including the plants and associated facilities etc.

Table-6.5-1: General requirements for workers' health and safety according to the labor law 2006 (Bangladesh).

Issues	Requirements
Health and Hygiene	<ul style="list-style-type: none"> • Cleanliness • Ventilation and temperature • Dust and fumes • Disposal of wastes and effluents • Overcrowding • Illumination • Latrines and urinals • Spittoons and dustbins
Safety	<ul style="list-style-type: none"> • Safety for building and equipment • Precautions in case of fire • Fencing of machinery • Floor, stair and passage way • Work on or near machinery in motion • Carrying of excessive weights
Compensation for accidents at work	<ul style="list-style-type: none"> • Owner's responsibility for compensation • Amount of compensation • Report on fatal accident and treatment • Compensation on contract and contract registration • Appeal
Dust and Fumes	<ul style="list-style-type: none"> • Any dust or fumes or other impurities likely to be injurious to the workers, effective measures shall be taken to prevent its accumulation and its inhalation by workers
Over-crowding	<ul style="list-style-type: none"> • No work room in any factory shall be overcrowded • At least five hundred cubic feet of space shall be provided for every worker employed in a work room
Latrines and urinals	<ul style="list-style-type: none"> • Sufficient latrines and urinals shall be provided • Shall be maintained in clean and sanitary condition • Shall be adequately lighted and ventilated
Precautions in case of fire	<ul style="list-style-type: none"> • Shall be provided with means of escape in case of fire • Effective measures shall be taken to ensure that all the workers are familiar with the means of escape • Fire fighting apparatus should be provide and maintained
First aid	<ul style="list-style-type: none"> • First aid facility provided and maintained • One for every one hundred and fifty workers • Shall be kept with a responsible trained person who shall be available during the working hours • In every facility where five hundred or more workers are employed, a dispensary shall be provided and maintained • Standby Ambulance at project site for any accident
Disposal of wastes and effluents	<ul style="list-style-type: none"> • Provide with proper disposal system for solid waste and effluents. • In case of a factory where no public sewerage system exists, prior approval of the arrangements should be made for the disposal of wastes and effluents
Occupational and poisoning diseases	<ul style="list-style-type: none"> • 16 occupational diseases are classified as follows: <ul style="list-style-type: none"> ➤ lead poisoning ➤ lead tetraethyl poisoning ➤ phosphorous poisoning ➤ mercury poisoning ➤ manganese poisoning ➤ arsenic poisoning ➤ poisoning by nitrous fume ➤ carbon disulfide poisoning ➤ benzene poisoning ➤ chrome ulceration ➤ anthrax ➤ silicosis ➤ poisoning by halogens ➤ primary epitheliomatous cancer of the skin

Issues	Requirements
	<ul style="list-style-type: none"> ➤ toxic anemia ➤ pathological manifestation due to radium or x-rays
Compensation	<ul style="list-style-type: none"> • If personal injury is caused to workmen by accident arising in the course of employment, employer shall be liable to act according to labor law 2006. • 36 occupational diseases have been termed as ones for which compensation is payable • Monthly payment as compensation for temporary disablement are: <ul style="list-style-type: none"> ➤ Compensation should be paid for the period of disablement or for one year whichever period is shorter ➤ Such compensation shall be paid at the rate of full monthly wages for the first two months ➤ Two thirds of the monthly wages for the next two months and at the rate of the half of the monthly wages for the subsequent months ➤ In case of chronic occupational diseases , half of the monthly wages during the period of disablement for a maximum period of two years shall be paid ➤ International/ national (whichever is beneficial for the officers and workers working under contractor) level insurance coverage shall be arranged for all workers during construction phase by the contractor

6.5.3 Health Hazards

The construction phase includes site preparation, plant construction and access road construction etc. The health hazards associated with these activities are mainly due to dust and noise pollution. Excessive noise can cause loss of hearing and psychological changes. Dust pollution can cause eye and respiratory irritation and in some cases allergic reactions. The inhalation of exhaust gases from construction vehicles and machinery can also cause harmful effect to the health. Stress can also be caused by working in shifts, high work load, poor living condition of workers etc.

A quantification of the measures of severity in health hazards is not well defined. They are slow acting and cumulative, their effects may not be visible for years. During plant installation and commissioning, exposure to the chemicals (paints, solvents, thinners etc.), batteries, welding materials, lubricants etc., may cause hazardous effect to the workers, which ultimately could cause anemia, liver and kidney damage, cardiovascular diseases and neurological disorder.

6.5.4 Remedial measures

To minimize the hazards arising from the activities at different phases of the pipeline and the plant construction and operation, the following measures will be taken:

- the employer (contractor during construction phase and in turnkey period) will inform his employees to submit full scale medical report (if possible) to the authority prior to join in to the company and medical board of the company will take decision on this report.
- works with volatile toxic chemicals will be undertaken in a well ventilated place and as per the corporate OHS guideline.
- laborers handling, toxic chemicals will be provided with protective gear and will be relieved frequently from their posting.
- workers exposed to an excessive noise should be provided with protective gear and be relieved frequently from their post
- workers exposed to dust will be provided appropriate musk and other protective gear.
- frequent spraying of water will be undertaken to minimize dust pollution and dispersion.
- persons undertaking construction and installation works shall have access to amenities for their welfare and personal hygiene needs such as sanitary toilets, potable drinking water, washing facilities, shelter sheds etc.
- proper disposal of waste will be in practice.
- health education and information on hygiene will be provided to the workers

- regular checks on drinking water quality (if the water supplied by the contractors/ company) will be ensured within work site.
- taking x-ray & handling of radioactive isotopes etc would be done by certified professionals only.

6.5.5 Safety

Strict rules and procedures for the execution of specific tasks, enforcement of the rules, and discipline amongst workers, maintenance of machineries used by providing all necessary gear or equipment will be provided for the safety of the workers.

The following guidelines will be followed to maintain the safety of the workers in addition to the contractors OHS policies:

- workers have to be informed about the possible damage or hazards related to their respective jobs / occupation
- proper warning sign shall be posted at different points during construction and operation of the pipeline system and the control station plants
- pedestrian movement and the traffic will be safely managed during construction phase for lowering the associated health and safety risks
- sufficient lighting will be ensured, where a person performs construction work or may be required to pass through, including access ways and emergency exit or passage without any risk to health and safety
- construction site needs to provide safe access to and egress from all places where they may be required to work or pass through. This includes the provision of emergency access and egress route that must be free from obstructions. This will be provided in consultation with the personnel engaged for the security of the premises.
- adequate perimeter fencing will be installed on the site before construction work commences and that will be maintained during the construction work and signs will be placed which is clearly visible from outside the site and would display emergency telephone numbers.
- electrical installations, materials, equipment and apparatus are designed, installed, used, maintained and tested to eliminate the risk of electrical shock, burns, fire or explosion in general.
- construction site will be kept orderly and tidy. Access ways will be kept clear of materials and debris. Access ways shall be maintained as non-slippery condition. All materials will be stored in an orderly manner so that it does not pose any risk to the health or safety of any person
- arrangements of first aid facility will be made accessible during construction and operation work.

6.5.6 Work in Confined Spaces

In the operational phase, noise pollution may pose risk to health. Baseline study measured the noise level near the generators and rotating and stationary machines and equipment which ranged from 90 dBA to 110 dBA. This level may cause hearing impairment of the workers if exposed 2-4 hours/day.

Supervisors, inspectors and related personnel who work in this area will be provided ear plugs or ear muffs.

Areas where people may be exposed to excessive noise will be sign posted as "Hearing Protection Areas" and their boundaries will be defined with red line. No person will be allowed to enter the respective areas unless wearing personal hearing protectors.

The confined work spaces will be provided with sufficient air to avoid any health risk. Adequate care will be taken to minimize stress and ergonomic design will be improved in course of time to minimize health hazards.

First aid facilities will be kept in place and evacuation plans for emergency situations will be facilitated with adequate drills, instructions and signs. Adequate fire fighting arrangements will be installed and maintained in workable condition on a regular basis. In case of emergency, fire fighters from district level will be called on.

6.5.7 Record Keeping and Reporting

Reporting will be regularly communicated to the higher authority as a routine work. Records of construction, installation, training, equipment maintenance, operation, fault detection and remedy will be maintained. Records will also be maintained for following the corporate guidelines by the contractors of the proposed project.

6.5.8 Pipeline and Plants Construction

Persons with control of the construction project sites will retain records for a reasonable period after the completion of the construction project about the occupational health and safety induction training and any other training given to persons directly engaged or trained by them to undertake construction work on the project.

6.5.9 Pipeline and Plants Operation

During operation of the pipeline system and the plants, arrangements will be made to keep records on any relevant tests, maintenance, inspection, commissioning and alteration of the Pipeline and the Plants and make those records available to any employee or relevant health and safety representative.

6.5.10 Noise

Audiometric test records of employees should be kept during the employee's period of employment and longer as necessary, as they may provide a useful reference for workers' compensation. The records will be kept in a safe, secure place and held as confidential documents.

6.5.11 Hazardous Substances

Assessment reports which indicate a need for monitoring and/or health surveillance together with the results of monitoring and/or health surveillance shall be kept as records in a suitable form for at least 30 years from the date of the last entry made. Retention for a period of at least 30 years is necessary because some health effects, such as cancers, may take a long time to become evident. The information kept will be valuable in epidemiological studies and for developing effective control strategies.

All other records, including assessment reports not indicating a need for monitoring and/or health surveillance and records of induction and training, shall be maintained for at least twelve years in a suitable form.

6.6 Responsibility of the contractor

Potential impacts could originate from contractor's activities. Therefore, GTCL shall ensure that the contractor takes due responsibility to mitigate the negative impacts and:

- Takes reasonable steps to protect the environment and avoid damage and nuisance arising from their activities and operations.
- Complies with statutes and regulations concerning the execution of work.

- Familiarizes with legislation and regulations relating to environmental protection that is relevant to their activities.
- Refers to national environmental quality guidelines.
- Be responsible for the costs of cleaning up any environmental pollution resulting from their activities, if methods for doing so are available and effective.
- Maintains sites under their control in a clean and tidy condition and shall provide appropriate and adequate facilities for the temporary storage of wastes before disposal.
- Shall not allow used oil or other petroleum wastes to be used as dust suppressants and reasonable precautions shall be taken to control and prevent accidental blow off of gas and/or spillage of petroleum products or discharge into atmosphere or water courses.
- Be responsible for the provision of adequate sanitary facilities for the construction workforce (including those employed under sub-contracts) at construction and camp sites. Vehicles operated by the Contractor (including sub-contractors) shall be maintained according to the original manufacturer's specifications and manuals with particular regard to the control of noise and/or smoke emissions.
- Takes reasonable measures to minimize dust blow arising from sites under their control by regular watering of soil stockpiles, bare soil, haul roads, non surfaced traffic areas and sources of fugitive dust, when conditions require dust suppression.
- Be responsible to pay compensation upon the appropriate monetary evaluation applicable to the local market if any damage is incurred to agricultural land or surrounding homesteads outside of the requisitioned land.
- Precautionary signboards/ danger signals/ propitiatory billboards shall be placed in appropriate places to notify people about the possible dangers particularly in the eve of non destructive testing inspections involving radiations and including but not limited to hydrostatic testing & commissioning of the pipeline system.
- Removes equipment, surplus material, rubbish and temporary works and leave the site in a clean condition to the satisfaction of the company's representatives after completion of construction activities.

6.7 Storage facilities for chemicals

During construction and operation in site; fuel, lubricants and other chemicals will be required for heavy equipment, vehicles etc. and thus a small portion of same may be required to be stored on site. The schematic diagram of chemical storage facility may be used by the contractor and subsequently GTCL.

The Contractor will design a catchment system to minimize spill damage. There is always a risk of fuel leakage either as the result of an accident, failure to close valves or failure of equipment or materials. Leaks caused by corrosion in oil storage tanks will be prevented to the maximum extent possible with coatings and Cathodic protection (both interior and exterior).

The contractor will employ early leak detection monitoring system where personnel will be aware and trained on oil spill prevention, mitigation and management of the situation such as how to stop further loss, isolate the source, contain the spread of contamination, clean up spills, and file an incident report.

Further at each stage of the construction and operation, the Contractor will maintain an inventory along with Material Safety Data Sheet (MSDS) of hydrocarbon and chemical sources up-to-date and include fuel tankers, fixed fuel dumps and their locations. The Contractor will maintain this practice and well developed contingency plan throughout their construction and operation up to final commissioning and handing over the pipeline system to GTCL. Contingency plans will be based on the location and volume of potential spills.

The main fuel is natural gas so there would not be any big types of oil spillage. In order to maintain a good industrial practice, the Contractor and subsequently GTCL will develop a leak minimization strategy as an integral part of facility design and maintenance procedures. Oil/ Condensate sumps will be provided for all drains to prevent contamination of rainwater drainage. Drip pans will be used where needed.

The contractor will construct separate storm water drainage systems for rainwater so that oil, condensate and chemical will not contaminate the natural stream. Suitable absorbent material will be available onsite for immediate prevention.

CHAPTER-7 ENVIRONMENTAL MONITORING PROGRAM FOR PERFORMANCE EVALUATION

7.1 Requirements for Management and Monitoring

Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions.

The purpose of the monitoring program is to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring program be designed and carried out. Environmental Monitoring in the EMP for this Gas pipeline project has been designed with the following objectives to:

- Measure the extent of expected or poorly quantified impacts;
- Ensure incorporation of Environmental Mitigation Measure during implementation of the proposed project;
- Observe effectiveness of Environmental Mitigation Measures;
- Ensure early detection of unexpected impacts and adoption of appropriate protection measures;
- Provide periodic reviews to observe adherence to Environmental Quality Standards (EQS) and adjust Environmental Mitigation Measures, if required; and
- Detect unacceptable level of impacts and adopt corrective measures.

7.2 Environmental Monitoring Parameters, Schedule and Costing

A monitoring program will be implemented for Dhanua-Elenga high-pressure gas pipeline. During the monitoring program the following parameters are to be taken care of:

- Ambient Air Quality
- Surface Water Quality
- Waste
- Noise / Vibration
- Social Environment i.e. Resettlement, Living / Livelihood
 - **Ambient Air Quality**-Necessary for construction/installation stage of the gas transmission pipeline project. Proposed monitoring items of Ambient Air quality are given below:
 - **Surface Water Quality** - Necessary for construction/installation stage of the gas transmission pipeline project. Proposed monitoring items of surface water quality are given below:
 - **Waste**- Necessary for construction/installation and operation stages of the gas transmission pipeline project. Proposed Monitoring items are given below:
 - **Noise / Vibration** - Necessary for construction/installation stage of the gas transmission pipeline project. Proposed Monitoring Items are Given below:
 - **Social Environment**- Necessary for a minimum of 2-year period after the last date of completion of all resettlement activities. It is expected that this minimum 2-year period of monitoring is adequate considering the small-scale nature of resettlement is involved. Social environment is taken care of in the ARAP report.

Environmental monitoring plan of the Dhanua-Elenga project is listed in the Table-7.2-1.

7.2-1 Environmental Monitoring Plan for Gas Transmission Pipeline (Dhanua-Elenga)-GTCL

Environmental Items	Environmental Parameters/ Monitoring Items	Unit	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method)	Responsible Agency	Cost of Monitoring (BDT)
Construction/Installation stage:							
Air Quality	SPM ₁₀	µgm/m ³	150 (Statutory Rules 2005)	50 (World Bank Guideline) 150 Interim Value	<ul style="list-style-type: none"> One Sampling Point near the project site another 1 km. (As usually practiced in Bangladesh) away from the project site. Per month one 24-hr. day sampling High Volume Dust Sampler 	Contractor	-20000/Set -Included in overall construction cost
	SPM _{2.5}	µgm/m ³	65 (Statutory Rules 2005)	25 (World Bank Guideline) 75 Interim Value	<ul style="list-style-type: none"> One Sampling Point near the project site another 1 km. (As usually practiced in Bangladesh) away from the project site. Per month one 24-hr. day sampling High Volume Dust Sampler 	Contractor	-20000/Set -Included in overall construction cost
Surface Water Quality	pH	-	6.5-8.5 (Fishery use)	6.5-9.0 (USEPA)	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly pH meter 	Contractor	-1500/Sampling Point -Included in overall construction cost
	SS (Suspended Solid)	mg/l	-	-	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly Filtration 	Contractor	-3000/Sampling Point -Included in overall construction cost

Environmental Items	Environmental Parameters/ Monitoring Items	Unit	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method)	Responsible Agency	Cost of Monitoring (BDT)
	BOD	mg/l	<6 (BOD) (Fishery use)	-	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly Titration 	Contractor	-3000/Sampling Point -Included in overall construction cost
	DO	mg/l	>5 (Fishery use)	3-9.5 (USEPA)	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly DO meter 	Contractor	-1500/Sampling Point -Included in overall construction cost
	Oil and Grease	mg/l	-	-	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly Gravimetric 	Contractor	-3000/Sampling Point -Included in overall construction cost
	Temperature	°C	25 (Fishery use)	-	<ul style="list-style-type: none"> Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing Monthly Thermometer 	Contractor	-1500/Sampling Point -Included in overall construction cost
Noise	Noise level (Residential Area)	dB	45 (Night-time)	45 (Night-time) (World Bank)	<ul style="list-style-type: none"> 50m from the construction site Per Month one 24-hr. day sampling Sound level meter 	Contractor	-2000/Set -Included in overall construction cost
			55 (Day-time)	55 (Day-time) (World Bank)			
Waste	Excess borrow pit soil	-	-	-	Worksite and Camp site (weekly)	Contractor	-Included in overall construction cost

Environmental Items	Environmental Parameters/ Monitoring Items	Unit	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method)	Responsible Agency	Cost of Monitoring (BDT)
	<ul style="list-style-type: none"> • Generated Solid waste • Sanitary waste • Housekeeping status 						
Operation stage:							
Waste	<ul style="list-style-type: none"> • Management of pigging waste 	-	-	-	Worksite (pig launcher and receiver locations)	GTCL	-Included in overall operation cost

7.3 In-house environmental monitoring system

7.3.1 Environmental Policy of GTCL

GTCL is committed to the protection of the environment and will conduct its operations in compliance with all relevant local, national and international environmental legislation and standards. GTCL will have an Environment Specialist (ES) in its team of client/contractor for supervising the environmental management & monitoring activities under this project through the Team Leader in close coordination with the concerned Technical Support Staff of GTCL. The detail of his assignment is given below:

ES will assist the GTCL team and its contractor in developing the prevailing situation based implementation and monitoring schedule and procedure including safety hazard mitigation plan and procedures as recommended in the EMP. He will prepare quarterly progress report in standard format and submit to GTCL. The report would fulfill the requirement of the laws, regulations and guidelines of GOB. He will also assist GTCL to prepare the semi-annual monitoring reports, fulfilling the aforementioned requirements, to be submitted to GTCL and DOE. A monitoring form (**Annex-3**) is formulated for the ES to assess the impact on environment due to the project work.

7.3.2 Environment and Safety (EAS) Management System Process

Besides defining management's requirements regarding EAS, in fulfillment of Petrobangla ESMS guidelines in conjunction with DOE rules and regulations, the GTCL Environmental Safety Management System (ESMS) establishes the processes to apply the system to their operations. These processes include steps to clarify accountability. These steps are listed as follows:

a. Specific Activities and Responsibilities

1. The first step is to clearly assign responsibility to meet each EAS requirement at all levels of the GTCL. This process begins at the top of the management and continues down through each level of the organization, so that until each involved person understands his/her, EAS responsibility. Managers and supervisors of the Technical Support Staff at every level of the project execution review each of the project activity performed by themselves and by their contractors and then would make his choice(s) of remedial action.
2. This process will continue in GTCL until all procedures have an assigned responsible person who will ensure that the procedure is implemented. In many cases, several people will be accountable for implementation of a procedure. For example, at the pipeline construction sites and at supporting field camps more than one person would be responsible for fulfilling the procedure regarding correct waste management.

b. Implement the System

In the implementation step, all of those responsible for implementing each EAS procedure will develop the approach and the system methodology needed for procedure implementation. Clearly defined roles and responsibilities are critical, along with the necessary training, to support implementation.

The exiting organizational set-up of GTCL is given in **Figure-7.3-1** and based on the same, the institutional arrangement designed for EMP of the Dhanua-Elenga Gas Transmission Pipeline project has been shown in **Figure-7.3-1** reflecting the inter-linkages between GTCL Technical Staff, and the Environmental Specialist so far as implementation, supervision and monitoring of the EAS issues are concerned.

c. Measure, Assess and Audit Progress

Measuring ESMS progress is critical to improving performance. A successful ESMS of GTCL must be a continually improving process. In its procedural assessment, a simple, five-point scale will be used to score performance in implementing the ESMS:

1. No evidence that the procedure is being implemented

2. Procedure is partially implemented
3. Procedure is fully implemented
4. Best practice (the absolutely exemplary performance of procedure implementation) to be held up as a model for others to emulate.
5. Measuring and monitoring ESMS performance by the Environmental Specialist (ES) of the contractor supported by the Technical staff of GTCL.

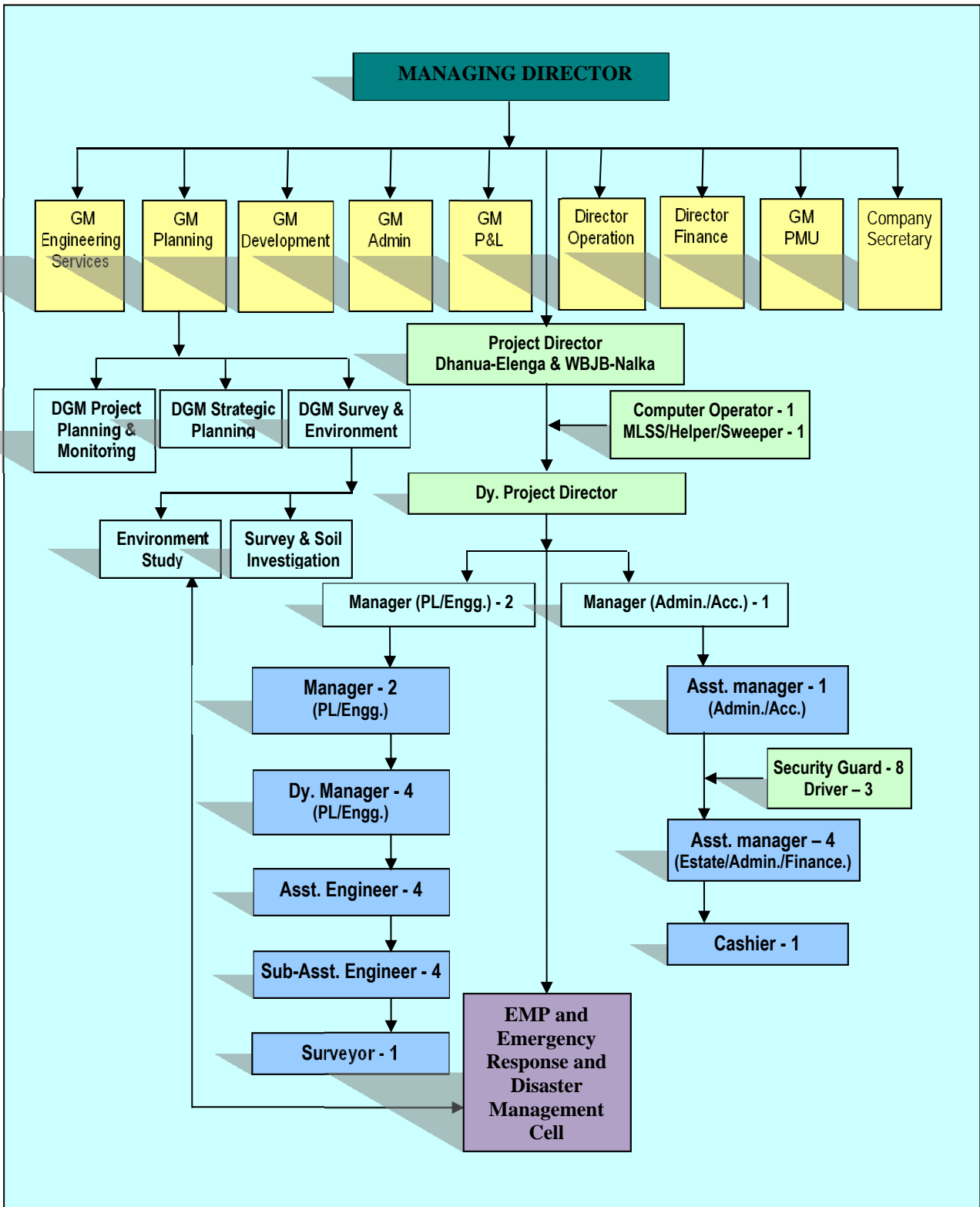


Figure-7.3-1: Existing and Project Implementation Organizational Set-up of GTCL

CHAPTER-8 BENEFICIAL IMPACTS

8.1 Introduction

In obtaining environmental clearance from DoE for construction of the proposed pipeline and installation of associated facilities, this task of Conducting the Environmental Impact Assessment (EIA) has been undertaken for the proposed 30" dia 52 Km Gas Transmission Pipeline along the selected route from Dhanua to Elenga including associated facilities. It has been revealed in the study that properly managed, gas operations can be expected to provide major benefits not only to the communities in which they take place but also bring in multilateral gains in terms of wider national socio-economic contexts.

8.2 Gas Demand and Supply Scenario of the Country

It is well perceived that, at this point of time and at a critical juncture of the global gas industry, Bangladesh, a developing country of the South Asia, is striving hard to meet the rising energy demand of its 160 million people amidst growing concern for the techno-economic and socio-environmental impacts of its only predominant non-renewable and limited source of some 7.5 trillion cubic feet (TCF) natural gas now flowing from 85 wells of its 29 onshore gas fields through a 1000 kilometer (KM) Transmission & 29,000 KM distribution network and thus serving some 2.3 million customer with a quantum of 1.5 billion cubic feet (BCF) as end of December 2010. Thus, the natural gas industry, the prime natural resource of Bangladesh is currently meeting the demand of over 73% of the country's commercial energy. It is estimated that current demand of gas is over 25,000 MMCFD against the production figures of marginally over 2,000 MMCFD.

Further, though the production figures could be raised and now already under planned process of drilling some more new wells and thus add a few million CFD yet transmission constraints would continue to lead to stranded gas in the north-eastern part of the major gas producing fields of the country. Unless simultaneous evacuation of this stranded gas is ensured. In another estimate it appears that demand growth of gas being 7 % per year, it may further enhance to 10 % if infrastructural facilities turn more congenial to expanded industrial investments.

8.2.1 Impact of Current Crisis of Gas

It was being divulged in recent dispatches that, inadequate supply of gas and or limitations in the transmission system to designated load centers is leading to reduction of 500 MW in electricity generation, cutting down fertilizer production, rationing gas supply to industries, barring the commissioning and or setting up new industries and thus idling huge investments including depriving new occupants of over 5,000 flats from gas and electricity

The low pressure situation in urban and sub-urban areas is also failing to serve even the existing domestic consumers who hardly consume 12% of the supply. The natural gas vehicle owners, who had not only been contributing to urban & sub-urban environments through using CNG but also substituting some US\$1000 million of foreign exchange per year are subjected to rationing and thus all expansion activities in the CNG sector including hundreds of crores of investments already made therein are apparently coming down to a standstill. This is in turn bringing back threats to the aforesaid environmentally pollution free urban & sub-urban communities.

8.2.2 Production & Other Consequential Losses in the Industries

Considering Nabinagar- Manikganj belt alone, the industry owners investing Tk. 3,000 Crores and employing 1,000,000 people are suffering from low pressure situations. Similarly, production in scores of industries from Konabari in Gazipur to Mirza Pur in Tangail has dropped by 80% since September,

2011 following diversion of gas to Jamuna Fertilizer for resuming production which remained shutting down for five and a half month for shortage of gas. Bangladesh Garment Manufacturer's and Exporters' Association said in October, 2011 that at least 300 of its export oriented factories have been running at loss for the recent gas crisis, leading to the owner's fear that they might fail in paying the wages of their employees not to speak of meeting the export targets. At the same time Kaliakoir-Mirzapur Industrial forum claimed that they have been sustaining losses of about Tk. 6 Crore a day from acute shortage of gas in their 50 different industries wherein 150,000 people have been sitting idle for the ongoing gas crisis. To cite an example, Square Pharmaceutical alone had been running their factory with 10 rented diesel generators consuming 10,000 liters of liquid fuel and making a loss of Tk. 2 Crore a day with nearly 5,000 employees sitting idle. These situations are obviously impeding industrial growth and causing potentially negative impact on the environment too.

8.2.3 Potential Multi-lateral Impacts of the Crisis of Gas

Additional import bills for millions of tons of petroleum & coal for the power plants and supplementing fertilizer reduced export earnings from stranded and or underutilized industrial units are not only putting stress on the forest but also curtailing employment opportunities and thus impacting upon the development efforts of the country. All these factors are causing a loss of about 2 % in the country's GDP.

Further, potential negative impact of burning of the additional petroleum in the diesel run captive power units and the liquid fuel based power plants, which could be substituted by gas, is tremendously contributing to environmental pollution, resulting health hazards and to aggravate climate change issues resulting from the enhancement of green house gas (GHG) emissions.

8.3 Objective of the Project

In the foregoing context of the gas related scenario and multi-dimensional impacts of the current crisis of gas in different load centers of the country, it may be well imagined that this gas transmission project on card would bring in multilateral beneficial impacts too. This is because, this long awaited big inch high pressure pipeline and ancillary facilities will not only be used for transmission of gas produced from the planned new exploration & development wells but also immediately assist in evacuating the gas stranded so long in the north –eastern region of the country. In further analyzing the objectives of the project, in the broader perspective, it transpires that this project has been undertaken basically:

- i) to establish a sustainable Gas Grid and ensure gas supply to the whole country.
- ii) to supply Natural Gas to the proposed power plants under PDB and fulfill industrial, commercial and domestic gas demand and thereby reducing use of imported fuel and destruction of trees as firewood and
- iii) to ensure overall economic development through increased production in the industrial and commercial sectors including substituting the fuel import bills.

8.4 Potential Benefits

Implementation of this project will essentially bring in certain potential benefits which are expected to be accruable but not limited to the following under different phases of its Pre-construction, Construction, and operation of the project: after its completion upon Testing & Commissioning .

- Increased local employment
- The transfer of technical and commercial skills and development of local capacity;
- A share in fiscal revenues at the local level
- Enhancement of local social infrastructure and improvement in the delivery of services, especially in areas such as health, education, transport and power as a result of increased public funds and investor contributions; and

- Positive multiplier effects in and beyond the communities in which the extractive operations exist.
- Enhance availability of environmentally pollution free and clean burning fuel and feed stock and thus accelerate:
 - Evacuation of stranded gas
 - Adding capacity to transmit additionally produced gas in future
 - Higher industrial growth
 - Greater employment generation
 - Higher export earnings
 - Reduce unfavorable balance of payment situation
 - Comfort low pressure situation for the industrial, commercial & domestic consumers
 - Ease gas connection to the awaiting flat owners and stranded industrial consumers,
 - Eliminate rationing of CNG refueling stations
 - Empower gas transmission & marketing companies with more operational flexibilities
 - Increase affordability of Gas marketing companies to provide gas to Power plants, Captive power units & fertilizer factories
 - Reduce import bills on Petroleum & Fertilizer and thus pressure on foret reserve
 - Lower cost of electricity generation and thus possible reduction of electricity tariff
 - Prompt gas operating companies to discharge their corporate social responsibilities
 - Reduce deforestation
 - Ensure cleaner environment and thus lesser health hazards with enhanced longevity.
 - Elevate socio-economic standard of living and thus contribute to poverty reduction.

8.5 Positive Impacts

8.5.1 Promoting Small-Scale Projects, Local Employment, and Local Entrepreneurship

Rural populations often have limited access to development opportunities. Two of the limiting factors are access to reliable modern energy sources and knowledge and capacity to be active participants in development. However, as a result of recent major energy projects and particularly in gas pipeline project, there is a window of opportunity to develop the capacity of rural/indigenous peoples to benefit more extensively from these projects.

Communities in isolated regions are not attractive targets for distributors of electricity or natural gas since they are perceived to lack the “critical mass” and the ability to pay. The use of natural gas has the potential for widening access to electricity, since it may readily be used for small-scale power generation and for a wide spectrum of household, commercial and small industrial uses. Using stranded gas through this new gas pipeline system, it is possible to address this obstacle by developing gas based small-scale economic projects for these rural communities.

To mitigate adverse impacts of such developments, it is of critical importance to develop within the indigenous communities a basic knowledge of the risks and benefits of the hydrocarbon industry. Working with their own organizations, indigenous peoples are attending Bank sponsored training programs aimed at developing and strengthening their capacity to participate in the monitoring of operations and in accessing to a share in the industry benefits.

8.5.2 Direct and indirect impacts during construction and operation

8.5.2.1 Social Impacts

The development of a pipeline from Dhanua to Elenga is likely to raise a number of social issues, which could impact on a range of stakeholders. In many cases, the impacts relating to these issues are likely to be manageable. The issues those are likely to create the most significant impacts are the

impacts of the project on income & livelihood of the affected persons and on the community during the construction and operation phases may be discussed in the first instance.

Nature of the impacts

The direct positive beneficial impacts of the project are expected to be felt at the local level. Since goods and services will be sourced from the National Capital District, it too will receive some of the indirect impacts. Based on the experience of large resource projects in gas pipeline sector, the local impacts of the project are expected to be in the form of:

- Employment created during the construction and operation phase
- Payments to landowners
- Improved infrastructure provision within the project area and improved connections between the project area and other centers
- Business opportunities generated by the supply of inputs such as fuel, security, and catering services to the project
- Employment and business opportunities resulting from the expenditure of incomes earned from the project and associated community and infrastructure projects.

The other direct impact is in the form of payment of royalties to landowners. Most of these payments will be spent in the local areas on food, vehicles, household durables and other items such as land purchase, farming etc. However, it is expected that some of the payments will be invested in local businesses.

The gas pipeline project will develop significant infrastructure including roads, bridges and telecommunications. The improved transport infrastructure will enhance access to remote areas and make education and health services more accessible.

It will also assist neighboring communities by providing opportunities for wage employment and for trading cash crops. In general, the infrastructure development would result in other significant benefits such as savings in transport costs and improved security of supply.

It is expected that some of the Government's proceeds from the project will be spent on the construction of new schools and health facilities, as well as the upgrade of existing facilities. Also, some of the funds would be spent on the employment and training of teachers and health professionals.

One of the significant impacts of the project will be the opportunities for local businesses. These opportunities include outsourcing for services such as catering, engineering, security, and fuel supply, managerial and technical assistance. The influx of workers into the project area will also increase the demand for various services, including food. Therefore there will be an opportunity for local farmers to increase their incomes by producing more food crops. The improved transport infrastructure may also make it easier for local producers to extend their supply networks to nearby markets.

However, despite the unique opportunity for governments at all levels to channel their share of the proceeds into improving infrastructure and services for the local communities, there is a risk that much of these resources will not reach the target beneficiaries. There is also a risk that the large sums of money flowing to individuals could aggravate social and health problems brought on by the consumption of alcohol and tobacco, imported foods, and could increase income inequalities.

Employment impacts

The direct impact of the gas project is an increase in urban skilled and unskilled employment levels. On the other hand, the rural unskilled employment levels are declining by lack of properly preparing

them by vocational training or other means of skilled training. These changes are consistent with a decline in activity in the agricultural sector and here it is observed that the largest fall in employment occurs in the unskilled sector which is the major supplier of labor to the smallholder agricultural sector.

Environmental Impacts

The benefits of the project will be realized primarily at the level of the national economy. The implementation of the proposed project will provide supply of clean burning fuel and necessary feed stock for the domestic, commercial and industrial consumers in general and Power plants and Fertilizer Factories in particular.

These will not only reduce Bangladesh's dependence on foreign energy resources but also help accruing a good number of benefits in terms of enhanced generation of electricity and production of fertilizer and other industrial products including opening up employment opportunities and thereby tremendously contribute to health, agricultural, forestry, commercial, industrial and economic development of the country.

However, natural gas being an intrinsically clean fuel compared with most alternatives, development of natural gas resources and transportation to the load centers for the consumers are, in general, environmentally sound options at the national and global level.

In fact, the proposed project activities would have no significant adverse environmental impact so far as a time bound execution program when application of advanced environment friendly construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the pipeline system.

As such, the execution of the project would stand environmentally sound and socio-economically sustainable with due adoption of the recommended mitigation measures and environmental management and monitoring processes.

8.6 Summary of the overall national beneficial impacts

The gas pipeline project will have a profound effect on the national economy. Not all of the potential impacts will necessarily be positive: a project of such size, relative to the economy as a whole, will inevitably create some stresses and strains across the economy. However the net benefits arising from the project will be very large provided the potential adverse pressures are properly managed.

Gas industries generate significant revenues for the national economy. Sound macroeconomic management and governance are required to ensure that the money generated from these projects is invested in local communities through policies that foster economic development and poverty reduction.

In fine, the project will increase real output at several times the current rate of growth with the potential benefits as highlighted in the recommendation of this report. It may be well understood that, the clear winners of any oil and gas expansion projects are the government sectors which receives very large revenue flows from taxes and other payments, urban households whose disposable incomes increase from the rapid increase in total employment and the manufacturing and service sectors, which benefit from the flow on effects.

Further, this project being a gas system expansion one, its added contribution would be to transmit more of the cleaner and environment friendly natural gas to the national grid to serve more consumers and for enhancing the capacity and pressure situation adequacy of the designated load centers of the country.

CHAPTER-9 INSTITUTIONAL CAPACITY

9.1 Key aspects of the study including the no. of competency of staff

The key aspects of the Dhanua to Elenga pipeline project are the social and environmental issues. These have been described in great details in Chapter-5 and Chapter-6 of this report. It is expected that GTCL would monitor the required mitigation measures through external and internal monitoring.

A. External Monitoring

It has been given to understand that one independent monitor will be hired by the Contractor of Gas Transmission Company Limited for undertaking external monitoring of the entire project. The detail tasks that the external monitor is required to perform may be stated as follows:

- Oversee the implementation of the Resettlement issues
- Determine whether Sound environmental management practices have been achieved
- Undertake external monitoring of Resettlement compensation activities
- Suggest suitable recommendations on remedial measures for midterm correction and improvement
- Resettlement issues are being carried out consistently with GOB's policies
- This Independent monitor is presumed to consider all technical, social and economic aspects of the Construction of Dhanua to Elenga Gas Transmission Pipeline installation project so far as its environmental, health, safety etc are concerned as well.

B. Internal Monitoring

Environmental Specialist under the **EMP and Emergency Response and Disaster Management unit** of GTCL will look after the overall environmental and social aspects of the pipeline project. The units will consists of one environmental specialist and be responsible for internal monitoring of the EMP implementation of each sub project. The detailed task of the internal monitor is stated below:

- Oversee the implementation of EMP
- Ensure that safety policy and procedures are strictly adhered to.
- Ensure that the environmental issues are appropriately addressed and any impacts are adequately addressed.
- Submit quarterly progress reports to GTCL which would contain progress made in EMP implementation with particular attention to compliance with the principles and matrix set out in the EMP.
- The report will also divulge concerns in EMP implementation, if any, and would suggest remedial steps as well.

In general the quarterly progress reports are to be forwarded to GTCL and would contain progress made in EMP implementation with particular attention to compliance as per principles and matrix set out in the EMP.

9.2 Size of operational budget

An estimated budget for Abbreviated Resettlement Action Plan (ARAP) implementation has been given in **Table-9.2-1**. This is based on the claimed values of the PAPs only. The total budget of the project is approximately 1.7 billion taka. In Chapter-10 of the ARAP report, the detail of the budgetary information is depicted.

The resettlement cost estimate includes all costs regarding resettlement preparation, compensation for land and structures, trees etc. including relocation.

Table- 9.2-1: Estimated Budget Based on Claimed Values

Cost Item	Claimed Amount (Taka)	Payment by Project
1. Budget for Acquisition	1,149,230,000	Rest as grant
2. i) Compensation for trees:		Rest as grant
ii) Income loss for fruit at 10% as grant lump sum amount:	17,307,000.00	

Cost Item	Claimed Amount (Taka)	Payment by Project
3. Compensation for Standing crops (land under acquisition)	4,942,766	Rest as grant
4. Cost of Structure House & Others	7,900,000.00	Rest as grant
Grand Total:	1,179,379,766.00	

9.3 Availability of appropriate technology and equipment

The contractor of GTCL should confirm appropriate technology and equipment to be deployed for implementation of the pipeline project. The materials, supplies, equipment and personnel requirements as well as the procedures to be applied therein for successful and environment friendly execution are largely guided by technical aspects so chosen by all groups concerned. Fulfillment of the requirements as such would thus, predominantly control the budget of the project execution. GTCL monitoring mechanism to be designated for the project should therefore continuingly monitor these issues, and particularly in respect of social and environmental aspects.

CHAPTER-10 PUBLIC CONSULTATION

10.1 Public Consultation

GTCL recognizes the importance of social and environmental factors for successful implementation of the proposed project. As such, it has retained a specific provision in the EIA process and simultaneously in future for preparing the Resettlement Action Plan report to plan and undertake a comprehensive program of public consultation, focus group discussion (FGD) and environmental investigation, so that study on both the aspects may proceed simultaneously.

In fact, an organized consultation with parties and persons interested in or affected by project activities, forms a critical part of best practice project planning and environmental impact assessment. Early and participative engagement of stakeholders in the project planning phase increases the likelihood of approval by regulatory authorities and the smooth implementation of project activities.

Feedback from the consultation process plays an important role in understanding the apprehensions and expectations of the members of the public in general and stakeholders in particular. Such inputs from them help development of a clear picture of the socio-economic and environmental base line of the project area.

The importance of stakeholder engagement has also been recognized by the Bangladesh Department of Environment in its guidelines ECA '95 and ECR '97 of DOE and thus stipulated the requirement for consultation activities to be integrated into project planning and implementation phases, including during EIA of planned projects. Further, as a matter of fact, such consultation and FGD are now considered an essential pre-requisite for better implementation of project as well.

The purpose of the consultation process adopted under this project was to keep the local inhabitants/ primary stakeholders informed about the project and to gather their opinion / suggestions to incorporate the same during the subsequent stages of project planning and implementation.

Further, since this 52 km 30" diameter Dhanua to Elenga high pressure Gas Transmission Pipeline project and its associated facilities being financed by the GTCL from its own resources and other development fund of different government organization, it was keenly felt necessary to have investigated about the qualitative and quantitative impact of the project on each and every project affected person (PAP) and its surrounding community and public amenities.

10.2 Methodology and Output

10.2.1 Focus Group Discussion (FGD) and Key Informant Interview (KII)

The process of public consultation was initiated and conducted in two stages. This was done in the 1st and 2nd Stages, during earlier EIA survey and study in December, 2013 to January, 2014 through focus group discussion (FGD) at and around different locations of the transmission pipeline right of way (ROW).

The consultant arranged 10 such public consultation meetings with the local stakeholders for information dissemination and community participation with the concerned NGO, and probable affected persons. The consultant and investigators investigated all the relevant matters regarding the project by arranging these meetings and group discussions for people's awareness.

BETS and local government were also present in these meetings to understand the people's views and suggestions. An open discussion was made on the proposed project and its positive and negative impacts, and then people's perceptions were written by the BETS representatives for record and reference.

BETS made several meetings with local people and GTCL for understanding the project works and future planning of the project. Local peoples were positive in sharing their views and the GTCL was especially helpful to share the available information with the consultant. Snaps of the discussion with local people and GTCL are listed below.



Site Visit and Field Investigation on 1st October 2013



Meeting at GTCL Office on 21st October 2013



Field Discussion on 6th December 2013

Field Visit on 13th January 2014

	
FGD Meeting at Chota Kalim High School, Village : Muladia, Upazila:Sripur, District:Gazipur Dated: 01-12-2013	FGD Meeting at Ratan Bazar Muktijodha Sangsad. Village: Ratanganj; Upazila:Kalihati; District:Tangail Dated: 17-01-2014

10.2.2 Checklist Used for Public Consultation

For uniformity and clarity in conducting the public consultation meetings, a checklist was devised by the consultants and was used to enable the participants to comprehend the issues easily. This has helped them so much so that they could effectively participate in the discussions and express their opinions from objective points of views. This participatory approach contained in the Checklist so devised and given below was well accepted by all the participants:

Consultants Checklist:

- Location of consultation
- Name and occupation of the participants
- Awareness of the participants about the Project
- Description of the Project
- Benefits of the Project
- Impacts of the Project on social and environmental components
- Concerns about the Project
- Expectations from the Project
- Suggestions about the Project

During the public consultations, social, environmental as well as cross-cutting issues were discussed in detail. In addition, such discussions also included the potential impacts of the project activities on environmental and social parameters, identification of sensitive issues, risks, potential threats, public concerns and expectations from the project.

10.3 Findings from Focus Group Discussion

The salient features of the opinions expressed by the participants of different profession have divulged in general that they are concerned with due compensation and rehabilitation wherever any damage is done and with request for providing gas in their localities on priority basis.

Though they have, in general, appreciated laying of pipeline as a development work of the country and in their opinion, it will help setting up industries, generate employment and its nature of impact is usually temporary, but note of caution was there from them that the work should be done carefully to avoid any accident in future and reinstatement along the alignment has to be done properly and promptly after completing the pipe laying works.

Participants in these consultation meetings were the land and house owners and available cross section of the local people along the Pipeline sites.

The participants in general welcomed the project and expected that the project will contribute to the national economy in many ways. As reported, the following major issues among others were raised in the public consultation meetings.

- Agricultural products including vegetation may be affected. Due compensation of which should be paid on the spot to the affected people.
- Assembly of people during project activities may damage crops and other trees.
- Noise pollution from vehicles and equipment at the project sites may cause disturbance to human being and wild life.
- Compensation for land as per government rate would not be a fair compensation to the affected person as it is far below prevailing market rate.
- There will be enhanced soil erosion particularly on the river banks, which should be addressed properly.
- Water pollution of the natural water bodies may be aggravated and should be taken care of as this water is used for agriculture and domestic purposes.
- Movement of vehicles may affect movement of people, especially women, children and disabled persons from one place to another.
- Air pollution due to dust and gaseous emission should be controlled.
- Environmental pollution through sanitation and waste materials as well as other social nuisance should be controlled.

10.4 Expectations of the People

The following expectations of the local people were evidenced during the consultations:

- Local personnel should be employed in different activities of the project on a priority basis.
- Preference should be given to engage local businessmen/ contractors in different phases of the project for construction and development depending in their suitability for such engagements.
- Compensation payment, in whatever form it may be, should be properly and promptly distributed so that the actual affected person gets his full share and in right time.
- Supply of gas would help improving their socio-economic conditions and therefore gas should be made available in the areas through which gas line would be passing through.

10.5 Responses Made to Comments from the Public

The PAPs raised several concerns in the different FGD meetings held in the project areas. However, there were certain suggestions, comments, and questions from them as well in the meetings. On behalf of GTCL and BETS Team experts, the survey team members responded to their concerns, suggestions and questions though explaining the situation and assuring the PAPs about doing their best in communicating their concerns to the appropriate authorities as applicable for due mitigation of their concerns and providing their all out support in favor of the PAPs and the local community. A brief on the responses made by the survey team to comments from the public is given below in Table-10.5-1.

Table-10.5-1 Responses made by the survey team to comments from the public

Serial	PAPs concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
1	PAPs and communities were not communicated earlier regarding the project	- As it was in preliminary and conceptual level, they weren't communicated earlier. Now they will be communicated by the GTCL from now at all stages of project onward.
2	Hassle free compensation specially from DC	- DC is a separate entity as for CCL, but GTCL officials and NGO to be contracted will support PAPs in getting hassle free compensation from DC - For additional grant, RU-GTCL will be responsible and there will be full co-operation from GTCL and NGO to be contracted.

Serial	PAPs concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
3	Concerns of regaining an identical land through purchase against the one lost through acquisition by GTCL	<ul style="list-style-type: none"> - GTCL would always encourages PAPs to purchase the lost land - As land for land is an unending process, project proponent will support additional grant for purchase of the land at the rate of full replacement cost at actual market price and this recommendation would be included in ARAP - The additional grant also includes stamp duty as registration fee - Inflation rate also included in case the payment is delayed - NGO support would be ensured for the PAPs - For fixation of upper value of land price, there will be Property Valuation Advisory Committee, where representatives of affected persons would also be committee members
4	People are unwilling to relocate their paternal land	<ul style="list-style-type: none"> - For the greater interest of development of the country, PAPs should support the project and thus refrain from being unwilling to allow acquisition of their land. - PAPs were expected to appreciate that the previous practice of forcefully evicting from the project land would no longer be applied to them, rather appreciating their concerns, project authority realize that this was not a justice and will now do whatever necessary to reasonably compensate them - They were assured that, it is now in practice in donor supported project that, there is a mandatory option that the PAPs must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. So, GTCL will safeguard their interest
5	PAPs will lose their Social Network, so they will lose socio economic support viz. credit support, social exclusion, safety and security	<ul style="list-style-type: none"> - It is true, but regaining their social network, there will be proposal of community support for host areas. - For transitional period, PAPs will be given 3 months income restoration grant - Host area facilities will make them free from isolation
6	Participants asked GTCL, PAPs have suffered a lot but not getting gas connection , so they need gas connection for the project affected communities	<ul style="list-style-type: none"> - GTCL only transmits but does not give gas connections for the consumers, these facts and demands of PAPs will be reflected in ARAP for attracting due support of GTCL for necessary actions to the concerned sister organization responsible for giving gas connection to the communities concerned
7	Why not job opportunities' for PAPs in GTCL?	<ul style="list-style-type: none"> - GTCL is a technical organization, it needs only skilled manpower. It is expected that some jobs may be provided to the qualified and skilled persons during construction and subsequent recruitment process. So PAPs and their dependents should keep an eye when the process starts - Further, CSR department, if originated in GTCL, would provide short technical training to the PAPs and their dependent for making them qualified for employment. - The demand will be reflected in ARAP and GTCL authority will try for positive response against this demand.
8	Credit support for purchasing land and income generating activities (IGA)	<ul style="list-style-type: none"> - Provision will be proposed from the contingency fund of the budget

Serial	PAPs concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
9	Concern about livelihood restoration	<ul style="list-style-type: none"> - There will livelihood restoration for marginal people, vulnerable and income losers - Provision of Training specialist, poverty reduction Specialist would be there for income restoration - Credit support and income restoration grant for three months would be proposed in the ARAP
10	Concern about eviction before payment	<ul style="list-style-type: none"> - They were assured that no one will be evicted before payment of Transfer Grant (TG), Construction Grant (CG), and before compensation payment - Eviction will start only when maximum payment is ensured

10.6 Conclusions and Recommendations on Public Consultation

The Dhanua-Elenga 30 inch diameter 52km Gas Transmission Pipe Line Project is considered to be a feasible project examined from both social and environmental points of view. Acquisition & requisition of land being on small strip alignment throughout the route with a number of control Stations on the way and Manifold and Metering Stations, the general conclusion of the study and preparing Environmental Impact Assessment (EIA) Report is that no significant negative environmental and social impact will be produced by the project interventions so long as due mitigation measures and actions are taken as per Environmental Management Plan (EMP) report. The study has also revealed the important areas, which need special emphasis during design and implementation. The following are the important considerations:

- a) Ensure institutional capacity of GTCL for implementing and monitoring EMP including formation of CDC & GRC with due representation from PAP and the authority and ensure budget provision in ADP of GTCL for implementing the EMP with due importance to social management plan as placed in the EIA report. Provide them with due adequate manpower, logistic supports and the fund as required.
- b) Arrange all preparatory works so that compensations are paid to all of the eligible PAP well before carrying out of any works at site with interventions in their properties and ensure adequacy of the grievance redress mechanism during post project evaluation and take care of the residual impact, if any, under the GOB regulations.
- c) Ensure incorporation of the provision of all mitigation measures including but not limited to reinstatement of all public roads and protection of river banks etc from erosion. Ensure identification and inclusion of all items relating to EMP to be carried out by the EPC contractor in their scope of work.

Acquisition under this project is not of a bulk nature. Landlessness, unemployment, homelessness, renting households, marginalization, morbidity, food insecurity, and social disarticulation are not envisaged except possible displacement. However, if any found during execution of works he/ they will have to be duly compensated. Only twenty five house establishments are along the pipeline together are to be taken special care of by the CDC & GRC about their due compensation and grant as applicable. Adequate compensation has been proposed for them in the mitigation plans.

The public roads, streams/ canals and banks of the rivers as affected by the project have been well identified and due mitigation measures have also been proposed for the same for example, loss of access to common property resources like roads, irrigation canals as identified have to be provided with alternative arrangements by the GTCL's contractor as suggested in the EMP.

CHAPTER-11 CONCLUSIONS AND RECOMMENDATION

11.1 General

The EIA of the proposed Dhanua-Elenga Gas Transmission Pipeline Project with Regulating & Metering Stations has been carried out at generic level in terms of both project design and environmental definition. This is believed to be the appropriate level of assessment for the present stage of project development.

The key areas of environmental sensitivity have been identified and the mitigation measures have been proposed. A management process has also been defined which should ensure that, among other issues, environmental sensitivity are adequately addressed at all stages of project development.

It may be pointed out that this EIA is the requirement of the DOE for issuing the Environmental Clearance and accordingly it has been prepared as per the TOR of GTCL and the guidelines of the ECA '95 and ECR '97 of DOE.

As such, this EIA report is intended for submission to the DOE and includes a broad coverage of the environmental, socio-economic, health and safety impacts etc. and its mitigation, management and monitoring plans.

It may further be mentioned here that, the project has appreciable impact on the PAP and their private and surrounding community related public properties and the environment and therefore small resettlement, restoration and mitigation measures had to be prepared and delineated in the Resettlement Action Plan.

Though effort has been made to present this report to have independent character, and the separately done RAP report has captured most of the social issues such as plot to plot details of the PAP, their loss of assets, land acquisition procedures, compensation payment, employment opportunity, loss or impact on public and community facilities etc yet certain issues being common in the perspective of environmental and social (ES) aspects, it might be felt convenient to the readers to go through both the reports for an integrated view of the overall impact of the project so far as the environmental and social aspects are concerned and the suggested mitigation, management and monitoring plans presented thereof.

11.2 Conclusions

The benefits of the project will be realized primarily at the level of the national economy. The implementation of the proposed project will provide supply of clean burning fuel and necessary feed stock for the domestic, commercial and industrial consumers in general and Power plants and Fertilizer Factories in particular. It will thus help overcoming the current crisis of gas in the respective load centers through evacuation of same from the producing gas fields.

These will not only reduce Bangladesh's dependence on foreign energy resources but also help accruing a good number of benefits in terms of enhanced generation of electricity and production of fertilizer and other industrial products including opening up employment opportunities and thereby tremendously contribute to health, agricultural, forestry, commercial, industrial and economic development of the country. Benefits in the project area will not be that significant except for some short term employment and business opportunities during the construction phase.

However, natural gas being an intrinsically clean fuel compared with most alternatives, development of natural gas resources and transportation to the load centers for the consumers are, in general, environmentally sound options at the national and global level.

Thus the proposed project activities have also no significant adverse environmental impact so far as a time bound execution program with application of advanced environment friendly construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the pipeline system.

On the basis of the project summary and other relevant reports provided to the consultant by GTCL and detailed survey conducted by the consultant along the project affected area, it may be concluded that in receiving the foregoing enhanced benefits, the project would minimize and mitigate most of its environmental and socio-economic impacts.

It is believed that GTCL will take due note of the concerns expressed during public consultations and duly attend to the mitigation measures suggested against each of them. At the same time, GTCL will avail itself of the opportunities in discharging its corporate social responsibilities in providing different facilities to the host communities as far as practicable.

As such, the execution of the project would stand environmentally sound and socio-economically sustainable with due adoption of the recommended mitigation measures and environmental management and monitoring processes.

11.3 Recommendations

It is recommended that the relevant legislations, rules, regulations and recommendations of concerned agencies, including but not limited to, the DOE, Inspectorate of Explosives, Department of Forests etc, is strictly complied with.

All necessary permissions are to be obtained by GTCL well in advance from the concerned authorities i.e. RHD, LGED, BIWTA etc. The conditions set forth in the permissions there of, if any, should be duly complied with.

All recommendations within the Environmental Management Plan (EMP) should be implemented without reduction in intent, scope or duration. The EMP being a live document those recommendations should be augmented with further specific information regarding potential impact mitigation if and when it becomes available.

Adequate and effective pollution prevention steps with respect to the following issues should still be particularly implemented. These include but not limited to the following:

- Erosion and sediment control measures;
- Judicious implementation of construction, operations and maintenance activities to have minimum potentially adverse impacts whatsoever;
- Regular and effective environmental monitoring with adequate staff and budget;
- Reporting to DOE, Inspectorate of Explosives etc. as required;
- Strengthening and ensuring preventive management practices are in place;
- Deploying adequate monitoring mechanisms as outlined in the EMP;
- Adoption of emergency response and disaster management plans as documented; and
- Adhering to standard and safe operating procedures in all activities.

Even though the probability of any unacceptable risk and chemical hazard etc arising from the proposed operations is unlikely, it is recommended that, the emergency response cell as proposed in the organizational set-up is duly operative and a team of environmental and safety professionals are full-time present on site under supervision and coordination of a qualified environmental and safety specialist when any works are conducted and during the progress of clean up and reinstatement activities at sites.

GTCL should continue to discharge its corporate social responsibilities and foster good community relations with local people through effective implementation of the community consultation strategy. This will tremendously contribute to the long term success of this project.

Ensuring adequate training to the involved professionals and scheduled monitoring of the mitigation measures would be yet another important management responsibility.

In line with the fore going recommendations, the following pertinent points may also be revisited in the interest of smooth, safe, environment-friendly and unhindered execution of the project.

Severe weather conditions would have an impact on the pipeline construction activities and may even cause stoppage of works during the cyclonic storms and rainy days. So it is, recommended that commencing construction in early winter season may help to reap the benefit of full dry spell of the season. Further,

- ✓ In order to enhance the occupational health and worker safety during the construction period, construction equipment would have to be kept in good order. Adequate safety measures should be taken and safety related equipment including PPE, firefighting equipment etc. must be provided in order to reduce the potential for accidents.
- ✓ GTCL will organize specific pre-project training / refreshers program on physical, chemical & biological hazards, health, safety and environmental issues for its Engineering & Management professionals to be involved in on-site execution and operation of the project. Such facilities of tailor-made training may be obtained from local professional institutions like BPI, Industrial Safety Board of Bangladesh (ISBB) of IEB, Engineering Staff College etc. These will further prepare the personnel designated for overseas training under the project at a later date.
- ✓ A well developed camp site management plan has to be adhered to as per recommendation made in the EMP in all aspects of its safe, hygienic, secured and environment friendly occupation and taking appropriate restoration steps after completion of the project.
- ✓ The topsoil from the trenching should be temporarily stored along the sides of the trench and used as back filling material upon completion of the pipeline construction activity.
- ✓ Felling of trees should be kept to a minimum. It is very important for the preservation and protection of natural ecosystem and avoiding undesirable erosion/ deposition.
- ✓ Any unavoidable loss of those belonging to the State including road side vegetation should be replenished by undertaking appropriate plantation program to be implemented before completing the project and continue throughout its operation.
- ✓ Due importance has to be put in to recommended environmental enhancement / restoration and bank / side slope erosion protection plans for the natural streams, rivers, roads and other physical community features impacted by the project.
- ✓ One of the major issues is the need to minimize disturbance to the local population in the areas of pipeline construction. Effort should be put in to arrive at a fair and equitable level of compensation for the affected trees to PAPs and all the land owning PAPs affected by their assets taken (permanent and temporary) for the project as per provision of GOB guidelines.
- ✓ Though none of the indigenous group member or squatters could be identified as PAP for resettlement in the project area along the strip alignment except 12 full structure losers including 3CBEs and 16 partial living structure losers which constituted structure loss of 28 (25 is living structure loser and 3 CBEs) in total. They should be duly compensated for and brought under skill development training, microfinance etc. of ARAP if found during execution period. A positive policy of giving priority to employing limited number of local people depending on their suitability during the construction phase may be adopted for uplifting harmonious relationship with the local community.

- ✓ In the post construction phase, the environmental impact of the project will be some loss of land utility along the pipeline alignments and a risk of leakage of gas due to improper maintenance or accident, if any. The former can be mitigated by adoption of a fair compensation policy and the latter by adequate maintenance and monitoring.

In fine, it has to be appreciated that, so far as enhancement of the benefits of the project and minimization of its negative impacts are concerned, appropriate management and monitoring of impact mitigation measures in respect of both environmental and social aspects are to be simultaneously taken care of by the project proponent GTCL.

Recapitulating the recommendations made in the EMP, it is presumed that GTCL will have an organizational structure of its own as placed in the chapter on EMP. GTCL will be assisted in supervision through contractor or by GTCL's own specialist, who in turn will be supported by the Environmental Specialist, a member of the Pipeline Consulting Group being appointed by GTCL. They will oversee and ensure that the parts of the jobs of GTCL & its contractor are done in the way it should be.

GTCL should therefore consider these jobs so identified in the EMP as given with estimated budget in their cost estimation and include the items in the scope of works of the contractor so that they make provision for it and reflect in their financial bid.

The contractor will then be directly performing those specific aspects of the EMP under close monitoring and supervision of GTCL and its consulting functionaries. In doing so, GTCL will attract attention and support from concerned agencies e.g. DOE, Inspectorate of explosives and will have strategic alliances with related GOB agencies like Local administration, police, fire brigades and health services for successful execution of the project.

GTCL is committed to taking necessary and appropriate mitigation measures as delineated in their own plan and as discussed in the present report. It has also appeared that, GTCL holds a very positive approach towards sustainable environmental management and will maintain standard quality of implementation of the program with due consideration to all standing rules and regulations. As such, the project may be recommended for implementation.

Since implementation of this project would go a long way to ameliorate crisis of gas in the downstream areas of Dhanua, both JICA & GTCL authorities are considering it as a national priority endeavor.

In consideration of the foregoing findings and commitments placed in this EIA Report, the DOE may approve and issue the Environmental Clearance Certificate in favor of Gas Transmission Co. Ltd. if and when applied for as a prerequisite for implementing construction and operation of the proposed gas transmission pipeline project with its associated facilities as per their schedule of execution.

**Annex-1 Environmental Checklist for Dhanua-Elenga Gas
Transmission Pipeline Project of GTCL**

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	<p>(1) EIA and Environmental Permits</p> <p>(2) Explanation to the Public</p>	<p>① Have EIA reports been officially completed?</p> <p>② Have EIA reports been approved by authorities of the host country's government?</p> <p>③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p>	<p>① Once completed long ago in 2005 and Environmental Clearance Certificate (ECC) for the Project was issued but it appears that it is no longer valid for this project. So, the EIA study (including ARAP Study) is completed in the middle of February 2014 since conducting of EIA is mandatory in Bangladesh for any gas pipeline project irrespective of the project scale. GTCL will submit this EIA report with necessary modification if any and local authority clearance i.e. NOC (No Objection Certificate) for obtaining the ECC from DOE.</p> <p>② No. EIA report approval obtained in 2005 is no longer valid now. GTCL will submit this EIA report with necessary modification, if any and obtaining local authority clearance i.e. NOC for approval of the Government authority i.e. DOE.</p> <p>③ Yes, EIA report approved in 2005 is no longer valid now. GTCL will submit this EIA report with necessary modification and local authority clearance i.e. NOC for approval of the Government authority i.e. DOE.</p> <p>④ No. GTCL will collect NOC from concerned local authorities of the ROW of the pipeline for this project.</p> <p>① EIA study included public consultation using FGD (focus group discussion method) & KII (Key Informant Interview) including interview survey which is an appropriate procedure used in Bangladesh where information disclosure was also made.</p> <p>Yes, the understanding of the public about the project was made and explained in brief in Section-10.2.1 & 10.3 of Chapter-10 of the EIA report and in details in Chapter-8 of the ARAP report.</p> <p>② Yes, proper response and comments of public are delineated in Section-10.5 of Chapter-10 of the EIA report and Section 8.6 of Chapter-8 of the ARAP report. It is</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
2 Mitigation Measures	(1) Water Quality	① Are adequate measures taken to prevent spills and discharges of crude oil and hazardous materials to the surrounding water areas?	expected that the feedback from Regulatory Authorities shall be available after placement of the EIA report to the DOE. ① Not significant for this gas pipeline project but mitigation measures are mentioned in Table-6.2-1 of Chapter-6 of the EIA report.
	(2) Wastes	① Are sludge's containing pollutants, such as oils, greases and heavy metals generated by pipeline cleaning (pigging operations) properly treated and disposed of in accordance with the country's standards?	① No obnoxious ingredients observed in pigging hole during construction. Existing gas pipeline operation (operational experience is more than 20 years) indicates waste generated by pipeline cleaning (pigging operations) is properly treated and disposed of in accordance with the standard requirement (buried underground). This issue has been carefully considered in Table-6.2-1 of Chapter-6 of the EIA report.
	(3) Soil Contamination	① Has the soil at the project site been contaminated in the past, and are adequate measures taken to prevent soil contamination by leaked materials, such as crude oil?	① Not significant for this gas pipeline project.
	(4) Noise and Vibration	① Do noise and vibrations from facility operations, such as pumping operations comply with the country's standards? ② Is there a possibility that noise from facility operations, such as pumping operations will affect humans and animals (wildlife and livestock)?	① It is evident from existing operational pipelines of more than 1000 km in length of GTCL. that no significant noise and vibrations from gas transmission pipeline operations is anticipated ② As of above no significant noise/vibration is anticipated.
	(1) Protected Areas	① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	① No. The project site is located in human (anthropogenic) influenced areas of residential, agricultural and vacant land areas only and there are no protected areas in its vicinity. Section-4.5.3 of Chapter-4 of EIA report described the ecologically sensitive areas (ESA) of Bangladesh. The project area is out of any national protected areas.
	(2) Ecosystem	① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or	① No ② No ③ Not applicable as no significant ecological impacts are anticipated ④ Not significant for an underground pipeline laid through
3 Natural Environment			

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		<p>international treaties and conventions?</p> <p>③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p> <p>④ Are adequate measures taken to prevent impacts on wildlife and livestock, such as disruption of migration routes, and habitat fragmentation of wildlife and livestock?</p> <p>⑤ Is there a possibility that installation of pipelines will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, disturbance of ecosystems due to introduction of exotic species (non-native inhabitants in the region) and pests? Are adequate measures for preventing such impacts considered?</p>	<p>areas of human/anthropogenic influence (There exists more than 1000 km of operational pipelines with no apparent adverse effects on ecosystem). Except temporary disruption of movement route of the livestock of the area during construction which has been duly taken care of in the EIA</p> <p>⑤ No such effects are anticipated consequent to this pipeline installation similar to the already installed and in operation pipelines as noted above. Except temporary clearing & grading of right of way in the pipeline route and which are duly reinstated after lying of pipeline.</p> <p>Section-4.5 of Chapter-4 described the Biological environment of the project area.</p>
	(3) Hydrology	<p>① In the case of offshore pipeline projects, is there a possibility that oceanographic condition changes due to installation of structures will adversely affect oceanographic conditions, such as induced currents, waves, and tidal currents? Is the possibility of water quality degradation by the installation of structures studied? Are adequate water quality control measures taken, if necessary?</p>	<p>① Not applicable</p>
	(4) Topography and Geology	<p>① In the case of onshore pipeline installation, is there a possibility that the installation of structures will cause a large-scale alteration of topographic features and geologic structures around the project site? In the case of coastal pipeline installation, is there a possibility that the installation of structures will result in elimination of beaches?</p>	<p>① This project is an onshore pipeline installation project and no adverse effects on either topographic features or geologic structures around the project site are anticipated consequent to the pipeline installation. Section4.3.1 & 4.3.2 of Chapter-4 of the EIA report described the topography and geology of the project area.</p>
4 Social Environment	(1) Resettlement	<p>① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?</p>	<p>① Yes. There will be small-scale involuntary resettlement caused by project implementation. The ROW is selected so as to minimize resettlement requirement to the maximum possible extent and the resettlement requirement is estimated at 25 households (total population is about 121 persons). The detail description of households' resettlement has been given in Table-4.3 & 4.4 of Chapter-4 of the ARAP report.</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		<p>③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>⑤ Are agreements with the affected persons obtained prior to resettlement?</p> <p>⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>⑦ Is a plan developed to monitor the impacts of resettlement?</p>	<p>② No. During the project implementation stage, GTCL will provide adequate explanation to affected persons on their relocation and compensation. In the official ARAP preparation these are to taken care of.</p> <p>③ Yes. The ARAP Study conducted in depth socioeconomic studies targeting population identified for involuntary resettlement and hence to formulate the ARAP Report conforming the relevant WB (World Bank) OPs (in particular OP 4.12 on involuntary resettlement) and JICA guideline. Chapter-4 of the ARAP report described the socioeconomic analysis.</p> <p>④ Yes. Due attention to such aspects has been given during the ARAP Study even though there is no presence of ethnic minorities and indigenous people in the project area.</p> <p>⑤ No. GTCL will do the necessary agreement with the PAPs and the ARAP study paid due attention to obtain consent from people resettled in an amicable manner.</p> <p>⑥ Yes. Figure 6.1.2.1 of Chapter-6 of the ARAP report described the organizational framework for properly implement the resettlement and the capacity and Chapter-10 of the same report describes the budget for the RAP implementation.</p> <p>⑦ Yes. Chapter-9 of the ARAP report describes the required monitoring plan for ARAP implementation.</p>
(2) Living and Livelihood		<p>① Is there a possibility that existence of pipeline will cause impacts on traffic in the surrounding areas, and impede the movement of inhabitants?</p>	<p>① Since pipeline is laid underground no such long-term impacts are anticipated as also could be visualized from the already operational pipelines of more than 1000 km in length. Except for temporary dislocation during construction. Table-5.2-1 of the environmental scoping section of Chapter-5 identified this environmental element and evaluates its impact as well.</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(3) Heritage	<p>① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?</p> <p>① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p>	<p>① There are no archeological, historical, cultural, and religious heritage sites in and around the vicinity of the ROW of the pipeline. Table-5.2-1 of the environmental scoping section of Chapter-5 identified the environmental element and evaluates its impact as well.</p> <p>① No adverse effect on the local landscape is anticipated since the pipeline is laid underground as also could be visualized from the already operational pipelines of more than 1000 km in length. Table-5.2-1 of Chapter-5 identified the potential impacts of the project area where this environmental item has not been considered since it has no impact on the environment.</p>
	(4) Landscape	<p>① Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?</p> <p>② Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p>	<p>① The pipeline will not interfere with any rights of ethnic minorities or indigenous peoples since there are no such people living in the project vicinity. Section 4.5.2 of Chapter-4 of the ARAP report described in details about the ethnic minorities and indigenous peoples of the project area.</p> <p>② Not applicable, since there is no such ethnic minority or indigenous people living in the project vicinity.</p>
5 Others	(1) Impacts during Construction	<p>① Are adequate measures considered to reduce impacts during construction (e.g. noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>② If construction activities adversely affect the land use and livelihood of inhabitants, is adequate compensation provided to local inhabitants for losses of land and livelihoods?</p> <p>③ If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>④ If construction activities cause impacts on traffic in surrounding areas, and impede the movement of inhabitants, are adequate measures considered to reduce impacts?</p> <p>⑤ If construction activities adversely affect the social</p>	<p>① Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. Mitigation measures for potential dust induced air pollution during construction include water spraying of dust prone land cleared site and vinyl sheet covering of dust prone materials. Since construction works will be conducted only in dry season no significant generation of turbid and wastewater is anticipated.</p> <p>② Yes. The required compensation due to construction activities on the land use and livelihood of inhabitants is duly determined in the EIA/ARAP Studies. Chapter-10 of the ARAP report describes the tentative budget.</p> <p>③ No significant adverse effect by construction activities on the natural environment (ecosystem) is anticipated since</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		<p>environment (including communicable diseases, such as HIV), are adequate measures considered to reduce impacts?</p> <p>⑥ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?</p>	<p>there are no ecologically important areas located in and around the vicinity of the project site. Table 5.2-1 of Chapter-5 and Table-6.2-1 of Chapter-6 of the EIA report describes the environmental scoping and mitigation/management plan of the project area.</p> <p>④ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. Mitigation measures to minimize interference with regular traffic include transportation of construction related materials during off-peak hours and holidays and others.</p> <p>⑤ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. In this respect instilling due awareness on the dangers and mitigation of communicable diseases by the construction contractor will be emphasized by the project management.</p> <p>⑥ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS of construction stages of the project. Construction contractor shall fully commit and abide to the concept of "Safety First".</p>
(2) Accident Prevention Measures		<p>① Are adequate accident prevention plans and mitigation measures developed to cover both the soft and hard aspects of the project, such as establishment of safety rules, installation of prevention facilities and equipment, and safety education for workers? Are adequate measures for emergency response to accidental events considered?</p> <p>② Are adequate accident prevention measures (e.g., installation of prevention facilities and equipment and establishment of prevention management framework) taken to prevent spills from crude oil and gas storage facilities, loading/unloading operations, transportation, and blow out during drilling?</p>	<p>① Table 6.2-1 and Section-6.5 of Chapter-6 of the EIA study dealt with these aspects as EHS duly separated between construction and operational stages of the project. Yes, adequate provision of implementing the emergency response plan would be committed and abided by the executing contractor.</p> <p>② There are no such significant activities in this gas transmission pipeline to take accident prevention measures except taking care of occupational health and safety measures. Table 6.2-1 and Section-6.5 of Chapter-6 of the EIA study dealt with accident prevention measures.</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(3) Monitoring	<p>① Does the proponent develops and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>② Are the items, methods and frequencies included in the monitoring program judged to be appropriate?</p> <p>③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p>	<p>① Table-7.2-1 of Chapter-7 of the EIA study developed the required monitoring program for implementation for the environmental items that are considered to have potential impacts. Monitoring program focused on air pollution (dust), noise, waste and water pollution control is regarded as necessary for the construction stage of the project only.</p> <p>② Yes, the items, methods and frequencies included in the monitoring program is well judged and appropriate. Periodical testing of the environmental parameters & results thereof subscribed to the adequacy of the EMP.</p> <p>③ Figure-7.3-1 of Chapter-7 of the EIA study established an adequate monitoring framework of the project.</p> <p>④ Yes. Section-7.3 of Chapter-7 of the EIA report described about the requirement and format and frequency of monitoring reports from the proponent to the regulatory authorities as per provisions of the existing regulatory framework.</p>
6 Note	Reference to Checklist of Other Sectors	<p>① Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).</p>	<p>① Checked and regarded as not that relevant since there is no forestry along the planned ROW of the pipeline installation.</p>
6 Note	Note on Using Environmental Checklist	<p>① If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of ozone layer, global warming).</p>	<p>① There is no significant trans-boundary or global issues to be impacted or involved by this project.</p>

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Annex-2 List of Reference

LIST OF REFERENCE

1. Banglapedia, National Encyclopedia of Bangladesh, 2006.
2. Bangladesh Environment Facing the 21st Century by SEHD.
3. Bangladesh Meteorological Department, 2013.
4. Guidelines For Environmental and Social Considerations, JICA, April-2010
5. BBS (2003), the statistical yearbook of Bangladesh.
6. BGS and DPHE, 2001. Arsenic contamination of groundwater in Bangladesh. BGS Technical Report, WC/00/19.
7. BOBLME (2011) Country report on pollution in the BOBLME – Bangladesh. BOBLME-2011-Ecology-01.
8. British Geological Survey, Natural Environment Research Council (NERC) 2001.
9. Canter, L.W., “Environmental Impact Assessment”. McGraw-Hill Inc., New York, 1977.
10. Centre for Hazard and Risk Research, Bangladesh.
11. Chief Editor: Islam, S., Managing Editor: Miah, S., “BANGLAPEDIA”, National Encyclopedia of Bangladesh, Asiatic Society of Bangladesh, March 2003.
12. Community Series, Tangail and Gazipur and Mymensingh Bangladesh Bureau of Statistics, 2011.
13. “EIA Guidelines for Industries”, Department of Environment, Ministry of Environment and Forest, Government of the Peoples Republic of Bangladesh, June 1997.
14. Environmental Conservation Rules, 1997.
15. FAO/WFP., 1991. Bangladesh: Report of Joint FAO/WFP Mission to Assess the Impact of the April 1991 Cyclone on the Food and Agricultural Sectors, Rome.
16. FAO (1988). Soils map of the world: revised legend. Food and Agriculture Organization of the United Nations, Rome. 119 p.
17. Farooque M. Hossain S.R 1996 Laws relating Environment in Bangladesh (BELA) Dhaka.
18. Geological Survey of Bangladesh, 2001.
19. Government of the People's Republic of Bangladesh, (1991). Statistical Yearbook of Bangladesh 1991. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Dhaka.
20. IEE/EIA/ARAP Report on Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge high pressure Gas Transmission Pipeline Project -2005.
21. Initial Environmental Examination (IEE) report on the third Gas Development Project by Resource Control Company 1993.
22. Islam, R. (edt.), 2004. Where lands meets the sea. A profile of coastal zone of Bangladesh. The University Press Limited, Dhaka, 2004.
23. Khalil, 1993. The catastrophic cyclone of April 1991: Its Impact on the economy of Bangladesh, Natural Hazards, 1993, Volume 8, Number 3, Pages 263-28.
24. Local Government Engineering Department (LGED), Bangladesh, 2011.
25. “Multilateral Environmental Agreement in Force in Bangladesh” Department of Environment (DoE), Bangladesh, 2011.
26. National Encyclopedia of Bangladesh, 2003.
27. Population Census 2001, February 2007, BBS; *Bangladesh Population Census 1991, March 1996.

