Government of the People's Republic of Bangladesh

GAS TRANSMISSION
COMPANY LIMITED (GTCL)
(A Company of Petrobangla)

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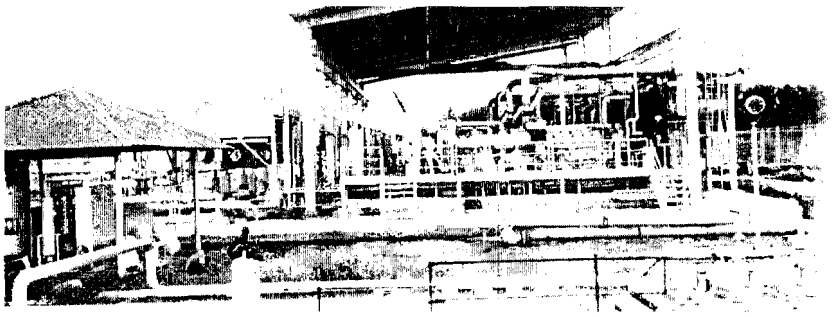
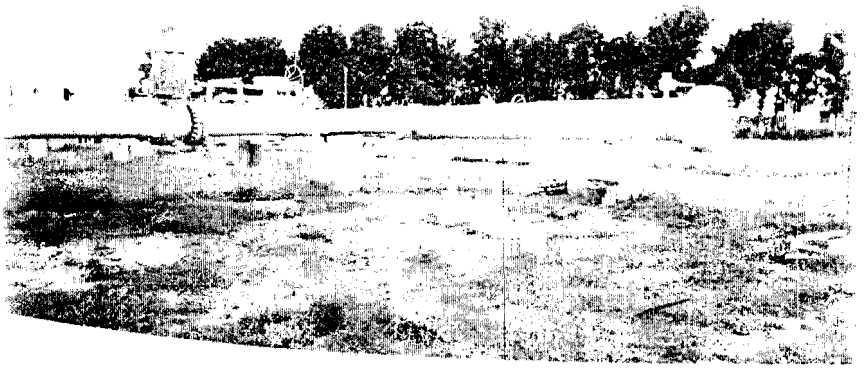
VOL. 3



Consulting Services for Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), and Resettlement Action Plan (RAP) of the Proposed Bakhrabad-Siddhirganj Gas Transmission Pipeline Project



EIA FINAL REPORT

(ESIA Vol-I)

June 2008

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BETS/WSE/LP-819/2008-06 (05) Dated: June 05, 2008

Mr. Md. Anwar Hossain
Deputy General Manager (Planning)
Gas Transmission Company Ltd. (GTCL)
Red Crecent - Borak Tower (4th-6th Floor)
71-72 Old Elephant road (Eskaton)
Dhaka-1213.

Subject : Submission of Final Environmental Impact Assessment (EIA) Report for the Proposed Bakhrabad-Siddhirganj Gas Transmission Pipeline Project.

Dear Sir,

With reference to above, we are pleased to submit herewith 2 (Two) copies of final EIA report for the stated project.

Thanking you and assuring you of our best services.

Yours faithfully,

Rupan Kanti Das
General Manager
Water Supply, Sanitation and Environment Dept

cc to:

1. Deputy Manager (Co-ord) to Managing Director, GTCL.
2. General Manager (Planning)
3. Mr. Alan Townsend, World Bank, with 4 Hard copies and 1 electronic file in CD.

Environmental Impact Assessment for Construction of Bakhrabad-Siddhirganj Gas Transmission Pipeline Project

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ABBREVIATION

ABBREVIATION

ADB	:	Asian Development Bank
AER	:	Agro-Ecological Region
AQM	:	Air Quality Management
BBS	:	Bangladesh Bureau of Statistics
BCAS	:	Bangladesh Centre for Advance studies
BETS	:	Bangladesh Engineering and Technological Services Ltd.
BMD	:	Bangladesh Meteorological Department
BWDB	:	Bangladesh Water Development Board
CGS	:	City Gate Station
CSMC	:	Construction Supervision and Monitoring Consultant
DAE	:	Department of Agricultural Extension
DC	:	Deputy Commissioner
DOE	:	Department of Environment
DOF	:	Department of Fisheries
DTW	:	Deep Tube Well
ECA	:	Ecologically Critical Area
ECR	:	Environment Conservation Rules 1997
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EPZ	:	Export Processing Zone
GIS	:	Geographic Information System
GOB	:	Government of Bangladesh
GPS	:	Global Positioning System
GSTP	:	Gas Sector Development Programme
GTCL	:	Gas Transmission Company Limited
IEC	:	Important Environmental Component
IEE	:	Initial Environmental Examination
IUCN	:	International Union for Conservation of Nature and Natural Resources or the World Conservation Union
JMB	:	Jamuna Multipurpose Bridge
KII	:	Key Important Informant
LGED	:	Local Government Engineering Department
NDT	:	Non Destructive Testing
NGO	:	Non-governmental Organization
NWMP	:	National Water Management Plan
PAP	:	Project Affected Person
PCP	:	Project Concept Paper
SDC	:	Study and Design Consultant
SRDI	:	Soil Resource Development Institute
TBS	:	Town Border Station
TOR	:	Terms of Reference
UNDP	:	United Nations Development Programme

GLOSSARY

GLOSSARY

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. 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, 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 *Bangla* 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: Unit of Bangladeshi currency

Terrestrial: Living on land

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

Union: Smallest unit of local self government comprising several villages

Upazila: Sub-district name. Upazila introduced in 1982

Zila: Bengali word of district.

EXECUTIVE SUMMARY

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1.0 Any Introduction?

1.1 What's the Background of the Project?

Natural gas is a significant national resource of Bangladesh. It is playing the key role by substituting it for imported fuel and thus saving hard earned foreign currency. The Government of the Peoples Republic of Bangladesh has attached high priority to the overall socio-economic development of the country through maximum and judicious utilization of its hydrocarbon resources. Its use in the power generation and industrial development sectors is gradually increasing and particularly about 85% of the electricity is, in fact, being generated from natural gas.

1.2 Who has planned for executing?

In appreciation of the great demand for natural gas to fulfill the growing need for industrialization and generation of power in the south-eastern region of the country, Gas Transmission Company Limited (GTCL) - a company of Petrobangla (PB) under the Energy and Mineral Resources Division of the Ministry of Power Energy and Mineral Resources has planned for executing a 30" diameter 60 km High Pressure Bakhrabad-Siddhirganj (BKB-SG) Gas Transmission Pipeline project with Regulating and Metering stations at SG and Meghnaghat (MGN) under the SG Peaking Power Project and with financing from the Word Bank (WB). It is expected that implementation of both SPPP and BSGTP will play an important role for the development of national economy.

1.3 What are the Objectives to Achieve?

The main objective of this gas transmission project with the pipeline from BKB to SG is to establish a sustainable Gas Grid and to meet gas demand of the power plants in SG, Haripur (HPR), MGN and surrounding areas. GTCL has also taken up this project in consideration of the existing situation and future higher demand of gas from domestic, commercial and different industrial consumers including meeting demand of the CNG stations of the region and the surrounding areas.

In fine, the objective of the project is as follows:

i) To establish a sustainable Gas Grid and ensure gas supply to the South-East Region of the country particularly SG-MGN area and the ones adjacent to the city of Dhaka and its peripheral load centers.

ii) To supply Natural Gas to the proposed power plants under PDB and fulfill industrial, commercial and domestic gas demand 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.

1.4 What's the Purpose of this EIA Report?

Gas Transmission Company Ltd. (GTCL) has intended to conduct the Initial Environmental Examination (IEE), Environment Impact Assessment EIA) and Resettlement Action Plan

(RAP) of the Project. In fact, as per the criteria of DOE, the project falls under the Red Category and hence requires both IEE and EIA prepared in accordance with the DOE guidelines for the Red category industrial project for issuing the site clearance and Environmental clearance respectively for the project.

Since, IEE report has already been prepared and submitted to DOE and DOE has in turn accorded Site Clearance for the Project to GTCL with certain conditions for fulfillment and inclusion in the EIA report. Accordingly, in order to develop a full-scale EMP and other issues and conditions set forth by the DOE while approving the IEE, this EIA report has been prepared as per the TOR of GTCL and the guidelines of the ECA '95 and ECR '97 of DOE.

1.5 How World Bank Get in to it?

The project has some environmental impacts and since these are of lesser degree as would be revealed from the subsequent chapters, it falls in the category "B" under the guidelines of the World Bank (WB) and as such, unlike DOE it does not require any Initial Environmental Examination (IEE), but it still needs the Environmental Impact Assessment (ESIA) studies along with preparation of the Resettlement Action Plan (RAP) report.

Since the project is being financed by WB, 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), their surrounding community, public amenities and the environment and as such, this EIA report in terms of ESIA is also the requirement of WB as ESIA Vol.-1 so far as EA is concerned where as the report on RAP has been separately submitted as ESIA Vol.-2.

1.6 What Guidelines have been followed in Preparing the Report?

This EIA report has been prepared basically following the EA and Cultural Recourses related WB guidelines OP 4.01 & OP 4.11. Further, since Involuntary Resettlement is involved in executing this project, WB guidelines OP 4.12 with further references made in the foregoing Operational Policies has also been closely taken in to consideration in addition to the relevant GOB ordinance ARIPO 1982 and guidelines of DOE.

1.7 Who has Prepared it and for whom?

Upon assignment from GTCL and the TOR so provided for, BETS Consulting Services Ltd. House No.10, Road No. 135, Gulshan-I, Dhaka-1212, Bangladesh has prepared this EIA (ESIA Vol.-1.) report. A multidisciplinary team comprising Senior Gas Pipeline & Environmental Specialists, Hydro-Geologist, Socio-economist and a Resettlement Specialist was assisted by Field Engineers and a number of enumerators during different phases of field survey, public consultation, data entry, compilation and analysis in developing and preparation of this report.

This EIA report is intended for submission to GTCL for DOE as well as World Bank and includes a broad coverage of the environmental, socio-economic, health and safety impacts etc and its mitigation, management and monitoring plans.

1.8 What does the Report Contain?

This report, presents the assessment of the environmental impact of the proposed project on the basis of physical, biological and socio-economical information on baseline condition so obtained through plot to plot survey of the ROW consisting of the homesteads, agricultural lands, natural canals, rivers and roads etc. on private and public assets along the strip alignment and the secondary data about environmental conditions in the project area, proceedings on public consultation, mitigation measures with overall management and

monitoring plan including estimated budget and the structural set ups as to how the project proponent GTCL organizes to implement these plans.

1.9 What's the Location of the Project?

The proposed gas transmission pipeline project is a 60 km high pressure gas transmission pipeline from BKB to SG via Comilla, Munshiganj and Narayanganj and passing through Muradnagar, Daudkandi, Gazaria, Sonargaon and Bandar Upazila of these districts. Various options were considered in selecting the route and the choice of the final one was influenced, decisively after having discussions with PDB and PGCB, by the fact that it is the shortest one and would therefore; minimize both total costs, execution time and the absolute level of environmental and social impacts.

1.10 How its Components are described?

The broken down components of the project consists of construction of 508 mm **i.e.** 30 inch 57 km high pressure transmission pipeline; 5500 meter HDD crossings for 5 rivers i.e. Gomoti-Meghna, Kojla, Meghna, Old Brahmaputra and Sitalakkha, 3 Regulating and Metering Stations (RMS) including 1 City Gate Station (CGS) at Meghna Ghat, Haripur, Siddhirganj as well as interface SCADA, Civil works and other ancillary works.

1.11 Why the Project is needed for?

This project has been taken-up primarily to supply additional gas required in the region for feeding the 2 x 150 MW peaking power plants 2 x 120 MW peaking power plants and 1x 210 MW thermal power plant at Siddhirganj; 360 MW power plant at Haripur, and the 450 MW Phase-II, 450 MW Phase-III and 450 MW Phase-IV power plants at Meghna Ghat. Moreover, this will meet the demand of gas to the existing and upcoming industries, CNG stations, commercial and domestic in project and surrounding areas.

In fact, due to absence of natural gas, investors are reluctant to establish mills and factories in this region. Though arrangement for gas supply to the divisional city of Dhaka is already in existence, execution of this project would reinforce the supply situation and to cover additional areas and apart from supporting industrialization of the region, would reduce the air pollution. Further, the achievable savings in fuel cost as well as reduced destruction of trees for fire wood are yet other steps towards fulfillment of the environmental friendly objectives.

2.0 How the Project is going?

GTCL is now at work since July, 2007 to construct the aforementioned BKB-SG 60 km high pressure natural gas transmission pipeline with 5 valve stations and 1 city gate station with regulating and metering stations and completing the system including its testing and commissioning by June, 2010.

2.1 Is the Selection of Pipeline Route Finalized?

Selection of the pipeline route has been finalized considering alternative routes through satellite image study, field checking and discussion with PDB and PGCB. The various options so considered presented almost similar environmental impacts in nature. The factors that were taken into consideration included access to the pipeline from the main road, avoidance of major roads, river, canals, railway and high way crossings and the local habitats etc. as much as possible and most importantly the length of the pipeline. The choice of the final route was influenced, decisively, by the fact that the chosen route is the shortest one and would therefore minimize both total costs and the absolute level of environmental and social impacts.

2.2 Any Physical Intervention yet?

No physical intervention has yet been under taken. Preparation of the route map and associated design for inviting tenders for the pipeline construction work is in progress now. Physical interventions will follow after obtaining due clearances from the concerned authorities including DOE. According to GTCL, the GOB approval of the project and financing provision of same under the loan granted by WB are being firmed up.

2.3 How about Engaging Consultant & Contractors?

The process of engaging expatriate and local consultants for bid evaluation, HDD crossings and civil works, regulating and metering stations, CP, QA & QC etc. are in progress. Environmental studies and Resettlement action plans are also being prepared for DOE and other clearances. GTCL is also working for engaging consultant for the design, construction, supervision, environmental management, quality control, testing and commissioning of the pipeline system. Preparation for engaging EPC contractor and materials for the project is also on the desk too.

2.4 What are the Major Components of the Project Activities?

The over all activities of the project are usually classified under three distinct phases e.g. pre-construction phase, construction phase and the operation & maintenance phase The major components of activities involved in this project are stipulated as below:

(i) Pipeline Routes Survey;
(ii) Land Acquisition and Requisition
(iii) Social Impact Management & Resettlement Actions
(iv) Clearance from DOE;
(v) Detail Drawing and Design;
(vi) Clearance from Concerned DC's;
(vii) Procurement of Materials;
(viii) Temporary Storage and Stack Yard
(ix) Appointment of EPC Contractor
(x) Site Camps & Equipment ,Vehicle and Crew Mobilization
(xi) Pipeline Construction & Special Crossings
(xii) Valve Stations, City Gate and Regulating & Metering Stations
(xiii) Quality Control & Quality Assurance
(xiv) Tie-in, Testing, Pigging and Commissioning
(xv) Operation & Maintenance
(xvi) Environmental Impact Management, Mitigation & Monitoring

3.0 How about Impact Mitigation Plans?

3.1 What's the Concept Working Behind?

Pipeline construction and operation, in general, has mostly temporary bio-physical environmental impact compared to that of the other industrial projects. However, certain socio-economic aspects might have some permanent residual impacts though. As such, among other topics, identification of potential impacts with mitigation measures with an environment

and social management plan is to there to indicate management response in implementing the mitigation measures and resettlement action plans.

This may be achieved through use of best management and monitoring practices as well as mitigation procedures and controls which will minimize the adverse social and environmental impacts and thereby lead to a satisfactory level of environment friendly execution of the project.

3.2 What are the Key Features of the Existing Bio-Physical Environment?

In order to assess the base line condition in preparing the EIA and RAP reports, a detail topographical survey has been conducted to identify the proposed pipeline route with assistance from the survey organization of GTCL. The study team has then compiled the required data to establish a comprehensive database on the bio-physical baseline conditions existing within the project area. This includes information on parameter such as surface and ground water, air quality, metrology, soils, noise and terrestrial and aquatic ecosystem.

Key features of the existing biophysical environment are described below:

- The region is characterized by high rainfall partially in the months of June to October.
- The main rivers of the study areas are, Gomoti - Meghna, Kajla, Meghna, Old Brahmaputra and Sitalakkha. Some Streams and natural canal exists in the areas.
- One Major Dhaka-Comilla High way is to be intercepted in the project area.
- The major sources of emission in the project area are road dust, motor vehicles, construction dust, wind blown dust from agricultural lands, biomass burning and brick kilns etc.
- The major habitats present within project area are cultivated land, homestead vegetation, road side vegetation, ponds, wetlands, etc.
- Most of the study area is comprised of agricultural land and wetlands for fisheries
- Main crops grown in the study area are Aman and Irri paddy in the main two seasons of the year. Besides these, potatoes, vegetables, maize, wheat, mustard, etc. are also cultivated in the project area. Fruits like mango, jack fruit, lemon, water melon, blackberry etc are also produced.
- The major employment activity in the project area is Agricultural production with wage laborers.
- The dominant religion in the area is Islam, with some areas of Hindu. A very few numbers of Christian & Buddhist communities are also there in the areas (Though none were found in the affected strip alignment of the project.
- The majority of the roads in the area are unpaved.

3.3 What are the Mitigation Measures for the Impacted Key Bio-Physical Issues?

3.3.1 Air Quality

The project has the potential to contribute some greenhouse gases to the atmosphere through two avenues:

- Emission of CO_2 and NO_2 from combustion of petroleum product by project staff, vehicles and generators etc.
- Fugitive emission of CH_4 from leakage of natural gas from the pipeline system

Mitigation measures will be implemented to reduce the potential impacts to appropriate level. These include:

- Regular weekly maintenance of project vehicles to reduce particular emissions

- Reducing travel distance and fuel consumption where possible.
- Generator use should be kept to a minimum.
- Continuous vigilance over the pipeline system to prevent leakages, if any.

3.3.2 Surface Water & Groundwater

Potential impacts on local surface water and groundwater quality may arise in different phases of the project, which include impacts from the field camps for construction crews, RMS & CGS plants and potential discharges of waste in the local area. Selected mitigation measures for ameliorating impacts on surface and groundwater in and around the study area include:

- Construction of pipeline is to be executed during dry season.
- Groundwater used for potable water by the construction crew will be tested to ensure that it meets the minimum environment standards of Bangladesh for safe drinking water.
- Containment of sanitary waste should be adequately disposed of avoid surface and ground water contamination.
- Safe disposal of drilling fluids & lube oil waste during HDD
- Monitoring of effluent quality from the plants and the pipeline dewatering activities.

3.3.3 Soil

The main potential impacts on soils expected as part of the project will arise from erosion and sedimentation. Erosion and sedimentation are likely to occur during river and stream crossing, during trenching activities and when discharging water under sedimentation during directional drilling, hydrostatic testing, pigging etc. Top soil shall be segregated from the other soil and shall be put to top during re-instatement works. Adequate bank protection has to be ensured.

3.3.4 Noise

Impacts on the local area from noise emission will be different through out the different sections of the project area. High intensity sound such as that emitted by equipment and machines used for excavating earth and welding pipes for long periods of time is potentially disturbing to nearby human population and wildlife. The following mitigation measures are to be taken:

- All operations are to be performed at day time
- Selection of low noise plant and equipments
- All generators and equipment must be maintained periodically
- A muffler in good working order shall have to be attached to the engine to reduce the level of noise so emitted.

3.3.5 Waste

The generation of waste product during construction of pipeline will be one of the most significant potential impacts of the project; the improper disposal of waste has the potential to cause environmental harm though contamination of surface and groundwater, soils, atmosphere etc. Indicative mitigation measure for the management of waste throughout the project includes:

- Project staff shall not throw away any waste product, solid, liquid or otherwise, during the construction work rather shall be kept in the designated place.
- All waste products shall be carried out during construction work and disposed of appropriately at the designated place.
- Sanitary waste shall not discharge on or near to any waterway or body of water.
- No machinery vehicle maintenance is to be carried out on site. It should be done at a designated workshop.
- Hazardous wastes will be specially handled, transported and disposed off.

3.3.6 Biodiversity

It is recognized that the activities within the project area have the potential impact upon the flora and fauna of the area. As such a number of specific mitigation measures are suggested in order to reduce the potential impact upon the biodiversity of flora and fauna to appropriate levels. These include:

- The level of noise made by crews during the work shall be kept to a minimum
- The use of vehicle horns to be avoided whist near colonies of birds or other wildlife
- Minimum vegetation should be removed during clearing ROW
- Prompt reinstatement of disturbed ground will be ensured to facilitate re-growing.

3.3.7 Agriculture and Cropping

When clearing the ROW and the requisitioned areas for the movement of equipment, vehicles etc. and construction of pipeline, the crops are damaged. This crop damage shall be properly compensated as per GOB rules, WB guidelines and the RAP. Elected representatives from local communities and the PAP should be allowed to join the committee to ensure justice and transparency during payment of compensation to crop damage. The Compensation Determination Committee (CDC) and Grievance Redress Committee will play their due role.

3.4 What are the Key Existing Socio-Economic Features?

The key existing socio-economic features as revealed from the data base prepared and analyzed following segment wise socio-economic survey conducted over the project affected area along the strip alignment of pipeline route has been summed–up and highlighted below:

3.4.1 Composition of Household Members

The field survey data shows that only 906 out of 911 PAP i.e. 99.45% of sample household is comprised of the male heads, where 0.55% of the sample house holds are maintained by female head.

3.4.2 Age Sex, Religion & Education Distribution

Age Sex distribution that children of age groups 1 to 14 is about 32.97%, household members of age groups 15 to 60 (main work force) is 64.11%, those of age group above 60 is about 2.93% . 96.49% are Muslims, 3.51% Hindus. The educational status reveals that about 13.64% is totally illiterate (who cannot read and write), about 5.38% can read and write without any formal education, primary level is 28.26%, secondary level is 24.08%, and also graduate and above is about 1.71%.

3.4.3 Main Occupation of the Household Members

9.34% is engaged as farmer, 26.80% in housework activities, 25.02% as students, 3.94% in service, 1.78% in small trade, 11.09% are children of less than 5 years and 3.60% are unemployed.

3.4.4 Monthly Income Patterns

17% of the house hold is Tk. 3000-5000, where 49% of them earn 5001-10000. 20% earn 10,001-15,000 and 8% have 1,001-20,000.

3.4.5 House Ownership

69.81% of the houses are Katcha (straw and bamboo roof with earthen wall/ earthen wall reinforced by sheet of woven cane & bamboo), 25.80% are Semi-Pucca (CI sheet roof with brick wall) and 4.06% are Pucca (reinforced concrete roof with brick wall) buildings.

3.4.6 Sources and Use of Water by Purpose

96.71% of the households drink tube wells water, around 3.29% of the households drink water from other source. The pond water is unsafe and is mostly used for bathing and cattle washing purposes.

3.4.7 Sanitation

63.45% of the project affected households have sanitary latrines. Among the remaining 30.95%, 3.84% use pits and hanging systems and 1.76% use open space or bushes for defecation.

3.4.8 Main Health Service Facilities of the Area

14.47% of them goes to the Govt. Hospital.12.29% of them go to the Union Health Clinic, 27.30% goes to Quack, followed by about 22.98% to private doctors, 4.06% to Private Hospital and 18.49% to Pharmacy.

3.4.9 Cultural Aspects

People residing in the surrounding areas of the project location are of different religions; Muslims, Hindus, Christians, and Buddhist, etc. Besides the general culture and heritage of the area, culture also differs due to the difference of the communities built-up by these religions in different locations of the project. The Muslims pray in the mosques and observe their religious festivals like Eid, the Hindus observe their Pujas (Durga puja, Kali puja, etc.) in the temples and the Christians observe their prayer in the church and observe Christmas. There are special gatherings among the villagers where cultural events are performed

4.0 How about Consultation with the Stakeholders and the PAP?

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. Community participation in the event of exigencies has to be encouraged and ensured. Further, formation of strategic alliance with local administrations, health centers, and fire brigades is always helpful.

4.1 What were the methodology and Tools?

During field survey in June July, 2007, FGD meetings were conducted in 9 different locations of the 3 districts and leaflets were distributed explaining the details of execution of the project and its probable impacts on the HH and the community around the strip alignment of the pipeline route. Again a plot to plot survey was conducted during December2007- January, 2008 to gather socio-economic details interview of all the homestead land, structure and tree owners. 759 Questionnaires were responded by owners themselves while 152 were responded by owner's relatives found present in HH during the survey.

4.2 What is the range of impact of the Project on the PAP?

Despite the fact that there was no marking on the proposed alignment as of the day of the latest surveying along the route in January, 2008, it appeared that 911 PAP will be both permanently and temporarily affected as pipe line will pass through their 1443 plots. Some of them have more than one entitlement. Out of these 911 PAP, all private land owners, 10 PAP are losing Structure, Land & Trees and 27 PAP are losing Land, & Trees. Out of the PAP

losing land, 1 is losing a part of his pond and another 1 is losing a part of his poultry farm. Structures of 17 PAP and 561 trees will have to be permanently removed.

4.3 What will be the Nature of Disturbance?

The temporary nature of disturbances in the project area will occur during construction, and the permanent impact shall be on long-term basis which will continue through the operation stages as well. Most of the agricultural lands encountered along the route were low lying ones and there have been some paddy fields which were said to be used for culturing fish during the rainy reason. Pipeline is also not crossing through any forest area any where along its alignment

4.4 Any Squatters, Tenants, Indigenous Groups or Tribal Communities Found?

Efforts have been made to identify and to look into the interest of squatters, indigenous people and tribal communities, but none such PAP was found on the alignment. Some vulnerable groups and some tenants have been found in the localities that would be affected. However, if any squatters, indigenous people and tribal communities or some more vulnerable groups and tenants are found during execution period, they would call for due compensation and resettlement as applicable.

4.5 How about Impacts on Vulnerable Groups & Severely Affected Households?

The socio-economic baseline study identified some categories of people who will feel the adverse impacts of the project more forcefully than others, or be rendered particularly vulnerable due to the project, either due to their present economic situation, excessive land loss relative to others or their age/disabilities. Segment wise detail analysis has been made on their socio-economic condition and quantum of loss vis-à-vis over all impact on their lively hood has been placed in the report.

The PAP who have been found to be losing over 20% of their assets or other wise determined Vulnerable or SAH may deserve special consideration in the form of cash grant, relocation allowance, skill training, microfinance, employment to them and/or their wards etc under the income restoration strategy as per provision of the GOB rules and the WB OP 4.12 besides due compensation payment for the loss of their assets etc. These issues have also been further detailed in the RAP doc. prepared for the project

4.6 What about the Attitude of the PAP towards the Project?

363 i.e. about 40 % of 911 PAP have expressed positive attitude toward the project without any specific condition beyond normal compensation or resettlement provision as per rules and 548 i.e. 60 % of them has also shown same positive attitude, but with certain conditions of proper compensation, providing job, providing land for land etc. 2 PAP suggested finding out alternative GOB land to pass through but none of the PAP had any negative views. In fact, all of the PAP including the ones asking land for land has offered a price / compensation for their assets so affected.

4.7 What about Organizational & Monitoring Aspects of RAP?

Organizational Responsibilities and Monitoring and Evaluation have to be initiated and performed by GTCL to be assisted by a Resettlement Specialist and the Environmental Specialist. This would be ensured with due promptness and pragmatic approach so that the implementation of RAP is achieved through establishing the proposed RIU offices, due

grievance mechanism and a fully operational MIS system conforming to the organizational set up as outlined in the RAP report.

4.8 Any Concern Expressed by the Members of the Public?

The salient features of the opinions expressed by the participants of different profession in focus group discussion (FGD) meeting have revealed in general that they are concerned with due compensation and rehabilitation wherever any damage is done and providing gas in their localities on priority basis as and when feasible. Some of them have also expressed concerns relating to water pollution, air pollution, noise, river bank erosion, disposal of wastes and impact on public property.

However, in general, the pipeline project has been appreciated by them. In their opinion, as a development work of the country, it will help setting up industries, generate employment and its nature of impact would be usually temporary. But note of caution was there from them that, apart from promptly compensating the PAP, the work should be done carefully to avoid any accident in future and proper reinstatement along the alignment has to be done and promptly as the pipe laying works would be progressing in their localities.

4.9 Any Implementation Schedule worked out for RAP?

It is expected that implementation of RAP would involve a good deal of continuous work directly dependent on payment of compensation etc. Resettlement work will be carried out on a 8 month time-base as stipulated during the period between July, 2008 & June2009 subject to extension as required by the project authorities. Since the work on the project would continue until June, 2010, the post evaluation of RAP is also to be scheduled for completion by that period.

5.0 How about the Environmental Management Plan?

A detailed Environmental Management Plan (EMP) has been proposed for this project. The EMP is designed as a practical guide to the implementation of the environment and social mitigation measures. It is intended to set out the finer details of what is required "in the field" including the "what, who, how, when and what cost" factors are associated with these measures.

This EMP will also form the primary mechanism for management, accountability and reporting on the project's social and environmental performance. It has been stressed in the EMP that the mitigation measures identified and management actions recommended there in, particularly addressing the specific public concerns, are to be implemented with due importance.

5.1 What is the Institutional Arrangement Proposed for the EMP?

The organizational set up and the institutional arrangement as proposed in the report for due implementation of the mitigation, management, monitoring of and reporting on the environmental impact aspects of the project has been endorsed by GTCL. Accordingly, the Project Director, through a Project Implementation Team, will be responsible for the over all implementation of the EMP. Technical Staff of GTCL and the Environmental Specialist (ES) of the Owner's Engineer will supervise, manage and monitor the works of the EPC contractor so far as the environmental impact issues of the project are concerned.

5.2 Any Budget worked out for Environmental Monitoring?

As experienced in executing different projects of similar dimension and magnitude and as opined by GTCL management during discussions with them, the environmental impact of execution of this project does not necessarily call for application of any substantial monitoring arrangements and procurement of specialized tools for measuring the qualities of different environmental elements impacted during the construction and operation phases.

Still then, it has been agreed with the GTCL management that they will, at the recommendation of ES, outsource undertaking the monitoring activities to a vendor who can do the monitoring periodically as and when deemed fit. Accordingly, for reference purpose, details of estimated cost of Tk. 981,000.00 for outsourcing monthly environmental monitoring during construction and operation phases and TK. 1,362,800.00 for procurement of equipments for environmental monitoring have been provided in the report.

5.3 Any Training recommended?

Yes. Training is essentially required for the officials to be assigned particularly to operate the in-house monitoring activities relating to HSE issues. This being an integral part for successful completion of this project as well, specialized low profile training on Safety and occupational health and Environmental management system has been recommended for a total of 4 persons at an estimated cost of Tk. 800,000.00 under the EMP of the project.

A tailor-made pre-project occupational health, safety & environmental management / refreshers training from local industrial safety institution(s) has also been recommended for the professionals to be posted to the project activities.

5.4 What are the Factors taken in to Account in Preparing this Report?

The report has incorporated environmental mitigation measures identified in the Environmental Impact Assessment (EIA) report and in fulfilling the conditions imposed by DOE while according site clearance for the project. It is a live document which has detailed how the potential impacts will be managed at the same time a fully defined procedure for integrated implementation of the EMP.

6.0 What about the Emergency Response Plan and Disaster Management Plans?

The need for drawing the emergency response plan (ERP) and disaster management plan (DMP) for the project of such dimension & magnitude and to be executed over a long period of time has been duly recognized in preparing the report. Accordingly, the outline with essential details of ERP & DMP has been included for establishing and operating the same. An assessment of environmental risk and potential hazards as well as the base line of the current emergency set-up and resources of GTCL has been presented in the report.

The provision of Emergency Response cell as proposed in the project set-up is in line with the existing one operating from their regional HQ at Demra. In fact, this regional ER Center will look after the ER issues of the BKB-SG pipeline as well after its completion.

7.0 Any Concluding Remark?

In view of foregoing presentations, it is believed that the present EIA Report has been prepared as per guide lines of DOE and as such, has fulfilled the conditions of the TOR of

GTCL. Further, since the project is being financed by the World Bank, the WB guidelines have also been duly taken care of. So, it is expected to meet the requirements of the WB as well so far as ESIA is concerned.

It is therefore recommended that the Department of Environment may issue necessary Environmental Clearance in favor of Gas Transmission Company Limited for execution of this 30" diameter 60 km High Pressure Bakhrabad - Siddhirganj Gas Transmission Pipeline project with associated facilities including Regulating and Metering Stations at Siddhirganj and Meghnaghat, - a priority project of national importance.

CHAPTER-01

INTRODUCTION

Chapter - 01

INTRODUCTION

1.1 Background

Natural gas is a significant national resource of Bangladesh. It is playing the key role by substituting it for imported fuel and thus saving hard earned foreign currency. The Government of the Peoples Republic of Bangladesh has attached high priority to the overall socio-economic development of the country through maximum and judicious utilization of its hydrocarbon resources. Its use in the power generation and industrial development sectors is gradually increasing and particularly about 85% of the electricity is, in fact, being generated from natural gas.

Accordingly, in appreciation of the great demand for natural gas to fulfill the growing need for industrialization and generation of power in the south-eastern region of the country, Gas Transmission Company Ltd. (GTCL), a company of Petrobangla (PB), has planned to construct a 30 inch diameter 60 km gas transmission pipeline from Bakhrabad-Siddhirganj via Narayanganj, Munshiganj & Comilla to be financed by the World Bank (WB).

The main goal of the project is to establish a sustainable Gas Grid and to meet gas demand in Siddhirganj, Haripur, Meghna Ghat and surrounding areas. The demand of natural gas in Siddhirganj power plant is increasing day by day as the 2*150 MW peaking plant & 2*120 MW peaking plant, 210 MW power plant and 1*360 MW power plant at Haripur would be requiring more gas. In addition to that 450 MW Phase-II, 450 MW Phase-III and 450 MW Phase-IV power plants are going to be constructed at Meghna Ghat. Moreover, GTCL has also taken up this project in consideration of the present situation and future higher demand of gas from domestic, commercial and industrial consumers of the region.

The purpose of this report is to present the Assessment of the Environmental Impact of execution and operation of the proposed Bakhrabad - Siddhirganj (BKB-SG) Gas Transmission Pipeline and associated facilities primarily based on the presently available information about environmental conditions in the project area.

1.2 Objective of the Project

The objective of the project is:

i) to establish a sustainable Gas Grid and ensure gas supply to the South-East Region of the country particularly Siddhirganj-Meghna Ghat area and the ones adjacent to the city of Dhaka and its peripheral load centers.

ii) to supply Natural Gas to the proposed power plants under PDB and fulfill industrial, commercial and domestic gas demand 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.

1.3 Purpose

The environmental legislation in Bangladesh, particularly, the Environmental Conservation Act, (Amendment 2002) states that any development project shall require environmental clearance from the Department of Environment (DOE). In compliance with the requirements of WB and DOE,

this EIA report on construction of BKB-SG gas transmission pipeline project has been prepared. According to WB guidelines the project falls under Category-B, which requires GTCL to conduct an Environmental and Social Impact Assessment (ESIA) i.e. Environmental Impact Assessment (EIA) in terms of DOE (as ESIA Vol.-1 for the WB) to obtain environmental clearance from the DOE and a separate Resettlement Action Plan (RAP) termed as ESIA Vol.–2 as well for the WB. In compliance to these requirements, BETS Consulting Services Ltd. House No. 10, Road No. 135, Gulshan-1, Dhaka-1212, has been assigned by the GTCL to prepare the EIA Report as per the TOR for the proposed Construction of High Pressure Gas Transmission Pipeline along with the control stations named as Regulating and Metering Stations (RMS).

1.4 Scope

This EIA Report for Construction of BKB-SG Gas Transmission Pipeline and the RMS identifies environmental impacts including health and safety issues and prepares an outline for mitigation measures and environmental management plan for the potential negative impacts and enhancement of positive environmental impacts. The report also includes a TOR for the EIA report as annexure along with figures, statistical tables and other reference and background materials.