28. Publications of 2011 2nd International Conference on Environmental Science and Technology IPCBEE vol.6 (2011) © (2011) IACSIT Press, Singapore.
29. Rao, M. N., Rao, H. V. N., "Air Pollution", Tata McGraw Hill Publishing Company, New Delhi, 1989.
30. Rashid, Harun Er; 1991, geography of Bangladesh; University press limited, Second revised edition, P. 33.
31. Talukder, J., G.D. Roy and M. Ahmed, 1992. Living with cyclone: Study on Storm Surge Prediction and Disaster Preparedness. Community Development Library, Dhaka, Bangladesh, pp: 124.
32. Profile on Environmental and Social Considerations in Bangladesh, JICA, July 2012
33. <http://www.earthsendangered.com/>, 2012.

Annex-3 Environmental Monitoring Form

Environmental Monitoring Form

A. Monitoring Locations

Insert a map with the GPS location of all monitoring stations.

B. Monitoring Time Details:

C. Monitoring Items

C-1 Noise Monitoring (Construction Stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Noise	Noise level (Residential Area)	dB		45 (Night-time)	45 (Night-time) (World Bank)	- 50m from the construction site	- Per Month one 24-hr. day sampling	- Sound level meter
				55 (Day-time)	55 (Day-time) (World Bank)			

C-2 Air Quality Monitoring (Construction Stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Air Quality	SPM ₁₀	µgm/m ³		150 (Statutory Rules 2005)	50 (World Bank Guideline) 150 Interim Value	- One Sampling Point near the project site another 1 km. (normal Practice in Bangladesh) away from the project site	- Per month one 24-hr. day sampling	- High Volume Dust Sampler
	SPM _{2.5}	µgm/m ³		65 (Statutory Rules 2005)	25 (World Bank Guideline) 75 Interim Value	- One Sampling Point near the project site another 1 km. (normal Practice in Bangladesh) away from the project site.	- Per month one 24-hr. day sampling	- High Volume Dust Sampler

C-3 Water Quality Monitoring (Construction Stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Surface Water Quality	pH	-		6.5-8.5 (Fishery use)	6.5-9.0 (USEPA)	- Both river banks (Bangshai, Slada, Safai, Tanki-1, Tanki-2 and Langolia) of the HDD Pipe Crossing	- Monthly	- pH meter
	SS (Suspended Solid)	mg/l		-	-	Ditto	Ditto	- Filtration
	BOD	mg/l		<6 (BOD) (Fishery use)	-	Ditto	Ditto	- Titration

	DO	mg/l		>5 (Fishery use)	3-9.5 (USEPA)	Ditto	Ditto	- DO meter
	Oil and Grease	mg/l		-	-	Ditto	Ditto	- Gravimetric
	Temperature	°C		25 (Fishery use)	-	Ditto	Ditto	- Thermometer

C-4 Waste Monitoring (Construction Stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Waste	- Excess borrow pit soil	-				- Worksite and Camp site	- Weekly	-
	- Generated Solid waste	-				ditto	Ditto	-
	- Sanitary waste	-				Ditto	Ditto	-
	- Housekeeping status	-				Ditto	Ditto	-

C-5 Waste Monitoring (Operation Stage-Implemented by GTCL)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Waste	- Management of pigging waste	-				- Worksite (pig launcher and receiver locations)	As required	-

Appendix 26:

FINAL REPORT OF EIA UPDATA STUDY

ON

WEST BANK OF JAMUNA BRIDGE-NALKA GAS

TRANSMISSION PIPELINE PROJECT OF GTCL



ORIENTAL CONSULTANTS Co., LTD., JAPAN

12-1, HONMACHI 3-CHOME, SHIBUYA-KU, TOKYO, 151-0071 JAPAN

**EIA UPDATE STUDY ON DHANUA - ELENGA AND WEST BANK OF
JAMUNA BRIDGE - NALKA GAS TRANSMISSION PIPELINE PROJECTS OF GTCL
Component-2 : West Bank of Jamuna Bridge–Nalka Sector Gas Transmission
Pipeline of 14 km in Length and 30" in Diameter**



FINAL REPORT

MARCH 2014

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Final Report of EIA Update Study on West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline Project of GTCL

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ABBREVIATION & GLOSSARY

ADB	Asian Development Bank
ADP	Annual Development Program
AER	Agro-Ecological Region
AEZ	Agro-ecological Zone
AQM	Air Quality Management
ARAP	Abbreviated Resettlement Action Plan
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advance Studies
BETS	Bangladesh Engineering and Technological Services Ltd.
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BPI	Bangladesh Petroleum Institute
BWDB	Bangladesh Water Development Board
CBE	Community Based Entrepreneurs
CCL	Cash Compensation Under Law
CDC	Community Development Council
CG	Construction Grant
CGS	City Gate Station
CNG	Compressed Natural Gas
CSMC	Construction Supervision and Monitoring Consultant
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DGM	Deputy General Manager
DOE	Department of Environment
DOF	Department of Fisheries
DPP	Development Project Proforma
DTW	Deep Tube Well
ECA	Ecologically Critical Area
ECA	Environmental Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules

EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
EPZ	Export Processing Zone
EQS	Environmental Quality Standards
ERP	Emergency Response Plan
ESMS	Environmental Safety Management System
FGD	Focus Group Discussion
GIS	Geographic Information System
GOB	Government of Bangladesh
GM	General Manager
GPS	Global Positioning System
GRC	Grievance Redress Committee
GTCL	Gas Transmission Company Limited
HDD	Horizontal Directional Drilling
IEC	Important Environmental Component
IEB	Institute of Engineers Bangladesh
IEE	Initial Environmental Examination
ISBB	Industrial Safety Board of Bangladesh
IUCN	International Union for Conservation of Nature and Natural Resources or the World Conservation Union
JICA	Japan International Cooperation Agency
KII	Key Informant Interview
LGED	Local Government Engineering Department
MMCFD	Millions of Cubic Feet per Day
MSDS	Material Safety Data Sheet
NDT	Non Destructive Testing
NGO	Non-governmental Organization
NWMP	National Water Management Plan
OHS	Operation Health and Safety
PAP	Project Affected Person
PCP	Project Concept Paper

PMU	Project Management Unit
PPE	Personal Protective Equipment
RHD	Roads and Highway Department
ROW	Right of Way
RU-GTCL	Resettlement Unit-Gas Transmission Company Limited
SDC	Study and Design Consultant
SRDI	Soil Resource Development Institute
TG	Transfer Grant
TOR	Terms of Reference
UNDP	United Nations Development Program
WBJB	West Bank of Jamuna Bridge

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water

Bangla: Bengali language.

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

Bazar: Market.

Beel: A "back swamp" or depression. It can be either perennial or seasonal.

Beneficial impacts: Impacts, which are considered to be desirable and useful.

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

Char: Newly accreted land: Land, sometimes islands, within main river channels and nearby mainland or in the estuary, subject to erosion and accretion

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

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

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

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

Environmental impact assessment (EIA)/Environmental assessment: The systematic, reproducible and interdisciplinary identification, prediction and evaluation, mitigation and management of impacts from a proposed development and its reasonable alternatives. It is sometimes known as environmental assessment.

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

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

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

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

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

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

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

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

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

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

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

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

Khal: Small Channel, Canal.

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

Mauza: A Bengali word for the smallest government administrative area corresponding to a village revenue unit.

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

Negative Impact: negative change from the existing situation due to the project.

Public involvement/Public consultation: A range of techniques that can be used to inform, consult or interact with stakeholders affected/to be affected by a proposal.

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

Stakeholders: Those who may be potentially affected by a proposal e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or take an interest in it.

Taka: Bangladeshi currency.

Terrestrial: Living on land.

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

Union: Smallest unit of local self government comprising several villages.

Upazila: *Sub-district.* *Upazila* introduced in 1982.

Zila: Bengali word of District.

EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) report covers the construction and operation of the proposed 30" dia 14 km Gas Transmission Pipeline from West Bank of Jamuna Bridge to Nalka. The project is under taken with a view to delivering gas through this pipeline which would eventually contribute to national gas grid and thus help significantly in narrowing the existing production-evacuation gap.

The volume of approximately 500 MMscfd gas as planned to be flowing through this pipeline would also tremendously help in overcoming the current crisis of same in the different industrial, commercial and domestic sectors including power plants and fertilizer factories downstream of the producing gas fields of the north-eastern region of the country.

The project is being financed by GTCL through utilization of different development funds. It is expected that implementation of this pipeline project will play an important role for the development of national economy. It is most likely that JICA will be a major financing partner in implementing the project.

The results of the EIA are based on information that was readily available from the documentations and maps of the project and the reports on the proposed right of way (ROW) provided by GTCL, reports on similar pipelines, interviews with the stakeholders and personnel involved in the construction of such other high pressure gas transmission pipeline. The result and recommendation from the DOE on the approved TOR of EIA and a detail field survey of the proposed project area where all the physical, biological and socio-economic existing features have been assessed in detail. In fact, the records of the fore going information and materials have been the basis of delivering the results of this EIA.

Pipeline construction and operation, in general, has temporary environmental impacts compared to other industrial projects. An environmental management plan is presented which indicates management action for the implementation of mitigation measures and the use of best management practices and mitigation procedures and controls which will have minimum adverse impacts on the environment. Overall long term environmental impacts, in fact, will be beneficial in the context of different technical and socio-economic considerations.

The most important measure to achieve a good level of environmental acceptability for the project is adherence to the national and international best practices in design and construction with due observance of rules regulations and standards. Accordingly route selections have been given high importance and avoidance of environmentally sensitive location has been an integral part of the process. This project pipeline will follow the existing 24 inches diameter WBJB-Nalka-Hatikumrul pipeline. There will be no acquisition of land for the pipeline route as because the pipeline route area is under Jamuna Bridge Authority but one hectare acquisition of private land for City Gate Station (CGS) would be required for this project. GTCL will flexibly select this land in any vacant area wherever possible close to the pipeline route and for this no Project Affected Peoples (PAPs) were identified during the field survey.

Any potential negative socio-economic impact will be temporary and minor in nature. Positive impacts on the other hand will include availability of less expensive and cleaner burning fuel, temporary employment for the local population and potential business opportunities. Mitigation measures include providing temporary housing, eating and sanitary facilities for the construction crew to prevent overtaxing the local infrastructure. Land use impact will be temporary and minor with the implementation of proper mitigation techniques.

Soil erosion and fertility impact will be temporary and minor with due reinstatement and bank protection measures as well as implementation of planed mitigation methods and procedures. Soil

fertility will be preserved by segregating the 30 cm topsoil layer from common fill material during trenching, and ensuring that the fertile soil is replaced on the top of the trench during backfilling operations. The soil erosion mitigation plan would include particular measures for conserving soil during river and stream crossings, during trenching activities and when discharging water and /or sediment during directional drilling, thrust boring, hydrostatic testing, pigging and dewatering etc.

Air quality impact appears to be negligible and less significant mitigation measure is necessary. Similarly noise and vibration impacts will be insignificant too. However efforts would be continued to keep and operate the machinery and equipments in good order to generate less noise and to control emission and dust particles. Surface and ground water quality impact will be temporary and minor with implementation of suggested mitigation methods and procedures. Sediment loading to surrounding water bodies is mitigated by controlling soil erosion. Soil erosion will be minimized by implementing the soil erosion plan.

Contamination of surface and ground water from sanitary solid waste will be minimized by implementation of the waste disposal plan. Ground water used for potable water by the construction crew will be tested to ensure that, it meets the minimum environmental standards of Bangladesh for safe drinking water.

Fish and wildlife impact would be quite temporary and minor with adequate mitigation measures. Natural fish production would be protected by controlling water pollution caused due to sanitary and solid waste, oil and grease, paints and other chemicals and sediments. Plans for mitigating the impacts of these pollutions are included in oil spill plan, waste disposal plan, soil erosion and fertility control plans.

Any environmental impact associated with the project activity is likely to have only a very minimal effect in any particular location and its social or biological community. Unlike many other operations, no large quantities of hazardous chemicals will be used. Therefore, potentially toxic discharges and emissions will not be a threat to the environment. Further, most adverse impacts can be offset by good environmental management practices.

Some reasonable expectations, views and opinion of stakeholders, important key informants and experienced personnel involved in the construction of such high pressure gas transmission pipeline have been included in findings. There were 2 focus group discussions (FGD) in two locations of the project adjacent areas. It has been revealed from these meetings that the majority of the people are in the meantime aware about the project activities. Though there were expression of some reservations, most of the villagers, peoples of the localities along the route welcomed the project as it will support a national benefit as well as create new jobs and business opportunities to the local people.

It is expected that GTCL and its contractors will ensure a smooth, environmentally compatible and socially acceptable execution of the project and will comply with national regulations and operational requirements. GTCL will perform as a responsible neighbor to the surrounding establishments and local people and discharge their corporate social responsibilities with due diligence as well.

In view of the forgoing considerations, it is expected that the present EIA Report, if and when placed for, will be approved by the Department of Environment and necessary Environmental Clearances would be issued in favor of safe and environment-friendly execution and operation of this priority project of national importance.

CHAPTER-1 INTRODUCTION

1.1 Background

In order to meet the surplus gas demand of gas based Power Plants and Fertilizer Factory of B-B region under Titas Gas Franchise area and proposed Power Plant at Sirajganj and Bogra as well as existing and being implemented Power Plants and Fertilizer Factory of PGCL Franchise area and also to expand National Gas Transmission Network system for equitable regional distribution of gas at designated pressure, GTCL has considered construction of West Bank of Jamuna Bridge-Nalka is to be anticipated.

1.2 Brief Description of the Assignment

West Bank of Jamuna Bridge-Nalka sector gas transmission pipeline is 14 km in length and 30 inch in diameter. This sector is a sub-component of the originally ADB planned project of “West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara Gas Transmission Pipeline Project” which had in detail EIA study in 2005. Only the EIA study will be carried out for this project component since no private sector related land acquisition (land belongs to Jamuna Bridge Authority only) for pipeline routing except one hectare of private land for CGS would be flexibly acquired by GTCL in any vacant area close to the pipeline route. And there no resettlement would be required as the pipeline will be installed along the ROW of existing pipeline route located by the side of the road to Nalka and land for CGS would be in vacant areas. As such the work requirement is the update of the available EIA report (2005) for the relevant 14km sector of West Bank of Jamuna Bridge-Nalka and hence to formulate updated EIA report.

1.3 Purpose of the Project

Objective of the EIA Study is to formulate relevant updated EIA reports on a draft basis for the construction of gas transmission pipelines selected for potential JICA finance. GTCL will be the executing agency of the project. The draft update EIA report will be formulated as appropriate so as to meet the requirement of environmental clearance of DOE of Bangladesh and also to conform to the guidelines for environmental and social considerations of JICA (2010).

1.4 Scope of the Present Study

The scoping of an EIA study is the process of short-listing those aspects of the environment which are relevant in the context of the proposed development. Scoping involved making an initial assessment of the nature of impacts which the project may have, and selecting for further study those aspects of the environment which might be affected by these impacts.

Three phases of project implementation are recognized as significant in terms of environmental impacts namely pre-construction, construction and post construction (operation and maintenance). The approach followed in this EIA is to consider the potential impacts of each component by the aforementioned phases of the development activity.

The EIA will identify potential impacts of the proposed project activity on environment, following DOE and JICA guidelines. The available EIA report of 2005 will also be used as a basis to prepare the Environmental Management Plan (EMP) to render or offset adverse impacts. The EMP shall also include Environmental Monitoring Plan and institutional arrangement for future monitoring.

1.5 Methodology

The report is prepared on the basis of the information of the project activities supplied by the project proponent (GTCL) and JICA Study Team. The consultant’s multidisciplinary team of experts made further site visits. The interaction between the project activity and the significant environmental component was made on the basis of a checklist. This checklist was prepared following the DOE

guidelines, different gas development projects and the consultant's experience on similar projects. Environmental and socio-economic data from different sources (BBS, DOE, Department of Meteorology, Agro-Climatic Survey of Bangladesh etc. and other EIA reports) of the proposed project area were collected to prepare baseline environmental and socio-economic profile. The contents of the report are as per the DOE and JICA guidelines.

1.6 EIA Team

BETS management has formed a multidisciplinary team of EIA experts of having experience of conducting Environmental Impact Assessment (EIA) of the similar projects. The list of EIA team members are listed below:

Name	Position
1. Md. Delawar Bakth	Team Leader/ Energy and Environment Expert
2. Dr. Md. Mohsinuzzaman Chowdhury	Biologist
3. Zahidul Islam Miah	Water Quality Specialist
4. Md. Nurul Alam Siddique	Environmental Engineer
5. A K M Fazlul Hoque Majumder	Social Expert
6. Humayun Kabir	ARAP Expert
7. Md. Mahidur Rahman Khan	GIS Specialist
8. Mir Towfiq Hussain	Field Coordinator

1.7 Limitation

Limitation confronted in the EIA study included the following:

- The field study/data collection of the project was hindered for the political unrest of the country

1.8 Acknowledgement

The EIA report is prepared basically with the support from GTCL, JICA Study Team and also from various government agencies including Bangladesh Meteorological Department (BMD), Soil Resource Development Institute (SRDI), Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), Department of Explosives, Department of Environment (DOE), Department of Agriculture Extension (DAE), etc. The project proponent was extremely positive in providing necessary information, documents and guidance during the undertaking and preparation of the Report.

CHAPTER-2

LEGISLATIVE, REGULATORY AND POLICY CONSIDERATIONS

2.1 Introduction

In any country, development projects are governed by some legal and/or institutional requirements. So, assessment of relevant policy, strategy and regulatory issues are very important for any project proponent or developer before they actually execute a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. The following sections review the relevant National legislative, regulatory and policy requirements along with some international ones.

Any Gas Exploration, Production, Transmission and Distribution Company are expected to conduct its operations in compliance with local, national and international legislation. In other words, the proposed project will be executed and operated in accordance with Bangladesh legislations and international agreements to which Bangladesh is a party.

2.2 Legal and Regulatory Framework

2.2.1 The EIA and Planning Process

2.2.1.1 Environmental Impact Assessment (EIA) Process

The policy and legal consideration in the EIA process will be the same and in addition some standards and guidelines of Environment Conservation Rules (ECR) of 1997 will be elaborated i.e. at present there are environmental standards in operation in Bangladesh as promulgated under the ECR of 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges including vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding.

2.2.1.2 Planning Process

EIA is the standard report / format for following up the rules and regulations in the planning process. The GTCL should comply with the policy and legal considerations.

2.2.2 Environmental Agencies

There are a number of agencies and organizations relevant to the environmental considerations/concerns in Bangladesh. Following sub-sections present a precise description of such organizations.

2.2.2.1 Ministry of Forest and Environment (MoFE)

The Ministry of Environment and Forest (MoEF) is the key government institution in Bangladesh for matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEF was created in 1989 and is presently a permanent member of the Executive Committee of the National Economic Council. This group is the major decision-making body for economic policy and is also responsible for approving public investment projects. The MoEF oversees the activities of the following agencies:

- Department of Environment (DOE);
- Department of Forest (DoF);
- Forest Industries Development Corporation;
- Bangladesh Forest Research Institute and Institute of Forestry;
- Forestry Division of the Bangladesh Agricultural Research Council and
- National Herbarium.

Of the above agencies precise description of the first two departments including other pertinent ones are presented below as considered relevant.

2.2.2.2 Department of Environment (DOE)

The Department of Environment (DOE), established in 1989 under the jurisdiction of the MoEF, is the executing agency for planning and implementing environmental issues including, but not limited to, the following activities:

- Reviewing environmental impact assessments and issuing environmental clearance where appropriate;
- Implementing environmental monitoring programs and enforcement measures;
- Developing and maintaining environmental data bases, and
- Coordinating international events with the MoEF (e.g., representing Bangladesh in international seminars, workshops, etc).

The DOE is headed by a Director General (DG) who is supported by a team of Directors, Deputy Directors, Assistant Directors, Engineers, and other technical staff (e.g. chemists and laboratory technicians). The DOE has regional offices, monitoring stations and several laboratories. Figure-2.2-1 shows the Organizational Set-up of DOE.

2.2.2.3 Department of Forest (DoF)

The Department of Forest (DoF), under the Ministry of Environment and Forest, is responsible for protection and management of the Reserve Forests in the country. The department manpower extends down to Union levels in areas where reserve forest exists. Officers of the DoF are responsible for protection of wildlife in these forest areas.

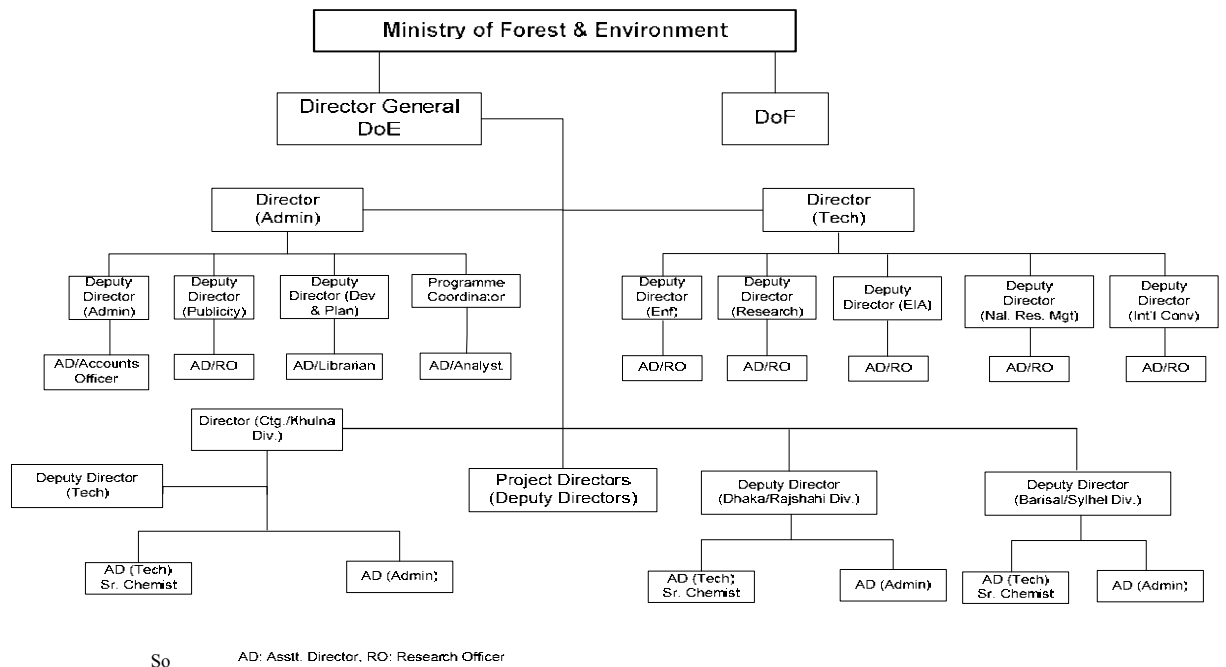


Figure-2.2-1: The Organizational Set-up of DOE

2.3 Relevant National Policies amid Legislation

The key pieces of policy and legislation which apply to such project execution program are described in the following sections.

2.3.1 National Conservation Strategy (NCS) 1992

National Conservation Strategy was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle; however the final approval of the document is yet to be made by the officials of the government.

For sustainable development in the energy sector, the strategy document offered various recommendations but none was there concerning the present specific pipeline project execution program or related matter.

For the 'Energy and Minerals' sector, the relevant strategy recommendations are:

- ✓ To use the minimum possible area of land in exploration sites;
- ✓ Rehabilitate sites when abandoned;
- ✓ To take precautionary measures against Environmental Pollution from liquid effluent, condensate recovery and dehydration plants; and
- ✓ Technology assessment for selection of appropriate technology

2.3.2 National Environmental Management Plan (NEMAP) 1995

The National Environmental Management Action Plan (NEMAP) is a wide ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements for a period during 1995 to 2005 and set out the framework within which the recommendations of the National Conservation Strategy are to be implemented.

NEMAP has the broad objectives of:

- ✓ Identification of key environmental issues affecting Bangladesh;
- ✓ Identification of actions necessary to halt or reduce the rate of environmental degradation;
- ✓ Improvement of the natural and built environment;
- ✓ Conservation of habitats and biodiversity;
- ✓ Promotion of sustainable development; and
- ✓ Improvement in the quality of life of the people.

One of the key issues in NEMAP regarding the energy sector has been that "energy conservation awareness is generally low throughout the country". NEMAP did not recognize mineral resources as an important sector and there is no separate discussion on this.

2.3.3 Forest Policy (1994)

The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation Program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

Amendments of the existing laws (acts, rules and regulations) relating to the forestry sector and creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties and Protocols (ICTPs).

2.3.4 The Bangladesh Forest Act 1927

The Forestry Act of 1927 provides for reserving forests over which the government has an acquired property right. This act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest.

Other Forest Acts

The Supplementary Rules of 1959 empower the concerned governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of wetlands in Bangladesh.

2.3.5 Industrial Policy (1999)

The National Industrial Policy, 1999 aims to ensure a high rate of investment by the public and private sectors, a strong productive sector, direct foreign investment, development of labour intensive industries, introduction of new appropriate technology, women's participation, development of small and cottage industries, entrepreneurship development, high growth of export, infrastructure development and environmentally sound industrial development.

WTO guidelines have been proposed to be followed in the Industry Policy. Following the guidelines may result in conflicts with intellectual property rights. Guidelines for mitigating such possible conflicts are absent in the policy document. No specific guidelines are given for sustainable extraction and utilization of raw materials for different industries.

One of the 17 objectives of the policy (Section 2.12; Chapter II) is "To ensure a process of industrialization which is environmentally sound and consistent with the resource endowment of the country". However, none of the 24 strategies of the policy relate to the environment.

2.3.6 National Water Policy (1999)

The National Water Policy of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

The water policy, however, fails to address issues like consequences of trans-boundary water disputes and watershed management.

2.3.7 National Tourism Policy (1992)

One of the aims of the policy statement is "Development of tourism resources of the country and their maintenance". Two special sections of the policy focus on 'archaeological and historical sites' and 'conservation of wildlife'.

2.3.8 Energy Policy (1995)

The National Energy Policy provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sounds sustainable energy development programs. The Policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.

One of the seven objectives (Section 1.2) addresses the environment and states, "(vi) to ensure environmentally sound sustainable energy development Programs causing minimum damage to the environment".

Seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present project:

- Environmental impact assessment should be made mandatory and should constitute an integral part of any new energy development project;
- Use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation.

2.3.9 Petroleum Policy (1993)

The Petroleum Policy has the primary objective of promoting, monitoring, and regulating all activities in the oil and gas sector in relation to exploration, development, refining, marketing and export. The Petroleum Policy mentions the need to “promote Environmental Impact Assessment” in the oil and gas sector and to formulate various laws, rules and policies for fostering safety and environmental protection. The Petroleum Policy further states that private companies, in consultation with the Ministry of Power, Energy and Mineral Resources and Petrobangla, are to contribute towards improving the state of the environment in their area(s) of operation.

The Petroleum Policy is now an integral part of the Energy Policy.

2.3.10 Bangladesh Gas Act 2010

Bangladesh Gas Act 2010 has been published in the Gazette of 19 July, 2010. This act has been passed in the parliament as 40th Act of 2010 to frame different rules for transmission, distribution, marketing, storage and delivery of natural gas and associated liquid Hydro carbon. This has covered appropriate use of same including relevant other issues. Ch-6 of this act has retained provisions of punishment and penalties up to 5 years or fine or both for theft and violations of different rules and regulations, contracts and agreements in consumption and business of Natural Gas, Condensates, CNG and LPG etc.

2.3.11 Petroleum Act (1974)

The Bangladesh Petroleum Act is enabling legislation which allows the Bangladesh Government to enter into all aspects of petroleum exploration, development, exploitation, processing, refining and marketing. In addition, the Government is authorized to enter into Petroleum Agreement(s) with any person(s) for the purpose of petroleum operations. The duties of such person(s) are:

- To ensure that petroleum operation is carried out in a proper and workman like manner and in accordance with good oil field practice.
- To carry out petroleum operation in any area in a manner that does not interfere with navigation, fishing and conservation of resources.
- To consider the factors connected with the ecology and environment.

Clause 6(2) of the Act sets out certain details related to environment and safety:

“In particular, and without prejudice to the generality of the foregoing provision, a person engaged in any petroleum operations shall, in carrying out such operations in any area:

- Control the flow and prevent the waste or escape’ in the area, of petroleum or water;
- Prevent the escape in that area of any mixture of water or drilling fluid with petroleum or any other matter;
- Prevent damage to petroleum-bearing strata in any area, whether adjacent to that area or not; and
- Keep separate any petroleum pool discovered in the area.”

2.3.12 Environmental Policy (1992)

Bangladesh National Environmental Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. The Environment Policy provides the

broader framework of sustainable development in the country. It also states that all major undertakings, which will have a bearing on the environment, (including setting up of an industrial establishment) must undertake an IEE / EIA before they initiate the project.

The Environment Policy delineates the Department of Environment (DoE), as the approving agency for all such IEE / EIA's to be undertaken in the country.

Policies of fifteen sectors are described in the Policy. Under the Energy and Fuel sector, the use of fuel that has the least environmental impact is encouraged in Section 3.4.1. Conservation of fossil fuel is stressed in Section 3.4.5 and the need for conducting EIA's before implementation of projects for fuel and mineral resources is stressed in Section 3.4.6.

Under the Environmental Action Plan Section of the Policy and sub-section 'Fuel and Energy', it is suggested that:

- The use of gas, coal, kerosene and petrol as fuel will be expanded in the rural areas, so that fuel wood, agricultural residues, and cow dung is conserved. This will help the use of agricultural residues, and cow dung etc. as manure; and
- Appropriate measures will be taken to ensure that extraction; distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem.
- Section 3.7 "Forest, Wildlife and Biodiversity" requires:
 - Conserve Wildlife and Biodiversity, strengthen related research and help dissemination and exchange of knowledge in these areas; and
 - Conserve and develop wetlands and protection of migratory birds.

2.3.13 Bangladesh Wildlife Preservation Act, 1973 (Amended in 1974)

The Bangladesh Wildlife (Preservation) Act of 1973 provides for the preservation, conservation and management of wildlife in Bangladesh. The earlier laws on wildlife preservation, namely, the Elephant Preservation Act 1879, the Wild Bird and Animals Protection Act 1912, and the Rhinoceros Preservation Act 1932 have been repealed and their provisions have been suitably incorporated in this law.

This Act encompasses a range of different activities including hunting and fishing although the provisions of greatest significance relate to the establishment of National Parks, Wildlife Sanctuaries and Game Reserves by the MoEF. Such designations have enormous significance for the types of developments that may take place.

This legislation does not provide scope for creation of a strong organization, which can adopt appropriate measures to protect wildlife. The importance of wildlife could have been highlighted in the legislation, which it does not do. Punitive provisions are not readily usable. The types of endangered and ecologically valuable animals/birds could have been highlighted in the legislation. It should have asked for active participation and specific action from local administration to protect wildlife. It also does not prescribe seasons when certain animal/birds cannot be hunted or captured.

An executive order issued in June 1998, in relation to the Bangladesh Wildlife Preservation Order of 1973 has imposed a ban for the next five years on hunting of any form of wildlife.

2.3.14 Environmental Conservation Act (1995, Amended in 2000 & 2002)

The Bangladesh Environment Conservation Act of 1995 (ECA '95) is currently the main legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has repealed the Environment Pollution Control Ordinance of 1977.

The main objectives of ECA '95 are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The Department of Environment (DOE) executes the Act under the leadership of the Director General (DG).

Bangladesh Environmental Conservation Act (Amendment 2000)

This amendment of the Act focuses on: (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Bangladesh Environmental Conservation Act (Amendment 2002)

This amendment of the Act elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

Bangladesh Environmental Conservation Act 2010

This amendment of ECA '95 has been published on 5 October, 2010 as Bangladesh Environmental Conservation Act, 2010. This is available in Bengali version and has references to the ECA'95 and the aforesaid other amendments. Some changes and inclusions has been made in different clauses particularly in defining the Ecologically Critical Area, framing certain rules and conditions in cutting and/or razing hills, handling disposal of hazardous wastes, managing ship breaking industries & wetlands, fixing responsibilities of environmental and safety management, obligations of obtaining and issuance of environmental clearance certificates and imposing penalties for violations including but not limited to filing cases for compensations, fixing fees and framing different rules under this Act.

2.3.15 Environmental Conservation Rules (1997)

These are the first set of rules, promulgated under the Environmental Conservation Act of 1995 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003). The Environment Conservation Rules of 1997 has provided 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 IEE/ EIA's according to categories of industrial and other development interventions.

The Rules are not explicit for various oil and gas exploration interventions. Rather, this is covered under the broader heading of "exploration, extraction and distribution of mineral resources" under the Red Category Projects.

The proposed project, according to the DOE, is considered under the Red category of the Environmental Conservation Rules, 1997 (Item 65: Exploration, extraction and distribution of mineral resources) [Page 3122 of the Bangladesh Gazette of 28 August 1997].

2.3.16 Mineral Gas Safety Rules 1991 (Amendment 2003)

This document is derived mainly from the American Society of Mechanical Engineers (ASME), American National Standard Institute (ANSI) and British Standards (BS), codes and practices etc. and Petroleum Act, 1934. These Rules deal with the materials, design and construction of gas pipelines, pipeline crossings of railways, testing and commissioning, protection against corrosion, pipeline operation and maintenance, storage and distribution, and reporting of accidents. The Rules are quite prescriptive, and include stipulations as to the separation distances between pipelines and the public properties and thoroughfare. The provisions of the rules have been updated through amendment in 2003.

2.3.17 Explosives Act, 1884

As per section 4 of the legislation,

"(1) "explosive" includes-

(a) means, gun powder, nitro-glycerine, dynamite, gun-cotton, blasting powders, fulminate of mercury or of other metals, cooled fires and every other substance, whether similar to those above-mentioned or not, used or manufactured with a view to produce a practical effect by explosion, or a pyrotechnic effect; and

(b) includes fog-signals, fireworks, fuses, rockets, percussion-caps, detonators, cartridges, ammunitions of all descriptions, and every adaptation or preparation of an explosive as above defined;

(3) "vessel" includes every ship, boat and other vessel used in navigation, whether propelled by oars or otherwise;

(4) "carriage" includes any carriage, wagon, cart, truck, vehicle or other means of conveying goods, or passengers by land, in whatever manner the same may be propelled:

(6) "import" means to bring into (Bangladesh) by sea or land."

Section 6 of the Act provides punishment for contravening notifications issued under the provisions of this law, which may extend to imprisonment of ten years with or without fine amounting to fifty thousand taka. Section 8 provides for punishment for failing to notify the Chief Inspector of Explosives in Bangladesh and also to the Officer-in-Charge of the nearest Police Station in case of an accident due to explosion of any explosives either during manufacturing, possession, usage or carriage. The punishment extends to three months of imprisonment and to a fine of up to five thousand taka.

Under the provisions of Explosives Rules, 2003 (rules made under the provision of section 5 of the Explosives Act, 1884), GTCL will be required to obtain licenses for explosive related activities i.e. import, transport and possession and for such GTCL will apply for a license to import explosives from the Chief Controller of Imports and Exports with the clearance from the Chief Inspector of Department

of Explosives. Application for transport and possession must be sought from the Chief Inspector of Department of Explosives.

2.3.18 Explosives Substances Act, 1908

In this statute in section 2 an “explosive substance” has been defined as follows –2. In this Act the expression “explosive substance” shall be deemed to include any materials for making any explosive substance; also any apparatus, machine implement or material used, or intended to be used, or adapted for causing, or aiding in causing, any explosion in or with any explosive substance; also any part of any such apparatus, machine or implement.”

Section 3 provides for maximum punishment of a life jail term for causing any explosion “...unlawfully and maliciously...to endanger life to cause serious injury to property...“, however, this statute does not come within the purview of this project as there will be no unlawful or malicious intention whatsoever.

2.3.19 Compliance with Bangladesh Labour Act, 2006

GTCL will employ workers in the field for the purposes of the construction works and as such must comply with the Bangladesh Labour Act, 2006. In this statute definition of labour is provided in section 2, whilst classification of a labour is entailed in section 4(1). Every labourer must be provided with a contract and an identification card (section 5). Whilst child labour is clearly defined in section 34, the nature of the activities will inherently exclude any child (section 40) or women labourers (section 45). Compliance to health and safety is provided in Chapters V (sections 51-60) and VI (sections 61-78), and special provisions regarding health and safety are provided in chapter VII (sections 79-85).

With regard to welfare of the labourers, chapter VIII states that first aid materials (section 89) are mandatory.

Regarding working hours for the laborers, chapter IX sections 101 & 102 and section 105-108 (overtime) are required to be followed. Payment of wages of the laborers is provided for in Chapter X (section 120-123 and 137 must be looked at specifically). Compensation for accidents during work (Chapter XII) is contained in sections 150-153 and 155. Schedule IV provides specific mention of laborers engaged in handling explosives and working in mines.

2.3.20 East Bengal Protection and Conservation of Fish Act (1950)

The East-Bengal Protection and Fish Conservation Act of 1950, as amended by the Protection and Conservation of Fish (Amendment) Ordinance of 1982 and the Protection and Conservation of Fish (Amendment) Act of 1995, provides provisions for the protection and conservation of fish in inland waters of Bangladesh. This is relatively unspecific and simply provides a means by which the Government may introduce rules to protect those inland waters not in private ownership.

This is framework legislation with rule making powers. Among others, some of these rules may:

Prohibit the destruction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, by trade effluent or otherwise.

2.3.21 The Protection and Conservation of Fish Rules (1985)

These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that “No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters”. Section 6 of the Rules states that -“No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters”.

2.3.22 The Penal Code (1860)

[Chapter XIV of offences affective Public health, safety, convenience, decency and morals]

The Bangladesh Penal Code of 1860 has some valid provisions related to pollution management, environmental protection and protection of health and safety. Some of these are: Article 277: Falling Water or Public Spring or Reservoir; Article 278: Making Atmosphere Noxious to Health; Article 284: Negligent Conduct with Respect to Poisonous Substance; Article 285: Negligent Conduct with Respect to Fire or Combustible Matter; and Article 286: Negligent Conduct with Respect to Explosive Substance.

2.3.23 Acquisition and Requisition of Immovable Property Ordinance (ARIPO 1982)

This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property.

The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors.

The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women & squatters and such other vulnerable groups are yet to be framed.

The amendments, which has been made to the ARIPO in 1993 has increased the amount of the premium (to reflect market or replacement values) for compulsory acquisition from 25 to 50% on the assessed value of the property. The 1994 amendment provides provision for payment of crop compensation to tenants. The ARIPO does not cover compensation for loss of wage income; it also doesn't cover losses of non-titled persons (squatters, encroachers, etc) aside from crop losses to tenants.

The policy framework and entitlements for the Projects are all based on this national law called Acquisition and Requisition of Immovable Property Ordinance of 1982.

For the purpose of acquisition and requisition of immovable properties in Bangladesh, the government, taking into consideration all previous Acts, Rules, Ordinances etc., have prepared 'Acquisition of Immovable Properties Manual-1997'. This manual guides all acquisition and requisition of immovable properties, for all related purposes whatsoever as well as payment of compensation for all sorts of losses.

2.4 Environmental Requirements for the Project

To execute any project under Red Category should adopt a policy of compliance with all the requirements for environmental permission and clearance, regardless of whether GTCL might otherwise is able to obtain exemptions from some or all of the rules.

In this case, it is necessary for the GTCL to obtain both site clearance and environmental clearance for this pipeline project. Since necessary exemption from submitting IEE for site clearance has already been obtained, this EIA report should be submitted with due coverage of the emergency response plan and the key map of the pipelines along with the list of documents required accompanying the application for environmental clearance for the pipeline project.

No Objection Certificate (NOC) is a prerequisite document for submitting EIA report to DOE and for this, GTCL has to collect NOC from the Jamuna Bridge Authority and the selected CGS areas

union(s) parishad office(s). GTCL will define the CGS location and from the union parishad chairman the NOC shall be collected then. Overall GTCL will submit this EIA report with local authority clearances i.e. NOC for obtaining the ECC from DOE.

It has also to ensure compliance with the Bangladesh Labor Law 2006 policy. The Labor Law encompasses the related occupational health and safety obligations and focus on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation.

2.5 Reference to pre-set criteria such as Protected Areas, sites of Bangladesh

Classification of Protected areas and environmentally-controlled areas in Bangladesh are shown in Table-2.5-1. Those areas are declared as National Park, Wildlife Sanctuary, Game Reserve, Botanical gardens and Eco-parks under the Wildlife (Preservation) Order, Reserved Forests and Protected Forests under the Forest Act and Ecologically Critical Areas (ECA) notified under the Environmental Conservation Act.

Table 2.5-1 Classification of Protected area, environmentally controlled area

Classification		Competent Authority	Governing law
A	National Parks	Department of Forest	Wildlife (Preservation) Order
B	Wildlife Sanctuaries		
C	Game Reserves		
D	Botanical Gardens, Eco-parks		
E	Reserved Forests, Protected Forests		Forest Act
F	Ecologically Critical Areas	Department of Environment	Environmental Conservation Act

(Source: Power System Master Plan 2010)

There are fifteen National parks, thirteen wildlife sanctuaries, five botanical gardens and eco-parks in Bangladesh notified under the Wildlife (Preservation) Order, having total area of 2,702.2 km². List of Protected areas and environmentally-controlled areas declared under the Wildlife (Preservation) Order are shown in Table-2.5-2. The project area is out of the protected area and environmentally controlled/critical area of Bangladesh. None of the area will be affected by the project interventions.

There are nine ECA, and the total area is 8,063.2 km² excluding the Gulshan-Banani-Baridhara Lake in Dhaka. Table-2.5-3 shows a list of ECA designated under the Environmental Conservation Act. The Environmental Conservation Act has provision for ECA declarations by the Director General of the Department of Environment in cases where ecosystem or biodiversity of area is considered to be threatened to reach a critical state. Along with the ECA declaration, each ECA has notification declared in which specific activities to be restricted in that ECA is specified.

Table 2.5-2 List of Protected area, environmentally controlled area

Item	No	Name	Place	Size (km ²)
A	1	Bhawal National Park	Gazipur	50.2
	2	Modhupur National Park	Tangail/ Mymensingh	84.4
	3	Ramsagar National Park	Dinajpur	0.3
	4	Himchari National Park	Cox's Bazar	17.3
	5	Lawachara National Park	Moulavibazar	12.5
	6	Kaptai National Park	Chittagong Hill Tracts	54.6
	7	Nijhum Dweep National Park	Noakhali	163.5
	8	Medha Kachhapia National Park	Cox's Bazar	4.0
	9	Satchari National Park	Habigonj	2.4
	10	Khadim Nagar National Park	Sylhet	6.8
	11	Baraiyadhala National Park	Chittagong	29.3
	12	Kuakata National Park	Patuakhali	16.1
	13	Nababgonj National Park	Dinajpur	5.2
	14	Shingra National Park	Dinajpur	3.1
	15	Kadigarh National Park	Mymensingh	3.4
B	1	Rema-Kalenga Wildlife Sanctuary	Hobigonj	18.0

Item	No	Name	Place	Size (km ²)
	2	Char Kukri-Mukri Wildlife Sanctuary	Bhola	0.4
	3	Sundarban (East) Wildlife Sanctuary	Bagerhat	312.3
	4	Sundarban (West) Wildlife Sanctuary	Satkhira	715.0
	5	Sundarban (South) Wildlife Sanctuary	Khulna	369.7
	6	Pablakhali Wildlife Sanctuary	Chittagong Hill Tracts	420.9
	7	Chunati Wildlife Sanctuary	Chittagong	77.6
	8	Fashiakhali Wildlife Sanctuary	Cox's Bazar	32.2
	9	Dudh Pukuria-Dhopachari Wildlife Sanctuary	Chittagong	47.2
	10	Hazarikhil Wildlife Sanctuary	Chittagong	29.1
	11	Sangu Wildlife Sanctuary	Bandarban	57.6
	12	Teknaf Wildlife Sanctuary	Cox's Bazar	116.2
	13	Tengragiri Wildlife Sanctuary	Barguna	40.5
	D	1	National Botanical Garden	Dhaka
2		Baldha Garden	Dhaka	-
3		Madhabkunda Eco-Park	Moulavibazar	2.7
4		Sitakunda Botanical Garden and Eco-park	Chittagong	8.1
5		Dulahazara Safari Parks	Cox's Bazar	6.0

(Source: <http://www.bforest.gov.bd/conservation.php>, accessed January 2011)

Table 2.5-3 List of Environmental Critical Areas

Item	No	Name	Place	Size (km ²)
F	1	The Sundarbans	Bagerhat, Khulna, Satkhira	7,620.3
	2	Cox's Bazar (Teknaf, Sea beach)	Cox's Bazar	104.7
	3	St. Martin Island	Cox's Bazar	5.9
	4	Sonadia Island	Cox's Bazar	49.2
	5	Hakaluki Haor	Moulavi Bazar	183.8
	6	Tanguar Haor	Sumamganj	97.3
	7	Marjat Baor	Jhinaidha	2
	8	Gulshan-Banani-Baridhara Lake	Dhaka	-
	9	Rivers (Buriganga, Turag, Sitalakhya and Balu) around Dhaka city	Dhaka	-

(Source: Biodiversity National Assessment and Programme of Action 2020, DOE Bangladesh, 2010)

2.6 Environmental Quality Standards

Environmental quality standards for surface water quality, air quality, noise, odor, sewerage, discharge, industrial effluents and industrial project emissions for Bangladesh are furnished in the following Tables.

Table-2.6-1 (A) Standards for Inland Surface Water

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

Source: Schedule-3, Rule 12, Environment Conservation Rules of 1997

Notes:

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

Table-2.6-1 (B) Standards for Drinking Water

Sl. No.	Parameter	Unit	Standard
1	Aluminum	mg/l	0.2
2	Ammonia (NH ₃)	"	0.5

Sl. No.	Parameter	Unit	Standard
3	Arsenic	"	0.05
4	Barium	"	0.01
5	Benzene	"	0.01
6	BOD5 20°C	"	0.2
7	Boron	"	1.0
8	Cadmium	"	0.005
9	Calcium	"	75
10	Chloride	"	150-600*
11	Chlorinated Alkanes	"	
	Carbontetrachloride	"	0.01
	1,1 Dichloroethylene	"	0.001
	1,2 Dichloroethylene	"	0.03
	Tetrachloroethylene	"	0.03
12	Trichloroethylene	"	0.09
	Carbontetrachloride	"	0.01
	1,1 Dichloroethylene	"	0.001
	1, 2 Dichloroethylene	"	0.03
13	Chlorine (Residual)	"	0.2
14	Chloroform	"	0.09
15	Chromium (Hexavalent)	"	0.05
16	Chromium (Total)	"	0.05
17	COD	"	4
18	Coliform (Fecal)	n/100 ml	0
19	Coliform (Total)	n/100 ml	0
20	Color	Hazen unit	15
21	Copper	mg/l	1
22	Cyanide	"	0.1
23	Detergents	"	0.2
24	DO	"	6
25	Fluoride	"	1
26	Hardness (as CaCO3)	"	200-500
27	Iron	"	0.3-1.0
28	Kjeldhl Nitrogen (total)	"	1
29	Lead	"	0.05
30	Magnesium	"	30-35
31	Manganese	"	0.1
32	Mercury	"	0.001
33	Nickel	"	0.1
34	Nitrate	"	10
35	Nitrite	"	<1
36	Odor	"	Odorless
37	Oil and grease	"	0.01
38	pH	"	6.5-8.5
39	Phenolic compounds	"	0.002
40	Phosphate	"	6
41	Phosphorus	"	0
42	Potassium	"	12
43	Radioactive materials (gross alpha activity)	Bq/l	0.01
44	Radioactive materials (gross beta activity)	Bq/l	0.1
45	Selenium	mg/l	0.01
46	Silver	"	0.02
47	Sodium	"	200
48	Suspended particulate matters	"	10
49	Sulfide	"	0
50	Sulfate	"	400
51	Total dissolved solids	"	10000
52	Temperature	°C	20-30
53	Tin	mg/l	2
54	Turbidity	JTU	10
55	Zinc	mg/l	5

Source: Schedule-3, Rule 12, Environment Conservation Rules of 1997

Table-2.6-2: Bangladesh Standards for Ambient Air Quality (All values in micrograms per cubic meters)

Sl. No.	Area	Suspended Particulate Matters(SPM)	Sulfur Dioxide (SO ₂)	Carbon Dioxide (CO ₂)	Oxides Nitrogen (NO _x)
1	Industrial and mixed	500	120	5000	100
2	Commercial and mixed	400	100	5000	100
3	Residential and rural	200	80	2000	80
4	Sensitive	100	30	1000	30

Source: Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Page 3123. Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali)

Note:

1. Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions
2. Any industrial unit located not at a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Residential and Rural' and 'Sensitive'.
3. Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

Table-2.6-3: Bangladesh Standards for Noise

Sl. No.	Area Category	Standard Values (all values in dBA)	
		Day	Night
1	Silent Zone	45	30
2	Residential area	50	40
3	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Source: Schedule 4, Rule-12, Environment Conservation Rules, 1997 (Page 3127, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali)

Note:

1. Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 pm to 6 am
3. Silent zones are areas up to a radius of 100 meter around hospitals, educational institutes or special establishments declared or to be declared as such by the Government. Use of vehicular horn, other signals and loudspeakers is prohibited in silent zones.

Table-2.6-4: Bangladesh Standards for Odor

Parameters	Unit	Values
Acetaldehyde	PPM	0.5-5.0
Ammonia	PPM	1.0-5.0
Hydrogen Sulfide	PPM	0.02-0.2
Methyl Disulfide	PPM	0.009-0.1
Methyl Mercaptan	PPM	0.02-0.2
Methyl Sulfide	PPM	0.01-0.2
Styrene	PPM	0.4-2.0
Trimethylamine	PPM	0.005-0.07

Source: Schedule-8, Rule-12, Environment Conservation Rules, 1997. (Page 3130, Bangladesh Gazette, 28 August 1997) (Own authentic translation from original Bengali version)

Note:

1. Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters):
 $Q = 0.108 \times He^2 \times Cm$, Where Q - gas emission rate (Nm³/hour), He - effective height of the outlet (m)
 Cm - above mentioned standard (PPM)
2. Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Table-2.6-5: Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	25

Parameters	Unit	Values
Suspended Solid (SS)	mg/l	100
Temperature	°C	30
Coli forms	number/100ml	1000

Source: Schedule-9, Rule-12, Environment Conservation Rules, 1997. (Page 3131, Bangladesh Gazette, 28 August 1997), (own authentic translation from original Bengali)

Note:

1. These standards are applicable for discharge into surface and inland water bodies.
2. Chlorination is to be done before Final discharge.

Table-2.6-6: Bangladesh Standards for Industrial Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	irrigable Land
1	Ammonical nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD at 20°C	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as Hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µmhos/cm	1200	1200	1200
14	Total dissolved solids	mg/l	2100	2100	2100
15	Fluoride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total Kjeldahl Nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet set	10
24	Oil and grease	mg/l	10	20	10
25	Phenol compounds (as CeHsOH)	mg/l	1.0	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	to be specified by Bangladesh Atomic Energy Commission)			
28	PH	-	6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total dissolved solids	mg/l	2100	2100	2100
32	Temperature	°C(summer)	40	40	40
		°C (winter)	45	45	45
33	Suspended solids	mg/l	150	500	200
34	Cyanide	mg/l	0.1	2.0	0.2

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3132-3134, Bangladesh Gazette, 28 August 1997), (own authentic translation from original Bengali version)

Note:

- These standards will be applicable for all industries other than those which are specified under 'industrial sector specific standards'.
- These standards will have to be complied from the moment of trial production in case of industries and from the moment of the very beginning in case of projects.
- These standards will have to be met at any point of time and any sampling. In case of need for ambient environment condition, these standards may be made stringent.
- Inland surface water will include drains, ponds, tanks, water bodies, ditches, canals, rivers, streams and estuaries.
- Public sewer means leading to full fledged joint treatment facility comprising primary and secondary treatment.
- Land for irrigation means organized irrigation of selected crops on adequate land determined on the basis of quantum and characteristics of waste water.

Table-2.6-7: Bangladesh Standards for Industrial Project Emissions

Sl. No	Parameters	Values (in mg/Nm ³)
1	Particulates (ka) Power station of capacity of 200 MW or more (kha) Power station of capacity less than 200 MW	150 350
2	Chlorine	150
3	Hydrochloric acid vapor and mist	350
4	Total fluoride (as F)	25
5	Sulfuric acid mist	50
6	Lead particulates	50
7	Mercury particulates	10
8	Sulfur dioxide (ka) Sulfuric acid production (DCDA * process) (kha) Sulfuric acid production (SCSA * process) (*DCDA: Double conversion, double absorption, SCSA; Single conversion single absorption)Lowest height of stack for sulfur dioxide dispersion: (ka) Coal based power plant 500 MW or more 200 MW - 500 MW Less than 200 MW (kha) Boiler Steam per hour- up to 15 tons Steam per hour - more than 15 tons (Q=S02 emission in kg/hour)	kg/ton acid 4 100 275m 220m 14(Q)03 11m 14(Q)03
9	Oxides of nitrogen (ka) Nitric acid production (kha) Gas based power stations 500 MW or more 200 - 500 MW Less than 200 MW (Ga) Metallurgical oven	3 kg/ton acid 50 ppm 50 ppm 40 ppm 30 ppm 200 ppm
10	Kiln soot and dust (ka) Blast furnace (kha) Brick kiln (Ga) Coke oven (Gha) Limekiln	Mg/Nm-1 500 1000 500 250

Source: Schedule-10, Rule-13, Environment Conservation Rules, 1997. (Page 3135-3136, Bangladesh Gazette, 28 August 1997) (own authentic translation from original Bengali).

2.7 International Treaties and Conventions

Bangladesh already had accessed to, ratified or signed a number of major international treaties, conventions and protocols related to environment protection and conservation of natural resources which shall have to be complied with during implementation of any project. The Environment related International conventions, protocols, treaties signed/ratified by Bangladesh are listed below:

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
01.	International Plant Protection Convention (Rome, 1951.)		01.09.78	
02.	International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.))		28.12.81 (entry into force)	
03.	Plant Protection Agreement for the South East Asia and Pacific Region (as amended) (Rome,		04.12.74 (AC) (entry into force)	

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
	1956.)			
04.	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (Moscow, 1963.)	13.03.85		
05.	Treaty on Principles governing the Activities of States in the Exploration and use of outer Space Including the Moon and Other Celestial Bodies (London, Moscow, Washington, 1967.)		14.01.86 (AC)	
06.	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)		04.02.82 (entry into force)	
07.	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").		20.04.92 (ratified)	
08.	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons, and on Their Destruction (London, Moscow, Washington, 1972.)		13.03.85	
09.	Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972.)		03.08.83 (Accepted) 03.11.83 (ratified)	
10.	Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention")	20.11.81	18.02.82	
11.	United Nations Convention on the Law of the Sea (Montego Bay, 1982.)		10.12.82	
12.	Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)		02.08.90 (AC) 31.10.90 (entry into force)	
13.	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)		02.08.90 31.10.90 (AC) (entry into force)	
13a.	London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)		18.03.94 (AC) 16.06.94 (entry into force)	
13b.	Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992		27.11.2000 (AT) 26.2.2001 (Entry into force)	

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
13c.	Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997		27.7.2001 (Accepted) 26.10.2001 (Entry into force)	
14.	Convention on Early Notification of a Nuclear Accident (Vienna, 1986.) 07.01.88 (ratified)		07.02.88 (entry into force)	
15.	Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency (Vienna, 1986.)		07.01.88 (ratified) 07.02.88 (entry into force)	
16.	Agreement on the Network of Aquaculture Centres in Asia and the Pacific (Bangkok, 1988.)		15.05.90 (ratified)	
17.	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989.)		01.04.93 (AC)	
18.	International Convention on Oil Pollution Preparedness, Response and Cooperation (London, 1990.)	30.11.90		In the process of ratification
19.	United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92	15.04.94	
20.	Convention on Biological Diversity, (Rio De Janeiro,1992.)	05.06.92	03.05.94	
21.	International Convention to Combat Desertification, (Paris 1994.)	14.10.94	26.01.1996 (Ratification) 26.12.1996 (entry into force)	
22.	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)		03.10.79 (AC) (entry into force)	
23.	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994.)	28.07.96		
24.	Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (New York, 1995.)	04.12.95		
25.	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction	14.01.93		

Sl. No.	Environment Related International Conventions, Protocols and Treaties	Signed	Ratified/Accessed(AC)/ Accepted(AT)/ Adaptation (AD)	Being Ratified
	(Paris, 1993.)			
26.	United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Paris, 1994.)	14.10.94	26.01.96	
27.	Convention on Nuclear Safety (Vienna, 1994.)	21.09.95	21.09.95 (AT)	
28.	Cartagena protocol on Biosafety to the Convention on Biological Diversity	24.5.2000	05.05.2004 (AC)	
29.	Convention on persistent Organic Pollutants, Stockholm	23.5.2001	12 March 2007	
30.	Kyoto protocol to the United Nations Framework Convention on Climate Change		21.8.2001 (AC) 11.12.1997 (AD)	

Source: "Multilateral Environmental Agreements in force in Bangladesh" Department of Environment (DOE), Bangladesh

The relevant environment related conventions, protocols and treaties are briefly presented below.

2.7.1 International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969))

The main objective of this convention is to take action to prevent pollution of the sea by oil discharged from ships. This Convention applies to all ships, except tankers of under 150 tons gross tonnage and other ships of under 500 tons gross tonnage, registered in the territory of, or having the nationality of, a party. Naval ships and ships engaged in whaling are also excepted (art. 2). Discharges are prohibited, except when a ship is proceeding en route or when the instantaneous rate of discharge does not exceed 60 liters per mile. The prohibition is not applicable when the following conditions are satisfied: in the case of a ship - the oil content of the discharge is less than 100 parts per million parts of the mixture, or the discharge is made as far as practicable from land; in the case of a tanker - the total quantity of oil discharged on a ballast voyage does not exceed one fifteen-thousandth of the total cargo-carrying capacity, or the tanker is more than 50 miles from the nearest land (art. 3); Exceptions to article 3 are provided in cases of necessity to secure safety of ships, save life or prevent damage to cargo, or where leakage is unavoidable and all measures have been taken to minimize it (art. 4). Ships are to be fitted within 12 months to prevent escape of oil into the bilges (art. 7). Parties undertake to provide appropriate facilities at ports and oil-loading terminals (art. 8). All ships covered by the Convention are to carry an oil record book in a form specified in the annex, to be completed whenever certain operations take place (art. 9). Parties agree to send texts of laws, decrees, orders and regulations giving effect to the Convention to the United Nations.

2.7.2 Rio Declaration

The 1992 United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

2.7.3 Convention on Biological Diversity, Rio de Janeiro, (1992)

The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 05 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

The Contracting Parties of the Convention have committed to:

- Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and
- Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account.

Obligation has been placed on State parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 4).

2.7.4 Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971)

This convention is also known as the Ramsar Convention. It was adopted 02 February, 1971 and entered into force on 21 December, 1975. Bangladesh has ratified the Convention 20 April, 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 127 Parties with 1085 wetland sites designated as Wetlands of International Importance'.

This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance', the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves.

Bangladesh has two Ramsar sites- Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) and Tanguar Haor (Northeast of Bangladesh). Both the Ramsar sites are located far away from this proposed project area. (Source: <http://www.ramsar.org/>)

2.7.5 United Nations Convention on the Law of the Sea, Montego Bay, (1982)

This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

Main objectives of the convention are:

- To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and
- To establish basic environmental protection principals and rules on global and regional cooperation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to alt sources of marine pollution.

2.7.6 Others (Convention and Agreements)

The following conventions and agreements may include provisions relevant to different aspects of oil and gas operations for environmental management, nature protection, and biodiversity conservation:

- Convention relative to the Preservation of Fauna and Flora in their Natural State 1933;
- International Convention for the Protection of Birds, Paris, 1950;
- International Plant Protection Convention, Rome. 1951;

- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972: This convention has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (Popularly known as CITES): This provides a framework for addressing over harvesting and exploitation patterns which threaten plant and animal species. Under CITES, governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns; and

Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988): This provides a framework for agreements between countries important to the migration of species that are threatened.

2.8 Compliance with International Guidelines and Standards

Under the study health and safety guidelines of few development agencies will be reviewed. This will include "JICA Guidelines for Environment and Social Consideration" (April, 2010), World Bank Operational Directives (OD-4.00, Annex-A), "Environmental, Health, and Safety Guidelines of the International Finance Corporation Guideline (IFC/EHS Guideline)".

2.8.1 Compliance with JICA Guidelines for Environmental and Social Consideration (April 2010)

JICA, which is responsible for official Development Assistance (ODA), plays a key role in contributing to sustainable development in developing countries. The inclusion of environmental and social costs in development costs and the social and institutional framework that makes such inclusion possible are crucial for sustainable development. Internalization and an institutional framework are requirements for measures regarding environmental and social considerations, and JICA is required to have suitable consideration for environmental and social impacts.

The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

2.8.2 Compliance with World Bank EA process

The WB introduced the Operational directive on Environmental Assessment (OD-4.00, Annex-A) in October 1989. This comprehensive and detailed new policy mandated an environmental assessment for all projects that may have significant impacts on the environment. After two years of the Bank experience with environmental assessments, the operational directive was revised to broaden its scope and applicability. Recognizing that the projects aimed at achieving environmental objectives could sometimes have negative and unanticipated effects, the new revised guideline OD.4.01 was introduced which incorporates a new system of classifying projects according to the nature and extent of their environmental impact. The Bank uses the following three categories to signal the appropriate level of EIA for any given project.

Category A: If the project is likely to have significant adverse impacts that are sensitive, diverse or unprecedented, or that affect an area broader than the sites or facilities subject to the physical area. EA for category A projects examines a project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" condition) and

recommends any measures needed to prevent, minimize, mitigate or compensate for adverse impacts and improve environmental performance. For Category A projects, the borrower is responsible for preparing an EIA report that includes an environmental management plan and a monitoring plan.

Category B: A proposed project falls under Category B if its potential adverse environmental impact on human populations or environmentally important areas including wetlands, forests, grasslands and other natural habitats are less adverse than that of Category A projects. The scope of EIA for Category B projects may vary from project to project, but it is narrower than that of Category A.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

2.8.3 IFC/EHS Guideline

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice, as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement.

2.9 Compliance with EIA Guidelines of DOE

The DOE has issued EIA Guidelines for Industries (this document was released in December 1997) and addresses the IEE and EIA for several industrial sectors and activities. Each Project Proponent shall conduct an IEE or EIA and is expected to consult and follow the DOE guidelines. Figure-2.2 shows the application procedure for obtaining site/environmental clearance.

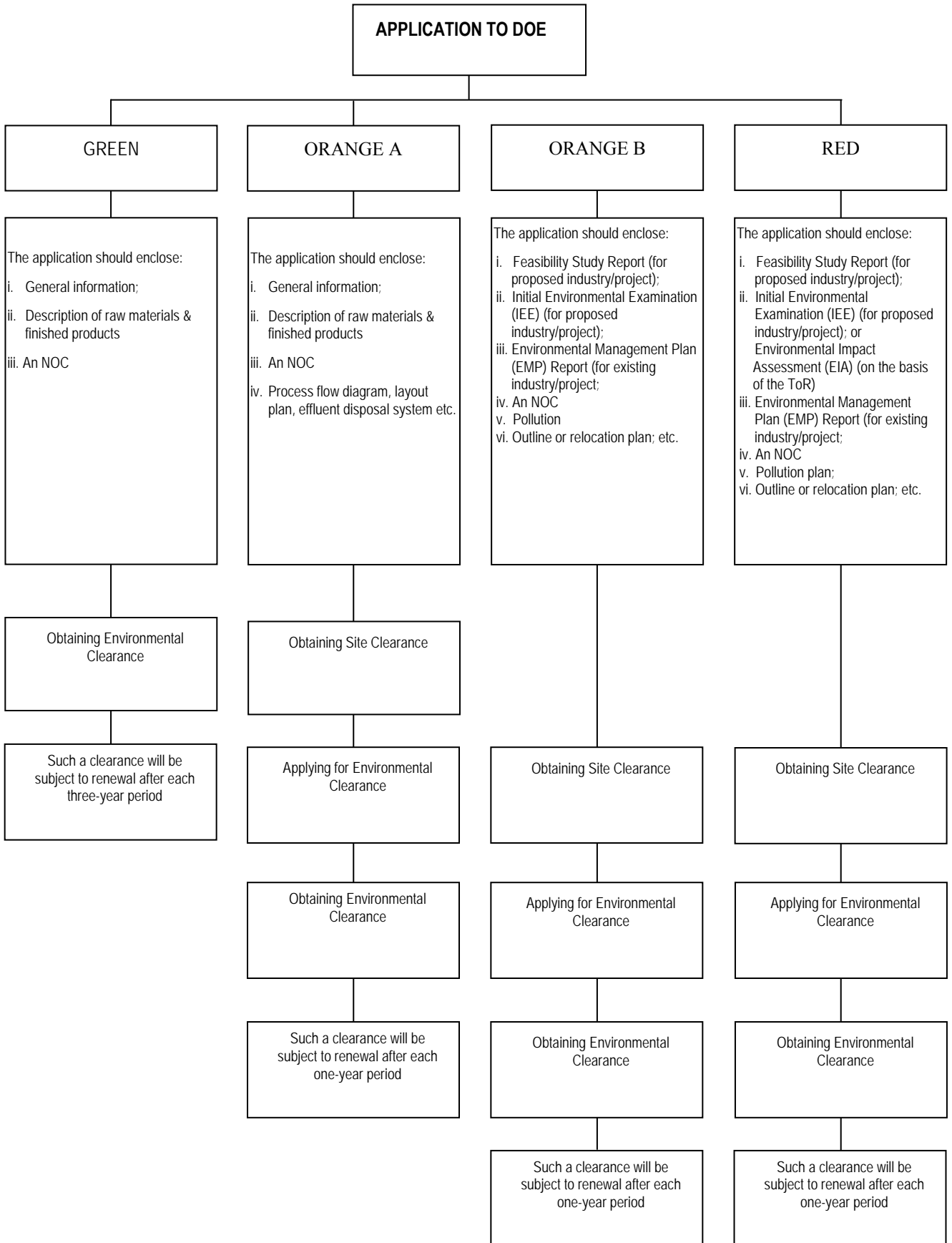


Figure-2.9-1: Steps Involved in Environmental Clearance Following DOE Guidelines

CHAPTER-3 PROJECT DESCRIPTION

3.1 General

Gas Transmission Company Limited (GTCL) has proposed to construct West Bank of Jamuna Bridge-Nalka 30 inch 14kms high pressure gas transmission pipeline, in place parallel to the “West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara Gas Transmission Pipeline Project”. The route of the pipeline would follow the same route as used in available West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara pipeline. The route assumed for the 2005 EIA studies has been reviewed recently (September 2013) by GTCL to confirm its suitability under present condition with focus on any possible minimization of resettlement requirement. As the result of review realignment of the originally planned ROW (2005) in some places along the initial 14km sector of the ROW located between West Bank of Jamuna Bridge-Nalka was made so as to avoid resettlement requirement.

3.1.1 Project Category

As per the criteria of DOE, the gas transmission pipeline falls under the Red Category and the same requires Environmental Impact Assessment (EIA). Though the project has some environmental impact but of lesser degree due to relatively short lengths i.e. only 14 km transmission pipeline with no acquisition for pipeline route which are described in the successive chapters.

3.1.2 Project Justification

The implementation of the proposed project will extend the additional supply of natural gas and thereby reducing Bangladesh’s dependence on imported fuel.

3.2 Project Location

The proposed routing for the high-pressure gas transmission pipeline from West Bank of Jamuna Bridge to Nalka travel through four thanas, six unions and nineteen mouzas of the Sirajganj district. Key route map of the project is shown in Figure-3.2-1. The details of the administrative units are tabulated in Table-3.2-1. Mouza map of the proposed Transmission pipeline is shown in Figure-3.2-2.

Table-3.2-1: Location of West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline Project

Sl. No.	District	Thana	Union	Mouza
1	Sirajganj	Royganj	Nalka	Jhakri
2	Sirajganj	Ullah Para	Hatikumrul	Pachila
3	Sirajganj	Ullah Para	Hatikumrul	Dhopakandi
4	Sirajganj	Ullah Para	Hatikumrul	Charia Shikar
5	Sirajganj	Kamarkhanda	Bhadraghat	Baniaganti
6	Sirajganj	Kamarkhanda	Bhadraghat	Madhya Bhadraghat
7	Sirajganj	Kamarkhanda	Jhawail	Par Jhaul Baghbari
8	Sirajganj	Kamarkhanda	Jhawail	Konabari
9	Sirajganj	Kamarkhanda	Jhawail	Swalpa Mamudpur
10	Sirajganj	Kamarkhanda	Jhawail	Jhaul
11	Sirajganj	Kamarkhanda	Jhawail	Balukul
12	Sirajganj	Kamarkhanda	Jhawail	Bharanga
13	Sirajganj	Sirajganj Sadar	Saidabad	Krishnapur Kadda
14	Sirajganj	Sirajganj Sadar	Saidabad	Sadanandapur
15	Sirajganj	Sirajganj Sadar	Saidabad	Saidabad
16	Sirajganj	Sirajganj Sadar	Saidabad	Dukhiabari
17	Sirajganj	Sirajganj Sadar	Saidabad	Jamtail Khidirpur
18	Sirajganj	Sirajganj Sadar	Saidabad	Jamtail Das
19	Sirajganj	Sirajganj Sadar	Shialkul	Dhukuria

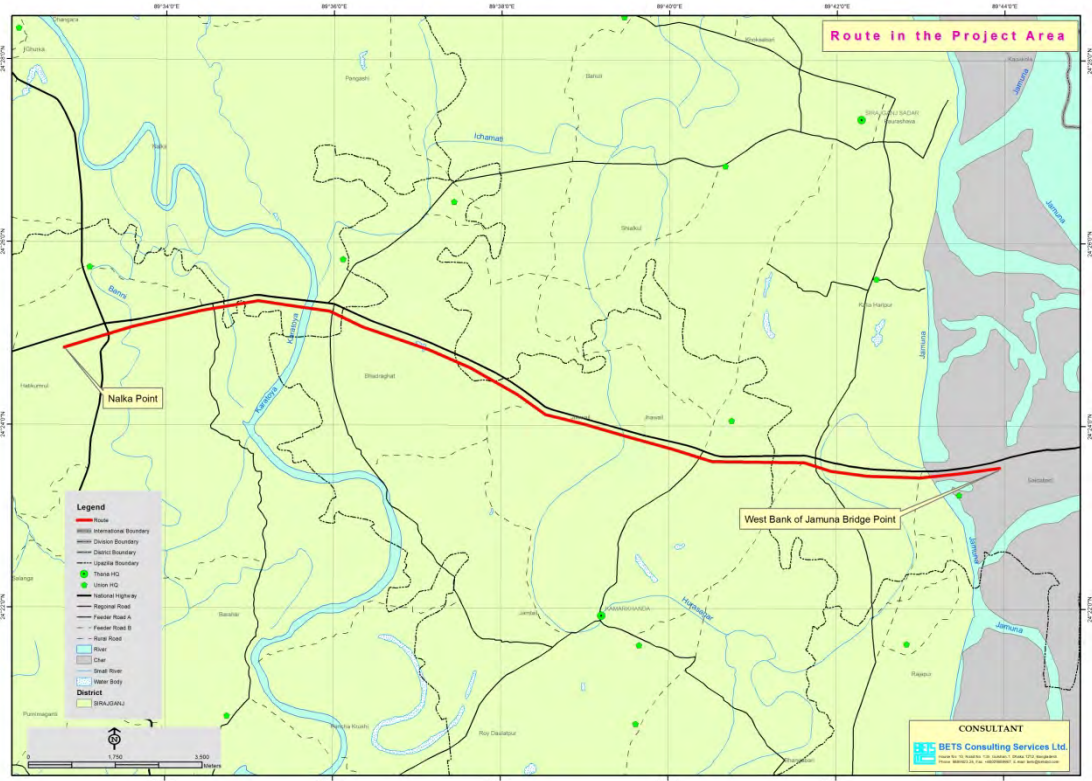


Figure3.2-1: Key Route Map of the Project Area

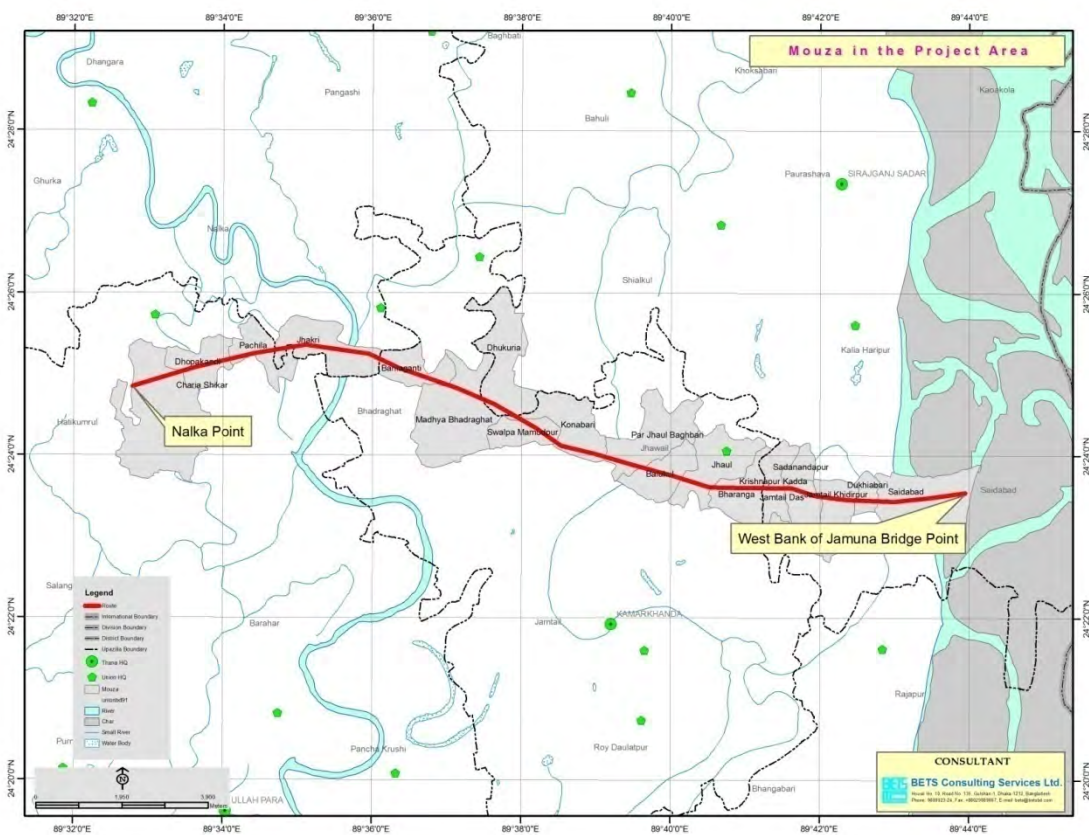


Figure3.2-2: Mouza Map of the Project Area

3.3 Physical Components of the Project

As per JICA Study Team provided data the physical components of the project are:

- I. 14km 30 inch, 1130 psig West Bank of Jamuna Bridge-Nalka high pressure pipeline construction
- II. Three major and seven minor Road Crossings are along the route
- III. One rail crossing along the route
- IV. Hook-up of the proposed pipeline by hot tapping with
 - One interface metering station
 - Five intake/off-take nozzle

3.4 Access to the Project Area

The proposed West Bank of Jamuna Bridge-Nalka high-pressure pipeline will follow the Tangail-Hatikumrul National Highway. The route of the pipeline will be spaced between the existing West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara Gas Transmission Pipeline and Tangail-Hatikumrul National Highway. Construction materials would be carried out from the Highway through these existing access roads at different sites of the project area. Imported materials may be carried out at project site through Dhaka-Chittagong Highway or through railway.

Figure-3.4-1 shows the communication network map, the probable access roads to the ROW for transportation of construction materials, pipeline and other related equipments.

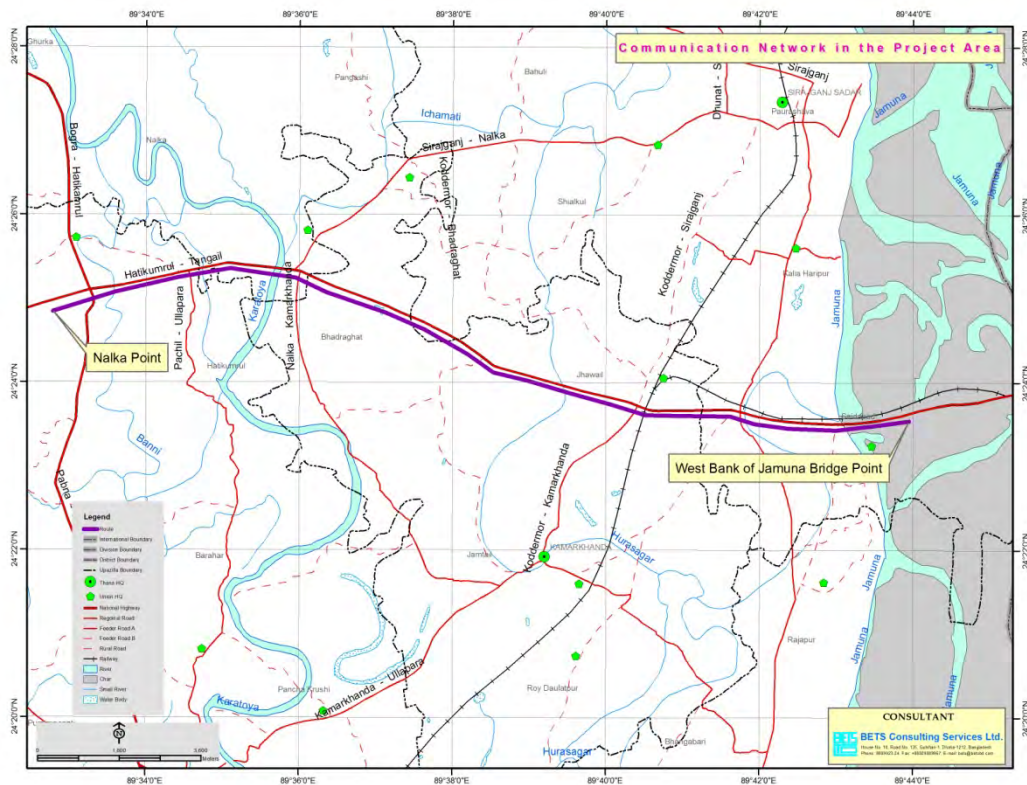


Figure 3.4-1: Communication Network Map of the Project Area

3.5 Basic Data including requirements of land

The basic data of the project are furnished in Table-3.5-1.

Table-3.5-1: Basic Data of the Project

Sl. No.	Item	Description
1.	Name of the Project	West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline

Sl. No.	Item	Description	
2.	Executing Agency	Gas Transmission Company Limited (GTCL)	
3.	Project Location	This 14km West Bank of Jamuna Bridge-Nalka high-pressure pipeline will pass through Sirajganj district.	
4.	Length of Transmission loop line in	14kms	
5.	Size (Diameter)	30 inch	
6.	Gas Transmission pressure at gas supply capacity	At East Bank of Jamuna valve station 750 psig	
7.	Physical work	a) Survey	Reconnaissance survey for EIA study
		b) Pipeline Construction	Construction of 30 inch, 14kms, 1130 psig High pressure Transmission pipeline, pigging, Hydro-testing and commissioning.
		c) River Crossing	No river crossing is on the route way and Horizontal Directional Drilling (HDD) is not required.
8.	Land Requirement	a) Acquisition	2-3 Acres (100mX100m) of land is required for City Gate Station (CGS)
		b) Requisition	No Requisition of land is needed
9.	Civil Construction	a) Office space	227 m ² at Sirajganj
		b) Residential area	300 m ² at Sirajganj
		c) Other construction	35,000 m ³ of Land Development, 1200 sqm of RCC Retaining wall, 400 m of Boundary Wall, 50 m ² of Ansar Building, 25m ² of Garage, 300m ² of Internal Road, 400m of Surface Drain, L.S of Water Supply Facilities, Electrical Supply Facilities, Water Reservoir System & Installation of Solar Panels at Sirajganj.
10.	Procurement	a) Equipment and Machinery	Line pipe, scraper trap, valves, fittings, bends, coating & wrapping materials, CP materials etc.
		b) Transport	Jeep 2 nos. & Micro 2 nos. (Both for Dhanua-Elenga and WBJB-Nalka project)
11.	Manpower of GTCL	a) Implementation period	27 nos. (Both for Dhanua-Elenga and WBJB-Nalka project)
		b) Operation period	60 nos. (Both for Dhanua-Elenga and WBJB-Nalka project)
12.	Project cost	Tk. 93,397.54 Lakh (USD 116.75m) (Both for Dhanua-Elenga and WBJB-Nalka project)	
13.	Project Implementation Period	July 2014 to December 2017 (Both for Dhanua-Elenga and WBJB-Nalka project)	

Source: Draft DPP of GTCL

3.6 Description of Valve Station along Pipeline Route

The proposed routing for the new pipeline from West Bank of Jamuna Bridge to Nalka valve station falls in the Sirajganj districts.

The proposed pipeline will be constructed parallel to the existing West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara Gas Transmission Pipeline Project and the government acquired land. Starting from West Bank of Jamuna valve station, the proposed pipeline will end at the Nalka valve station as a loopline.

3.7 Analysis of Suitability of Alternative Routes

The proposed pipeline will pass within the existing 24" dia pipeline and Tangail-Hatikumrul National Highway by keeping 1.5m safety distance with the existing gas pipeline. No acquisition of land for the pipeline route is required. As per gas safety rules 1991, 1.5m minimum safety clearance from the existing pipeline shall be maintained strictly all along the pipeline route. For this the best option and

as well as the suitable pipeline route of the project is to follow the existing pipeline route by keeping 1.5m clearance.

3.8 Description of Pipeline Construction, Metering Stations and Other Facilities

The design and construction of pipeline to meet local condition is of most important. Key activities during pre-construction phase of pipelines must conform to the Bangladesh Mineral gas safety rules of 1991 amended up to 2003. Pipelines are buried and the clearance from the crown of the pipeline to the surface is minimum 90 cm. All sections of the pipeline must be pigged; therefore, adequate provision has to be kept for this purpose while designing the pipeline system.

➤ Pipeline Route Selection

In this project the pipeline route selection was easy for GTCL, because the existing pipeline of 24" diameter and the available acquired land of Jamuna Bridge Authority all along the transmission pipeline. As per gas safety rules, 1993 (amended in 2003), the pipeline route will follow the existing gas pipeline with 1.5m safety distance from the existing one.

➤ Impact Prediction

Impacts of the pipeline on infrastructure, human and ecological systems are a critical aspect of pipeline route selection and construction.

➤ Miscellaneous Factors to be considered in Pipeline Construction

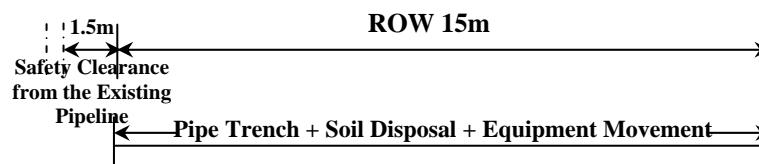
- Temporary Storage and Stack Yard
- Fire Fighting
- Equipment and Vehicle Mobilization
- Construction of Temporary Access Roads

3.9 Key activities during construction phase

In consideration of the basic data of the project as shown in **Table 3.5-1**, the key activities involve survey, pipeline constructions, special crossings & civil construction etc. for the 14km high pressure pipelines from West Bank of Jamuna Bridge-Nalka. The salient features of these activities are highlighted below in the context of environmental considerations:

- *Setting up Pipeline Route and Working Areas*-The pipeline route will follow existing 24" diameter gas pipeline. The minimum safety clearance from the existing pipeline shall be maintained 1.5m as per Gas Safety Rules 1993 amended up to 2003. The width of the normal right of way is 15 meters where pipe trenching, soil disposal & equipment movement shall be carried out.
- *Fences and Gates for Temporary Crossings*- It is essential to demarcate the crossing areas of roads and other special areas. Prior to other construction operations, substantial gates or gaps in all fences must be installed which intersect the right of way to permit passage of construction equipment along the right of way.
- *Grading*- The purpose of grading is to provide adequate right of way access and ditch-line preparation to complete construction. Attempts should be made to lay the pipeline in areas which will minimize grading, thus reducing environmental impacts.

The ROW of the pipe alignment is shown in the sketch below:



The contractor shall prepare the construction working area on the ROW sufficient in width to run the vehicles and for construction of pipelines in accordance with project alignment drawings and specification and good pipeline practice. All existing access, drainage and irrigation system shall be maintained across agricultural land.

- *Route Selection-* Selection of the route has been made so that it provides a “path of least resistance” and ensures the most practical locations. Consideration of good pipeline practices and potential environmental impacts should now be taken in to account.
- *Survey-* Fine-tune the right of way onsite to minimize grading by avoiding previously undetected problem areas.
- *Inspection-* Provide guidance for the Contractor- for quality works keeping good communication at each step of activities.
- *Width of Right-of-Way-*Determine optimum width of right-of-way for the pipeline and its ancillary facilities at different locations.
- *Pipe Diameter Factor-*The larger the diameter of pipe, the greater right of way width is required. Large diameter pipe will not “rope” into the ditch, thus requiring very accurate bends. However, the pipeline of this project being 30” in diameter and there would be no variation in the width of ROW.
- *Ditch Depth Factor-*The amount of soil excavated from the ditch to meet the construction specifications is the main factor in determining the width of right of way with respect to ditch depth.
- *Stringing-*Pipes should be strung only on the right of way which has been cleared and where necessary grading has been completed. Pipe should be strung to facilitate for proper progress of the subsequent activities viz. welding, coating, wrapping, laying etc.
- *Welding-* All pipe joints must be welded in accordance with the proper specification. The welded pipes and joints shall undergo non-destructive testing (NDT) to ensure proper quality of the pipeline joints and necessary repair & replacement of the defective ones as required.
- *Coating and Wrapping of Pipeline-*The pipeline should be of 3 layer polyethylene (PE) coating. Except for Horizontal Directional Drilled crossings all pipelines at river crossings shall be pre-coated with CWC over PE coating.
- *Horizontal Directional Drilling-*There is no HDD in this project.
- *Lowering-*In-Commencement of the laying work shall take place as soon as possible after the trench has been excavated and the NDT and Holiday Detection (HD) are completed. In this operation, special care shall be taken to ensure that the pipe coating sustains no damage and that the pipe is not laid in tension. Any damage to the pipe coating during the lowering operation shall be repaired before back-filling commences.
- *Tieing-In-*Separate welded sections of the pipeline shall be tied-in to a continuous system in such a manner that no stress will be introduced into the pipe as a consequence of the tie-in operation.
- *Protection against Trench Collapse:* For the protection against trench collapse, sloping of the trench by cutting back at the trench walls to an angle should be done where it is unlikely that the soil will shift. Shoring the sides of an excavation using timber, mechanical or hydraulic systems, or using a trench box to protect workers inside a trench should be made. The box is moved along as the trench progresses, with workers

required to be outside of the trench while the trench box is being moved.

- *Cathodic Protection*-Cathodic protection test points shall be installed and connected to temporary cathodic protection facilities in accordance with the specification as the final operation of lowering or tying-in. The installation shall require inspection before back-fill is placed.
- *Back-filling*-Before any back-filling is started, it must be assured that the pipeline is evenly bedded upon the bottom of the trench throughout its length, in its correct position and is not riding upon any stones, rock or other material which may be harmful to the pipe or the coating. When back-filling in progress, no rocks, hard clods or other hard objects shall be permitted to fall on the coated pipe. Compaction of back-filling by an approved method shall be such as to prevent any subsequent settlement.
- *Reinstatement and Clean-Up*-As soon as the pipe has been laid and back-filling in the right of way is completed, all working areas should be cleaned up to ensure that they are returned to their original status as much as possible.
- *Route Markers*
 - Route Marker-Reinforced cement concrete posts (route markers) shall be installed except at aerial marker locations, on both sides of road, river and canal crossings and at interval along the pipeline route with a maximum separation distance of 0.2 km between markers.
 - Aerial Marker-Aerial markers shall be installed at every horizontal bend and at intervals along the pipeline route with a maximum separation distance of 1.6 km between the aerial markers.

Pipeline Cleaning, Pigging, Hydrostatic Testing and commissioning

It is required to carry out hydrostatic strength and leakage tests and drying before the pipeline is accepted for mechanical completion and commissioning. Necessary pigging, purging and dewatering are essential activities for final commissioning of the pipeline sections.

Commissioning

All installation facilities shall be purged with Nitrogen prior to commissioning and provision shall also be made for Nitrogen to be used in the pipeline commissioning phase. Upon completion of the commissioning and appropriate reinstatement and clean up of the ROW including installation of ROW markers and aerial markers in accordance with the program and procedures, to the satisfaction of the engineer, the pipeline system will be taken over for operation by the company.

Metering Stations and Other Permanent Above-ground Facilities

Small permanent parcels of land are required for metering stations, valves/stations, scraper facilities and to provide adequate pipeline clearance at major river crossing. 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 (including the guide lines for scrapers trap stations and river crossing operation).

Scraper Traps

➤ **Purpose**

To clean or internally inspect a pipeline without interrupting fluid flow.

➤ **Location**

Scraper or pig launching traps are located at the start of the pipeline with receiving traps located at the downstream end. Intermediate launching and receiving facilities

are generally installed:

- Where the pipeline length from the nearest launcher exceeds the recommended maximum travel distance of the pig or scraper being used.
- At compressor stations.

➤ **Components**

The following are main components required for scraper trap facilities:

- ❖ Receiver or launcher barrel complete with:
 - Quick-opening closure
 - Barrel Blow-down
 - Barrel drains on receivers.
- ❖ Various valves to alter fluid flow through the assembly.
- ❖ Kicker lines to initiate pig travel or to draw the pig into the barrel.
- ❖ Trap isolation valve.
- ❖ Assemblies bypass flow line.
- ❖ Pig passage indicator.

Valve Assemblies

1) Block Valves

i. Purpose

Block valve assemblies are used to isolate sections of mainline or a long lateral if a line break occurs or when maintenance in a section of the line is necessary.

ii. Required Components

The following are the main components required for a block valve assembly:

- ❖ A gate or ball valve the size of the mainline.
- ❖ Two blows downs, either remote from or directly connected to the mainline, interconnected for equalizing the pressure on both sides of the block valve.
- ❖ A riser on each side of the block valve to provide a power supply for a hydraulic/ pneumatic operator, or for taking fluid samples, connecting pressure gauges or performing flow tests.

iii. Block Valve Location

- Code requirements for maximum block valve spacing vary with Class Location as follows:

Class Location	ASME B31.8	CAN/CSA Z184
1	32 km	None (32 km norm)
2	24 km	25 km
3	16 km	13 km
4	8 km	8 km

- Ease of access and site conditions should always be evaluated when selecting a location for a valve assembly.

2) Side Valves

a. Purpose

- The side valve assembly is required to isolate the lateral from the mainline in situations where a line break may occur or when maintenance of the lateral may be necessary.
- The check valve in the assembly is to prevent reverse flow, or flow from the mainline up the inflowing lateral when the pressure in the lateral is less than that in the mainline. Check valves are not required on sales (off-take) laterals.

b. Required Components

A side valve assembly consists of the following components:

- A gate or ball valve the size of the lateral.
- A check valve and bypass line (receipt laterals).
- A blow down with appropriate valving.
- A flange and insulation set to separate the lateral electrically from the mainline.
- Test leads from the mainline and the lateral.

c. Location

These assemblies are located on the lateral immediately adjacent to the mainline.

Pipeline/ Metering Station Operations

Many activities are associated with operation of gas transmission and distribution pipelines and metering stations. Some of these are:

- Removing and replacement of the length of the pipeline section, valves, meters, regulators etc on occasions for the purposes of inspection, repair & maintenance.
- Repair and maintenance activity
- Pigging of pipe for cleaning purposes. This occurs on an infrequent basis. Significant waste is generated that requires proper disposal.
- Operation and maintenance of metering station. Often includes workshop and vehicle maintenance activities.
- Some hazardous materials (paints, thinners, POL, odorant) are generated.
- Condensate is generated at metering stations which requires proper handling and storage.

3.10 Work Schedule

The project is scheduled to start from July 2014 and will be completed in June 2017. After completion of the project work, GTCL will be able to supply 500 MMCFD gas through this line keeping the pressure at 1130 psig in West Bank of Jamuna valve station and 1000 psig at valve station Nalka respectively. This loop-line will meet the present and future gas demand of Titas Gas and Paschimanchal Franchise Areas. The work schedule of the project is shown in bar chart diagram **3.10-1**.

3.11 Investment cost and funding arrangement

The proposal of proposed 30" dia X 66km (14km WBJB-Nalka + 52km D-E) X 1000psig transmission pipeline project is envisaged for implementation with the following investment cost (Lakh Tk.):

Local Currency (LC)	Tk. 46735.53	USD 58.42 M	
Foreign Exchange (FE)	Tk. 46662.01	USD 58.33 M	
Total	Tk. 93397.54	USD 116.75 M	Source: Draft DPP of GTCL

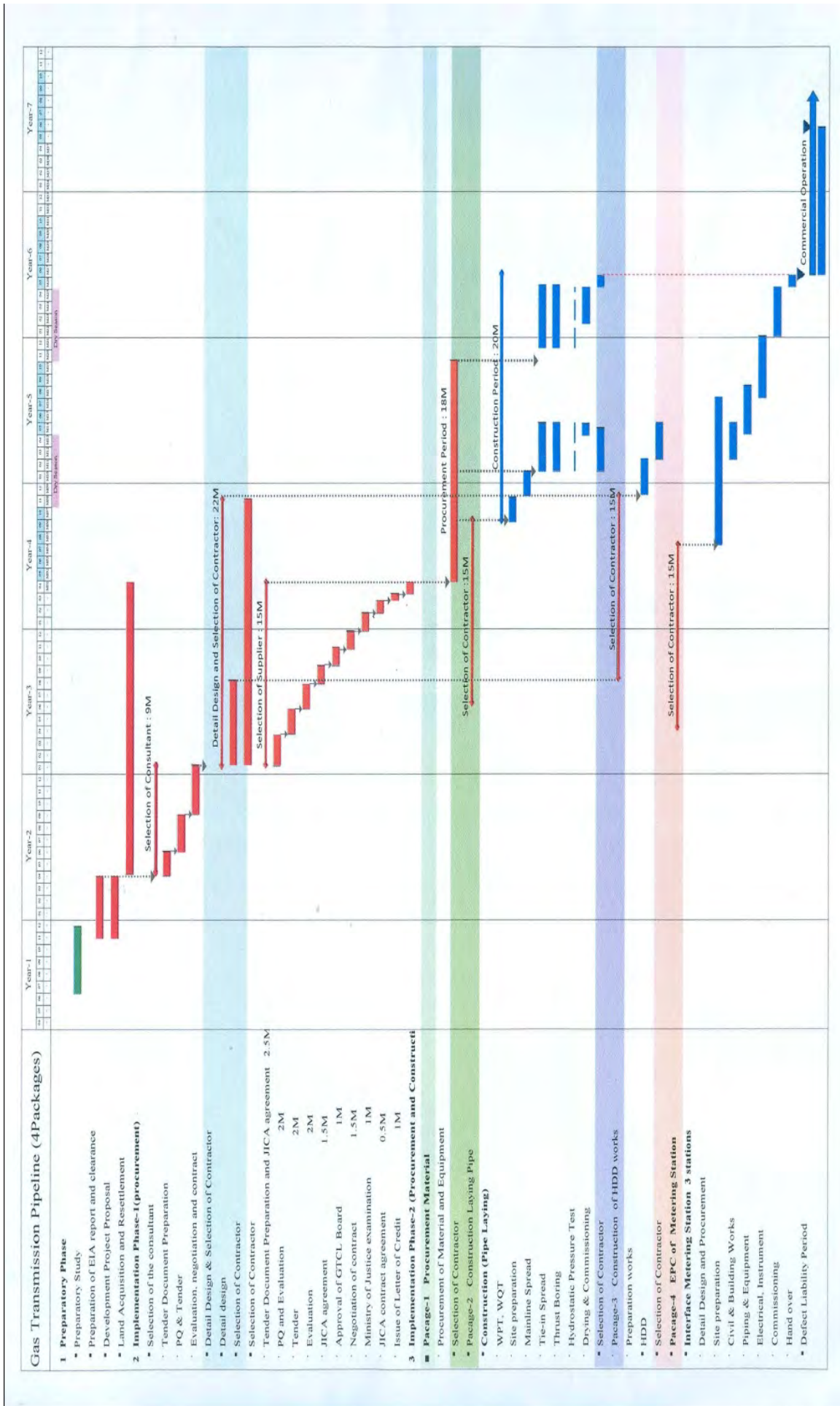


Figure: 3.10-1 Tentative Schedule of the Dhanua-Elenga and West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline Project

CHAPTER-4 BASELINES/EXISTING ENVIRONMENT

4.1 Introduction

There are two principal objectives in examining and defining the existing environment in an EIA study:

- To recognize potential environmental impacts of the project and enable mitigation measures to be identified.
- To provide a baseline against which environmental conditions in the future may be measured, to assist in identifying changes which might be attributable to the project and equally to document conditions which were either existing or developing before the introduction of the project and not due to the project.

Detail environmental features of 14kms West Bank of Jamuna Bridge-Nalka loop-line route have been recorded through field study and secondary data and report reviewing.

For EIA study the emphasis is given on the environmental features that are of particular significance to the present project. Considerations are given to both the environment and ancillary area that seems to be affected.

4.2 Study Area

The following districts, thanas, unions and the numbers of villages fall within the project area. Detailed location of the project area is shown in Table-4.2-1.

Table-4.2-1: Project Area

Project	District	Thana	Union	Mouza
West Bank of Jamuna-Nalka	Sirajganj	Ullah Para	Hatikumrul	3
	Sirajganj	Kamarkhanda	Bhadraghat	2
	Sirajganj	Kamarkhanda	Jhawail	6
	Sirajganj	Sirajganj Sadar	Saidabad	6
	Sirajganj	Sirajganj Sadar	Shialkul	1

The study area is almost entirely agricultural consisting of small plots for raising crops and vegetated areas used for grazing farm animals. Low marshy lands are used for cultivation of paddy. The communities also support fish cultivation in small man made ponds. Individual farming homesteads exist adjacent to the route. The areas adjacent to thanas contain most of the homes and business that support the agricultural effort.

4.3 Physical Environment

West Bank of Jamuna Bridge-Nalka loopleveline route traverses the Brahmaputra Flood Plain and the Young meander flood plain (usually called the Jamuna Flood Plain), comprises irregular pattern of rides and basins with areas of more irregular low laying areas with internal rivers and channels.

4.3.1 Geology

Topographically, the project area is almost flood plain; falls in Barind Tract consists of alluvial sand, Barind clay residuum, alluvial slit, alluvial slit and clay, marshy clay and peat with many depressions, passing through the river Boral, Padma, Pocha Boral and Ichamoti (Garadaho). The alluvial slit, which is the largest Pleistocene Terrace of the country, is made up of the Pleistocene alluvium, also known as older alluvium. Tectonically, this region is situated in the Precambrian Indian Platform, mostly in the saddle and shelf area of the shield. This platform region is covered mostly by tertiary and quaternary sediments and recent alluvium. The Barind is floored by the characteristic Pleistocene sediments known as the Madhupur (Barind) Clay. The Madhupur Clay is reddish brown in color, oxidized, sticky and rather compact old natural levees, high flood plains or filled-in gullies. The

Madhupur Clay, with its average thickness of 8 metres, consists of over-consolidated clayey silt and is underlain by the Plio-Pleistocene Dupi Tila Formation. Most depressions and channels are tectonically controlled.

Sirajganj district lies on the Northern part of Madhupur Tract along the Boral River. This tract is made of sediments of Pleistocene age which is underlain by the Plio-Pleistocene Dupi Tila Formation. Figure 4.3-1 shows the geological map of the project area.

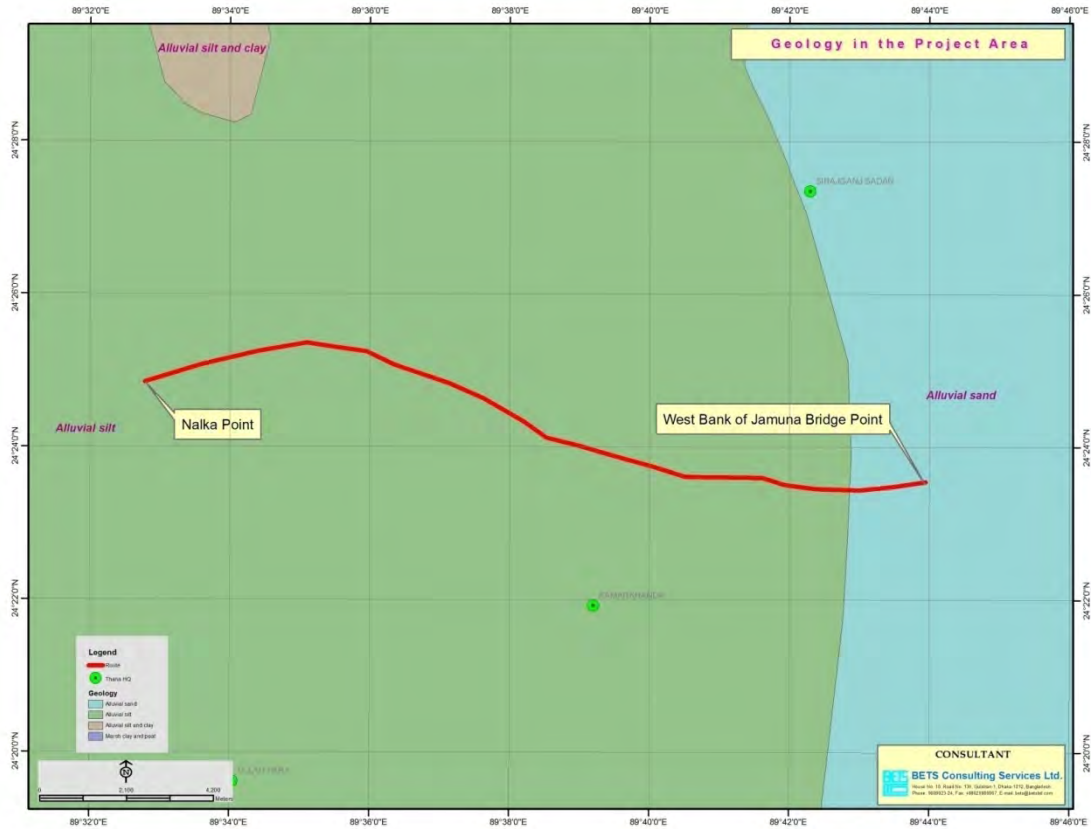


Figure-4.3-1 Geological Map of the Project Area

4.3.2 Topology

The topology of the project area is a plain field all along the route. Sirajganj district falls in the AEZ-4, 5 & 25 i.e. Karatoa_Bangali Floodplain; Atrai Basin & Level Barind Tract. The project area is medium high land i.e. on an average 16m elevation with respect to the Public Works Department (PWD) datum. The route area is relatively high and cannot hold waters during monsoon. Figure-4.3-2 shows the topology of the project area.



Figure-4.3-2 Topology of the Project Area

4.3.3 Ground water

Bangladesh is located over a subsiding basin of tectonic origin with a great thickness of sedimentary strata. This is an unconsolidated alluvial deposit of Recent to sub-Recent age overlying marine sediments. The recent delta and alluvial plains of the Ganges, Brahmaputra and the Meghna Rivers constitute the upper formation. The near surface Quaternary alluvium contains good aquifer characteristics (transmission and storage coefficients). The groundwater storage reservoir has three divisions; upper clay and silt layer, a middle composite aquifer (fine to very fine sand) and a main aquifer consisting of medium to coarse sand. The project areas ground water characteristics are relatively good but high iron content is observed.

4.3.4 Land Conditions (Topography)

The distribution of land levels in relation to seasonal flooding i.e. depth of flooding are the following types:

- i. Highland (H): land which is above normal flood-level.
- ii. Medium Highland (MH): land which is normally flooded about 90 cm deep during the flood season.
- iii. Medium Lowland (ML): Land which is normally flooded between 90 cm. and 180 cm. deep during the flood season.
- iv. Lowland (L): land which is normally flooded between 180 and 300 cm deep during the flood season.
- v. Very Lowland (VL): land which is normally flooded deeper than 300 cm during the flood season.

Project area falls in the Medium High Land where the agricultural activities are mostly taken care of. Figure-4.3-3 shows the land type of the project area.



Figure: 4.3-3 Land Type of the Project Area

4.3.5 Soil

As a flood basin in the confluence of the Brahmaputra and Meghna rivers, the area is subjected to periodic flooding and sediment deposition, which adds fertility for crop production. However, soil fertility is rapidly depleted by up to three planting per year and application of fertilizer is required to provide necessary crop nutrition’s. The government of Bangladesh identified declining soil fertility as a serious national problem in their 1992 Draft Environment Policy.

Food and Agricultural Organization (FAO) conducted a number of surveys in the sixties and developed a detailed soil classification of Bangladesh which is now used for various purposes. The FAO classification presents a series of 28 general soil classes of Bangladesh. The project survey area falls in the following soil tract group:

- Acid basin clays
- Calcareous dark grey floodplain soils and calcareous brown floodplain soils
- Grey Terrace soils

4.3.6 Riverbed Morphology

The term river morphology used to describe the shapes of river channels and how they change over time. The morphology of a river channel is a function of a number of processes and environmental conditions, including the composition and erodibility of the bed and banks (e.g., sand, clay, bedrock); vegetation and the rate of plant growth; the availability of sediment; the size and composition of the sediment moving through the channel; the rate of sediment transport through the channel and the rate of deposition on the floodplain, banks, bars, and bed; and regional aggradations or degradation due to subsidence or uplift. Karatoya River is the only river which has to be crossed by the gas pipeline and this river is almost dried up during the dry season. As per GTCL suggestion this river does not need any HDD for crossing the gas pipeline.

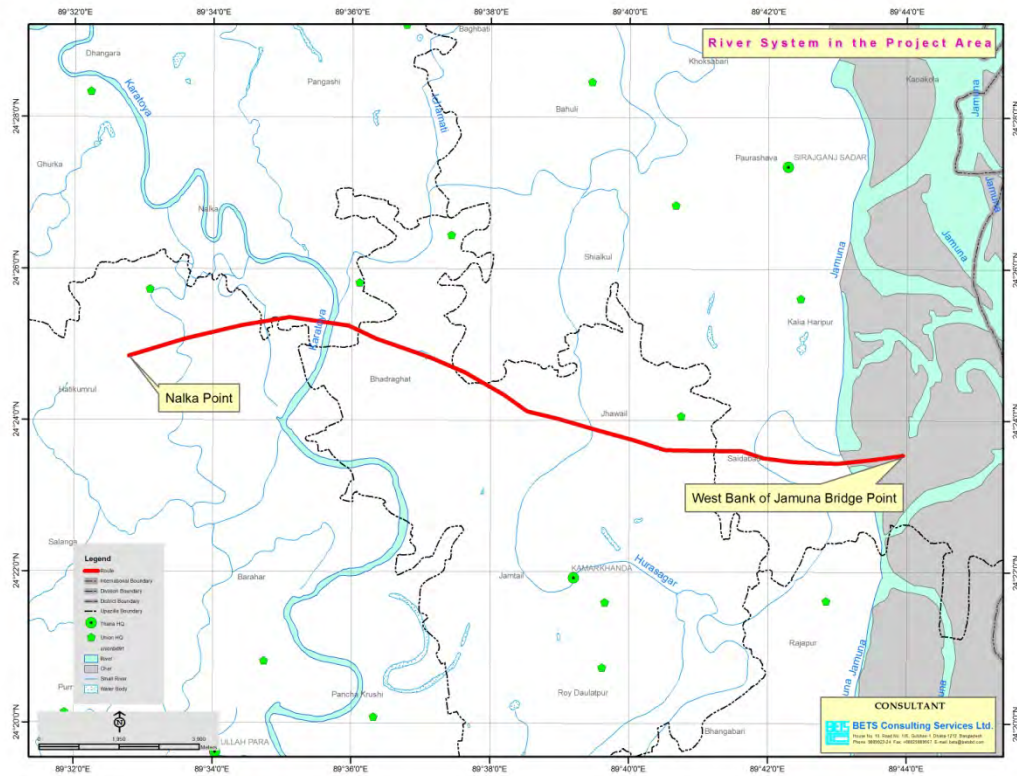


Figure-4.3-4 River System of the Project Area

4.3.7 Seismic Activity

The project area falls within earthquake Zone-II of the seismic-zoning map of Bangladesh. The probable maximum intensity predicted for this zone is 6.0 to 6.5, with a seismic coefficient of 0.05-0.04 (Geological survey of Bangladesh; pers. Comm., 1979). The country is divided into three Seismic Zones with respect to the ranges of seismic co-efficient where the Zone-I is the most severe and Zone-III. Figure-4.3-2 shows the Seismic Zoning Map of the Project Area.

4.3.8 Geomorphology

The project area falls in Karatoa-Bangali Floodplain. This floodplain apparently comprises a mixture of Tista and Brahmaputra sediments. Most areas have smooth, broad, floodplain ridges and almost level basins. The soils are grey silt loams and silty clay loams on ridges and grey or dark grey clays in basins. Five general soil types occur in the region; of which, Noncalcareous Grey Floodplain and Noncalcareous Dark Floodplain soils predominate. They are moderately acidic throughout. Organic matter content is low in ridge soils and moderate in basins. General fertility is medium. Figure-4.3-6 shows the geomorphology of the project area.

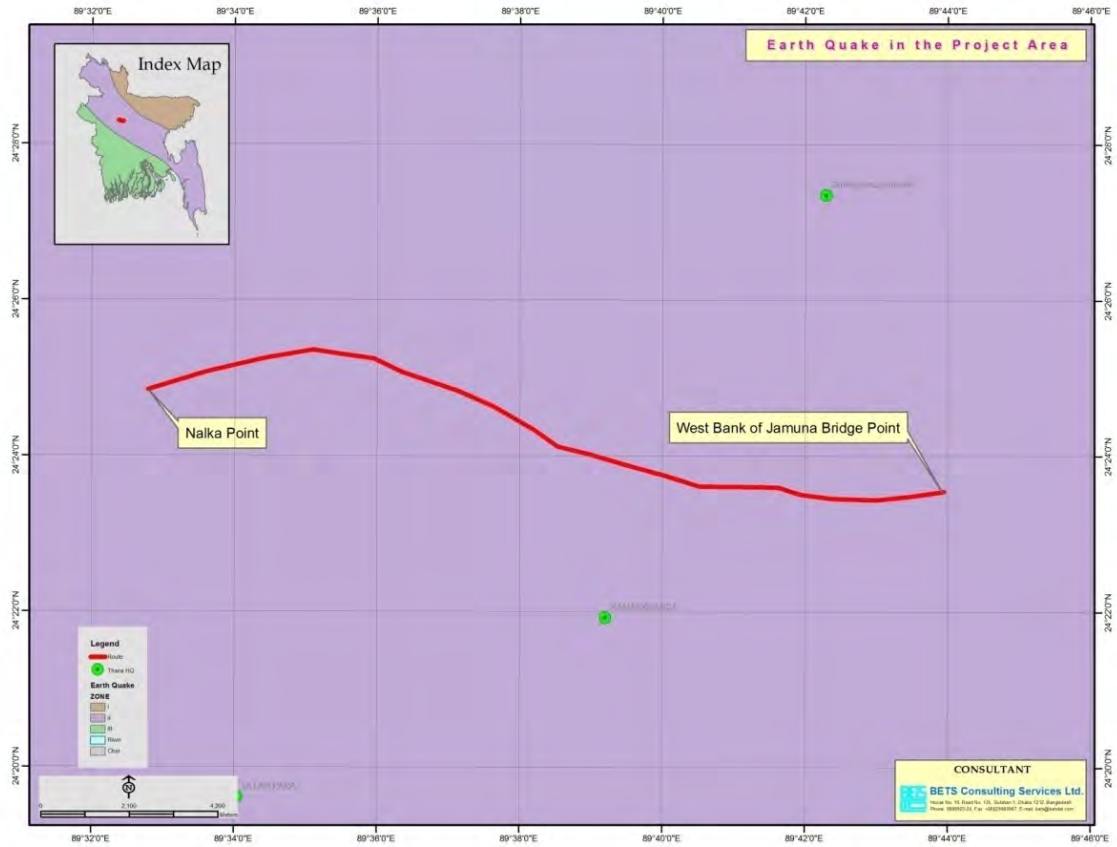


Figure-4.3-5 Seismic Zoning Map of the Project Area

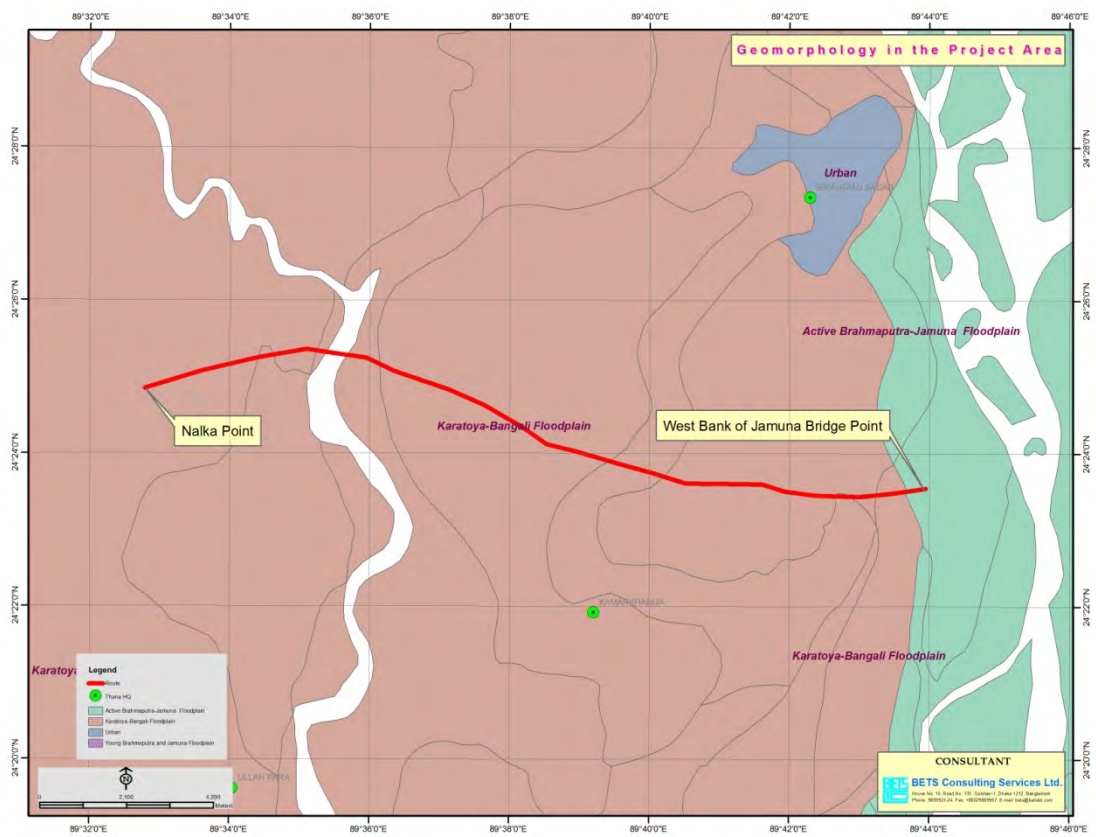


Figure-4.3-6 Geomorphological Map of the Project Area

4.3.9 Meteorology

The region has a tropical climate with three main seasons – the hot and humid summer, the rainy season and the mild and relatively dry winter. The climate of Bangladesh exhibits pronounced seasonal variability associated with monsoon winds - predominantly from the southwest during summer, from the northeast during winter and light and variable during spring and autumn.

Climatic data for the project area was obtained from the meteorological station located in Ishurdi which is maintained by the Bangladesh Meteorological Department (BMD). Meteorological data collected include temperature, humidity and rainfall. Summarized meteorological data are listed below.

Temperature

The average minimum temperature in Bangladesh lies within November to February which varies generally from 6.2°C to 13.4°C while the maximum temperature is seen in May which is around 39.5°C.

Table-4.3-1 Climatic data of the year 2012 in the project Area

Station	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Minimum Temperature (°C)													
Ishurdi		11.55	12.41	17.83	23.05	25.68	26.78	26.48	26.67	26.21	21.70	16.23	11.79
Maximum Temperature (°C)													
Ishurdi		21.52	24.81	29.27	31.01	30.63	31.15	30.79	30.54	30.58	29.86	26.25	21.71

Source: Bangladesh Meteorological Department

Humidity

As seen from meteorological data the average yearly humidity in the region varied from 79% to 87% depicted data of the last ten years. In general, the relative humidity of the study area is the lowest in January to April and from May there is a steady increase until November and then December decrease is observed down to January again.

Table-4.3-2 Monthly Average Relative Humidity 2012 by Station (%)

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Ishurdi	79	66	60	68	71	81	87	86	86	83	80	86

Source: Bangladesh Meteorological Department

Rainfall

The maximum annual rainfall in the last ten year the project area is about 2885mm. In Rabi season (November-February), Pre-monsoon season (March-May) and in Monsoon season (June-October) maximum rainfall are about 86 mm, 69 mm and 215 mm respectively.

Table-4.3-3 Monthly Rainfall of 2012 by Station (mm)

Station	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Ishurdi	12	0	5	51	69	177	215	97	178	157	86	15

Source: Bangladesh Meteorological Department

Table-4.3-4: Climatic Data of the Project Area

Meteorological Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ishurdi Station										
Max. Temp (°C)	30.68	31.06	31.3	31.75	31.2	31	31.9	32.5	30.8	31.39
Min. Temp (°C)	20.61	20.74	21.12	20.87	20.5	20.76	20.8	21.1	20.26	20.53
Rainfall (mm)	1080	1789	1819	1286	1573	1304	1292	893	1736	1062
Humidity (%)	79.75	78.08	77.75	77.33	77.67	79.33	76.42	77.42	78.75	77.75

Source: Bangladesh Meteorological Department

Solar Radiation

Solar radiation design heat flux in Bangladesh is 5 kWh / m².

Winds

Winds around the project area can reach from min 9 km/h (Winter Season) to max 100 km/h (Summer Season).

4.3.10 Hydrology Conditions (Surface and Ground Water Hydrology)

Surface Water: Bangladesh is the world's largest delta and also the land of many water bodies. Water dominates life, people and economy of Bangladesh. Water is the most important re-source of Bangladesh and the basis of its agricultural productivity. But excess of water is the cause of floods, the greatest natural hazard of Bangladesh. The developmental needs have changed the pattern of water use, given rise to conflict of interests, incorporated new technologies and have raised major environmental concerns. The different aquatic ecosystems have their own characteristics and their production patterns. The interaction between water resources, their uses and developmental needs raises many environmental concerns. Main rivers of the project area are the Karatoya River. This river is almost dried in winter and lost its navigability. There are many ponds in the vicinity of the project area.

Ground Water: The ground water table fluctuation of the project area indicates the recharge and discharge to the ground water reservoir. The highest ground water occurs during the month of August-September when the aquifer recharges fully and the lowest ground water table occurs during April-May due to natural discharge and ground water use for domestic and irrigation purposes.

4.3.11 Existing Surface Water and Land Use

In the south of the existing gas pipeline route there were many ponds observed during the field visit. A river named Karatoya was also unearthed in the field visit. Figure-4.3-7 shows the satellite image showing surface water body glimpse of the project area.

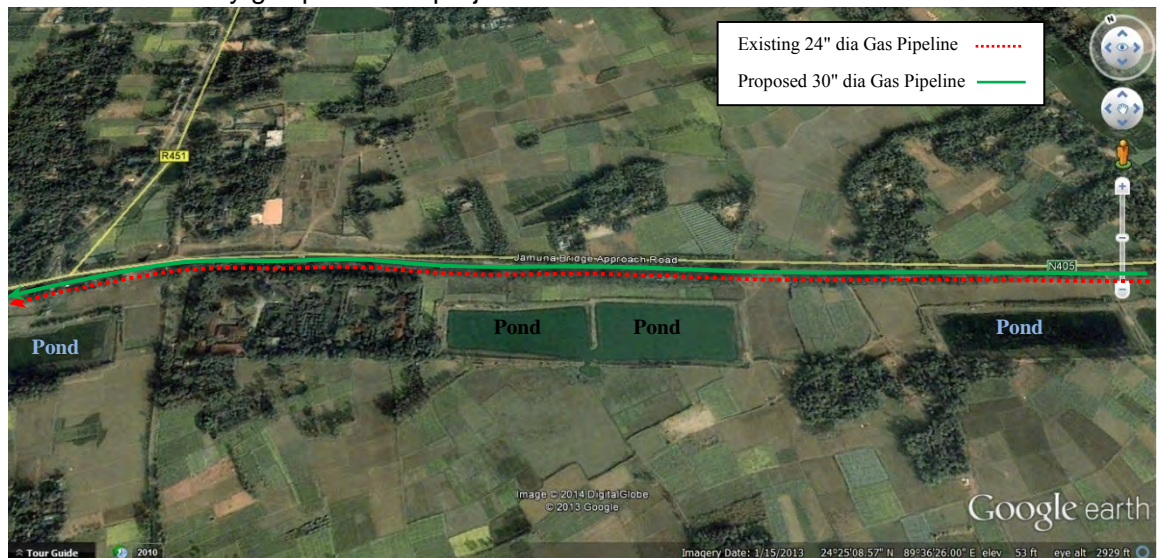


Figure-4.3-7 Satellite Image of Existing Surface Water Body Glimpse of the Project Area

4.4 Environmental Quality

Environmental quality is a set of properties and characteristics of the environment, either generalized or local, as they impinge on human beings and other organisms. It is a measure of the condition of an environment relative to the requirements of one or more species and or to any human need or purpose.

Environmental quality is a general term which can refer to varied characteristics that relate to the natural environment as well as the built environment, such as air and water purity or pollution, noise and the potential effects which such characteristics may have on physical and mental health caused by human activities. In this project study air, water, soil, noise and sediment quality are taken into consideration which are describing in details below.

4.4.1 Ambient Air Quality

There is no official secondary air quality data for the project area due to the non-availability of a regular air quality-monitoring program. However, the prevailing conditions are generally typical of rural Bangladesh, which implies generally good conditions, with the exception of towns, industrial pockets and areas immediately adjacent to roads. These may experience increased pollution from vehicular sources and dust. The principal source of pollutants in the region is from vehicular traffic.

4.4.2 Water Quality

Surface Water: In the vicinity of the project area, five ponds and the only Karatoya River's onsite water quality tests were conducted in the winter season only. All inland surface water quality parameters test results satisfied the Bangladesh Standards (ECR'97). During the field test, minimum ground water level of the ponds and the stagnant surface water condition of the Karatoya River were observed. Location of surface water onsite testing points and its water quality results are listed below:



Onsite Test (OT)-1 (Close to Nalka Valve Station) Pond Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°25'20.53"N 89°35'43.08"E
1	Temperature	°C	-	22
2	pH	-	6.5-8.5	7.8
3	DO	mg/l	≥5	7
4	E.C	(µs/cm)	-	0.2
5	TDS	(mg/l)	-	130

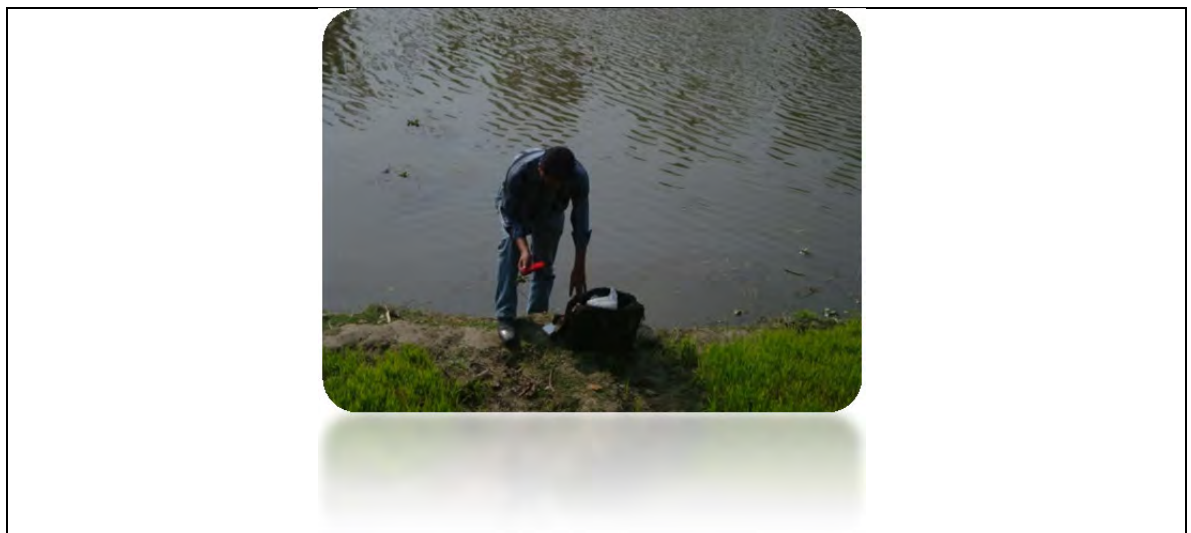


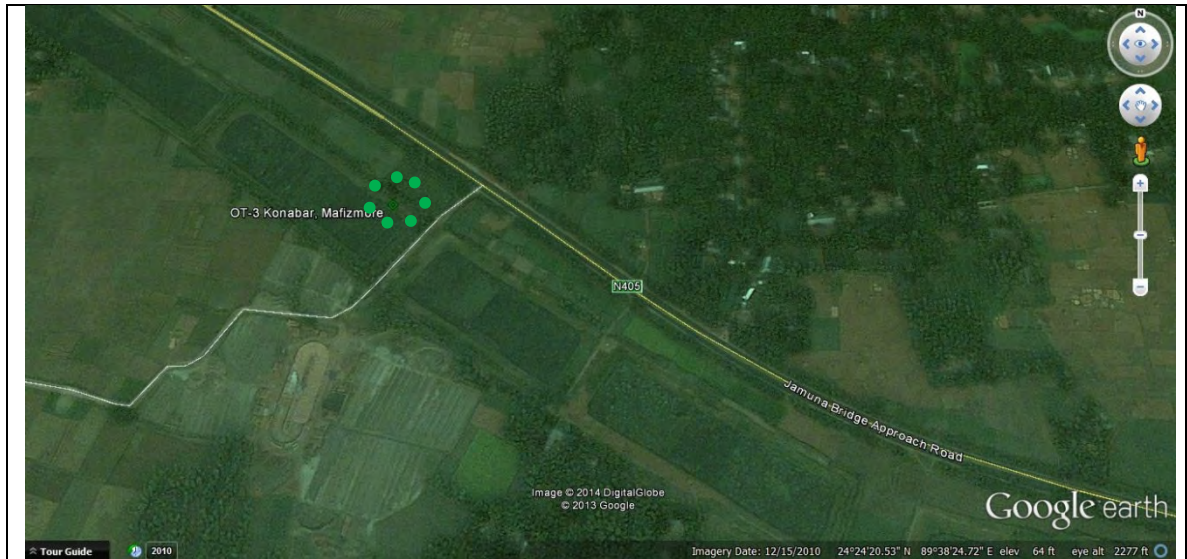
Onsite Test (OT)-2 Pond Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°24'55.80"N 89°36'58.46"E
1	Temperature	°C	-	19
2	pH	-	6.5-8.5	7.7
3	DO	mg/l	≥5	7.4
4	E.C	(µs/cm)	-	0.2
5	TDS	(mg/l)	-	120





Onsite Test (OT)-3 (Konabari Mofizmore) Pond Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result

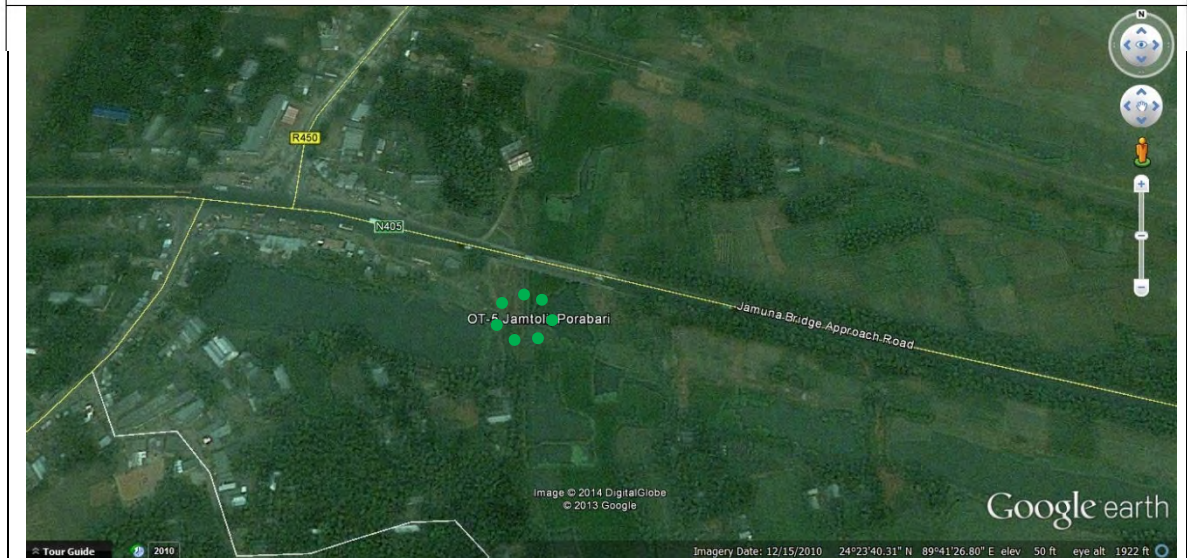
Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°24'19.29"N 89°38'11.48"E
1	Temperature	°C	-	21
2	pH	-	6.5-8.5	7.9
3	DO	mg/l	≥5	7.1
4	E.C	(µs/cm)	-	0.2
5	TDS	(mg/l)	-	130



Onsite Test (OT)-4 (at Balukul) Pond Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result				
Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°23'52.53"N 89°39'39.22"E
1	Temperature	°C	-	20
2	pH	-	6.5-8.5	6.9
3	DO	mg/l	≥5	4.7
4	E.C	(µs/cm)	-	0.2
5	TDS	(mg/l)	-	140



Onsite Test (OT)-5 (at Jamtoli, Porabari) Karatoya River Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°23'39.57"N 89°41'36.25"E
1	Temperature	°C	-	21
2	pH	-	6.5-8.5	7.5
3	DO	mg/l	≥5	7.6
4	E.C	(µs/cm)	-	0.5
5	TDS	(mg/l)	-	280



Onsite Test (OT)-6 (at Saidabad) Pond Water Quality Test Result

Sampling Date: 13th January 2014

Onsite Test Result

Sl. No.	Water Quality Parameters	Unit	BD Standard (ECR'97)	24°23'33.54"N 89°43'36.64"E
1	Temperature	°C	-	21
2	pH	-	6.5-8.5	7.8
3	DO	mg/l	≥5	6.7
4	E.C	(µs/cm)	-	0.4
5	TDS	(mg/l)	-	140

4.4.3 Soil Quality

The land use pattern of the country is influenced by agro ecology, soil physiographic and climatic factors. According to the variations of all these factors and agricultural potential, the total land area has been classified into thirty agro ecological zones which are grouped into twenty major physiographic units. The project area falls into the Karatoya-Bangali Flood Plain. The soil of the project area is acidic silt loamy to clayey and organic content is low. The soil quality of the project area is listed below in Table-4.4-1.

Table-4.4-1: Soil Quality of the Project area.

Sl. No.	Agro-Ecological Zone (AEZ)	Soil Parameter	Soil Quality based on Land Type
1	Karatoya-Bangali Flood Plain	Texture	Silt-Loam
		pH	5.4-5.7
		Organic Matter Status	Low

4.4.4 Noise Level

Yet another serious threat to the quality of the environment is noise pollution. High-intensity sound, such as that emitted by machines used for excavating earth and welding pipes, for long periods of time is disturbing and potentially damaging to nearby human populations and wildlife. When continued for long periods of time it can also permanently damage the hearing of workers engaged in the area. While 50 dB (decibels) creates severe discomfort, 85dB is usually considered as the critical level for ear damage. The Environmental Quality Standards for Bangladesh (DOE, 1997) have set noise guidelines for industrial sites in Bangladesh. According to this standard, noise level should not exceed 75dB in the daytime and 70dB at night. Table-4.4-1 presents noise level standards of Bangladesh. The data show that for sensitive areas like hospitals and schools the ambient noise level is much higher than the allowable limits.

Table-4.4-1: Bangladesh Standard of Noise Level

Sl. No.	Area Category	Standards Values (all values in dBA)	
		Day	Night
1	Silent zone	45	30
2	Residential area	50	40
3	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Source: Schedule 4, Rule-12, Environment Conservation Rules 1997. (Page 3127, Bangladesh Gazette, 28 August 1997). Own authentic translation from original Bengali

Note:

1. Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 p.m. to 6 a.m.

4.5 Biological Environment

Every species of the floral and faunal diversity of the project area play an important role in its natural community and ecosystem and removal of that species is likely to have adverse impact. Bio- habitant of the study area may be divided into major types viz. terrestrial and wetland habitat.

4.5.1 Terrestrial Habitats and fauna

Total thirty nine (39) species of terrestrial fauna were identified during reconnaissance field visit which are very common all over the country. Of the total fauna five (5) species of amphibian, eight (8) species of reptiles, seven (7) species of mammals and 19 (nineteen) species of birds.

Table-4.5-1 Terrestrial Fauna List

Sl. No.	Local Name	Scientific Name	Status
Terrestrial Fauna Amphibian			
1	Kuno Bang	<i>Bufo melanostictus</i>	Common
2	Geso Bang	<i>Rhacophorus maximus</i>	F. Common
3	Ballon Frog	<i>Uperonon globulus</i>	-
4	Jhi Jhi Bang	<i>Rana timnocharis</i>	-
5	Sona Bang	<i>Rana tigruna</i>	Rare
Terrestrial Fauna Reptiles			
1	Dhura Shap	<i>Amphiesma stolata</i>	Common
2	Matik Shap	<i>Atrretium schistosum</i>	Common
3	Tiktiki	<i>Hemidactylus brooke</i>	Common
4	Kari Katta	<i>Kachugotectum</i>	Common
5	Daraish Shap	<i>Ptyas mucosus</i>	Common
6	Gokhra	<i>Naja lutra</i>	F. Common
7	Kassap	<i>Chitra idica</i>	Rare
8	Gui Shap	<i>Varanus nubulosus</i>	Rare
Terrestrial Fauna Mammals			
1	Badur	<i>Pteropus giganteus</i>	Common

Sl. No.	Local Name	Scientific Name	Status
2	Idur	<i>Mus musculus</i>	Common
3	Shial	<i>Vulpes bengalensis</i>	Common
4	Chika	<i>Pipistrellus.sp</i>	Common
5	Bagdash	<i>Viverra zibetha</i>	F. Common
6	Khekshial	<i>Canes aureas</i>	F. Common
7	Begi	<i>Herpestes</i>	Rare
Terrestrial Fauna Birds			
1	Choroi	<i>Passer domesticus</i>	Common
2	Doyel	<i>Opsychus sularis</i>	Common
3	Bulbuli	<i>Spizixos canifreons</i>	Common
4	Bagari	<i>Emberiza spodocephala</i>	Common
5	Ghughu	<i>Streptapelia Orientalis</i>	Common
6	Shalik	<i>Stuma contra</i>	Common
7	Kak	<i>Carvus splendens</i>	Common
8	Bok	<i>Ardea alba</i>	Common
9	Kokil	<i>Eudynamus scolopacea</i>	F. Common
10	Tuntuni	<i>Orthotomus sutorius</i>	F. Common
11	Chil	<i>Milvus migrans</i>	F. Common
12	Machranga	<i>Helcyon smyrrensis</i>	F. Common
13	Tota	<i>Psittacula alezandari</i>	F. Common
14	Tia	<i>Psittacula Krameri</i>	F. Common
15	Badur	<i>Pteropus giganteus</i>	F. Common
16	Pecha	<i>Tyto alba</i>	Rare
17	Halud pakhi	<i>Oriolus xanthornus</i>	Rare
18	Shakun	<i>Gyps bengalensis</i>	Rare
19	Kathokra	<i>Picus canus</i>	Rare

Source: Field Observation

Endangered and threatened Species

The reconnaissance survey report shows that five species were in Endangered and five species were in threatened. Out of recorded thirty nine terrestrial fauna of the project area, classified endangered and threatened species of different categories are shown in tabular form below.

Table-4.5-2 Endangered and threatened fauna list

Sl. No.	Local Name	Scientific Name	Status
Amphibian			
1	Jhi Jhi Bang	<i>Rana Limnocharis</i>	Endangered
2	Sona Bang	<i>Rana tigrina</i>	Threatened
Reptiles			
1	Gokhra	<i>Naja lutra</i>	Endangered
2	Gui Shap	<i>Varanus flevescens</i>	Threatened
Mammals			
1	Khekshial	<i>Vulpes bengalensis</i>	Endangered
2	Khatash	<i>Viverricula indica</i>	Threatened
Birds			
1	Mach Ranga	<i>Helcyon smyrrensis</i>	Endangered
2	Halud Pakhi	<i>Oriolus xanthornus</i>	Endangered
3	Pecha	<i>Tyto alba</i>	Threatened
4	Kath Thokra	<i>Picus canus</i>	Threatened

Source: Field Observation

Terrestrial Natural Flora

Total 36 (thirty six) terrestrial flora species were recorded during reconnaissance field visit in the project area. The major habitat patterns of the project were the agricultural fields, homesteads, roadside and open land. Flora identified through interview were classified under three categories as stated below:

- ✓ Terrestrial Natural flora

- ✓ Terrestrial planted flora and
- ✓ Medicinal flora

The recorded terrestrial floras from field area under each category have been listed below.

Table-4.5-3 Terrestrial Flora

Sl. No.	Local Name	Scientific Name	Status
Natural Flora			
1	Boiraj	<i>Anesoptera scaphula (Roxb)</i>	Common
2	Jam	<i>Syzygium spp</i>	Common
3	Bansh	<i>Bambusa spp</i>	Common
4	Am	<i>Melia agedaroch</i>	Common
5	Korrooi	<i>Albizia procera benth</i>	Common
6	Kadam	<i>Anthocephalus chinensis</i>	Common
7	Sitki	<i>Phyllanthus reticulates</i>	Common
8	Borrooi	<i>Zizyphus mauritiana</i>	Common
9	Peyara	<i>Psidium guajava</i>	Common
10	Kalagas	<i>Musa spp</i>	Common
11	Shimul	<i>Bombax cetha</i>	F. Common
12	Tetul	<i>Tamarindus indicus L.</i>	F. Common
13	Dumur	<i>Ficus hispida L.f</i>	F. Common
14	Shora	<i>Streblus asper (Lower)</i>	F. Common
15	Jika	<i>Lannea Koromandelica</i>	F. Common
16	Tal	<i>Botshddud flabellifra L.</i>	Rare
17	Hizal	<i>Borringtonia racemosa</i>	Rare
18	Nim	<i>Acadirachta indica</i>	Rare
Planted Flora			
1	Amgas	<i>Melia agedarach</i>	Common
2	Kathal	<i>Artocarpus heterophutlus</i>	Common
3	Supari	<i>Areca catechu</i>	Common
4	Kadam	<i>Anthocephalus chinensis rich</i>	Common
5	Satni	<i>Alstonia acholaris Br.</i>	Common
6	Kalagas	<i>Mysa spp.</i>	Common
7	Lebu	<i>Citrus aurantifolia</i>	F. Common
8	Peara	<i>Psidium guajava</i>	F. Common
9	Narikel	<i>Cocos nucifera</i>	F. Common
10	Jampbura	<i>Citrus grandis</i>	F. Common
11	Tetul	<i>Tamarindus indicus</i>	Rare
12	Jalpai	<i>Elacocarps roustus</i>	Rare
13	Tal	<i>Borrassus flabellifera L</i>	Rare
Herbal/ Medicinal Flora			
1	Akhanda	<i>Calotropis gigantea</i>	Common
2	Bashok	<i>Adhtoda vasica nees</i>	Common
3	Tulshipata	<i>Ocimum americanun L.</i>	Common
4	Dumur	<i>Ficus hispida L.F.</i>	Common
5	Nim	<i>Acadirachta indica</i>	Common

Source: Field Observation

Endangered and threatened Terrestrial Natural Flora

Two endangered and two threatened species were found in the project area out of the studied 36 (thirty six) species.

Table-4.5-4 Endangered and threatened flora list

Sl. No.	Local Name	Scientific Name	Status
1	Tal	<i>Borrassus flabellifera L.</i>	Endangered
2	Tetul	<i>Tamarindus indicus L.</i>	Endangered
3	Tezpata	<i>Cinnamomum tamala (Nees)</i>	Threatened
4	Jambura	<i>Citrus grandis</i>	Threatened

Source: Field Observation

4.5.2 Aquatic life and fisheries

Aquatic Fauna

Total six (6) aquatic fauna species were recorded from the project area. These aquatic faunas directly depend on the availability of water bodies. Most of the water bodies were intensively exploited and habitat was highly disturbed by human intervention. Aquatic fauna are listed in the tabular form below:

Table-4.5-5 Aquatic Fauna

Sl. No.	Local Name	Scientific Name	Status
1	Kakra	<i>Seylla serratta</i>	Common
2	Shamuk	<i>Anastemus oscitans</i>	Common
3	Bang	<i>Bufo melanostictus</i>	Common
4	Guishap	<i>Varanus bengalensis</i>	F. Common
5	Dhora Shap	<i>Xencehrophis piscator</i>	F. Common
6	Kachim	<i>Trionyx gangeticus</i>	F. Common

Source: Field Observation

Endangered and Threatened Aquatic Fauna

One endangered and one threatened aquatic fauna out of six species were observed in the project area. They are listed below:

Table-4.5-6 Endangered and Threatened Aquatic Fauna

Sl. No.	Local Name	Scientific Name	Status
1	Gui Shap	<i>Varanus bel/ ngalensis</i>	Endangered
2	Kachim	<i>Trionyx gangeticus</i>	Threatened

Source: Field Observation

Aquatic Flora

Total eight (8) aquatic floras were recorded from the project area. In a tabular form these are listed below:

Table-4.5-7 Aquatic Flora

Sl. No.	Local Name	Scientific Name	Status
1	Dholkalmi	<i>Ipomoea fistulosa</i>	Common
2	Muthagas	<i>Cyperus spp</i>	Common
3	Kachuripana	<i>Elchhornis</i>	Common
4	Sheola	<i>Biysca octandra</i>	Common
5	Ghagra	<i>Xanthium indicum</i>	Common
6	Khudi Kachuripana	<i>Lemna Spp</i>	F. Common
7	Hizal	<i>Baringtonia acutangula</i>	F. Common
8	Kalmi	<i>Ipomoea albo L.</i>	F. Common

Source: Field Observation

Endangered and Threatened Species

One endangered and one threatened aquatic flora out of six species was experiential in the project area. They are listed below:

Table-4.5-8 Endangered and Threatened Aquatic Flora

Sl. No.	Local Name	Scientific Name	Status
1	Jal Padma	<i>Nelumbo nucifera gaertn</i>	Endangered
2	Sheorah	<i>Streblus asper lour</i>	Threatened

Source: Field Observation

Fisheries:

Considering the fish sanctuary and fish production of the country the project area are not so important like other region. The following fishes are common in the inland surface water of the project area.

Some common fishes of the project area are listed below:

- Mola (*Amblypharyngodon mola*)
- Tilapia (*Oreochromis mossambicus*)
- Phopa Chanda (*Pseudambassis baculis*)
- Chenua (*Sisor rabdophorus*)
- Pangasius (*Pangasianodon hypophthalmus*)
- Arwari (*Hemibagrus menoda*)
- Puiya (*Lepidocephalichthys berdmorei*)
- Putitor mohashoul (*Tor putitora*)
- Ghora chela (*Securicula gora*)
- Chela (*Salmostoma acinaces*)
- Darkina (*Rasbora daniconius*)
- Mola punti (*Puntius guganio*)
- Gilipunti (*Puntius gelius*)
- Black Carp (*Mylopharyngodon piceus*)
- Koi (*Cyprinus carpio*)
- Engraulidae (*Setipinna taty*)
- Broadhead Catfish *Clarias gariepinus*
- Tiashol(*Channa barca*)
- Katol (*Catla Catla*)
- Rajputi (*Barbonymus Gonionotus*)

4.5.3 Biodiversity/Environmentally Sensitive Areas

The Bangladesh Environment Conservation Act, 1995 includes provision for Ecologically Sensitive Area (ESA) declarations by the director general of the Department of the Environment in certain cases where the ecosystem is considered to be in danger of reaching a critical state. If the government is satisfied that due to the degradation of the environment, the ecosystem of any area has reached or is danger of reaching a critical state, the government may, by notification in the official gazette, declare that area an ESA. The government shall specify, through the notification provided in sub-clause (1) or by separate notification, which of the operations or processes cannot be initiated or continued in the ESA. Our project area is out of the designated ESA of Bangladesh. The gas pipeline in future will not affect the ESA.

Table 4.5-9: Ecologically Sensitive Areas

Sl. No.	Name	Districts	Area (Ha)
1	The Sundarbans	Bagerhat, Khulna, Satkhira	762,034
2	Cox's Bazar (Teknaf, Sea beach)	Cox's Bazar	10,465
3	St. Martin Island	Cox's Bazar	590
4	Sonadia Island	Cox's Bazar	4,916
5	Hakaluki Haor	Maulavi Bazar	18,383
6	Tanguar Haor	Sunamganj	9,727
7	Marjat Baor	Jhinaidha	200
8	Gulshan-Banani-Baridhara Lake	Dhaka	n.a

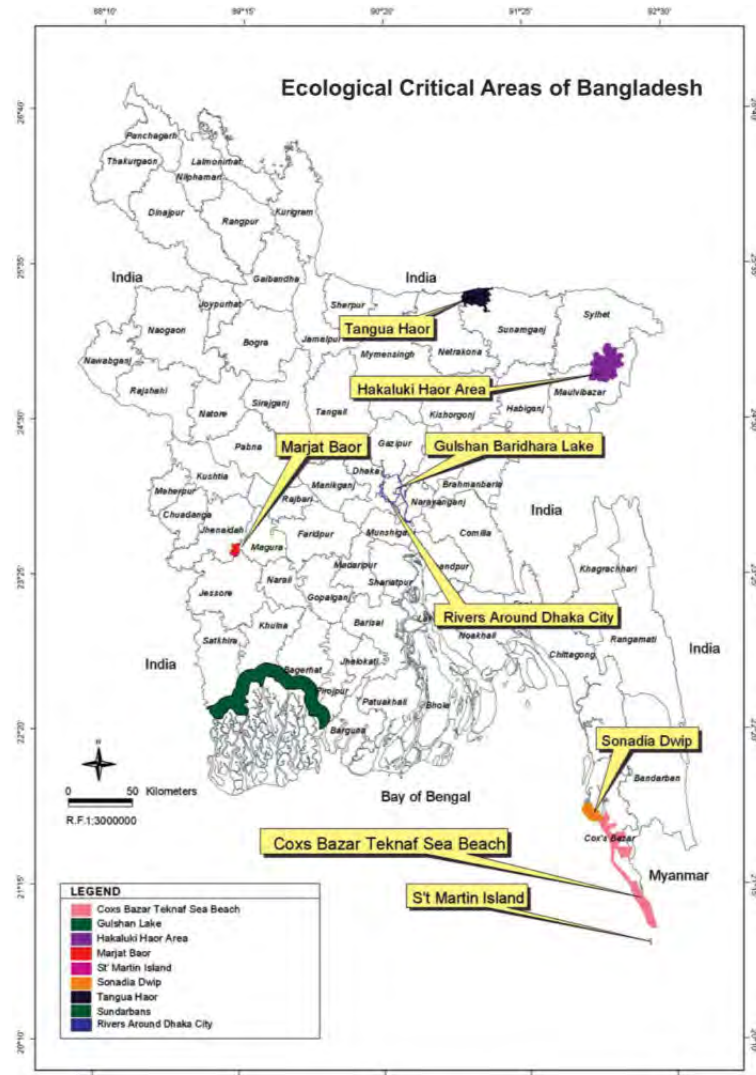


Figure-4.5-1 Ecologically Critical/Sensitive Areas of Bangladesh

4.6 Natural Hazards and Risks

Natural Hazard is any natural event which has an adverse socio-economic impact on the human being. Alternatively, an extreme natural event, such as a cyclone, an earthquake or a flood, that is not caused by human beings. These are naturally occurring phenomena that only become hazardous due to the intervention of human infrastructure. The vulnerability of human infrastructure to destruction (risk) by a disaster is also an important factor in understanding natural hazards. The distribution and impact of natural hazards is unequal with greatest loss of life and property in the developing part of the world. This is not because of greater hazard frequency but simply because of greater vulnerability. In the table-4.6-1 more than hundred years' disaster, events, and affected information are listed below.

Table-4.6-1 EM-DAT Information 1907 to 2004

Disaster	# of Events	Total Killed	Avg. # Killed	Total Affected	Avg. # Affected
Cyclone	137	614,112	4,483	63,817,281	465,820
Drought	5	18	4	25,002,000	5,000,400
Earthquake	6	34	6	19,125	3,188
Flood	64	50,310	786	369,678,156	5,776,221
Volcano	-	-	-	-	-

Source: Centre for hazard and Risk Research, Bangladesh, 2011

The hotspots maps of **Centre for Hazard and Risk Research** indicate that cyclones and floods pose the greatest risk to Bangladesh on a country level. Sub-nationally, the northern and eastern regions of the country are susceptible to earthquakes while the southeast is particularly vulnerable to all five

hazards. Lastly, the combined multi-hazard maps (Figure-4.6-1) for mortality and GDP show that Bangladesh ranks in the top 3 deciles of risk when compared to the rest of the world. Figure-4.6-2 shows the mortality and GDP deciles of Bangladesh.