Scope of the EIA Report will address:

- Relevant existing government policy and legislative requirements concerning the project;
- Project description including technical environmental aspects of the proposed activities;
- Description and evaluation of the project area from an environmental, biological and socio-economic, health and safety point of views;
- Delineation of potential technical environmental, biological and socio-economic issues believed to be significant from the proposed project;
- Assessment of potential environmental, biological and socio-economic impacts including health and safety issues of the proposed project activities and their management practices;
- Documentation of local community, stakeholders and key important informants' concerns and opinion/ advice; and
- Recommendations of abatement/ mitigation/management measures to ensure environmental, biological, and social compatibility that comply with Bangladesh national as well as international environmental, legal, health and safety requirements and national environmental quality standards.

1.5 Methodology

The EIA study has been conducted and the present report is prepared mainly on the basis of information provided by GTCL. Secondary information and other pertinent data were collected from relevant sources and through field observations, public consultations, surveys, etc.

During this process, the following steps were followed:

- Collection of information relating to the study from GTCL;
- Detailed understanding of the scope of the assignment and activities involved on the surrounding environment;
- Institutional arrangements and mechanisms including engagement of resource personnel / field staff available for assignments, mobilization and necessary orientations;

- Collection of data on environmental, social, health and natural resource component parameters of the project area;
- Collection and review of reports and references. This included EIA Guidelines of DOE for Industries, Environmental Policies, Strategies and Acts, World Bank (WB) Operational Policy Guidelines including the ones on the involuntary resettlement aspects, EA source book, International Union for Conservation of Nature and Natural Resources (IUCN) Guidelines for Environment Protection for Oil and Gas Sector etc.
- Met and gathered information from various government agencies of concern (i.e., Local Union Councils, Upazila Councils, WARPO, DAE, IUCN, SRDI, LGED, DOE, WDB, Forest Department, Department of Fisheries, Department of Agriculture, Department of Explosives, Department of Public Health Engineering (DPHE), Land Acquisition (LA) Sector of District Administration, Fire fighting and Civil Defense and Petrobangla (PB) etc.);
- Undertook field visits and field surveys to various sites which represented the project's geographical coverage, ecosystems and communities including potential environmental, biological and social including health and safety problems;
- Conducted a representative survey using a prepared questionnaire covering a wide cross-section of people in the study area to acquire field-level data on the existing environmental, biological, health and socio-economic impacts of the project;
- Collected water samples from predetermined points and areas within the study area and analyzed the relevant parameters;
- Performed critical analysis of the data and information;
- Prepared relevant maps using Arc Info Geographic Information System (GIS) software;
- Identified sources of environmental and biodiversity degradation and social disturbances of significance;
- Identified environmental, biological, social and health impacts and evaluated their significance and consequences;
- Consulted the project affected persons, local community, stakeholders and the key informants and officials in the project area through public consultation process;
- Presented an outline of the Environmental Management Plan (EMP) for future mitigation measures of environmental, biological, social and health & safety issues; and
- Prepared the EIA Report.

1.6 Limitations

A full scale EIA/ SIA and RAP study is generally carried out after completing the detailed design of the project, though its Environmental management and monitoring plan still remains to be a live document. In the case of the present project, only the route alignment is fixed but detailed design of the project is yet to be finalized.

Therefore a tentative idea of the construction activity and design of this project as provided by GTCL has been considered for conducting the EIA and the RAP studies and the out put on EA with SIA is placed in this EIA (ESIA Vol.-1) report and that with more stress on SIA in RAP (ESIA Vol.-2) report submitted separately.

Initially a batch of 4 field workers with multidisciplinary background helped the Consulting Team by collecting data from the field during June-July, 2007 and another batch of 15 enumerators were deployed for revisiting the ROW and conducted the plot to plot survey of the house holds including, among other issues, physical, biological and social environment along the 60 km strip alignment of the project during December, 2007-January, 2008 under close coordination and guidance from BETS, GTCL and WB..

1.7 Structure of the Report

The report Environmental Impact Assessment for Construction of BKB-SG Gas Transmission Pipeline Project with Regulating & Metering Stations has been structured in compliance with the guide lines of the DOE and the requirement of the TOR.

CHAPTER-1: INTRODUCTION: The introduction chapter presents a brief overview of the assignment along with the background, objective of the project, purpose, scope, methodology, acknowledgement, consulting team, limitations & the structure of the report with listing of references and the appendices.

CHAPTER-02: POLICY AND LEGAL CONSIDERATIONS

- Introduction
- Relevant National Policies and Legislation
- Compliance with WB Environmental Assessment Process
- World Bank Policy OP 4.01 on Environmental Assessment OP 4.12 on Resettlement and OP 4.11 on Cultural Resources
- Compliance with DOE EIA Guidelines
- Compliance with International Requirement
- BKB-SG Gas Pipeline Project Compliance with Statutory Regulations

CHAPTER-03: PROJECT DESCRIPTION

- Project Location
- Present Status
- Project Category
- Project Justification
- Pre-Construction Phase
- Construction Phase
- Operation and Maintenance Phase
- BKB-SG Gas Transmission Pipeline
- Proposed Schedule of Implementation
- Present Plans and Status of the Project
- Project Category
- Need of the Project
- Project Location
- Project Data

- About the Project
- Satellite Image of Proposed Alignment
- Operational System of the Project Design
- Safety System of the Project Design

CHAPTER-04: BASELINE EXISTING ENVIRONMENT

- Introduction
- Study Area
- Physical Environment: Groundwater, Noise, Land Types & Soil Types
- Biological Environment, Introduction, Wetland Habitat, Terrestrial Habitat, Fisheries & Socio-Economic Environment with Population and Demography and Utility and Services
- Statistical Analysis of Demographic, Socio-Economic and Community Health Data including Cultural Aspects

CHAPTER-05: PUBLIC CONSULTATION

- Public Consultation
- Methodology
- Findings from Public Consultations
- Expectations of the People
- Public Consultation Results

CHAPTER-06: ANALYSIS OF SUITABILITY FOR ALTERNATIVE ROUTES

- Route Selection Factors
- Location of Selected Routes
- Comparative Analysis
- Major Environmental Features along different options
- Findings

CHAPTER-07: IDENTIFICATION, ANALYSIS AND MITIGATION OF POTENTIAL IMPACTS

- General
- Identification of Impacts
- Analysis of Impacts and Suggested Mitigation Measures
- Air Quality
- Socio-Economic
- Noise and Vibration
- Land and Soil
- River Crossing
- Surface and Groundwater
- Floral and Faunal
- Summary

CHAPTER-08: ANALYSIS AND DESCRIPTION OF THE MITIGATION MEASURES

- Introduction
- Mitigation Measure of Project Impacts
- Air Quality
- Mitigation Plan for Land Use
- Mitigation plan for Noise and Vibration
- Soil Erosion and Fertility Control Plan
- Surface and Ground Water- Mitigation Plans
- Mitigation Plans for Biodiversity

- Mitigation plan for Historical and Archaeological Resources
- Mitigation plan for Socioeconomic Impact

CHAPTER-09: ENVIRONMENTAL MANAGEMENT PLAN

- General
- Scope of EMP
- Environmental Policy Statement of GTCL
- Assignment of the Environment Specialist
- Organizational Aspects
- Health, Environment & Safety Management Plan
- Environmental Management Costs
- Environmental Monitoring Plan
- Pre-Construction Phase
- Construction Phase
- Safety and Hazard Mitigation Plan
- Responsibility of the Contractor
- Emergency Response and Disaster Management Plan
- Emergency Response Planning
- Specialized Equipment
- Training
- Safety Orientation
- Approach to Emergency Response
- Guidelines for Disaster Management
- Occupational Health and Safety (OHS)
- Storage Facilities for Chemicals, Fuel, Oil and Grease
- House Keeping

CHAPTER-10: CONCLUSIONS AND RECOMMENDATIONS

- General
- Conclusion
- Recommendations

The tables, figures, annexes and list of references including the abbreviations and a glossary have been presented at different places of the report as per the table of content.

1.8 Acknowledgement

The EIA Report has been prepared with the support from GTCL and the World Bank and various government agencies including but not limited to Bangladesh Meteorological Department (BMD), Soil Resource Development Institute (SRDI), Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), Department of Environment (DOE), Department of Agriculture Extension (DAE), etc.

The Project proponent GTCL and the project financing agency WB have been extremely positive in providing necessary information, documents, guidance and support all the way during undertaking and preparation of the EIA Report.

The EIA Team acknowledges this with thanks and gratitude.

1.9 EIA Team

The present EIA Report has been developed by a multidisciplinary team of BETS Consultants. The following Team conducted the EIA:

Mr. Delawar Bakht, PEng.	:	Team Leader
Mr. A S M Saeed	:	Gas Pipeline Specialist
Dr. Md. Showkat Osman	:	Environmental Specialist
Mr. Tarek Bin Hossain, PEng.	:	Geologist/ Hydrologist
Dr. Shaker Ahmed	:	Socio-economist
Dr. A.K.M. Nazrul Islam	:	Ecologist
Mr. Md. Humayun KabiR		Resettlement Specialist

The specialist team of consultants has been continuingly assisted by Engr. Asif Masud, Environmental Engineer and a number of enumerators and logistic service providers during different phases of field survey, public consultation, data entry, compilation and analysis including preparation of this report.

1.10 References

During preparation of the EIA Report, a number of references were consulted. These are included in the list of References/ Bibliography. The abbreviations and a glossary have also been provided as a part of this report.

CHAPTER-02

POLICY AND LEGAL CONSIDERATIONS

Chapter - 02
POLICY AND LEGAL 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 Co. is expected to conduct its operations in compliance with local, national and international legislation. In other wards, the proposed project will be executed and operated in accordance with Bangladesh legislations and international agreements to which Bangladesh is a party.

2.2 Relevant National Policies and Legislation

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

2.2.1 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 principal; 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.

2.2.2 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.

2.2.3. Fifth Five-Year Plan (1997-2002)

This is the last Five-Year Plan of the country. Presently there is no such Plan except a Three Year Rolling Plan instead. However, the just concluded Five Year Plan has a lot of relevance in the present context and expresses the planning notion of the Government while considering environmental and related issues and their integration in national planning.

The last Five-Year Plan was formally published (in March 1998 and had a separate chapter (Chapter X, Pages 177 to 189) devoting to 'environment and sustainable development'. The chapter talks about major environmental issues of the country, areas of special concern, cleaning up of hot spot pollution areas, public and private sector cooperation and tools to achieve that, Government-NGO cooperation, financial and disaster management.

The Fifth Five Year Plan in its section, 'Oil, gas and natural resources' (Chapter XVI, Page 363) sets out, among others, the following relevant objectives:

- Conduct geological and geophysical surveys in order to explore and discover new indigenous energy resources; and
- Meet most of increased demand for commercial energy through the development of indigenous gas.

As part of the policies and strategies under the same section, the following are noteworthy:

- Conservation and economic use of natural gas will be promoted;
- In order to accelerate development activities, efforts will be made to gradually involve the private sector in exploration, production, transportation and sale of oil and gas;
- Environmental Impact Assessments will be made mandatory for energy development projects; and
- Geological and geophysical activities will be geared up.

2.2.4 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).

2.2.5 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 wastelands in Bangladesh.

2.2.6 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.

2.2.7 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.

2.2.8 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'.

2.2.9 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.

2.2.10 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.

2.2.11 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."

2.2.12 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.

2.2.13 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.

2.2.14 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.

2.2.15 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].

2.2.16 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.

2.2.17 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.

2.2.18 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".

2.2.19 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.

2.2.20 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.

2.3 Compliance with WB Environmental Assessment (EA) Process

In 1989 the Bank adopted Operational Directive (OD) 4.00, "Annex A: Environmental Assessment". EA became standard procedure for Bank financed investment project. In 1991 the directive was as OD 4.01, which has subsequently been changed to operational policy OP 4.01 in January 1999 and the operational policy statement has been updated in March, 2007. EA is designed to be a flexible process that part of project preparation allows environmental issues to be addressed in a timely and cost-effective way during project preparation and implementation.

The primary responsibility for the EA process lies with the borrower. The Bank's role is to advise borrower throughout the process, to confirm that practice and quality are consistent with EA requirements and to ensure that the process feeds effectively into project preparation and implementation.

2.4 World Bank Policy OP 4.12 on Resettlement and OP 4.11 on Cultural Resources

The Bakhrabad-Siddhirganj (BKB-SG) Gas Transmission Pipeline Project has been termed by the WB as a green field one and is scheduled to be executed under the financing provisions of the World Bank. Hence, OP 4.12 of the WB policy guide lines on resettlement and OP 4.11 on Cultural Resources are to be taken in to consideration in dealing with the land acquisition and requisition required for installing the pipelines & plants of the project. The details about the OP 4.12 and the certain specific issues the borrower should take in to consideration during implementation of the project have been discussed in the Resettlement Action Plan report However, the WB policy requirements in these respects may be summarized below:

i) Avoiding or minimizing adverse project impacts where possible;

ii) Consulting with affected people (AP) in project planning and implementation;

iii) Disclosure of RAP and project related information to the affected person;

iv) Payment of compensation for acquired assets at the market/replacement value;

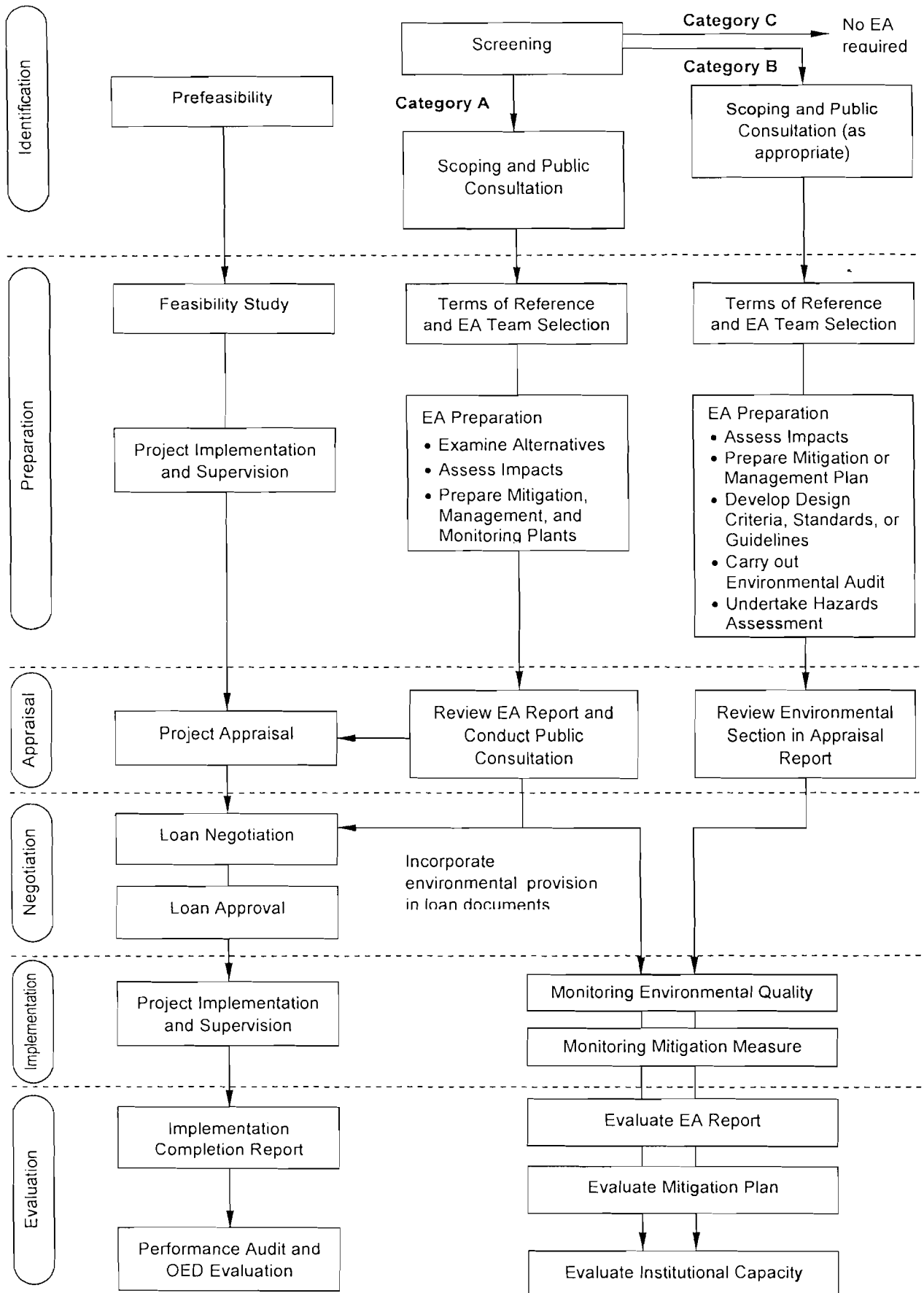
v) Resettlement assistance to PAPs, including non titled persons (informal dwellers/ squatters and encroachers);

vi) Income restoration and rehabilitation program; and

vii) Special attention for vulnerable groups.

Consistent with the World Bank policy, a framework and resettlement procedural guidelines will ensure that persons affected by land acquisition will be eligible for appropriate compensation and rehabilitation assistance. The framework reflects the GOB land acquisition regulations as well as World Bank policy for all types of losses (land, crops/ trees, structures, business/employment, and workdays/wages). If land for land is not a feasible option (or not required due to nature and scope of the project), AP will be compensated at full replacement costs. In addition, PAP 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. Further, the female-headed households, indigenous peoples' households and other vulnerable households will be eligible for further cash assistance for relocation and house construction grants.

Figure-A: The Environmental Assessment Process



Note: OED, World Bank Operation Evaluation Department

2.5 Compliance with DOE EIA Guidelines

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-B** shows the application procedure for obtaining site/environmental clearance.

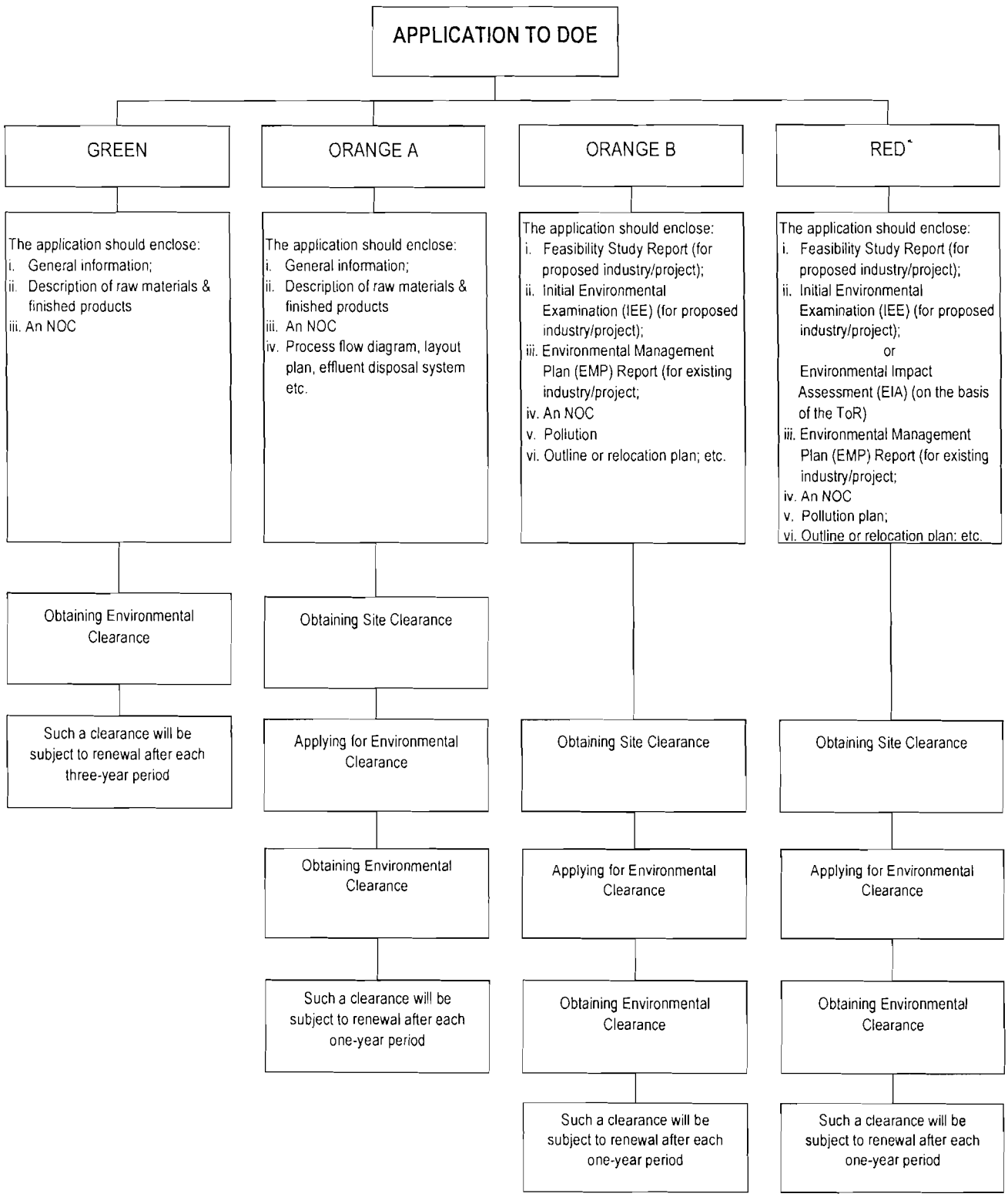


Figure-B: Steps Involved in Environmental Clearance Following DoE Guidelines

2.6 Compliance with International Requirements

Bangladesh has 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 the project. The pertinent ones of these are highlighted below:

2.6.1 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".

2.6.2 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 program 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).

2.6.3 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).

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

This Convention was adopted on 10 December 1982 at Monte go 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 co-operation, 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.

2.6.5 Others

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 convection 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.

Table-2.1: 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	Oxides Nitrogen (NOx)
Ka	Industrial and mixed	500	120	5000	100
Kha	Commercial and mixed	400	100	5000	100
Ga	Residential and rural	200	80	2000	80
Gha	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 'Ga' and 'Gha'.
3. Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

Table-2.2: Bangladesh Standards for Noise

Sl. No.	Area Category	Standard Values (all values in dBA)	
		Day	Night
Ka	Silent Zone	45	30
Kha	Residential area	50	40
Ga	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
Gha	Commercial area	70	60
Umma	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-2.3: 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 xHe2 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-2.4: Bangladesh Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	06-Sep
Phosphate	mg/l	25
Suspended Solid (SS)	mg/l	100
Temperature	°C	30
Coli forms	number/100ml	1000

Source: Schedule-8, Rule-l3, 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-2.5: 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)	umhoms/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	005	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) °C (winter)	40 45	40 45	40 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: 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	150
	(kha) Power station of capacity less than 200 MW	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	kg/ton acid
	*(ka) Sulfuric acid production (DCDA * process)*	4
	*(kha) Sulfuric acid production (SCSA * process)*	100
	*(*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	275m
	200 MW - 500 MW	220m
	Less than 200 MW	$14(Q)^{03}$
	(kha) Boiler	
	Steam per hour- up to 15 tons	11m
	Steam per hour - more than 15 tons	$14(Q)^{03}$
	($Q=SO_2$ emission in kg/hour)	
9	Oxides of nitrogen	3 kg/ton acid
	(ka) Nitric acid production	50 ppm
	(kha) Gas based power stations	50 ppm
	500 MW or more	40 ppm
	200 - 500 MW	30 ppm
	Less than 200 MW	200 ppm
	(Ga) Metallurgical oven	
10	Kiln soot and dust	Mg/Nm^{-1}
	(ka) Blast furnace	500
	(kha) Brick kiln	1000
	(Ga) Coke oven	500
	(Gha) Limekiln	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 Gas Transmission Pipeline Project Compliance with Statutory Regulations

Such companies should adopt a policy of Compliance with all the requirements for environmental permission and clearance, regardless of whether the company might other wise is able to obtain exemptions from some or all of the rules.

In this case, it is necessary for the company to obtain both site clearance and environmental clearance for this pipeline project. Since 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.

It has also to ensure compliance with the Bangladesh Labor Law 2006 and World Bank Group's EHS 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.

CHAPTER-03

PROJECT DESCRIPTION

Chapter - 03

PROJECT DESCRIPTION

3.1 Project Location

The proposed project is located in the eastern Bangladesh with its boundary covering the districts of Comilla, Munshiganj, Narayanganj and passing through the Muradnagar, Daudkandi, Gazaria, Sonargaon and Bandar Upazila of these districts. **Figure-C** shows the map of proposed BKB-SG (BKB-SG) Gas Transmission Pipeline route. Gas Transmission Company Ltd. (GTCL) a company of Petrobangla (PB) has proposed to construct a 508 mm (30 inch) diameter 60 km high pressure gas transmission pipeline following the route so selected from BKB to SG.

3.2 Present Plans and Status of the Project

GTCL plans to construct the aforementioned BKB-SG 60 km high pressure natural gas transmission pipeline with regulating and metering stations, but no physical intervention has yet been under taken. Selection of the pipeline route has been finalized considering alternative routes through satellite image study and field checking.

Preparation of the route map and associated design for inviting tenders for the pipeline construction work is in progress now. Physical interventions will follow after obtaining due clearances from the concerned authorities. According to GTCL, the approval of DPP of the project is under process and financing provision of same is mainly based on the loan granted by WB.

Simultaneously, the process of engaging expatriate and local consultants for bid evaluation, the detail pipeline design, HDD crossings and civil works, regulating and metering stations, CP, QA & QC etc. are in progress. Environmental studies and Resettlement action plans are also being prepared for DOE and other clearances. GTCL is also working for engaging consultant for the design, construction, supervision, quality control, testing and commissioning of the pipeline system.

In order to assess the base line condition in preparing the EIA and RAP reports, a detail topographical survey has been conducted to identify the proposed pipeline route with assistance from the survey organization of GLCL. The purpose of this report is to present the Assessment of the Environmental Impact of the proposed project on the basis of physical, biological and socio-economical information so obtained through plot to plot survey of ROW consisting of the homesteads, agricultural lands, natural canals, rivers and roads etc. on private and public assets along the strip alignment and the secondary data about environmental conditions in the project area.

3.3 Project Category

As per the criteria of DOE, the project falls under the Red Category and hence requires Environmental Impact Assessment (EIA) prepared in accordance with the DOE guidelines for the Red category industrial project.

The project has some environmental impacts and since these are of lesser degree as would be revealed from the subsequent chapters, it falls in the category "B" under the guidelines of the World Bank (WB) and as such, unlike DOE it does not require any Initial Environmental Examination (IEE), but it still needs the Environmental Impact Assessment (ESIA) studies along with preparation of the Resettlement Action Plan report. These are to be done as per guide lines provided in the WB operational policy docs. OP 4.01, OP 4.12 & 4.11 and further references made there in.

3.4 Need and Justification for the Project

With the construction of the Meghna Bridge in the south-eastern region of the country, an excellent communication system has been developed with Dhaka and the south-eastern region. As a result favourable environment has been created for industrialization in the south-east and central regions of the country. On the other hand due to absence of natural gas, investors are reluctant to establish mills and factories in this region. Though arrangement for gas supply to the divisional city of Dhaka is already in existence, this project is proposed to reinforce the supply situation and to cover additional areas at this instance under financing from the WB.

According to the industrial policy of GOB, agro-processing industries should get priority in the industrialization drive. Moreover, in addition to the need of gas for 2*150 MW peaking plant, 2*120 MW peaking plant, 210 MW thermal power plant, 1*360 MW power plant at Haripur, the construction of 450 MW phase-2, 450 MW phase-3 and 450 MW phase-4 power plants at Meghna Ghat has created yet other potential gas consumers. So, for the overall socio-economic development of the divisional city of Dhaka with the hinterlands, there is crying need for the expansion of Natural Gas Transmission System. Such initiation of supply of gas to this part of the country will, apart from supporting industrialization of the region, reduce the air pollution. Further, the achievable savings in fuel cost as well as reduced destruction of trees for fire wood are yet other steps towards fulfilment of the environmental friendly objectives.

3.4.1 Major Components of the Project Activities

The major components of the project activities are stipulated as below:

(i) Pipeline routes survey;
(ii) Land Acquisition and Requisition Plan
(iii) Clearance from DOE;
(iv) Detail Drawing and Design;
(v) Clearance from concerned DC's;
(vi) Procurement of materials;
(vii) Temporary Storage and Stack Yard
(viii) Equipment and Vehicle Mobilization
(ix) Pipeline construction and
(x) Testing and commissioning

These activities are classified under three distinct phases as described in the following sub-sections.

3.4.1.1 Pre-Construction Phase

Activities for pre-construction phase are described below.

Pipeline Route Survey

Figure-C shows proposed location of pipeline ROW where a number of factors are taken into consideration, such as access to the pipeline from the main road, major road crossing and avoidance of railway and high way crossings as much as possible. Since the pipeline route has been finally selected considering other alternative routes, a detailed survey work will be carried out along the entire route according to the time schedule.

Land Acquisition and Requisition Plan

Following the demarcation of a ROW along the selected route, a plan will be submitted to the DC's Office for respective permanent & temporary land acquisition and requisition formalities. Simultaneously, setting up offices for implementation of Resettlement Action Plan and formation of Compensation Determination Committee (CDC) and Grievance Redress committee (GRC) etc will follow.

Detail drawing and design:

Pipeline construction must conform to Bangladesh Mineral Gas & Minerals Safety Rules of 1991 having an amendment in 2003. Environmental factors that may affect the routing or design of pipeline would include homesteads & population density, historic buildings if any, water bodies, graveyards, parks, and religious and cultural institutions etc. These aspects will be taken into consideration before finalization of pipeline design.

Procurement of materials:

GTCL will procure jeeps, pick up for this project. These items along with office furniture, machinery, accessories and pipeline materials will be procured following purchase procedures of GOB as well as guidelines of the WB.

Temporary Storage and Stack Yard

A temporary storage and stack yard to facilitate construction activities will be established for easy access from the main road. The main stack yard will store pipes, machinery, and equipment and would be located in designated areas between BKB and SG.

Equipment and Vehicle Mobilization

An adequate number of supervision vehicles will be acquired prior to commencement of work. Equipment and machinery will be documented (itemized) and their current condition evaluated to ensure proper working condition prior to start-up of the project. The graders, dozers, side booms, trenching machine, excavators, welding machines, compressors, water pumps, dump trucks, crane and other associated machinery, tools and equipment will be inspected routinely.

3.4.1.2 Construction Phase

Once preliminary preparations are completed, the project would be ready to commence the construction phase. Major construction activities include; preparation of work site areas, establishing the pipeline route and determining the amount of right of way necessary for actual digging, trenching, pipeline stringing, welding, back filling, testing and commissioning. These activities will be scheduled sequentially to maximize efficiency and to ensure the completion of the total pipeline construction within the dry working season. Some of the construction activities and their completion methodologies will require special attention. The main activities to be taken into consideration during pipeline construction are as follows:

Manpower Engagement

Pipeline construction work will be conducted using both mechanized equipment and manual labour where necessary. The major activities include ROW clearing, pipe stringing, welding, trenching and testing. For this purpose, a number of skilled, semi-skilled and unskilled workers will be employed. Overall supervision of the construction activities will be made by the professionals from GTCL. Pipeline supervisors and inspectors will permanently be involved with the project along with other personnel. They will monitor and report on construction activities to the head office regularly. A total of 20 officials including managers, engineers, and accountants will be involved for the project. In addition another 18 staff will be engaged during implementation of the project.

Pipeline Route and Working Areas

The width of the pipeline trench for this project is approximately 1.0 meter, but about 8 meters right-of-way (ROW) will be permanently acquired in addition to 15 meter strip under temporary requisition along the pipeline ROW for the smooth works. In some cases, the width of the ROW may vary up to 3+/-meters depending upon the accessibility into the location. For construction in the Private land and in the highway a reduced ROW width will be utilized wherever possible.

In general, the Contractor shall clear and grade the ROW by removal of crop and vegetation. Trees, gardens etc. will be avoided whenever possible. Debris shall be removed to the extreme edge of the right-of-way so that these are not mixed with trench backfill material.

Grading

The purpose of grading is to provide adequate right-of-way access and ditch-line preparation to complete construction. In order to achieve this goal, a detailed survey shall be conducted using proper supervision and inspection practices. Attempts should be made to lay the pipeline in areas, which will minimize grading.

Pipe Diameter Factor

For the project, 30 inch pipe will be used throughout the ROW. The larger the diameter of pipe, the greater right-of-way width is required. Large diameter pipe will require very accurate bends. The amounts of tough bends are usually kept to a minimum. Increasing the number of bends increases the amount of grading, coupled with the fact that specialized heavy equipment is necessary.

Ditch Depth Factor

The amount of soil excavated from the ditch to meet construction specifications is the main factor in determining the width of right-of-way with respect to ditch depth. Ditch depth will vary depending on the use of the pipeline (the top of the pipeline will always be a minimum of 36 inches from the surface), soil characteristics and applicable codes and regulations.

Stringing

Pipes should be strung only on the right-of-way which has been cleared and where grading has been completed. The Contractor shall ensure that the pipe is strung for proper placement of the pipe size. Pipes shall be raised on sandbags.

Coating of Pipeline

The pipeline will be coated using 3 layer polyethylenes (3 LPE). Buried pipes and fittings shall be protected against corrosion by means of external coating and wrapping. Holiday detectors shall be used to detect any holiday and shall be repaired.

River Crossing

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.

Trenching and Trench Dimensions

The pipeline will have casing whenever it crosses a highway or rail track. The minimum depth of cover shall be measured from the top of the pipe to the surface of the working grade. Crown

materials along the surface of the ground level will not be considered as a part of the depth of cover. The specified depth of trench can be varied as suggested by the Engineer or his representatives considering the site condition. The trench shall be carefully cut so that the pipe is evenly bedded throughout its length with sufficient joint holes and trial holes made where necessary. The minimum base width of the trench shall be specified in supplemental/ standard drawings.

Lowering-in: Commencement of the lowering-in shall take place as soon as possible after the trench has been excavated.

Tie-in: Separate welded joint sections of the pipeline shall be tied into a continuous system in such a manner that no stress will be induced into the pipe as a consequence of the tie-in operation.

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 tie-in is in progress. The installation shall require inspection before back-fill is placed.

Back Filling: Before any back filing is performed, the pipeline will be evenly bedded upon the bottom of the trench throughout its length and will be correctly positioned. Holiday detector shall be used to detect holiday if any and shall be repaired before backfilling. Compaction of back filling material shall be performed by an approved method to prevent any subsequent settlement.

Re-instatement and Clean-up: As soon as the pipeline has been laid and backfilled, the right of way and work areas will be cleaned up to ensure that they are returned to their original status as much as possible.

Route Markers: Reinforced concrete route markers shall be installed along the pipeline route on both sides of roads, rail, and river crossings with a maximum of 0.2 km separation distance between the 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.

Commissioning: The pipeline shall be commissioned following hydrostatic testing, pigging and dewatering. 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 cathodic protection test points, ROW markers and aerial markers etc in accordance with the programme 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 regulating and metering stations, valve stations, scraper traps and ancillary facilities and to provide adequate pipeline clearance at major river crossing etc. Construction activities for metering stations are similar to those employed for process plants, i.e., site preparation (grading, drainage construction, fencing, etc.) and plant construction/ installation.

3.4.1.3 Operation and Maintenance Phase

Once the pipeline is commissioned, it is ready to transport gas at a regulated pressure. Operation and maintenance of the pipeline starts from the day it is commercially commissioned.

Maintenance of the pipeline requires constant vigilance. Emergency crews must be trained and be immediately available to repair line breaks, installing leak clamps, changing any section of pipes and other necessary repairs along the pipeline route. Patrolmen who are to log down any noticeable changes on the right-of-way must regularly walk along the pipeline route. Flowing of impressed current is specially designed and commissioned to cathodicly protect the pipeline. Test poles are installed for monitoring the potential difference at the pipeline performed to ensure proper cathodic protection of the pipeline system.

The operation and maintenance activities must include the following:

- Patrolman's ROW recording to ensure that there is no encroachment and no visible problems;
- Ground installations to be regularly checked and maintained; and
- Pigging of the pipeline to be under taken every two years or as deemed necessary.

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 like paints, thinners, POL and odorant etc are generated.
- Condensate is generated at metering stations, which requires proper handling, storage and transportation to fractionation and blending plants.