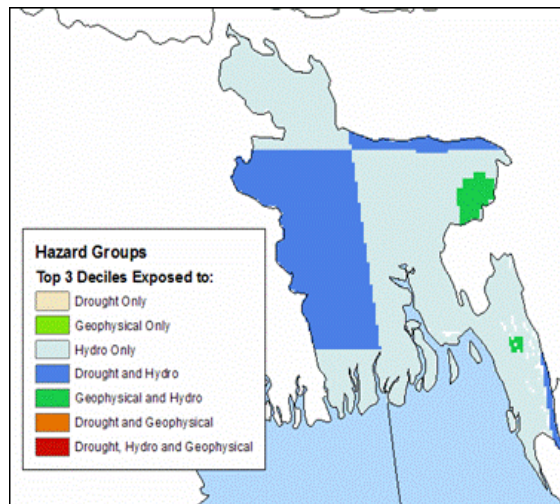


Figure-4.6-1 Multi-Hazard Disaster Risk Hotspots by Hazard Groups (Top Three Deciles)

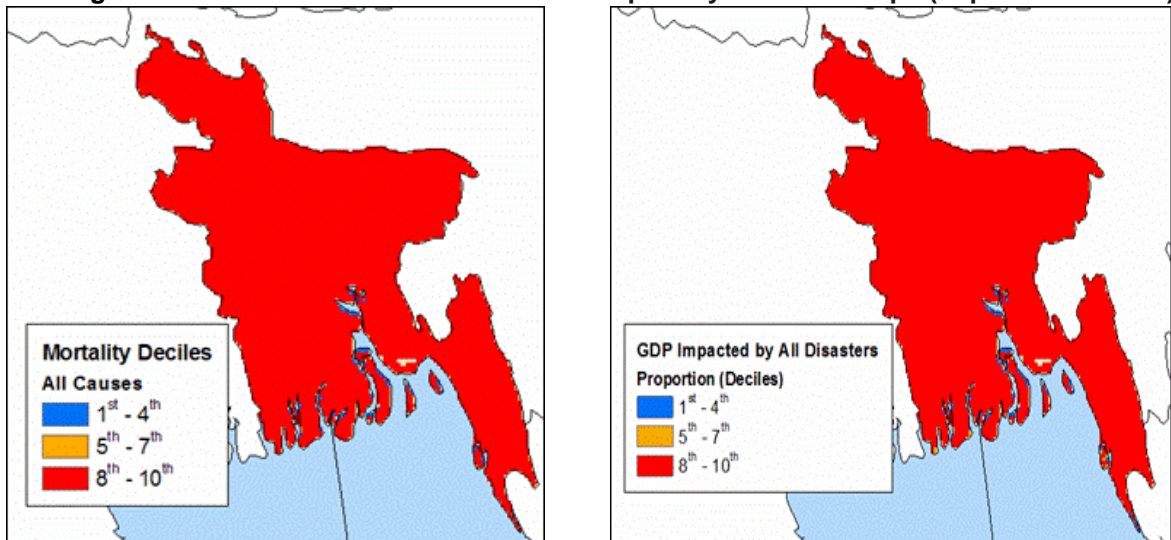


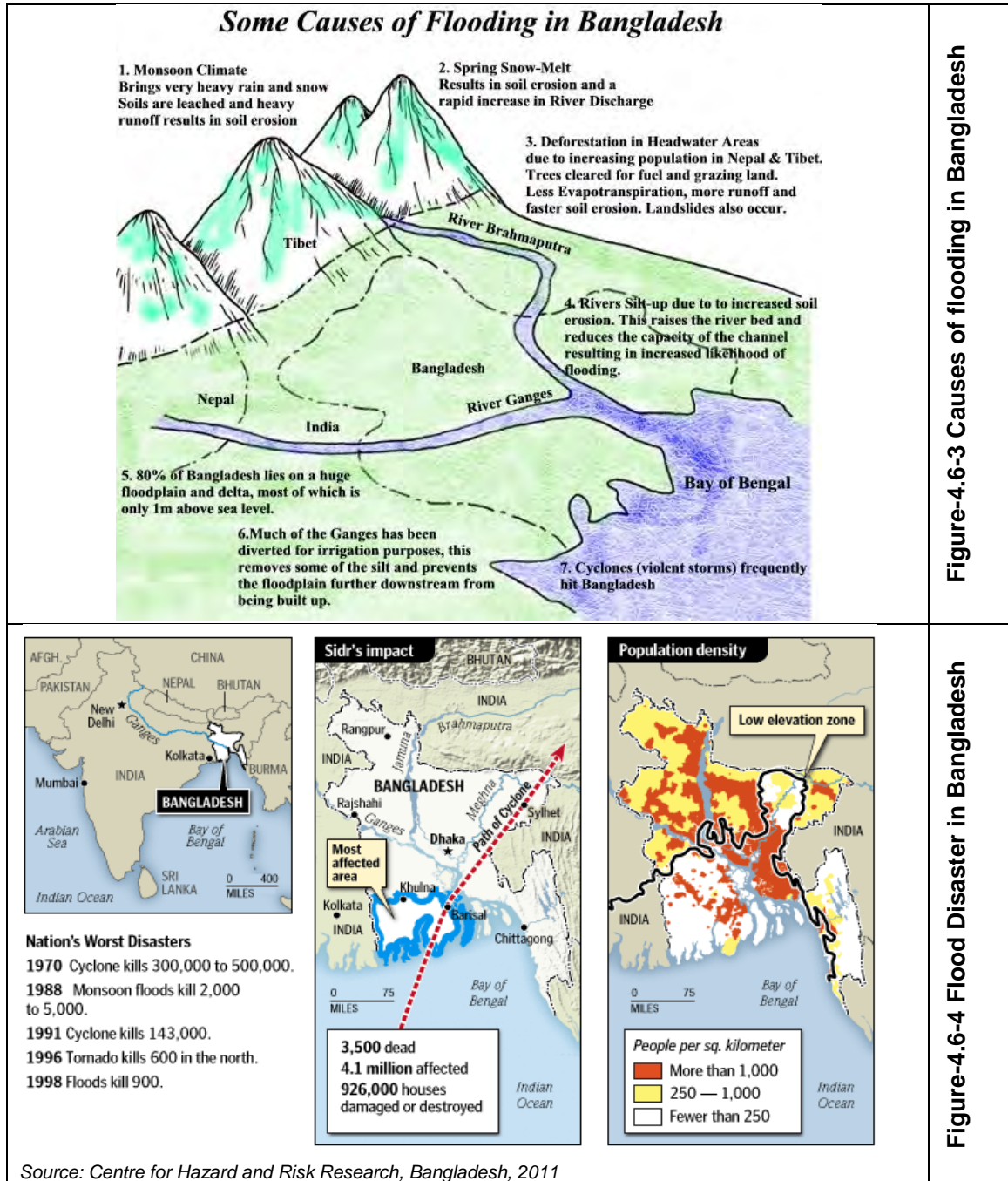
Figure-4.6-2 Multi-Hazard Disaster Risk Hotspots

(All Hazards combined and weighted by Mortality and Proportion of GDP Impacted)

Source: Centre for Hazard and Risk Research, Bangladesh, 2011

4.6.1 Flooding

Bangladesh is one of the world’s most densely populated country and one of the most susceptible countries to flood disasters. It also has one of the three most powerful rivers passing though it Ganges, Meghna and Brahmaputra. About one half of the land area in Bangladesh is at an elevation of less than 8 meters above sea level. Up to 30% of the country has been covered with flood waters. In 1991 more 200,000 deaths resulted from flooding and associated tropical cyclones. Causes of flood are shown in the **Figure-4.6-3** and **Figure-4.6-4**.



4.6.2 Seismic Effects

Bangladesh is located close to the plate boundary between the northward moving Indian plate and the Eurasian plate. During 1869-1930, five earthquakes with magnitude $M \geq 7$ have affected parts of Bangladesh. Two of them had their epicentres inside Bangladesh. Repeat of similar earthquakes which appears to be quite likely can now cause great devastation due to the rapid growth of densely populated urban areas with construction lacking quality as well as earthquake resistant design. Even moderate earthquakes close to the urban cities may cause great havoc. In rural areas of high seismic risk, highly vulnerable mud-walled houses are quite common. During the last seven or eight years, the occurrence and damage caused by some earthquakes (magnitude between 4 and 6) in the south-eastern part of the country inside the country or near the country's border, has raised the level of awareness among the general people and the government as well. The project area didn't feel any seismic effect in the recent past.

4.6.3 Cyclones and Storms

Cyclone is a tropical storm or atmospheric turbulence involving circular motion of winds, occurs in Bangladesh as a natural hazard. The tropics can be regarded as the region lying between 30°N latitude and 30°S latitude. All the tropical seas of the earth with the exception of the south Atlantic and southeast Pacific give birth to deadly atmospheric phenomena known as tropical cyclones. On an average, 80 tropical cyclones are formed every year all over the globe.

The project area is out of the tropical storm considering the previous history of the cyclone. **Figure 4.6-5** shows the cyclonic storm track where clearly revealed the project area cyclonic storm risk. In 1991 and 1996 the project area was under the disaster of cyclone and the table-4.6-2 below shows the major Cyclonic Storms disaster in the Project Area.

Table-4.6-2 Major Cyclonic Storms disaster in the Project Area

Date of Occurrence	Place of Occurrence	Area of Devastation (Sq. km.)	Duration of Storm (Minutes)	Maximum Wind Speed (Km/hr.)	People killed	Number of Injured
20-04-1990	Sirajganj	77.7	40	193	29	2000

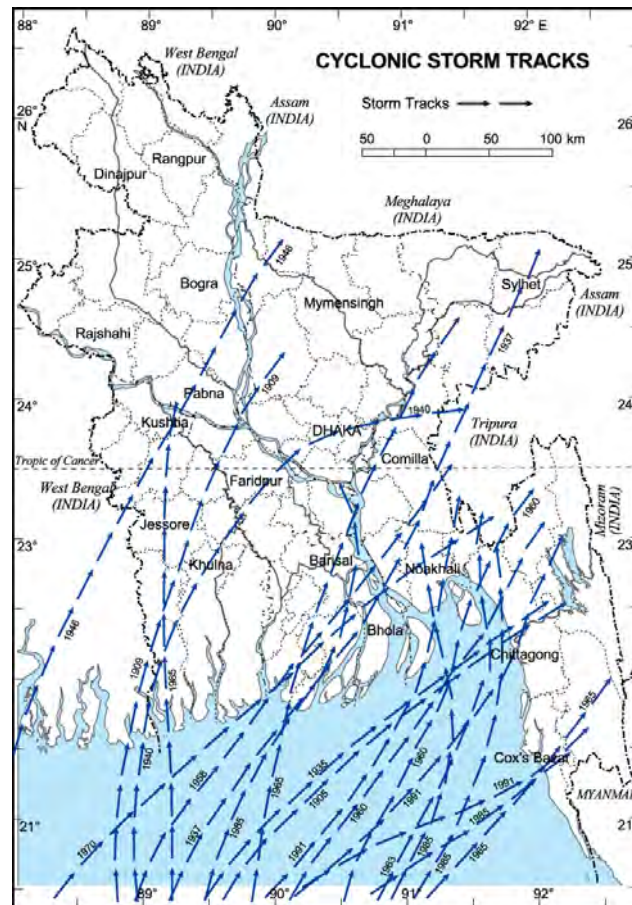


Figure-4.6-5 Project area Cyclonic Significance

Source: National Encyclopedia of Bangladesh, 2003

4.6.4 Erosion

The deltaic coastline of Bangladesh can be recognised as consisting of two basic physiographic units: the inactive or abandoned Ganges tidal plain and the active Meghna deltaic plain. While the Ganges tidal plain is relatively old, the Meghna deltaic plain is geologically very young. The Meghna deltaic plain extends from the Chittagong coast in the east to Tentulia Channel in the west. The erosion-

accretion processes take place much more within this part. Broad map comparisons indicate that the delta of the Ganges-Brahmaputra Rivers has not grown significantly toward the sea over last two centuries. The project area is not significantly affected by erosion like other area of Bangladesh.

4.7 Socio-economic Environment

4.7.1 Economy and employment: employment structure and cultural issue in employment

Erosion of Jamuna West Bank came to a halt after the construction of guide bund and river training works being carried out for protection of Jamuna Bridge.

The phenomenon of erosion, continuous displacement and resettlement, and loss of property and entitlements have been stopped due to protective measures. Since exposure to severity of erosion has come to an end, the economic condition of the people living in this area has been better off compared to shocks and vulnerabilities dominated their lives and livelihood. The land prices have increased up significantly. Internal communication has improved a lot paving the economic opportunities. Socio-economic characteristics of a traditional rural setting seem to be reeling under a transformation with the influence of better communication and economic activities enhanced by Jamuna Bridge.

Syedabad Bazar is the entry point northern districts at the starting point of Jamuna Bridge. This is an economic hub of the area.

In most of the areas along Jamuna-Nalka areas, large number weaving communities live for generations. Weaving is the main sources of income. Besides, large number of population earns their livelihood as day labourer and petty business.

Soyedabad village is famous for handloom. Handloom is inter-generational business, skills and techniques handed down to generations. Main occupation includes agriculture and handloom. Sarotia and Dhukaibari villages are economically vulnerable. Majority of the population draw their sustenance from wage labour. However, the villages along the West Bank of Jamuna–Nalka were prone to river erosion. Guide bund constructed for protecting Jamuna Bridge.

Family labour is the main labour force for running handloom. Besides, a few households own large numbers of households. They employ the worker on contract basis. In this area, women's mobility is not restricted by cultural taboos. Significant numbers of women also work in handloom industry. Migration of wage labourer is not significant although the area is well-connected with other districts. In Soyedabad, 5% women work as handloom worker. Women of the households owning handloom works as family labour. Wage rate of handloom worker varies from Tk300 to 400 per day. (Source:FGD)

Household income varies in accordance with occupation. In Soyedabad, the income of 50% households ranges between Tk. 6000 to 7000 per month. Thirty percent earn Tk.8,000 to 10,000 monthly, 15% earns Tk.10,000 to 20,000 and 5% earn more than 20,000 monthly. Thirty percent people earns livelihood from various types of business. Besides, 70% of the population either wage labor or working as handloom worker. (Source: FGD)

Dhukaibari (literally mean "is another village which is not v far from Jamuna Bridge to Nalka national highway. Dhukaibari is a poverty stricken area. Large number of population is handloom worker, daily labour and earth worker and daily labour. Thirty percent of them are also engaged in various types of petty trade. Roughly 20% are handloom worker, 5% service holder, 20% agriculture labor and 10% are non agriculture labor and 15% unemployed. Dire poverty situation prevails in this village. Daily

income of 80% of the people is 100 taka per day. Only 5% household earns more than Tk.5000.00 per month. (Source: FGD)

The area was prone to river erosion. The river training works during Jamuna Bridge construction halted erosion.

Table-4.7-1: Occupation of the West Bank

Types of Occupation	Primary Occupation (No)	%	Secondary Occupation (No)	%
Farmer	11	6.8	2	100.0
Fisherman	0	0.0	0	0.0
Agriculture	0	0.0	0	0.0
Non agriculture Labor	0	0.0	0	0.0
Service	9	5.6	0	0.0
Small business	25	15.4	0	0.0
Household work	43	26.5	0	0.0
Student	63	38.9	0	0.0
Child	5	3.1	0	0.0
Retired/handicapped	3	1.9	0	0.0
Unemployed	2	1.2	0	0.0
Service in Abroad	1	0.6	0	0.0
Others	0	0.0	0	0.0
Total	162	100.0	2	100.0

4.7.2 Population: Demographic profile and ethnic composition

In Soyedabad village total household are 1500 and population is 7000 and in Syedabad 400 households. In Dhukaibari, there are 1000 households and population is around 5000.

Homogenous populations without ethnic diversity are the residents of the area delineated within West Bank of Jamuna to Nakla. Thirty six respondents have been interviewed in addition to, 46 FGD participants. The average household size is 4.6, which is in close proximity national average (4.4).

The literacy rate is 87% which is much higher than national average 59.82% (Literacy Assessment Survey (LAS) 2011, published in 2013). However, in the village of Soyedabad education rate is 60%. In Dhukaibari, literacy rate is about 50%.

4.7.3 Disease

Dysentery, diarrhoea and pneumonia are common disease in the project area.

Table-4.7-2: Disease suffered

Disease	No	%
Diarrhea	20	34.5
Typhoid	7	12.1
Dysentery/gastroenteritis	9	15.5

Disease	No	%
Jaundice	12	20.7
Skin disease	3	5.2
Titanus		0.0
TB	1	1.7
Pneumonia	2	3.4
Asthma	1	1.7
Others	3	5.2
Total	58	100.0

4.7.4 Water and Sanitation

69% percent household uses deep tube well water for drinking, cooking and bathing. Besides, 14% households collect water from STW and 17% have access to supply water. Every household owns a tube well.

Table-4.7-3: Source of drinking Water

Type of use	Drinking (no)	%	Cooking (no)	%	Bathing (no)	%	Cattle/goat washing (no)	%
STW	5	14	5	14	5	14	3	11
DTW	25	69	25	69	25	69	19	68
Water supply	6	17	6	17	6	17	6	21
Well		0		0		0		0
Pond		0		0		0		0
Canal/River		0		0		0		0
Total	36	100	36	100	36	100	28	100

4.7.5 Income and Expenditure

Income profile of households shows that 31% of the incomes come from trade and business. The other sources includes agriculture (21%), and services (30%).

It should be mentioned that 8.8% households are indebted. Average weekly expenditure of household is Tk. 2,952.

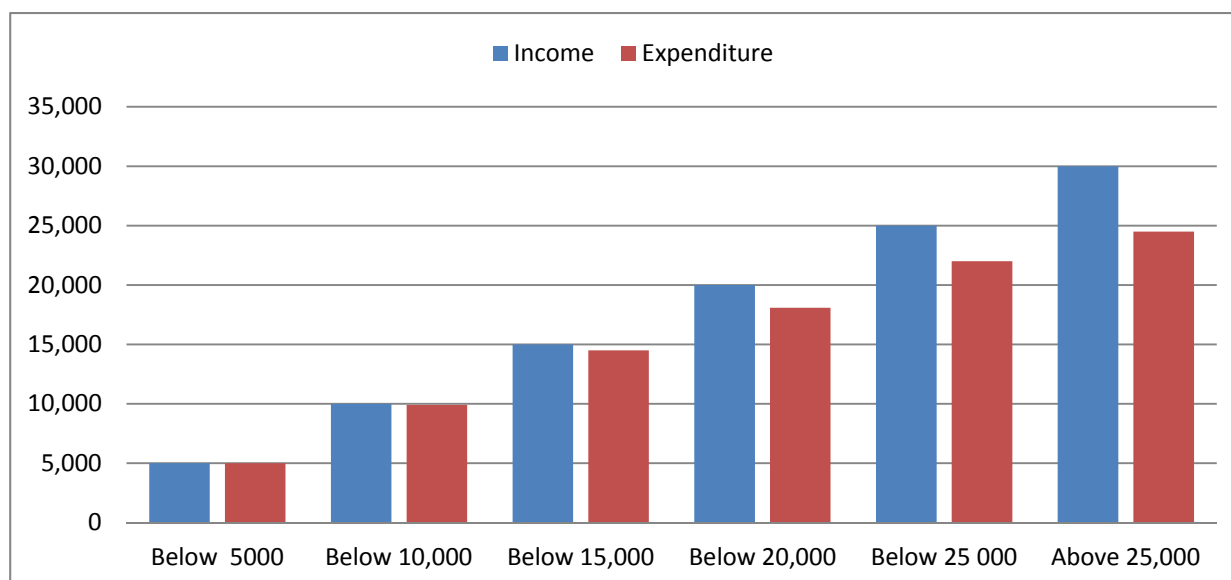
56% percent respondents reported that unexpectedly huge expenditure incurred due to treatment cost while 22% mentioned cost of social events as a major expenditure.

Table-4.7-4: Sources of income

Sources of income	%
Agriculture	21
Trade/Business/Industry	31
Wage	5
Organization work	30

Sources of income	%
Miscellaneous	12
Total	100

Figure-4.7-1: Income and Expenditure



4.7.6 Land and Tenancy

65% percent households cultivate own land. Out of 36 respondents, 16 households have agricultural land. In Dhukaibari, landless people are about 10% in the village. 30% household owns only homestead land. Both in Syedabad and Soyedabad land price is comparatively higher. The value of agricultural land is Tk. 40,000 per decimal. IRRI paddy and Aman are the main crops being cultivated in the area and pulse “mashkalai (Black Gram) variety of pulse is also commonly cultivated. Data on cultivation of vegetables clearly indicates that practice kitchen gardening seems to be declining.

All the respondents have their own homestead. Out of 36 respondents, 16 households owns agricultural land amounting to 695 decimal in total indicating that most of the households are small and marginal farmers. However, a large number poor landless people live in this area.

In Soyedabad about 10% land is government owned as Khas land of Bangladesh. Water Development Board acquired the land.

Table-4.7-5: Type of Farmer/Tenancy

Type	No	%
Cultivation own land	17	65
Own and other's land	0	0
only owner of land	8	31
Share cropper	1	4
Total	26	100.0
Cropping pattern (%)		
Type	%	

Single crop	27
Double crop	67
Triple crop	11

4.7.7 Settlement and housing

Walls of the most of the houses are made of concrete bricks. However, 9 houses are built with iron sheets. Tin is the main materials for roofs. Out of 36 respondents, 7 respondents reside in building.

4.7.8 Asset and Entitlement

Asset profile of the respondents indicates the changes in the lifestyle of the people living in this area. All the 36 respondents have mobile phone. Thirty two households have television. Majority of them uses fan (29 respondents). Out of 36, 15 households' rear poultry and 21 households have cow. The data shows that the respondents' main occupation includes mainly weaving and running small business. Although, 17 respondents cultivate their own minuscule of land but agriculture was not mentioned as their mainly source of drawing sustenance and income.

Table-4.7-6: Land Asset of the household

Asset	Respondent	Own land (decimal)
Homestead	36	779
Agriculture land (Irrigation)	16	695
Agriculture land (no irrigation)	0	
Pond	1	6

Table-4.7-7: Household assets: furniture, electrical and electronic

Item	No. of Respondent	%	Value (BDT)
Khat/chowki	36	100	9775
Chair/table	36	100	2311
Almira	18	47	7050
Alna	34	89	2006
Showcase	10	26	6600
Dressing Table	7	18	3686
Trunk/wooden box	1	3	800
Sofa	5	13	18300
Cassette player	1	3	3000
Radio	-	-	-
Television	32	84	9244
VCP/ CD player	1	3	2800
Freeze	12	32	20333
Fan/table fan	29	76	3503
Sewing machine	1	3	2000
Wrist watch/ wall clock	30	79	587

Item	No. of Respondent	%	Value (BDT)
Ornament: gold (bhor)	8	21	96875
Ornament: silver (bhor)	-	-	-
Mobile phone	36	95	6489
Others (specify)	2	5	2250

Table-4.7-8: Livestock Assets

Description	Respondent	%	Owned (Tk.)
Poultry birds	15	42	25325
Cow	21	58	584700
Bullock		0	
Other cattle		0	
Buffalo		0	
Sheep		0	
Calf (Below 1 year)	3	8	13000
Goat	1	3	5000
Sheep		0	
Duck	2	6	1500
Chicks	2	6	1400
Other animal			

4.7.9 Poverty Status

Out of 36 respondents, majority belongs to middle class, 3 (three are) poor, 1 (one) ultra poor and 2 (Two) respondents are rich.

4.7.10 Knowledge about project

Out of 36 respondents, 24 informed that they knew about the project. While asked, respondents mentioned that the project would not have any adverse effect on land or any structure.

4.7.11 Fisheries

In Soyedabad, there is a water body in the village with an approximate area of 200 acre. Villagers cultivate fishes on cooperative basis. Some are working as fisherman. River Jamuna is in vicinity.

Fishing communities: Fisher folks were forced to leave fishing since fish population in Jamuna continues to denuding. However, still there are fishing communities in some villages down to Jamuna Bridge.

Commercial important species

Eel and Pabda are commercially important species in the project area.

Fishing Resources:

Local fish species are diminishing gradually. There is no fishing community in the study area. According to local sources, more than 60 species were available in Jamuna. Most of these species declined alarmingly. Cypriniformes is the most diversified fish.

CHAPTER-5 IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS

5.1 General Overview of Environmental Impacts

An environmental impact is defined as any change to an existing condition of the environment. Findings of the assessment are presented according to site preparation, construction and operation phases. The impacts will be determined as significant, positive or negative, direct or indirect, long term or short term.

The potential environmental impacts of the proposed project have been assessed by using checklists. Checklists are comprehensive lists of environmental effects and impacts indicator designed to simulate and analyze to think broadly about possible consequence of contemplated actions. **Annex-1** represents the checklist developed for the proposed pipeline project. In the checklist, actions that may affect at the various stages of the project activities are listed and the confirmations of the environmental considerations for this project are recorded.

5.2 Identification of Impacts

Table-5.2-1 shows the scoping of the project considering various project activities, impact evaluation of in different stages of the project.

In reviewing impacts, the following issues are generally addressed:

- Air Quality;
- Noise and Vibration;
- Waste
- Soil
- Climate Change Factor
- Topography
- Geology
- Hydrology
- Ecosystem
- Biodiversity
- Protected areas
- Areas of environmental /ecological significance
- Local Economy
- Resettlement
- Indigenous people
- Cultural Heritage
- Health and Safety

Table-5.2-1 Environmental Scoping for West Bank of Jamuna Bridge-Nalka Pipeline Project

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
Environment quality and pollution control	Air quality	B-	D	During construction, air pollutants are expected from land clearance, movement of heavy equipment and trucks, which would generate mostly dust and to some extent exhaust gaseous emission (CO, NOx, SOx, and others). During O&M, no significant air pollutant emission is expected since pipeline is laid underground and conveys compressed natural gas.
	Water quality	B-	D	There are no crossings of surface water bodies such as rivers and ponds along the entire 14km ROW of the planned pipeline route. So no directly adverse effect on water quality consequent to the project is anticipated but nearby ponds might have some indirect adverse effect if unwanted dumping is taken place in the nearby pond. However, no long-term adverse effects on the nearby water quality is anticipated during the project operational stage since the pipeline is laid underground and will not affect any water body.
	Noise/vibration	B-	D	Noise and vibration during construction/installation of pipeline is a critical aspect and could not be entirely eliminated. Still, work prone to potentially high noise/vibration shall be scheduled for day-time only. As also noted above, since the pipeline is laid underground there is no potential noise/vibration issue is involved during operation stage of the project.
	Waste	B-	B-/D	Waste generation during construction activities include excess borrow pit soil due to pipeline trench back-filling following pipe laying, sanitary and solid waste generation due to working personnel and other construction related works. Waste generated during operation of the pipeline is pigging waste that has already been generated consequent to the existing gas transmission pipelines of more than 1000 km in length. As such this pipeline with length of only 14 km will result only in marginal increase in pigging waste generation. Still, pigging waste management is a long-term requirement. These wastes due to construction and operation have to be managed properly with a good and effective waste management system.
	Soil	B-	D	Trenching and subsequent back-filling following pipeline work has potential to affect agricultural fertility of excavated and refilled land area. However, long-term adverse effects on soil fertility due to underground (laid) pipeline are regarded as not that significant.
	Climate change Factors	D	D	Natural gas results in less CO2 emission in comparison to other liquid petroleum sources. Still, in overall, any such beneficial effects on overall climate change factors is regarded as not that significant when this project effect is individually taken into account.

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
Natural Environment	Topography	D	D	The project is not that large-scale to significantly affect topography that is also evident from already laid and operational gas transmission pipelines of more than 1000 km in length.
	Geology	D	D	Similar to the topography case of above potential adverse effects on geology is regarded as not that significant.
	Hydrology	D	D	Similar to the topography case of above potential adverse effects on hydrology is regarded as not that significant.
	Ecosystem	D	D	The project is not expected to affect the ecosystem since there is no important ecosystem that would be affected by the installation of the pipeline that will be laid underground in-parallel/near-by already existing underground pipeline.
	Biodiversity	D	D	Any potential adverse effect on biodiversity due to linear trenching and backfilling following pipe laying is regarded as only marginal and not that significant considering the highly anthropogenic influenced nature of the project affected area located by the side of highway. In the operation stage since land is restored to original state as the pipeline is laid underground there would be no adverse effect on biodiversity.
	Protected areas	D	D	There are no protected areas located in and around the vicinity of the planned ROW of pipeline route and hence there is no adverse effect.
	Areas of environmental /ecological significance	D	D	There are no environmentally or ecologically significant, critical or vulnerable areas located in and around the vicinity of the planned ROW of the pipeline route, condition similar to the case of protected area of above.
Social Environment	Local Economy	B+	B+	Implementation of the project involving very significant demand for even unskilled labor for trenching and backfilling work has potential for local employment opportunity during construction stage of the project thereby contributing to local economy. This is also possible to some extent during the operation stage as well for maintenance of facilities such as valve stations and also for patrolling work to ensure the integrity and protection of ROW (of the newly laid underground pipeline).
	Resettlement	D	D	The entire ROW of the planned pipeline route located by the side of existing underground pipeline belongs to Jamuna Bridge Authority, a state entity of Bangladesh. Moreover, there are no inhabitants living along the entire ROW of the planned pipeline route. As such no private sector owned land acquisition or resettlement requirement is encountered along the pipeline route. But 100mX100m i.e. 2-3Acres of land will be needed to acquire with proper payment of compensation for City Gate Station (CGS) where

Classification of Environment	Environment Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
				no resettlement would be required since that will be only on vacant land.
	Indigenous people	D	D	There are no indigenous people living in and around the vicinity of the ROW of the planned pipeline route. So no adverse effect is anticipated.
	Cultural Heritage	D	D	There are no cultural heritage sites located in and around the vicinity of the ROW of the planned pipeline route. So no adverse effect is anticipated.
	Health and Safety	B-	D	Health and safety of construction personnel is very important aspect in the construction management by contractor. Instilling due awareness among migrant workers on the dangers of communicable diseases and the importance in respecting the customs and traditions of village people is the most significant social aspect to be addressed by the construction contractor. Full commitment and adherence to the concept of "Safety First" in the conduct of all construction related activities by the construction contractor is necessary for enhanced safety of construction work force. No significant safety issue is anticipated consequent to the operation of the underground gas transmission pipeline with due adherence to safety guidelines of GTCL (having more than 20-year operational experience in gas transmission pipelines).

Legend:

A+/- : Significant positive/negative impact is expected

B+/- : Positive/negative impact is expected

C+/- : Extent of positive impact/extent of negative impact is unknown (needs further investigation and clarification or whether the impact can be clarified as the ESC Study progresses)

D : No significant impact is expected or no impact at all is expected

5.3 Preconstruction Phase

The construction of 30 inch 14 km West Bank of Jamuna Bridge-Nalka gas transmission loop line will not require any acquisition for pipeline route but 2-3 acres of land is needed for City Gas Station (CGS).

Disturbance of Population

The route for this 30 inch new loop line has been finally determined so that, the loop line will be routed parallel to the existing 24 inch West Bank of Jamuna Bridge-Nalka pipeline. It is assumed that there will be no disturbance to the population.

Disturbance of Communication and Utilities

For this project, the communication disturbance will be less in the project area. Some connecting road from the highway to the unions and one rail crossing will be interrupted due to project work. There will be no utility disturbance due to this project activity.

5.4 Construction Phase

The implementation of West Bank of Jamuna Bridge-Nalka loopline project will not require any acquisition for pipeline route but 2-3 Acres of land to be acquired for CGS.

Labor Market Impact and Income Generation

The pipeline and facility construction activities will entail direct employment of local manpower by the contractor and the supervision team. The local manpower will be primarily employed as drivers and unskilled labor. Patrolmen will be hired locally.

The indirect effects of the construction activities will affect local tradesmen and landowners who can sell food and other commodities to the construction and Inspection Teams.

Soil Erosion and Fertility

Potential impacts to soils include compaction, erosion and loss of fertility. The proposed pipeline route will be affected by grading and construction, resulting in various degrees of compaction.

Road access is very easy all along the pipeline route. Experience from previous pipeline construction works under similar soil conditions in Bangladesh recall that compaction has limited affect on agricultural capability after reinstatement of the ROW.

The impact will be minimized in the long term if construction and reclamation procedures are performed according to strict soil protection guidelines.

Mixing of topsoil and horizons can occur during trenching and back filling. Mixing of sub-soil with the cultivation layer would result in a negative effect considering that the majority of the project area is used for agricultural purposes.

Trenching and subsequent backfilling will subject soil to potential erosion. The erosion potential is greatest during the rainy season and when flooding is prevalent. Trenching and backfilling also subjects topsoil to potential mixing with less fertile lower layer soil resulting in loss of fertility.

There is a national highway parallel to the pipeline route and it will be easy for transporting the construction materials and manpower to the worksites by trucks and other vehicles.

With proper mitigation techniques, construction of the pipeline is considered to have a minor impact on soil fertility and erosion.

Soil Erosion and Fertility Control Plan

Construction activities shall be conducted so as to minimize soil erosion, loss of soil fertility and sedimentation of water bodies. Grading shall be limited as much as possible to minimize disturbing vegetated areas and subject them to potential erosion. Contractor shall install erosion controls on all disturbed critical areas. A critical area is any area subject to erosion due to slope angle, and areas impacted by large flows such as river/stream banks, a discharged hydrostatic pressure water and slurry from directional drilling under river bottoms. For this project, all soils are considered highly erodible.

General Trenching and Backfilling Activities

Trenches shall be backfilled as soon as possible to minimize erosion potential. Spoil piles shall not be placed on slopes greater than 5% or adjacent to water bodies where they may be washed away by high water or run-off. The upper 30 cm fertile soil level shall be conserved by segregating fertile spoil piles from common fill spoil piles. The soil is highly erodible in areas where vegetation has been disturbed. Disturbed slopes greater than 30 percent shall be stabilized with sand bags, slopes between 5 and 30 percent seeded and stabilized with jute mats anchored with stakes.

Storm water and ground water pumped from trenches and hydrostatic pressure water drained from the pipeline shall be released under controlled conditions. Discharged water shall be directed to vegetate areas to minimize erosion and filter out sediment. The discharge flow shall be controlled to prevent washout of the vegetation and subsequent erosion.

Surface Water

Surface water may be adversely impacted by contaminated storm water runoff from maintenance areas. Oil, grease, chemicals, paints and solvents used in the construction activities may be the sources of this storm water contamination. Implementing the oil spill plan will reduce the risk of contamination by chemicals, paints and oil & grease etc.

Trenching and back filling at river crossing will increase sediment loads to those water bodies. This impact will be minimized by using conservative construction crossing procedures and adequately stabilizing the banks disturbed by construction activities. The river/stream crossing plan will minimize soil erosion and sediment loading of the watercourse.

Improperly handled sanitary waste generated by the construction force may be carried by storm water runoff to contaminate nearby surface waters, if not properly treated and handled. Use of sanitary latrines and adequate treatment facilities as detailed in the waste disposal section will eliminate this possibility.

Ground Water

Ground water may be adversely impacted by percolation of contaminants from maintenance areas polluted with oil, grease, or chemicals. Spills and leaks of chemicals, paints and solvents used in the construction activities may also be a source of ground water contamination. Contaminates from improperly handled sanitary waste generated by the construction force may percolate to ground water if not properly contained and treated.

Shallow ground water, brought to the surface through tube-wells may be used as drinking water by the construction force. Lack of proper sanitary facilities for the local population may result into contamination of this water supply as has been the case in other similar areas.

5.5 Operation Phase

Loss of Use of Land

Potential environmental impacts from the operation of pipeline are limited to the loss of utility of land along the pipeline alignment due to the requirement for a ROW for patrolmen to patrol the line, and for operations personnel to gain access to valve stations.

A specified safety zone in either side of the pipeline is required under the Bangladesh Mineral, gas safety rules to be kept free of residences.

CHAPTER-6 ENVIRONMENTAL MANAGEMENT AND MITIGATION PLAN / PROCEDURES

6.1 Introduction

In the context of a project, environmental management is concerned with the implementation of the measures necessary to minimize or offset adverse impacts and to enhance beneficial impacts. The prime function of EIA is to provide a basis for shaping the project so that overall environmental performance is enhanced this cannot be achieved. Unless the mitigation and benefit enhancement measures identified in the project EIA are fully implemented.

In order to be effective, environmental management must be fully integrated with the overall project management effort, which itself should aim at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions efficiently throughout its life.

At this stage of West Bank of Jamuna Bridge-Nalka loop line project, the environmental management plan has been prepared in outline only, as many important elements of the project are yet to be fully defined. However, the plan indicated in the following sections indicates the broad approach which should be adopted. The plan should be expanded during the detailed design stage when more information is available, and a fully detailed environmental management plan should be prepared at that time.

The identified mitigation measures are means of reducing the potential impacts of the project to the residual levels. The task of management is to ensure that the mitigation is carried out and the targets (assessed residual impacts) are met surpassed. The Environmental Management System (EMS) is the set of procedures, which should allow the management team to achieve this objective. The EMS is not, however, a substitute for management, which still needs to be exercised, in the environmental dimension of the project just as much as in any other dimension, such as the financial, or personnel aspects.

6.2 Mitigation Measures of Project Impacts

6.2.1 Preconstruction Phase

During the pre-construction phase of the project, the critical activities of route selection and preliminary design will be taking place. Land acquisition will be initiated only for CGS and specifications and contract documents shall be prepared as well. The responsibility for delivery of those mitigation measures identified in this EIA as related to the design and the operation of the project, and those associated with site selection, will be with GTCL directly.

Prior to contractor mobilization and the commencement of construction, environmental management will cover six principal groups of activities:

- Review of EIA and identification of additional mitigation/enhancement measures as necessary for all subprojects.
- Supervision of a detailed environmental survey of the pipeline route, to provide information to the design process and to assemble baseline data.
- Preparation of a comprehensive Environmental Management Plan for the project which provides for the implementation of mitigation measures identified in the EIA and subsequent reviews.
- Preparation of detailed designs which give due consideration to minimization of adverse impacts and benefit enhancement.
- Preparation of tender and construction contract documentation which contains appropriate clauses to allow control of impacts arising from construction activities.

Responsibility for reviewing of EIA, preparation of the EMP, detailed design and the preparation of tender and contract documentation lies with the planning division of GTCL. Overall responsibility for environmental management in these respects will lie with GTCL management.

6.2.2 Construction Phase

Implementation of mitigation measures for the construction phase should be achieved in the following manner. The EIA and the GTCL environmental management plan for the project should be issued to

tenderers as part of the tender documents. Tenderers should be asked to submit a Contractor's Environmental Management Plan for their site operations which addresses the issues identified in the EIA, and show how they propose to implement the mitigation measures identified therein. The contractor's EMP should address the following issues:

- Waste management (including spoil)
- Surface and groundwater management
- Traffic management
- Noise management (working hours etc)

Environmental management during the construction phase is essentially concerned with controlling impacts, which could result from the activities of the contractor, through enforcement of those contract clauses, which relate to environmental protection. It is important to recognize that the clauses relating to control of construction impacts will not themselves have any effect unless they are fully implemented and enforced.

Primary responsibility for construction supervision and contract management will lie with the Engineer, as defined in the construction contract. This person will be appointed by and from GTCL, and will have overall responsibility for environmental management during the construction phase. It is anticipated that the Engineer will be assisted in construction supervision by staff from consultants, and that day-to-day responsibilities for site supervision, including environmental management aspects, will lie with the Engineer's Representative, who will have specific powers and responsibilities delegated to him by the Engineer.

It is recommended that a full/part-time local Environmental Specialist should be appointed as a member of the construction supervision team. He would visit all sites on a regular basis and generally provide advice and assistance in relation to all aspects of environmental management during the construction period. He should encourage work crews to be aware of possible environmental issues which they may encounter during their work, as these may not always be expected even when prior investigation and survey has been carried out.

6.2.3 Operation Phase

Some of the impacts which are expected to occur during the operational phase are essentially related to the design of the project, and in this respect the principal environmental management functions are the responsibility of the design consultants. Matter relating to safety and risk management, will be the responsibility of the local authorities concerned.

Matters relating to routine and periodic maintenance will be the responsibility of GTCL and environmental management responsibilities will also lie with this body.

It is therefore recommended that GTCL will:

- Upgrades emergency response system with due input to their stock of their equipments, tools and PPE.
- Revisit their policy statement and personnel awareness program to commensurate with the diversified project components in their ongoing and upcoming project implementation plans.
- Strengthen their capacity of manpower and technology through continuous professional development plans for their designated officials responsible for taking care of HSE issues of the company in general and particularly for this project.

Environmental Impact Mitigation/Management Plan of WBJB-Nalka Project is shown in Table-6.2-1.

Table 6.2-1: Environmental Impact Mitigation/Management Plan (WBJB-Nalka)

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost
1. Construction					
1.1	Local Economies such as Employment, livelihood etc. ✓ Cultivators are influenced	<ul style="list-style-type: none"> Proper compensation payment for acquired land for CGS at the project area Income loss can be mitigated by providing alternative job opportunities for PAPs who has to provide land for CGS construction area. 	GTCL/Contractor	GTCL and External Monitoring Agency	49,400,000.00 BDT (Total compensation cost of land acquisition for 1ha (100m*100m) land for CGS at the project area)
1.2	Local conflicts of interest ✓ candidates of construction workers may have some conflicts between communities	<ul style="list-style-type: none"> Clear information about the needs of labor (number and qualification) should be provided with local people. The job skills and the priority for the people of the City Gate Station (CGS) area shall be taken into account and therefore workers can be chosen. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.3	Accident ✓ Construction workers can have harmful and critical troubles	<ul style="list-style-type: none"> Follow Health and Safety Management Plan (HSMP) rules and regulations designated by contractors 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.4	HIV/AIDS ✓ Transmission of disease by inflow of migrant workers	<ul style="list-style-type: none"> An HIV-AIDS awareness campaign via approved service provider shall be implemented 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.5	Gender ✓ Salary gap between genders	<ul style="list-style-type: none"> Monitoring of payment to workers by the contractor shall be implemented not to allow payment gaps between male and female. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.6	Children's right ✓ A bunch of children come and work in construction site	<ul style="list-style-type: none"> Regular monitoring of sites to guide contractors and their related firms to discourage child labor. When the child labor will be detected, necessary and decisive actions to the violating firms are implemented. Some assistance for parents of working child. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.7	Flora and Fauna ✓ Loss of Species diversity, Damage to habitat, Loss of species due to disposal of petroleum oil lubricants and toxic refuse	<ul style="list-style-type: none"> Any illegal discharge of waste water, leaked oil shall be prohibited Construction development area shall be fixed, not to develop or cut trees out of project area Night lighting in construction should be restricted to the construction site. Quick recovery of the backfilled trenches in rainy season which will follow the reemergence of vegetation by rain 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.8	Air Pollution ✓ Dust rising from unpaved road,	<ul style="list-style-type: none"> Good maintenance and operation of equipment and vehicles Use environmentally-friendly material 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost
1.9	<p>emission of Greenhouse gas, heat emission and others during construction</p> <p>Water Pollution</p> <p>✓ Construction sludge, mud water from earthwork, domestic waste liquid from worker's camp, and oil leaking from construction vessel</p>	<ul style="list-style-type: none"> • Spraying water to suppress the dust rising • Cover entire load with tarpaulin to prevent the load from being blown. • Good maintenance of material • Monitoring and regular meeting for air quality • Generated construction sludge is to be treated by silt basin and remaining sludge is disposed at designated dumping site • Turbid water from construction work area is treated in silt basin for satisfying water quality standard and drain away to the nearest drainage or river • Domestic water is treated by septic tank for satisfying water quality standard and drain away to the nearest drainage or river. • Water quality including contents of arsenic will be checked before using groundwater as potable water for construction workers. • Waste oil shall be stored without leaking before legal disposal process. • Re-fuelling place to equipment/ vehicles shall be concreted floor • Fuel and oil shall be stored at concrete floored tank surrounded with concrete fence • Equipment and vehicles are properly maintained not to cause leaking of fuel onto ground surface. Inspection sheet of maintenance record shall be submitted regularly • Batteries containing liquid inside shall be kept on impervious place to prevent battery liquid that contains hazardous heavy metals leaks and percolate into sub-ground • To be on the safe side, study on groundwater will be implemented by the consultant during detailed design stage in order not to cause adverse impact on surrounding wells. • Preparation of a waste management plan to achieve reuse, reclamation and recycling of materials. • Construction work shall be carried out in dry season (practical only in dry season for pipe laying work) only. • Emphasize due construction planning with the intention that the trench portion excavated will be fully completed and backfilled with pipe laid underground within the dry- 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.10	<p>Soil erosion</p> <p>✓ Practical construction period selection, washed off excavated soil</p>		Contractor	GTCL/Supervising Consultant	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost
		<p>season so that the topography is fully restored to original condition.</p> <ul style="list-style-type: none"> No excess excavated soil mount is left behind to be washed off during rains (erosion soil runoff mitigation). 			
1.11	<p>Soil pollution</p> <ul style="list-style-type: none"> ✓ leakage of oil, and borrow can contaminate soil 	<ul style="list-style-type: none"> Disposal at designated dumping site Soil quality testing Disposal of waste oil without leakage Refueling place having concreted floor Preserved in the tank surrounded with concrete fence Equipment and vehicles are properly maintained Batteries containing liquid inside shall be kept on impervious place 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.12	<p>Waste</p> <ul style="list-style-type: none"> ✓ Generation of construction sludge and domestic waste 	<ul style="list-style-type: none"> Minimize volume to use silt basin before disposing Segregate waste to minimize waste material Disposed in designated dumping site instructed by the section handling waste Recycled as possible with consideration of soil property. 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.13	<p>Transportation of Material, Equipment, Pipes etc.</p>	<ul style="list-style-type: none"> Minimize interference to regular traffic Effective measures to be taken to minimize dispersion of dust (in case of dust prone material excess soil transport) 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.14	<p>Noise and Vibrations</p> <ul style="list-style-type: none"> ✓ Noise and vibration from construction machines and vehicles 	<ul style="list-style-type: none"> Periodical maintenance of construction vehicles Installation of sound insulation cover on boundary near residential area 	Contractor	GTCL/Supervising Consultant and DOE	Included in overall construction cost
1.15	<p>Offensive Odor</p> <ul style="list-style-type: none"> ✓ Open burning of construction waste, improper treatment of human liquid waste, exhausted smoke from heavy equipment etc. 	<ul style="list-style-type: none"> Prohibition of open burning Proper treatment of camp waste Proper maintenance of heavy equipment. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.16	<p>Bottom sediment</p> <ul style="list-style-type: none"> ✓ Waste dumped into nearby ponds can contaminate pond water 	<ul style="list-style-type: none"> Construction contractor will be obliged to no dumping of waste into the nearby pond 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.17	<p>Construction Safety Measures</p>	<ul style="list-style-type: none"> Employees shall be provided with appropriate training on different topics Employees shall be provided with appropriate PPE's (safety shoe, safety Helmet, safety goggles, hand gloves, ear plug, etc) 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost
1.18	Emergency Response Plan	<ul style="list-style-type: none"> • Employees shall be provided with appropriate first aid facility and Health surveillance. • Medical tie up shall be established with ambulance facility. • Drinking water with healthy food shall be supplied at site with suitable dining area. • Toilet/mobile toilet shall be arranged. • Suitable lifting equipments and tools & tackles shall be arranged. • Proper supervision shall be arranged at each location of sites. • Environmental parameters test shall be conducted on frequent interval. • Motivational HSE programs shall be arranged for the promotion of health & safety. • Emergency response team • First aid facilities at sites and camp • 24 Hours Hospital tie-ups with ambulance facility. • Training facility for how to response in any emergency. • Mock drill exercise to response during any real emergency. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.19	Occupational Health and Safety	<ul style="list-style-type: none"> • Ensure that where it is possible for a worker to fall through a vertical distance, the worker is protected from the falling by <ul style="list-style-type: none"> ✓ A guard rail around the work area ✓ A safe net; or ✓ A fall arresting device • Protection against trench collapse • Wearing proper clothing • Eye protection • Foot protection • Respiratory protective equipment • Safety for Building and equipment • Precautions in case of fire • Fencing of machinery • Any dust or fumes or other Impurities likely to be injurious to the workers effective measure shall be taken to prevent its accumulation and its inhalation by workers 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost
1.20	Hydrostatic test water not treated with biocides, corrosion inhibitor	<ul style="list-style-type: none"> • The hydro test water will be diluted prior to discharge. 	Contractor	GTCL/Supervising Consultant	Included in overall construction cost

Sl. No.	Potential Impact	Mitigation/Management Measures	Responsible Agency	Supervising Agency	Cost
	and oxygen scavengers				
2. Operation					
2.1	Pigging Waste ✓ Pipe cleaning waste (pigging grit - scale, rust, or other foreign material)	<ul style="list-style-type: none"> Pigging waste is assessed as containing mostly silt material by GTCL and currently it is buried underground. 	GTCL	GTCL/Petro Bangla	Included in overall operational cost
2.2	Operational Safety	<ul style="list-style-type: none"> It is recommended that GTCL will continue to follow the gas safety rules and its updates in timely manner. 	GTCL	GTCL/Petro Bangla	Included in overall operational cost
2.3	Emergency Response System	<ul style="list-style-type: none"> It is recommended that GTCL will equip its personnel with due awareness training, appropriate PPE and Safety guidelines to respond Emergency situations. 	GTCL	GTCL/Petro Bangla	Included in overall operational cost

6.3 Identify immitigable impact as residual impact, Technical & financial plan for proposed Environmental Mitigation

6.3.1 Organizational Management Aspects

Executive responsibility for project management commonly involves a number of organizations, each with specific responsibilities for particular aspects during the pre-construction, construction and operation & maintenance phases. Following accumulation of the database of environmental measurements, the management measures with regard to controlling the potential impacts that could occur during different phases of the project should indicate responsibilities for the various actions concerned.

The environmental management team should, therefore, detail the management actions required with fixation of specific individual responsibilities for these actions particularly in respect of Policy and leadership for continuous improvement through, training and orientation, fulfilling the regulatory requirements in environment, safety and health. The responsibilities would also include risk management and ensuring emergency preparedness and response, incident reporting & investigation and maintaining harmonious community relations.

Environment and Safety (EAS) Management System Process

Besides defining management's requirements regarding EAS, the GTCL ESMS establishes the processes to apply the system to their operations. These processes include steps to clarify accountability. These steps are listed as follows:

Specific Activities and Responsibilities

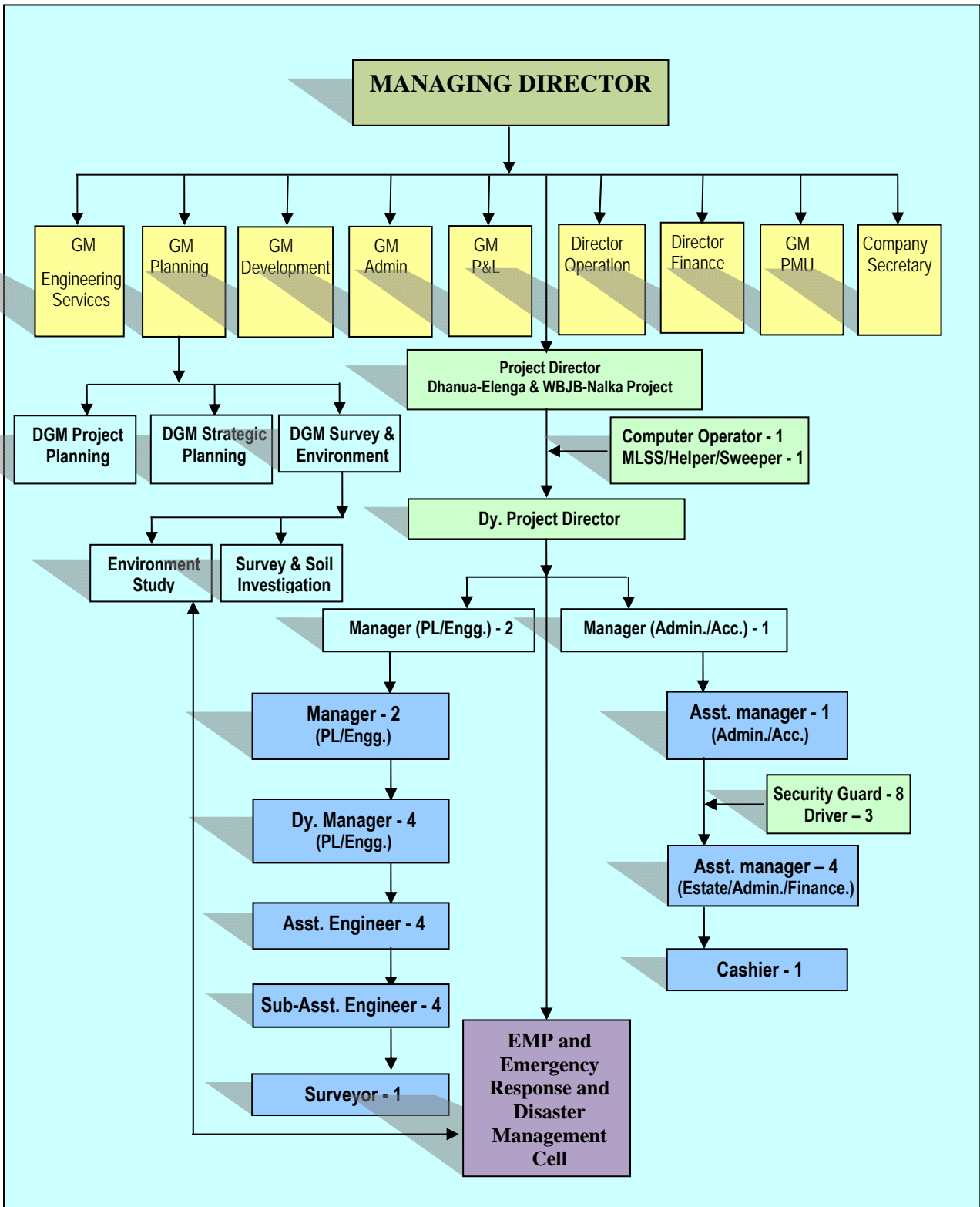
1. The first step is to clearly assign responsibility to meet each EAS requirement at all levels of the GTCL. This process begins at the top of management and continues down through each level of the organization, so that until each affected person understands his/her EAS responsibility. Managers and supervisors of the Technical Support Staff at every level of the project execution would review each of the project activity performed by themselves, by their contractors including the contractor and then would make his choice(s) of remedial action.
2. This process will continue in GTCL until all procedures have an assigned responsible person who will assure that the procedure is implemented. In many cases, several people will be accountable for implementation of a procedure. For example, at the pipeline construction sites and at supporting field camps more than one person would be responsible for fulfilling the procedure regarding correct waste management.

Implement the System

In the implementation step, all of those responsible for implementing each EAS procedure will develop the approach and the systems needed for procedure implementation. Clearly defined roles and responsibilities are critical, along with the necessary training, to support implementation.

The institutional arrangement designed for EMP of the WBJB-NAIka Gas Transmission Pipeline project has been shown in **Figure-6.3-1** reflecting the inter-linkages between GTCL Technical Staff, the Contractor and the Environmental Specialist of the client/contractor so far as implementation, supervision and monitoring of the EAS issues are concerned.

Figure-6.3-1: Existing and Project Implementation Organizational Set-up of GTCL



6.4 Emergency Response Plan and disaster management plan

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

- People
- Property
- Environment

Keeping these priorities in mind, the six steps described below constitute most of the emergency response phases. It is important to realize that although the six discrete steps have been identified several of the steps may be activated simultaneously.

The emergency procedures identify 'who does what and when' in the event of an emergency. Responsibility for who is in charge and their coordination of emergency actions shall have to be identified. The following are important events that require emergency procedures at any given time or may be occurring all at once.

It is also important to remember that emergency response must be adapted to individual circumstances and may require inventive, adaptive or creative solutions to difficult problems with very little time for planning or debate. Further, to improve the response capabilities, cooperative arrangements and organizations must be established for providing the appropriate equipment and expertise.

Nature of Emergency & Hazardous Situations may be of any or all of the following categories:

I. Emergency

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

II. Natural Disasters

- Flood,
- Earthquake/ cyclone,
- Storm/ typhoon/ tornados, and
- Cloud burst lightning.

III. External Factors

- Food poisoning / water poisoning,
- Sabotage, and
- War.

Six Steps in Emergency Response

Step-1: Determine the potential hazards associated with the incident, substance or circumstances and take appropriate action. Identify the type and qualities of dangerous goods involved and any known associated hazards. Determine potential hazards stemming from local conditions such as inclement weather, contaminated water bodies etc and ensure that the initial response team is aware of these conditions.

Step- 2: Determine the source / cause of event resulting to emergency and prevent further losses.

Step- 3: Conduct assessment of the incident site for further information on hazards or remedies.

Step- 4: Initiate redress procedures.

Step- 5: Report the incidence, its nature, cause, impact, applied redress procedures and any further assistance required etc. to concerned officials of GTCL, any other concerned agencies

of the government and / or land owner / neighborhood community.

Step- 6: Take appropriate steps with respect to hazards to wildlife, other resources and addressing public and media concerns and issues, as applicable. Response priorities are to protect human lives, property and the environment in and around the project sites.

6.4.1 Emergency Response Plan of Construction Stage

The purpose of an Emergency Response Plan (ERP) is to describe the procedures to ensure the health and safety of staff and the public in the event of any incident. Although Emergency Response Plans for gas pipelines have a different scope than those of other facilities, the purpose and key elements of the plans are similar.

Three levels of planning (reduced, normal and special) may be used depending on the particular circumstance, potential incidence rate and the location and number of residents living in the community/locality in close proximity along the project sites.

The scope of the ERP is also dependant on the potential impact of the project activities, complexity of evacuation logistics and proximity to public facilities. A key feature of all plans is the designation of an Emergency Planning Zone which defines the area to be evacuated or protected in the event of an emergency.

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

The contents of a plan must include a definition of “an Emergency” and an action plan to address that emergency. This includes defining the “Stages of Alert” that may be applicable for various aspects of the work. This is important since it requires good coordination between aspects such as welding, testing, commissioning and Tie-in etc. Each action plan defines what level of evacuation should be occurring, who should be notified, what monitoring should be done and when emergency response teams are notified.

Another essential component of an ERP is the definition of responsibilities of the emergency response personnel including: off-site and on-site personnel, team coordinators, safety and evacuation personnel, monitoring crews, public relations and government personnel. Evacuation procedures, evacuation centers, communication systems equipment lists and post emergency procedures must also be defined.

The roles and responsibilities for the various government departments are to be defined and coordinated within the plan which should include the provision for the company/government to establish an on-site command post and a main control headquarters to provide advice to affected persons, Union Parishad (councils), local administrations, fire brigade and the media.

To ensure preparedness, there should be provision for testing the response and usefulness of the planned emergency response exercises. These exercises usually involve the company and contractor personnel as well as various government organizations and the community leaderships that would be involved in actual emergency incidents

6.4.2 Assessment of Environmental Risks and Potential Hazards for Various Scenarios of Chemical Emergency during Pipeline Operation

Environmental risks and potential hazards for various scenarios of chemical emergency during pipeline operation generates from inappropriate handling, use, transportation, storage and disposal of hazardous chemicals. Hazardous materials are classified as those that present an excessive risk to

property, the environment or human health due to their physical and / or chemical characteristics. The materials classified as Hazardous include:

- Explosives;
- Compressed gases, including toxic or flammable gases;
- Flammable solids;
- Oxidizing substances;
- Radioactive material;
- Toxic and infectious substances; and
- Corrosive substances etc.

6.4.2.1 General Approach to Risk Assessment

The objective of any chemical hazard management plan is to ensure safety for both the local community and the environment in general. So, any plan would aim to reduce risks of emergencies related to hazardous material use, handling, storage or disposal.

The principal approach to risk assessment is obviously based on the postulation of:

- a certain probability of major accidents occurring at a specific site and
- an estimate of potential damage to the population and the environment around the site

Probability of risk within any identification framework for various scenarios of chemical emergency during pipeline operation is usually derived from statistical data. The probability of a major accident depends on the failure ratio of technical installations, the frequency of hazardous goods transports etc. The damage assessment depends on various factors such as amounts of chemicals stored or transported, dispersion distances for different chemical substances, toxic properties of chemical substances, population density etc.

The resulting risk is presented as an expectation value (mathematically a multiplication of probability and damage) or as a cumulative risk curve. These calculations are carried out separately for human and environmental damages and for all relevant risk sources.

The employment of Geographic Information Systems (GIS) methods allows one to visualize the risk levels and to assign them to specific geographical areas. Furthermore, GIS facilitates the interpretation of data and of the final results. The accumulated risk layers lead to interesting, sometimes surprising results, because several minor events accumulated at the same geographical site might result in a significant total risk.

In the foregoing context, anticipated major risk assessment problem to be faced by GTCL may include the possible increase in conflicts between risk-inducing activities and land-use planning, more intensely used emerging built-up areas and increasing redevelopment of sub-urban sites close to its pipeline system into areas of industrial and mixed use ones, producing new risk exposure situations.

6.4.2.2 Chemical Hazards

Some of the major and potential issues causing most of the chemical emergencies during pipeline operation may be listed as follows:

- Oxygen Deficiency
- Combustibility
- Flammability
- Flash Point
- Gas / Vapor Explosions
- Corrosiveness and
- Reactivity

Usually any hazardous situation related to fires and explosions involves.

- a. Physical destruction due to shock waves, heat and flying objects
- b. Initiation of secondary fires or creation of flammable conditions
- c. Release of toxic and corrosive compounds into the surrounding environment.
- d. BLEVE - The build-up of internal pressure in combination with a weakened containing shell (or tank) can result in an instantaneous release and ignition of vapour, known as a BLEVE (an acronym for Boiling Liquid Expanding Vapour Explosion). A BLEVE' results when a flammable liquid is rapidly heated to relatively high temperatures above its boiling point.

The possibilities cannot be ruled out about GTCL being subjected to any one or more of the cause and effect of the foregoing potential chemical hazards at any time of its activities during construction, testing, commissioning, operation & maintenance of the WBJB-Nalka high pressure gas transmission system.

6.5 Occupational Health amid Safety Management Plan

In work places, good industrial practice will be maintained during construction and operation by the contractor and EMU, GTCL respectively. During construction phase, the contractor will follow their own corporate Occupation Health and Safety (OHS) procedures, that procedures will be produced to the GTCL prior to the construction work.

The state of art OHS practice will be followed by the contractor, in case of any lapses in definition and understanding of the environmental parameters and tests, the Engineering Procurement Construction contractor will be obliged to follow the Bangladesh EHS policy.

OHS committee will monitor and train the workers. Weekly / fortnightly training will be conducted to aware the workers under the contractors obligation. The cost regarding those activities will be borne by the executors. Regular Tool Box safety meetings at the beginning of each days work should be encouraged.

6.5.1 General Requirements

Bangladesh Labour Law encompasses the related occupational health and safety obligations under the Labour Law 2006. This law has focused on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation. The salient features of the general requirements for the workers' health and safety stated in the referred law is presented in **Table-6.5-1** This law is commonly followed in Bangladesh by the employers, and there are punitive provisions to in case of non-compliance to same.

6.5.2 Workplace Environmental Quality

The proposed gas pipeline and plants project has two main phases- (i) the construction of infrastructure, installation and commissioning of the pipeline and the plants & equipment, (ii) operation of the pipeline system including the plants and associated facilities etc.

Table-6.5-1: General requirements for workers' health and safety according to the labor law 2006 (Bangladesh)

Issues	Requirements
Health and Hygiene	<ul style="list-style-type: none"> • Cleanliness • Ventilation and temperature • Dust and fumes • Disposal of wastes and effluents • Overcrowding • Illumination • Latrines and urinals • Spittoons and dustbins
Safety	<ul style="list-style-type: none"> • Safety for building and equipment • Precautions in case of fire

Issues	Requirements
	<ul style="list-style-type: none"> • Fencing of machinery • Floor, stair and passage way • Work on or near machinery in motion • Carrying of excessive weights
Compensation for accidents at work	<ul style="list-style-type: none"> • Owner's responsibility for compensation • Amount of compensation • Report on fatal accident and treatment • Compensation on contract and contract registration • Appeal
Dust and Fumes	<ul style="list-style-type: none"> • Any dust or fumes or other impurities likely to be injurious to the workers, effective measures shall be taken to prevent its accumulation and its inhalation by workers
Over-crowding	<ul style="list-style-type: none"> • No work room in any factory shall be overcrowded • At least five hundred cubic feet of space shall be provided for every worker employed in a work room
Latrines and urinals	<ul style="list-style-type: none"> • Sufficient latrines and urinals shall be provided • Shall be maintained in clean and sanitary condition • Shall be adequately lighted and ventilated
Precautions in case of fire	<ul style="list-style-type: none"> • Shall be provided with means of escape in case of fire • Effective measures shall be taken to ensure that all the workers are familiar with the means of escape • Fire fighting apparatus should be provide and maintained
First aid	<ul style="list-style-type: none"> • First aid facility provided and maintained • One for every one hundred and fifty workers • Shall be kept with a responsible trained person who shall be available during the working hours • In every facility where five hundred or more workers are employed, a dispensary shall be provided and maintained • Standby Ambulance at project site for any accident
Disposal of wastes and effluents	<ul style="list-style-type: none"> • Provide with proper disposal system for solid waste and effluents. • In case of a factory where no public sewerage system exists, prior approval of the arrangements should be made for the disposal of wastes and effluents
Occupational and poisoning diseases	<ul style="list-style-type: none"> • 16 occupational diseases are classified as follows: <ul style="list-style-type: none"> ➤ lead poisoning ➤ lead tetraethyl poisoning ➤ phosphorous poisoning ➤ mercury poisoning ➤ manganese poisoning ➤ arsenic poisoning ➤ poisoning by nitrous fume ➤ carbon disulfide poisoning ➤ benzene poisoning ➤ chrome ulceration ➤ anthrax ➤ silicosis ➤ poisoning by halogens ➤ primary epitheliomatous cancer of the skin ➤ toxic anemia ➤ pathological manifestation due to radium or x-rays
Compensation	<ul style="list-style-type: none"> • If personal injury is caused to workmen by accident arising in the course of employment, employer shall be liable to act according to labor law 2006. • 36 occupational diseases have been termed as ones for which compensation is payable <ul style="list-style-type: none"> • Monthly payment as compensation for temporary disablement are: <ul style="list-style-type: none"> ➤ Compensation should be paid for the period of disablement or for one year whichever period is shorter ➤ Such compensation shall be paid at the rate of full monthly wages for the first two months ➤ Two thirds of the monthly wages for the next two months and at the rate of the half of the monthly wages for the subsequent months

Issues	Requirements
	<ul style="list-style-type: none"> ➤ In case of chronic occupational diseases , half of the monthly wages during the period of disablement for a maximum period of two years shall be paid ➤ International/ national (whichever is beneficial for the officers and workers working under contractor) level insurance coverage shall be arranged for all workers during construction phase by the contractor

6.5.3 Health Hazards

The construction phase includes site preparation, plant construction and access road construction etc. The health hazards associated with these activities are mainly due to dust and noise pollution. Excessive noise can cause loss of hearing and psychological changes. Dust pollution can cause eye and respiratory irritation and in some cases allergic reactions. The inhalation of exhaust gases from construction vehicles and machinery can also cause harmful effect to the health. Stress can also be caused by working in shifts, high work load, poor living condition of workers etc.

A quantification of the measures of severity in health hazards is not well defined. They are slow acting and cumulative, their effects may not be visible for years. During plant installation and commissioning, exposure to the chemicals (paints, solvents, thinners etc.), batteries, welding materials, lubricants etc., may cause hazardous effect to the workers, which ultimately could cause anaemia, liver and kidney damage, cardiovascular diseases and neurological disorder.

6.5.4 Remedial measures

To minimize the hazards arising from the activities at different phases of the pipeline and the plant construction and operation, the following measures will be taken:

- the employer (contractor during construction phase and in turnkey period) will inform his employees to submit full scale medical report (if possible) to the authority prior to join in to the company and medical board of the company will take decision on this report.
- works with volatile toxic chemicals will be undertaken in a well ventilated place and as per the corporate OHS guideline.
- labourers handling, toxic chemicals will be provided with protective gear and will be relieved frequently from their posting.
- workers exposed to an excessive noise should be provided with protective gear and be relieved frequently from their post
- workers exposed to dust will be provided appropriate musk and other protective gear.
- frequent spraying of water will be undertaken to minimize dust pollution and dispersion.
- persons undertaking construction and installation works shall have access to amenities for their welfare and personal hygiene needs such as sanitary toilets, potable drinking water, washing facilities, shelter sheds etc.
- proper disposal of waste will be in practice.
- health education and information on hygiene will be provided to the workers
- regular checks on drinking water quality (if the water supplied by the contractors/ company) will be ensured within work site.
- taking x-ray & handling of radioactive isotopes etc would be done by certified professionals only.

6.5.5 Safety

Strict rules and procedures for the execution of specific tasks, enforcement of the rules, and discipline amongst workers, maintenance of machineries used by providing all necessary gear or equipment will be provided for the safety of the workers.

The following guidelines will be followed to maintain the safety of the workers in addition to the contractors OHS policies:

- workers have to be informed about the possible damage or hazards related to their respective jobs / occupation
- proper warning sign shall be posted at different points during construction and operation of the pipeline system and the control station plants
- pedestrian movement and the traffic will be safely managed during construction phase for lowering the associated health and safety risks
- sufficient lighting will be ensured, where a person performs construction work or may be required to pass through, including access ways and emergency exit or passage without any risk to health and safety
- construction site needs to provide safe access to and egress from all places where they may be required to work or pass through. This includes the provision of emergency access and egress route that must be free from obstructions. This will be provided in consultation with the personnel engaged for the security of the premises.
- adequate perimeter fencing will be installed on the site before construction work commences and that will be maintained during the construction work and signs will be placed which is clearly visible from outside the site and would display emergency telephone numbers.
- electrical installations, materials, equipment and apparatus are designed, installed, used, maintained and tested to eliminate the risk of electrical shock, burns, fire or explosion in general.
- construction site will be kept orderly and tidy. Access ways will be kept clear of materials and debris. Access ways shall be maintained as non-slippery condition. All materials will be stored in an orderly manner so that it does not pose any risk to the health or safety of any person
- arrangements of first aid facility will be made accessible during construction and operation work.

6.5.6 Work in Confined Spaces

In the operational phase, noise pollution may pose risk to health. Baseline study measured the noise level near the generators and rotating and stationary machines and equipment which ranged from 90 dBA to 110 dBA. This level may cause hearing impairment of the workers if exposed 2-4 hours/day.

Supervisors, inspectors and related personnel who work in this area will be provided ear plugs or ear muffs.

Areas where people may be exposed to excessive noise will be sign posted as "Hearing Protection Areas" and their boundaries will be defined with red line. No person will be allowed to enter the respective areas unless wearing personal hearing protectors.

The confined work spaces will be provided with sufficient air to avoid any health risk. Adequate care will be taken to minimize stress and ergonomic design will be improved in course of time to minimize health hazards.

First aid facilities will be kept in place and evacuation plans for emergency situations will be facilitated with adequate drills, instructions and signs. Adequate fire fighting arrangements will be installed and maintained in workable condition on a regular basis. In case of emergency, fire fighters from district level will be called on.

6.5.7 Record Keeping and Reporting

Reporting will be regularly communicated to the higher authority as a routine work. Records of

construction, installation, training, equipment maintenance, operation, fault detection and remedy will be maintained. Records will also be maintained for following the corporate guidelines by the contractors of the proposed project.

6.5.8 Pipeline and Plants Construction

Persons with control of the construction project sites will retain records for a reasonable period after the completion of the construction project about the occupational health and safety induction training and any other training given to persons directly engaged or trained by them to undertake construction work on the project.

6.5.9 Pipeline and Plants Operation

During operation of the pipeline system and the plants, arrangements will be made to keep records on any relevant tests, maintenance, inspection, commissioning and alteration of the Pipeline and the Plants and make those records available to any employee or relevant health and safety representative.

6.5.10 Noise

Audiometric test records of employees should be kept during the employee's period of employment and longer as necessary, as they may provide a useful reference for workers' compensation. The records will be kept in a safe, secure place and held as confidential documents.

6.5.11 Hazardous Substances

Assessment reports which indicate a need for monitoring and/or health surveillance together with the results of monitoring and/or health surveillance shall be kept as records in a suitable form for at least 30 years from the date of the last entry made. Retention for a period of at least 30 years is necessary because some health effects, such as cancers, may take a long time to become evident. The information kept will be valuable in epidemiological studies and for developing effective control strategies.

All other records, including assessment reports not indicating a need for monitoring and/or health surveillance and records of induction and training, shall be maintained for at least twelve years in a suitable form.

6.6 Responsibility of the contractor

Potential impacts could originate from contractor's activities. Therefore, GTCL shall ensure that the contractor takes due responsibility to mitigate the negative impacts and:

- Takes reasonable steps to protect the environment and avoid damage and nuisance arising from their activities and operations.
- Complies with statutes and regulations concerning the execution of work.
- Familiarizes with legislation and regulations relating to environmental protection that is relevant to their activities.
- Refers to national environmental quality guidelines.
- Be responsible for the costs of cleaning up any environmental pollution resulting from their activities, if methods for doing so are available and effective.
- Maintains sites under their control in a clean and tidy condition and shall provide appropriate and adequate facilities for the temporary storage of wastes before disposal.
- Shall not allow used oil or other petroleum wastes to be used as dust suppressants and reasonable precautions shall be taken to control and prevent accidental blow off of gas and/or spillage of petroleum products or discharge into atmosphere or water courses.

- Be responsible for the provision of adequate sanitary facilities for the construction workforce (including those employed under sub-contracts) at construction and camp sites. Vehicles operated by the Contractor (including sub-contractors) shall be maintained according to the original manufacturer's specifications and manuals with particular regard to the control of noise and/or smoke emissions.
- Takes reasonable measures to minimize dust blow arising from sites under their control by regular watering of soil stockpiles, bare soil, haul roads, non surfaced traffic areas and sources of fugitive dust, when conditions require dust suppression.
- Be responsible to pay compensation upon the appropriate monetary evaluation applicable to the local market if any damage is incurred to agricultural land or surrounding homesteads outside of the requisitioned land.
- Precautionary signboards/ danger signals/ propitiatory billboards shall be placed in appropriate places to notify people about the possible dangers particularly in the eve of non destructive testing inspections involving radiations and including but not limited to hydrostatic testing & commissioning of the pipeline system.
- Removes equipment, surplus material, rubbish and temporary works and leave the site in a clean condition to the satisfaction of the company's representatives after completion of construction activities.

6.7 Storage facilities for chemicals

During construction and operation in site; fuel, lubricants and other chemicals will be required for heavy equipment, vehicles etc. and thus a small portion of same may be required to be stored on site. The schematic diagram of chemical storage facility may be used by the contractor and subsequently GTCL.

The Contractor will design a catchment system to minimize spill damage. There is always a risk of fuel leakage either as the result of an accident, failure to close valves or failure of equipment or materials. Leaks caused by corrosion in oil storage tanks will be prevented to the maximum extent possible with coatings and Cathodic protection (both interior and exterior).

The contractor will employ early leak detection monitoring system where personnel will be aware and trained on oil spill prevention, mitigation and management of the situation such as how to stop further loss, isolate the source, contain the spread of contamination, clean up spills, and file an incident report.

Further at each stage of the construction and operation, the Contractor will maintain an inventory along with Material Safety Data Sheet (MSDS) of hydrocarbon and chemical sources up-to-date and include fuel tankers, fixed fuel dumps and their locations. The Contractor will maintain this practice and well developed contingency plan throughout their construction and operation up to final commissioning and handing over the pipeline system to GTCL. Contingency plans will be based on the location and volume of potential spills.