3.5 Salient Features of the BKB-SG Gas Transmission Pipeline

Pipeline construction has some potential to cause adverse environmental impacts because a pipeline is a linear one and although it has a narrow footprint, it potentially affects a large number of locations it passes through along the ROW. However, pipeline construction is a well-developed process worldwide and the petroleum and natural gas pipeline construction industries have developed working practices both at home and abroad, which substantially mitigate the negative impacts of installing pipelines.

A total of 60 km Gas Transmission pipeline will be constructed from BKB to SG under this Project. The pipeline will pass mainly through agricultural land including crossing the Comilla-Meghna, Kajla, Meghna, Old Brahmaputra and Sitalakhya rivers, RHD roads. The proposed alignment of the pipeline ROW including salient features is shown in **Figure-C**. In fact, the pipeline will also have a few valve stations and 3 regulating and metering stations / city gate with scraper traps and other ancillary facilities.

The pipeline will also cross a number of LGED feeder roads connecting different villages with the district towns and small canals. In order to avoid disruption to navigation, fishery and other aquatic resources, Horizontal Directional Drilling (HDD) will be used across the major river crossings like the thrust-boring method will be practiced for major road. However, except for movement of heavy vehicle and equipment during the construction phase, no disruption of local traffic is foreseen during the operation stage, as the pipeline will be all through, a sub-surface one.

The main features of the project site have been illustrated some of in the photographs and have been annexed at **Annex-5**.

Photo-1: Public Consultation at Talighati Village (21.02.2006)

Photo-2: Public Consultation at Junction of Gazitola to Fulbari HBB road at Arang Ghata Mouza (22.02.2006)

Photo-3: Consultation with Mr. Monirul Islam, Additional District Commissioner, Khulna Division, Khulna (22.02.2006)

Photo-4: Consultation with Mr. Abdul Salam, Divisional Commissioner, Khulna (22.02.2006)

Photo-5: Consultation with Mr. Shaharuzzaman Mortoza, President, Chamber of Commerce & Industry, Khulna (22.02.2006)

Photo-6: Public Consultation with Mr. Mahabubur Rahman, Chairman 7 No. Raigram Union at Singair Bazar, Kaliganj (23.02.2006)

Photo-7: Crossing of Paddy & Sugarcane field, (23.02.2006)

Photo-8: Crossing of Betel-Leaf field, at Singair Bazar, Kaliganj (23.02.2006)

Photo-9: Road Crossing of Kushtia-Jhenaidah main road near Soil Resource Development Institute of Jhenaidah (23.02.2006)

Photo-10: The pipeline will cross the Chitra River by Horizontal Directional Drilling (HDD), (23.02.2006)

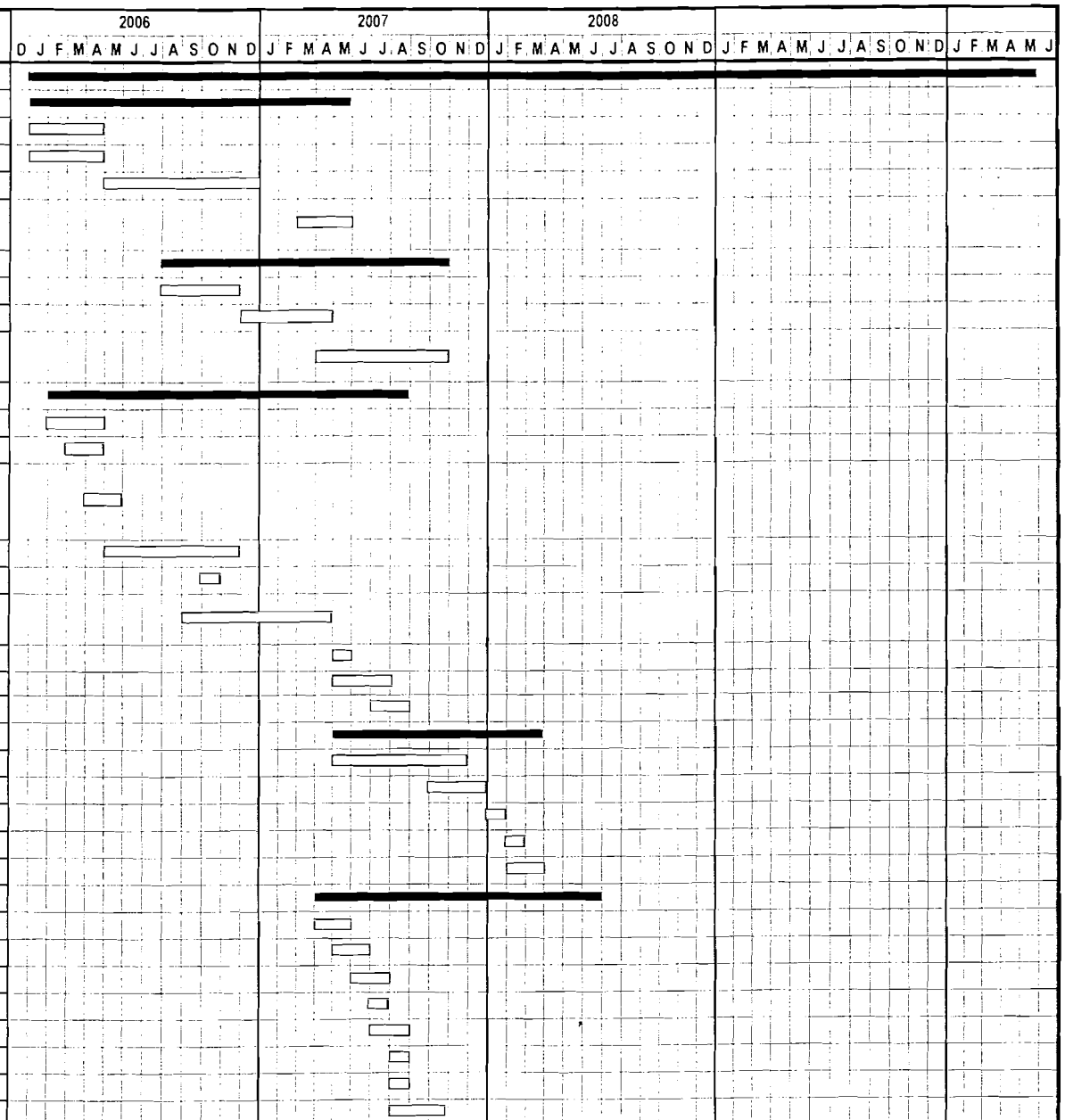
3.6 Proposed Schedule of Implementation

The project activities may be divided into a pre-construction phase, a construction phase, and an operation and maintenance phase. The project activity schedule is shown in **Figure-L** depicting relevant aspects of these phases.

Figure 3.2: Project Activity Schedule

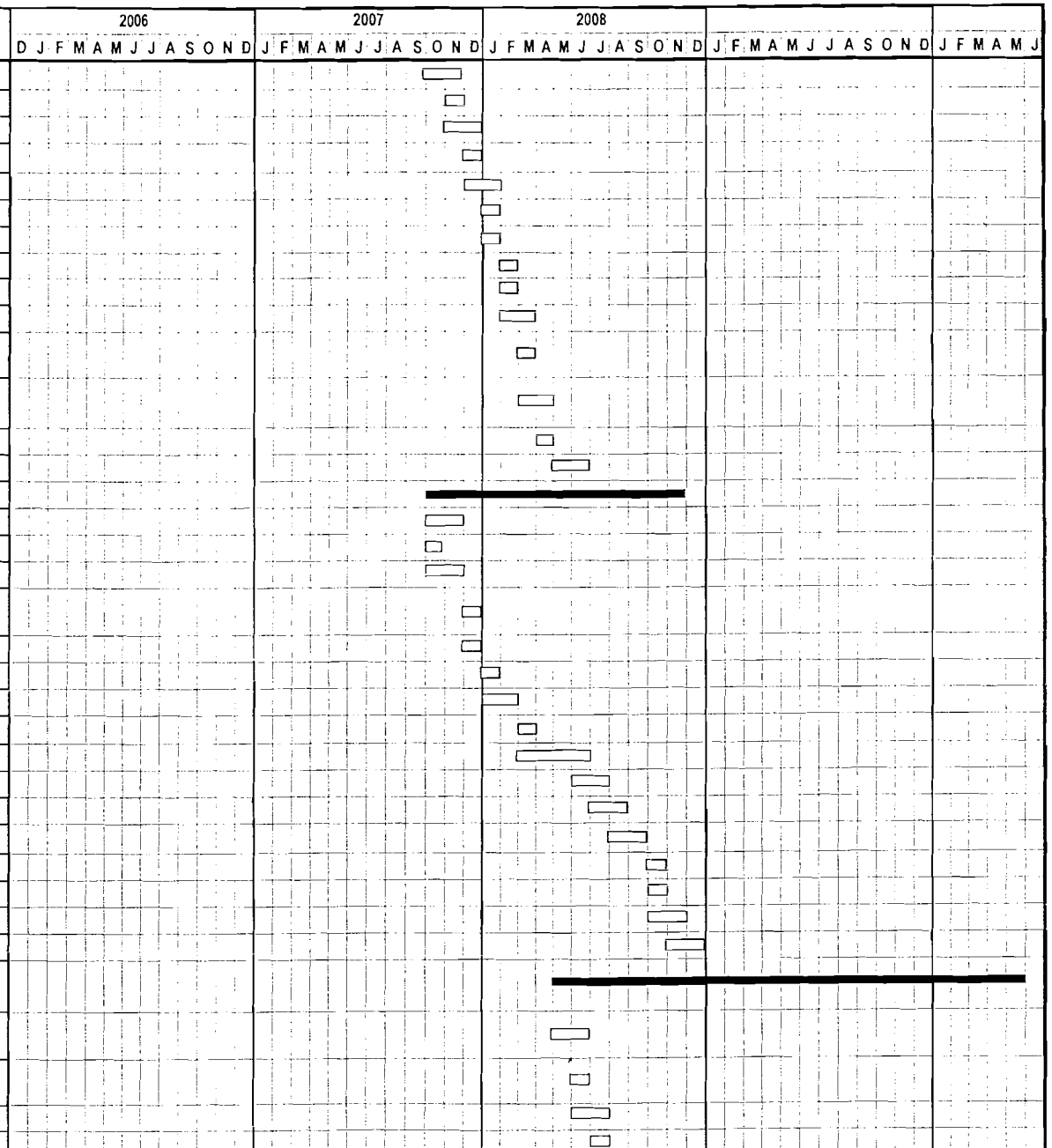
BAKHRABAD-SIDDHIRGANJ 30" x 60 KM GAS TRANSMISSION PIPELINE PROJECT

ID	Task Name	Duration	Start	Finish
1	**Bakhrabad-Siddhirganj Project**	**1612 days?**	**Sun 01-01-06**	**Mon 31-05-10**
2	**Survey**	**507 days**	**Sun 01-01-06**	**Tue 22-05-07**
3	Engagement of Surveyor	114 days	Sun 01-01-06	Mon 24-04-06
4	Reconnaissance Survey & Route Selection & Map Collection	108 days	Sun 01-01-06	Tue 18-04-06
5	Detail Survey	226 days	Sun 07-05-06	Mon 18-12-06
6	Preparation of alignment sheet, Collection of documents in favour of Land Owner, Preparation Plot Index etc.	59 days	Sun 25-03-07	Tue 22-05-07
7	**Environmental Study**	**445 days**	**Sun 06-08-06**	**Thu 25-10-07**
8	RFP preparation and Approval	116 days	Sun 06-08-06	Wed 29-11-06
9	Engagement of Consultant	140 days	Thu 30-11-06	Wed 18-04-07
10	Report Preparation of IEE, EIA & RAP by Consultant and submit to GTCL	190 days	Thu 19-04-07	Thu 25-10-07
11	**DPP**	**568 days**	**Thu 02-02-06**	**Thu 23-08-07**
12	DPP preparation and send to Petrobangla	60 days	Thu 02-02-06	Sun 02-04-06
13	DPP of Ministry	2 days	Mon 03-04-06	Tue 04-04-06
14	DPP to Planning Commission (DPP examination, arrangement, of Inter Divisional meeting and preparation of minutes, Recast DPP and submit to Ministry through Petrobangla)	56 days	Wed 05-04-06	Tue 30-05-06
15	DPP tp PEC meeting (1st time)	104 days	Wed 31-05-06	Mon 11-09-06
16	Minutes of PEC meeting	9 days	Tue 12-09-06	Wed 20-09-06
17	**Recast of DPP as per PEC meeting and World Bank estimate and submit to Planning Commission through PB, Ministry**	**215 days**	**Thu 21-09-06**	**Mon 23-04-07**
18	PEC meeting (2nd time)	1 day	Mon 28-05-07	Mon 28-05-07
19	Recasted DPP send to Planning through Petrobangla & Ministry	58 days	Tue 29-05-07	Wed 25-07-07
20	Approval of DPP from ECNEC	30 days	Wed 25-07-07	Thu 23-08-07
21	**Loan Processing**	**317 days**	**Sun 20-05-07**	**Mon 31-03-08**
22	Project Appraisal	195 days	Sun 20-05-07	Fri 30-11-07
23	Loan Negotiation	106 days	Mon 17-09-07	Mon 31-12-07
24	Board Presentation	30 days	Wed 02-01-08	Thu 31-01-08
25	Signing of Loan Agreement	28 days	Fri 01-02-08	Thu 28-02-08
26	Declare Loan Effective	32 days	Fri 29-02-08	Mon 31-03-08
27	**Engagement of Owners Engineer (Consult)**	**422 days**	**Sun 15-04-07**	**Mon 09-06-08**
28	Submission of RFP for Banks Review	42 days	Sun 15-04-07	Sat 26-05-07
29	Banks Oversvation Comments/ Comments	30 days	Sun 27-05-07	Mon 25-06-07
30	Submit updated version of the RFP	14 days	Tue 26-06-07	Mon 09-07-07
31	Banks Observation & Comments	6 days	Tue 10-07-07	Sun 15-07-07
32	Submit final updated version of RFP	22 days	Mon 16-07-07	Mon 06-08-07
33	Banks no objection of updated RFP	16 days	Tue 07-08-07	Wed 22-08-07
34	Issue RFP to Short Listed firm	7 days	Thu 23-08-07	Wed 29-08-07
35	Receive Proposals	49 days	Thu 30-08-07	Wed 17-10-07