The main fuel is natural gas so there would not be any big types of oil spillage. In order to maintain a good industrial practice, the Contractor and subsequently GTCL will develop a leak minimization strategy as an integral part of facility design and maintenance procedures. Oil/ Condensate sumps will be provided for all drains to prevent contamination of rainwater drainage. Drip pans will be used where needed.

The contractor will construct separate storm water drainage systems for rainwater so that oil, condensate and chemical will not contaminate the natural stream. Suitable absorbent material will be available onsite for immediate prevention.

CHAPTER-7 ENVIRONMENTAL MONITORING PROGRAM FOR PERFORMANCE EVALUATION

7.1 Requirements for Management and Monitoring

Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions.

The purpose of the monitoring program is to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring program be designed and carried out. Environmental Monitoring in the EMP for this Gas pipeline project has been designed with the following objectives to:

- Measure the extent of expected or poorly quantified impacts;
- Ensure incorporation of Environmental Mitigation Measure during implementation of the proposed project;
- Observe effectiveness of Environmental Mitigation Measures;
- Ensure early detection of unexpected impacts and adoption of appropriate protection measures;
- Provide periodic reviews to observe adherence to Environmental Quality Standards (EQS) and adjust Environmental Mitigation Measures, if required; and
- Detect unacceptable level of impacts and adopt corrective measure

7.2 Monitoring parameters and schedule

A monitoring program will be implemented for West Bank of Jamuna Bridge-Nalka high-pressure gas pipeline. The following parameters are to be taken care of in the monitoring program:

- Ambient Air Quality
- Surface Water Quality
- Waste
- Noise / Vibration
- Social Environment i.e. Resettlement, Living / Livelihood

Ambient Air Quality- Monitoring is necessary for construction/installation stage of the gas transmission pipeline project.

Waste- Monitoring is necessary for construction/installation and operation stages of the gas transmission pipeline project.

Noise / Vibration - Monitoring is necessary for construction/installation stage of the gas transmission pipeline project.

Social Environment- 1 hectare i.e. 100mX100m area would be required for the City Gate Station (CGS) of the project where the resettlement is not be required. For this the social issues are not required to monitor for this project.

Environmental monitoring plan of the WBJB-Nalka project is listed in the Table-7.2-1.

Table 7.2-1 Environmental Monitoring Plan for Gas Transmission Pipeline (West Bank of Jamuna Bridge-Nalka)-GTCL

Environmental Items	Environmental Parameters/ Monitoring Items	Unit	Bangladesh Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method)	Responsible Agency	Cost of Monitoring (BDT)
Construction/installation stage:							
Air Quality	SPM ₁₀	µgm/m ³	150 (Statutory Rules 2005)	50 (World Bank Guideline) 150 Interim Value	<ul style="list-style-type: none"> One Sampling Point near the project site another 1 km. (normal practice in Bangladesh) away from the project site Per month one 24-hr. day sampling High Volume Dust Sampler 	Contractor	-2000/Set -Included in overall construction cost
	SPM _{2.5}	µgm/m ³	65 (Statutory Rules 2005)	25 (World Bank Guideline) 75 Interim Value	<ul style="list-style-type: none"> One Sampling Point near the project site another 1 km. (normal practice in Bangladesh) away from the project site. Per month one 24-hr. day sampling High Volume Dust Sampler 	Contractor	-2000/Set -Included in overall construction cost
Noise	Noise level (Residential Area)	dB	45 (Night-time)	45 (Night-time) (World Bank)	<ul style="list-style-type: none"> 50m from the construction site Per Month one 24-hr. day sampling Sound level meter 	Contractor	-2000/Set -Included in overall construction cost
			55 (Day-time)	55 (Day-time) (World Bank)			
Waste	<ul style="list-style-type: none"> Excess borrow pit soil Generated Solid waste Sanitary waste Housekeeping status 	-	-	-	Worksite and Camp site (weekly)	Contractor	-Included in overall construction cost
			-	-			
Operation stage:							
Waste	<ul style="list-style-type: none"> Management of piggig waste 	-	-	-	Worksite (pig launcher and receiver locations)	GTCL	-Included in overall operation cost

7.3 In-house environmental monitoring system

7.3.1 Environmental Policy of GTCL

GTCL is committed to the protection of the environment and will conduct its operations in compliance with all relevant local, national and international environmental legislation and standards. GTCL will have an Environment Specialist (ES) in its team of client/contractor for supervising the environmental management & monitoring activities under this project through the Team Leader in close coordination with the concerned Technical Support Staff of GTCL. The detail of his assignment is given below:

ES will assist the GTCL team and its contractor in developing the prevailing situation based implementation and monitoring schedule and procedure including safety hazard mitigation plan and procedures as recommended in the EMP. He will prepare quarterly progress report in standard format and submit to GTCL. The report would fulfill the requirement of the laws, regulations and guidelines of GOB. He will also assist GTCL to prepare the semi-annual monitoring reports, fulfilling the aforementioned requirements, to be submitted to GTCL and DOE.

7.3.2 Environment and Safety (EAS) Management System Process

Besides defining management's requirements regarding EAS, in fulfillment of Petrobangla ESMS guidelines in conjunction with DOE rules and regulations, the GTCL ESMS establishes the processes to apply the system to their operations. These processes include steps to clarify accountability. These steps are listed as follows:

a. Specific Activities and Responsibilities

1. The first step is to clearly assign responsibility to meet each EAS requirement at all levels of the GTCL. This process begins at the top of the management and continues down through each level of the organization, so that until each involved person understands his/her, EAS responsibility. Managers and supervisors of the Technical Support Staff at every level of the project execution review each of the project activity performed by themselves and by their contractors and then would make his choice(s) of remedial action.
2. This process will continue in GTCL until all procedures have an assigned responsible person who will ensure that the procedure is implemented. In many cases, several people will be accountable for implementation of a procedure. For example, at the pipeline construction sites and at supporting field camps more than one person would be responsible for fulfilling the procedure regarding correct waste management.

b. Implement the System

In the implementation step, all of those responsible for implementing each EAS procedure will develop the approach and the system methodology needed for procedure implementation. Clearly defined roles and responsibilities are critical, along with the necessary training, to support implementation.

The exiting organizational set-up of GTCL is given in **Figure-7.3-1** and based on the same, the institutional arrangement designed for EMP of the WBJB-Nalka Gas Transmission Pipeline project has been shown in **Figure-7.3-1** reflecting the inter-linkages between GTCL Technical Staff, and the Environmental Specialist so far as implementation, supervision and monitoring of the EAS issues are concerned.

c. Measure, Assess and Audit Progress

Measuring ESMS progress is critical to improving performance. A successful ESMS of GTCL must be a continually improving process. In its procedural assessment, a simple, five-point scale will be used to score performance in implementing the ESMS:

1. No evidence that the procedure is being implemented
2. Procedure is partially implemented
3. Procedure is fully implemented
4. Best practice (the absolutely exemplary performance of procedure implementation) to be held up as a model for others to emulate.
5. Measuring and monitoring ESMS performance by the Environmental Specialist (ES) of the contractor supported by the Technical staff of GTCL.

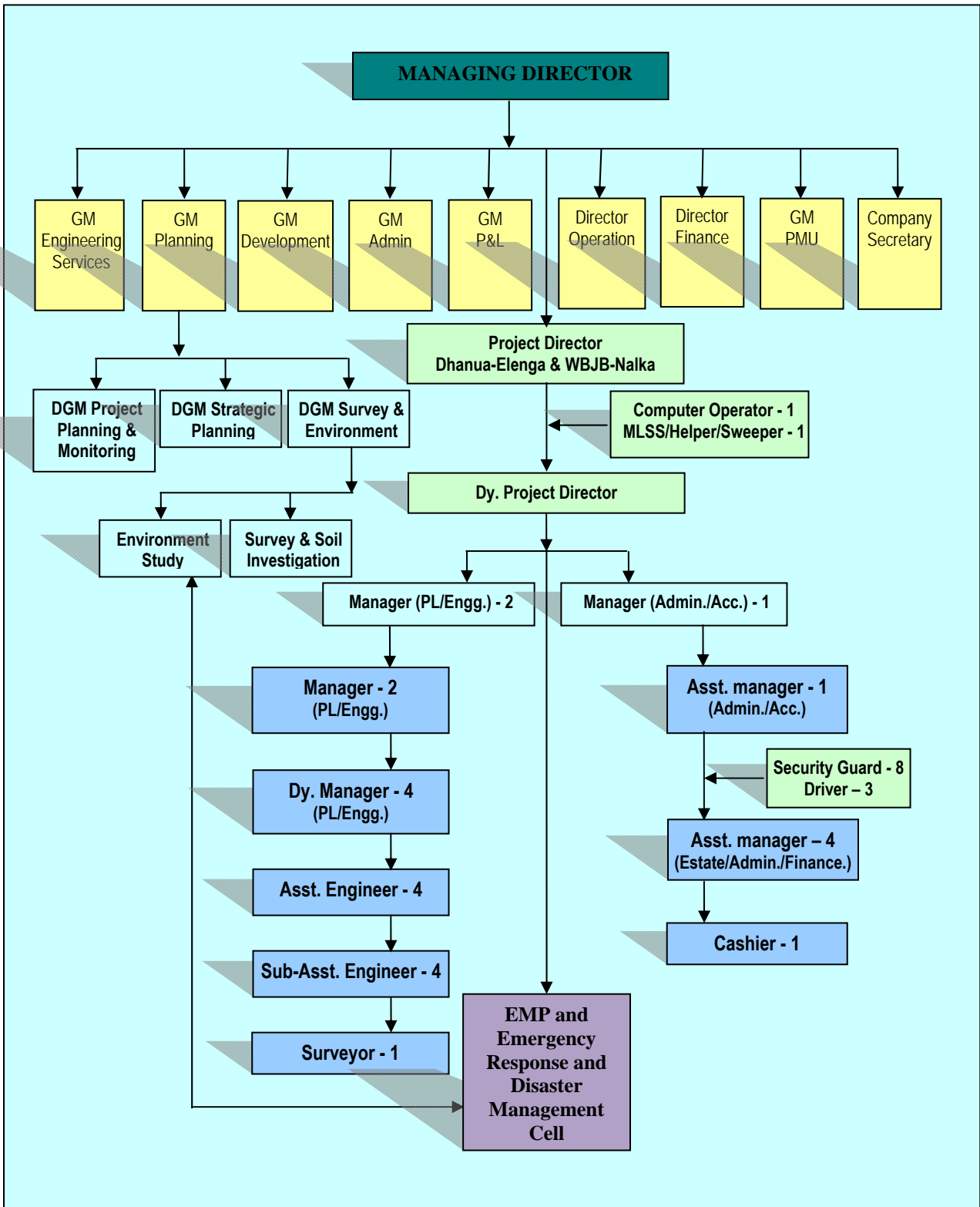


Figure-7.3-1: Existing and Project Implementation Organizational Set-up of GTCL

CHAPTER-8 BENEFICIAL IMPACTS

8.1 Introduction

In obtaining environmental clearance from DoE for construction of the proposed pipeline and installation of associated facilities, this task of Conducting the Environmental Impact Assessment (EIA) has been undertaken for the proposed 30" dia 14 Km Gas Transmission Pipeline along the selected route from WBJB-Nalka including associated facilities. It has been revealed in the study that properly managed, gas operations can be expected to provide major benefits not only to the communities in which they take place but also bring in multilateral gains in terms of wider national socio-economic contexts.

8.2 Gas Demand and Supply Scenario of the Country

It is well perceived that, at this point of time and at a critical juncture of the global gas industry, Bangladesh, a developing country of the South Asia, is striving hard to meet the rising energy demand of its 160 million people amidst growing concern for the techno-economic and socio-environmental impacts of its only predominant non-renewable and limited source of some 7.5 trillion cubic feet (TCF) natural gas now flowing from 85 wells of its 29 onshore gas fields through a 1000 kilometer (KM) Transmission & 29,000 KM distribution network and thus serving some 2.3 million customer with a quantum of 1.5 billion cubic feet (BCF) as end of December 2010. Thus, the natural gas industry, the prime natural resource of Bangladesh is currently meeting the demand of over 73% of the country's commercial energy. It is estimated that current demand of gas is over 25,000 MMCFD against the production figures of marginally over 2,000 MMCFD.

Further, though the production figures could be raised and now already under planned process of drilling some more new wells and thus add a few million CFD yet transmission constraints would continue to lead to stranded gas in the north-eastern part of the major gas producing fields of the country. Unless simultaneous evacuation of this stranded gas is ensured. In another estimate it appears that demand growth of gas being 7 % per year, it may further enhance to 10 % if infrastructural facilities turn more congenial to expanded industrial investments.

8.2.1 Impact of Current Crisis of Gas

it was being divulged in recent dispatches that, inadequate supply of gas and or limitations in the transmission system to designated load centers is leading to reduction of 500 MW in electricity generation, cutting down fertilizer production, rationing gas supply to industries, barring the commissioning and or setting up new industries and thus idling huge investments including depriving new occupants of over 5,000 flats from gas and electricity

The low pressure situation in urban and sub-urban areas is also failing to serve even the existing domestic consumers who hardly consume 12% of the supply. The natural gas vehicle owners, who had not only been contributing to urban & sub-urban environments through using CNG but also substituting some US\$1000 million of foreign exchange per year are subjected to rationing and thus all expansion activities in the CNG sector including hundreds of crores of investments already made therein are apparently coming down to a standstill. This is in turn bringing back threats to the aforesaid environmentally pollution free urban & sub-urban communities.

8.2.2 Production & Other Consequential Losses in the Industries

Considering Nabinagar- Manikganj belt alone, the industry owners investing Tk. 3,000 Crores and employing 1,000,000 people are suffering from low pressure situations. Similarly, production in scores

of industries from Konabari in Gazipur to Mirzapur in Tangail has dropped by 80% since September, 2011 following diversion of gas to Jamuna Fertilizer for resuming production which remained shutting down for five and a half month for shortage of gas. Bangladesh Garment Manufacturer's and Exporters' Association said in October, 2011 that at least 300 of its export oriented factories have been running at loss for the recent gas crisis, leading to the owner's fear that they might fail in paying the wages of their employees not to speak of meeting the export targets. At the same time Kaliakoir-Mirzapur Industrial forum claimed that they have been sustaining losses of about Tk. 6 Crore a day from acute shortage of gas in their 50 different industries wherein 150,000 people have been sitting idle for the ongoing gas crisis. To cite an example, Square Pharmaceutical alone had been running their factory with 10 rented diesel generators consuming 10,000 liters of liquid fuel and making a loss of Tk. 2 Crore a day with nearly 5,000 employees sitting idle. These situations are obviously impeding industrial growth and causing potentially negative impact on the environment too.

8.2.3 Potential Multi-lateral Impacts of the Crisis of Gas

Additional import bills for millions of tons of petroleum & coal for the power plants and supplementing fertilizer reduced export earnings from stranded and or underutilized industrial units are not only putting stress on the forest but also curtailing employment opportunities and thus impacting upon the development efforts of the country. All these factors are causing a loss of about 2 % in the country's GDP.

Further, potential negative impact of burning of the additional petroleum in the diesel run captive power units and the liquid fuel based power plants, which could be substituted by gas, is tremendously contributing to environmental pollution, resulting health hazards and to aggravate climate change issues resulting from the enhancement of green house gas (GHG) emissions.

8.3 Objective of the Project

In the foregoing context of the gas related scenario and multi-dimensional impacts of the current crisis of gas in different load centers of the country, it may be well imagined that this gas transmission project on card would bring in multilateral beneficial impacts too. This is because, this long awaited big inch high pressure pipeline and ancillary facilities will not only be used for transmission of gas produced from the planned new exploration & development wells but also immediately assist in evacuating the gas stranded so long in the north-eastern region of the country. In further analyzing the objectives of the project, in the broader perspective, it transpires that this project has been undertaken basically:

- i) to establish a sustainable Gas Grid and ensure gas supply to the whole country.
- ii) to supply Natural Gas to the proposed power plants under PDB and fulfill industrial, commercial and domestic gas demand and thereby reducing use of imported fuel and destruction of trees as firewood and
- iii) to ensure overall economic development through increased production in the industrial and commercial sectors including substituting the fuel import bills.

8.4 Potential Benefits

Implementation of this project will essentially bring in certain potential benefits which are expected to be accruable but not limited to the following under different phases of its Pre-construction, Construction, and operation of the project: after its completion upon Testing & Commissioning.

- Increased local employment
- The transfer of technical and commercial skills and development of local capacity;
- A share in fiscal revenues at the local level
- Enhancement of local social infrastructure and improvement in the delivery of services, especially in areas such as health, education, transport and power as a result of

- increased public funds and investor contributions; and
- Positive multiplier effects in and beyond the communities in which the extractive operations exist.
 - Enhance availability of environmentally pollution free and clean burning fuel and feed stock and thus accelerate:
 - Evacuation of stranded gas
 - Adding capacity to transmit additionally produced gas in future
 - Higher industrial growth
 - Greater employment generation
 - Higher export earnings
 - Reduce unfavorable balance of payment situation
 - Comfort low pressure situation for the industrial, commercial & domestic consumers
 - Ease gas connection to the awaiting flat owners and stranded industrial consumers,
 - Eliminate rationing of CNG refueling stations
 - Empower gas transmission & marketing companies with more operational flexibilities
 - Increase affordability of Gas marketing companies to provide gas to Power plants, Captive power units & fertilizer factories
 - Reduce import bills on Petroleum & Fertilizer and thus pressure on forest reserve
 - Lower cost of electricity generation and thus possible reduction of electricity tariff
 - Prompt gas operating companies to discharge their corporate social responsibilities
 - Reduce deforestation
 - Ensure cleaner environment and thus lesser health hazards with enhanced longevity.
 - Elevate socio-economic standard of living and thus contribute to poverty reduction.

8.5 Positive Impacts

8.5.1 Promoting Small-Scale Projects, Local Employment and Local Entrepreneurship

Rural populations often have limited access to development opportunities. Two of the limiting factors are access to reliable modern energy sources and knowledge and capacity to be active participants in development. However, as a result of recent major energy projects and particularly in gas pipeline project, there is a window of opportunity to develop the capacity of rural/indigenous peoples to benefit more extensively from these projects.

Communities in isolated regions are not attractive targets for distributors of electricity or natural gas since they are perceived to lack the “critical mass” and the ability to pay. The use of natural gas has the potential for widening access to electricity, since it may readily be used for small-scale power generation and for a wide spectrum of household, commercial and small industrial uses. Using stranded gas through this new gas pipeline system, it is possible to address this obstacle by developing gas based small-scale economic projects for these rural communities.

To mitigate adverse impacts of such developments, it is of critical importance to develop within the indigenous communities a basic knowledge of the risks and benefits of the hydrocarbon industry. Working with their own organizations, indigenous peoples are attending Bank sponsored training programs aimed at developing and strengthening their capacity to participate in the monitoring of operations and in accessing to a share in the industry benefits.

8.5.2 Direct and indirect impacts during construction and operation

8.5.2.1 Social Impacts

The development of a pipeline from West Bank of Jamuna Bridge to Nalka is likely to raise a number of social issues, which could impact on a range of stakeholders. In many cases, the impacts relating to these issues are likely to be manageable. The issues those are likely to create the most significant

impacts are the impacts of the project on income & livelihood of the affected persons and on the community during the construction and operation phases may be discussed in the first instance.

Nature of the impacts

The direct positive beneficial impacts of the project are expected to be felt at the local level. Since goods and services will be sourced from the National Capital District, it too will receive some of the indirect impacts. Based on the experience of large resource projects in gas pipeline sector, the local impacts of the project are expected to be in the form of:

- Employment created during the construction and operation phase
- Payments to landowners only for the CGS
- Improved infrastructure provision within the project area and improved connections between the project area and other centers
- Business opportunities generated by the supply of inputs such as fuel, security, and catering services to the project
- Employment and business opportunities resulting from the expenditure of incomes earned from the project and associated community and infrastructure projects.

The other direct impact is in the form of payment of royalties to landowners. Most of these payments will be spent in the local areas on food, vehicles, household durables and other items such as land purchase, farming etc. However, it is expected that some of the payments will be invested in local businesses.

The gas pipeline project will develop significant infrastructure including roads, bridges and telecommunications. The improved transport infrastructure will enhance access to remote areas and make education and health services more accessible.

It will also assist neighboring communities by providing opportunities for wage employment and for trading cash crops. In general, the infrastructure development would result in other significant benefits such as savings in transport costs and improved security of supply.

It is expected that some of the Government's proceeds from the project will be spent on the construction of new schools and health facilities, as well as the upgrade of existing facilities. Also, some of the funds would be spent on the employment and training of teachers and health professionals.

One of the significant impacts of the project will be the opportunities for local businesses. These opportunities include outsourcing for services such as catering, engineering, security, and fuel supply, managerial and technical assistance. The influx of workers into the project area will also increase the demand for various services, including food. Therefore there will be an opportunity for local farmers to increase their incomes by producing more food crops. The improved transport infrastructure may also make it easier for local producers to extend their supply networks to nearby markets.

However, despite the unique opportunity for governments at all levels to channel their share of the proceeds into improving infrastructure and services for the local communities, there is a risk that much of these resources will not reach the target beneficiaries. There is also a risk that the large sums of money flowing to individuals could aggravate social and health problems brought on by the consumption of alcohol and tobacco, imported foods, and could increase income inequalities.

Employment impacts

The direct impact of the gas project is an increase in urban skilled and unskilled employment levels. On the other hand, the rural unskilled employment levels are declining by lack of properly preparing

them by vocational training or other means of skilled training. These changes are consistent with a decline in activity in the agricultural sector and here it is observed that the largest fall in employment occurs in the unskilled sector which is the major supplier of labor to the smallholder agricultural sector.

Environmental Impacts

The benefits of the project will be realized primarily at the level of the national economy. The implementation of the proposed project will provide supply of clean burning fuel and necessary feed stock for the domestic, commercial and industrial consumers in general and Power plants and Fertilizer Factories in particular.

These will not only reduce Bangladesh's dependence on foreign energy resources but also help accruing a good number of benefits in terms of enhanced generation of electricity and production of fertilizer and other industrial products including opening up employment opportunities and thereby tremendously contribute to health, agricultural, forestry, commercial, industrial and economic development of the country.

However, natural gas being an intrinsically clean fuel compared with most alternatives, development of natural gas resources and transportation to the load centers for the consumers are, in general, environmentally sound options at the national and global level.

In fact, the proposed project activities would have no significant adverse environmental impact so far as a time bound execution program when application of advanced environment friendly construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the pipeline system.

As such, the execution of the project would stand environmentally sound and socio-economically sustainable with due adoption of the recommended mitigation measures and environmental management and monitoring processes.

8.6 Summary of the overall national beneficial impacts

The gas pipeline project will have a profound effect on the national economy. Not all of the potential impacts will necessarily be positive: a project of such size, relative to the economy as a whole, will inevitably create some stresses and strains across the economy. However the net benefits arising from the project will be very large provided the potential adverse pressures are properly managed.

Gas industries generate significant revenues for the national economy. Sound macroeconomic management and governance are required to ensure that the money generated from these projects is invested in local communities through policies that foster economic development and poverty reduction.

In fine, the project will increase real output at several times the current rate of growth with the potential benefits as highlighted in the recommendation of this report. It may be well understood that, the clear winners of any oil and gas expansion projects are the government sectors which receives very large revenue flows from taxes and other payments, urban households whose disposable incomes increase from the rapid increase in total employment and the manufacturing and service sectors, which benefit from the flow on effects.

Further, this project being a gas system expansion one, its added contribution would be to transmit more of the cleaner and environment friendly natural gas to the national grid to serve more consumers and for enhancing the capacity and pressure situation adequacy of the designated load centers of the country.

CHAPTER-9 INSTITUTIONAL CAPACITY

9.1 Key aspects of the study including the no. of competency of staff

The key aspects of the West Bank of Jamuna Bridge to Nalka gas pipeline project are the environmental issues. These have been described in great details in Chapter-5 and Chapter-6 of this report. It is expected that GTCL would monitor the required mitigation measures through external and internal monitoring.

A. External Monitoring

It has been given to understand that one independent monitor will be hired by the Contractor of Gas Transmission Company Limited for undertaking external monitoring of the entire project. The detail tasks that the external monitor is required to perform may be stated as follows:

- Determine whether Sound environmental management practices have been achieved
- Suggest suitable recommendations on remedial measures for midterm correction and improvement
- This Independent monitor is presumed to consider all technical, social and economic aspects of the Construction of West Bank of Jamuna Bridge to Nalka Gas Transmission Pipeline installation project so far as its environmental, health, safety etc. are concerned as well.

B. Internal Monitoring

Environmental Specialist under the **EMP and Emergency Response and Disaster Management unit** of GTCL will look after the overall environmental and social aspects of the pipeline project. The units will consists of one environmental specialist and be responsible for internal monitoring of the EMP implementation of each sub project. The detailed task of the internal monitor is stated below:

- Oversee the implementation of EMP
- Ensure that safety policy and procedures are strictly adhered to.
- Ensure that the environmental issues are appropriately addressed and any impacts are adequately addressed.
- Submit quarterly progress reports to GTCL which would contain progress made in EMP implementation with particular attention to compliance with the principles and matrix set out in the EMP.
- The report will also divulge concerns in EMP implementation, if any, and would suggest remedial steps as well.

In general the quarterly progress reports are to be forwarded to GTCL and would contain progress made in EMP implementation with particular attention to compliance as per principles and matrix set out in the EMP.

9.2 Size of operational budget

An estimated budget for Land acquisition required only for CGS has been given in **Table-9.2-1**. This is based on assumption and the field survey estimation.

Table-9.2-1 Cost of land acquisition and compensation (WBJB-Nalka)

No.	Item of cost	Cost (BDT)
1.	Land acquisition and compensation for CGS at Nalka of 1 ha area (100 m*100 m) including all related lost land assets like trees and others	49,400,000.00
2	Total cost of land acquisition and compensation	49,400,000.00

Note: Assuming cost per decimal Tk.2,00,000

9.3 Availability of appropriate technology and equipment

The contractor of GTCL should confirm appropriate technology and equipment to be deployed for implementation of the pipeline project. The materials, supplies, equipment and personnel requirements as well as the procedures to be applied therein for successful and environment friendly execution are largely guided by technical aspects so chosen by all groups concerned. Fulfillment of the requirements as such would thus, predominantly control the budget of the project execution. GTCL monitoring mechanism to be designated for the project should therefore continually monitor these issues, and particularly in respect of social and environmental aspects.

CHAPTER-10 CONSULTATIONS WITH STAKEHOLDERS / PUBLIC CONSULTATION

10.1 Public Consultation

GTCL recognizes the importance of social and environmental factors for successful implementation of the proposed project. As such, it has retained a specific provision in the EIA process to plan and undertake a comprehensive program of public consultation, focus group discussion (FGD) and environmental investigation, so that study on both the aspects may proceed simultaneously.

In fact, an organized consultation with parties and persons interested about the project forms a critical part of best practice project planning and environmental impact assessment. Early and participative engagement of stakeholders in the project planning phase increases the likelihood of approval by regulatory authorities and the smooth implementation of project activities.

Feedback from the consultation process plays an important role in understanding the apprehensions and expectations of the members of the public in general and stakeholders in particular. Such inputs from them help development of a clear picture of the socio-economic and environmental base line of the project area.

The importance of stakeholder engagement has also been recognized by the Bangladesh Department of Environment in its guidelines ECA '95 and ECR '97 of DOE and thus stipulated the requirement for consultation activities to be integrated into project planning and implementation phases, including during EIA of planned projects. Further, as a matter of fact, such consultation and FGD are now considered an essential pre-requisite for better implementation of project as well.

The purpose of the consultation process adopted under this project was to keep the local inhabitants/ primary stakeholders informed about the project and to gather their opinion / suggestions to incorporate the same during the subsequent stages of project planning and implementation.

Further, since this 14 km 30" diameter West Bank of Jamuna Bridge to Nalka high pressure Gas Transmission Pipeline project and its associated facilities being financed by the GTCL from its own resources and other development fund of different government organization, it was keenly felt necessary to have investigated about the qualitative and quantitative impact of the project on each and every project stakeholders and its surrounding community and public amenities.

10.2 Methodology and Output

10.2.1 Focus Group Discussion (FGD)

The process of public consultation was initiated and conducted during EIA survey in the mid of January, 2014 through focus group discussion (FGD) at and around different locations of the transmission pipeline right of way (ROW).

The consultant had arranged 2 public consultation meetings with the local stakeholders for information dissemination and community participation. The consultant and investigators investigated all the relevant matters regarding the project by arranging these meetings and group discussions for people's awareness.

An open discussion was made on the proposed project and its positive and negative impacts, and then people's perceptions were written by the BETS representatives for record and reference.

The two meetings with local people were conducted for understanding the project works and future planning of the project. Local peoples were positive in sharing their views and the GTCL was especially helpful to share the available information with the consultant.

10.2.2 Checklist Used for Public Consultation

For uniformity and clarity in conducting the public consultation meetings, a checklist was devised by the consultants and was used to enable the participants to comprehend the issues easily. This has helped them so much so that they could effectively participate in the discussions and express their opinions from objective points of views. This participatory approach contained in the Checklist so devised and given below was well accepted by all the participants:


Consultants Checklist:

- Location of consultation
- Name and occupation of the participants
- Awareness of the participants about the Project
- Description of the Project
- Benefits of the Project
- Impacts of the Project on social and environmental components
- Concerns about the Project
- Expectations from the Project
- Suggestions about the Project


During the public consultations, social, environmental as well as cross-cutting issues were discussed in detail. In addition, such discussions also included the potential impacts of the project activities on environmental and social parameters, identification of sensitive issues, risks, potential threats, public concerns and expectations from the project.

10.3 Findings from Focus Group Discussion

The salient features of the opinions expressed by the participants of different profession have divulged in general that they are concerned with due compensation and rehabilitation wherever any damage is done and with request for providing gas in their localities on priority basis. The details of the FGDs are listed below:

FGD-1	
Location:	Soydabad, Village/ Mouza: Soydabad; Union: Soydabad: Upazila: Sirajganj
Date of Meeting:	14 th January 2014
Description of Location:	Soydabad Bazar is the entry point of the northern districts of Sirajganj at the beginning of Jamuna Bridge. About 400 households reside in the village. A good number of handlooms are in the village. Occupation pattern: Weaver- 30%, farmer-30%, Small business- 20%, Agrilabour-10%, non agriculture labour-10%.
Discussion Output	<ul style="list-style-type: none"> • Gas transmission project is encouraging for the local people • Local people are benefited due to Jamuna Bridge and Railway communication • The projects linked to the Jamuna Bridge and Railway communication i.e. GT has greatly changed their economic condition • Rural character has changed, the area was river eroded area but due to river training this problem is solved. As a result the land price substantially increased • This area is now became well communicated and the prospect of industrialization is bright also • Local people need the domestic gas connection
FGD Snap:	
List of Participant:	

Sl. No.	Name	Village	Occupation
1	Zahid Hossan	Soydabad	Social Work
2	Anwar Shikh	„	Teacher
3	Md. Harun	„	Businessman
4	Md. Chan Mian	„	Agriculture
5	Md. Matin Mian	„	Student
6	Shamsul Hoq	„	Businessman
7	Aktar Hossan	„	Small Business

FGD-2			
Location:	Dukhiabari, Village/ Mouza: Soydabad; Union: Soydabad: Upazila: Sirajganj		
Date of Meeting:	14 th January 2014		
Description of Location:	<p>Dukiabari is a small and poor village. Name ‘Dukhibari’ means ‘abode of sorrow’ which reflects the economic condition of the village. Communication system of the project area is well but most of the people are poor and mostly working class. Household No-1000 and Population around 5000. The village is not very far from the Jamuna Bridge-Nalka national highway. Landless people are about 10% in the village and 30% household got only homestead land.</p> <p>Economic condition is not good. Handloom worker, weaving, fishing and earth worker and daily labor are the main occupation. Most of the people are engaged with different type of small business and they are about 30%. Roughly 20% are as handloom worker, 5% service holder, 20% is agriculture laborer and 10% are non-agriculture labor, 15% are unemployed.</p> <p>There is no health centre in the village and they have to district headquarter for treatment.</p> <p>There is a primary school in the village and the education rate is about 50%. And most of the people are class 5 passed. Local inhabitants are interested for education and poverty is a barrier for them. Regarding the project they have following suggestions. Drinking water quality of the project area is good and arsenic free.</p>		
Discussion Output	<ul style="list-style-type: none"> • Gas transmission project is encouraging for the local people • This area is now became well communicated and the prospect of industrialization is bright also • Local people need the domestic gas connection 		
FGD Snap:			
List of Participant:			
Sl. No.	Name	Village	Occupation
1	Saiful Mian	Dukhiabari	Service
2	Tanu Mia	„	Business
3	Md. Ibrahim	„	Agriculture
4	Abdur Rashid Mobile:01749755399	„	Agriculture

	5	Selim Sheikh	''	Teacher
	6	Arman Mian	''	Social Work
	7	Darach Shikh	''	Agriculture
	8	Jamiruddin Shekh	''	''
	9	Jahurul Shekh	''	Daily Labour
	10	Hamidul Islam 01768957778	''	Student
	11	Sankar mondol	''	Daily labour
	12	Sabuj 01744950181	''	Student
	13	Tarikul Islam	''	Teacher
	14	Reba Rani	''	Housewife
	15	Rehana khatun	''	''
	16	Modhu Mala	''	''
	17	Mukti Rani	''	''
	18	Rojina Khatun	''	''
	19	Anil Chandra Sarker	''	Service
	20	Saiful Mian	''	Service

Though they have, in general, appreciated laying of pipeline as a development work of the country and in their opinion, it will help setting up industries, generate employment and its nature of impact is usually temporary, but note of caution was there from them that the work should be done carefully to avoid any accident in future and reinstatement along the alignment has to be done properly and promptly after completing the pipe laying works.

Participants in these consultation meetings were the land and house owners of the vicinity of the project area.

The participants in general welcomed the project and expected that the project will contribute to the national economy in many ways. As reported, the following major issues among others were raised in the public consultation meetings.

- Noise pollution from vehicles and equipment at the project sites may cause disturbance to human being and wild life.
- There will be enhanced soil erosion particularly on the Ponds/river banks, which should be addressed properly.
- Water pollution of the natural water bodies may be aggravated and should be taken care of as this water is used for agriculture and domestic purposes.
- Movement of vehicles may affect movement of people, especially women, children and disabled persons from one place to another.
- Air pollution due to dust and gaseous emission should be controlled.
- Environmental pollution through sanitation and waste materials as well as other social nuisance should be controlled.

10.4 Expectations of the People

The following expectations of the local people were evidenced during the consultations:

- Local personnel should be employed in different activities of the project on a priority basis.
- Preference should be given to engage local businessmen/ contractors in different phases of the project for construction and development depending in their suitability for such engagements.
- Compensation payment, in whatever form it may be, should be properly and promptly distributed so that the actual affected person gets his full share and in right time.
- Supply of gas would help improving their socio-economic conditions and therefore gas should be made available in the areas through which gas line would be passing through.

10.5 Responses Made to Comments from the Public

People raised several concerns in the FGD meetings held in the project areas. However, there were certain suggestions, comments, and questions from them as well in the meetings. On behalf of GTCL and BETS Team experts, the survey team members responded to their concerns, suggestions and questions though explaining the situation and assuring the peoples about doing their best in communicating their concerns to the appropriate authorities as applicable for due mitigation of their concerns and providing their all out support in favor of the local community. A brief on the responses made by the survey team to comments from the public is given below in Table-10.5-1.

Table-10.5-1 Responses made by the survey team to comments from the public

Serial	Peoples concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
1	Communities were not communicated earlier regarding the project	✓ As it was in preliminary and conceptual level, they weren't communicated earlier. Now they will be communicated by the GTCL from now at all stages of project onward.
2	Participants asked GTCL, Peoples are not getting gas connection, so they need gas connection for the their communities	✓ GTCL only transmits but does not give gas connections for the consumers, these facts and demands of peoples will be reflected in this report for attracting due support of GTCL for necessary actions to the concerned sister organization responsible for giving gas connection to the communities concerned
3	Why not job opportunities' for local peoples in GTCL?	✓ GTCL is a technical organization, it needs only skilled manpower. It is expected that some jobs may be provided to the qualified and skilled persons during construction and subsequent recruitment process. So local peoples should keep an eye when the process starts

10.6 Conclusions and Recommendations on Public Consultation

The West Bank of Jamuna Bridge-Nalka 30 inch diameter 14km Gas Transmission Pipe Line Project is considered to be a feasible project examined from both social and environmental points of view. Acquisition of land being on CGS the general conclusion of the study and preparing Environmental Impact Assessment (EIA) Report is that no significant negative environmental and social impact will be produced by the project interventions so long as due mitigation measures and actions are taken as per Environmental Management Plan (EMP) report. The study has also revealed the important areas, which need special emphasis during design and implementation. The following are the important considerations:

- a) Ensure institutional capacity of GTCL for implementing and monitoring EMP with due importance to social management plan as placed in the EIA report. Provide them with due adequate manpower, logistic supports and the fund as required.
- b) Ensure incorporation of the provision of all mitigation measures including but not limited to reinstatement of all public roads and protection of river banks etc. from erosion. Ensure identification and inclusion of all items relating to EMP to be carried out by the EPC contractor in their scope of work.

Acquisition under this project is not of a bulk nature. Adequate compensation has been proposed for them in the mitigation plans for acquiring the required CGS land.

CHAPTER-11 CONCLUSIONS AND RECOMMENDATION

11.1 General

The EIA of the proposed West Bank of Jamuna Bridge-Nalka Gas Transmission Pipeline Project with Regulating & Metering Stations has been carried out at generic level in terms of both project design and environmental definition. This is believed to be the appropriate level of assessment for the present stage of project development.

The key areas of environmental sensitivity have been identified and the mitigation measures have been proposed. A management process has also been defined which should ensure that, among other issues, environmental sensitivity are adequately addressed at all stages of project development.

It may be pointed out that this EIA is the requirement of the DOE for issuing the Environmental Clearance and accordingly it has been prepared as per the TOR of GTCL and the guidelines of the ECA '95 and ECR '97 of DOE.

As such, this EIA report is intended for submission to the DOE and includes a broad coverage of the environmental, socio-economic, health and safety impacts etc and its mitigation, management and monitoring plans.

It may further be mentioned here that, the project has very minimal adverse impact on the community and their private and surrounding community related public properties and the environment and therefore small acquisition of land for CGS should be properly compensated.

11.2 Conclusions

The benefits of the project will be realized primarily at the level of the national economy. The implementation of the proposed project will provide supply of clean burning fuel and necessary feed stock for the domestic, commercial and industrial consumers in general and Power plants and Fertilizer Factories in particular. It will thus help overcoming the current crisis of gas in the respective load centers through evacuation of same from the producing gas fields.

These will not only reduce Bangladesh's dependence on foreign energy resources but also help accruing a good number of benefits in terms of enhanced generation of electricity and production of fertilizer and other industrial products including opening up employment opportunities and thereby tremendously contribute to health, agricultural, forestry, commercial, industrial and economic development of the country. Benefits in the project area will not be that significant except for some short term employment and business opportunities during the construction phase.

However, natural gas being an intrinsically clean fuel compared with most alternatives, development of natural gas resources and transportation to the load centers for the consumers are, in general, environmentally sound options at the national and global level.

Thus the proposed project activities have also no significant adverse environmental impact so far as a time bound execution program with application of advanced environment friendly construction technology is ensured. The mitigation measures are well within such codes and practices of construction and operation of the pipeline system.

On the basis of the project summary and other relevant reports provided to the consultant by GTCL and detailed survey conducted by the consultant along the project affected area, it may be concluded that in receiving the foregoing enhanced benefits, the project would minimize and mitigate most of its environmental and socio-economic impacts.

It is believed that GTCL will take due note of the concerns expressed during public consultations and duly attend to the mitigation measures suggested against each of them. At the same time, GTCL will avail itself of the opportunities in discharging its corporate social responsibilities in providing different facilities to the host communities as far as practicable.

As such, the execution of the project would stand environmentally sound and socio-economically sustainable with due adoption of the recommended mitigation measures and environmental management and monitoring processes.

11.3 Recommendations

It is recommended that the relevant legislations, rules, regulations and recommendations of concerned agencies, including but not limited to, the DOE, Inspectorate of Explosives, Department of Forests etc, is strictly complied with.

All necessary permissions are to be obtained by GTCL well in advance from the concerned authorities i.e. Jamuna Bridge Authority, RHD, LGED, BIWTA etc. The conditions set forth in the permissions there of, if any, should be duly complied with.

All recommendations within the Environmental Management Plan (EMP) should be implemented without reduction in intent, scope or duration. The EMP being a live document those recommendations should be augmented with further specific information regarding potential impact mitigation if and when it becomes available.

Adequate and effective pollution prevention steps with respect to the following issues should still be particularly implemented. These include but not limited to the following:

- Erosion and sediment control measures;
- Judicious implementation of construction, operations and maintenance activities to have minimum potentially adverse impacts whatsoever;
- Regular and effective environmental monitoring with adequate staff and budget;
- Reporting to DOE, Inspectorate of Explosives etc. as required;
- Strengthening and ensuring preventive management practices are in place;
- Deploying adequate monitoring mechanisms as outlined in the EMP;
- Adoption of emergency response and disaster management plans as documented; and
- Adhering to standard and safe operating procedures in all activities.

Even though the probability of any unacceptable risk and chemical hazard etc arising from the proposed operations is unlikely, it is recommended that, the emergency response cell as proposed in the organizational set-up is duly operative and a team of environmental and safety professionals are full-time present on site under supervision and coordination of a qualified environmental and safety specialist when any works are conducted and during the progress of clean up and reinstatement activities at sites.

GTCL should continue to discharge its corporate social responsibilities and foster good community relations with local people through effective implementation of the community consultation strategy. This will tremendously contribute to the long term success of this project.

Ensuring adequate training to the involved professionals and scheduled monitoring of the mitigation measures would be yet another important management responsibility.

In line with the fore going recommendations, the following pertinent points may also be revisited in the interest of smooth, safe, environment-friendly and unhindered execution of the project:

Severe weather conditions would have an impact on the pipeline construction activities and may even cause stoppage of works during the cyclonic storms and rainy days. So it is, recommended that commencing construction in early winter season may help to reap the benefit of full dry spell of the season. Further,

- ✓ In order to enhance the occupational health and worker safety during the construction period, construction equipment would have to be kept in good order. Adequate safety measures should be taken and safety related equipment including PPE, firefighting equipment etc. must be provided in order to reduce the potential for accidents.
- ✓ GTCL will organize specific pre-project training / refreshers program on physical, chemical & biological hazards, health, safety and environmental issues for its Engineering & Management professionals to be involved in on-site execution and operation of the project. Such facilities of tailor-made training may be obtained from local professional institutions like BPI, Industrial Safety Board of Bangladesh (ISBB) of IEB, Engineering Staff College etc. These will further prepare the personnel designated for overseas training under the project at a later date.
- ✓ A well developed camp site management plan has to be adhered to as per recommendation made in the EMP in all aspects of its safe, hygienic, secured and environment friendly occupation and taking appropriate restoration steps after completion of the project.
- ✓ The topsoil from the trenching should be temporarily stored along the sides of the trench and used as back filling material upon completion of the pipeline construction activity.
- ✓ Any unavoidable loss of those belonging to the State including road side vegetation should be replenished by undertaking appropriate plantation program to be implemented before completing the project and continue throughout its operation.
- ✓ Due importance has to be put in to recommended environmental enhancement / restoration and bank / side slope erosion protection plans for the river, roads impacted by the project.
- ✓ One of the major issues is the need to minimize disturbance to the local population in the areas of pipeline construction. Effort should be put in to arrive at a fair and equitable level of compensation for the land owning peoples affected by their assets taken for the project for CGS as per provision of GOB guidelines.
- ✓ In the post construction phase, the environmental impact of the project will be some loss of land utility along the pipeline alignments and a risk of leakage of gas due to improper maintenance or accident, if any. The former can be mitigated by adoption of a fair compensation policy and the latter by adequate maintenance and monitoring.

In fine, it has to be appreciated that, so far as enhancement of the benefits of the project and minimization of its negative impacts are concerned, appropriate management and monitoring of impact mitigation measures in respect of both environmental and social aspects are to be simultaneously taken care of by the project proponent GTCL.

Recapitulating the recommendations made in the EMP, it is presumed that GTCL will have an organizational structure of its own as placed in the chapter on EMP. GTCL will be assisted in supervision through contractor or by GTCL's own specialist, who in turn will be supported by the Environmental Specialist, a member of the Pipeline Consulting Group being appointed by GTCL. They will oversee and ensure that the parts of the jobs of GTCL & its contractor are done in the way it should be.

GTCL should therefore consider these jobs so identified in the EMP as given with estimated budget in their cost estimation and include the items in the scope of works of the contractor so that they make provision for it and reflect in their financial bid.

The contractor will then be directly performing those specific aspects of the EMP under close monitoring and supervision of GTCL and its consulting functionaries. In doing so, GTCL will attract attention and support from concerned agencies e.g. DOE, inspectorate of explosives and will have strategic alliances with related GOB agencies like Local administration, police, fire brigades and health services for successful execution of the project.

GTCL is committed to taking necessary and appropriate mitigation measures as delineated in their own plan and as discussed in the present report. It has also appeared that, GTCL holds a very positive approach towards sustainable environmental management and will maintain standard quality of implementation of the program with due consideration to all standing rules and regulations. As such, the project may be recommended for implementation.

Since implementation of this project would go a long way to ameliorate crisis of gas in the downstream areas of West Bank of Jamuna Bridge, both JICA & GTCL authorities are considering it as a national priority endeavor.

In consideration of the foregoing findings and commitments placed in this EIA Report, the DOE may approve and issue the Environmental Clearance Certificate in favor of Gas Transmission Co. Ltd. if and when applied for as a prerequisite for implementing construction and operation of the proposed gas transmission pipeline project with its associated facilities as per their schedule of execution.

**Annex-1 Environmental Checklist for West Bank of Jamuna
Bridge-Nalka Gas Transmission Pipeline Project of GTCL**

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	<p>① Have EIA reports been officially completed?</p> <p>② Have EIA reports been approved by authorities of the host country's government?</p> <p>③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p>	<p>① Once completed long ago in 2005 and Environmental Clearance Certificate (ECC) for the Project was issued but it appears that it is no longer valid for this project. So, the EIA study is completed in the middle of February 2014 since conducting of EIA is mandatory in Bangladesh for any gas pipeline project irrespective of the project scale. GTCL will submit this EIA report with necessary modification and local authority clearance i.e. No Objection Certificate (NOC) of Jamuna Bridge Authority, Union Parishad Chairman's clearance (City Gate Station (CGS) areas) for obtaining the ECC from DOE.</p> <p>② No. EIA report approval obtained in 2005 is no longer valid now. GTCL will submit this EIA report with necessary modification, if any and obtaining local authority clearance i.e. NOC for approval of the Government authority i.e. DOE.</p> <p>③ Yes, EIA report approved in 2005 is no longer valid now. GTCL will submit this EIA report with necessary modification and local authority clearance i.e. NOC for approval of the Government authority i.e. DOE.</p> <p>④ No. GTCL will collect NOC from concerned local authorities of the ROW of the pipeline for this project.</p>
	(2) Explanation to the Public	<p>① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public?</p> <p>② Are proper responses made to comments from the public and regulatory authorities?</p>	<p>① EIA study included public consultation using FGD (focus group discussion method) including interview survey which is an appropriate procedure used in Bangladesh where information disclosure was also made.</p> <p>Yes, the understanding of the public about the project was made and explained in brief in Section-10.3 of Chapter-10 of the EIA report.</p> <p>② Yes, proper response and comments of public are delineated in Section-10.5 of Chapter-10 of the EIA report. The Regulatory Authorities feedback shall come after the EIA report placement to the DOE.</p>
2 Mitigation Measures	(1) Water Quality	<p>① Are adequate measures taken prevent spills and discharges of crude oil and hazardous materials to the surrounding water areas?</p>	<p>① Not significant for this gas pipeline project but mitigation measures are mentioned in Table-6.2-1 of Chapter-6 of the EIA report.</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(2) Wastes	<p>① Are sludges containing pollutants, such as oils, greases and heavy metals generated by pipeline cleaning (pigging operations) properly treated and disposed of in accordance with the country's standards?</p>	<p>① No obnoxious ingredients observed in pigging hole during construction. Existing gas pipeline operation (operational experience is more than 20 years) indicates waste generated by pipeline cleaning (pigging operations) is properly treated and disposed of in accordance with the standard requirement (buried underground). This issue has been carefully considered in Table-6.2-1 of Chapter-6 of the EIA report.</p> <p>① Not significant for this gas pipeline project.</p>
	(3) Soil Contamination	<p>① Has the soil at the project site been contaminated in the past, and are adequate measures taken to prevent soil contamination by leaked materials, such as crude oil?</p>	
	(4) Noise and Vibration	<p>① Do noise and vibrations from facility operations, such as pumping operations comply with the country's standards? ② Is there a possibility that noise from facility operations, such as pumping operations will affect humans and animals (wildlife and livestock)?</p>	<p>① No significant noise and vibrations from gas transmission pipeline operations is anticipated that is also evident from existing operational pipelines of more than 1000 km in length of GTCL.</p> <p>② As of above no significant noise/vibration is anticipated.</p>
3 Natural Environment	(1) Protected Areas	<p>① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?</p>	<p>① No. The project site is located in human (anthropogenic) influenced areas of residential, agricultural and vacant land areas only and there are no protected areas in its vicinity. Section-4.5.3 of Chapter-4 of EIA report described the ecologically sensitive areas (ESA) of Bangladesh. The project area is out of any national protected areas.</p>
3 Natural Environment	(2) Ecosystem	<p>① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? ③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? ④ Are adequate measures taken to prevent impacts on wildlife and livestock, such as disruption of migration routes, and habitat fragmentation of wildlife and livestock? ⑤ Is there a possibility that installation of pipelines will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, disturbance of ecosystems due to introduction of exotic species (non-native inhabitants in the region) and pests? Are adequate measures for preventing such</p>	<p>① No ② No ③ Not applicable as no significant ecological impacts are anticipated ④ Not applicable for an underground pipeline laid by the side of road ⑤ No such effects are anticipated consequent to this pipeline installation. Except temporary clearing & grading of right of way in the pipeline route and which are duly reinstated after laying of pipeline.</p> <p>Section-4.5 of Chapter-4 described the Biological environment of the project area.</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		<p>impacts considered?</p> <p>① In the case of offshore pipeline projects, is there a possibility that oceanographic condition changes due to installation of structures will adversely affect oceanographic conditions, such as induced currents, waves, and tidal currents? Is the possibility of water quality degradation by the installation of structures studied? Are adequate water quality control measures taken, if necessary?</p>	<p>① Not applicable</p>
	(3) Hydrology	<p>① In the case of onshore pipeline installation, is there a possibility that the installation of structures will cause a large-scale alteration of topographic features and geologic structures around the project site? In the case of coastal pipeline installation, is there a possibility that the installation of structures will result in elimination of beaches?</p>	<p>① This project is an onshore pipeline installation project and no adverse effects on either topographic features or geologic structures around the project site are anticipated consequent to the pipeline installation. Section 4.3.1 & 4.3.2 of Chapter-4 of the EIA report described the topography and geology of the project area.</p>
4 Social Environment	(1) Resettlement	<p>① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?</p> <p>③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>⑤ Are agreements with the affected persons obtained prior to resettlement?</p> <p>⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>⑦ Is a plan developed to monitor the impacts of resettlement?</p>	<p>① There is no involuntary resettlement caused by project implementation.</p> <p>② Not applicable since there is no involuntary resettlement.</p> <p>③ Not applicable since there is no involuntary resettlement.</p> <p>④ Not applicable since there is no involuntary resettlement.</p> <p>⑤ Not applicable since there is no involuntary resettlement.</p> <p>⑥ Not applicable since there is no involuntary resettlement.</p> <p>⑦ Not applicable since there is no involuntary resettlement.</p>
	(2) Living and Livelihood	<p>① Is there a possibility that existence of pipeline will cause impacts on traffic in the surrounding areas, and impede the movement of inhabitants?</p>	<p>① Since pipeline is laid underground no such long-term impacts are anticipated as also could be visualized from the already operational pipelines of more than 1000 km in length. Except for temporary dislocation during construction. Table-5.2-1 of the environmental</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			scoping section of Chapter-5 identified the environmental element and evaluates its impact as well.
	(3) Heritage	<p>① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?</p> <p>① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p>	<p>① There are no archeological, historical, cultural, and religious heritage sites in and around the vicinity of the ROW of the pipeline. Table-5.2-1 of the environmental scoping section of Chapter-5 identified the environmental element and evaluates its impact as well.</p> <p>① No adverse effect on the local landscape is anticipated since the pipeline is laid underground as also could be visualized from the already operational pipelines of more than 1000 km in length. Table-5.2-1 of Chapter-5 identified the potential impacts of the project area where this environmental item has not been considered since it has no impact on the environment.</p>
	(4) Landscape		<p>① The pipeline will not interfere with any rights of ethnic minorities or indigenous peoples since there are no such people living in the project vicinity.</p> <p>② Not necessary since there are no such ethnic minorities or indigenous people living in the project vicinity.</p> <p>Section-4.7.1 of Chapter-4 of the EIA report described details about the demographic profile and ethnic composition (100% census survey) of the project area.</p>
	(5) Ethnic Minorities and Indigenous Peoples	<p>① Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?</p> <p>② Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p>	
5 Others	(1) Impacts during Construction	<p>① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>② If construction activities adversely affect the land use and livelihood of inhabitants, is adequate compensation provided to local inhabitants for losses of land and livelihoods?</p> <p>③ If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>④ If construction activities cause impacts on traffic in surrounding areas, and impede the movement of inhabitants, are adequate measures considered to reduce impacts?</p> <p>⑤ If construction activities adversely affect the social environment (including communicable diseases, such as HIV), are adequate measures considered to reduce impacts?</p> <p>⑥ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including</p>	<p>① Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. Mitigation measures for potential dust induced air pollution during construction include water spraying of dust prone land cleared site and vinyl sheet covering of dust prone materials. Since construction works will be conducted only in dry season no significant generation of turbid and wastewater is anticipated.</p> <p>② Yes. The required compensation due to construction activities on the land use is only for City Gate Station (CGS) which will be in a vacant land and livelihood of inhabitants won't get any problem. Table 6.2-1: Environmental Impact Mitigation/Management Plan (WJB-Nalka) of Chapter-6 of the EIA report noted the tentative cost of the land.</p> <p>③ No significant adverse effect by construction activities on the natural environment (ecosystem) is anticipated since there are no ecologically important areas located in and around the vicinity of the</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		workers?	<p>project site. Table 5.2-1 of Chapter-5 and Table-6.2-1 of Chapter-6 of the EIA report describes the environmental scoping and mitigation/management plan of the project area.</p> <p>④ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. Mitigation measures to minimize interference with regular traffic include transportation of construction related materials during off-peak hours and holidays and others.</p> <p>⑤ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS for construction stage of the project. In this respect instilling due awareness on the dangers and mitigation of communicable diseases by the construction contractor will be emphasized by the project management.</p> <p>⑥ Table-6.2-1 of Chapter-6 of the EIA report deals with these aspects as EHS of construction stages of the project. Construction contractor shall fully commit and abide to the concept of “Safety First”.</p>
(2) Accident Prevention Measures		<p>① Are adequate accident prevention plans and mitigation measures developed to cover both the soft and hard aspects of the project, such as establishment of safety rules, installation of prevention facilities and equipment, and safety education for workers? Are adequate measures for emergency response to accidental events considered?</p> <p>② Are adequate accident prevention measures (e.g., installation of prevention facilities and equipment and establishment of prevention management framework) taken to prevent spills from crude oil and gas storage facilities, loading/unloading operations, transportation, and blow out during drilling?</p>	<p>① Table 6.2-1 and Section-6.5 of Chapter-6 of the EIA study dealt with these aspects as EHS duly separated between construction and operational stages of the project. Yes, adequate provision of implementing the emergency response plan would be committed and abided by the executing contractor.</p> <p>② There are no such significant activities in this gas transmission pipeline to take accident prevention measures except taking care of occupational health and safety measures. Table 6.2-1 and Section-6.5 of Chapter-6 of the EIA study dealt with accident prevention measures.</p>
(3) Monitoring		<p>① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>② Are the items, methods and frequencies included in the monitoring program judged to be appropriate?</p> <p>③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of</p>	<p>① Table-7.2-1 of Chapter-7 of the EIA study developed the required monitoring program for implementation for the environmental items that are considered to have potential impacts. Monitoring program focused on air pollution (dust), noise and waste pollution control is regarded as necessary for the construction stage of the project only.</p> <p>② Yes, the items, methods and frequencies included in the monitoring program is well judged and appropriate. Periodical testing of the environmental parameters & results thereof subscribed to the adequacy of the EMP.</p> <p>③ Figure-7.3-1 of Chapter-7 of the EIA study established an adequate</p>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
6 Note		reports from the proponent to the regulatory authorities?	<p>monitoring framework of the project.</p> <p>④ Yes. Section-7.3 of Chapter-7 of the EIA report described about the requirement and format and frequency of monitoring reports from the proponent to the regulatory authorities as per provisions of the existing regulatory framework.</p>
6 Note	Reference to Checklist of Other Sectors	<p>① Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g. projects including large areas of deforestation).</p>	<p>① Checked and regarded as not that relevant since there is no forestry along the planned ROW of the pipeline installation.</p>
6 Note	Note on Using Environmental Checklist	<p>① If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of ozone layer, global warming).</p>	<p>① There is no significant trans-boundary or global issues to be impacted or involved by this project.</p>

Annex-2 List of Reference

LIST OF REFERENCE

1. Banglapedia, National Encyclopedia of Bangladesh, 2006.
2. Bangladesh Environment Facing the 21st Century by SEHD.
3. Bangladesh Meteorological Department, 2013.
4. Guidelines For Environmental and Social Considerations, JICA, April-2010
5. BBS (2003), The statistical yearbook of Bangladesh.
6. BGS and DPHE, 2001. Arsenic contamination of groundwater in Bangladesh. BGS Technical Report, WC/00/19.
7. BOBLME (2011) Country report on pollution in the BOBLME – Bangladesh. BOBLME-2011-Ecology-01.
8. British Geological Survey, Natural Environment Research Council (NERC) 2001.
9. Canter, L.W., “Environmental Impact Assessment”. McGraw-Hill Inc., New York, 1977.
10. Centre for Hazard and Risk Research, Bangladesh.
11. Chief Editor: Islam, S., Managing Editor: Miah, S., “BANGLAPEDIA”, National Encyclopedia of Bangladesh, Asiatic Society of Bangladesh, March 2003.
12. Community Series Sirajganj Bangladesh Bureau of Statistics, 2011.
13. “EIA Guidelines for Industries”, Department of Environment, Ministry of Environment and Forest, Government of the Peoples Republic of Bangladesh, June 1997.
14. Environmental Conservation Rules, 1997.
15. FAO/WFP., 1991. Bangladesh: Report of Joint FAO/WFP Mission to Assess the Impact of the April 1991 Cyclone on the Food and Agricultural Sectors, Rome.
16. FAO (1988). Soils map of the world: revised legend. Food and Agriculture Organization of the United Nations, Rome. 119 p.
17. Farooque M. Hossain S.R 1996 Laws relating Environment in Bangladesh (BELA) Dhaka.
18. Geological Survey of Bangladesh, 2001.
19. Government of the People's Republic of Bangladesh, (1991). Statistical Yearbook of Bangladesh 1991. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Dhaka.
20. IEE/EIA/ARAP Report on West Bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara high pressure Gas Transmission Pipeline Project -2005.
21. Initial Environmental Examination (IEE) report on the third Gas Development Project by Resource Control Company 1993.
22. Islam, R. (edt.), 2004. Where lands meets the sea. A profile of coastal zone of Bangladesh. The University Press Limited, Dhaka, 2004.
23. Khalil, 1993. The catastrophic cyclone of April 1991: Its Impact on the economy of Bangladesh, Natural Hazards, 1993, Volume 8, Number 3, Pages 263-28.
24. Local Government Engineering Department (LGED), Bangladesh, 2011.
25. “Multilateral Environmental Agreement in Force in Bangladesh” Department of Environment (DoE), Bangladesh, 2011.
26. National Encyclopedia of Bangladesh, 2003.
27. Population Census 2001, February 2007, BBS; *Bangladesh Population Census 1991, March 1996.

28. Publications of 2011 2nd International Conference on Environmental Science and Technology IPCBEE vol.6 (2011) © (2011) IACSIT Press, Singapore.
29. Rao, M. N., Rao, H. V. N., "Air Pollution", Tata McGraw Hill Publishing Company, New Delhi, 1989.
30. Rashid, Harun Er; 1991, geography of Bangladesh; University press limited, Second revised edition, P. 33.
31. Talukder, J., G.D. Roy and M. Ahmed, 1992. Living with cyclone: Study on Storm Surge Prediction and Disaster Preparedness. Community Development Library, Dhaka, Bangladesh, pp: 124.
32. Profile on Environmental and Social Considerations in Bangladesh, JICA, July 2012
33. <http://www.earthsendangered.com/>, 2012.

Annex-3 Environmental Monitoring Form

Environmental Monitoring Form

A. Monitoring Locations

Insert a map with the GPS location of all monitoring stations.

B. Monitoring Time Details:

C. Monitoring Items

C-1 Noise Monitoring (Construction stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Noise	Noise level (Residential Area)	dB		45 (Night-time)	45 (Night-time) (World Bank)	- 50m from the construction site	- Per Month one 24-hr. day sampling	- Sound level meter
				55 (Day-time)	55 (Day-time) (World Bank)			

C-2 Air Quality Monitoring (Construction stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Air Quality	SPM ₁₀	µgm/m ³		150 (Statutory Rules 2005)	50 (World Bank Guideline) 150 Interim Value	- One Sampling Point near the project site another 1 km. (normal Practice in Bangladesh) away from the project site	- Per month one 24-hr. day sampling	- High Volume Dust Sampler
	SPM _{2.5}	µgm/m ³		65 (Statutory Rules 2005)	25 (World Bank Guideline) 75 Interim Value	- One Sampling Point near the project site another 1 km. (normal Practice in Bangladesh) away from the project site.	- Per month one 24-hr. day sampling	- High Volume Dust Sampler

C-3 Waste Monitoring (Construction stage-Implemented by Construction Contractor)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Waste	- Excess borrow pit soil	-				- Worksite and Camp site	- Weekly	-
	- Generated Solid waste	-				ditto	Ditto	-
	- Sanitary waste	-				Ditto	Ditto	-
	- Housekeeping status	-				Ditto	Ditto	-

C-4 Waste Monitoring (Operation stage-Implemented by GTCL)

Environmental Items	Monitoring Items	Unit	Field Result	Bangladesh Standards	Referred International Standards	Measurement Point	Frequency	Method
Waste	- Management of pigging waste	-				- Worksite (pig launcher and receiver locations)	As required	-

Appendix 27:

**FINAL REPORT OF ABBREVIATED RESETTLEMENT
ACTION PLAN (ARAP)
OF
DHANUA-ELENGA SECTOR GAS TRANSMISSION
PIPELINE PROJECT**



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ARAP UPDATE STUDY ON DHANUA – ELENGA GAS TRANSMISSION PIPELINE PROJECT OF GTCL



FINAL REPORT

MARCH 2014

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ABBREVIATIONS

ARAP	Abbreviated Resettlement Action Plan
Aman	Paddy cultivated in late monsoon and harvested in early winter
BBS	Bangladesh Bureau of Statistics
Boro	Paddy cultivated late winter and harvested in summer
CSR	Corporate Social Responsibility, social work done by large or corporate organization
CG	Construction Grant
CCL	Cash Compensation under the Law
DPs	Displaced Persons
DPD	Deputy Project Director
DESGTP	Dhanua Elenga Sector Gas Transmission Project
DOE	Department of Environment
EA	Executive Authority
EP	Entitled Person
EP File	Entitled Person File
EC	Entitlement Card
EIA	Environmental Impact Assessment
ECC	Environmental Clearance Certificate
GTCL	Gas Transmission Company Ltd
GoB	Government of Bangladesh
GRC	Grievance Redress Committee
JICA	Japan International Co-operation Agency
JVIT	Joint Verification Inventory Team
IEE	Initial Environmental Evaluation
LAO	Land Acquisition Officer
LA Section	Land Acquisition Section of Deputy Commissioner
LMS	Land Market Survey
MARV	Maximum Allowable Replacement Value
Pourashava	Local government Unit in the urban area in the sub district level
PCP	Project Concept Paper
PD	Project Director
PVAC	Property Valuation Advisory Committee
PAPs	Project Affected Persons
RU-GTCL	Resettlement Unit- Executing Authority
RAC	Resettlement Advisory Committee
RAP	Resettlement Action Plan
RS	Resettlement Site
RP	Resettlement Policy
SA	State Acquisition
SCC	Social Clearance Certificate
SDE	Sub Divisional Engineer
SES	Socio Economic Survey
SDU	Social Development Unit
SSC	Secondary School Certificate
HSC	Higher Secondary School Certificate
HH	Household
TOR	Term of Reference
Union	Local government body in the grass root level
Upazila	Administrative unit, Sub district

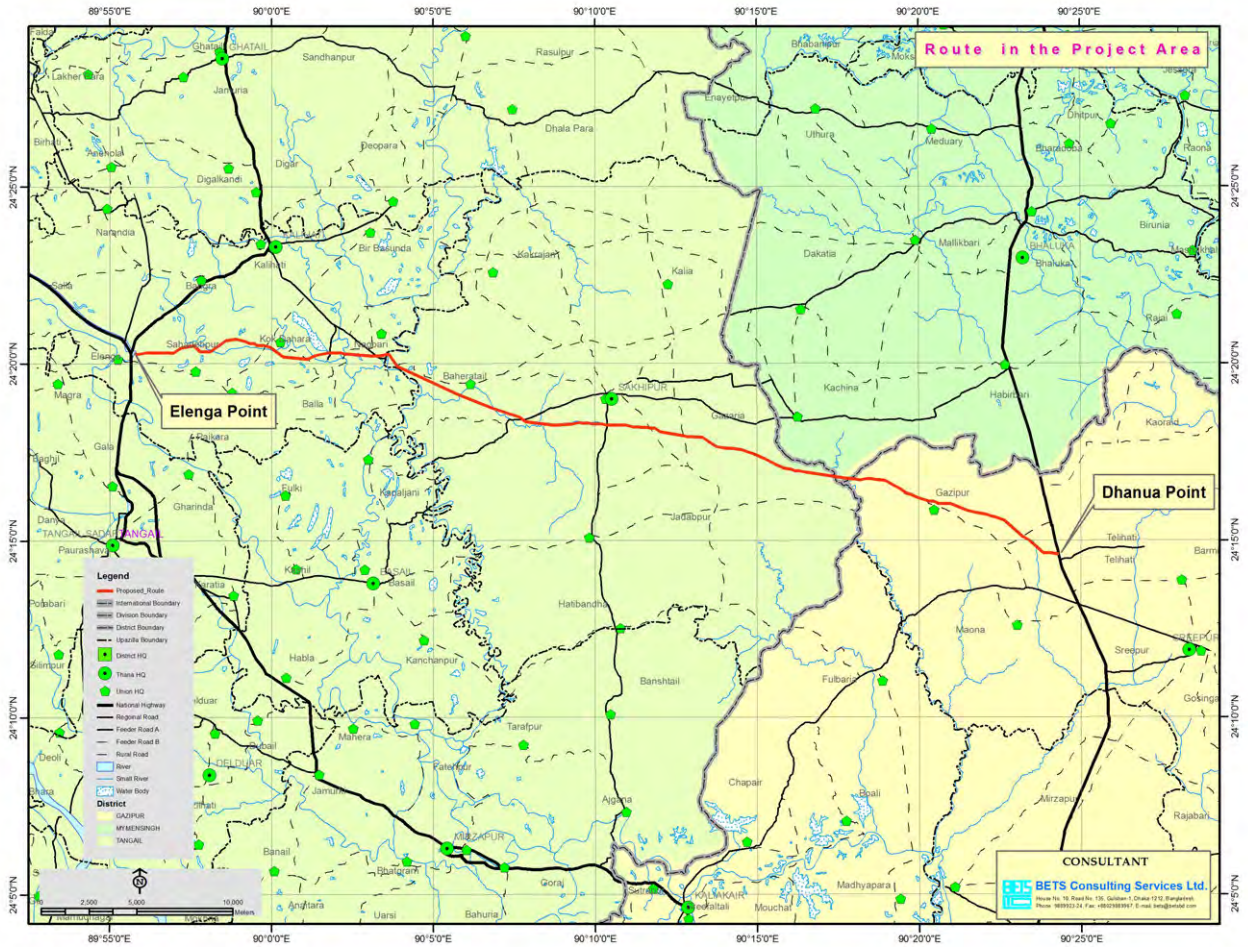


Figure-1 Key Route Map of the Project

EXECUTIVE SUMMARY

Project Scope

This Abbreviated Resettlement Action Plan (ARAP) report has several aspects. These are Land Acquisition, Resettlement Plan for income restoration of PAPs at pre project position. It also includes a brief description of socio economic condition of the affected person, and project area. In the RAP, extent of entitlements, compensation policy, institutional arrangement, monitoring and evaluation of resettlement process, tentative resettlement budget have been discussed for 52 km Dhanua Elenga Sector Gas Transmission Project (DESGTP). The project is proposed to be financed by JICA. The ARAP report has been prepared on the basis of various pertinent documents, findings of field survey, land acquisition and involuntary resettlement policies of the Government, the JICA's Guidelines for Environmental and Social Considerations (2010) and operational policies on involuntary resettlement, and experiences on similar projects in the country.

Starting point of the present gas transmission project is Dhanua of Sripur Upazila under Gazipur district. Ending point is Elenga of Kalihati Upazila of Tangail district. To upgrade existing Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge Gas transmission Pipeline project with current insufficient gas transmission and to meet increasing demand, realignment of the originally planned ROW (2005) in some places along the initial 32km sector of the ROW located between Dhanua and Sulgrampur was made so as to minimize resettlement requirement. The project will be implemented with the assistance from the Japan International Cooperation Agency (JICA).

Study of Resettlement Issues of the Project

The JICA has deployed a study team of experts consisting of different specialties for assisting GTCL in conducting and updating technical, environmental and social studies for the proposed project. The Team in turn has simultaneously engaged BETS Consulting Services Ltd (BETS) for preparing this ARAP Report which is a social aspect document conforming to the JICA Guidelines (2010) focused on land acquisition and involuntary resettlement.

Accordingly, the socio economic survey has been conducted by the BETS Team of Specialists and Enumerators along with representatives from GTCL for identifying the extent of loss and benchmark condition of Project affected person (PAPs) in and around the project areas. It has eventually transpired that:

- The amount of land under land acquisition is 41.69 hectares and land under requisition is 78 hectares.
- Total affected household as structure losers are 28 (25 households and 3 Commercial & Business Enterprises (CBEs) of which 12 are full structure losers and rest are partial structure losers.
- It is estimated there will be 400 agriculture land losers.
- Total tree losses are 2469 on private land and 3300 trees on government forest land.

Requirement of Resettlement & Regulatory Provisions

Resettlement needs to ensure co-operation between GTCL and the affected persons. It has been experienced that, in most cases, project implementation is delayed and there may be public agitation too in absence of amicable resettlement.

In Bangladesh due to lack of proper resettlement planning, sometimes projects have been suspended, abandoned or delayed. Implementation of project forcibly by law enforcing authority may create permanent unrest and dissatisfaction. Bangladesh has neither an officially announced national resettlement policy nor any law regarding resettlement except a short guideline from the Land Ministry.

Usually, donor supported project has due resettlement provisions but the Government supported ones have no proper resettlement planning. So, in recent days project implementation was being hampered by the agitated affected public in some cases. This is because, in most cases, DC's compensation payment is inadequate to cover replacement cost at up-to-date market price. So, smooth project implementation would require amicable participation of GTCL and the project affected persons both the titled and untitled ones.

Mechanism of Administering Resettlement

Successful project completion needs proper compensation. As per JICA guidelines of project intervention, GTCL will resettle affected persons at the rate of full replacement cost, as DC's payment don't ensure the full income restoration of the affected persons. So, ARAP has been designed considering reality of time as project affected persons (PAPs) will be resettled based on both justice, social practice, equity and law that no one will suffer due to project in any manner.

Additional payment will be decided and determined by Property Valuation Advisory Committee (PVAC) comprising one representative from GTCL, One from implementing NGO, One local government public representative and two from the PAPs .In addition to that there will be provision for Grievance Redress Committee (GRC) which will be formed for solving any sorts of grievance from PAPs except court case(s).

This ARAP has included issues raised by the PAPS and suggestion given by affected community during Focus Group Discussion (FGD) in the right of Way (ROW). There were 10 consultation meetings held during SES and individual interview with the PAPs. The issues raised by the PAPS and suggestions given by affected community has been duly recorded, responded to in the meetings and reproduced in this report for information and further actions by the concerned authorities.

Though in fact, it is not legally mandatory to resettle any affected person at full replacement cost, but from the point of view of socio-economic aspect, resettlement is a socio-economic reality in Bangladesh. In absence of resettlement law it is difficult to execute the detailed resettlement package other than special permission and undertaking of the concerned organization for which acquisition is done. So, in such cases, in addition to approval of the concerned ministry, vetting of law ministry may also be necessary for obtaining legal explanation and support for implementation of the resettlement package for the project.

For the present project, it has been suggested to form a resettlement unit (RU), with support of contracted NGO as implementing agency, to build rapport with the affected people and to take

necessary action for implementation including livelihood restoration and monitoring of ARAP. Also, a property valuation advisory committee (PVAC) has been proposed to investigate and recommend about the additional payment requirement other than that worked out by the DC office.

Also, it has been proposed to form a five member Grievance Redress Committee (GRC) in each Union/Pourashava for mitigating grievances raised by the PAPs. The Committee will be headed by an officer of RU of GTCL equivalent to Manager (RU). Other members will be the concerned Manger of the NGO as a member from NGO, a public representative i.e. chairman/member/councilor of the concerned Union Parishad/ Pourashava as local government public representative and 2 representatives from affected persons in the concerned Union as the affected person's representative

The committee will receive the application(s) from the affected stakeholders about their grievances and action will follow to solve the grievances every month. This Abbreviated Resettlement Action Plan (ARAP) is the outline of resettling the affected persons to at least pre project condition at the rate of full replacement cost for the construction of Dhanua Elenga Sector Gas Transmission Pipeline Project (DESGTP).

Measures and Approaches Proposed for Resettlement

GTCL has determined the project site and gas pipeline route in a way to minimize resettlement impacts, avoiding major settlements and densely populated areas. The pipeline has crossed government-owned lands in Sakhipur. Care has been taken to avoid homestead and business areas, if there is any in most of the cases. The ARAP outlines measures and approaches necessary for land acquisition and land requisition that would reduce the resulting resettlement impacts as per guidelines of JICA within the framework of the regulations of the Government of the People's Republic of Bangladesh.

According to these guidelines, the project affected housing occupants and land owners would be given all supports in regaining their previous socio economic conditions as early as possible. In the present project, number of project affected displaced units identified are only 28 (25 households and 3 CBE(s) of poultry farms. That is why, as desired, all resettlement related issues have been presented in abridged and simplified style in the ARAP. As mentioned above, the total affected households are 432, identified so far on project affected land owners. And 25 affected households will lose their living structure and to be resettled. Exact figure will be finalized after Deputy Commissioner's (DC) payment.

Project Alignment and Affected Households and Land Owners Categories

The gas pipe line of this Gas Transmission Improvement project has been designed to mostly pass along the existing gas line. The required Right of Way (ROW) would be a strip alignment involving acquisition of land mainly from paddy fields and in some locations from government forest land. The nature of disturbances in the project area is of two types; temporary and permanent, i.e. one that is very temporary in nature occurring during pre- construction and construction period and the other impact is on long-term basis relating to acquisition of land and displacement of structures and households. However, present project has no indigenous groups or squatters living in and around the project area to be affected by the project. There are three female headed households (FHHH) in the sample survey of affected land owners. Since this 3 is found out of 30 % sample survey, the total number would be 10 FHHH.