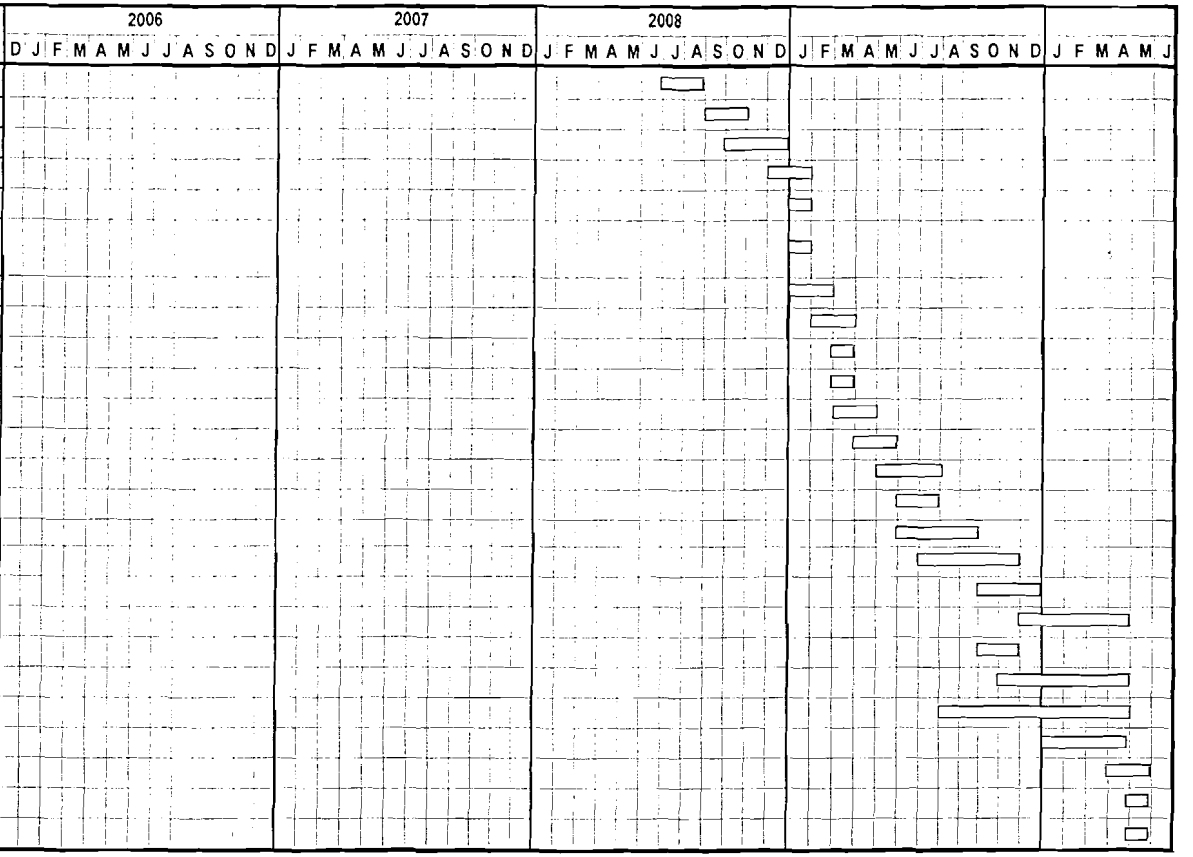
BAKHRABAD-SIDDHIRGANJ 30" x 60 KM GAS TRANSMISSION PIPELINE PROJECT

ID	Task Name	Duration	Start	Finish
36	Evaluation of Technical Proposals (TP)	31 days	Thu 18-10-07	Sat 17-11-07
37	Approval of GTCL Board	10 days	Sun 18-11-07	Tue 27-11-07
38	Submission to Bank the evaluation of TP	5 days	Wed 28-11-07	Sun 02-12-07
39	Bank's No objection to open financial Proposals	15 days	Mon 03-12-07	Mon 17-12-07
40	Opening of Financial Proposals	16 days	Tue 18-12-07	Wed 02-01-08
41	Evaluation of Financial Proposals	15 days	Thu 03-01-08	Thu 17-01-08
42	Approval by GTCL Board for Contract Negotiation	14 days	Fri 18-01-08	Thu 31-01-08
43	Negotiation with 1st ranked firm and initialed Draft contract	21 days	Fri 01-02-08	Thu 21-02-08
44	Submission of draft contract to NBR for clearance	4 days	Fri 22-02-08	Mon 25-02-08
45	NBR clears the draft contract	27 days	Tue 26-02-08	Sun 23-03-08
46	Submission of evaluation of financial proposals and negotiated draft contract to bank	4 days	Mon 24-03-08	Thu 27-03-08
47	Bank's no objection to Evaluation of financial proposal's and draft negotiated contract	27 days	Fri 28-03-08	Wed 23-04-08
48	Ready for signing of contract for consultancy service	7 days	Thu 24-04-08	Wed 30-04-08
49	Consultant Mobilization	40 days	Thu 01-05-08	Mon 09-06-08
50	Land Acquisition and Regulation	433 days	Tue 18-09-07	Sun 23-11-08
51	**Preparation and Board Approval**	**15 days**	**Tue 18-09-07**	**Tue 02-10-07**
52	Adminstrative Approval from Petrobangla & Ministry	15 days	Wed 03-10-07	Wed 17-10-07
53	Submission to different District Authorities	15 days	Thu 18-10-07	Thu 01-11-07
54	Preliminary assessment, rectification, feasibility studies and DLAC meeting	30 days	Fri 02-11-07	Sat 01-12-07
55	Notice U/S-iii by LA Authorities	30 days	Sun 02-12-07	Mon 31-12-07
56	Join inventory and video	30 days	Tue 01-01-08	Wed 30-01-08
57	Hearing by LA Authorities to land owner	30 days	Thu 31-01-08	Fri 29-02-08
58	Submission of proposals to Land Ministry for Government Approval	15 days	Sat 01-03-08	Sat 15-03-08
59	Approval from Land Ministry	90 days	Sun 16-03-08	Fri 13-06-08
60	Notice U/S-VI by LA Authorities	21 days	Sat 14-06-08	Fri 04-07-08
61	Rate collection for compensation	30 days	Sat 05-07-08	Sun 03-08-08
62	Preparation and submission of estimate to GTCL	30 days	Mon 04-08-08	Tue 02-09-08
63	Placement of fund by GTCL	7 days	Wed 03-09-08	Tue 09-09-08
64	Notice U/S-VII by LA Authorities	15 days	Wed 10-09-08	Wed 24-09-08
65	Payment of compensation to Land Owners	30 days	Thu 25-09-08	Fri 24-10-08
66	Handover of physical possession to GTCL	30 days	Sat 25-10-08	Sun 23-11-08
67	**Preparation of Bid Document and engagement of EPC contractor and completion of the project**	**784 days?**	**Tue 08-04-08**	**Mon 31-05-10**
68	Consultant (a) Checks Drawings (b) Design the system and (c) prepares bill of Materials and bidding documents	60 days	Tue 08-04-08	Fri 06-06-08
69	Submission of bidding documents for EPC contract to bank for clearance	6 days	Sat 07-06-08	Thu 12-06-08
70	Bank's no objection of bidding documents	30 days	Fri 13-06-08	Sat 12-07-08
71	Board Approval	15 days	Sun 13-07-08	Sun 27-07-08



BAKHRABAD-SIDDHIRGANJ 30" x 60 KM GAS TRANSMISSION PIPELINE PROJECT

ID	Task Name	Duration	Start	Finish
72	Issue IFB	5 days	Mon 28-07-08	Fri 01-08-08
73	Received bids	90 days	Sat 02-08-08	Thu 30-10-08
74	Evaluation of bids	60 days	Fri 31-10-08	Mon 29-12-08
75	Approval by GTCL Board	15 days	Tue 30-12-08	Tue 13-01-09
76	Submission to bank for no objection	2 days	Wed 14-01-09	Thu 15-01-09
77	Bank's no objection to Evaluation and proposal to issue Notification of Awards	15 days	Fri 16-01-09	Fri 30-01-09
78	Issue notification ofawards	4 days	Sat 31-01-09	Tue 03-02-09
79	Submission of PG	28 days	Wed 04-02-09	Tue 03-03-09
80	Verification of PG & Signing of contract	15 days	Wed 04-03-09	Wed 18-03-09
81	Request to bank for issuance of commitment	7 days	Thu 19-03-09	Wed 25-03-09
82	Bank issue commitment	21 days	Thu 26-03-09	Wed 15-04-09
83	Issue notice to commence the works to EPC contract	20 days	Thu 16-04-09	Tue 05-05-09
84	Submission of Drawing & Design	60 days	Wed 06-05-09	Sat 04-07-09
85	Approval od design and drawing by GTCL	45 days	Sat 06-06-09	Mon 20-07-09
86	Finalization of vendor and issing procurement by EPC contractor	90 days	Mon 15-06-09	Sat 12-09-09
87	Delivery of pipeline materials	150 days	Wed 15-07-09	Fri 11-12-09
88	Mobilization of Equipment and manpower	60 days	Thu 15-10-09	Sun 13-12-09
89	Commencement and mechanical completion of pipeline	138 days	Mon 14-12-09	Fri 30-04-10
90	Mobilization of Drilling rig for river-crossing	60 days	Tue 01-09-09	Fri 30-10-09
91	River crossing	180 days	Sun 01-11-09	Thu 2-04-10
92	Supply & Installation of RMS (03 nos.)	270 days	Sat 01-08-09	Tue 27-04-10
93	Instilation of SCADA system	120 days	Fri 01-01-10	Fri 30-04-10
94	Construcition of CP system	60 days	Thu 01-04-10	Sun 30-05-10
95	Testing and commissioning of pipeline	31 days	Sat 01-05-10	Mon 31-05-10
96	Testing and commissioning of PMS	31 days	Sat 01-05-10	Mon 31-05-10



Date: Wed 08-08-07

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Mile Task
Split

3.7 Project Data

The project data are furnished in **Table 3.1**

Table 3.1: Project Data of the BKB- SG Gas Transmission Pipeline Project

Bakhrabad-Siddhirganj Gas Transmission Pipeline Project

(In lakh Taka)

		Pre-Construction Works	Cost
I.	(a)	**Land Acquisition ***	
	(i)	48 hec. of land is required by taking 08 meter strip and 01 hec of land is required for 05 nos. valve stations i.e., 49 hec of land is required as per Natural Gas Safety Act. 1991 (Amended in 2003) for laying of 60 km long gas transmission line@ 5.50 million/ hector.	2695.000
	(ii)	3.575 hec. of Land is required for 1 No. RMS at Meghnaghat and 10 m strip of land at Meghnaghat Power Plant area: @ 5.31 million/ hec/year : 1.75 hec. (Rental Basis) 1 No. RMS at Haripur : @ 100.00 million/hec. : 1.00 hec.	1557.630
		1 No. CGS at Siddhirganj and 10 m strip of land for linepipe at Haripur & Siddhirganj : @ 0.6587 million/hec/year : 0.825 hec (Rental Basis) and 0.175 hec. Land for Residential Building at Siddihirganj (outside powerplant) @ 150.00 million/hec.	
		Total Land : 3.575 hec.	
	(b)	**Land Requisition/ Right of Way ***	
	(i)	90.00 hector of land is required for 2 years period temporary requisition (15 M strip) for providing working area during pipe laying works and other construction works (payment of compensation for crops/ trees/ structure etc. to be damaged) @ Tk. 3.0 Lakh/ hector/ year.	540.000
	(ii)	5 hector additional land is required for 1 year period temporary requisition for 5 nos. River crossing (payment of compensation for crops/ trees/ structure etc. to be damaged @ Tk. 3.0 Lakh/ hector/ year.	15.000
	(c)	**Land Development ****	
		80000.00 m^2 of Land Development for CGS/RMS at Haripur, Meghnaghat and other locations @ Tk. 189.00 /m^2	151.200
	(d)	**Route Survey**	
	(i)	Route Survey by Local Contractor	6.000
	(ii)	Soil and sub-surface Investigation	10.000
	(e)	Initial Environmental Examination (IEE), Environmental Impat Assessment (EIA) and Resettlement Action Plan (RAP)	15.000

* Land acquisition and recquisition cost have been calculated 20% higher than actual cost of DCF project

** Land development cost has been prepared on the basis of PWD standard and rates in 2004

II.		**Construction Works**		**Cost**
	(a)	Toporaphical and geotechnical survey, details design, Engineering, Procurement construction, Testing & Commisioning of Bakhrabad-Siddhirganj Pipeline including river crossing by HDD method and installation of RMS/CGS at Siddhirganj, Haripur & Meghnaghat on EPC basis.		
	(a.1)	Detaild Survey & Drawing, Design		1163.574
			FE:	1163.574
	(a.2)	30 inch dia, 57 km construction of pipeline including CP System & other pipeline related facilities at Bakhrabad Gas field, Meghnaghat, Haripur, Siddhirganj etc. * (with 5% allowance)		4749.630
			FE:	3617.787
	(a.3)	5500 Meter River crossing (Gomuti, Kajla, Meghna, Old Brahmaputra, Sitalakhya) by HDD method on EPC basis.		6449.800
			FE:	5604.868
	(a.4)	03 Nos. RMS/CGS Installatin at Meghnaghat, Haripur & Siddihirganj on EPC basis.		2113.110
			FE:	1655.745
	(a.5)	Interfacing of SCADA System on Turn-key basis for Bakhrabad-Siddhirganj pipeline.		2145.000
			FE:	1991.143
	(b)	**Civil Works**		
	(b.1)	**Functional Building ****		
		480 sq.m Office Building (Control Room, Security Building, workshop etc.) at Meghnaghat, Haripur, Siddhirganj.		60.000
	(b.2)	**Residential Building**		
		1594 sq.m Residential and Dormatory Building at Meghnaghat, Haripur		216.784
	(b.3)	**Other Construction Works ****		
		Boundary wall, Water and Electrical facilities (Multi purpose use) etc. at Bakhrabad Gas Field, Meghnaghat, Haripur, Siddihirganj		118.898
III.	(a)	**Imported Machinery & Equipment *****		
	(i)	Imported Machinery and Equipment for Pipeline		24884.356
			FE:	24884.356
	(ii)	Pre-Shipment Inspection (1% of Materials cost)		248.844
			FE:	248.844
	(iii)	CD-VAT		11795.303
	(iv)	Landing charge, Port dues, Insurance, Transportation cost to site		2488.436
			FE:	2488.436
	(b)	Office equipment, Fixtures, software and hardware for Network analysis		186.149
			FE:	171.149
IV.		**Transport/ Vehicles**		
		Jeep (2000-3000 C.C) : 04 Nos.		140.000
			FE:	140.000
V.	(a)	**Manpower**		
		Office-16 Nos.		120.658
		Staff-10 Nos.		23.937
		Total: 26 Nos.		**144.595**
	(b)	**Training**		171.149
			FE:	171.149

* Pipeline construcion and other cost have been calculated on rational basis of the estimate prepared by World Bank's consultant and in house committee of the company.

** Accommodation area and Estimated cost for Civil Construction Works have been prepared on the basis of PWD standard and rate at 2004.

*** Cost of Machinery and equipment have been calculated on the basis of the estimate prepared by World Bank's consultant.

VI.		Other Costs		Cost
	(a)	Consultancy		2021.990
			FE:	1923.390
	(b)	POL & Maintenance of Vehicle, Office rent, Entertainment, Telephone, Water Supply, Electricity Bill etc. (1%)		620.654
		Total Base Cost :		64708.102
			FE	42318.536
			LC	22389.566
	(c)	Interest during construction (LC 4% & FE 5%)		1084.144
			FE	761.734
	(d)	Contingency 5% (Physical and Financial)		1133.380
			FE	0.000
	(e)	Cost Escalaton 5%		1638.434
			FE	0.000
		Total :		**68564.060**
			FE	43080.270
			LC	25483.790

❒ 1 US $ = 69.69 Taka

3.8 *Operational and Safety System* of the Project

3.8.1 Satellite Image of Proposed Alignment

The satellite image of 0.6 and 6 meter resolution has been processed and prepared covering the entire route of the pipeline highlighting the special crossings, the habitats and critical sections of the pipeline and plant components for having an understanding of the over all configuration of the project and its operational features.

3.8.2 Operational System of the Project Design

The major operational controls of the pipeline system are to monitor the design operating parameters of flowing gas in respect of pressure, velocity and quality of gas. These controls are mainly exercised through valve stations, regulating and metering stations and the scraper traps, etc. so that, gas is never allowed to flow over the designed maximum operating pressure, not exceed the design velocity or not being wet beyond specified liquid content per unit (say 7 lb / million cu).

Further, pipelines when get exposed on removal or scour of the backfill, it may turn more vulnerable to failure and collapse due to likely physical interventions. Similarly, maintenance and monitoring of the CP system are also important for operational controls for securing the design life of the pipeline system. The route markers, both land and aerial, are also equally important to remain in position for facilitating due patrolling and performing the reporting procedures.

3.8.3 Safety System of the Project Design

The project design essentially considers protection from three basic types of hazards, for example, physiological, biological & chemical, so far as safety system is concerned. So, due consideration of anticipated risk and analysis of hazards that might be associated with it are of fore most importance.

Accordingly, all standard practices and recognized codes of procedures, equipments, methods and behavioural trainings of all involved in execution of the project have to be duly incorporated in the design, construction, commissioning and operation phases of the project. The procedures and practices are to be well defined in the bid documents and relevant brochures & leaflets for attaining the safe work target which is equally important for the personal welfare of the company employees/ contractors/ service providers/ villagers and the onlookers etc. as well.

CHAPTER-04

BASELINE EXISTING ENVIRONMENT

Chapter - 04

BASELINE EXISTING ENVIRONMENT

4.1 Introduction

Baseline data on environment is important to understand existing physical, biological, cultural and social environmental characteristics. This information forms the basis to analyze the probable impacts of the project activities. Mainly there are two principal objectives in examining and defining the existing environment.

a. To recognize potential environmental impacts of the project and enable mitigation measures to be identified.
b. To provide a base line against which environmental conditions may be measured of the project in the future, and to document conditions which were either existing or developing before the introduction of the project and not due to the project.

4.2 Study Area

The proposed pipeline construction project is located in Narayanganj, Munshiganj and Comilla Districts. The total length of the pipeline route is approximately 60 km traversing mostly the private agricultural land, where it will pass through 1 major Dhaka-Comilla highway and will have to cross 5 rivers namely Sitalakhya, Old Brahmaputra, Meghna, Kajla, and Gomuti-Meghna.

4.3 Physical Environment

4.3.1 Climate

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 Comilla and maintained by the Bangladesh Meteorological Department (BMD). Meteorological data collected include temperature, humidity, rainfall, sunshine, solar radiation and wind speed. This information is summarized below.

Temperature

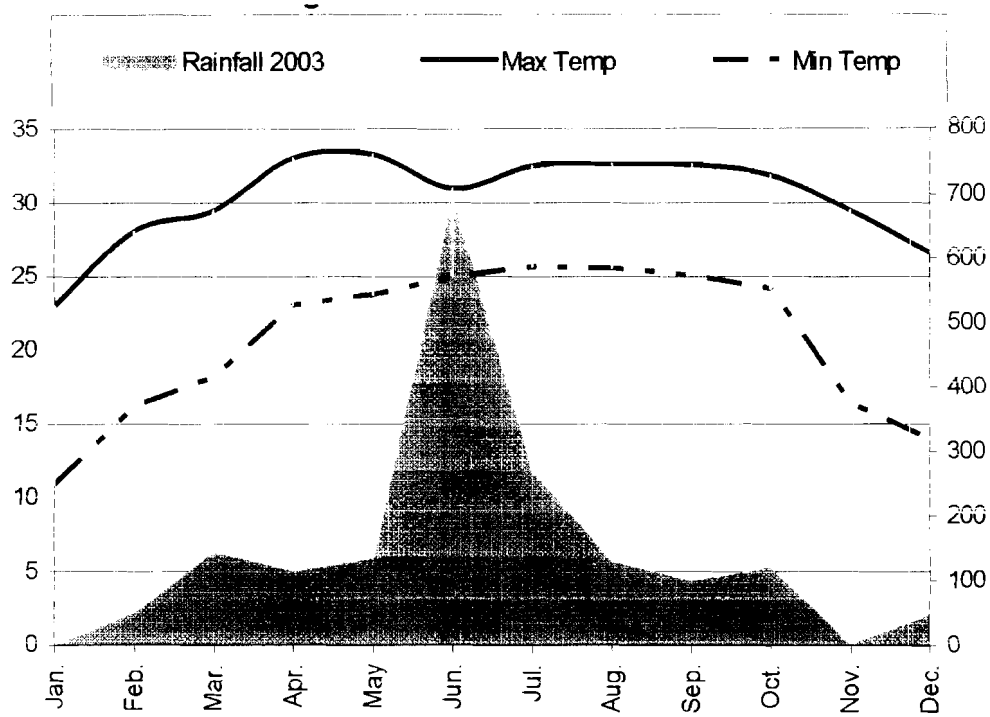
The average minimum temperature in Bangladesh lies within November to February which varies generally from 10.9°C to 16.4°C while the maximum temperature is seen in May which is around 33.3°C. **Table 4.1** shows the monthly average mean, maximum and minimum temperature at Comilla for the year 2003.

Table-4.1: Climatic Data of Comilla for the year 2003

Month	Max Temp (°C)	Min temp (°C)	Humidity %	Rainfall mm
Jan.	23.0	10.9	79	0
Feb.	28.1	16.2	69	50
Mar.	29.5	18.2	79	145
Apr.	33.1	23.1	77	116
May	33.3	23.8	76	136
Jun.	31.0	25.0	85	699
Jul.	32.5	25.7	81	271
Aug.	32.7	25.6	79	131
Sep.	32.6	25.1	83	101
Oct.	31.9	24.2	83	122
Nov.	29.5	16.4	78	3
Dec.	26.6	14.0	86	49

Source: Bangladesh Meteorological Department, 2003

Figure: Climatic Chart: Comilla



Humidity

As seen from **Table-4.1,** the average monthly humidity in the region varied from 69% to 86% at the years 2003. In general, the relative humidity of the study area is the lowest in March and April and from May there is a steady increase until July and then gradual decrease is observed down to March again.