Implementation strategy

The ARAP thus prepared has provisions for all viable scopes in compensating the Project Affected land owners and 25 living structure losers. Displaced persons would be

- i) compensated for their losses,
- ii) assisted with the resettlement in simplified form only and
- iii) assisted in their efforts to regain or improve their socio economic conditions.

It is expected that the simple policy matrix presented in the ARAP would make the entitlements more precise. This has also included operational aspects such as implementation issues and the respective responsible agencies thereof too. Since the provision of land for land is not feasible, Cash Compensation under the Law (CCL) for land will be determined and paid by the concerned Deputy Commissioner (DC) using funds provided by the project executing agencies. Further, as per the existing law, the DC of the respective area shall consider CCL which includes 50% premium.

Additional grants other than DC's payment will be provided up to the maximum allowable replacement value (MARV). The amount of same will be decided by the RU through PVAC and it is proposed to engage an NGO for conducting resettlement work for three years period. PVAC through NGO will carry out separate market survey for determination of additional payment to cover as a replacement value if needed. PVAC comprising member from the RU, NGO, local government representative and representative of affected people will evaluate the situation if anyone is deprived for the project. They will take necessary funds from the project authority (RU-GTCL) and this fund would also include additional payment other than DC covering actual market price as replacement value.

On the other hand Joint Verification Inventory Team (JVIT) will comprise of the representatives from RU-GTCL, LA section of DC office and NGO for primary assessment of affected land and assets. Moreover, as mentioned above, the GRC will be formed for solving any grievances arisen there from.

In further explaining the mechanism, the JVIT has been proposed for determining the PAPs' assets lost in the acquired land for project proponents and gas transmission pipeline, and PVAC and GRC will be formed for determining actual price of affected assets and for redressing the grievances that may arise during implementation respectively. Video filming will be needed as a precaution to check against fake structures on the proposed alignment before serving notices for land acquisition. Adequate information campaign will be carried out for ensuring participation of the PAPs, beneficiaries and stockholders in the implementation of ARAP.

Organizational Responsibilities

The Resettlement Unit (RU) of GTCL is responsible for the implementation of ARAP, as well as management and monitoring of same. But an experienced NGO will do the job in the field on behalf of RU-GTCL will handle informal and emergency cases of resettlement and social issues relating to the project implementation. In addition, RU will seek cooperation and participation of other government agencies such as district administration, forest department, agriculture department etc in the implementation of ARAP. Forest department and agriculture department will support DC administration in CCL price determination of trees and crops respectively. Proposed budget for resettlement action plan has been estimated to be BDT. 1,696,763,795

Monitoring and Evaluation

Monitoring and Evaluation is an important task for measuring the periodic progress of activities under the resettlement program and will be done from RU-GTCL. This would help to identify the constraints in the progress as well as to determine the remedial measure. Development and establishment of a Computerized Management Information System (CMIS) would be an essential requirement for RU-GTCL to ensure due monitoring and measurement of periodic progress of the resettlement and meeting emergency resettlement information needs. The CMIS will provide information for better planning and proper decision-making on resettlement issues for the GTCL. As cited earlier, the core idea of ARAP is to resettle the affected persons to at least pre project condition. So, as per JICA guidelines, it has been proposed that ARAP monitoring will have to be carried out for a minimum period of 2 years after completion of resettlement of the last household.

Time Schedule for Implementation

This ARAP has provided a series of resettlement activities. Of these, a number of activities have to be executed simultaneously for smooth implementation of the plan. As such, a time schedule for starting and finishing of each of the activities has been planned too. It may be noted that the ARAP implementation is a series of continuous work directly dependent on cash compensation under the law (CCL) payment by the deputy commissioner of concerned district administration. It has been planned that such activities for this project will continue for a period of 3 years from July 2014 to June 2017. Further, livelihood monitoring will be for a period of minimum 2 years after resettlement of the households.

It is presumed that tentative time frame for resettlement work would start from July 2014 and will be finished within June 2015 but NGO activities will be for 3 years period which would be started in July 2014 to continue until June 2017. On the other hand, livelihood monitoring for the project would be for 2 more years beginning from the date after the last household gets resettled as per JICA guidelines. In fine, the livelihood monitoring is targeted from January 2015 to June 2017.

Chapter-1

Introduction

1.0 Introduction

This is the Abbreviated Resettlement Action Plan (ARAP) of Dhanua Elenga Sector Gas Transmission Project of GTCL. It has been prepared for the resettlement and rehabilitation of the Project Affected persons (PAPs). The issues as construed and expounded in ARAP draws upon ascertaining the extent of damage, displacement and dislocation of the households, assets, crops, trees relating to construction of the 52 km Dhanua Elenga Sector Gas Transmission Pipeline Project (DESGTP). The pipeline has crossed through Sripur, Sakhipur, Gazipur Sadar, Bhaluka, Bashail, Kalihati (Elenga). The concerned districts are Gazipur, Mymensingh and Tangail.

However, mitigation measures, entitlements of the affected persons, legal issues, institutional arrangements of resettlement and rehabilitations have been discussed in the present ARAP. This project involves acquisition & requisition of a strip alignment. Average breadth of the alignment is 23 meter, in which 8 meter is for acquisition and 15 meter for requisition. The ARAP report has been prepared on the basis of various pertinent documents, findings of field survey, land acquisition and involuntary resettlement policies of the Government, the JICA's Guidelines for Environmental and Social Considerations (2010) and operational policies on involuntary resettlement, and experiences on similar projects in the country.

This report outlines the Abbreviated Resettlement Action Plan (ARAP) for the proposed Dhanua Elenga (52 km) Gas Transmission, which forms part of the Natural Gas Efficiency Project of the People's Republic of Bangladesh for transmission of the Gas Sector Development Project. The Project has been undertaken by the Gas Transmission Company Limited (GTCL), a company of Petrobangla under Power, Energy and Mineral Resource Ministry of the Government of the People's Republic of Bangladesh. The pipeline will help to establish a sustainable natural gas grid that would meet projected gas demands in less developed southwestern regions of the country.

The Project, which is proposed for financing by Japan International Cooperation Agency (JICA), comprises four components including (i) gas transmission, (ii) field appraisal, and (iii) institutional strengthening and (iv) gas distribution. The pipeline design includes elements that minimize resettlement impacts avoiding major settlements and dense populations. The proposed pipeline crossed some government-owned lands wherever possible. Care has been taken to avoid homestead, business areas and squatters in most cases.

This ARAP report has several aspects. These are Land Acquisition and Resettlement Action Plan (RAP) which includes socio economic condition of the project area, extent of entitlements, compensation policy, institutional arrangement, monitoring and evaluation of resettlement process, tentative resettlement budget for 52 km DESGTP project.

1.1 Project Background

The project is located near North West of Capital City Dhaka. The present gas transmission supply project started from Dhanua in Gazipur and ending in Elenga in Tangail. To cope with

current insufficient supply and increasing demand of natural gas, the GTCL planned to construct a new gas transmission pipeline along the existing gas pipeline of 52km length and 30 inch diameter with assistance from the Japan International Cooperation Agency (JICA). The GOB requested the assistance of the Government of Japan with regard to the improvement of gas transmission project in the name of ‘The Natural Gas Efficiency Project in the Peoples Republic of Bangladesh’ and Government of Japan agreed to undertake the study. Based on the agreement, the JICA dispatched a JICA study team consisting of various experts to GTCL for conducting an EIA study and Preparation of ARAP for the Dhanua-Elenga sector gas transmission pipeline project under gas transmission efficiency Improvement Project.

The environmental legislation in Bangladesh, particularly, the Environmental Conservation Act, 1997 (Amendment 2000) states that any development project shall require environmental clearance from the Department of Environment (DOE), Ministry of Environment and Forest (MoEF), Government of the People’s’ Republic of Bangladesh. The proposed project would require an Environmental Impact Assessment (EIA) in accordance with Environmental Conservation Rules of 1997,) and to obtain both Site Clearance Certificate (SCC) and then Environmental Clearance Certificate (ECC) from the DOE.

The proposed project will have to meet and follow the JICA’s guidelines on Environmental and Social Consideration for the loan projects for obtaining necessary clearance from JICA. Thus, in order to implement the construction of proposed gas transmission pipeline project, the Environmental study i.e. EIA and Resettlement Action Plan (RAP) conducted accordingly. Present ARAP is the outcome of that initiative.

Chapter-2

Project Objectives

2.0 Project objectives:

The following objectives of the Resettlement Plan are consistent and congruent with JICA guidelines and adequately fulfill the environmental and social considerations:

- 1) Involuntary resettlement should be avoided where feasible. If population displacement is unavoidable it should be retained at the minimum.
- 2) Since some displacement is unavoidable, resettlement plans should be developed as a planned change. Any involuntary resettlement should, as far as possible, be conceived and executed as development programs with appropriate time bound actions and budgets. Resettled persons should be provided with sufficient resources and opportunities to reestablish their homes and livelihoods as soon as possible, and to share in project benefits.
- 3) The adversely affected persons should be (i) compensated for their losses at full replacement cost (ii) assisted with the move and supported during the transition period of relocation;(iii) assisted in their efforts to improve their former living standards, income earning capacity, and production level, or at least to restore them. The adversely affected population should also include indigenous group, ethnic minorities and pastoralist who may have usufruct or customary rights to the land or other resources taken from the project. Particular attention should be given to the needs of the poorest affected person, female-headed households and other vulnerable groups to be resettled.
- 4) Community participation in planning and implementing resettlement program should be encouraged. The affected people should be fully informed and closely consulted on resettlement and compensation options.
- 5) Land, alternative source of income, skill Livelihood Training, housing, infrastructure and other compensation should be provided to the adversely affected populations who have usufruct or customary rights to the land or other resources taken for the project. Absence of legal title to land should not be a bar to compensate those depriving an income from the land or living on the land.

Involuntary displacement should not be worse off in terms of their socio economic condition. Attempts will be made to make the PAPs better off after relocation through both direct compensation and remedial measures.

To achieve the above, the ARAP has the following specific objectives to:

Develop a compensation and resettlement policy by clearly defining various types of losses or impacts, entitled persons and entitlement to compensation and resettlement, and specifying the implementation issues and actors;

- i) Asses the socio economic status of the PAPs prior to land acquisition and resettlement cost of land and other assets, which should serve as benchmark for implementation of ARAP, and consult the affected people and host community on various resettlement issues at the inception stage;
- ii) Determine the losses and entitlement of each EP (Entitled Person) under the adopted policy framework.;

- iii) Develop an appropriate implementation strategy and sound organization structure to carry out the resettlement program;
- iv) Prepare a development oriented resettlement budget; and
- v) Develop implementation schedule, monitoring and evaluation and management information system for implementation of ARAP.

2.1 Scope and Necessity of Land Acquisition and Resettlement

The Project will involve land acquisition for the construction of the Dhanua Elenga Sector Gas Transmission Project (DESG). An estimated 41.69 hectares (which includes 5.3 hectares government land) will be permanently acquired and 78 hectares would be temporarily acquired for 52 kilometers (km) of pipeline of 8-meter final width within a 23-meter width during construction. Apart from the pipeline alignment, some of the acquisitioned land will be used for construction of different ancillary facilities and stations.

The report has dealt with the two basic issues, one is land acquisition and another is resettlement. As a requiring body, GTCL will take initiative to solve all issues of land acquisition and resettlement. But legally GTCL directly can do nothing in land acquisition except allocating fund in favor of district administration i.e. Deputy Commissioner (DC). After receiving the allocated fund, DC will do all out action for land acquisition on behalf of requiring body. Similarly resettlement work will be carried out by an experienced non-government organization NGO on behalf of requiring body. GTCL in all cases will act as a catalyst. However, as an executing agency (EA) GTCL will have to monitor, supervise the work and ensure timely completion of the project.

2.1.1 Baseline Information for ARAP:

Baseline information for ARAP has been gathered from the information of both primary and secondary sources.

2.1.2 Review the Laws and Guidelines for Land Acquisition

The consultants have thoroughly gone through the existing laws of the land in connection with land acquisition and presented their findings and recommendations in this report.

2.1.3 Custom and traditions of Land Acquisition:

Consideration to customs and traditions, particularly in land acquisition, is of paramount importance for any development project. In Bangladesh, the custom and traditions in land acquisition is applied for specific areas such as Chittagong Hill Tracts. District administration deals with land acquisition as per the laws of the country. The district administration acts on behalf of requiring body.

Chapter-3

Methodology and Survey design for preparation of ARAP

3.0 Methodology and Survey design for preparation of ARAP

A set of questionnaires have been designed for data collection. The questionnaires have been used for obtaining data and information for both the socio-economic assessment and acquisition purposes. The methodology builds on the following key issues:

1. Establishing a socio-economic profile for the project area: For this purpose it was necessary that a socio-economic survey was conducted among the sample of households who are living along the proposed ROW.

For physical and directly affected structure and tree loss, orchard loss, crop loss, homestead loss, agricultural land loss, (partly or fully) all households in the acquired land were interviewed. At the same time, affected person with business loss or likely to suffer occupational disruption (income loss) were interviewed.

2. Establishing an inventory of losses: For the purpose of resettlement planning, an inventory were prepared based on data and information in relation to project's impacts on cultivations, housing, crops and trees and indigenous populations (no such community were foundation in the project areas) along the ROW. Separate format and questions had attached with the questionnaire for collecting required information on losses.
3. Women, indigenous people and vulnerable person's impact assessment: Exclusive consultations with such affected women's groups, vulnerable persons, and indigenous people(not available) in the project sites were conducted in order to elicit information and assess not only about their socio-economic conditions but also to ascertain how they could be involved in and benefit from the proposed project.
4. Public consultations: For the purpose of disclosing information about the proposed project and eliciting the views and concerns of the communities, which were eventually fed into the project design and its implementation procedures, public consultations were organized across various locations of project sites.
5. Focus Group Discussion: The FGD sessions also were organized with the community leaders, farmers, landless, women, public representatives, representatives of the local organizations. Information disclosure was the integral part of the FGD. The process of informed consent would be ensured through this process and sessions could be steered through initiating informative and vivid discussions on pertinent issues.

3.1 Survey Methodology and Tools:

The major survey tools were structured questionnaires. Also, Focus group discussions organized in various key spots of the project areas. The instruments included:

- One structured questionnaire for PAPs, Checklist for Community people for the Dhanua – Elenga project people. The questionnaires and checklist administered among the PAPs and community people.
- FGD Checklist has been prepared covering main topics of social, environmental and resettlement issues.
- Stakeholder consultation sessions steered and facilitated by the Consultants and survey team.
- A total of 10 FGDs conducted for Dhanua-Elenga project location and Stakeholder consultation sessions organized which included the respective government officials, elected public representatives, member of the civil society and representative from different cross-section of the society.
- The sample size for the household survey was 150 across different locations of the pipeline corridor which includes all structure losers and one third of land losers. Population or Probability size (PPS)/ proportionate to population or probability/ random sampling techniques, which are statistically valid sampling size and representative as determined based on geographical spread of the proposed projects and the approximate population figures within the project sites.
- An experienced survey team has conducted the socio economic survey (SES). The team comprised one supervisor and 5 experienced field investigators cum enumerators.

3.2 Objectives of the Survey

The socio economic survey for DESGTP is intended to provide basic socio economic information of the people going to be affected, temporarily or permanently, due to the requisition and acquisition of land and property respectively for this project.

Chapter-4

Socio Economic Analysis

4.0 Socio economic condition of the project site

The proposed pipeline is designed to cross through Sreepur, Sakhipur, Gazipur Sadar, Bhaluka, Bashail Kalihati (Elenga). The concerned districts are Gazipur, Mymensingh and Tangail. Both highland and low lying land are affected by the project. The highland will be under triple cropping area. Sakhipur and Sreepur are highland and some forest land has also been affected. On the other hand, Basail and Elenga points are mainly low lying area and are mainly double cropped ones. In most cases the gas pipeline is passing through paddy fields. At the present point of time, the land area is under cultivation of HYV (high yielding variety) Aman paddy. Cropping pattern of the area constitutes that after harvesting Aman, winter vegetables are cultivated in the land. And then HYV of Boro rice is being cultivated here. West portion of Sakhipur and Basail Elenga areas are mostly low-lying ones and in some areas there are water bodies for aquaculture. But formally no water body is under acquisition.

4.1 General

The pipeline will cross four districts at different locations. The districts are Gazipur, Mymensingh (very small portion in Bhaluka Upazila), and Tangail. And the Upazilas (Sub districts) are Sreepur, Sakhipur, Basail (small portion), Kalihati. During survey, consultation and field visits it was found that, among different losses for the development interventions, mainly involved of temporary and permanent impacts and loss of agricultural land, structures and trees. In some places the alignment will cross some commercial places too. The temporary and permanent losses have been derived based on proportionate distribution and this is a tentative figure.

The Pipeline has to pass through 1 railway crossing (Rajbari area), major road crossing at 5 locations, minor road crossing at 15 locations, river crossing through HDD at six rivers namely Bangshai, Salda, Salai, Tanki-1 & Tanki,-2, Langolia. It will also have 2 interface metering stations and 2 valve stations. The Pipe diameter is 30 inch and will be operated at maximum allowable pressure of 1,130 psig.

It is presumed that, some trees will be affected under forest land. The forest land will be under Gazaria Union Parishad of Sakhipur Upazila. The village and Mouza of the forest land are Patarpur, Kalidash, Gazaria Kirtankhola and Protimabanki under Sakhipur sub district. Tree species and number are Akashmani-500, Sinapata-1000, Jackfruit-500, mango-300, Segun-500, Mehgani-500. Among the trees, Mehgani, Plantain, Mango, Jackfruit etc. are important varieties. There are also trees on private land. (See details in table-4.4.5) Most of the affected land is mainly paddy fields. At least 80% of total affected land is productive one. Whenever the contractor requires any working space and temporary requisition of land is needed, demolishing the structures and removal trees are to be carried out on payment of proper compensation.

After completion of the gas pipeline, most of the owners are likely to cultivate their land again. Requisition land is only procured through renting of cropland. The GTCL will request the concerned DC to take proper step for acquisition of proposed land. Then demarcation, joint verification, cost estimation and serving legal notice will be done by the DC's administration. Funds for the direct payment involved in land acquisition for the structures, land, trees and crop

losses would be placed at their disposal by GTCL on request. Video Filming on the proposed alignment is also important to check fake structures erected after the issue of the legal notice.

GTCL will arrange video filming with support of DC office and NGO prior to serving Section-3 notice. And section-3 will be the cutoff date of getting compensation. Erected structures after issuance of legal notice will not be compensated. After fund placement to the district administration, the DC office would make payment to PAPs. The relocation and extra payment from resettlement program will start thereafter.

The time lapse between the two payments will be at the minimum. GTCL will try to manage the two payments within one or two months. So both the payments at the same time will help them to improve their social condition and living standards. On the other hand GTCL will try to provide payments prior to take possession of the land and assets on the replacement cost. This in brief is the current legal procedure of any acquisition/requisition process.

Working in the PAPs' land, cutting of trees and demolition of any structures will require payment of compensation to 25 hhs owners including housing compensation for resettled households. In addition to that there are 3 CBEs to be compensated for. These resettlement facilities are likely to be provided to the PAPs by the efforts of GTCL, with support of contracted NGO.

4.2 Socio economic condition of Affected People

A brief summary of the category wise socio economic status has been presented in the following paragraphs and have been given in the following section.

i) Land losers PAPs:

Literacy rate of the PAPs (Table-4.5.4.1) is 81% for land losers PAPs and it is comparatively high as semi urban area.

Average income and expenditure (Table-4.5.8.1) of the 122 land losers is monthly 11,896 and Tk.10, 508.

In case of land losers 39.35% are engaged in farming (Table-4.5.5.1), 36.06% are small business and 15.57% are in service.

Type of land owned by the PAPs is shown in Table.4.5.13.1 In case of land owners, total land owned by 122 respondents is 4314 decimal (43.14 acre) and acquired land is 1289 decimal (12.89 acre), so percentage of acquired land is 29.88%.

ii) Household losers PAPs for resettlement:

In case of 25 structure losers household's, the literacy rate is 96%(Tab-4.5.4.1). It means that they are of better social awareness among the people of the area.

As stated earlier, the average income and expenditure (Table-4.5.8.1) of the 25 structure losers households is monthly Tk.16, 029.and TK.14, 161 respectively

The category wise occupation of the HH has been presented at Table-4.5.5.1 It may be seen there from that for these 25 hh, 20% are farmer, 44% are in Small business and 8% are service holders.

Type of land owned by the PAPs is shown in Table.4.5.13.1. Of the 25 hh structure loser total land owned is 590 decimal (5.90 acre) of which 302(3.02 acre) decimal are going to be acquired. So in percentage 51.19 % land is affected by the land acquisition process.

iii) CBEs Loser PAPs for Relocation: There are three CBEs as per socio economic survey. They are required to relocate their poultry farming business to some other suitable places. Socio economic background of these three businessmen has been presented below:

They are all Muslims by religion having an average family size 4.7. Their average monthly family income is Tk.36, 667 and average monthly expenditure is Tk.26, 667 as per field survey. They live in semi pucca and pucca houses. They owned a total land of 1.38 acres but their loss under acquisition is 0.97 acre. All poultry farm owners are educated. Their educational backgrounds are as follows. One completed master's degree, one completed higher secondary certificate (HSC) and rest one completed secondary education. Their main businesses are poultry rearing. In each poultry farm, there are about 2000 poultry birds in each of these farms. Average capital of the poultry farm is about BDT 1 million.

Overall socio economic condition of the affected people: Details socio economic condition of the affected people has been given in the following section. The area is predominantly Muslim. No ethnic minority or indigenous people are found in the project ROW and its adjacent areas. All respondents PAPs are Muslim. The socio economic survey shows that households size in the subproject area are almost same, averaging 5.00 compared with the national average of 4.35(Census 2011,BBS)

Out of 150-affected households surveyed (Table-4.5.3.1) female-headed households are only 3 in the project area. That means women headed household is 2.46%. Literacy rate is generally high and is roughly at, 81.% (Table-4.5.4.1) for affected land owner household heads wherein that for affected family members it is 86.69%, illiterate is 2.73% and below 4 years child 10.58% (Table-4.5.4.2), This is pretty high in comparison with that of national average of literacy rate 47.68(Census 2011). Occupational pattern of household head (hh) of PAPs in case of land loser households are, about 39.35% (Table-4.5.5.1) engaged in agriculture, 36.06% in Small business, 15.57% in service. Further, agriculture laborers are 1.64% while unemployed ones are 1.64%, Income pattern of the PAP's household are shown in the Table-4.5.8.2. Some 9% household earn below Tk.5000, 44% earn Tk. 5,001 to .10, 000 and 34 % earn Tk10, 001 to 15,000 per month.

4.3. Socio Economic Survey and Analysis of Data

A field study has been carried out to assess the exact situation of the affected persons and the people adjacent to the pipeline alignment. Total surveyed PAPs are 150. One third of all affected land losers were interviewed by random selection of which 114 PAPs are permanent land loser and 36 are temporary land losers. Of the structure loser project affected households, full structure losers are 12 including 3 CBEs and partial structure losers are 16. It may be mentioned that a total of 25 structure losers are currently living in these affected structures. Other 3 structure losers are the 3 CBEs.

Survey questionnaires were filled up for every kilometer of the route. There are about 1500 affected plots as per cadastral map in the project site. More than one plot is owned by a single owner. At the same time, one is temporary loser and another one is a permanent loser. It is estimated that, there are about 432 affected house holds.

Exact figure will be found after Deputy Commissioner's (DC) payment through land acquisition (LA) section and during implementation period provided no more houses are found built in the planned ROW. In fact, this is a provisional assessment and actual land ownership will be proved

after receiving all necessary documents following payment made from the DC's office as per law. All available structures and trees losers were interviewed. About one third of the land loser affected persons were also interviewed. Investigators were engaged to collect the data by structured questionnaire.

The figure of 432 referred to above is related to affected persons of 52 km Dhanua Elenga Sector Gas Transmission Project (DESGTP). The authority will update the figure at the time of detailed design and during the period of implementation. No sharecroppers, tenants and absentee landowners were identified.

4.4 Findings of the Survey: An Overview

In this section, some of the major findings of the survey from consultation and field observation are given. Among the affected person most are the farmers and some are small traders, three poultry farm will be affected as business installation in the project area. Except some marginal income losers, there are no squatters found as vulnerable groups. There are 3 female-headed households who will be affected in the project area. It appeared that no indigenous people will be affected in the project site. However, there may be some vulnerable affected persons i.e. elderly, handicapped, women headed marginal farmers etc identified during the implementation period. In the next chapter income restoration strategy for both PAPs and the vulnerable are discussed. So, the authority should take care of all necessary measures, as and when found required.

Table 4.4.1 and Table-4.4.1.1 respectively deals with details of Village wise Structure Type and type of Business Loss in the affected areas.

Table: 4.4.1 Project Affected Structures and Project Affected Units (PAUs)

Sl. No.	District	Upazila	Union	Mouza	Household Members	Single Story Structure		
						Wood/Tin/Mud(No.)	Bricks/RCC (No.)	Total (No.)
1	Tangail	Sakhipur	Gazaria	Garh Gobindapur	9	2	0	2
2	Gazipur	Sreepur	Gazipur	Banshbari	3	1	0	1
3	Gazipur	Sreepur	Gazipur	Dhanua	34	4	3	7
4	Gazipur	Sreepur	Gazipur	Gazipur	26	2	2	4
5	Gazipur	Sreepur	Gazipur	Sailat	8	1	1	2
6	Tangail	Kalihati	kubdala	Mahish Jora	4	1	0	1
7	Tangail	Kalihati	Nagbari	Pakutia	22	5	0	5
8	Tangail	Kalihati	Sahadebpur	Pathanda	4	1	0	1
9	Tangail	Sakhipur	Dariapur	Pratima Banki	10	2	0	2
10	Tangail	Sakhipur	Kupdara	Badda	6	1	0	1
11	Tangail	Sakhipur	kupdara	Banshbari	4	1	0	1
12	Tangail	Sakhipur	Daria pur	Silimpur	4	0	1	1
					134	21	7	28

Note: Note: No double story building is affected. Single story structures are tin roofed brick made semi pucca structure i.e. roof structure is made of tin; side walls and floors are made of brick.

There are three Business structures of Poultry farm in the above mark colored row, one in each row.

Table-4.4.2 : Permanently Affected Land Types of Dhanua-Elenga Project

Sl. No.	Village/Mouza	Union	Upazila/Sub-district	Homestead Land (m ²)	Farm Land (m ²)	Commercial Land (m ²)	Total (m ²)
A. Permanent Affected Land Type for Transmission Pipeline ROW							
1	Mulaid	Maona	Sripur	0	4499.65	0	4499.65
2	Moona	Maona	,,	0	14347.89	0	14347.89
3	Dhanua	Gazipur	,,	809.8	8852.55	0	9662.35
4	Dhanua	Gazipur	,,	0	12839.37	0	12839.37
5	Gazipur	Gazipur	,,	404.7	28232.15	40.47	28677.32
6	Sylat	Gazipur	,,	0	4525.64	0	4525.64
7	Bashbari	Gazipur	,,	404.7	19221.05	0	19625.75
8	Kachina	Kachina	Gafargaon	0	8440	0	8440
9	Kalmegha	Nagpur	Basail	0	24701.12	0	24701.12
10	Moucharia Pathar	Gazaria	,,	0	16886.94	0	16886.94
11	Gazaria Kirton khola	Gazaria	,,	404.7	20172.28	0	20764.98
12	Kalidash	Gazaria	,,	404.7	14802.82	0	15207.52
13	Protimabanki	Dariapur	,,	2023.5	24877.32	200	27100.82
14	Gorgobindapur	Gazaria	,,	404.7	10449.39	0	10854.09
15	Chhota Mouza	Gazaria	,,	0	13719.08	0	13907.08
16	Silimpur	Dariapur	,,	0	14870.09	0	14870.09
17	Salgram	Baheratali	Kalihati	0	6756.88	0	6756.88
18	Batua	Shahadevpur	,,	0	11355.72	0	11543.72
19	Gateshwari	Shahadevpur	,,	0	4023.63	0	4023.63
20	Gatewar	Shahadevpur	,,	0	10230.54	0	10230.54
21	Gohaliabari	Shahadevpur	,,	0	12835.71	0	13023.71
22	Dabail	Shahadevpur	,,	0	10428.07	0	10616.07
23	Kaligati	Shahadevpur	,,	0	9828.71	0	9828.71
24	Nagbari	Nagbari	,,	0	5066.47	0	5066.47
25	Pakutia	Nagbari	,,	1214.1	3084.19	0	4298.29
26	Balla	Balla	,,	0	5619.92	0	5619.92
27	Badda	Kubadala	,,	404.7	6073.22	0	6477.92
28	Sigair	Kubdala	,,	0	3447.82	0	3447.82
29	Dattagram	Kubdala	,,	0	4636.7	0	4986.7
29	Bania	Kubadala	,,	0	2110.85	0	2110.85
30	Kokedohra	Kubadala	,,	0	8261.08	0	8261.08
31	Savar	Kubdala	,,	0	736.95	0	736.95
32	Bolidi	Kubadala	,,	0	6664.42	0	6664.42
33	Kendua	Kubadala	,,	0	3599.11	0	3949.11
34	Mohibijora	Kubadala	,,	404.7	8451.7	0	8856.4
35	Patiltapara	Shahadevpur	,,	0	10071.3	0	10071.3
36	Mandail	Basail	,,	0	2471.4	0	2471.4

Sl. No.	Village/Mouza	Union	Upazila/Sub-district	Homestead Land (m ²)	Farm Land (m ²)	Commercial Land (m ²)	Total (m ²)
37	Demukha	Shahadevpur	„	0	7609.02	0	7859.02
38	Pathanda	Shahadevpur	„	809.4	4394.59	0	5203.99
39	Mashinda	Basail	„	0	8287.52	0	8287.52
40	Rajabari	Bangla	„	0	8749.26	0	8749.26
Total				7689.7	406232.12	240.47	416052.3
B. Two Valve Stations (25X25 (including 8m ROW)) (Farm Land Area 21.0 decimal i.e. 0.085Hectares)							850
Grand Total							416902.3
Total Acquisitioned Area is 41.69 Hactares							

Table 4.4.3 shows the detail picture of the Number of Project Affected Units (PAUs) and Affected Persons (APs).

Table-4.4.3: Number of Project Affected Units (PAUs) and Affected Persons (APs) of Dhanua-Elenga

Type of Loss		No. of PAUs			No. of APs		
		Legal	Illegal	Total	Legal	Illegal	Total
Required for Displacement							
1	HH (Structure owner on Gov. land)	0	-	-	0	-	0
2	HH (Structure on Private land)	25 (counted)	-	-	121	-	121
3	HH (Tenants)	0	-	-	0	-	0
4	CBEs (Structure owner Gov. land)	0	-	-	0	-	0
5	CBEs (Structure owner on Private land)	3 (counted)	-	-	13	-	13
6	CBEs (Tenants)	-	-	-	-	-	-
7	Community owned structures including physical cultural resources	0	-	-	0	-	0
Not required for displacement							
8	Land owners	400 (estimated)	-	-	2000	-	2000
9	Wage earners	4	-	-	20	-	20
Grand Total(1-9)		432			2154		2154

HH: House Hold, CBEs: Commercial and Business Enterprises

1. These four structure loser households are employees in the poultry farm who are affected but need no displacement

Table.4.4.4 List of Affected Structure Losers PAPs

Sl. No.	Name	Fathers name	District	Upazila	Union	Mouza	Type of structure			Household members
							Floor	Wall	Roof	
1	Md. Hanif	Late Dudu	Tangail	Sakhipur	Gazaria	Garh Gobindapur	Mud	Mud	Tin	5
2	Akbor	Akramul	Tangail	Sakhipur	Dariapur	Silimpur	RCC	RCC	Tin	4
3	Habibur rahman	shahin mondol	Gazipur	Sreepur	Gazipur	Sailat	RCC	RCC	Tin	4
4	Md. Abdus Rashid	Late Hazmat ali	Gazipur	Sreepur	Gazipur	Gazipur	Mud	Mud	Tin	6
5	Azizul haque	Abdul Mutalib	Gazipur	Sreepur	Gazipur	Dhanua	Mud	Mud	Tin	5
6	Md. Mujibur Rahman	Badur Khaleque	Gazipur	Sreepur	Gazipur	Dhanua	Mud	Mud	Tin	4
7	Jubor Ali	Abdul Mutalib	Gazipur	Sreepur	Gazipur	Dhanua	Mud	RCC	Tin	4
8	Azim uddin	Late Samed Ali	Gazipur	Sreepur	Gazipur	Gazipur	RCC	RCC	Tin	10
9	Md. Helal uddin	Late Samsuddin	Gazipur	Sreepur	Gazipur	Dhanua	RCC	RCC	Tin	6

Sl. No.	Name	Fathers name	District	Upazila	Union	Mouza	Type of structure			Household members
							Floor	Wall	Roof	
10	Md. Mostafa Kamal	Md. Waise uddin	Gazipur	Sreepur	Gazipur	Gazipur	RCC	RCC	Tin	5
11	Somon Islam	Hadi Islam	Gazipur	Sreepur	Gazipur	Dhanua	RCC	RCC	Tin	5
12	Humayun kabir	saiful kabir	Tangail	Kalihati	Kubdala	Mahish Jora	Mud	Tin	Tin	4
13	Halim	Abdul Mutalib	Gazipur	Sreepur	Gazipur	Dhanua	Mud	Tin	Tin	4
14	Md. Kawsar	Late Abdul latif	Tangail	Kalihati	Nagbari	Pakutia	Mud	Tin	Tin	4
15	Altaf Hossain	Md. Joinal Abden	Gazipur	Sreepur	Gazipur	Gazipur	Mud	Tin	Tin	5
16	Md. Hakmot ali	Md. Nasir	Gazipur	Sreepur	Gazipur	Banshbari	Mud	Tin	Tin	3
√17	Md. Julhas	Md.yunus	Tangail	Sakhipur	Sokhipur municipality	Garh Gobindapur	RCC	Tin	Tin	4
18	Sarful Islam	monju islam	Tangail	Kalihati	Nagbari	Pakutia	RCC	Tin	Tin	4
19	Ismail Hossain	Nur zamal hossain	Tangail	Kalihati	Nagbari	Pakutia	RCC	Tin	Tin	4
20	Mostofa	Hasmot	Tangail	Kalihati	Nagbari	Pakutia	RCC	Tin	Tin	5
√21	Ripon islam	Md. Nurul Islam	Tangail	Kalihati	Nagbari	Pakutia	RCC	Tin	Tin	5
22	Selim	Bosiruddin	Tangail	Kalihati	Sahadebpur	Pathanda	RCC	Tin	Tin	4
23	Abul hassan	sidur hassan	Tangail	Sakhipur	Kubdala	Banshbari	Mud	Tin	Tin	4
√24	Rafikul Islam	Abul hossain	Tangail	Sakhipur	Dariapur	Pratima Banki	Mud	Tin	Tin	4
25	Based Mia	Fazlur Mia	Tangail	Sakhipur	Kubdala	Badda	Mud	Tin	Tin	6
26	Abdul aziz	Md lebu miah	Tangail	Sakhipur	Gazaria	promita banki	Mud	Tin	Tin	6
27	Md. Mostafa kamal	Md. Lal mia	Tangail	Sreepur	Gazipur	Sailat	Mud	Tin	Tin	4
28	Raham Ali	Late Hasan Ali	Gazipur	Sreepur	Gazipur	Dhanua	Mud	Tin	Tin	6
(Note: Tick mark rows is for poultry farm owner), Total Displaced Affected Persons										134

Table- 4.4.5 Mouzawise Tree loss in the Affected Areas

District	Upazila	Affected mouza	Banana	Jackfruit	Mango	Lichy	Papaya	Coconut	Guava	Blackberry	Jambora	Bel	Katbel	Ata	Boroi	Sofeda	Amloky	Dalim	Chalta	Kamranga	Lebo	Orange	Others	Total	
Tangail	Sreepur	Dhanua	22	84	64	4	25	30	5	3	4	7	0	0	11	1	0	0	0	4	1	0	21	286	
Tangail	Sakhipur	Bansbari	26	47	37	0	6	12	0	0	0	0	0	0	4	0	0	0	0	0	0	0	5	137	
Tangail	Sreepur	Gazipur	48	36	58	0	5	15	11	3	4	4	0	1	10	0	1	0	1	1	3	1	9	211	
Tangail	Sreepur	Sailat	24	30	41	1	8	9	5	1	2	1			5				1	1	1		5	134	
Tangail	Sakhipur	Salgrampur	20	12	14	0	12	5	3	0	1	1	0	0	3	0	0	0	0	0	0	0	0	0	71
Tangail	Kalihati	Banira	4	8	9	0	7	3	3	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	38
Tangail	Kalihati	Badda					1	1	1		1												2	6	
Tangail	Kalihati	Baldhi	16	15	20		8	4	8	3					4										78
Tangail	Kalihati	Dattagram	19	13	12			5	3	2					3										57
Tangail	Kalihati	kendua	20	10	16		11	5	4						1										67
Tangail	Kalihati	Kok Dahara	17	14	13	0	11	4	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	64
Tangail	Kalihati	Mahish Jora	31	18	20		7	8	10	1	1				5					2	3				106
Tangail	Sakhipur	Pakutia	9	11	18	0	3	12	1	2	5	0	0	0	2	0	0	0	0	1	1	0	86	151	
Tangail	Kalihati	Nagbari		6	7		4	4	4			1			2						1				29
Tangail	Kalihati	Dimukha	19	17	17	0	10	5	3	0	0	0	0	0	5	0	0	0	0	0	2	0	0	0	78
Tangail	Kalihati	Mundail	0	8	12	0	6	3	4	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	35
Tangail	Sakhipur	Pathanda	31	58	30	7	8	4	6	2	1	1	0	0	6	0	0	0	0	0	3	0	52	209	
Tangail	Kalihati	Patita Para	43	18	15		5	6	7						4						3				101
Tangail	Sakhipur	Kalidas	12	13	13	1	11	6	6	0	2	1	1	0	2	0	0	0	0	0	1	0	0	0	69
Tangail	Sakhipur	Pratima Banki	25	8	5	0	14	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	57
Tangail	Sakhipur	Silimpur	40	36	34	0	9	11	7	0	4	0	0	0	6	0	0	1	0	1	4	0	0	0	153
Tangail	Sakhipur	Chhota Mausa	7	21	21		3	7	3		2				2		1			1					68
Tangail	Sakhipur	Garh Gobindepur	51	24	48	0	4	4	9	0	0	0	0	0	4	0	0	0	0	0	0	0	61	205	
Tangail	Sakhipur	Gazaria Kirtankhola	15	7	6		5	3	2						2										40
Tangail	Sakhipur	Moucharia Pathanda		3	5		6	1	2						1						1				19
		Total	499	517	535	13	189	169	110	19	27	16	1	1	91	1	2	1	1	11	24	1	241	2,469	

4.5 General Socio-Economic Condition of the affected Area

4.5.1. Permanent and Temporary land loss

Table-4.5.1 Type of Affected Person surveyed based Permanent and Temporary land loss

Type of Loss	No of PAPs	%
Permanent Land Loser	114(includin25 households and 3 CBS)	76
Temporary Land loser	36	24
Total	150	100%

Table-4.5.1 shows, type of affected person in terms of permanent land loss. Total 150 PAP's households were sampled for survey and 432 PAPs were identified. Among the identified PAPs 114(76%) are Permanent Land Loser and 36(24%) temporary land loser.

4.5.2 Religious Status of PAPs surveyed & Demographic Status of Surveyed households

Tab-4.5.2.1 Religious Status of PAPs Surveyed

Type	Respondent of structure losers	%	Respondent of land losers	%
Muslim	25	100	122	100
Hindu	0	0	0	0
Christian	0	0	0	0
Buddhist	0	0	0	0
Total	25	100	122	100

In the Table-4.5.2.1 religious breakdown of the area is given. The area is predominantly Muslim. No ethnic minority or indigenous people are found in the project ROW and adjacent areas. It is found that Muslim (100%) is the main religious community and no household from other communities are available in the area.

Tab-4.5.2.2 Demographic Status of Surveyed households

Status	122 land losers	%	25 structure losers	%
Male	298	54	66	55
Female	250	46	54	45
Total	548	100	120	100
Average HH size	4.49		4.8	

Table4.5.2.2 shows demographic character of the affected household .Family size in the 25 structure loser and land loser households is 4.49 and 4.8 respectively

The socio economic survey shows that households size in the subproject area are almost same, averaging 5.00 compared with the national average of 4.35(Census 2011,BBS)

4.5.3 Respondents Position Regarding Vulnerability

Tab-4.5.3.1 Type of Respondents regarding vulnerability

Type of Respondents	No.	%	No.	%
Women headed hh	3	2.46	0	0
Ethnic minority	0	0	0	0
Indigenous people	0	0	0	0
Physically handicapped/elderly/retired	4	3.28	0	0
Squatter	0	0	0	0
Others non vulnerable	115	94.26	25	100
Total	122	100	25	100

Out of 150-affected households surveyed (Table-4.5.3.1) female-headed households are only 3 in the project area. That means women headed household is 3(2.46 %) for land losers HH. Since this 3 is found out of 30 % sample survey, the total number would be 10 FHHH. Women are most vulnerable in the society. Female-headed households and handicapped will be provided with specialized livelihood and skills. Livelihood Training according to vulnerable group's entitlements has been cited in the entitlement matrix. Members of female-headed households will also be provided preference for project related employment. The resettlement policy of JICA has special emphasis on the issue in favor of vulnerable. Special information dissemination will also be undertaken for female-headed household's .But, no squatter or indigenous minority people have been identified.

4.5.4 Education

Table-4.5.4.1 Category wise Education of the HH head

Class Attended	Respondent of structure loser	%	Respondent of land loser	%
Illiterate	1	4	23	19
Only read and write	0	0	0	0
Class 1 to class 5	4	16	11	9
Class 6 to 10	6	24	14	12
SSC/equivalent	0	0	0	0
HSC/equivalent	5	20	21	17
Degree/graduate	3	12	11	9
Masters/honors	4	16	15	12
Others	2	8	27	22
Total	25	100	122	100

Literacy rate of the PAPs (Table-4.5.4.1) for land loser is 81% and it is comparatively high. In case of 25 structure losers households it is 96%. It means better social awareness of the people of the area, which is comparatively high among the affected household national average 47.68% (BBS, Census-2011).

Table-4.5.4.2 Education of the of the affected family

Class Attended	122 land loser hh	%	25 structure loser hh	%
Child under 4 years	58	10.58	11	9.17
Illiterate	15	2.73	2	1.67
Class 1 to class 5	9	1.64	7	5.83

Class Attended	122 land loser hh	%	25 structure loser hh	%
Class 6 to 10	54	9.85	17	14.16
SSC/equivalent	28	5.12	4	3.33
HSC/equivalent	183	33.39	45	37.5
Degree/graduate	87	15.87	14	11.67
Masters/honors	47	8.58	8	6.67
Others	67	12.24	12	10
Total	548	100	120	100

(Note: SSC- Secondary School Certificate, HSC - Higher Secondary School Certificate)

The Table-4.5.4.2 shows the education pattern of the surveyed households. The literacy rate is pretty high in comparison with national average of 47.68% (Census 2011). Currently nationwide enrollment has increased largely and thus about 90% of school-age children of the locality are attending schools.

4.5.5 Occupation

Table-4.5.5.1 Category wise Occupation of the Household Head

Occupation	Respondent of structure loser	%	Respondent of land loser	%
Farmer	5	20.0	48	39.35
Fisherman	0	0.0	0	0.0
Agriculture labor	0	0.0	2	1.64
Non agriculture Labor	3	12.0	0	0.0
Service	2	8.0	19	15.57
Small business	11	44.0	44	36.06
Household work	2	8.0	3	2.46
Student	0	0.0	3	2.46
Retired/handicapped	0	0.0	0	0.0
Unemployed	0	0.0	2	1.64
Service in Abroad	2	8.0	0	0
Others	0	0.0	1	0.82
Total	25	100	122	100

In Table-4.5.5.1 Category wise Occupation of the HHH has been presented. Some of the population are engaged in agriculture among the hh heads, 20% are farmers among the 25 hh heads but in case of land losers, 39.35% are engaged in farming. and 8% in service.

Table-4.5.5.2 Occupational pattern of the affected family

Occupation	Primary Occupation (No)	%	Secondary Occupation (No)	%	Primary Occupation (No)	%	Secondary Occupation (No)	%
Farmer	76	13.87	9	64	9	7.50	1	33
Fisherman	0	0	1	7	0	0	0	0
Agriculture labor	2	0.36	0	0	0	0	0	0
Non agriculture Labor	0	0	0	0	1	0.83	0	0
Service	21	3.83	0	0	5	4.17	0	0

Occupation	Primary Occupation (No)	%	Secondary Occupation (No)	%	Primary Occupation (No)	%	Secondary Occupation (No)	%
Small business	51	9.31	2	14	19	15.84	0	0
Household work	150	27.37	0	0	32	26.67	0	0
Student	176	32.12	0	0	37	30.82	0	0
Child	58	10.58	0	0	12	10.00	0	0
Retired/handicapped	0	0	0	0	0	0	0	0
Unemployed	5	0.91	0	0	0	0	0	0
Service in Abroad	3	0.55	0	0	5	4.17	0	0
Others	6	1.10	2	14	0	0	2	67
Total	548 122 land loser hh	100	14	100	120 25 structure loser hh	100	3	100

Occupational pattern of PAPs indicates that 13.87% engaged in farming as primary occupation in land loser households. The ones in small business, service and as agriculture laborers are 9.31%, 3.83% and 0.36% of the 122 land losers respectively., Similarly, out of the 25 structure losers, 7.50% are engaged in farming, there are 15.84% in small business and 0.83% in non agricultural laborers but none in the category of agricultural laborers.

4.5.6 Marital Status of the affected family

Table-4.5.6.1 Marital Status of the affected family

Marital Status	122 land losers	%	25 structure losers	%
Married	313	57	61	51
Unmarried	235	43	59	49
Widow	0	0	0	0
Widower	0	0	0	0
Divorced	0	0	0	0
Separated	0	0	0	0
Others	0	0	0	0
Total	548	100	120	100

Table-4.5.6.1 shows that married ones are, in case of 122 land losers and 25 structures 57% and 51 % respectively. Divorced, widows or separated were not found in the marital status of the affected families.

4.5.7 Age Structure of the Human resource of the family

Tab-4.5.7.1 Age structure of the affected family

Age Group	122 land loser families		25 structure loser families	
	No.	%	No.	%
0-5	31	6	9	8
6-7	21	4	7	6
8-18	168	31	38	32
19-30	111	20	21	18
31-45	158	29	30	25
46-60	43	8	10	8

Age Group	122 land loser families		25 structure loser families	
Age	No.	%	No.	%
61+	16	3	5	4
Total	548	100	120	100

Table-4.5.7.1 shows the age structure of the manpower of the 122 land loser families surveyed in the sample households. Among land losers 31% population is in the age category of between 8-18, 20% population is in age group of 19-30, 29% population is in age category of 31-45, 8% population in the age group of 46-60 and 3% population is in age group of 61+ where as. 6% population is in the age group 0-5. It may be mentioned here that in case of 25 structure loser families, the numbers are slightly different.

4.5.8 Income Pattern of affected family

Table-4.5.8.1 Monthly income and Expenditure

	Respondent of structure loser		Respondent of land loser	
	Income (Tk)	Expenditure (Tk)	Income (Tk)	Expenditure (Tk)
Average	16029	14161	11896	10508
N	25		122	

Table-4.5.8.1 shows the average income and expenditure of the affected families. In case of 25 structure losers households, it has been observed that their income is Tk.16,029 and expenditure is Tk.14,161 per month and that for 122 land losers it is Tk.11,896 and Tk.10,508 respectively per month.

Table-4.5.8.2 Monthly Income Pattern of the affected household

Income range	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Below Tk 5000	11	9	1	4
5001 to 10,000	54	44	12	48
10,001 to 15,000	42	34	7	28
15,001 to 20,000	9	7	1	4
20,001 to 25 000	2	2	1	4
25,0000+	4	3	3	12
Total	122	100	25	100

Income pattern of the PAP's household are shown in the Table-.4.5.8.2. It reflects that 9% land loser household earn below Tk.5000 per month, 44% household earn Tk 5,001 to .10,000 and 34 % household earn Tk10,001 to 15,000 per month. On the other hand in case of 25 structure losers in the said income groups, the income amounts are 4%, 48%, and 28% respectively.

4.5.9. Cropping Pattern of the Affected Area

Crops	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Paddy HYV	93	76.23	3	12
Paddy local	3	2.46	0	0
wheat	1	0.82	0	0

Crops	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
pulse	0	0	0	0
Maize	0	0	1	4
Vegetables	0	0	0	0
others	3	2.46	0	0
No cultivation	22	18.03	21	84
Total	122	100	25	100

Cropping pattern as shown in Table-4.5.8.3 for the area mainly indicates cultivation of High Yielding variety (HYV) 76.23% for the 122 land losers. Their main crop is boro and it is cultivated in the dry season with maximum land being irrigated for high yielding variety. It has also been observed that about 84% of the 25 Structure Losers Household are not engaged in cultivation and only 12% engaged in cultivating HYV paddy.

4.5.10 Survey Team Observation of PAPs Condition

Table-4.5.9.1. Economic Condition of the affected person according to survey team

PAPs	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Ultra Poor	6	5	2	8
Poor	32	26	7	28
Middle class	82	67	14	56
Rich	2	2	2	8
Total	122	100	25	100

Note: Ultra Poor indicates the section of families who are living below poverty line

Table-4.5.9.1 shows the economic condition and the poverty level of the PAPs. Among 122 land losers surveyed, it has been observed that 5% are ultra poor, 26% are poor and 67% are in the middle income group while 2% could be treated as rich. But this economic situation has been considered in the context And. also it will be considered of the situation of rural or semi urban area of Bangladesh. But in case of the 25 structure losers these percentages are 8%.28%, 56% and 8% respectively.

Table- 4.5.9.2. Social network of the affected person

PAPs	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Good	99	81	18	72
Poor	23	19	7	28
Bad	0	0	0	0
Total	122	100	25	100

Table-4.5.9.2 shows the social network of the affected community. The area is highly active zone near regional highway in the North West region of the country and well communicated with other areas. Further, education rate is comparatively high too. So, the people of the area are more sensitive and conscious. Displaced persons will have to be given proper support in regaining social network in their host areas. GTCL will perform the corporate social responsibility (CSR) activities in the host areas and it is expected that this will provide them opportunity of well access to the host communities.

4.5.11 PAPs Location

Table-4.5.11.1 Respondent's Residence

PAPs	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Within 50 meter	52	43	22	88
51 m -225 meter	62	51	2	8
226 meter-500meter	6	5	0	0
501 meter to 1km	2	2	0	0
1km+	0	0	1	4
Total	122	100	25	100

Table 4.5.11.1 gives an idea of the affected respondent's location which is at the project vicinity. It is estimated about 43% of land losers are located in the vicinity of the project areas. Others are absentee land owners including relatives of the rural people who are currently living in urban and other area.

4.5.12. Social and Economic Impact of the Project and PAPs Comments regarding Project implementation

Though the amount of land acquisition is relatively small, yet the impact will be, in general positive. Total affected households will be 432 approximately including both structure losers and land losers. The number of all sorts of affected trees are (2469 +3300) both for private and public land. The trees are in the Khas land (government land-amounted 5.38ha). Number of affected Structure is 28. Out of these structures, 3 are poultry farm (CBEs) and the other 25 are the residential households to be resettled. Acquisition land amount to 42.73 ha and that of the requisition land is 78 ha.

It is expected that the implementation of the gas transmission pipeline will improve the socio economic scenario of the region, resulting in employment generation, environment friendly fuel supply, enhanced electricity generation and industrial production. The region is rapidly becoming economically important. Urbanization in Gazipur and Tangail is rapidly increasing. It is now a business hub of the country. Tangail is the land bridge of both north and south regions of the country.

It may be mentioned, several public universities are lying in the area. Moreover, one public university is located in Tangail. Jamuna Bridge is the largest bridge infrastructure of the country. The 100km Jamuna Bridge rail Link Project has connected Gazipur, Tangail, Sirajganj and northern districts. Both Tangail and Sirajganj are famous for handloom industry. Largest reserve forest of the country (viz."Bhawaler Gar") is located about 15 km away from the project site at Sreepur and Sakhipur. Natural beauty of the area attracts everyone. The area is well connected by road, rail and river with other areas of the country. But most of areas have no gas connection.

Affected community desired for gas connection in all points of the project area, which in their opinion, can save forest resources reducing dependency on wood, a catalyst of industrialization and a source of clean energy. The area is growing an emerging hub of the country. In Gazipur, coal based brickfield is a threat for environment. A lot of brick field have been developed in the area. Sulphur emission is high in comparison of other areas. So, if gas is used for brickfield for brick burning will create employment and growth.

The region has no fertilizer factory. Gas supply will make fertilizer factory possible and create agriculture development and employment also. On the other hand gas supply will help to construct Electricity plant. Gas supply will directly help in industrial development as well as for household fuel. It will also contribute to save ecology. The area has been found to be rich in cultural heritage and natural beauty. The mighty Jamuna River has crossed beside the project area.

In fine, all section of people will be benefited by the project. The proposed resettlement program will enable the affected persons to regain economic condition to their previous state. Most of the affected persons hold a positive view regarding construction of gas transmission line. Following Table 4.5.12.1 shows the people's perception about the gas pipeline and PAPs' views for supporting the project. It may be concluded there from that, if GTCL fulfill their demands, no one will oppose the project. Their demands include: appropriate compensation of land at market value, and their housing structure be saved keeping the pipeline diverted from their homestead. Here, it may be important to note that only a small number of housing structures will be affected in the project and proper compensation has been proposed in ARAP at the rate of full replacement cost.

Table 4.5.12.1.PAP's Comments Regarding Project implementation

Comments Of respondents	122 Land Loser household		25 Structure Losers Household	
	No.	%	No.	%
Appropriate Compensation Provided	66	54.2	9	36
Support is short time basis if not proper compensation	1	0.8	1	4
House are not affected	34	27.9	6	24
land for land provided	5	4.1	3	12
alternative house provided	0	0	0	0
Others support	4	3.2	5	20
No Comments	12	9.8	1	4
Total	122	100	25	100

Accordingly, in preparation of the report, consideration of the resettlement issues has been taken into account for all the affected persons to mitigate these negative impacts of the project. In other words, necessary mitigation program has been proposed in solving the resettlement issues and the income related measures. These are also the issues of resettlement policy of the JICA. The mitigation measures will be applicable considering the respective nature of impacts and as such, GTCL will proper attempt in minimizing income related issues by a pragmatic plan as per guideline of ARAP.

4.5.13 Category wise Land ownership and land loss

Table.4.5.13.1.Type of household owns land

Type	25 Structure Losers Household		122 Land Loser household	
	Total owned land (decimal)	Total affected land (decimal)	Total owned land (decimal)	Total affected land (decimal)
Homestead	454	250	320	101
Agriculture	136	52	3994	1188
Water body	0	0	0	0
Total	590	302	4314	1289
N	25		122	

Type of land owned by the PAPs is shown in the above Table.4.5.13.1. Out of the total land of 590 decimal (5.90 acre) owned by the 25 hh structure losers, a quantity of 302 (3.02 acre) decimal lands is scheduled to be acquired. So in percentage 51.19 % of their land is affected. In case of 4314 decimal (43.14 acre) land owned by 122 land losers, the quantity of land to be acquired is 1289 decimal (12.89 acre), so percentage of their acquired land is 29.88%.

4.5.14. Category wise Asset Owner of PAPs

Table.4.5.14.1 Category wise

Others important assets owns

Types	25 Structure Losers Household own asset	%	No. of total asset own	122 Land Loser household own asset	%	No. of total asset own
Radio/Cassette player	1	4	2	8	7	14
TV	22	88	26	110	90	113
Freeze	8	32	8	36	30	38
Cot	4	16	5	14	11	18
Almari	21	84	26	108	89	154
Fan	20	80	60	99	81	241
AC				2	2	6
Camera				3	2	3
Cycle	15	60	14	66	54	67
motor cycle	3	12	3	10	8	11
Car				1	1	1
Nasimon/auto rickshaw				1	1	1
Others	2	8	3		0	0
N		25			122	

In the above table, ownership of different assets has been shown. This shows their living standard.

Chapter-5

Policy Framework

5.0 Policy Framework: The Relevant Laws, Regulations and Guidelines of Resettlement

The policy framework and entitlements for the Project are based on national law (Acquisition and Requisition of Immoveable Property Ordinance of 1982) and JICA's Policy on Involuntary Resettlement. Government is legally bound for payment of Cash compensation under the law (CCL) and premium money, but by administrative instance, government is doing all recognized efforts in regaining affected persons' socio economic position and special attention are being made for vulnerable, indigenous people and female-headed households.

Acquisition and Requisition of Immoveable Property Ordinance (ARIPO)-of 1982 has its subsequent amendments held in 1993 and 1994. It covers all cases of acquisition and requisition (temporary acquisition) by the government for public purpose and interest. The legal processes are initiated by the Deputy Commissioner (DC), of the concerned district with a detailed map of the area and a land acquisition plan.

5.1 JICA Policy Requirement:

- People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponent etc in a timely manner and prior compensation, at full replacement cost, must be provided as much as possible.
- Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre project level.
- Measures to achieve this may include, providing land and monetary compensation for losses(to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement site.
- JICA confirms that project do not deviate from the world Bank's Safeguard policies and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards international standards, treaties, and declarations, etc; and to the good practices etc, a developed nations including Japan, when appropriate.
- In case of indigenous peoples, any adverse impacts may have on indigenous people are to be avoided when feasible by exploring all viable alternative, when avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous people for their losses
- Appropriate participation by affected people and their communities must be promoted in the planning, implementation and monitoring of the resettlement action plans and measures to prevent the loss of their livelihood.
- Appropriate and accessible grievance mechanisms must be established for the affected people and their communities
- For projects that will result in large scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.

- Consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.
- Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities, all members which are susceptible to environmental and social impacts and may have little access to decision making process within the society.

The key principle of JICA policies on involuntary resettlement is summarized below:

- (1) Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- (2) When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken
- (3) People who must be resettled involuntarily and people whose means of livelihood will of assistance must be provided prior to displacement
- (4) For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12
- (5) In preparing a resettlement action plan, consultations must be held with the affected people and their be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- (6) Compensation must be based on the full replacement cost¹ as much as possible. Compensation and other kinds communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
- (7) Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
- (8) Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.
- (9) Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP 4.12 is as follows:
- (10) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census

¹ Description of “replacement cost” is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors’ fees, plus the cost of any registration and transfer taxes.

that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advantage of such benefits.

- (11) Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
- (12) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
- (13) Provide support for the transition period (between displacement and livelihood restoration. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.
- (14) In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

5.2 Measures for Resettlement

In short, following measures are to be taken

- i) Avoiding or minimizing adverse project impacts where possible
- ii) Consulting with project affected people (PAP) in project planning and implementation, including
- iii) Disclosure of Resettlement Action Plan (RAP) and project related information
- iv) Payment of compensation for acquired assets at the market/replacement value
- v) Resettlement assistance to PAPs, including non titled persons (informal dwellers/squatters and encroachers);
- vi) Income restoration and rehabilitation program; and
- vii) Special attention for vulnerable groups

Consistent with the JICA policy, this framework and resettlement procedural guidelines will apply for the concerned project. This will ensure that persons affected by land acquisition and resettlement will be eligible for appropriate compensation and rehabilitation assistance. The framework reflects the governments land acquisition and regulation as well as JICA's Guidelines for Environmental and Social Considerations (2010) as policy on Involuntary Resettlement and other social safeguard guidelines. It stipulates eligibility and provisions for all types of losses (land, crops/trees, structures, business/employment, and workdays/wages). If land for land is not a feasible option, PAPs will be compensated at full replacement costs. In addition PAPs will receive additional grants to match replacement cost for lost assets (land and houses), transaction costs such as documentary stamps and registration costs (in case of purchase of replacements land), other cash grants and resettlement assistance such as shifting allowances, compensation for loss of workdays/income due to dislocation. Female –headed households, indigenous peoples households, other vulnerable households will be eligible for further cash assistance for relocation and house construction.

5.3 Legal Framework of GOB

The policy framework and entitlements for the Projects are based on national law, *Acquisition and Requisition of Immovable Property Ordinance of 1982(ARIPO)* and JICA's 'Guideline's for Environmental and Social Considerations (2010).' on resettlement.

Deputy Commissioner (DC) is empowered to permanently acquisition or temporarily requisition of property and eligible for compensation to the Project Affected Person (PAP). DC assesses the level of compensation, taking into consideration factors such as: land transactions in the locality over the past 12 months. The amendments to the ARIPO in 1993 increased the amount of the premium for compulsory acquisition from 25 to 50% on the assessed value of the property. The 1994 amendment provides provision for payment of crop compensation to tenants. The ARIPO does not cover compensation for loss of wage income; it also does not cover losses of non-titled persons (Sharecropper, squatters, encroachers, etc.) aside from crop losses to tenants. Still in the project are no non titled are identified and all 150 surveyed affected household are found legal owner.

For the purpose of acquisition and requisition of immovable properties in Bangladesh, the government, taking into consideration all previous Acts, Rules, Ordinances etc., have prepared '**Acquisition of Immovable Properties Manual-1997**'. This manual guides all acquisition and requisition of immovable properties, for the purposes whatsoever as well as payment of compensation for all sorts of losses. Summary of the manual has given below

(1) Legal Framework on Land Acquisition

Following Table 5.3.1 shows relevant ordinance and acts on land acquisition in Bangladesh.

Table-5.3.1- Relevant ordinance and Act on land acquisition and resettlement

Title	Year	Outline
Acquisition and Requisition of Immovable Property Ordinance	1982	The Ordinance (Ordinance 11 of 1982) has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948), this Ordinance deals only with immovable property. Under the ordinance II of 1982, any private property(except places for religious worship, graveyard and cremation ground) can not be acquired by the government for public purpose or interest. Detailed procedures have been prescribed to ensure that a deputy commissioner proceeds systematically and on sound principles in such cases, leaving room for owners to raise objections which must be disposed of after due hearing. In addition, the Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors. The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women & squatters and such other vulnerable groups are yet to be framed.

The Acquisition of Immovable Property Rules 1982	1982	The Acquisition of Immovable Property Rules of 1982, are made for the exercise of the powers conferred upon by Section 46 of the Acquisition and Requisition of Immovable Property Ordinance 1982.
Land Reform Ordinance	1984	Under the Ordinance 1984, families owning lands up to 60 Bighas (about 6.7 ha) at a given time were to be barred from acquiring further land by purchase, inheritance, or otherwise. A family or person inheriting lands in excess of 60 Bighas would have to surrender the 'surplus' land, for which due compensation was to be paid. In addition, the Ordinance is a bar on the eviction from rural homestead, even in the process of law, for non-payment of rent or tax.
The Movable Property Requisition (Compensation) Rules, 1990	1990	The Rules makes provision for constituting a Compensation Assessment Committee in each district for determining compensation for any requisitioned vehicle, vessel or bus, truck, minibuss etc. In case of requisition of a vehicle or vessel, the order of requisition should clearly state the period of requisition, purpose of requisition, and the amount of compensation to be awarded.
Acquisition and Requisition Act, 1994 (under determining compensation)	1994	In December 1994 the government passed a rule in order to amend the provisions of the Acquisition of Property on Emergency Basis Act 1989 for determining compensation under the Acquisition and Requisition Act. According to this Rule, in case of an arbitration suit lodged against the compensation determined by the Deputy Commissioner an increase of only an additional 10 % of the compensation can be awarded by the Arbitrators. Similarly, the Arbitration Appellate Tribunal should limit its award to within this additional 10 %.

Source; Acquisition and Requisition of Immovable Property Ordinance 1982,
Land Reform Ordinance, 1984
Banglapedia "National Encyclopedia of Bangladesh", February 2006, Asiatic Society of Bangladesh

5.3.1 Comparison between JICA Policy and Bangladesh's Law

Comparison between JICA and Bangladeshi laws

No.	JICA Guidelines	Laws of Bangladesh	Gap between JICA Guidelines Laws of Bangladesh	Adopted measure in ARAP
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	No formal laws, act or ordinance but common practice at the time of project formulation	There is practice but not legally bound	Income restoration grant and Income Generating Activities(IGA) Livelihood Training
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	No formal laws, act or ordinance but common practice at the time of project formulation; compensation by DC as Cash compensation under law(CCL);50% premium on calculated amount	It is insufficient in terms of actual market price as replacement value	Additional amount on DC's payment which is calculated on Land market survey(LMS) decided by property valuation advisory committee(PVAC)
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	No legal provision	Insufficient compensation, support and practice to restore pre project living standard and production level	1.Additional grant on DC's payment as LMS 2. Stamp duty refund by body GTCL 3. IGA Livelihood Training etc
4.	Compensation must be based on the full	No legal provision	Compensation is below the replacement cost	Additional grant on DC's payment as LMS decided by

No.	JICA Guidelines	Laws of Bangladesh	Gap between JICA Guidelines Laws of Bangladesh	Adopted measure in ARAP
	replacement cost as much as possible. (JICA GL)			PVAC
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	No legal provision	Normally displaced before getting compensation and support	1.Provision at least 50% PAPs are paid 2.Transfer grant(TG), and construction grant(CG) are paid prior to displacement
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	Not such legal bindings in the law	Though no legal provision but practice in donor funded project	Abbreviated Resettlement Action Plan(ARAP) has provision to disclosure key provisions of resettlement issues to disclose among public
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	No such arrangement in the law, even no scope of RAP	Preparation of RAP is a social reality	ARAP has been prepared on the basis of prior consultations of affected people and their communities
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	No provision of consultations in the law but there is a practice of consultations in donor project	In fact when consultations held, it is clearly understandable to the affected in their local language	Provision of consultations in their local language in ARAP, before the project formulation, implementation period and post project period, at least 2 years after project completion. Project authority will distribute a brochure highlighting key issues of the project and ARAP to the affected.
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	No provision and guideline in law	Stakeholders normally remain in dark regarding project formulation, implementation and monitoring issues	PAPs are consulted about the ARAP issues during Socio Economic survey(SES) and ARAP has clearly outlined PAP's participation through GRC and PVAC
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	There is a scope of arbitration regarding payment related issues for titled owner in case of under Acquisition and Requisition of Immovable Property Ordinance(ARIPO)-1982	But this is not easy for common people and doesn't ensure compensation at the rate of full replacement cost, but for non titled owners do not get any compensation and not get income restoration support	Through PVAC and GRC both titled and non titled owner can able grievances except any issue in the court
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	No provisions of early identification of affected persons, there is act incase of Jamuna Bridge Project (land acquisition)(Compensation Refusal Laws)-1994(Act No-14); for refusal of compensation of fake structure.	Cut of date off date is treated,Section-3 notice and SES which is later as a practice	Provision of Joint Verification Inventory Team(JVIT) and video filming for structure and tree loss and Socio economic survey for overall loss assets, structure and identification of PAPs

No.	JICA Guidelines	Laws of Bangladesh	Gap between JICA Guidelines Laws of Bangladesh	Adopted measure in ARAP
12.	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	No compensation for non titled owner and squatter in the law	Vulnerable and squatter are deprived	Non titled owner and squatter have right to get compensation TG, CG, structure value and IGA support from NGO
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	No support in the law	Lack of legal support, but in donor supported project there is example of Resettlement Site(RS) specially for vulnerable homestead loser	Support of land I purchase if PAPs purchase land e.g. Stamp duty, money refund up to replacement value
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	No support in the law	Lack Livelihood restoration support	Three months Grant of livelihood support
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	No guideline in the line	No distinction or priority in Bangladesh's law regarding vulnerability	Special priority in ARAP, income generating activities(IGA), microcredit etc; No indigenous people in the project area
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	No such guideline in the law	Bangladesh law is not clear	Although identified land losers are 400 households (about 2000), the resettlement household for resettlement is only 25,(122 persons) ,that is less than 200.As such ARAP is prepared. Details are in the concerned section of socio economic analysis.

Chapter-6

Institutional Arrangement

6.1 Institutional Arrangement/ Institutional and Implementation Framework (Institutional Responsibility and Grievance Redress Mechanism)

6.1.1 Organizational Responsibilities

For smooth implementation of a project, institutional arrangement and framework is very important. Institutional responsibilities are the building block for commencement of resettlement and rehabilitation works. The implementation of ARAP hinges on institutional set –up with a pool of required manpower and clearly delineated specific responsibilities, to be discharged jointly and severally in order to attain the goals of ARAP.

However, implementation of ARAP in different phases underlines the requirement of integrating the roles of the proposed manpower including responsibilities assigned on the organizations involved in carrying out the resettlement work. GTCL, being the responsible executing agency of the project, would play leading role in the process of implementation and subsequent livelihood restoration monitoring of ARAP. The framework of implementation clearly underlines that GTCL would assign and deploy the staffs to monitor, supervise and guide the implementation of ARAP. The organizational framework also underpins the pivotal role of GTCL drawing upon the action plan and defining the roles and responsibilities of the manpower assigned for carrying out ARAP.

This chapter is intended to depict the organizational set up and responsibilities.

6.1.2 Organizational Framework

The RU-GTCL is responsible for the resettlement of the people affected by the project. For efficient implementation and management of the resettlement activities, a Resettlement Unit (RU) headed by Manager (Resettlement) is to be established. The RU-GTCL will be responsible for the implementation, management and monitoring of the ARAP for the Dhanua Elenga Sector Gas Transmission (DESGT) part of the project. The Project Coordination Unit (PCU) shall have to be set up in GTCL for monitoring implementation of the Gas Transmission Component. This will provide overall coordination in respect of land acquisition and with regard to resettlement activities for all subcomponents.

Most of the cross-sections of the route of the pipeline traverse through across the same route as laid out in EIA and Resettlement Plan (RP) documents prepared in 2005. Present project is rerouting or realignment of the originally planned and existing ROW of 2005. The resettlement plan draws upon the clear assessment of losses and ascertainment of the requirements for livelihood restoration.

From the practical point of view and in the light of complexities involved with such an implementation, it wouldn't be feasible for the RU-GTCL to recruit, deploy and carry out the implementation of ARAP for a brief period. Keeping this perspective in view and the much needed framework for smooth implementation, the proposed ARAP emphasizes engagement of an experienced NGO.

GTCL engaged experienced NGO for such type of work in the past. GTCL will engage similar NGO only for carrying out the work but a safeguard and Resettlement Specialist would also be engaged by GTCL for supervision and monitoring of the works of contracted NGO in close cooperation and co-ordination with the Deputy Project Director (RU-GTCL) and overseeing the policy related issues. NGO would be solely responsible for implementation of ARAP. The Resettlement Unit (RU-GTCL) will monitor the activities and NGO would jointly ensure the payment of the affected PAPs. It is proposed that the affected persons would be resettled at the rate of full replacement/relocation cost including house shifting cost. In addition, RU-GTCL will seek cooperation and participation of other government agencies such as District Administration, Forest Department, Agriculture Department as well as Lending Institutions in the implementation of the resettlement program.

Deputy Project Director RU-GTCL shall make arrangement for its entire staff of resettlement unit so that proper orientation is provided to them regarding resettlement activities. This would help the smooth progress of the project implementation.

For safeguarding the women's interest, JICA resettlement policy of Guidelines for Environmental and Social Considerations has strong appeal of gender issues. So, in order to mitigate the gender issues, GTCL will make provision in recruiting female staff both for RU-GTCL and NGO. Therefore RU-GTCL should be dealing with this issue to ensure better resettlement of woman stakeholders.

The RU-GTCL is responsible for:

- Overall implementation of the Resettlement Plan within the policy guidelines of GOB including those of JICA.
- Timely release of funds to the District Administration and to the resettlement unit as necessary to implement the resettlement program according to the approved implementation schedule.
- Delegating appropriate responsibility and power to the Deputy Project Director (RU-GTCL) as required for smooth implementation and subsequent livelihood restoration and monitoring of ARAP implementation.