Rainfall

The maximum rainfall at the year 2003 in Comilla and in its vicinity is about 699 mm. In Rabi season (November-February), Pre-monsoon season (March-May) and in Monsoon season (June-October) maximum rainfall are about 50 mm, 145 mm and 699 mm respectively (**Table-4.1**).

4.3.2 Topography and Geology

The geology of the project area had to be examined as part of the overall quaternary geology of the Bengal Basin. The margins of this Basin contain consolidated Pliocene to Eocene sediments, folded and faulted and dipping steeply under the basin. During the Pleistocene period, flood plain sediment was deposited over the northern and eastern areas of the basin from early Ganges, Brahmaputra and Meghna river systems. The Pleistocene Terrace areas are generally above the level of present day monsoonal flooding. In these area alluvial deposits of probable quaternary age was deposited chiefly by the present and ancestral Brahmaputra, Ganges and Megha river systems. Areas of older Pleistocene alluvium north of Dhaka rise above younger holocene alluvium.

The broad tectonic aspects of the geologic structure of Bangladesh have not yet been adequately evaluated. Folding and faults are generally responsible for the development of alignment and changes in drainage system. It is known that some rivers follow faulted zones. **Figure-D** shows the segment wise general regional geology of the area.

4.3.3 Digital Elevation Model

A digital elevation model (DEM) is a digital representation of ground surface topography or terrain. It is also widely known as a digital terrain model (DTM). A DEM can be represented as a raster (a grid of squares) or as a triangular irregular network. DEMs are commonly built using remote sensing techniques; however, they may also be built from land surveying. DEMs are used often in geographic information systems, and are the most common basis for digitally-produced relief maps. **Figure-E** shows the segment wise DEM of the proposed gas transmission pipeline project.

4.3.4 Seismicity

Bangladesh is divided into three Seismic Zones with respect to the ranges of seismic co-efficient, of them Zone-I as the most severe and Zone-III the least severe. The project area falls within Zone-II of the seismic-zoning map of Bangladesh **Figure-F** and seismically it is quiet.

Zoning	Area Mercalli Scale	Modified
I	North and eastern regions of Bangladesh (Seismically most active)	IX
II	Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla, Noakhali and western part of Chittagong Folded belt.	VIII
III	Khulna division S-E Bangladesh (Seismically relatively quiet)	VII

4.3.5 River system

The rivers that lie within the vicinity of project area are mainly Sitalakhya, Old Brahmaputra, Meghna, Kajla, and Gomuti-Meghna Rivers and a number of drainage khals that carries run off from adjacent areas. **Figure-G** shows the segment wise River system of the project area.

4.3.6 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 and some small industries.

4.3.7 Surface Water

4.3.7.1 Water Course Systems

There are five rivers in Muradnagar, Chandina, Daudkandi, Gojaria, Sonargaon, Bandar and Narayanganj upazilas. Among them, the Sitalakhya, Old Brahmaputra, Meghna, Kajla, and Gomuti-Meghna rivers are notable.

4.3.7.2 Description of Rivers

Gumti: originates from Dumur in the northeastern hilly region of Tripura state of India. From its source it flows about 150 km along a meandering course through the hills, turns west and enters Bangladesh near Katak Bazar (Comilla Sadar). Then it takes a meandering course again and passes through the northern side of Comilla town and east of mainamati. Keeping Burichang upazila on the north, it cuts through Debidwar upazila and reaches Companiganj Bazar. The distance from Mainamati to Companiganj Bazar is about 60 km. From Companiganj it turns west and finally falls into the meghna at Shapta in Daudkandi upazila. The segment between Companiganj and Daudkandi is about 50 km long. The Gumti is about 135 km long within Bangladesh. The dakatia is one of the important tributaries of the Gumti and the Buri river is its distributary.

Old Brahmaputra: a river that originates from the left bank of the BRAHMAPUTRA to the north of Bahadurabad. Flowing more or less to the southeast it passes by Jamalpur and Mymensingh towns and falls into the MEGHNA at Bhairab Bazar. River shifting has been a characteristic feature of the BENGAL BASIN, affecting small sections or even the entire river. The most dramatic was the shifting of the courses of the TISTA, Brahmaputra and lower GANGES river channels as evident from maps prepared hundreds of years ago. James RENNELL produced the most accurate map back in 1760. According to this map, the Brahmaputra at that time was flowing a course east of the MADHUPUR TRACT, presently known as the Old Brahmaputra. The lower part of the Brahmaputra channel between Dhaka and Mymensingh subsequently was silted up diverting the Old Brahmaputra flow to SHITALAKSHYA river and then to the DHALESHWARI and Meghna rivers southeast of Dhaka.

Shitalakshya: originates from the OLD BRAHMAPUTRA and bifurcates into two courses at Toke in Gazipur district. One of the courses named the BANAR flows southwest and at Lakpur is renamed as the Shitalakshya. It then flows east of Narayanganj town. The Shitalakshya falls into the DHALESHWARI near Kalagachhiya. The length of the river is about 110 km and the width near Narayanganj is about 300 m but reduces to about 100 m in the upper reach. Its highest discharge has been measured at 2,600 cumec at Demra. The river is navigable throughout the year and shows little erosional tendency.

4.3.7.3 Agricultural Activities

Agricultural activities are increasing with the use of chemical fertilizers and pesticides. The runoff from these agricultural fields may contribute to surface water pollution. Available information from field surveys suggests that the surface water quality is deteriorating with time.

4.3.8 Groundwater

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.

Groundwater table fluctuations indicate the recharge and discharge to the groundwater reservoir. The highest groundwater table occurs in the study area during the month of August-September when the aquifer recharges fully and the lowest is during February-March due to natural discharge and groundwater use for domestic and irrigation purposes.

4.3.9 Noise

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 discomfort, 85dB is usually considered as the critical level for ear damage. The Environmental Quality Standards for Bangladesh (DoE, 1991) 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 4.2** 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.

Silent zones are areas up to a radius of 100 meter around hospitals, educational institutions 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 zone.

4.3.10 Land Types

Table-4.3 Presents the Divisions and Zilawise Distribution of Agriculture Land Types Five land types are recognized on the basis of the configuration of the study area, which are:

- Highland
- Medium highland
- Medium lowland
- Lowland
- Very lowland

4.3.11 Soil Types

General soil types in the project are present on the following **Table 4.4**, basis of the study.

Table: 4.4 Characteristics of General Soil Types

General Soil Types	Division/Zila of important occurrence	Characteristics
Non-calcareous Alluvium	**Chittagong**: Comilla, Coxs Bazar, Habiganj, Khagrachhari, Moulvi Bazar, Sunamganj, Sylhet. **Dhaka**: Narayanganj,	Raw sandy and silty alluvial deposits, usually stratified either from the surface or below the cultivated topsoil in the active floodplain areas (young char lands) or massive in the older flood plain areas. Brahmaputra and Teesta alluvia are rich in mica and biotite; alluvia of other rivers are less micaceous. They are neutral to alkaline in reaction. They are saline in the coastal tidal areas.
Calcareous Alluvium	**Dhaka:** Munshiganj.	Calcareous Alluvium is similar in characteristics to the Non-calcareous Alluvium in addition; they are slightly to moderately calcareous due to presence of calcities derived mostly from the Gangetic sources. St. Martins Islam as sands mixed with calcereous coral debris. They are saline in the coastal tidal areas.
Non-calcareous Grey Floodplain Soil	**Chittagong:** Comilla, **Dhaka:** Munshiganj, Narayanganj,	Prismatic and/or blocky structured predominantly grey sandy barns to silty clay barns on young floodplain ridges and silty clay barns to clays in basins, slightly acid to neutral. They become saline in dry season in the coastal tidal areas.
Grey Piedmont Soils	**Chittagong:** Comilla,	Structured, grey sandy barns to clays, strongly acid, developed in piedmont out-wash in the piedmont aprons and valleys in areas adjoining or within the north-eastern hilly region. These soils are often affected by flash floods from the hills and liable to burial by fresh sandy deposits.
Acid Basin Clays	**Chittagong:** Comilla,	Very strongly acid, grey to dark grey heavy plastic clays mainly occurring in the Sylhet haor and Chalan beel areas and in deep valleys of the Madhupur Tract. They are usually seasonally deeply flooded and have heavy consistence.
Non-calcareous Dark Grey Floodplain Soils	**Chittagong:** Comilla, **Dhaka:** Munshiganj, Narayanganj.	Structured dark grey loamy soils on old flood plain ridges and clay in basins. Slightly acid to some what alkaline in reaction. The basin clays have heavy consistence.
Calcareous Dark Grey Floodplain Soils	**Dhaka:** Munshiganj.	Structured dark grey silty clay loams to heavy clays occurring in basins and on bow ridges of the old Ganges river floodplain and locally in the Ganges tidal floodplain and old Meghna estuarine flood plain. Soils are calcareous within a depth of 1.2 m below the surface. Clays are highly cracking when dry, drought prone and have heavy consistence. They become saline in the day season in the Tidal floodplain.
Calcareous Brown Floodplain Soils	**Dhaka:** Munshiganj.	Calcareous, brown silt barns to bight silty clays, occurring in the Ganges river floodplain and locally in the young and old Meghna estuarine floodplains. Locally they are leached of lime up to a depth of 1 m from the surface.

Source: Soil Resource Department Institute (SRDI), Ministry of Agriculture, 2002

4.4 Biological Environment

4.4.1 Introduction

The habitats of the study area sustain wildlife as well as plant communities. But many of these remain unrecognized. Verities of plant species and wild animals have been identified and recorded during IEE study for the project.

Every species play an important role in its natural community and ecosystem and removal of that species is likely to have adverse impact.

Bio-habitat of the project area may be divided into two major types viz-terrestrial habitat and wetland (aquatic) habitat.

4.4.2 Wetland Habitat

Wetland Flora

Wetland flora plays a vital role in nature. It grows mainly in aquatic habitats viz. beels, ponds, canals ditches or low lying cultivated fields. From a rapid survey in different wetland and aquatic habitat, a number of species have been identified as shown in **Table-4.5**.

Wetland Fauna

The wildlife that fully or partially depends on water reservoir such as river, canal and pond etc. for life, shelter, food, nesting, breeding and reproduces inside the water reservoir is known as wetland fauna. Important aquatic fauna comprises some species of amphibians, reptiles, birds and mammals. Aquatic fauna may act as sensitive bio-indicators of the altered state of the ecosystem resulting from human influence. The survey area represents two major type of wetland's namely permanent wetland (rivers, canals and fishponds) and seasonal wetland (agricultural land during flood).

4.4.3 Terrestrial Habitat

Terrestrial Flora

Terrestrial flora is classified according to their habitats. In the study area, terrestrial floras are present mainly in the homestead regions, roadsides, village groves, playgrounds, upland/high cultivated lands. Human being as well as wildlife uses these floral species for different purposes. They play an important role in the socio-economic and ecological balance. From a rapid field survey in different terrestrial habitats of the study area, a number of species have been identified and shown in **Table-4.6**.

Terrestrial Fauna

Wildlife that fully depends on the terrestrial ecosystems for life, shelter, food, breeding is called terrestrial fauna. A number of terrestrial species have been identified during the brief and rapid assessment in the project area as shown in the **Table-4.7a, Table-4.7b** and **Table-4.7c.**

4.4.4 Fisheries

Fish comprises over 70% of the protein for the population and are a critical resource of the country. Fish production occurs naturally in the rivers and wet lands and is cultured in fish nurseries and along the pipeline route in ponds. It has been reported by the Bangladesh Centre of Advanced Studies that fresh water fish production has declined significantly due to over fishing, pollution, deforestation and construction of hydraulic structures. Natural reproduction of fish is tightly barred and linked to the cycle of annual flooding and any activities that upset the cycle would have an adverse impact on this critical resource. In addition activities that increase the sediment loading of rivers and estuaries especially during the window of time when spawning eradication occurs and when survival of fingerlings is critical may also have an adverse impact on fish production. Since recent past, there has been a trend in cultivating fish in paddy land in and around the dryad area during rainy season.

4.5 Socio-Economic Environment

4.5.1 Population and Demography

The project area designated for the construction of gas pipeline traverses through Narayanganj, Munshiganj and Comilla District. Population and demographic characteristics of these Upazilas are shown in **Table-4.8**. The Table shows that the population density per/sq. km. varies significantly among the different Upazilas and districts. The project area is mostly agricultural land with scattered settlement. Most of the people are Farmers. Statement on Demographic Statistics along the Route, Summary of Segment wise Land Structure and Tree Loser PAPs, Details of Upazila &

Segment wise Physical and Environmental Features, Details of Road etc are present at different tables from **4.9 to 4.11.**

4.5.2 Statistical Analysis of Demographic, Socio-Economic and Community Health Data

For a better understanding of the different demographic, socio-economic and health related information about the population and the community in and around the project area, a closer look may be achieved from the 10 different tables from **4.12 to 4.21** cited below and placed at **Annex-1**.

It may be observed that , these has covered both area specific and project specific information including the ones about the project affected persons, their community , socio-economic living standard and their attitude towards implementation of the project.

Composition of Household Members

Distribution of household members with household heads is presented in **Table-4.12**.

The data shows that the 99.45% of sample household is comprised of the male heads, where 0.55% of the sample house holds are maintained by female head.

Age Sex Distribution

Age Sex distribution of the household members is presented in **Table-4.13.**

The table shows the distribution of the age groups of the household members by their sex. From the table we can see that children of age groups 1 to 14 is about 32.97%, household members of age groups 15 to 60 (main work force) is 64.11%, those of age group above 60 is about 2.93%

Religious and Ethnic Composition

Distribution of the households by their religion is summarized in **Table-4.14.**

It shows that the sample households are comprised of 96.49% Muslims, 3.51% Hindus.

Educational Status of the Population

The educational status of the members of the household has been summarized in **Table-4.15**.

The table shows the distribution of the educational status of the household members by sex. This reveals that about 13.64% of the sample population is totally illiterate (who cannot read and write), about 5.38% can read and write without any formal education, primary level is 28.26%, secondary level is 24.08%, and also graduate and above is about 1.71%.

Economy and Employment

Main Occupation of the Household Members

Main occupations of the household members are summarized in **Table-4.16** by their sex.
The table shows that the maximum of 9.34% is engaged as farmer, 26.80% in housework activities, 25.02% as students, 3.94% in service, 1.78% in small trade, 11.09% are children of less than 5 years and 3.60% are unemployed.

Monthly Income Patterns

Monthly income pattern of the sample households are presented in **Table-4.17**.

The Table shows that the range of monthly income of 17% of the sample house hold is Tk. 3000-5000, where 49% of them earn 5001-10000. 20% earn 10,001-15,000 and 8% have 1,001-20,000.

Quality of Life Values

House Ownership

The distribution of the sample households by types of their residential house with respect to ownership and construction is presented in **Table-4.18**.

The table also shows that 69.81% of the houses are Katcha (straw and bamboo roof with earthen wall/ earthen wall reinforced by sheet of woven cane & bamboo), 25.80% are Semi-Pucca (CI sheet roof with brick wall) and 4.06% are Pucca (reinforced concrete roof with brick wall) buildings.

Water and Sanitation

Sources and Use of Water by Purpose

Sources of water and their use were investigated and the results are summarized in **Table-4.19.**

The Table shows that around 96.71% of the households drink tube wells water, around 3.29% of the households drink water from other source. The pond water is unsafe and is mostly used for bathing and cattle washing purposes.

Sanitation

The sanitation practice of the sample households and the types of latrines used are shown in **Table-4.20**.

The Table shows that 63.45% of the project affected households have sanitary latrines. Among the remaining 30.95%, 3.84% use pits and hanging systems and 1.76% use open space or bushes for defecation.

Health Status

Main Health Service Facilities of the Area

Responses by sample households on their main health service facilities in the area are presented in **Table-4.21.**

The table shows affected household opinions on their main health service facilities in the area, where 14.47% of them goes to the Govt. Hospital.12.29% of them go to the Union Health Clinic, 27.30% goes to Quack, followed by about 22.98% to private doctors, 4.06% to Private Hospital and 18.49% to Pharmacy.

Cultural Aspects

People residing in the surrounding areas of the project location are of different religions; Muslims, Hindus, Christians, and Buddhist, etc. Besides the general culture and heritage of the area, culture also differs due to the difference of the communities built-up by these religions in different locations of the project. The Muslims pray in the mosques and observe their religious festivals like Eid, the Hindus observe their Pujas (Durga puja, Kali puja, etc.) in the temples and the Christians observe their prayer in the church and observe Christmas. There are special gatherings among the villagers where cultural events are performed and special foods are prepared.

CHAPTER-05

PUBLIC CONSULTATION

Chapter – 05

PUBLIC CONSULTATION

5.1 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 for preparing the Resettlement Action Plan (RAP) 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 in puts from them helps 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 RAP 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 60 km 30 inch diameter BKB-SG high pressure Gas Transmission Pipeline project and its associated facilities being financed by the WB, 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 & public amenities and the environment as EA guidelines of the WB OP 4.01 to be read with 4.11 & 4.12.

5.2 Methodology and Output

5.2.1 Focus Group Discussion

The process of public consultation was initiated and conducted in two stages. This was done in the 1st Stage, during earlier IEE & EIA/ RAP studies in June-July, 2007 through focus group discussion (FGD) at and around different locations of the transmission pipeline right of way (ROW) and at valve station block land sites.

The consultant arranged 9 such 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.

Representative(s) of GTCL, BETS and local government were also present in these meetings to understand the people's views and suggestions. Leaflets on the proposed project in Bengali were distributed among the participants. A sample one is placed in the Appendix. 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 details of the FGD meeting in stage-1 records have been incorporated in the report in a summary format and presented in **Table-5.1** for reference. These meetings were held at 9 different places of the 3 districts along the pipeline alignment during field survey where in 110 persons were present in total including those from GTCL & BETS.

As part of the foregoing consultation process under the EIA study, group discussion with stakeholders was organized to record their views and opinions. Participants in these consultation meetings included elected representatives, local leaders, women groups, representatives of professional groups like agriculturist, businessmen, farmers, school teachers, religious leaders, NGO and public representatives as well as members and chairman of the Union Councils and the consultant has carefully studied all types of impacts in the locality of the proposed gas pipeline In addition, a number of Key Informant Interviews were also carried out with selected key individuals.