Figure-6.1.2.1: Institutional Set-up Diagram of the Resettlement Unit

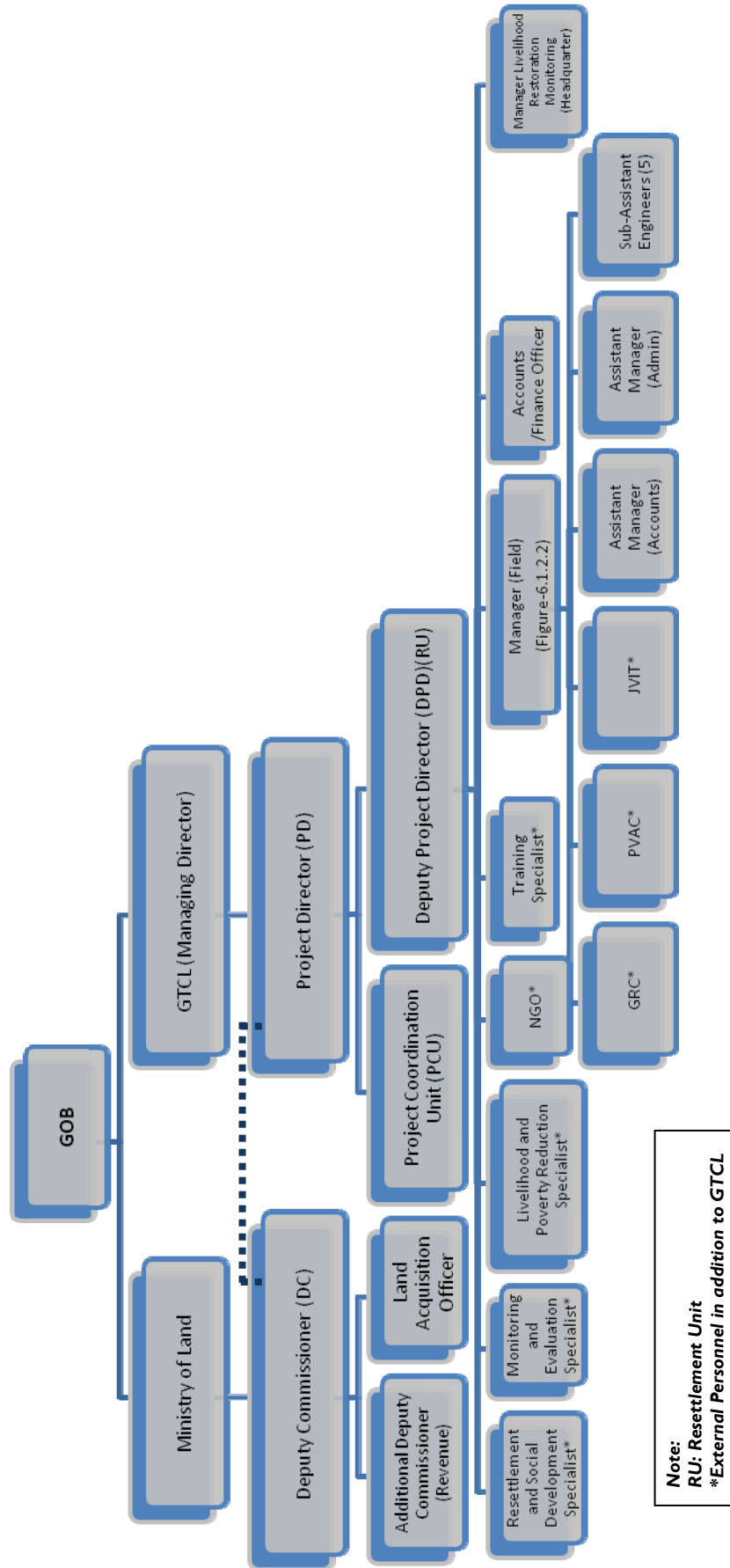
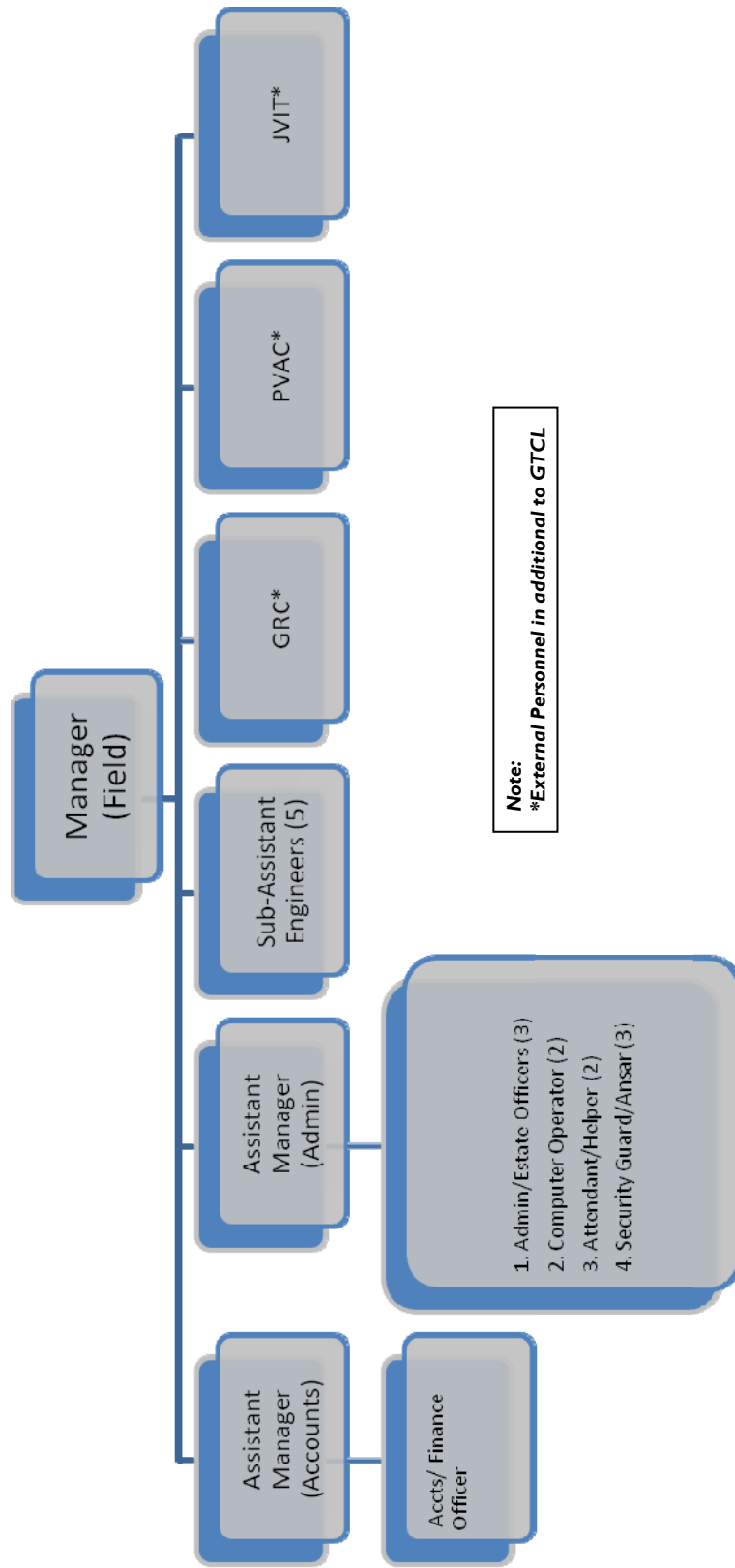


Figure-6.1.2.2: Set-up Diagram of the Manager (Field)



6.1.3 Resettlement Unit (RU-GTCL)

6.1.3.1 Tasks

The main tasks of the Resettlement Unit (RU-GTCL) are:

- Overall planning, implementation and monitoring of the resettlement program.
- Design and set up of necessary computer facilities.
- Ensure that all PAPs are identified and provided with their respective entitlement according to the resettlement policy.
- Ensure timely acquisition of lands by the district administration, and payment of compensation prior to construction.
- Form JVIT and make those operational.
- Form PVAC and make those operational
- Monitor the effectiveness of entitlement packages and propose modification, when necessary.
- Prepare Term of Reference for Contractor/other agencies that are to execute specified components of resettlement program, gender issues etc.
- Select and appoint contractors/agencies include gender, resettlement issues in the contract for compliance and monitor their progress.
- Prepare monthly and quarterly progress report. for Project Director (PD)
- Study and monitor unforeseen adverse impacts during and after construction works.
- Liaise with other governmental and non-governmental agencies in the country on matters of mutual interest related to resettlement.

6.1.3.2 Staff

Organogram of the Manager (Field) is shown at Figure-6.1.2.2. During the period of resettlement implementation, most of the staff will be deployed in the field.

One Manager will be based in the field for the full duration of the resettlement works. Liaison between the field and Head Quarters i.e. Dhaka will be through bi-weekly visit of the Manager of the field office.

Resettlement field workers will be recruited by the NGO from the project area to assist in village level implementation of ARAP.

6.1.4 Logistics

NGO will establish three field offices at Dhanua, Sakhipur and Elenga and RU will establish a field office for supervision and support to the NGO, and will make it operational. The field staff will be provided with necessary vehicles and other transport facilities. The RU will set up the field office.

6.1.5 Recruitment

Recruitment, Livelihood Training and deployment of RU staff will be materialized as per implementation schedule with specific job description. And it would be done by internal arrangement of the GTCL.

6.1.6 Job Description

➤ **Function of Deputy Project Director**

Deputy Project Director (RU-GTCL) will be the head of the Resettlement Unit and he/she will work under the overall guidance and supervision of the PD. The Deputy Project Director will be directly responsible for executing all tasks assigned to the Resettlement Unit and any other tasks assigned to him by the PD from time to time.

Deputy Project Director, as the head of the Resettlement Unit will:

- Prepare job descriptions for Managers, delegate tasks, responsibilities and powers to them, and supervise their work.
- Plan, organize and manage the implementation of ARAP in consultation with other participating agencies and in accordance with the time schedule.
- Identify and bring to the notice of the PD any policy and the administrative or financial actions that are necessary at the governmental level for smooth implementation of ARAP.
- Submit comprehensive periodic progress reports to PD and other concerned agencies.
 - (a) Appointing and guidance to any officer to liaise with DC office.
 - (b) Manage documentation prior and post payments to construction.

Project Manger will also exercise the power in establishment matters including the following:

Project Manger will arrange appointment of project staff with prior sanction of the posts. In cases of recruitment, promotion, transfer and disciplinary action against the staff, normal rules of the Government/GTCL will be followed.

There will be administrative control over all officers and staff of the resettlement unit including sanction of leave.

➤ **Resettlement and Social Development Specialist**

Resettlement and Social Development Specialist will be recruited for one year period from January, 2015 and if needed time will be extended and will be stationed in RU. He will be responsible to Deputy Project Director (RU-GTCL). Overall responsibility of resettlement specialist includes to,

- Ensure proper implementation of ARAP.
- Guidance for DPD to develop TOR for NGO for gender and resettlement issues in contract.
- Visit field and support PAPs in getting compensation and grants from concerned office and authority (DC offices).
- Identify any unseen resettlement issues during implementation.
- Monitor NGO activities in implementing ARAP.
- Support in preparation of data base of PAPs
- Support Vulnerable, handicapped, women headed in income restoration and getting compensation.
- Submit monthly report to DPD (RU-GTCL) highlighting progress and problems, solution of ARAP implementation

➤ **Monitoring and Evaluation Expert**

Monitoring and Evaluation Expert will be recruited for one year period from July 2014 and if needed time will be extended and will be stationed in RU-GTCL. He will be responsible to Deputy

Project Director (DPD) for all monitoring and resettlement related issues. Overall responsibility of Monitoring and Evaluation Experts includes to:

- Reporting implementation of all resettlement related issues.
- Guidance DPD Documentation of information and develop computerized management information system (CMIS).
- Preparation of Entitlement Person (EP) file regarding compensation and grants from concerned office and authority (DC office, NGO etc)
- Evaluation of existing format for monitoring
- Design new format for Monitoring for RU and NGO activities in implementing ARAP

➤ **Livelihood Restoration and Poverty Reduction Specialist**

Livelihood restoration and Poverty Reduction Specialist will be recruited for one year period and if needed time will be extended and will be stationed in RU. He will be responsible to Deputy Project Director (DPD) for all poverty reduction issues for income restoration includes to,

- Identify Income generating (IGA) Livelihood Training for PAPs
- Suggest DPD for income restoration issues of PAPs
- Support Livelihood Training Specialist for Income generating Livelihood Training modules
- Support Community to Poverty reduction, entrepreneurship development of the project for particular resettled person
- Support NGO regarding income restoration for PAPs
- Liaise the local government representative and concerned government office in poverty reduction
- Arrange workshop, meeting with the community of resettled households

➤ **Livelihood Training Specialist**

Livelihood Training Specialist will be recruited for one year period from July 2014 and if needed time will be extended and will be stationed in RU-GTCL. He will be responsible to Project Director Deputy Project Director (DPD). Responsibility of Livelihood Training Specialist Includes:

- Liaise with Poverty Reduction and Income Restoration Specialist/ Resettlement and Social Development Specialist/Livelihood Manager for Livelihood Training issues
- Develop Livelihood Training Module
- Liaise with concerned government and non government organization
- Arrange Livelihood Training with support of contracted NGO
- Supervise and Support Contracted NGO for arranging Livelihood Training
- Prepare Budget for Livelihood Training
- Ensure quality of Livelihood Training

➤ **Functions of Manager**

The Manager will be the field-level implementing official of the Resettlement Unit and will maintain direct contact with NGO. The Manager will be provided with necessary supporting staff including accounts officer and logistic and be stationed at field and will be responsible for the overall implementation of all field level operation related to resettlement. This would include:

- a) Ensure timely payment of entitlements to PAPs.
- b) Develop a system of verification of all transactions.
- c) Keep close contact with PAPs, inform them about entitlement and resettlement program, verify claims and grievances and accordingly take necessary actions.

- d) Ensure that all legal and administrative formalities necessary for giving entitlement to PAPs are completed.
- e) Submit regular progress report.

6.2 ARAP implementation Committees

In case of implementation of ARAP there is provision of three working committees. These are Joint verification Inventory Team (JVIT) for making inventory of asset loss, Property Valuation Advisory Team (PVAC) for fixing land price for additional grant and for grievance solution Grievance Redress Committee (GRC). The details are given below.

6.2.1 Joint Verification Inventory Team (JVIT)

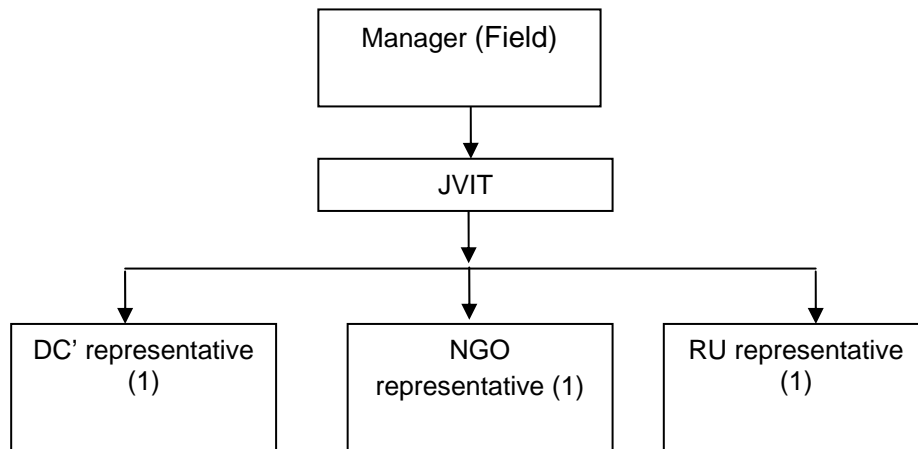


Figure: 6.2.1.1 JVIT

Joint Verification Inventory Team (JVIT) is a team formed for identification of structure and preparation of inventory of assets and will be comprised one from Land Acquisition Section of DC, one from GTCL and one from NGO. JVIT may arrange video filming to check fake structure.

6.2.2 Property Valuation Advisory Committee

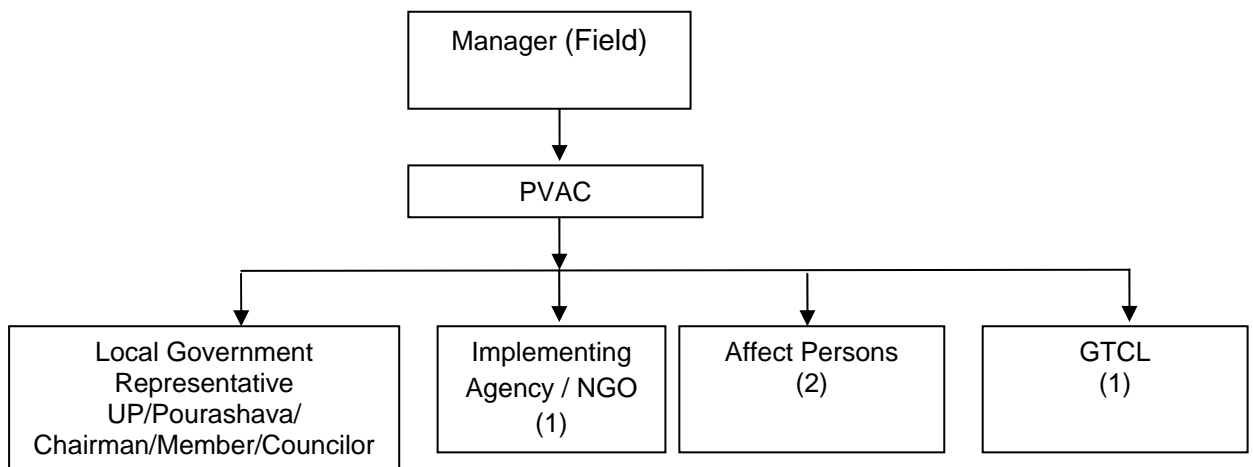


Figure: 6.2.2.1 PVAC

Property Valuation Advisory Committee will play a vital role for additional payment after payment of DC for titled and non titled PAPs and will be formed by one public representative, one from GTCL, one from NGO and two from affected person from concerned union. The committee

comprises of five members. Here, DC will have no representatives. It is a committee other than DC's Land Acquisition officer (LAO) to cover compensation up to replacement cost.

6.2.3 Grievance Redress Committee

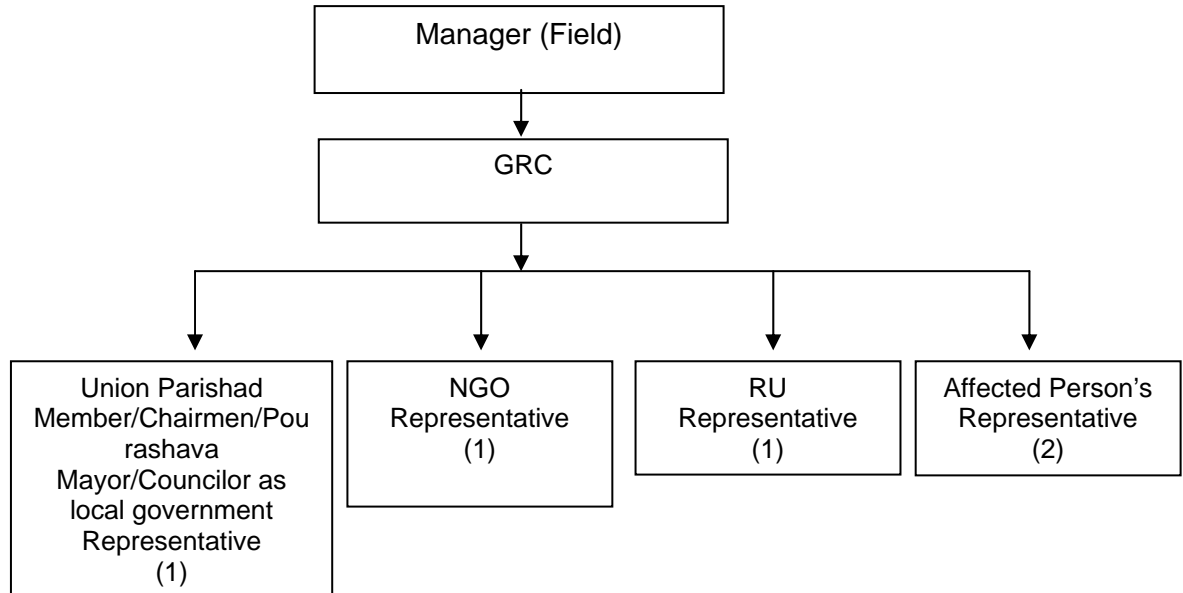


Figure: 6.2.3.1 GRC Organogram

A five member grievance redress committee will be formed in each Union/Pourashava and will work for solving grievances raised by the PAPS. Concerned Manager of the NGO will be from NGO and a public representative i.e. chairman/member/ councilor of the concerned Union Parishad/ Pourashava of the local government public representative and 2 representatives from affected persons in the concerned Union as the affected person's representative headed by a officer of RU of GTCL equivalent to Manager. The committee will receive the application from the affected stakeholders about their grievances and they will solve the grievances every month. Other than disputes relating to ownership rights under the court of law, the GRC will review grievances involving all resettlement benefits, relocation, and other assistance. Grievances will be redressed within 2-4 weeks from the date of lodging the complaints. The PAPs can appeal the decision of the GRC in the appropriate court of law or to DC, depending on the nature of the grievance. All documents of grievances and judgment will be registered and filed both GRC member of NGO and project office of GTCL in the field and aggrieved PAP will get a copy by judgment within 30 days of lodging complain. It is important to note that the GRC will follow up directly with DC office for expediting resolution of any outstanding issues.

6.3. Livelihood Restoration Program

6.3.1 Vocational Livelihood Training Target Groups

The PAPs in particular belongs to housing structure for resettlement, who do not have definite means of livelihood are eligible for vocational Livelihood Training. However, those individuals and households who are landless and those who were earlier dependent on wage labor or tenant farming/share cropping, but may not be able to continue with the same activity after relocation. Special focus group would be women, educated youths and traditional artisans. The selection criteria for Livelihood Training as target groups are as follows:

- 25 HH for resettlement , out of whom, the ones who are interested in income generating livelihood training
- Women headed HH / handicap/elderly PAPs or their dependents
- PAPs whose family income is below Tk.10, 000 per month
- PAPs whose 50% or more land has been acquisitioned will be brought under livelihood training for themselves and their dependents.
- PAPs whose primary occupations are farming
- Stakeholders (youth/women or others) from host areas where PAPs are resettled as incentive for cordial acceptance of the resettled families
- Any persons identified in future as per guidelines from resettlement viewpoint
- 4 Wage labors in the Poultry Farm

6.3.2 Broad Livelihood Training Modules

Skills and trades are expected to provide full time employment of the PAPs after the Livelihood Training:

These are new skills that would require relatively long period of Livelihood Training (2-6 months) and need to be carried out at an existing or specially created facility. Some suitable trades are presented below; the most suitable skills are identified as suitable for the region. Concerned Livelihood specialist will finalize which Livelihood Training will be fruitful. Among these, Fish culture, and Poultry farming have large demand in the area. On the other hand as new trade palm oil culture is a future prospect and there is a gap of technical support needed in the farm to extract oil. Already In the area Sakhipur a large number of Palm tree farms have been developed. As an industrial belt industrial sewing operator have also have great demand in the area. Some prospective trade has been mentioned for Livelihood Training below. These are,

- Motor/automobile mechanics(specially rural vehicle 'Nasimon', tempo, CNG, battery driven Auto rickshaw, Motorcycle etc;
- Driving;
- Rickshaw assembling and repairing;
- Secretarial skills/word processing and computer skills;
- Plumbing, electrician, metal works;
- Manufacture of rural sanitary equipments.
- Technician for Mobile repairing
- Biogas Plant technician
- Solar technician
- Technician for Improved Cook Stoves(ICS)
- Poultry Rearing
- Beef fattening
- Tailoring and Sewing Operating
- Mushroom Cultivation
- Pisciculture and Fish breeding technician
- Pearl Culture from Oyster (Technology dissemination from Fishery research Institute of Mymensingh)
- Fish breeding
- Fish Cultivation in Cage in Open water
- Shrimp Cultivation (for sweet water species)
- Food processing
- Furniture technician/Carpentry

- Fish processing
- Food Processing
- Palm tree Cultivation/Palm Oil Processing /Extraction Technician
- Strawberry Cultivation
- Vegetable cultivation/crop diversification;
- Low cost house construction;
- Animal husbandry/dairy;
- Hand looms.
- Electronics technician(Toy making etc)
- Marketing Trade
- Primary Health care
- Mason work/ Construction work

Some of these skills like metal works and manufacture of sanitary equipments can lead to establishment of small-scale enterprises. In such cases the trainees would need additional Livelihood Training to start small enterprise either individually or collectively.

Livelihood Training in these skills will be mainly organized at existing Livelihood Training facilities such as industrial Livelihood Training institutes, existing workshops or through informal apprenticeship with master mechanics. The Livelihood Training will be organized by NGO but it will be accomplished under guidance of Livelihood and Poverty Reduction Specialist and Livelihood Training Specialist from RU

The target group would be young men and women with required basic level of education. The trainees will be from affected household and host area (where PAPs resettled) communities. The PAPs and his/her dependent will be eligible for Livelihood Training

Improvement of existing skills:

There are some technical labors, whose incomes are constrained due to low level of skill, engaged in the following activities

A comprehensive Livelihood Training program will be designed and implemented for upgrading the skill of those labors.

The primary target group would be those who are currently engaged in similar kind of activity. The Livelihood Training would be of short duration (3 to 15 days) and in most cases would be conducted at a central village. Specific Livelihood Training inputs required for each group are identified by NGOs. The NGOs also assess and provide extension services at required level.

Supplementary income generating activities:

These are specifically aimed to provide additional income. The following areas are considered as suitable; these are the outline of the probable Livelihood Trainings. The Livelihood Training demand will be confined between one and two as per market demand of the area. At the implementation period the authority will decide in this connection. After Livelihood Training the RU will provide some seed money for small business for income restoration to the trained PAPs. The authority will give market oriented ideas and awareness and will create access with the local bank for getting better banking facilities (credit etc). The Livelihood Training of large number of PAPs may not be what is required but a focus on marginal, vulnerable and female-headed

households and resettled households. The supplementary Livelihood Training issues are as follows:

- Plant nurseries;
- Tailoring and handicrafts;
- Bee keeping;
- Homestead gardening.

The primary target group would be women. They would be trained through brief Livelihood Training camps (3 to 7 days) organized at the village level. Credit and equipments would be arranged. The NGO & RU would also arrange tie-ups with other agencies for marketing of the products. For example, Forest Department & RU under the forestation program can buy saplings from these village nurseries. Livelihood Training in handicrafts products would be conditional to effective marketing tie-ups with concerned agencies.

Skills aimed at improving general quality of life:

These skills are not expected to bring any direct economic benefits but can have significant impact on the life of PAPs, particularly women. This is an awareness program only. The areas of Training would be:

- Community health-hygiene, MCH, family welfare;
- Food and Nutrition
- Disease awareness and immunization(Diabetics, Dysentery, Hepatitis ,AIDS, Pneumonia, Malnutrition, TB etc)
- Gender Discrimination
- Eve Teasing(Teasing girls and women)
- Drug addiction
- Poverty reduction and mobilization of social fund

This program will be exclusively for women and will be conducted at villages. The initial Training would be of about three-day duration and will be followed by one-day refresher sessions after one to three months. Some of the trained women will be employed later as trainers.

6.3.3 Overall Management of the Livelihood Training Program

The entire vocational Livelihood Training package will be contracted out to NGO who have experience and capacity to organize and to manage large-scale vocational Livelihood Training programs. In case more than one NGO is contracted their areas of operation (geographically or activity-wise) will be clearly delineated. This NGO in turn may sub contract some of the Livelihood Training programs to other smaller specialized NGO or appropriate Livelihood Training institutions.

- The contracted NGO is responsible for designing specific Livelihood Training modules, selecting the eligible trainees, and organizing and managing the Livelihood Training program according to a time schedule and budget agreed beforehand with the RU-GTCL. They are also responsible to liaise with credit institutions, arranging loans and developing tie-ups for supply of inputs and marketing wherever necessary. They would also follow up and monitor the post Livelihood Training performance of the trained persons at least for one year. The full operational plan of vocational Livelihood Training and the implementation schedule will be prepared by NGO.

6.4 About Budget Provision

Cost Estimate is exclusively related to for DC's land payment. But in ARAP budget will be a tentative estimate for land price and resettlement activities. The GTCL will coordinate and supervise the resettlement program through its Resettlement Unit (RU-GTCL). Present ARAP has a provision for NGO for resettlement work. Information campaign or dissemination will be done by Resettlement Assistants through an NGO and there will be a lump sum budget for NGO arrangement. The proposed budget is given in the relevant section Chapter-10. Administrative cost is purely involved with the GTCL. Salary and administrative cost of its permanent staff and will be borne by the permanent budget provision of the GTCL. Only cost of NGO involvement and cost for logistic support, land and resettlement budget are included here.

6.5 Time Schedule for Implementation

The ARAP provides a series of resettlement activities. Of these, a number of activities have to be executed simultaneously for smooth implementation of the ARAP. As such, a time schedule for starting and finishing of each of the activities has been planned. Figure-6.5.1 shows the schedule of different resettlement activities with their starting and finishing dates. Tentative day for resettlement work will be started from July 2014 and will be finished within June, 2015. NGO activities will be for 3 years period and it will be recruited on July, 2014. On the other hand, livelihood monitoring for more 2 years period minimum as per JICA guidelines after last household is resettled. But here livelihood monitoring is targeted from 2015 to march 2017. But due to unavoidable causes or DC's CCL payment work may be delayed. But it is expected that within the period ARAP will be easily completed.

Payment may need more time due to legal procedure. It may be mentioned here that the itemized activities of the Resettlement Plan (ARAP) will be scheduled to meet the legal time frame and timely implementation of the Project work. Land acquisition is an essential part of project implementation. A project having sufficient lead-time between fixing project alignment and actual start of construction does not face any difficulty in acquiring land. There exists a well-defined procedure of land acquisition as well as resettlement in Bangladesh. However, there are few pre-requisites to be completed before going into the process of land acquisition. These Pre-requisites are:

- Approval of project document like TAPP/PCP/PP/DPP
- Approval of project plan
- Approval of land plan and land schedule
- Administrative approval of land requirement from the ministry, and
- Budget provision for land acquisition.

6.5.1 The timeframe of the civil work

For reference, a tentative time schedule of construction of the gas pipeline may be mentioned here. Compensations are provided and disbursed to affected persons prior to possession of land and assets on the basis of resettlement cost in a manner satisfactory to JICA. So GTCL will try to ensure DC's Payment (CCL+50% premium) plus additional (Replacement Cost).

Detail Engineering Design will be started from July'2014 to next 28month and Construction Period will be started from Nov'2016 to next 20 month.

It is expected that most of the CCL +50% Premium will have to be paid to PAPs before the project could take possession of the assets.

6.6 Step-wise land acquisition as well as resettlement process

When the aforementioned pre-requisites are fulfilled, the step-wise activities of land acquisition process to be followed are presented below:

- Submission of land acquisition proposal by the RU-GTCL to the Deputy Commissioner.
- Holding District Land Acquisition meeting and providing land allocation.
- Serving Notice under Section 3 to the affected persons.
- Joint verification.
- Final approval of land to be acquired by the Deputy Commissioner (for area of land 50 bighas or less) or the Land Ministry (for area of land over 50 bighas) on the basis of land area requirement.
- Serving notice under Section 6 to settle any dispute
- Estimation of jointly verified property for compensation and informing requiring body.
- Acceptance of estimate of cost compensation and placement of fund to the Deputy Commissioner by the requiring body.
- Serving Notice 7 by the Deputy Commissioner to the affected land owners for disbursement of compensation.
- Disbursement of compensation as per estimate to the affected persons.
- Giving possession of land to the requiring body.
- Cash compensation under law (CCL) Payment by DC.

If the foregoing steps are followed on time, DC will complete the payment within the year Oct, 2015 and will make major payments within the middle of 2016-. Compensation are provided and disbursed to affected persons prior to possession of land and assets on the basis of replacement cost in a manner satisfactory to JICA. This means that CCL+50% premium plus additional grant (replacement cost) will have to be paid to PAPs before the project could take possession of the assets. The GTCL and NGO will give proper support to the affected persons and will help the PAPs in collecting legal documents for CCL.

Land acquisition is a continuous process. Within the year 2015- major acquisition activities will be carried out. GTCL will seriously work then if fund is available and continuous liaison with the DC office is maintained, the acquisition will be completed at the earliest. RU can support 25 household in getting CCL from DC and then ensuring additional payment from RU can expedite the resettlement activities.

6.7 Valuation of structures and trees

Payment of compensation for structure is calculated according to DC's joint verification record. Normally Public Works Department (PWD) calculates the price of the structure and on the basis of which the DC makes payment. Extra payment is usually decided by Property Valuation Advisory Team (PVAC), a joint committee formed by GTCL, DC and NGO representative.

Similarly payment for trees is also calculated on the basis of DC's joint verification document (a joint record by GTCL, NGO and DC's representative). Then it is sent to concerned forest office of the government. They decide the price of trees. DC pays the amount. PVAC Committee will decide about additional price of trees from resettlement viewpoint.

6.8 ARAP Implementation

It has been pointed out earlier that the implementation of the proposed project will require a minimum quantum of acquisition land for the construction of gas pipeline. As a result, timely payment of compensation relating to land acquisition will be needed. As this is a strip acquisition, compensation and impacts will be relatively low in comparison with other projects involving major land acquisition.

RU will seriously work for completion of work within the allocated time, so land acquisition time could be shorter if fund is available and continuous liaison with the DC office is maintained.

NGO hiring process is set at three months consistent with other projects. The process will be through competitive bidding system; selection of NGO, analyzing their proposal both technical and financial and contract arrangement needs sufficient time.

Formally information Campaign will commence after July, 2014 and will continue throughout implementation period. Also information disclosure will be carried out as soon as the ARAP is approved and the at least 60 days before the commencement of civil work. In fact informal information campaign has already been started during conducting socio economic survey. During survey time probable affected person's comments suggestion has been taken through consultation meeting, focus group meeting with different stakeholders and there will be a leaflet for the affected person. The suggestions and comments have been incorporated in this ARAP. After finalization of ARAP resettlement brochure with entitlements will be distributed to the people and contents will be disseminated through media and website. PAPs identification needs more time, as without DC's payment no one legally will be declared as affected person or entitled

person. For receiving payments from DC office, one should have a lot of legal documents chronologically, but in Bangladesh it is difficult to show all the chronological documents, as most have no valid chronological documents. In the rural areas people are poor and illiterate. They have little knowledge about land related legal matters. In fact most land documents are not up-to-date in the rural areas. So legal PAPs identification, by the DC office will take time. In this connection CCL payment needs more time. So, acquisition and PAPs identifications will not be same. After DC's payment of reasonable number of affected person's CCL, NGO can start identification of APs for further resettlement Plan (RP) related payment and activities. In this case DC's identification and NGO identification of PAPs have some difference in resettlement activities. One will have to understand the basic differences of DC's identification and NGO identification of PAPs. Basically DC is not the party of resettlement. But for helping and to expedite the resettlement work, GTCL will appoint the NGO early and even before DC starts payment of compensation and more time is allocated for NGO as implementing agency.

GTCL will make a EP file for each affected person for resettlement and it will be treated as ID cards and entitlement documents, earlier activities will give better result. As discussed above, due to legal cause DC's CCL payment takes time. Without DC's identification of PAPs, making EP file is difficult. If DC can ensure earlier payment, EP file and subsequent activities will be started earlier. Regarding payment of compensation, hand-to-hand payment is not possible. In present system after confirming legal documents of affected persons, a crossed-Cheque will be issued in favor of APs. Cash money may be lost, snatched or will be consumed by the poor APs as proved in earlier project. So, account payee Cheque for compensation is a safety measure for the APs. Same situation is also applicable in case of Livelihood Training and micro-credit for the PAPs who are not directly dependents on DC's payment for identification. All the resettlement activities will be started earlier. Finally it can be suggested; if possible; all resettlement activities for income restoration will be started from July 2014 and should be completed before the construction of civil work.

ARAP implementation is very important in case of resettlement. Without proper ARAP implementation work of the project will not be completed smoothly. That is why, a time bound ARAP implementation is needed. As a small proportion of people are affected here but whole construction work will need 3years, So, three years resettlement work is sufficient for all sorts work including livelihood restoration related Livelihood Training program. But RU will continue at least 2years post monitoring resettlement work as per JICA guideline. An experienced Non Government Organization will do the resettlement work for three years period. But post project monitoring will be conducted by concerned RU. The starting of NGO activity will be from the serving of Section-3 notice of the DC office. Earlier appointment of NGO will not be to speed up the program without support from DC's office. DC office work is related with so many bureaucratic problems. In previous projects, NGO and consultant identified these sorts of problems. For speedy work, CCL+50% should be expedited by the support of GTCL and NGO. GTCL will safeguard the interest of the affected persons before deploying NGO and at the same time will do the information campaign. On the other hand at the implementation period, GTCL and concerned NGO will verify the necessity of the income generating Livelihood Training. The cost will be from the project fund. It is to be confirmed that no affected persons will be shifted at least without paying transfer grant especially for business and structure loser and crop loser without providing income restoration grant. In addition vulnerable PAPs interest will be handled very carefully both from RU and NGO, as their socio economic condition will be targeted to be improved. They are the female, elderly, squatter and the people who are in extreme poverty. During actual implementation or the resettlement, particular attention will be given to female PAPs. A survey will be carried out during the implementation of the ARAP and gender disaggregated data shall be collected.

It is remembered here, as the actual implementation may not always be on schedule, the authority will confirm that the compensation of the acquired properties will be calculated at the time of dispossession and are not based on an assessment which might have taken place one or two year earlier and does not account for inflation. For actual replacement price the base year price may be inflated minimum at 10% per year as other resettlement project. So compensation rate will be established according to the law at time of dispossession.

The requiring body for the project is the Gas Transmission Company Limited (GTCL). RU would be responsible for processing, coordinating, and supervising all such projects. RU will have overall coordination, planning, implementation, management and monitoring and financing responsibilities for the ARAP. The GTCL will ensure the participation of key institutions including the local government in ARAP implementation. Further, experienced NGO will be hired for ARAP implementation with clearly defined tasks, including Livelihood Training and community-based social development programs as appropriate.

Chapter-7

Policy Matrix

7.0 Land Acquisition and Compensation Policy Matrix

The Resettlement Matrix presented below identified income or livelihood loss and the compensation payment mechanism. Concerned Grievance Redress Committee (GRC) and Property Valuation Advisory Committee (PVAC) will solve any future problems and modifications of relevant issues if needed. During SES no water body or squatter were found affected but at the implementation period, there may be any income loss of adjacent water bodies or squatter may be identified. So, in policy matrix, there have been some entitlements regarding this.

Details of entitlement policy matrix have been presented in the section of 7.1 but a brief summary is given here for easy understanding. In case of all sorts of acquisition of land, concerned LA section of DC is responsible for primary payment of compensation. All additional compensation will be paid by RU-GTCL with support of up to replacement cost .PVAC will finalize the additional payment through land market survey. Stamp duty refund for land purchase at 20% will be for replacement value of land will be paid by RU-GTCL. However, at 10% inflated value of replacement value as additional grant will be counted for every year delayed payment on surveyed replacement price. Income restoration assistance will be paid where applicable. Three months income restoration grants at the rate of Tk.500.00 per day for marginal farmer, poor land owner, wage earner, handicapped, elderly PAPs, and women headed household, tenant and share cropper. PAPs opting for purchase of land should identify the homestead land.

Project will explore to check the possibility of staggering the evacuation of PAPs to ease the resettlement process. If homestead loss less than 100 sqm, land-for-land will be prioritized. Though in SES no untitled PAPs identified, during implementation any squatter or non titled entitlement may be identified with genuine cause.

In case of temporary loss of land regardless of use, the maximum amount of cash grant will be the difference between the total DC's Payment and the rent of land or income & profit lost determined by PVAC. Rental Value is to be paid to the affected people.

For Loss of Ponds and fish stock, If pond is on public land and not under lease from Government, PAP is entitled to compensation for 50% of the existing fish stock, and allowed to retain the entire fish stock, Payment of compensation at the replacement/market value on DC's payment.

In case of Loss of houses, Structures used for living and commercial activities, PVAC will find out realistic construction costs of the most common types of houses/structures. The costs determined will be used in cases of disputes/grievances regarding compensation rates for structures. Affected person will take salvageable materials, he will get dismantling and re-construction grant, PVAC will decide extra payment on DC's. Transfer grant (TG) of Tk.15, 000.

House construction grant (HCG) at 1/5 of DC's payment subject to minimum of Tk. 20,000. PAP permitted to retain salvageable building materials.

In case of Untitled PAPs (squatters on public/private lands will get Cash grant equivalent to the replacement market price of a 100 sq. meter land. Transfer grant of Tk. 10,000.

House construction grant (HCG)(TG)t at 1/5th of DC's Payment subject to minimum of Tk. 20.000 PAP permitted to retain salvageable building materials. Cash compensation is for losses of Income due to loss of property.

Loss of usufruct right on mortgaged Leased, and 'Khai-Khalasil', 150% of yearly, income to lessee, for contract period, Cash grant to cover difference between DC's Payment and replacement value.

Loss of standing crops entitlement, DC's Payment Cash grant to cover the difference between DC's Payment and the replacement cost. Minimum two crops and multiple crops in case protracted implementation.

In case of affected trees, DC's Payment , Cash grant to cover the difference between the DC's Payment premium and current market value, PAP to be permitted to cut and take away the trees and fruits and will be given 5 years fruit values for fruit bearing trees.

7.1 Entitlement Policy Matrix

Type of Losses	Definition of PAPs	Entitlement	Implementation Issue	Agency Responsible
1. Loss of agricultural land	Owner(s) of a plot as recorded in title deeds	a. DC's Payment b. Cash grant to cover the difference between DC's payment and cost equivalent to replacement land c. Cash compensation for losses of profits and income due to the loss of property or access d. Stamp duties on purchase of land	a. Replacement value will be determined by the PVAC. The maximum amount of cash grant Will be the difference between the total of DC's payment and the replacement value determined. Payment of compensation at the replacement market value on DC's payment. This will be decided by PVAC (Property Valuation Advisory Committee). (b)Income restoration assistance where applicable. Three months income restoration grant at the rate of Tk.500.00 per day for marginal farmer, tenant and share cropper (c)Stamp duty will be refunded at 20% increase on replacement value of acquired land determined by PVAC.	a. Land Acquisition (LA) section-Deputy Commissioner (DC) b. Cash grants-, jointly NGO& RU-GTCL c. Cash Refund-jointly NGO& RU-GTCL d. jointly NGO& RU-GTCL
2. Loss of commercial land (rural and urban)	Owner(s) of plot as recorded in title deeds	a. DC's Payment b. Cash grant to cover the difference between the DC's payment and the replacement cost of equivalent replacement land c. Cash compensation for losses of profits and income due to the loss of property or access d. Stamp duties on purchase of land	a. Replacement value will be determined by the PVAC. The maximum amount of cash grant will be the difference between the total of DC's payment and the replacement value determined by PVAC. (b)Losses of profits and income due to the loss of property or access (c)Stamp duty will be refunded at 20% increase on replacement value of acquired land determined by PVAC.	a. LA Section, DC b . Cash grants-, jointly NGO& RU-GTCL c. Cash Refund-jointly NGO& RU-GTCL d. jointly NGO& RU-GTCL
3. Loss of homestead land (rural	Owner(s) of homestead plot as recorded in	a. DC's Payment b. Cash grant to cover the difference between the DC's	a. PAPs opting for purchase should identify the homestead land.	a. LA Section, DC b. Cash grants jointly NGO& RU-

Type of Losses	Definition of PAPs	Entitlement	Implementation Issue	Agency Responsible
and urban)	title deeds	Payment and the cost of equivalent replacement land c. Stamp duty refund	b. Project will explore to check the possibility of staggering the evacuation of PAPs to ease the resettlement process. If homestead loss less than 100 sqm, land-for-land will be prioritized. (c) Payment of compensation at the replacement/market value on DC's payment. This will be decided by PVAC. (d) Stamp duty will be refunded at 20% increase on market/replacement price of acquired land.	GTCL c. Refund- jointly NGO& RU-GTCL
4. Loss of homestead (rural and urban)	Households living as squatters on public/private land	a. Cash grant equivalent to the replacement market price of a 100 sq. meter land	a. List of eligible persons will be finalized by (Joint Inventory Verification Team) JVIT. b. PAPs opting for purchase should identify the homestead land. c. RU-GTCL will explore the possibility of staggering the evacuation of PAPs to ease the resettlement process.	a. LA Section- DC b. Cash grants- Project jointly NGO& RU-GTCL c. Refund Project, jointly NGO& RU-GTCL
5. Temporary loss of land regardless of use	Titled and untitled PAPs	a. DC's Payment b. Cash grant to cover the difference between the DC's Payment and the PVAC assessed rental value or income/profit lost c. Cash grant to reflect expenses of vacating land, reoccupying land and damages, in accordance with ARIPO	a. The maximum amount of cash grant will be the difference between the total DC's Payment and the rent of land or income & profit lost determined by PVAC. Rental Value is to be paid to the affected people b. EA will ensure contractors reinstate land and affected common resources to pre-project levels upon project completion. Contractors will also maintain common infrastructure during construction including irrigation and drainage.	a. LA section-DC b. Cash grants- Project jointly NGO& RU-GTCL c. / Contractor
6. Loss of Ponds and fish stock	Legal owner of pond to get compensation for land while usufruct right holder, legal or socially recognized, PAPs to get compensation for fish stock	a. DC's Payment b. Cash grant to cover the difference between DC's Payment and the replacement cost of pond, including cost of land and digging c. Cash compensation for losses of profits and Income due to the loss of property d. Livelihood Training	a. Replacement value will be determined by PVAC b. If pond is on public land and not under lease from Government, PAP is entitled to compensation for 50% of the existing fish stock, and allowed to retain the entire fish stock. Payment of compensation at the replacement/market value on DC's payment. Stamp duty will be refunded at 20% increase on market price of acquired land. Three months income restoration grant at Tk500 per day for wage loser	a. LA section-DC b. Cash grant- Project, jointly NGO& RU-GTCL c. jointly NGO& RU-GTCL
7. Loss of Aquaculture Farm (Gher)	Legal owner of gher to get compensation for land while	a. DC's Payment b. Cash grant to cover the difference between DC's Payment and the replacement	a. Replacement value will be determined by PVAC. Loss of profit will also be considered b. If gher is on public land and not	a. LA Section-DC b. Cash grant- Project- jointly NGO& RU-GTCL

Type of Losses	Definition of PAPs	Entitlement	Implementation Issue	Agency Responsible
	usufruct right holder, legal or socially recognized, PAPs to get compensation for fish stock	cost of gher, including cost of land and digging c. Cash compensation for losses of profits and Income due to the loss of property d. Livelihood Training	under lease from Government, AP is entitled to compensation for 50% of the existing fish stock, and allowed to retain the entire fish stock	c. jointly NGO& RU-GTCL
8. Loss of houses, Structures used for living and commercial activities (rural and urban areas)	Legal owner of structure	a. DC's Payment b. Transfer grant of Tk.15,000 c. House construction grant at 1/5 of DC's payment subject to minimum of Tk. 20,000. PAP permitted to retain salvageable building materials e. Cash compensation for losses of profits and income due to the loss of property	PVAC will find out realistic construction costs of the most common types of houses/structures. The costs determined will be used in cases of disputes/grievances regarding compensation rates for structures. Affected person will take salvageable materials, he will get dismantling and re-construction grant, PVAC will decide extra payment on DC's	a. LA Section-DC b. Cash grants-Project jointly NGO& RU-GTCL c. Refund-Project-jointly NGO& RU-GTCL
9. Loss of houses/ structures used for living and commercial activities (rural and urban areas)	Untitled PAPs (squatters on public/private lands)	a. DC's Payment b. Transfer grant of Tk. 10,000 c. House construction grant at 1/5 th of DC's Payment subject to minimum of Tk. 20,000 d. PAP permitted to retain salvageable building materials e. Cash compensation for losses of Income due to loss of property	PVAC will find out realistic construction costs of the most common types of houses/structures. The costs will be determined and used in cases of disputes/grievances regarding compensation rates for structures. Affected person will take salvageable materials, he will get dismantling and re-construction grant, PVAC will decide extra payment on DC's Cash compensation at replacement value. Here on site relocation may provide in the project sites. In addition PAPs will be permitted to get salvageable building materials	a.LA section- DC b. Cash grants-Project jointly NGO& RU-GTCL c. Refund-Project jointly NGO& RU-GTCL
10. Loss of timber and fruit trees, bamboo and banana groves	Legal owners determined by DC and untitled users of land	a. DC's Payment b. Cash grant to cover the difference between the DC's Payment premium and current market value c. PAP to be permitted to cut and take away the trees and fruits and will be given 5 years fruit values for fruit bearing trees	a. Government will issue executive orders allowing the PAPs to cut and take away the tree and fruits. Income Restoration Grant, the affected person will take Market value paid for the acquired trees, but PAPs will be permitted to get salvageable trees.	a.LA section DC b. Cash grant-project- jointly NGO& jointly NGO& RU-GTCL
11. Loss of Banana farm	Legal owners determined by DC and untitled users of land	a. DC's Payment b. Cash grant to cover the difference between the DC's Payment and current market value at the rate of replacement cost c. PAP to be permitted to and take away the banana plant d. PAP will get replacement cost of banana farm and 5 years profit loss	Government will issue executive orders allowing the APs to take away the banana plant, Payment of compensation for making the Banana farm. Additional payment will be decided by PVAT,	a.LA section DC b. Cash grant-project, RU-GTCL
12. Loss of standing crops	Cultivator (see definition)	a. DC's Payment b. Cash grant to cover the difference between DC's	a. Market value at harvest determined by PVAC b. Verify whether or not crops are	a. LA section-DC b. Cash grant-Project- jointly

Type of Losses	Definition of PAPs	Entitlement	Implementation Issue	Agency Responsible
		Payment and the replacement cost c. Minimum two crops and multiple crops in case protracted implementation	In existence at the time of handover Price of existing crop will be refunded. Three months income restoration grant for farmer and sharecropper	NGO& RU-GTCL
13. Loss of wage income	Affected wage laborer in agriculture or non-agriculture sectors,	a. One time cash grant of Tk 45,000 (Tk 500x90 days) b. Livelihood Training	PAPs to be trained in productive activity, trade or skill. RU will appoint relevant Livelihood Training specialist to develop suitable Livelihood Training and credit modules and provide Livelihood Training. Cost of Livelihood Training facilities and Livelihood Training will be borne by Project. Special scheme will be developed for women PAPs. RU-GTCL will sign an MOU with scheduled bank and local branches of the concerned commercial bank will be Instructed by and to provide loans to trained persons on a priority basis.	a. Cash grant-Project, jointly NGO& RU-GTCL b. Livelihood Training-Project-jointly NGO& RU-GTCL c. Loan-Financial Institutions.
14.a) Loss of business Income from displaced commercial premises (rural and urban) b) To discontinue employment for the persons employed in shops and business due to the project	1. Any businessperson operating on the premises as tenant at the time of notification 2. Owner of the rented out premises	a. DC's Payment b. One time moving assistance of Tk. 10,000 b. 1/4 the of yearly income will be given as income restoration grant and minimum amount will be Tk15,000 per month for three months and will be decided by PVAC c. 3 month's rent to owner of the premise on private land will be decided by PVAC d. Cash grant to cover the difference the Dc's payment the actual income loss e. Livelihood Training	1. Compensation for loss of business income determined by PVAC. 2. 2. Rent of premises determined by PVAC through verification. 3. Potential trainees selected by JVIT 4. Three months income restoration grant and will be given. JVIT will decide the fact for employee of the business	a. DC b. Cash grant-Project jointly NGO& RU-GTCL c. Moving assistance-Project jointly NGO& -GTCL d. Livelihood Training Project - jointly NGO& RU-GTCL
15. Loss of usufruct right on mortgaged. Leased, and Khai-Khalasi land.	1. Persons with legal agreement 2. Persons with verbal agreement	a. DC's Payment b. 150% of yearly income to lessee, for contract period C. Cash grant to cover difference between DC's Payment and replacement value	1. Legal agreement Legal owner and mortgage/leaseholder will be paid by DC. 2. Verbal agreement Legal owner will pay the outstanding liabilities upon receipt of DC's payment. 3. If the legal payment of DC is smaller than replacement value, legal owner will get top up as grant: if i) all liabilities are already paid up, ii) if not, the legal owner will get residual. If liabilities exceed the amount of grant, the landowner will pay. 4. In case of any dispute, GRC will verify and decide.	LA section jointly NGO& DC
16. Disruption of private or common	Titled owner, tenant, untitled user, community	Restoration to original status	1. Prior to disruption verify existing crops or structures to be restored after project completion	Contractor

Type of Losses	Definition of PAPs	Entitlement	Implementation Issue	Agency Responsible
property				
17 Vulnerable PAPs	Female headed, (PAP. and households with less than Tk. 5,000 monthly Income	a. Assistance to mitigate negative Impacts on vulnerable groups b. Three month income restoration grant Tk.45,000 at the rate of Tk15,000 monthly	1. Livelihood and skills Livelihood Training 2. Preference for project related employment 3. Income Restoration Grant	1.Project RU-GTCL
18. Unforeseen loss	Person affected adversely by Project other than the above categories.		Mitigation measures to be proposed by RU-GTCL Project will closely coordinate activities, monitor, and mitigate adverse Impacts.	Mitigation Assistance- Project- jointly NGO& GTCL

Chapter-8

Public Consultation

8.0 Evaluation of the result of Public Consultation with Displaced Person

8.1 Summary of Consultation

Consultations with the key stakeholders were held at the time of field survey. It is a continuous process till the completion of the project. RU and NGO will do that job formally from July 2014 after Set up of RU but informally from sep. 2013 at the time of socio economic survey. During socio economic survey (SES), the affected person and key community persons were interviewed. Among the key community persons are the school teachers, village leaders and local government's member and Chairman were also contacted in group and individually and female headed household were also interviewed through focus group meeting with the help of the villagers. At implementation period the implementation NGO will do the job as a routine work. Some local NGO representatives were interviewed during the survey.

8.2 Focus Group Discussion (FGD) Summary:

- The affected persons should be given scope of employment during construction period
- To ensure reduced tree and structure loss
- To ensure proper compensation at the rate full replacement cost
- Community and religious sites are to be saved, the planned route has saved
- To provide scope of gas consumption facilities to the villagers
- Unemployed youths are to be given scope of Livelihood Training and employment.

8.3 Key Informant Interview (KII) Summary Report

- GTCL should take care about the public safety as well as pipelines at critical locations. In order to remove any fear of explosion the authority should exercise adequate care in construction & maintenance of pipeline.
- Pipeline should be laid & buried properly after welding construction is over.
- Works should be faster lessening the loss of production of crops.
- The gas should be cheap and available to the limited income group at the earliest possible opportunity and consideration of any subsidy/discount at the initial stage would be highly appreciated which will ensure cordial relation with the stakeholders.
- Ensure use of quality material & best workmanship for safe and durable pipeline system and to provide uninterrupted supply to the consumers.
- Prompt placement of fund by the requiring bodies for quick completion of acquisition and requisition.
- The executing agency (GTCL) should follow all rules, regulations and standards in construction, operation and maintenance of the gas system in-terms of public safety and stakeholder's well being.
- Care should be taken for ensuring the least possible damage to Local Government Engineering Department (LGED) built rural roads & structures during construction of pipeline and informing them well ahead in crossing such roads.
- Emergency response plan should be taken to meet any eventual accident thereafter.

- Steps should be taken for the efficient & selective use of natural gas & particularly to encourage Condensed Natural Gas (CNG) for all sorts of land & river transports to save foreign exchange and favoring the environment from use of lead & sulphur prone imported petroleum products and specially brick fields in the region, this is public expectation.

8.4 Focus Group Discussion (FGD) with the affected people

Following FGD meetings were held with the PAPs and summary of the meeting are given below:

No	Date	Place	Contents of Consultation/main comments and answers
1	1.12.2013	Mulaid High School, Dhanua, Sreepur, Gazipur	<ol style="list-style-type: none"> 1. The communities were not earlier communicated about the gas transmission project. 2. After briefing of socio-economic survey team, they agreed to support the project. 3. They agreed to support the successful cooperation of the project 4. They actually not know the extent of environmental damage of the project and have counter proposal to replant the same number of trees to be planted in the project area which are affected. 5. Demand of gas connection for the affected community. It is irony of the common people who suffer most do not get benefit. On the other hand, the area also suffers fuel wood problem both shortage of fuel trees and simultaneously cost concerns. In past the area has no fuel wood problem. But at present times the trees are gradually rapid urbanization and industrialization. 6. They affected people would be more happy if earlier disclosed the acquisition issue to the affected people and more fruitful suggestion would be given. And the loss would be made minimum.
2	3.12.2013	Protimabanki; Sakhipur; Tangail	<ol style="list-style-type: none"> 1. Equitable compensation is to be ensued for the affected 2. Hassle free compensation 3. Direct payment to the affected without intermediary support 4. Extra compensation of fruit bearing trees
3	5.12.13	Bhutani Bazar, Village-Purbo Pratimabanki ; Union - Dariapur Upazila : Sakhipur:District: Tangail	<ol style="list-style-type: none"> 1. Proper Compensation 2. Compensation before dislocation 3. Gas connection for the affected community 4. Income restoration support 5. Need income restoration Livelihood Training, these may be agriculture, driving, computer etc. Educated suggested computer Livelihood Training
4	8.12.2013	AzugiChala; Village: Azugi Chala; Union: Gazipur; Upazila: Sripur; District: Gazipur	<ol style="list-style-type: none"> 1. They will support the project with greater interest of the country. 2. Expecting proper compensation 3. Hassle free payment, earlier they had to pay bribe in the DC office regarding payment; they expect GTCL will help them in getting proper and direct payment to the people.
5	14.12.2013	, Purbo Pratimabanki ; Dariapur Union, Sakhipur, Tangail	<ol style="list-style-type: none"> 1. Affected person needs proper compensation 2. Well, they will support the project for the greater interest of the country 3. Need income restoration Livelihood Training, these may be agriculture, driving, computer etc. Educated suggested computer Livelihood Training 4. Expecting gas connection for industrial development in the area Project Authority should manage alternative land 3. Project will damage their livelihood 4. To provide job for the affected
6	15.1.2014	Pouzan Bazar; Village: Pouzan ; Upazila: Kalihati; Tangail	<ol style="list-style-type: none"> 1. Proper Compensation 2. Project Authority should manage alternative land 3. Project will damage their livelihood 4. To provide job for the affected 5. Concern of being landless 6. Supply gas to affected community

No	Date	Place	Contents of Consultation/main comments and answers
7	17.1.2014	Ratanganj; Village: Nagbari ; Upazila: Kalihati; District: Tangail,; Tangail	<ol style="list-style-type: none"> 1. Proper Compensation 2. Project will damage their livelihood 3. To provide job for the affected 4. Concern of being landless 5. Supply gas to affected community 6. Timely payment of compensation 7. Income generating Livelihood Training
8	17.1.2014	Kukdahra; Village: Kukdahra ; Union: Bukdahra Upazila: Kalihati; District: Tangail ,	<ol style="list-style-type: none"> 1. Compensation up to market price 2. Poor and vulnerable need special support 3. Job facilities in GTCL 4. Contractors must use local labor 5. Road should be rehabilitated
9	18.1.2014	Balla Bazar; Village: Balla ; Union: Balla Upazila: Kalihati; District: Tangail,	<ol style="list-style-type: none"> 1. No negative impact of the project except land acquisition is reported from the participants. They need proper compensation and gas connection to the locality. 2. There is fuel wood problem in the village, so gas connection is indispensable. As an affected community, they are entitled for gas connection. On the other hand handloom industry will be highly benefited if gas is connected. For dying purpose gas fuel is very helpful and cost effective. The quality of 'Sari' will be increased. So, export and income will be increased
10	19.1.2014	Village: Baldi; Union:Kudhahra Upazila: Kalihati; District: Tangail,	<ol style="list-style-type: none"> 1. No negative impact of the project except land acquisition 2. They need .proper compensation 3. gas connection for PAPS 4. There is fuel wood problem in the village, so gas connection is indispensable.

8.5 Views of the Project Stakeholders

8.5.1 Introduction

There are different types of stakeholders in any development project area. They have different ideas, views and suggestions about the advancement of their locality. The local stakeholders have different needs and understanding regarding the project as well. The PAPs i.e. the directly project affected persons are commonly worried about shifting and or re-building of their residences and structures, the market prices for the same, hassles during compensations payment, harassment at Land Acquisition (LA) offices. While the other local stakeholders are concerned about adequate land price and compensation payment procedures and time frame, community support, income loss and restoration, social rehabilitation etc. The stakeholders of the project area are generally divided into four categories.

- Living Structure Losers
- CBE Losers
- Agricultural Land Losers
- Other Stakeholders

8.5.2 Views of Living Structure Losers

In fact, living structure loses for the PAPs are touchy matters because a lot of memories and sentimental issues are tied all around about their ancestors land and homestead they are to be parted with. Usually, people have been using these properties from generation to generation.

- People don't want to lose the place and shift elsewhere.
- Some of the land losers felt that they will not be able to purchase any land in the vicinity of their kith and kin with the compensated amount.
- Peoples expected the top up compensation as per market rate.

- People will lose their social network.
- Peoples are worried about DC's payment which may not cover the market price. So they want the real market price in compensation payments.
- People don't want any hassle in the compensation payment
- Project should offer alternative land option
- They seek job opportunities in GTCL for the affected peoples
- In time payment of compensation should be ensured
- Concern of being Landless should have special treatment

8.5.3 Views of CBEs Losers

- Provision of Income restoration grant should be in the project
- Peoples want gas connection for business expansion
- Peoples want Credit Support for resuming their business at a new location
- Provision of income generating Livelihood Training should be under this project
- Project may damage their livelihood, so care should be taken that they are not in serious problem
- Make sure the job opportunities in GTCL for the affected peoples

8.5.4 Views of Agricultural Land Losers

- Peoples need proper compensation for PAPs
- Peoples want gas connection for the locality
- At least PAPs should have the gas connection
- Poor and vulnerable peoples need special support from GTCL
- Provision of income generating Livelihood Training should be under this project
- Project activities may hamper their livelihood, so care should be taken so that they are not in serious problem
- Make sure the job opportunities are there in GTCL for the affected peoples
- Project area peoples are losing their land so their concern of being Landless should be duly taken in to account by the project authority.
- They said, it is irony that who suffer loses for the project don't get gas connection, the people of the community have earlier given their land for gas pipeline but didn't get gas connection as yet.

8.5.5 Views of Other Stakeholders

- Since there is fuel wood problem in the localities, hence they made it a point that gas connection is indispensable for the local people
- Many handloom industries can be developed in the project area if there is access to gas connection and thus people will be benefited by:
 - New job opportunity and less production cost of the handloom products
 - Gas fuel is very helpful and cost effective for dying purpose
 - The quality of 'Sari' will be enhanced. So, export and income will be increased.
 - Gas connection will create large scale economic development and employment generation of the area through this and other backward linkage industries.
- Local labor will have to be deployed by the contractors during construction work
- Damaged road should be rehabilitated as soon as possible
- Poor and vulnerable people should have special support
- Local people will support the project for the greater interest of the country

- Gas connection in the affected locality is important as it would save natural forest resources and thus natural beauty of the project area as well.
- Make sure the job opportunities in GTCL for the affected peoples
- GTCL will support the development of the project area and its neighborhood community

8.6 Responses Made to Comments from the Public

The PAPs raised several concerns in the different FGD meetings held in the project areas. However, there were certain suggestions, comments, and questions from them as well in the meetings. On behalf of GTCL and ARAP Team experts, the survey team members responded to their concerns, suggestions and questions though explaining the situation and assuring the PAPs about doing their best in communicating their concerns to the appropriate authorities as applicable for due mitigation of their concerns and providing their all out support in favor of the PAPs and the local community. A brief on the responses made by the survey team to comments from the Public is given below:

Serial	PAPs concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
1	PAPs and communities were not communicated earlier regarding the project	<ul style="list-style-type: none"> • As it was in preliminary and conceptual level, they weren't communicated earlier. Now they will be communicated by the GTCL from now at all stages of project onward.
2	Hassle free compensation specially from DC	<ul style="list-style-type: none"> • DC is a separate entity as for CCL, but GTCL officials and NGO to be contracted will support PAPs in getting hassle free compensation from DC • For additional grant, RU-GTCL will be responsible and there will be full co-operation from GTCL and NGO to be contracted.
3	Concerns of regaining an identical land through purchase against the one lost through acquisition by GTCL	<ul style="list-style-type: none"> • GTCL would always encourages PAPs to purchase the lost land • As land for land is an unending process, project proponent will support additional grant for purchase of the land at the rate of full replacement cost at actual market price and this recommendation would be included in ARAP • The additional grant also includes stamp duty as registration fee • Inflation rate also included in case the payment is delayed • NGO support would be ensured for the PAPs • For fixation of upper value of land price, there will be Property Valuation Advisory Committee, where representatives of affected persons would also be committee members
4	People are unwilling to relocate their paternal land	<ul style="list-style-type: none"> • For the greater interest of development of the country, PAPs should support the project and thus refrain from being unwilling to allow acquisition of their land. • PAPs were expected to appreciate that the previous practice of forcefully evicting from the project land would no longer be applied to them, rather appreciating their concerns, project authority realize that this was not a justice and will now do whatever necessary to reasonably compensate them • They were assured that, it is now in practice in donor supported project that, there is a mandatory option that the PAPs must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. So, GTCL will safeguard their interest
5	PAPs will lose their Social Network, so they will lose socio economic support viz .credit support, social exclusion, safety and security	<ul style="list-style-type: none"> • It is true, but regaining their social network, there will be proposal of community support for host areas. • For transitional period, PAPs will be given 3 months income restoration grant • Host area facilities will make them free from isolation
6	Participants asked GTCL,	<ul style="list-style-type: none"> • GTCL only transmits but does not give gas connections for the

Serial	PAPs concerns, questions, comments and Suggestions	Response from the Survey Team of the Project Proponent (GTCL & BETS)
	PAPs have suffered a lot but not getting gas connection, so they need gas connection for the project affected communities	consumers, these facts and demands of PAPs will be reflected in ARAP for attracting due support of GTCL for necessary actions to the concerned sister organization responsible for giving gas connection to the communities concerned
7	Why not job opportunities' for PAPs in GTCL?	<ul style="list-style-type: none"> • GTCL is a technical organization, it needs only skilled manpower. It is expected that some jobs may be provided to the qualified and skilled persons during construction and subsequent recruitment process. So PAPs and their dependents should keep an eye when the process starts • Further, CSR department, if originated in GTCL, would provide short technical training to the PAPs and their dependent for making them qualified for employment. • The demand will be reflected in ARAP and GTCL authority will try for positive response against this demand.
8	Credit support for purchasing land and income generating activities(IGA)	<ul style="list-style-type: none"> • Provision will be proposed from the contingency fund of the budget
9	Concern about livelihood restoration	<ul style="list-style-type: none"> • There will livelihood restoration for marginal people, vulnerable and income losers • Provision of Training specialist, poverty reduction Specialist would be there for income restoration • Credit support and income restoration grant for three months would be proposed in the ARAP
10	Concern about eviction before payment	<ul style="list-style-type: none"> • They were assured that no one will be evicted before payment of Transfer Grant (TG), Construction Grant (CG), and before compensation payment • Eviction will start only when maximum payment is ensured

Chapter-9

Resettlement Monitoring and Evaluation

9.0 Resettlement Monitoring and Evaluation

9.1 Monitoring and Evaluation

Monitoring & Evaluation is an important task for measuring the periodic progress of activities under resettlement program. This helps to identify the constraints and bottlenecks in the progress as well as to determine remedial measures. Resettlement being a complex nature of task, it needs development and establishment of Computerized Management Information System (CMIS). The main objective of the CMIS is to provide the management of the project with an efficient tool for better planning and control of different project tasks. So, GTCL will develop a computerized management information system in monitoring resettlement work. Software will be developed for CMIS. The authority will appoint experienced system analyst, programmer for this. All sorts of resettlement information, land acquisition, Entitlement Person (EP) file including all information and entitlements, pre and post acquisition and requisition information of resettlement will be provided for CMIS. Socio economic background of the concerned affected persons will be recorded for ready reference. The authority will arrange necessary step in this connection for proper and successful resettlement. GTCL through project RU will arrange yearly progress monitoring up to five years of which 3 years for implementation period and minimum 2 years can start just after completion of last house resettlement, so may be less than 5 years. Project authority will carry out at least two years post project intensive monitoring to follow any adverse impact and will do any needful necessary for the affected from the contingency fund.

The major input in to the system will be:

- Affected household data
- Land acquisition data
- Data on losses
- Resettlement entitlement and delivery data
- Resettlement monitoring and evaluation data
- Other management related data
- Monitoring and Evaluation (M&E) are critical for ensuring effective implementation of the ARAP and achievement of the set targets. Resettlement monitoring is a continuous process of data collection, dialogue with the various stakeholders, analysis & reporting and feedback to management to enable timely adjustment of implementation procedures and entitlements, if required.
- The monitoring will commence with the commencement of the Project implementation and shall continue throughout the implementation of the Project.
- At the implementation period, field officials will design a format for monthly resettlement monitoring and data collection. GTCL will prepare a post-resettlement evaluation report at the end of the Project activity. The report should provide evidence whether adverse effects of the project have been mitigated adequately or at least pre-project standard of living and income have been restored as a result of the ARAP.

Some monitoring indicators are given below. This might help as proper guideline for implementation and monitoring of ARAP. In addition to that GTCL will appoint Monitoring and Evaluation Specialist for further developing indicators and format for further needs or may modify from the changed needs for efficient implementation of ARAP.

The GRC, NGO as implementing agency, GTCL RU and Accounts section will develop standard reporting formats and reports will be submitted on a monthly basis highlighting constraints and suggestion for implementing of ARAP.

GTCL RU will arrange monthly review meeting with assistance of NGO for identifying the problems and proper suggestions will be given to the implementing NGO and minutes will be sent to the concerned persons and higher authority.

For smooth implementation of the affected person's problem, GRC will have a direct contact with the field. They will make monthly report for DPD-RU and will suggest DPD for both NGO and GTCL.

The NGO, executing the program will monitor PAPs participation in the vocational Livelihood Training and other economic rehabilitation program. Records will be maintained about their attendance and the payments.

Post resettlement socio economic survey for evaluation will be carried out on the basis of a TOR to be developed by a resettlement expert engaged by GTCL. The survey document will be the final project document.

The implementing NGO will develop Computerized Management Monitoring System and will supply to the GTCL and implementing NGO and GTCL will preserve the data.

9.2 Internal and External Monitoring

Implementation of the ARAP will be monitored regularly. A Computerized Management Information System (CMIS) will be established to provide: Integrity of data records, better planning and decision making, improved resettlement services, problem detection on resettlement issues, and project expenses and implementation within limits and schedules. The CMIS will provide: household files for PAPs containing losses and entitlement, scheduled monitoring reports, progress reports, and financial reports. The RU-GTCL will establish a quarterly monitoring system involving staff of the NGO. The RU-GTCL will prepare progress reports on all aspects of land acquisition and resettlement activities. The report contains progress made in ARAP implementation with particular attention to compliance with the principles and matrix set out in the plan. GTCL will hire Independent auditors acceptable to JICA to carry out external monitoring of the resettlement operations within two months of loan effective date. The External monitor's report will be submitted simultaneously to the GTCL and JICA regularly. The monitoring consultant will be selected within three months of loan approval. Monitoring will be carried out every year during project implementation.

For efficient implementation and management of the ARAP, some review work is needed. This will be internal and external. The authority will produce monthly and quarterly reports for monitoring the progress. GTCL will engage efficient consultant from outside for total review of the project after the implementation period. At the same time JICA and other stakeholders may arrange separate study to monitor the implementation of ARAP. GTCL will carry out a midterm internal evaluation for the affected person at the implementation period. Following formats are proposed to use the progress monitoring of all relevant ARAP works. In addition to following formats internal Monitoring Specialist, Resettlement Specialist may develop other formats or may change following formats if necessary.

Resettlement Monitoring and Evaluation Forms:

Monitoring Format-1: Monthly Progress Report Format for Resettlement Monitoring

Reporting Month:

Sl. No.	Component	Unit Total	Completed %	Cumulative Achievement	Completed	Progress During Reporting Month	Status & Remarks
1. Resettlement Preparation:							
1.1	Identification of PAPs	No.					
1.2	Group Meeting with PAPs,	No.					
1.3	Distribution of Compensation for Structures	Tk.					
1.4	Compensation for crop/tree	Tk.					
2. Payment of Compensation							
2.1	Land: (agriculture/homestead)	Tk.					
2.2	Compensation for Structures	Tk.					
2.3	Compensation for Crop/tree	Tk.					
3. Relocation and Income Restoration Activities							
3.1	Relocation of Households	No.					
3.2	Payment of Transfer Grant	Tk.					
3.3	Income Restoration Grant	Tk.					

Public consultation is a very important aspect for monitoring purpose and it is a continuous process. Resettlement Unit (RU) of GTCL will use this format for reporting public consultation in their monthly and quarterly progress report. NGO will submit it to the RU-GTCL and to the JICA.

Monitoring Format-2: Monitoring Format for Public Consultation

Serial	Date	Place	No. of Participants	Contents of the consultation, main comments and answers
1				
2				

Following format is intended for exclusive use of RU of GTCL. After recruiting NGO, relevant part will be used by the NGO for monitoring and the report will be submitted to RU of GTCL and JICA.

Monitoring Format-3: Acquisition and Resettlement Activities Monitoring Form

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the quarter	Till the last quarter	Up to the quarter	Till the last quarter	Up to the quarter		
Preparation of ARAP									
Employment of Consultants		Man month							
Implementation of Census Survey(Including Socio Economic Survey)									
Approval of ARAP			Date of Approval						
Finalization of PAPs List		No of PAPs							

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the quarter	Till the last quarter	Up to the quarter	Till the last quarter	Up to the quarter		
Progress of Compensation payment		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							
Lot 3		No of HHs							
Lot 4		No of HHs							
Progress of Land Acquisition(All Lots)		m ²							
Lot 1		m ²							
Lot 2		m ²							
Lot 3		m ²							
Lot 4		m ²							
Progress of Asset Replacement (All lots)		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							
Lot 3		No of HHs							
Lot 4		No of HHs							
Progress of Relocation of People (All Lots)		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							
Lot 3		No of HHs							
Lot 4		No of HHs							

Monitoring of certain indicators are very important for due implementation of involuntary resettlement issues and thus ensuring congenial social environment. As per JICA guidelines it should be at least for a minimum of 2 years period after the last date of completion of all resettlement activities. It is expected that minimum 2 years period of monitoring is adequate considering the small scale nature of resettlement is involved. Proposed monitoring items are given below on a tentative basis for livelihood and resettlement monitoring. In addition to above, the monitoring indicators will be reported on monthly, quarterly and annual basis. The reporting will be on the following monitoring indicators.

Monitoring Format-4: Indicator-wise Monitoring Results during Report Period(Livelihood Monitoring)

Serial	Monitoring Item/Indicator	Report Period			
		Month-1	Month-2	Month-3	-----
1	Amicable Negotiation (Total 100%) Cumulative progress				
2	Successful grievance resolution(No.) Cumulative progress				
3	Timely delivery of Compensation(in Taka) Cumulative progress				
4	Satisfied with agreed resettlement (No. of PAPs) Cumulative progress				
5	Restoration of income (No. of PAPs) Cumulative progress				
6	Restoration of economic/agricultural activities (No. of PAPs) Cumulative progress				
7	No of occupational disruption and major damages (No. of PAPs) Cumulative Figure				
8	Home/homestead rehabilitated (No. of PAPs) Cumulative progress				
9	Uninterrupted access to community facilities and services (No. of PAPs) Cumulative progress				
10	Wells, drains, canals, road reinstated (No./length in meter) Cumulative progress				
11	Enhanced social relations and networks (No. of PAPs) Cumulative progress				
12	Enhanced livelihood through effective use of compensation (No. of PAPs) Cumulative progress				
13	Livelihood Training Provided(Nos. of PAPs) -Trade 1 -Trade 2 -Trade 3				
14	Microcredit Provided -In Tk. -No. PAPs				
15	-Transfer Grants(TG) -Construction Grants (CG)				

Note: Initial Assumptions:

- No. of Total PAPs:
- Total amount of Compensation in Tk.
- Total No. of PAPs having access to community facilities
- Total no. of wells, drains to be reinstated
- Total length of canals to be reinstated in Km.
- Total length of roads to be reinstated in Km.

Chapter-10

Budget

10. Tentative Budget

Budget is calculated on the following type of loss and ARAP management principles as applicable:

DESCRIPTION OF LOSSES	APPLICABILITY CONSIDERATION
(a) Payment of Compensation	
▫ Land	√
▫ House sites	√
▫ Houses	√
▫ Trees/crops	√
▫ Business loss	√
▫ Other immovable properties	×
(b) Resettlement	
▫ Purchase and development of resettlement sites	×
▫ Civil amenities	×
▫ Social infrastructure	×
▫ Movement of PAPs	√
▫ Transportation of household goods, salvageable items, cattle etc	√
▫ Transit camps including temporary shelters, provision of health care	×
▫ Potable water, food, firewood, fodder etc.	×
▫ Resettlement Allowance	√
(c) Rehabilitation	
▫ Resettlement package including land-for-land, productive assets for income restoration, linkage with Government schemes	×
▫ Resettlement Allowance, Awareness Buildup and Livelihood Training etc.	√
(d) RU-GTCL	
▫ Socio-economic studies and ARAP	√
▫ Awareness Buildup and Livelihood Training of GTCL staff	×
▫ Monitoring and Evaluation	√
(e) Project Administration	
Capital including building, equipment, furniture and vehicles	√
Recurring including salaries, stationary, postage, fuel, maintenance of equipment and vehicles etc.	√
Contingencies	√

Though the resettlement budget has been estimated on the above principles yet in future, it will be rearranged on the basis of the changed needs. So a tentative budget has been prepared and placed on available data. The resettlement cost estimate includes all costs regarding resettlement preparation, compensation for land and structures including relocation. GTCL will allocate necessary funds for implementation of the plan.

The budget is prepared considering following assumptions, figures and facts.

1. From socio-economic survey (SES) the average land price per decimal (40.47 sq meter) is Tk2, 92,941 for homestead land and Tk.1, 16186 for agriculture land. But in consideration of different contributing issues like importance of the location and proximity of suburban areas, low lying and economically less important areas etc the preparation of the budget has been based on estimated land prices of Tk,150,000 per decimal of Dhanua-Salgrampur and Tk. 50,000 for Salgrampur- Elena section. These estimated numbers of the budget has been considered in consultation with GTCL project team.
2. Assuming average value of the trees at Tk.3, 000 irrespective of size and varieties, it also includes 50% premium and 5 yrs compensation of fruits
3. The renting of requisition land is based on the assumption that the production rate is 60 Mound (37.5 Kg=1 Mound) per acre and the price of Paddy is Tk.800 per Mound.
4. Land related conflicts may cause delay in payment of compensation for land
5. Assumed figure for income loser=100
6. Temporary Requisition budget is estimated for two seasons' crop i.e. paddy production at 60 Mound (1md=37.5kg approx) per acre in a single season.
7. Administrative cost will be there at 5% and that of incidental charges at 10 %.
8. Budget will be updated based on detailed technical design and 100% inventory of the losses. GTCL will meet the shortfall in the resettlement budget, if any.
9. More than one persons including dependents of PAPs may be under livelihood and awareness training of PAPs families., At this stage it is presumed that a number of 500 trainee will be taken in to consideration.

Estimated Budget

Cost Item	Amount (Tk.)	Payment	
		DC	Project
1. Replacement Value of Land (41.69ha including 8m ROW & 25mX25m valve stations)			
1.1. Dhanua to Salgrampur (32Km. Pipeline Route) (Land Area 6323.2 decimal i.e. 25.6 Ha at Tk. 150000 per decimal)	948,480,000	CCL+50% Premium	Rest as grant
1.2. Salgrampur to Elenga (20Km. Pipeline Route) (Land Area 3952 decimal i.e. 16 Ha at Tk. 50000 per decimal)	197,600,000		
1.3. Two Valve Stations (25X25 (including 8m ROW)) (Land Area 21.0 decimal i.e. 0.085 Ha at Tk. 150000 per decimal)	3,150,000		
Sub-total of Resttlement Value of Land	1,149,230,000		
2. Compensation for Affected Structure (28 Structures)		CCL+50% Premium	Rest as grant
2.1 Cost of Structures	7,900,000		
(i) Tin Shed Structures, 21x200,000 (Tk.200,000/structure)=4400,000; (ii) Semi Pucca Structures 7x500,000 (Tk. 500,000/structure)=3500,000			
2.2. Transfer Grant & Dismantling Cost	980,000		
(i) For Tin Shed Structures 21x30,000 (Tk. 30000/structure)= 630,000 (ii) Semi Pucca Structures 7x50,000 (Tk. 50,000/structure)=350,000			
iii) Construction Grant Tin Shed Structures 21x50,000 (Tk. 50,000/structure) =1050,000 (iv) Semi Pucca Structures 7X 100,000 (Tk. 100,000/structure)=700,000	1,750,000		
3. Compensation for Trees (2469 trees on private land+3300 trees on government forest)		CCL+50% Premium	Rest as grant
i) Trees 5769x3000(Tk. 3000/tree) =17,307,000	17,307,000		
4. Compensation for Standing Crops		CCL+50% Premium	Rest as grant
4.1. Land Under Acquisition: (60mdx41.69X2.47xTk 800) =Tk4,942,766	4,942,766		
4.2 Renting of Requisition Land 60mdx2x78x2.47xTk 800=18,495,360	18,495,360		
5. Compensation. Business Loss, 3 Poultry Farm of 2000 Poultry Bird Each, One Year profit Loss at Tk. 50,000,Bank Interest etc,	4,800,000	CCL+50% Premium	Rest as Grant

Cost Item	Amount (Tk.)	Payment	
		DC	Project
(1000,000 capital eachX3)+(50,000x12x3)=Tk.4,800,000			
6. One Time Cash Grant: Assuming Income Loser = 100 (Tk. 500per dayx90daysx100)=Tk4,500,000	4,500,000	NGO	Grant
7. Stamp Duty as Additional Grant at 20% on Land Price	229,846,000	NGO	Grant
8. Training Cost Tk. 10,000x500 PAP (Lump sum amount to cover both awareness and livelihood training)	5,000,000	NGO	Grant
9. Cost of NGO Services (Lump sum Amount)	20,000,000	-	-
10. Monitoring and Evaluation (Lump sum)	2,000,000		
Total:	1,466,751,126		
11. Incidental charge (i) 10% on Estimated Cost :	146,675,113	-	-
12. Administrative Cost at 5% on Estimated Cost :	73,337,556		
13. Revolving Fund for Microcredit Poor Assuming 500 PAPS, (TK20,000x500)	10,000,000		
Grand Total	1,696,763,795		

Source: Field Survey, Public Discussion & Consultation with GTCL Project Team

Chapter-11

Conclusion & Recommendations

11. Conclusion

It is a recognized fact that the Basic object of this ARAP is to ensure proper resettlement for the PAPs and thus to identify and elaborate the actions needed for the ARAP implementation Expert Committee. Further, a well developed plan of action with duly proposed manpower and logistic support framework for this resettlement mechanism is yet another issue of priority and importance for successful implementation of the program

It is believed that due care and attention has been given to prepare this report incorporating requisite field data, views of the directly and indirectly affected stakeholders and the project proponent GTCL's undertakings, obligation and commitments so far as practicable under the given circumstances provisions in practice.

Recommendations

It is recommended that due attention and taking all necessary steps by all concerned should be directed towards ensuring proper and on time resettlement for the PAPs of the project. Main concern in this regard primarily rests on the RAP Expert Committee for a successful implementation of the RAP.

ARAP has several options for proper resettlement. These are:

- provision of forming GRC, PVAC, TG& CG payment,
- paying additional grant for land purchase to cover replacement cost,
- livelihood monitoring,
- credit facilities,
- IGA training etc.

It is suggested that RU-GTCL will ensure one or more of these as applicable and opted for within the earliest time of starting the resettlement work.

There is a concern of erecting fake structure in the ROW. Therefore, it is stressed that

- RU-GTCL will think about engaging the Patrolmen of respective sections of the existing transmission line and guard against such sort of immoral activities. This is in view of the fact that these Patrolmen of GTCL are usually appointed from the locality and have good relationship with the residents of the area. Further, most of the members of the adjacent community are known to these Patrolmen. Therefore, they can be of good assistance to easily preventing erection of fake structures by any quarter provided they are given additional duty and incentive for the purpose.
- Earlier acquisition procedure with DC, soonest possible forming and activating Joint Verification Inventory Team (JVIT) and additional efforts of video filming would also prove effective in prevention of erecting fake structures in the ROW.

Public Consultation is encouraged as a tool for creation of a cordial relation with the PAPs and the community and thus safeguarding PAP's interest on the basis of equity, justice and on humanitarian ground. So it is suggested that any dispute or dissatisfaction is resolved through undertaking Public Consultation

Finally, as a responsible organization, GTCL can do a lot for the PAPs and the affected and host communities by doing

- CSR activities and implementing social and economic issues mentioned in the ARAP like
- Providing suitable job for them and
- Timely disposing TG, CG and additional grants for the PAPS.

So, it is expected that a successful resettlement and checking of false structures can be ensured by taking appropriate measures following the foregoing recommendations and that will result in to a win-win position both for PAPs and the RU GTCL

Annex-1
List of references

List of References:

- a. Land Acquisition and Resettlement Plan, Jamuna Bridge Railway Link project, 1997
- b. Revised Resettlement Action Plan, Jamuna Multipurpose Bridge Project, 1994
- c. IEE/EIA/ARAP Report on Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge high pressure Gas Transmission Pipeline Project -2005.
- d. Guidelines For Environmental and Social Considerations, JICA, April-2010
- e. BBS (2011), The Statistical Yearbook of Bangladesh.
- f. Banglapedia, National Encyclopedia of Bangladesh, 2006.

Annex-2
List of Affected Land Owner Identified (Acquisition/Requisition)

List of affected Land Owner Identified(Acquisition/Requisition)

Qno	Name of PAP	Father's Name	Upazila	Union	Mouza	Plot (No)	Total owned land (dec)	Total affected land (dec)	Acquisition land (dec)	Requisition land (dec)	Type of land	land Price per (Dec)(tk)
001	Osman ali	Monammed ali	Sreepur	Gazipur	Dhanua	2209	22	4	4		Homestead	50000
002	Abdul Alim	Hamid Master	Sreepur	Gazaria	Dhanua	2153	14	5	5		Agriculture	120000
003	Somon Islam	Hadi Islam	Sreepur	Gazipur	Dhanua	2100	30	7	7	84	Homestead	120000
004	Jamilur Rahman	Mosharrif Hossain	Sreepur	Gazipur	Dhanua	2553	55	5	5		Agriculture	50000
005	Abul Kasham	arman Ali	Sreepur	Gazipur	Dhanua	2269	18	7		7	Agriculture	80000
006	Md. Jamal	Late Kamal uddin	Sreepur	Gazipur	Dhanua	2660	2	9		9	Agriculture	100000
007	Abu Sayed	Late Meser uddin	Sreepur	Gazipur	Dhanua	2684	30	7	7		Agriculture	40000
008	Jakir Hossain	Mostofa Kamal	Sreepur	Gazipur	Dhanua	2700	60	5	5		Homestead	100000
009	Abdul latif	Abdul Karim	Sreepur	Gazipur	Dhanua	2155	33	11	22		Homestead	200000
010	Md. Khalilur Rahman	Late Nayeab Ali	Sreepur	Gazipur	Dhanua	2683	50	5	5		Agriculture	50000
011	Akram Gazi	Mahabub uliah	Sreepur	Gazipur	Dhanua	2258	12	2	2		Homestead	100000
012	Kitab Ali	Abdul Hekim	Sreepur	Gazipur	Dhanua	2508	18	7	7		Homestead	50000
013	Helal Mia	Harun Mia	Sreepur	Gazipur	Dhanua	73	16	7	7		Homestead	100000
014	Masum Ali	Abdul Ali	Sreepur	Gazipur	Dhanua	2193	51	11	11		Homestead	50000
015	Raham Ali	Late Hasan Ali	Sreepur	Gazipur	Dhanua	1645	4	0	0	50	Homestead	50000
016	Moslim uddin Khaka	Late Sabir uddin	Sreepur	Maona	Dhanua	73	20	4			Homestead	1500000
017	Md. Mujibur Rahman	Badur Khaleque	Sreepur	Gazipur	Dhanua	1701	8	4			Homestead	100000
018	Md. Helal uddin	Late Samsuddin	Sreepur	Gazipur	Dhanua	2193	35	11			Homestead	300000
019	Md. Nurul Islam	Late Md. Altabuiddin	Sreepur	Gazipur	Gazipur	4132	110	0	0		Homestead	100000
020	Hasan Mia	Moslem Mollah	Sreepur	Gazipur	Gazipur	2583	20	5	5		Homestead	50000
021	Md. Shafiq	Mohashin	Sreepur	Gazipur	Gazipur	2580	60	6	6		Agriculture	500000
022	Sakawat Hossain	Nurul Islam	Sreepur	Gazipur	Gazipur	4342	12	0		0	Agriculture	60000
023	Altaf Hossain	Md. Jinal Abden	Sreepur	Gazipur	Gazipur	4827	17				Homestead	300000
024	Jashim Sarker	Rustum Ali	Sreepur	Gazipur	Gazipur	2551	5	0	0		Homestead	100000
025	Mustofa Sarker	Mukul Sarker	Sreepur	Gazipur	Gazipur	2551	5	0	0		Homestead	100000
026	Siraj Sarker	Mukul Sarker	Sreepur	Gazipur	Gazipur	2551	5	0	0		Homestead	100000
027	Nijam Sarker	Sobdul Sarker	Sreepur	Gazipur	Gazipur	2551	5	0	0		Homestead	100000
028	Mrs. Nazma	Late Suckdul Sarker	Sreepur	Gazipur	Gazipur	5021	5	0			Homestead	
029	Monowara Khatun	Late Idresh Ali	Sreepur	Gazipur	Gazipur	4782	8				Homestead	120000
030	Md. Mostafa Kamal	Md. Waise uddin	Sreepur	Gazipur	Gazipur	4827	28				Homestead	100000
031	Md. Abdul Sattar	Late Shahbuddin	Sreepur	Gazipur	Gazipur	4243	17				Homestead	50000
032	Akter Hossain	Shahabuddin	Sreepur	Gazipur	Gazipur	4244	17	9	9		Homestead	50000
033	Safikul	Shahid Mia	Sreepur	Gazipur	Sailat	2277	17	7	40		Homestead	400000
034	Abul Basher	Ayub Ali	Sreepur	Gazipur	Sailat	2276	25	13	13		Homestead	30000
035	Alimuddin	Late Amiruddin	Sreepur	Gazipur	Sailat	2279	30	2		2	Agriculture	100000
036	Md. Soheb	Md. Amiruddin	Sreepur	Gazipur	Sailat	2403	20	4			Agriculture	80000
037	Samad Talukder	Ibrahim Talukder	Sreepur	Gazipur	Sailat	2404	80	16	8		Agriculture	800000
038	Abdul Gafur	Monsur Ali	Sreepur	Gazipur	Sailat	2273	35	11	11		Agriculture	1100000

Qno	Name of PAP	Father's Name	Upazila	Union	Mouza	Plot (No)	Total owned land (dec)	Total affected land (dec)	Acquisition land (dec)	Requisition land (dec)	Type of land	land Price per (Dec)(tk)
039	Chan mia	Mahammad Ali	Sreepur	Gazipur	Sailat	2403	40	6	6		Agriculture	60000
040	Dil mohmud	Shafiq master	Sreepur	Gazipur	Sailat	2277	55	56	2	54		280000
041	Md. Mostafa kamal	Md. Lal mia	Sreepur	Gazipur	Sailat	2425	8				Homestead	60000
042	Habibur rahman	shahin mondol	Sreepur	Gazipur	Sailat	93	15	1	1		Homestead	50000
043	Muffajjal	Late Abdur Rahim	Sreepur	Gazipur	Sailat	2276	14	0			Homestead	50000
044	Safiruddin Fakir	Mofizuddin	Sreepur	Gazipur	Banshbari	1621	35	7	7		Homestead	60000
045	Samsul Haque	Nayeb Ali	Sreepur	Gazipur	Banshbari	44	30	0			Homestead	50000
046	Md. Hakmot ali	Md. Nasir	Sreepur	Gazipur	Banshbari	50	17				Homestead	20000
047	Md. Mojibur Rahman	Md. Fazor Ali	Sreepur	Gazipur	Banshbari	908	16	1	1		Homestead	110000
048	Hazi Md. Delwar hossain	late Haji Abdul gofur	Sreepur	Gazipur	Banshbari	1723	35	0	0		Homestead	50000
049	Waejuddin	Md. Moner uddin	Sreepur	Gazipur	Banshbari	1624	54	1	1			50000
050	Kazol	korim	Sakhipur	Gazaria	Moucharia Pathanda	2584	18	7	7		Homestead	30000
051	Bahadur	Amin	Sakhipur	Gazaria	Pathanda	2574	160	91	91		Homestead	30000
052	Nasir	Tomieur	Sakhipur	Gazaria	Pathanda	2572	57	21	21		Homestead	30000
053	Forid	Hanif	Sakhipur	Gazaria	Pathanda	2582	18	4	4		Homestead	30000
054	Towhid3	Almas	Sakhipur	Gazaria	Gazaria Kirtankhola	2167	18	4	4		Homestead	40000
055	Jamaluddin	Kamaluddin	Sakhipur	Gazaria	Gazaria Kirtankhola	2165	52	24	1	23	Homestead	40000
056	Rayhan Mia	Showkat Mia	Sakhipur	Daria pur	Kalidas	2527	112	59	17	42	Homestead	50000
057	Shyamol	Rajin	Sakhipur	Daria pur	Kalidas	2525	37	11	1	10	Homestead	50000
058	Omar Ali	Majid	Sakhipur	Daria pur	Kalidas	1065	55	40	55	15	Others	20000
059	Samsul Alam	Mozamal Hoque	Sakhipur	Daria pur	Kalidas	1069	172	104	34	70	Agriculture	530000
060	Abdul Barek	Abul Hossain	Sakhipur	Gazaria	Kalidas	812	20	10	11	44		50000
061	Abul Kalam	Kalu Miah	Sakhipur	Gazaria	Pratima Banki	552	20	2	2		Homestead	50000
062	Nazmul	Late Ajhar Ali	Sakhipur	Gazaria	Garh Gobindapur	1305	30	4	9		Homestead	50000
063	Anwar	Yaar Mahmud	Sakhipur	Gazaria	Garh Gobindapur	1387	27	10	1	9	Homestead	50000
064	Md. Hanif	Late Dudu Mia	Sakhipur	Gazaria	Garh Gobindapur	1385	15	1		1	Homestead	50000
065	Safik	usuf Ali	Sakhipur	Gazaria	Garh Gobindapur	1390	80	32	6	26	Homestead	50000
066	Md. Robiul Islam	Md. Sirajul Islam	Sakhipur	Gazaria	Chhota Mause	1051	42	17	17		Homestead	40000

Qno	Name of PAP	Father's Name	Upazila	Union	Mouza	Plot (No)	Total owned land (dec)	Total affected land (dec)	Acquisition land (dec)	Requisition land (dec)	Type of land	land Price per (Dec)(tk)
067	Zaman	jalil	Sakhipur	Gazaria	Chhota Mausa	1045	224	116	35	81	Homestead	50000
068	Hayath Mia	Helal Mia	Sakhipur	Gazaria	Chhota Mausa	35	50	16	16		Homestead	50000
069	Yunus	Abul	Sakhipur	Gazaria	Chhota Mausa	34	50	7	7			50000
070	Abul Hossen	Fazal Mia	Sakhipur	Gazaria	Chhota Mausa	1109	40	15	15		Homestead	50000
071	Abdur Rashid Mia	Hasan uddin	Sakhipur	Gazaria	Chhota Mausa	1072	50	15	15		Agriculture	50000
072	Shamim Hossain	Abul Hossain	Sakhipur	Gazaria	Chhota Mausa	1107	150	4	4		Homestead	30000
073	Md. Sojib	Md. Rofik	Sakhipur	Gazaria	Silimpur	1013	45	14	2	12	Homestead	60000
074	Kamrul	Khairul	Sakhipur	Gazaria	Silimpur	1015	72	29		29	Homestead	60000
075	Md. Shahajan	Late Nurmuhammad	Sakhipur	Gazaria	Silimpur	243,240	13	0	0		Homestead	50000
076	Abdul Hamid	Late Abdul Halim	Sakhipur	Gazaria	Silimpur	268	58	9	9			50000
077	Hasan Ali	Abbas ali	Sakhipur	Gazaria	Silimpur	1014,10	256	32	16	16	Agriculture	4800000
078	Akbor	Akramul	Sakhipur	Daria pur	Silimpur	269	89	44	11	33	Homestead	60000
079	Alhaj Md. Ibrahim	Late Lsmall sikder	Sakhipur	Baheratal	Salgrampur	433	40	1	0	1	Homestead	50000
080	Md. Rubel	Hanif	Kalihati	Baheratal	Salgrampur	496	32	13	13		Homestead	60000
081	Joinal	Jolil	Kalihati	Baheratal	Salgrampur	420	23	12	12		Homestead	60000
082	Saidul	Nijami	Kalihati	Baheratal	Salgrampur	419	61	21	21		Homestead	50000
083	Sohel	Shajahan	Kalihati	Nagbari	Nagbari	633	18	2	2		Homestead	60000
084	Loban	Soleman	Kalihati	Nagbari	Nagbari	612	68	34	13	21	Homestead	60000
085	Shipu Mia	Razzak Ali	Kalihati	Nagbari	Nagbari	650	18	2	2		Homestead	50000
086	Khaili Mia	late Abdul Rahman	Kalihati	Nagbari	Nagbari	630	30	9	6	3	Homestead	50000
087	Md. Kawsar	Late Abdul latif	Kalihati	Nagbari	Pakutia	766	12	106		3	Homestead	100000
088	Md. Khalilur Rahman	Late Hashem Ali	Sakhipur	Nagbari	Pakutia	786	50	7	7		Agriculture	50000
089	Md. Rana	Md. Sinhab	Kalihati	kupdora	Mahish Jora	572	16	6		6	Homestead	60000
090	Ratan Ali	Abdus Salam	Kalihati	kupdala	Mahish Jora	566	30	2	2		Homestead	80000
091	Md. Selim	Nur Mohammad	Kalihati	Kubdala	Mahish Jora	565	20	4	4		Homestead	800000
092	Md. Samad	Md. Kashem	Kalihati	Kupdora	Mahish Jora	461	22	12	2	10	Homestead	60000
093	Ajir Mia	Chan Mia	Kalihati	Kupdora	Mahish Jora	468	18	7	1	6	Homestead	60000
094	Hasu mia	Rajib Mia	Kalihati	Kupdora	Mahish Jora	397	10	1	1		Homestead	60000
095	Sharif Hossain	Ujjol Mia	Kalihati	Kupdora	Mahish Jora	583	17	5		5	Homestead	60000
096	Abdur Rashid	Hasan	Kalihati	Kok Dahara	Badda	958	25	9		9	Agriculture	100000
097	Sadek Ali	Sofik Mia	Kalihati	Kupdora	Dattagram	235	22	9	9		Homestead	90000
098	Suruj Mia	Kola Mia	Kalihati	Kupdora	Dattagram	199	45	12	12		Homestead	90000
099	Sana Mia	Sumon Mia	Kalihati	Kupdora	Dattagram	212	20	0	0		Homestead	90000

Qno	Name of PAP	Father's Name	Upazila	Union	Mouza	Plot (No)	Total owned land (dec)	Total affected land (dec)	Acquisition land (dec)	Requisition land (dec)	Type of land	land Price per (Dec)(tk)
100	Arjan Ali	Mijan Mia	Kalihati	Kupdora	Banira	686	17	4	4		Homestead	60000
101	Md. Samim	Md. Ajjul Hoq	Kalihati	kupdora	Banira	688	20	8	8		Homestead	60000
102	Rasel	motin	Kalihati	kupdora	Banira	687	21	8	8		Homestead	60000
103	Fajul Amin	Bodnur Amin	Kalihati	kupdora	Kok Dahara	338	13	0	0		Homestead	60000
104	Monu mia	Setu mia	Kalihati	kupdora	Kok Dahara	334	18	7	7		Homestead	60000
105	Solim mia	lebu mia	Kalihati	kupdora	Balchi	328	16	3	3		Homestead	50000
106	Rony talukder	Siraj Talukder	Kalihati	kupdora	Balchi	349	37	18	18	18	Homestead	50000
107	Sahjahan mai	Sebul mia	Kalihati	kupdora	Balchi	345	22	13	13	13		60000
108	Mashuk Mia	Rajon Mia	Kalihati	Kupdora	Balchi	343	13	3	3		Homestead	50000
109	Harun mia	dolu mia	Kalihati	kupdora	Balchi	305	52	19		19	Homestead	60000
110	Raja mia	sonu mia	Kalihati	kupdora	Kendua	776	26	3		3	Homestead	60000
111	Saheb Ali	Rohmot Ali	Kalihati	Kupdora	kendua	775	28	15		15	Homestead	50000
112	Lavly	Nasem	Kalihati	Kupdora	kendua	766	19	6		6	Homestead	60000
113	Amir Ali	late intaj Ali	Kalihati	Sahadebpur	Pathanda	217	11	4	4			50000
114	Mojibur Rahman	Moynuddin	Kalihati	Sahadebpur	Pathanda	422	10	9	9		Homestead	50000
115	Abdul kuddus	Doulath khan	Kalihati	Sahadebpur	Pathanda	414	30	14	14		Homestead	50000
116	Anwar Hossain	abdur Rahman	Kalihati	Sahadebpur	Pathanda	172	18	8		8	Homestead	100000
117	Subid mai	Suna Mia	Kalihati	Sahadebpur	Pathanda	395	18	3	3		Homestead	60000
118	Shamsul	Sirajul	Kalihati	Sahadebpur	Pathanda	118	12	4	4		Homestead	60000
119	Bablu	khalak	Kalihati	Sahadebpur	Patita Para	100	47	22	1	21	Agriculture	60000
120	Mizan Ahmed	Sakil Ahmed	Kalihati	Sahadebpur	Patita Para	107	17	4	4		Homestead	60000
121	Rajib mia	Sikandar Mia	Kalihati	Sahadebpur	Patita Para	106	17	4	4		Homestead	60000
122	Alom	Nurul hoq	Kalihati	Sahadebpur	Patita Para	549	17	2	2		Homestead	60000
123	Sohag	kamrul	Kalihati	Sahadebpur	Patita Para	547	47	18	4	14	Homestead	60000
124	Amzad ali	Aur Ali	Kalihati	Sahadebpur	Patita Para	477	14	8	8		Homestead	60000
125	Robin Alam	Asad Alam	Kalihati	Sahadebpur	Patita Para	470	44	19	3	16	Homestead	60000

Qno	Name of PAP	Father's Name	Upazila	Union	Mouza	Plot (No)	Total owned land (dec)	Total affected land (dec)	Acquisition land (dec)	Requisition land (dec)	Type of land	land Price per (Dec)(tk)
126	Md. Jolil Mia	Md. Rohim mia	Kalihati	Sahadebpur	Dimukha	151	18	9	9		Agriculture	60000
127	Soleman	shorab	Kalihati	Sahadebpur	Dimukha	241	18	1	1		Homestead	60000
128	Pavel	Rubel	Kalihati	Sahadebpur	Dimukha Dimukha	240	18	7	7		Homestead	60000
129	Masum	kader	Kalihati	Sahadebpur	Dimukha	235	15	0	0		Homestead	60000
130	Shamim	Abdullah	Kalihati	Sahadebpur	Dimukha Dimukha	234	18	6	6		Homestead	60000
131	Ekramul	Emrul	Kalihati	Sahadebpur	Mundail	252	17	9	9		Homestead	60000
132	Shuvo	Arman	Kalihati	Sahadebpur	Mundail Mundail	250	17	5	5		Homestead	60000
133	Rubel Mia	monir mia	Kalihati	Sahadebpur	Mundail	251	17	0	0		Homestead	60000
134	Nure Alam	Nowshad alam	Kalihati	kupdora	kok Dahara	328	18	7	7		Homestead	60000
135	Azim uddin	Late Somed Ali	Sreepur	Gazipur	Gazipur	4192	17	1	1		Homestead	50000
136	Md. Abdus Rashid	Late Hazmat ali	Sreepur	Gazipur	Gazipur	4139	60	21	8	13	Homestead	90000
137	Halim	Abdul Mutalib	Sreepur	Gazipur	Dhanua	93	6	1	1		Homestead	200000
138	Azizul haque	Abdul Mutalib	Sreepur	Gazipur	Dhanua	93	6	1	1		Homestead	200000
139	Humayun kabir	saiful kabir	Kalihati	kubdala	Mahish Jora	590	12	3	3		Homestead	120000
140	Md. Julhas	Md.yunus	Sakhipur	Sokhipur municipality	Garh Gobindapur	1388	42	33	33			90000
141	Mostofa	Hasmot	Kalihati	Nagbari	Pakutia	766	19	1	1		Homestead	70000
142	Ripon islam	Md. Nurul Islam	Kalihati	Nagbari	Pakutia	765	27	1	1	1	Homestead	70000
143	Sarful Islam	monju islam	Kalihati	Nagbari	Pakutia	767	35	18	18		Homestead	70000
144	Ismail Hossain	Nur zamal hossain	Kalihati	Nagbari	Pakutia	768	30	3	3		Homestead	110000
145	Selim	Bosiruddin	Kalihati	Sahadebpur	Pathanda	394	54	15	15		Homestead	150000
146	Abdul aziz	Md lebu miah	Sakhipur	Gazaria	promita banki	719	40	13	13		Homestead	1300000
147	Rafikul Islam	Abul hossain	Sakhipur	Dariapur	Pratima Banki	581	138	126	126	24	Homestead	200000
148	Abul hassan	sidur hassan	Sakhipur	kupdara	Banshabari	2027	15	45	22	23	Homestead	50000
149	Based Mia	Fazlur Mia	Sakhipur	Kupdara	Badda	971	7	2	2		Homestead	50000
150	Jubor Ali	Abdul Mutalib	Sreepur	Gazipur	Dhanua	93	6	1	1		Homestead	200000

Annex-3
Public Consultation and Picture of the Affected Area

Public Consultation and Picture of the affected Area

Public Consultation, **FGD- 1**, Place of the Meeting: Mulaid High School
PremiseTime:4.PM;Date:1.12.2013



Participants of FGD meeting,Place:Chota Kalim High School,
Village : Muladia,Upazila: Sripur,; Dist: Gazipur

Attendance:

FGD highlights: Meeting was held in presence of affected (PAP) and non affected (NAP) people of the community.

1. The community earlier not communicated about the gas transmission project.
2. After briefing by socio-economic survey team, they supported the project.
3. They agreed to support the successful cooperation of the project
4. They actually not know the extent of environmental damage of the project and have counter proposal to replant the same number of trees to be planted in the project area which are affected.
5. In the area was deep forest about 25 years. then wild hen, fox, monkey, 'garial, reptiles like 'guishap' were available. But these are endangered variety now
6. Demand of gas connection for the affected community. It is irony of the common people who suffer most do not get benefit. On the other hand, the area also suffers fuel wood problem both shortage of fuel trees and simultaneously cost concerns. In past the area has no fuel wood problem. But at present times the trees are gradually rapid urbanization and industrialization.
7. Fish like 'Magur' 'Shinghi', 'Kai', 'Puti', baim(Eeel" are gradually diminishing

8. They affected people would be more happy earlier disclosed the acquisition issue to the affected people and more fruitful suggestion would be given and the loss would be minimum.
9. Air pollution is comparatively more due to urbanization.
10. In recent days employment is increasing gradually. Child marriage is gradually decreasing now. Women employment is increasing. Risk of HIV AIDS is more now as family structure is gradually decreasing but people have less awareness about this. Demand of nutrition of food and supply of pure drinking water is more.
11. Child mortality is decreasing

Attendance:

Serial No	Name	Village	Occupation
1	Md.Sadikul Islam	Mulaid	Service
2.	Hazi Amzad	,,	Service
3	Abdul Hannan Sazal Phone:01716-093356	,,	Head Master,Hazi Chota Kalim High school
4	Md. Abdul Kader	,,	College Teacher
5	Md. Sadekul Islam Farhad	,,	Deed Writer, Subregistry Office Sripur
6	Mobarak Hossain	,,	Business
7	Abdul Alim Badal	,,	Head Master, M. A Hamid Ideal High School
8	Md. Abdul Aziz	,,	Agriculture
9	Md. Sirajul Islam	,,	Agriculture

Public Consultation, FGD-2; Place of the Meeting: Ramjan Mian's Bari ,Moucharia Pathar, Gazaria Union Parishad, Upazila Shakhipur-Time:10AM-Date:-3.12.2013



Photo:FGD meeting;Meeting place: Ramjan Mian's Bari, ;Village:Gazaria; Union: Gazaria;Upazila:Sakhipur; Distict:Tangail

Summary discussion: Household number of the village is about-400.Main occupation of the village are, agriculture-50%, agriculture labour10%-, non agriculture labour10%, small business-20%, service10%..Following suggestion regarding the project is as follows.

- They will supported the project with greater interest of the country.
- Expecting proper compensation
- Hassle free payment, earlier they had to pay bribe in the DC office regarding payment; they expect GTCL will help them in getting proper and direct payment to the people.
- Equitable compensation is to be ensued for the affected
- Hassle free compensation
- Direct payment to the affected without intermediary support
- Extra compensation of fruit bearing trees



Photo:Affected house of Md. Abdul Barek under aquisition land.

Village:Moucharia Patar; Mouza Patar;Union: Gazaria;Upazila :Sakhipur; District:Tangail

Attendance:

Serial	Name	Village	Occupation
1	Atikul Islam	Gazaria	Grocery Shop
2	Md Saizuddin 01712724580	„	Shop owner
3	Abul Kashem	„	Business
4	Rafiqul Islam	„	Business
5	Jalil Mian 01849131861	„	Business
6	Sharif Hossan	„	Tea Shop
7	Hazi Abdul Awal	„	Farmer
8	Moju Mian	„	Driver

Public Consultation, FGD-3; Place of the Meeting:Bhutani Bazar, Village-Purbo Pratimabanki ; Union - Dariapur Upazila : Sakhipur:District: Tangail-Time:10AM
Date:-5.12.2013



Photo:Affected housing structure of Md. Abul Kalam
Village:Protimabanki;Mouza: Protimabanki; Pourashava:Sakhipur; District:Tangail

Population of the village is Purbapratimabari about 3,000. In the village, there are four mosque and two primary school, one Junior Madrasha(religious school).Of the occupation70% are farmer, 10% serviceholder,15% businessmen and 5% have others occupation.99% female are housewives and 1% are with different occupation. The families are mostly conservative. There are three rural doctor (quack) are working in the village.

In the FGD meeting no one has opposed against gas transmission project. But they raised question whether GTCL will give gas connections in the village? And they urge to connect gas for the affected community.

They have no specific idea about whether any negative impact due gas transmission project in the area. Many wild bird have been extinctedand due to diminishing trend of trees.

Highlights and suggestions regarding project are as follows.

- Affected person needs proper compensation
- Well, they will support the project for the greater interest of the country
- Need income restoration training, these may be agriculture, driving, computer etc. Educated suggested computer training
- Expecting gas connection for industrial development in the area
- Compensation before dislocation
- Gas connection for the affected community
- Income restoration support

Attendance:

Serial	Name	Village	Occupation
1	Md. Mostafizur Rahman	Purbo Protimabanki	Teacher
2	Abdul Halim Mondal	,,	Agriculture
3	Abu Bakar	,,	Business
4	Abu Jaar Sarker	,,	Business
5	Zakaria Chowdhuri	,,	Service
6	Hasan Jamil	,,	Agriculture
7	Nowsher Ali	,,	Business
8	Abdul Hamid Pramanik	,,	Wood Business
9	Jabed Bhuyan	,,	Agriculture

FGD No-4.Place of Meeting: AzugiChala; Village: Azugi Chala; Union: Gazipur; Upazila: Sripur; District: Gazipur, Date:-8.12.2013, Time:-11AM

Population of the village is about 2000 nos. Household no is about 300. Major occupation of the village is agriculture, about 45% and agriculture labor is 5%.Other than agriculture most of the inhabitants work in the transport sector. They drive CNG auto rickshaw, rickshaw van. Occupation in the transport sector is about 25%. Small business 5% and unemployed is 15%. Remittance earner is about 5%. 12 workers lives in abroad.Land ownership pattern are not good. 60% households have only homestead land only but economic condition is not bad. Education rate is about 60%. Rich household-5%,middle class 40% and lower middle class-30%, unemployed-20%,vulnerable-5%.Two handicapped live in the village.

Regarding project following suggestion have been given in the meeting.

- Equitable compensation is to be ensued for the affected
- Hassle free compensation, earlier they had to pay bribe in the DC office regarding payment; they expect GTCL will help them in getting proper and direct payment to the people
- Direct payment to the affected without intermediary support
- Extra compensation of fruit bearing trees



Photo:Affected Banana Grooves of Md. Abdul Gafur
Village:Shailat;Mouza: Shailat; Union :Gazipur; Upazila: Sripur; District:Gazipur

Attendance:

Serial	Name	Azugichala	Occupation
1	Md. Nazrul Islam	,,	Teacher
2	Hasan Ali Sarker	,,	Business
3	Alif Howlader	,,	Agriculture
4	Naim uddin Bepari	,,	Business
5	Dildar Ali	,,	Agriculture
6	Md.Zakir Hossain	,,	Agriculture
7	Mostafa Mia	,,	Business

FGD No-5 Place of Meeting: Protimabanik; Village: Protimabanik ; Union: Dariapur; Upazila: Shakhipur; District: Tangail, Date:-14.1.14, Time:3.PM



Photo:Affected Agriculture land,

Village: Purbo Protimabanki; Mouza: Protimabanki; Union: Dariapur; Upazila: Sakhipur; District: Tangail

Summary of FGD;

Population: 2,000. Household: 400. Mainly agriculture is the occupation. 40% are engaged in agriculture, 30% are engaged in different types of business. 15% are service holders, 5% living abroad and 10% daily labor. Rate of education is about 60

Highlights of Public consultation

1. Proper Compensation
2. Project Authority should manage alternative land
3. Project will damage their livelihood
4. To provide job for the affected
5. Concern of being landless
6. Supply gas to affected community pure

Attendance:

Serial	Name	Village	Occupation
1	Zulhash Mian	PurboProtimabanki	Agriculture
2	Shafique	„	Grocery Shop
3	Abul Kalam	„	Agriculture
4	Mostafa	„	Service
5	Mozammel Hossan	„	Social Worker
6	Nazmul Hossan Mobile:01754123351	„	Business
7	Razzaque Ali	„	Agriculture

FGD No-6 Place of Meeting: Pouzan Bazar; Village: Pouzan ; Upazila: Kalihati; District: Tangail,
Date:15.1.2014, Time:-11AM



Photo:FGD meeting; Place: Pouzan Bazar; Village: Pouzan;Mouza: POuzan;
Union:Shahadebpur; Upazila: Kalihati; District:Tangail

Summary highlights of the meeting:

Population of the village is 2000 and household number is 400. Education rate is 50%. Educational institution: Primary school -1; Madrasha-1. Religious Institution: Mosque-1. Community health centre-1. Of the population Muslim-80% and Hindu-20%. 70% household is dependent on agriculture. 25% population depend on diversified occupation and 5% living abroad as remittance earner. The village is well communicated. So, economic condition is comparatively good. Monthly income range of the household, Tk5000 to Tk10, 000 is about 70%, Tk10, 000 to Tk20, 000 is about 15%, Tk.20, 000 to 50,000 is about 10%, 5% is above the Tk50, 000 monthly. In the village there is market. So, some are engaged with business. In addition to that, due to market facility marketing of agricultural is comparatively easy.

Source of drinking water is TW and it is free of arsenic. According to the participant no negative impact of the project and they support it. But they want proper compensation and resettlement for the project affected persons. Land price is high. Price of agriculture land is Tk.around 40, 000 per decimal(0.01acre). High and roadside land price is Tk.100, 000 per decimal and in case of commercial importance it is Tk2, 00,000 to 4, 00,000 per decimal. The participants urged GTCL authority following suggestions,

- Gas connection for the affected and host community
- Gas connection will be environmental development and will saving forest resource
- Proper compensation for the PAPs
- Proper Compensation
- Project Authority should manage alternative land
- Project will damage their livelihood
- To provide job for the affected
- Concern of being landless
- Supply gas to affected community

Attendance:

Serial	Name	Village	Occupation
1	Monsur Rahim 01721771843	Pouzan	Business
2	Shafiqul Islam 01719559322;01719559322	”	”
3	Nurujzaman Manik 01761532986	”	”
4	Abdul Quddus 01759167059	Mondail	”
5	Abdul Kader 01742892042	”	”
6	M.H Kabir 01786529828	”	
7	Mominul Islam	”	Remittance earner
8	Md. Shahjahan	”	Agriculture
9	Shekh Farid	Poujan	”
10	Md. Hyder Ali	Baningpur	Retired
11	Ali Asgar	Poujan	Business
12	Md Rafiq	mondail	”

FGD No-7. Place of Meeting: Ratanganj; Village: Nagbari ; Upazila: Kalihati; District: Tangail, Date:17.1.2014, Time:-11AM



Participants of FGD meeting, Place:Ratan Bazar Muktijodha Sangsad,; Among the participants local stakeholders , businessmen and political leaders are present; AL leader Mr. Nur Alam and Grameen Bank manager were also present. Village:Ratanganj;Mouza: Ratanganj; Union:Nagbari; Upazila:Kalihati; District:Tangail

Summary highlights of the meeting:

The village located near the Bangshai river of Kalihati sub district. Though the village is a remote village of the Kalihati upazila the village is comparatively developed. This is the main centre of 'Tangail Sari' which nationally and internationally. Ratanganj is the second production centre of Tangail Sari. About 30,000 migrant worker in this area. Traditional handloom is the main sources of the economy.A large section of the people are living abroad as remittance earner. The population of the village is about 10,000. Household is about 2,000.Educational institution: Primary School-1, Kindergarten-3, Junior High School-1; Religious Institution: Mosque-5 nos, temple-4 nos, Fish culture is an important occupation. About two hundred people are engaged in fish culture.

Wage of the handloom are vary Tk500 to 1200 per day depends on productivity.Duringg eid festival handloom worker earns more. Minimum wages is between is Tk.300 to 500 per day. Income of van driver is Tk.500 per day. Main income source is handloom and second is foreign remittance.15% of workforce is living in abroad. Minimum income of remittance is tk.20, 000. No unemployment is in the village. Monthly income upto Tk.10,000 is income is 50% household of the village.20% household earns around Tk.20,000 monthly.15% remittance earner, 10% household earn Tk.50,000 monthly.5% household earner monthly1,00,000 .



Photo:Affected Poultry Farm of Md. Rafiqul Islam

Village: Bir Pakutia; Mouza : Pakutia, Union : Nagbari, Upazila: Kalihati; District:Tangail.

Education rate is 80% in the area. The village is educated. 95% women are housewife. No gender discrimination is in the area. Agriculture is developed in the area. Three crops are Aman, Oilseeds and HYV paddy as cropping pattern. Price of agriculture land 35,000 per decimal, commercial land tk.1, 00,000 per decimal to3, 00,000 per decimal.



Photo: Paddy field of affected area,

Village:Pakutia; Mouza: Pakutia;Union: Nagabari ;Upazila : Kalihati ; District : Tangail

Suggestions from the participants,

- In handloom per month fuel charge 1 lakh(1,00,000) per handloom factory for dying and other price, but gas connection reduce fuel cost largely
- Proper Compensation
- Project will damage their livelihood
- To provide job for the affected
- Concern of being landless
- Supply gas to affected community
- Timely payment of compensation
- Income generating training

Attendance:

Serial	Name	Village	Occupation
1	Anwar Hossain 01797251105	kalihati	Business
2	Dewar Hossain	Thurbari	”
3	Md. Lebu Sawdogar 01716219050	Ratonganj	”
4	Sudev Shaha 0174622955	Gonobari	”
5	Indrojit Kormoker 01713742927	Rotonganj	”
6	Jontu Shaha 01713535403	”	”
7	Md. Fazlur Rahman	”	”
8	Md. Nur Alam 01710894255	Shomjani	”
9	Md. Bacchu Mia 017712522691	Rotonganj	Agriculture
10	Md. Nur Islam	”	”
11	Md. Mosharrif 017884753952	”	Business
12	Sudonna Sutrador 01741229548	”	Carpenter
13	Md. Lat Mia 017160981	”	Business
14	Baghabat Kormoker 01770662165	Shumjani	”
15	Ashish Shaha 017125976686	Rotonganj	”

FGD No-8. Place of Meeting: Kukdahra; Village: Kukdahra ; Union: Bukdahra Upazila: Kalihati; District: Tangail, Date:17.1.2014, Time:-3PM



Participants of FGD meeting, Place:Kokdahara Bazar,, Concerned union Md.Farhad Hossain
Chairman Kokdahara UP were present in the meeting
Village:kukdahara;Mouza:bukdahra; Union:Bukdahra:UpazilaKalihati; DistrictTangail

Kukdahara also an industrial belt, is important for handloom and comparatively solvent area. Population-3000, Household is about 600. Both Hindu and Muslim reside in the village. Most household are linked with handloom occupation. There are three mosques and three temples in the village. Muslim Population is 60% and Hindu population is 40%. Education facilities: primary school-1, Madrasha-1, Kindergarten-2.

Cropping pattern in the village is 3 crops in a year. HYV Aman, Boro and oilseeds. wage of agriculture labor is 400 taka per day. In the handloom factory, weaver mainly works on daily basis.. Their wages is paid on the basis of productivity. They earn per day Tk500 to 1000 per day. Kukdahara bazar locates in the village. Most of the household are related business. No of Wage earners and living in the abroad is about 5%.Rate of unemployment is 10%.

Income range within Tk 5,000 is 10%, between Tk 5,000 to 10,000 is 60%, 10,000 to 20,000 is 25%, 20,000 to 50,000 is 5%.

The area is well communicated, so they take health service from upazila and district hospital.

There is no social conflict in the village. Women are commonly engaged in household work.

Tube well water is the main source of drinking water. No major disease in the village.

Agriculture land price is between 30,000 to 35,000 per decimal but high, roadside and commercial area prices is Tk.2,00,000 to 3,00,000 per decimal.



Photo: Affected household Structure of Humayun Kabir,
Village : Mohish jora; Mouza: Mohishjora, Union: Bukdahara: Upazila: Kalihati; District: Tangail

Project Impact and suggestions

1. No negative impact of the project except land acquisition. They need proper compensation and gas connection to the locality.
2. Compensation upto market price
3. Poor and vulnerable need special support
4. Job facilities in GTCL
5. Contractors must use local labor
6. Road should be rehabilitated

Attendance:

Serial	Name	Village	Occupation
1	Md. Ajgor Ali 01733296630	Kukdahra	Business
2	Bashudeb banik 01717898139	''	''
3	Ajhar Ali 017688711010	''	Handloom Business
4	Nizam uddin	''	Electrician
5	Shubash Banik	''	Business
6	Hamidur rahman 01725500457	Badda	''
7	Akram Ali 01725210609	Kukdahra	''
8	Belayet Hossain 01732016571	''	''
9	Saiful Islam 01735906568	''	''
10	Fazlu Mian	''	''

Serial	Name	Village	Occupation
	01728595602		
11	Ramkrishna 01913013824	''	''
12	Abdul Baset	''	''
13	Shahinoor Mia	''	''
14	Montosh Sarker	''	''
15	Sambhu Nath Banik 01915100271	''	''

FGD No-9. Place of Meeting: Balla Bazar; Village: Balla ; Union:Balla Upazila: Kalihati; District: Tangail, Date:18.1.2014, Time:-11AM



Photo:Participants of FGD meeting, Place:Balla Bazar AL office, Among the participants local stakeholders , businessmen and political leaders are present; Village:Balla;Mouza: Balla; Union:Nagbari; Upazila:Kalihati; District:Tangail.

Balla also a handloom village.Populaton-10,000, Household is about 2000.Both Hindu and Muslim reside in the village with communal harmony. Most household are linked with handloom occupation. There are 3 mosques and 2 temples in the village. There is a historical mosque 'Adina Mosque' located here. But there is no impact of the project on it from the project. Muslim Population is 70% and Hindu population is 30%. Education facilities: primary school-2, Madrasha-1, Kindergarten-2. High schoo-2.Recently a textile college has been established here and office of Textile board established with cost of 100 million taka.

Both agriculture and handloom are the economic activities of the village. Average income of the poor is Tk500 per day. Cropping pattern in the village is 3 crops in a year. HYV Aman, Boro and oilseeds. Paddy production per bigha is 30 maund. Here, as Rabi(winter vegetables and oilseed) crop mustard is largely cultivated.

Wage of agriculture labor is 400 taka per day. In the handloom factory, weaver mainly works on daily basis. Their wages is paid on the basis of productivity. They earn per day Tk500 to 1000

per day. No of Wage earners and living in the abroad is about 10%.Rate of unemployment is 10%.

Income range between Tk 5,000 to 10,000 is 60%, 10,000 to 20,000 is 20%, 20,000 to 50,000 is 10% and Tk.10,000 to 1,00,000 is 10%.

The population of the area is roughly 10,000 but they have employed at least 15,000 migrated handloom worker. It is very interesting. Also the whole union is famous for handloom. If gas connection is available, the area will be business hub for the area and more and more migrant worker will get job in the area.

The area is well communicated, village road are pucca. So, they take health service from upazila and district hospital.

There is no social conflict in the village. Women are commonly engaged in household work. Tube well water is the main source of drinking water. No major disease in the village.

Agriculture land price is between 50,000 per decimal but high , roadside and commercial area prices is Tk 3,00,000-7,00,000 per decimal especially in case handloom commercial area.



Photo:Handloom in the affected village is weaving famous Tangail Sari, Village Bir Pakutia; Mouza:Pakutia; Union Nagkari; Upazila Kalihati; District: Tangail

Project Impact

- No negative impact of the project except land acquisition is reported from the participants. They need proper compensation and gas connection to the locality.
- There is fuel wood problem in the village, so gas connection is indispensable. As a affected community, they are entitled for gas connection. On the other hand handloom industry will be highly benefited if gas is connected. For dying purpose gas fuel is very helpful and cost effective. The quality of 'Sari' will be increased. So, export and income will be increased.

Attendance:

Serial	Name	Village	Occupation
1	Ahmad Ali 01721684071	Balla	Business
2	Minhaj 01716306576	''	''
3	Md. Abul Kalam 0176916799	''	Teacher
4	Md. Bakul Ahmed	Momingar	Business
5	Najir Hossain 01751668413	Balla	Business
6	Shahjahan Mian	''	''
7	Hasnat Ali 01929607471	''	Agriculture
8	Azhar Ali	''	''
9	Ali Hossain 01746045151	''	''

FGD:10, Place of Meeting: Baldi; Village: Baldi ; Union:Kudhahra Upazila: Kalihati; District: Tangail, Date:19.1.2014, Time:-11AM



Photo:FGD meeting;Meeting Place:Baldi Bazar Madrsha Premises;
Village:Baldi;Mouza:Baldi;Union: Kukdahra;Upazila:kalihati;Dist Tangail

Summary of FGD:

Population:5000

Household No:1000. Education rate:50% and there is a primary school and one madrasha are located in the village

Most of the people are farmer. sf the people are living abroad about 10%. Both hindu and Mulim live in the village.Muslim;60%, Hindu-40%. In the villge there is a market nmed Baldi bazar.

Project Impact

- No negative impact of the project except land acquisition
- They need proper compensation
- gas connection for PAPS
- There is fuel wood problem in the village, so gas connection is indispensable.

Attendance:

Serial	Name	Village	Occupation
1	Hazi Abu bakar Sikder 01715867317	Baldi	Social Work
2	Hafez Md Hafizur Rahman 01727623575	„	Teacher
3	Amir Hossan	„	Agriculture
4	Yad Ali	„	„
5	Nowsher Ali	„	Business
6	Moyezuddin	„	Daily labor
7	Syed Ali	„	Teacher
8	Alam Sikder	„	Driver
9	Md. Azhar Ali	„	Business
10	Mostafa kamal	„	Service
11	Zakir Hossan	„	Masson
12	Fahad Hossan 01712231132	Pooshna	Kokdahara UP Chairman

Annex-4
Survey Questionnaire

Resettlement Related Questionnaire

Proponent: Gas Transmission Company Ltd. (GTCL)

Study Team: BETS Consulting Services Ltd.

Dhanua-Elenga Sector Gas Transmission Project

Note:

1. Only for Project Affected Person (PAP) along the pipeline right of way of the Dhanua-Elenga Sector Gas Transmission Pipeline Project
2. All to be resettled household heads will be interviewed for resettlement survey
3. One third of the agriculture land loser will be under sample survey.
4. All Squatters will be under survey, both public land and private land
5. Share cropper will be under survey
6. Employees of the business and factory will have to be covered
7. If any community structure is affected and its owner is required to be interviewed, in that case concerned committee of the community will be interviewed.

Questionnaire No:

A. Description of the Household/Roster

101. Name of the Affected person:			
102. Father's Name:			
103. Name of the respondent:			
Question	Code:	Answer	
104. Respondent's Relation to the affected person:	1=Household head 2=Husband/Wife 3=Father/Mother 4=Brother/Sister 5=Daughter in Law/Son in Law 6=Father in Law/ Mother in Law 7=Maid servant 8=Grand son/Grand daughter 9= Other		
105. Village:			
106. Mouza:			
107. Union:			
108. Upazila:			
109. District:			
110. Name of the affected mouza:			
111. Plot No:			

Questionnaire: PAP

Question	Code	Answer
112. Type of Respondents	1= Living in the acquired land 2= Living in the requisitioned land 3=Absentee Land owner/Living outside the acquired land 4=Living near the ROW	
113. Type of respondents regarding vulnerability	1=Women headed households 2=Ethnic minority 3=Indigenous people 4= Physically handicapped 5=Squatter 6=Others	
114. Type of Affected Land	1=Permanent Land loser(Acquisition) 2=Temporary Land loser(Requisition) 3=Both Permanent and Temporary land loser	
115. Type of Loss (Structure)	1= Full Loss 2= Partial Loss	
116. Type of Loss (Home stead Land)	1= Full Loss 2= Partial Loss	
117. Type of Loss (Agriculture Land)	1=Land under Rabi crop 2= Boro Crop 3=Aus 4=Aman 5=Fallow land 6=Others	
118. Loss of trees	1=Fruit 2=Timber 3=Both type 4=Others	
119. Loss of Business	1=Tea stall 2=Grocery shop 3=Medicine shop 4=Rice mill 5=Factory 6= Poultry firm 7=Others	
120. Loss of water bodies	1=Pond 2= Pond with aquaculture 3=Open water low lying area	
121. Only share Cropper	1=Land cultivated below 1 acre 2=Land cultivated between 1 acre to 2 acre 3=Land cultivated above 2 acre	
122. Others /Squatter	1=On relative's land 2=On Govt. Land 3=Others	

B. Socio Economic Issues

Question	Code	Answer
123. Religion	1= Muslim, 2= Hindu 3= Christian 4= Buddhist 5= Others	

Questionnaire: PAP

Information of Households

124. Total Family Members:	Male	Female	Total

125. Family Information (Starting from Family Head), please use code

SL	Relation with Household Head	Marital Status	Age	Sex	Education	Main Occupation	Secondary Occupation	Work Place
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Code

Relation:

Household Head = 1
 Husband/Wife = 2
 Father/Mother = 3
 Brother/Sister = 4
 Daughter in Law/Son in Law = 5
 Father in Law/ Mother in Law = 6
 Maid servant = 7
 Grand son/Grand daughter = 8

Marital Status:

Married = 1
 Unmarried = 2
 Widow = 3
 Widower = 4
 Divorced = 5 Separated = 5
 Others = 6

Sex:

Male = 1
 Female = 2

Education:

Illiterate = 1
 Only Read = 2
 Read and write = 3
 Child (below four yrs) = 4
 Primary=(class-1 to class 5) = 5
 Secondary (class-6 to class 10) = 6
 SSC/ Equivalent = 7
 HSC/Equivalent = 8
 Degree = 9
 Masters, Honors = 10
 Others = 11

Occupation:

Farmer = 1
 Fisherman = 2
 Agriculture Labor = 3
 Non Agriculture Labor = 4
 Service = 5
 Small Business = 6
 Household Work = 7
 Student = 8
 Child = 9
 Retired/Handicapped = 10
 Unemployed = 11
 Service in Abroad = 12
 Others = 13

Work Place:

Village = 1
 Union = 2
 Upazila = 3
 District = 4
 Other district = 5
 Abroad = 6

Questionnaire: PAP

Serial	Name	No.
9	Cycle	
10	Motor Cycle	
11	Car	
12	Cart/Nasimon/Auto-rickshaw	
13	Others-----	

D. Water Supply and Sanitation

135. Water Source (please Tick):

Type of use	STW	DTW	Water Supply	Well	Pond	Canal/River (Mention Name)
Drinking						
Cooking/Washing						
Bathing						
Cattle/Goat Washing						

Question	Code	Answer
136. Do you have own TW?	1=Yes 2=No	
137. If yes, Condition of TW	1=working 2= Out of order	
138. Do your TW free of Arsenic?	1=Yes 2= No 3=Not Examined	
139. If No, How far is the nearest TW from your house? (ft.)		
138. Do your TW free of Arsenic?	1=Yes 2= No 3=Not Examined	
141. Type of latrine?	1=Sanitary 2=Pit 3=Hanging 4=Open Place 5=Others	
142. Hand washing after toilet use?	1=Only water 2=Soap 3=Ash 4=Soil 5=Others	

E. Health Information:

Disease suffered you and your Family in Last 2 Years

Question	Code	Answer
143. Name of disease	1=Diarrhea 2=Typhoid 3= Dysentery/ Gastroenteritis 4= Jaundice 5= Skin disease 6= Tetanus 7=TB 8= Pneumonia 9= Asthma 10=others	
144. Type of treatment	1=Herbal 2=Homoeopathy, 3=Village doctor/Pharmacy, 4=MBBS+, 5=No treatment, 6=No ability 7=Unknown, 8= other	
145. Health Facilities in the area	1=Government Hospital 2=Union health complex 3=Good doctor 4=Private clinic 5=NGO clinic 6=Good pharmacy 7=Village doctor 8=Others	

F. Agriculture Related Information

146. Last year Cultivated

Sl. No.	Name of Crop	Area of Land (Decimals)	Product ion(kg)	Price/ Kg (BDT)	Sl. No.	Name of Crop	Area of Land (Decimals)	Producti on(kg)	Price/ Kg (BDT)
1	T. Aman				11	Chili			
2	B. Aman				12	Dhania			
3	Aus HYV				13	Turmeric			
4	HYV Boro				14	Zinger			
5	Jute				15	Sugarcane			
6	Potato				16	Mustard			
7	Sweet Potato				17	Nut			
8	Pulse				18	Betel Nut			
9	Onion				19	Others			
10	Garlic								

Note: T. Aman- Transplanted Aman;B. Aman- Broadcasting Aman;HYV- High Yielding Variety ;Aman- Planted in late monsoon and harvested in winter; Boro- cultivated in late winter and harvested in Summer: Aus – cultivated in summer and harvested in monsoon

Question	Code	Answer
147. Type of Farmer	1=Cultivation own land 2=Own and other's land 3= Only owner of land 4=Share cropper 5=Squatter	

148. Mention land use terms and conditions in practice in your area e.g. in cases of rent, mortgage, share cropping etc.:

G. Trees/Garden

151. Trees owned

Sl.	Name of the Trees	Qty	Sl.	Name of the Trees	Qty	Sl. No.	Name of the Trees	Qty	Sl.	Name of the Trees	Qty
1.	Kola		7.	Peara		13.	Boroi		19.	Lebo	
2.	Kathal		8.	Kalojum		14.	Sofeda		20.	Komla	
3.	Aam		9.	Jambora		15.	Amloky		21.	Apel	
4.	Lichu		10.	Bel		16.	Dalim		22.	Others	
5.	Pepe		11.	Katbel		17.	Chalta		24.		
6.	Narkel		12.	Ata		18.	Kamranga		25.		

Questionnaire: PAP

151a. Price of trees (permanent/temporary) in the affected land

Name of Tree	Big size (no.)	Approximate price (Tk)	Middle size (no.)	Approximate price (Tk)	Small size (no.)	Approximate price (Tk)

H. Vegetables cultivated (Use tick mark)

152. Vegetables

Sl.	Name of vegetables	Sl.	Name of vegetables	Sl.	Name of vegetables
1.	Lau	10.	Dondal	19.	Barbati
2.	Komra	11.	Puishak	20.	Kakrul
3.	Misti komra	12.	Lalshak	21.	Tomato
4.	Data	13.	Sagina	22.	Fulcapi
5.	Redice	14.	Arhar	23.	Badacapi
6.	Benjil	15.	Darash	24.	Karala
7.	Patal	16.	Olcapi	25.	Shalgam
8.	Jinga	17.	Sosha	26.	Kachu
9.	Chicinga	18.	Shim	27.	Ostra

I. Economic Information

153. No of Income earning member in the family:	Male	Female	Total

154. Monthly Average Income of the Family (Tk)	
155. Monthly Expenditure of the Family (Tk)	
156. Last year loan interest (Tick)	1=Yes 2=No
157. Last year loan received if any (Tk)	
158. Source (Tick)	1= Bank 2=NGO/Other
159. Total Family Loan (Tk)	

J. Description of fish culture?

160. Fish culture in the affected land

Name of the Fish	Qty	Rate/kg/BDT

161. Water body fish culture (tick)	1= Paddy Field:	2=Pond
162. Fish culture area (decimal)	(i) Paddy Field:	(ii) Pond:

Questionnaire: PAP

162a. Amount of loss for fish culture (Tk)	
162b. In case of poultry firm no of poultry bird:	
162c. Total loss of poultry bird in (Tk)	

163. Type of Fishes in your area:
164. Endangered fish varieties:
165. Extinct fish varieties:
166. Exotic fish varieties:

167. Type of Fishes in your area (tick)	1=Ruhi 2=Katla 3=Boal 4= Shoal 5= Telapia 6=Singhi 7=Magur 8= Fry 9=Other
178. Type of affected land	1=Cultivated 2=Uncultivated land 3=Abandoned /fallow
179. Plot no: (Number)	
180. Mouza: (Number)	
181. Land category (tick)	1=Homestead 2=Agriculture 3=Water body 4=Commercial 5= Khas 6=Structure 7= Business 8=Others

K. 182. Type of affected land and land ownership

Type of Loss	Area of Land Owned (decimal)	Affected Land (decimal)	Price/ decimal (Tk)	Permanent Loss (decimal)	Temporary Loss (decimal)
a) Homestead land					
b) Agriculture land					
c) Water body					
d) Fallow land					
e) Total land (decimal)					

183. If the land is not cultivated by the owner, please mention name of the sharecropper and his address

SL.No.	Name and Fathers Name	Address
1		
2		
3		

Questionnaire: PAP

185. Description of affected structure (permanent/temporary)	Length(ft)	Width (ft)	Value(tk)
186. Type of affected floor (tick)	1=Thatched 3=RCC(Pucca/ Concrete) 5=Combination of	2=Tin 4=Mud	
187. Type of affected wall (tick)	1=Thatched 3=RCC(Pucca/ Concrete) 5=Combination of	2=Tin 4=Mud	
188. Type of affected roof (tick)	1=Thatched 3=RCC(Pucca/ Concrete) 5=Combination of	2=Tin 4=Mud	
189. Structure constructed (year)			
190. Type of Business:			
191. Daily loss of income/Business (Tk):			
192. Total Amount (Tk):			

193. Type of loss (tick)	1=Permanent 2=Temporary
194. Type of crops affected (permanent/temporary) (tick)	1=Paddy local 2= Paddy HYV 3= Wheat 4=Pulse 5=Vegetable 6= Maize 7=Others
195. Affected crop area: (acre)	
196. Total amount of crop (Tk)	
197. Variety Paddy Cultivated:	
198. Type of damaged land (tick)	1=Single crop 2=Double crop 3=Triple crop
199. Type of crop rotation:	
200. Area of affected pond/ Water bodies (decimal)	
201. Fish Culture in the Affected Pond:	

Questionnaire: PAP

202. What kind of compensation is preferable?(tick)	1=Alternative Land 2=Compensation in cash 3=Others
203. In case of job loss for commercial business what sorts of support do you need:	
204. In case of share cropper what support do you need?	
205. Compensation Process/Mode of Payment (tick)	1=By NGO 2= Directly from DC office 3=Directly by executing agency 4= Others
206. Do you need training and assistance for income restoration?	1=Yes 2=No
207. Name of training (tick)	1=Beef Fattening 2=Agriculture training 3=Handicrafts 4=Computer 5=Driving 6=Others
208. Other assistance (tick)	1=Micro credit 2= Marketing support in case of handicraft and agriculture production 3= Community support for host community
209. Do you think you may face problems about gas pipeline (tick)	1=Yes 2=No
210. If yes what kinds of problems?	1=PAP may not be resettled properly 2=Harassment from DC Office 3=Damaged road may not be repaired 4=others
211 Is there any litigation about acquired/ to be acquired land?	1=Yes 2=No
212. If yes, what type?	

L. Community Related Questions:

213. Do you think community property will be affected by the project in your area?	1=Yes 2=No
214. If yes, type of Community Property affected (tick)	1=Forest 2=Park 3=Mosque/ Eidgah/Temple/ Church 4=play ground 5=Graveyard 6= Archeological Site/ Cultural Heritage 7=Road 8= Health centre 9=Source of drinking water 10=Irrigation canal 11= Educational Institution 12=Others

Questionnaire: PAP

215. Area (sq. feet)	a) Length (ft):	
	b) Width(ft):	
216. Other Property will be Affected	(Numbers)	
	a) Well:	
	b) Tube well:	
	c) Govt. land (decimal):	
	d) Pond	
	e) Others	
217. Amount of loss (taka)		

M. About Project

218. Do you know transmission pipeline is likely to cross your land?	1=Yes	2=No
What is your Comment, if any?		
219. Would you like to co-operate during construction of the pipeline project?	1=Yes	2=No
220. Is support relating to any condition, Types of condition (If conditions apply?)	1= appropriate compensation provided 2= It is short time based 3=Houses are not affected 4=land for land provided 5=Alternative house provide 6=Other support	
221. Do you have suggestions about the project	1=Yes	2=No
222. Do you have any suggestion regarding project?	1=Construction should be completed during dry season 2=No eviction before compensation 3=Damaged road is to be repaired by GTCL 4=Providing transfer and construction grant 5=Income restoration allowance for productive land and business 6=CSR support for host and affected areas 7=Preferring local affected people in the construction work 8=Providing suitable job for affected and local people 9=Gender guideline for construction Company 10=Include five year fruit value for fruit bearing tree	

Questionnaire: PAP

	11= Three months income restoration allowance for vulnerable/handicapped and squatters 12= Others...
--	---

N. Observation of Member Survey Team:

223. Economic condition of house hold	1=Ultra Poor 2= Poor 3= Middle class 4= Rich
224. Level of awareness of respondent	1= Good 2= Poor 3= Bad
225. Location respondent's residence	1= Within 50meter of Row 2= Between 51m to Quarter Km 3= Quarter to half Km 4= Half Km to 1 Km 5= More than 1 Km
226. Respondent's social network	1= Good 2= Poor 3= Bad

Name of Field Investigator:

Signature: _____ **Date:** _____

Mobile No.: _____

Annex-5
Terms of Reference (TOR)

**Preparatory Survey
On
The Natural Gas Efficiency Project in the Peoples Republic of Bangladesh**

**TERMS OF REFERENCE (TOR)
FOR
EIA AND/OR ARAP UPDATE STUDY ON SELECTED GAS
TRANSMISSION PIPELINES PROJECTS OF GTCL**

1. OBJECTIVE AND TARGET PROJECTS

Objective of the EIA (environmental impact assessment) and/or ARAP (abbreviated resettlement action plan) Study is to formulate relevant updated EIA and /or ARAP reports on a draft basis for the construction of gas transmission pipelines selected for potential JICA finance. GTCL (Gas Transmission Company Limited) will be the executing agency of the project. The draft Update EIA/ARAP reports will be formulated as appropriate so as to meet the requirement of environmental clearance of DoE (Department of Environment) of Bangladesh and also to conform to the guidelines for environmental and social considerations of JICA (2010). The term ARAP implies that potential resettlement requirement of population involved will not be that large in numbers (small-scale resettlement).

There are 2 target transmission pipelines project components and the relevant update work requirement on EIA/ARAP varies according to the target project component as follows:

1. Dauna–Elenga sector gas transmission pipeline of 52 km in length and 30 inch in diameter (Component-1)

For this project component EIA and RAP (as RP) had already been once completed in 2005 and this sector is a sub-component of the originally ADB planned project of “Monohordi-Dhanua-Elenga-East Bank of Jamuna Bridge Gas Transmission Pipeline Project”. As such the work requirement is the update of both the available EIA and RP reports (2005) for the relevant 52 km sector of Dauna-Elenga and hence to formulate updated EIA and ARAP reports.

It is further noted that, in overall, the route of the pipeline would mostly follow the same route as used in available EIA and RP Reports of 2005. The route assumed for the 2005 EIA and RP studies has been reviewed recently (September 2013) by GTCL to confirm its suitability under present condition with focus on any possible minimization of resettlement requirement. As the result of review realignment of the originally planned ROW (2005) in some places along the initial 32 km sector of the

ROW located between Dhanua and Sulgrampur was made so as to minimize resettlement requirement. Such reviewed route survey data will be obtained by the Consultant from GTCL and used for the update studies as appropriate (EIA/ARAP).

2. West Bank of Jamuna Bridge–Nalka sector gas transmission pipeline of 14 km in length and 30 inch in diameter (Component-2)

For this project component also, similar to Component-1 of above, EIA and RAP (as RP) had already been once completed in 2005 and this sector is a sub-component of the originally ADB planned project of “West bank of Jamuna Bridge-Nalka-Hatikumrul-Ishwardi-Bheramara Gas Transmission Pipeline Project”. Still for this project component work requirement will be limited to the update of the available EIA report (2005) for the relevant 14 km sector of West Bank of Jamuna Bridge–Nalka and hence to formulate updated EIA only since no private sector related land acquisition (land belongs to Jamuna Bridge Authority only) or resettlement is required as the pipeline will be installed along the ROW of existing pipeline route located by the side of the road to Nalka

In summary work requirement of each of the 2 project component is as follows:

- Component-1 : Formulation of updated EIA and ARAP Reports (2 study reports)
- Component-2 : Formulation of updated EIA Report only (1 study report)

2. STUDY METHODOLOGY

2.1 Introduction

The EIA/ARAP Update Study as appropriate for the target 2 components of gas transmission pipeline projects would initially review the available relevant EIA/RP reports as mentioned under item 1 of above. Based on the review additional data collection works would be conducted so as to update the baseline environmental and social condition to current status as the most significant work requirement. With the utilization of duly updated baseline data along with updated legal and regulatory requirements the updated EIA and ARAP Reports will be formulated following the similar format and contents as the available EIA and RP reports of 2005.

The consultant of this contract will maintain effective co-ordination with both the JICA Study Team and GTCL since these update EIA/ARAP studies will be carried out in parallel with the conduct of technical study by the JICA Study Team as preparatory survey on natural gas efficiency project in Bangladesh.

2.2 Data Collection

2.2.1 Secondary Data

In principle available secondary data will be utilized for the maximum possible extent to define and update the baseline natural, ecological, soil, water and ambient environmental condition (non-social environmental condition) for both the projects targeted for the formulation of updated EIA Reports. The available EIA Reports of 2005 will form the basis for determining the additional data collection work requirement so as to arrive at updated baseline non-social environmental condition and hence also to account for any recent historical changes since 2005.

2.2.2 Primary Data

In principle primary data collection work will be confined to social aspects concerned to public perception and related resettlement and asset compensation aspects for the ARAP and hence most relevant to updated ARAP studies for Component-1. Social survey would principally focus on direct interview survey targeting all population identified for resettlement (Component-1) and also public consultation following similar method used in the available EIA study reports (FGD/focus group discussion method) and required for both the 2 update EIA studies of project components 1 and 2.

(1) Social survey

On average 25 number households for each of the 2 project components (in total 50 number households) are considered as adequate for social survey. In this respect it is presumed that resettlement households will not exceed 25 for the relevant project Component-1. It is noted that there is no land acquisition or resettlement requirement for project Component-2 targeted for update EIA study only. All households targeted for resettlement (Component-1) will be covered by the social survey. Other households will be selected based on potential for land acquisition either temporary or permanent. When these requirements are not sufficient or invalid (this is the case for project Component-2 since there is no privately owned land acquisition or resettlement requirement) then population living in the vicinity of the pipeline route will be selected as target for social survey. Social survey will be carried out with direct questionnaire based interview survey with head of household (or prime member of household).

The questionnaire for direct interview survey would be composed of 2 parts as follows:

Part-1 of the questionnaire will be focused on public perception of the project by people living in the vicinity of each of the 2 target project components that would also incorporate social indicators of household population composition, housing condition including sanitation/public health, utilities like piped water supply, sewerage, electricity and gas supply service, occupation and income level

and others. This part will cover the entire population targeted for the social survey.

Part-2 of the questionnaire will be focused on potential resettlement and/or asset compensation aspects consequent to the implementation of the project on update ARAP (Component-1 only) and will be entirely focused on population having potential for resettlement and or asset compensation and hence could be considered as people directly affected by the project. This questionnaire survey will be formulated and conducted so as to determine affected people preference on type of compensation and related aspects and also to determine the value of housing and related assets so as to determine the amount of compensation and hence to formulate the updated ARAP Report for Component-1.

3. REPORTING OF UPDATED EIA/ARAP

The Consultant (Update EIA/ARAP Team) shall submit the following reports to JICA Study Team at the designated time in both hard copy (one each for each of the 3 Update EIA and ARAP studies) and electronic file form (in CD). The total time frame for the completion of the Update EIA/ARAP Study is 3.5 months.

- (1) Interim Update EIA Report and ARAP Report (in English, 1 hard copy for each of the 3 update study with total of 3 reports and CD)

Interim Update EIA Report and ARAP Report would incorporate progress and provisional results of surveys/studies, remaining works and issues (if any) and significant provisional findings of the Update EIA/ARAP Study and will be submitted within 1.5 months after commencement of the Study.

- (2) Draft Final Update EIA Report and ARAP Report (in English, 1 hard copy for each of the 3 update study with total of 3 reports and CD)

Draft Final Update EIA Report and ARAP Report for due review and comments by JICA Study Team and related governmental agencies of Bangladesh (GTCL) will be submitted within 3 months after commencement of the study.

- (3) Final Update EIA Report and ARAP Report (in English, 1 hard copy of each of the 3 update study with total of 3 reports and CD)

Final Update EIA Report and ARAP Report shall be prepared based on the comments or suggestions as required by JICA Study Team and related governmental agencies of Bangladesh such as GTCL. Final Update Reports shall be submitted within 2 weeks after receipt of comments on the Draft Final Reports. All records, photographs of field survey, data and relevant unpublished documents collected during the conduct of the Update EIA/ARAP Study shall be submitted along

with this Final Update EIA Report and ARAP Report.

In this regard typical contents of EIA and ARAP Reports are given in the APPENDIX below.

4. STAFFING REQUIREMENT FOR THE UPDATE EIA/ARAP STUDY TEAM

The following specialties (experts) provided by the Consultant will be needed as the prime expertise for the conduct of the Update EIA/ARAP Study. All assigned experts shall conform to the requirement as independent experts with no affiliation to the project proponent (MoPEMR and other natural gas production, transmission and distribution related agencies like BGFCL, GTCL, TGTDC, KGDCL) and other certification and credentials for the conduct of EIA/RAP/ARAP Studies as per any relevant governmental (DoE) regulations of Bangladesh.

- 1) Team Leader / Energy and Environment Expert
- 2) Biologist
- 3) Environment/Water Quality Specialist
- 4) Social Expert(1)
- 5) Social Expert(2)/ARAP Expert

6. OTHER ISSUES

Any other issues concerning the conduct of Update EIA/ARAP Study not mentioned above shall be settled amicably with mutual agreement between JICA Study Team and the Consultant.

APPENDIX

Typical Contents of EIA and ARAP Reports

(a) Typical Content of EIA Report

The EIA Report will be organized based on the following typical format as normally followed in Bangladesh with *Executive Summary* followed with *Main Report* having following typical contents:

- (1) Introduction
 - 1) The objective and scope of the study
 - 2) The relevant laws, regulations and guidelines used in EIA study
 - 3) EIA implementing organization and experts of the team
- (2) Policy, legal and administrative framework, guidelines concerning to environmental, social and EIA/RAP aspects of Bangladesh (Legislative, Regulatory and Policy Considerations), with due focus on natural gas industrial sector
- (3) Description of the Project
- (4) Description of the Baseline Existing Environment
 - 1) Meteorology (temperature, winds, solar radiation and rainfall), Topography and Geology
 - 2) Aquatic and terrestrial biota (fauna and flora) including protected/peculiar areas in and around the project sites, if any
 - 3) Environmental condition of the project sites principally based on ambient environmental aspects such as terrestrial and aquatic ecology, surface water quality and ambient air quality.
 - 4) Basic socioeconomic condition (population, landuse and peculiar features if any) and cultural/historical/archeological treasures around the project sites
- (5) Identification and Evaluation of Potential Environmental and Social Impacts
- (6) Environmental Management and Mitigation Plans and Procedures
 - 1) Management and Mitigating actions at pre-construction stage
 - 2) Management and Mitigating actions at construction stage
 - 3) Management and Mitigating actions at operation (post construction) stage
- (7) Environmental Monitoring Program for Performance Evaluation
- (8) Beneficial Effects
- (9) Institutional Capacity Requirements
- (10) Public Consultation
- (11) Conclusion and Recommendations
- (12) List of references
- (13) Appendices

(b) Typical Content of the ARAP Report

The ARAP Report will be organized based on similar format as for EIA report with *Executive*

Summary followed with *Main Report* having the following contents:

- (1) Introduction (Background, Scope and Objective of Land acquisition and Resettlement)
- (2) Socio-Economic Survey and Data Analysis (Census of project affected persons, ownership and valuation of assets and others)
- (3) Policy and Legal Framework
- (4) Description on compensation, entitlement (with entitlement policy matrix) and other resettlement assistance to be provided so as to facilitate amicable land acquisition and resettlement
- (5) Evaluation of the result of consultation with potentially displaced people about acceptable alternatives on means of compensation, areas of resettlement and other aspects
- (6) Institutional responsibility for implementation of resettlement and the required procedures for grievance redress claims by resettled people (PAPs/project affected persons) in the form of “Institutional and Implementation Framework”
- (7) Proposal on arrangement for resettlement monitoring and implementation including required assistance on job training and assistance on living expense for resettled people
- (8) Tentative timetable and budget as deemed appropriate for the implementation of ARAP
- (9) List of references
- (10) Appendices