As mentioned above, the detail records of the individual discussion held at different places along the project areas have been placed at **Tables-5.2 to 5.10** and its summary is shown at **Table-5.11**. Some of the names of the participants along with the opinion expressed by them are depicted in these tables, which have also been considered indicative during preparation of RAP (ESIA Vol.-2). Information dissemination and consultation shall have to continue throughout the project implementation period.

5.2.2 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.

5.3 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. **Table-5.2** through **5.10** reveals the number and composition of the participants in these meetings.

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.

5.4 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.

5.5 Public Consultation Results

The findings as recorded from public consultations have been presented in the **Table-5.12** indicating the critical issues. The names of some of the participants present in the meetings are listed at the **Table-5.2** through **5.10** on FGD records.

5.5.1 Consultation with Project Affected Person

Since the entire pipeline alignment could not be covered during the monsoon season, direct one to one consultation with each individual PAP at all affected HH during the stage-2 of consultation was conducted in the dry season of December, 2007 - January, 2008. This time a structured questionnaire was devised to collect all relevant socio-economic condition of the PAP along the strip alignment of the project.

The suggestions on the losses, mitigation options and implementation strategies were taken from the people and the information and comments provided by each individual owner or his relative present in the HH was duly recorded in the questionnaire well structured to cover all relevant points respective to his socio-economic condition, attitude towards implementation and his claim / expectation of compensation for the losses he is going to incur for the project.

This time, members of the local government, local elites and people of different profession, representatives of GTCL, its survey organization NSO, BETS and WB were present to understand the views and suggestions of the PAP and the local people when the background, nature and components of project, summary findings of the EIA and SIA/RAP studies in respect of its positive and negative impacts etc including market value of their assets being affected, payment of compensation and grievance redress mechanism were discussed in details.

A summary of such meetings has been placed at **Table-5.13** where in a total of 998 persons were present including all of the Land, House & Tree Owner 911 PAP in presence of 38 persons of the focus group and local people covering all the plots along the entire pipeline route. Individual consultation was also conducted with the owner of the lone affected business establishment along the route - a poultry farm. The response of each and every PAP to the questionnaire has been duly recorded and then compiled in the master database prepared for the study.

5.5.2 Summary of Public Consultation

The summary of the different types of unconditional/ conditional response to acquisition/ requisition received from the PAP is given below in **Table-5.14**.

The details of the 5 km segment wise list of plots of the 49 PAP requested for compensation in the form of land for land is placed at **Table-5.15**.

Miscellaneous other conditions cited by the 18 privately owned assets like land, tree and structure losing PAP as evident is placed in **Table-5.16**.

Potential Impacts, enhancement / mitigation measures, recommended management actions including fixing of executive responsibilities based on the environmental, health and safety issues, particularly public concerns relating to water pollution, air pollution, noise, river bank erosion and disposal of materials as well as enhancement of public property has been elaborated in the Chapter-9 on EMP of this report at Table-9.3: Management Actions and Responsibilities.

5.5.3 Discussion Relating to Public Property

According to the present alignment of the pipe line, some public land in the river banks and some roads are to be affected by the project. This affected land, infrastructures and facilities will create problems in turn for the local community to live smooth life. For example, access road being

blocked during pipeline crossings, movement of human and transports. Alternative access roads will have to be arranged for mitigating the inconvenience.

Thread bear discussion was held with GTCL on this issue and it has been revealed that due permission will be sought from respective authorities following finalization of design of the pipeline sections with exact location of the crossing points, dimensions of crossings and tentative schedules etc and such permissions will be obtained on due payment of fees and other charges as asked for by these authorities like LGED, BIWTA, RHD and LA section of the district administration etc.

Further, it has been disclosed that all works related to reinstatement, erosion protection, alternate thoroughfare provision etc. required thereof to mitigate the public inconveniences and restoration of damages will be included in the tender doc of the EPC contractors.

5.6 Response to Gas Pipeline

Summary of PAP response to gas pipeline construction is placed in **Table-5.17**, where from it can be seen that none of the 911 PAP has disagreed to the execution of the project, 363 has given straight support while 548 have communicated certain conditions like providing job during construction, direct payment of compensation, payment should made without any hassle, homestead for homestead, payment should be made before starting the work etc for considerations and 2 of them pleaded for alternate suggestions stating that there will be no loss if the line is laid along the govt. land. These have been detailed in the tables referred to in foregoing sub-section 5.5.2.

5.7 Conclusions and Recommendations

5.7.1 Conclusion

The Bakhrabad-Siddhirganj 1000 PSIG 30 inch diameter 60 km 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 through out the route with a number of Valve Stations on the way and Regulating and & Metering Stations at 2 block lands at Meghnadhat & Siddhirganj, 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 resettlement actions are taken as per Environmental Management Plan (EMP) and the Resettlement Action Plan (RAP) report respectively. 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 and RAP including formation of CDC & GRC with due representation from PAP and the authority and ensure budget provision in ADP of GTCL for implementing the RAP and the EMP with due importance to social management plan as placed in the EIA (ESIA Vol.-I) Report and the recommendations made at the RAP (ESIA Vol.-II) 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 & the WB policy frame work OP 4.12.

c) Ensure incorporation of the provision of all mitigation measures including but not limited for due 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.

d) Monitor progress of implementation of both EMP and RAP through Owner's Engineer including deployment of Environmental Specialist of the independent Pipeline Consulting Group with their placement in the organization chart recommended at **Figure-9.1** in **Chapter-9** of this report and ensure progress reporting to the management of GTCL and other concerned authorities e.g. DOE, WB etc as applicable.

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 of 17 privately owning households. However, if any found during execution of works he/ they will have to be duly compensated. Only one business establishment of a poultry farm is along the pipeline together with a few vulnerable PAP and about 4 female headed house holds 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 EPC contractor as suggested in the EMP.

CHAPTER-06

ANALYSIS OF SUITABILITY FOR ALTERNATIVE ROUTES

Chapter - 06

ANALYSIS OF SUITABILITY FOR ALTERNATIVE ROUTES

6.1 Route Selection Factors

To minimize the adverse impact on the environment, identification of a suitable corridor for gas transmission pipeline is very important. The actual distance may vary or increase significantly from the aerial distance and will depend on alternative options for selecting a particular route. Which ever is the pipeline route, it will pass through numerous agricultural lands, vegetation, private land and river and drainage canal. Three options have been considered in selecting the proposed Gas Transmission pipeline right-of-way (ROW). Factors those were taken into account include:

- Length of the Route
- Minimal Highway Crossing;
- Avoid Railway tracks 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.
- Minimum cost and least level of absolute environmental and social impacts.

6.2 Location of Selected Routes

As stated in para 6.1 above, in selecting a feasible pipeline route for the project in question, three different options were studied shown in **Figure-J**. There are options are described below.

Option-I starts at the proposed Bakhrabad City Gate Station (CGS) and pass different villages and chars i.e. Gangotia, Jafura, Kasarkanda, Bariakuri, Titarkandi, Luittashori, Ampal, Namotkandi, Sailakandi, Pacpukuria, Biti paspukuria, Chouhoddi, Norshihopur, Adampur, Bitman, Shinggula, Malikhil, Vitpur, Gilatoly, Isapur, Chapara, Daspara, Dhakargao, Uttar Gazipur, Kajirkona, Chorkumaria, Moddhamkandi, Pora Chok Bouisa, Vober Char, Vater Char, Loskordi, Jamaldi, Kabilgonj, Voirobdi, Vagalpur, Madhabpur, Noagoa, Char Islampur, Tajpur, Bajurbag, Baligao, Kuraiabari, Kandapara, Koudhala, Fulor, Sharagvag, Muradpur and at the end Horipur CGS. After Putia Basara the pipeline crosses the Dhaka-Comilla highway.

Option-II starting at the proposed Bakhrabad City Gate Station (CGS), the pipeline route runs parallel to the option 1 route. The pipeline runs through Sutarkandi, Putiazur, Kajiiatal, Ampal, Banshkait, Naloorara, PAnti, Schcbtali, Surjyapur, Birtala villages and then crosses the Dhaka-Comilla highway. The pipeline than crosses Thirkhala, Lasmipur, Timchita, Bekisatpara, Dhakargaon, Nagarkandi, Char Perid, Hoglakandi, Char Sahebani, Dariakandi, Nibir Char, Manglergaon, Durgaprashadkandi, Musapa, Jhashir Char and Laksmankhola.

Option-III starting at the proposed Bakhrabad City Gate Station (CGS) at, the pipeline route runs parallel to the option 1 route. The gas transmission pipeline crosses Jahapur, Manik Char, Subilar Char, Melan Char, Kalipur, Kashipur, Nagarpara and crosses the national highway of Dhaka-Comilla. After crossing the highway it passes Malikhi, Amirabad,

Bhogalpur, Kazirkota, Bausia, Lakshmipur, Minergaon, Tengar Char, Lashkardi, Nuton Char, Ashaidi, Sashaerbag, Jashir Char, Baligaon, Sarail and at the end at Horipur CGS.

6.3 Comparative Analysis

6.3.1 Major Environmental Features along different options

Preliminary surveys have been conducted in the entire study area and have provided three alternative options. GPS coordinates for the routes have been recorded and then plotted on maps in order to generate a more realistic view of the different features of each route. Comparative analysis of route features is shown in **Table-6.1**.

Table 6.1: Comparative analysis of salient features of alternative routes

Different Features							
Alternate Routes	Length in kilometers	National highway	River Crossing	Khal Crossing	Habitation	Number of Trees	Remarks
Option-I	66	1	5	26	68	2375	No Common Property Resources e.g mosques, eating joints and rest places, tube well, schools etc have been falling along the route, within the 23 meter strip of ROW to be acquired / requisitioned in any of these options except a part of a privately owned pond in the ROW option III. at plot No.121 Mouza North Nasaruddin Upazilla Daudkandi ion segment km 25-30.
Option-II	70	1	5	32	52	2070	
Option-III	60	1	5	26	17	561	

Khals: Usually a strip of 8 meter across the respective width of the Khals has to be permanently acquisitioned from GOB land through DC's LA section for laying the pipeline. No further requisition is usually required (subject to confirmation by DC's LA section) since khals are crossed through open cut method and subsequently the banks & the bottom of the khals are duly reinstated after pipe lying across the same is over. Details of the pipeline section including depth of cover from top of the pipeline up to the bottom of the khals are so designed and handed out to the EPC contractor for execution that pipelines are protected from scouring or other disturbances. Simultaneously, bank protection specifications will also be duly incorporated in the EPC contract.

River Crossings: Usually a strip of 8 meter wide and 60meter long pieces of land on average in both banks of the river is acquisitioned from GOB land through DC's LA section for lying of pipe line. Additionally, another strip of 50 meter wide and 100 meter long piece of land in the other bank of the river is requisitioned from GOB/private land through DC's LA section at the respective river crossing sites to facilitate storage of equipment and operation of HDD rigs. A pond of 15mX10mX2.5 m size is required for storage /disposal of drilling fluid which are water based mud and as such bio-degradable. Such ponds are dug in the additionally requisitioned area for each crossing site.

Main Road: No separate land acquisition / requisition are usually required for main road crossings except taking permission from R & H authorities on paying requisite fees /lease amount for same. This is also because the Thrust Boring Machine operation is conducted in one side of the road on the acquisitioned / requisitioned land and subsequently reinstated as in pre-project condition. This is done by the EPC contractor as part of their job under the contract with GTCL.

Rural Roads Same is the case with regional rural roads which are done using TBM except that the permissions are to be obtained from LGED authorities. Similarly, minor roads of local administration / LGED are crossed through open cut method and provision of the alternative pathways and subsequent reinstatements are the part of the job of the EPC contractor.

Irrigation Schemes: Usually alternative arrangements of water flow for the limited period of pipe lying across the Irrigation schemes to encounter are managed by the EPC contractor as these are done as part of their job and hardly any additional / separate land acquisition / requisition are required for the same.

Display of Physical Features: Several maps placed at Figures – C, D E, F, G, H and I include maps of the proposed routes of the pipeline indicating general regional geology, digital elevation, seismic zones, river system, land type and soil type in and around the project area: and in some cases for the alternative routes as well. Additionally, 3 more segment wise maps in larger scale has been placed at Figures - X, Y & Z showing strip of pipeline with (considering structures & trees to be too small indentations to be appropriately dotted and hence provided in details in the data sheets at RAP doc.) prominently displayed physical features e.g. wetlands, roads, rivers, khals etc to be crossed by the pipeline.

6.4 Findings

Option 1: Parallel to the existing 20" Diameter Bakhrabad-Demra Transmission pipeline.

The existing 20" Diameter Bakhrabad-Demra pipeline was build during early eighties the route of which was considered initially advantageous to follow for the proposed second pipeline since with this options reduce the involvement of new acquisition of land. But this option ultimately was avoided due to the following reasons:

(a) Over the last 25 years since construction of the pipeline large industrial units, markets, habitations etc. have been established/ grown along the major portion of the route which are physical obstacles for any pipeline construction and calls for demolition of such establishments.

(b) When the Dhaka-Chittagang Highway expansion programme will be implemented, major portion of the existing pipeline route including the route for this pipeline, if laid parallel to the existing one, would go under the expansion portion of the Highway which is not a desired situation.

(c) The length would be 66 km upto Siddhirganj since the existing pipeline terminates at Demra (not Siddhirganj).

Option 2: Bakhrabad to Siddhirganj via Haripur proposed 360 MW Power Plant.

The route was also not considered though most of the areas from Bakhrabad to Haripur were agricultural land up to the proposed 360 MW Haripur Power Plant, since the length would be 70 km up to Siddhirganj. Further, the Haripur portion of the pipeline route will pass through the proposed 360 MW Power Plant to terminate at the specified location of 2 x 120 MW Power Plant at Siddhirganj. At the same

time this route would affect around 50-60 permanent habitations, 32 natural stream crossings and will affect over 2000 trees.

Option 3: Bakhrabad to Siddhirganj via Haripur.

Under this option, portion of the route from Bakhrabad to Haripur would remain same as Option-2 above for reasons mentioned therein and the remaining portion of the route will be through the corridor between proposed 360 MW Power Plant and 100 MW existing Power Plant at Haripur. Having the lowest route length of 60 km, it will affect less permanent habitations of around 20-25 as against that of 50-60 and with fewer number of trees and natural streams than that in Option-2. As such, the route has been finalized based on minimum obstacles and after having discussions with PDB and PGCB especially for the location of the adjoining Power Plants.

In view of the foregoing discussion and the salient features as shown in **Table 6.1**, it appears Option-III poses the best route among the three alternatives as this route has minimum length and road crossings including water bodies, obstruction to habitation and number of trees. During comparison it has also been apparent that Option-III is with minimum cost and disturbance to the environment (Air, water, soil, etc.) and stands most favourable in consideration of other technical and social points of view.

It has been observed by GTCL that it was awfully difficult to get a strip of land on both sides of the Sitalakhya River, since both the sides are fully dedicated for installation of different Power Plants. However, the matter has been resolved after several site visits and discussions with PDB and PGCB.

6.5 Conclusion

In fact, the various options that were considered presented almost similar environmental impacts in nature; and that the choice of the final route was influenced, decisively, by the fact that the chosen route is the shortest one which therefore minimizes both total costs and the absolute level of environmental and social impacts. It is, therefore, concluded that Option-III is considered the most suitable for implementing this Gas Transmission Pipeline project.

CHAPTER-07

IDENTIFICATION, ANALYSIS AND MITIGATION OF POTENTIAL IMPACTS

Chapter - 07

IDENTIFICATION, ANALYSIS AND MITIGATION OF POTENTIAL IMPACTS

7.1 General

This chapter identifies and evaluates the potential impacts associated with the construction of Gas Transmission Pipeline from Bakhrabad to Siddhirganj. Impact identification and risk ranking requires an examination of interactions between Important Environmental Components (IEC) and project activities. A number of IEC have been identified based on DOE guidelines and the WB Operational Policy docs OP 4.01 on EA and 4.11 on Cultural Resources with additional literature review including review of national & international reference documents and prior professional experience.

7.2 Identification of Impacts

Table-7.1 shows the various project activities, potential negative impacts and risk ranking (severity versus duration) of potential negative impacts of the proposed project.

In reviewing impacts, this Section addresses the following issues:

- Air Quality;
- Noise and Vibration;
- Natural Gas Emission
- Surface Water Quality;
- Groundwater Quality;
- Soil Resources;
- Land Erosion;
- Seismology;
- Biodiversity;
- Interference with Navigation /Fisheries
- Land Use;
- Transportation / Traffic; and
- Other Social Aspects.
  - A. Project Affected Persons (PAP)
  - B. Local Community Level
  - C. National Level

Table-7.1: Project Activities and Potential Negative Impacts

Activity	Potential Negative Impacts	Severity	Duration
Pre-Construction Phase			
Land acquisition Clearing of access road	Socio-Economic Loss of land and crop Loss of vegetation	 M M	 P T
Construction Phase			
Dust emission from excavated soil Dust emission from movement of vehicles Emission of smoke from vehicles	Air Quality Public nuisance Air pollution Air pollution	 M N N	 T T T

Activity	Potential Negative Impacts	Severity	Duration
Noise from vehicles and equipment	Noise and Vibration Nuisance to local people, livestock etc.	M	T
Erosion from disturbed soil Blockage of natural existing creeks	Surface Water Quality Turbidity and sedimentation Water logging	M M	T T
Discharge of domestic wastes	Ground Water Quality Contamination of aquifer	N	T
Excavation of soil and land levelling Mixing fertile top soil with unfertile subsoil Discharge of toxic wastes Movement of heavy vehicles	Soil Resources Erosion Loss of fertility Soil degradation due to pollution Soil compaction	M N to M N to M M	T T T T
Excavation of soil Clearance of vegetation Movement of vehicle Noise from construction equipment	Biodiversity Loss of natural vegetation Loss of plants Obstruction to traffic / animal movement Nuisance to people and animals	M M N M	P P T T
Excavation of land Movement of heavy vehicles Solid waste disposal Interference with navigation/fisheries Protection of workers' health and safety	Other Social Aspects Loss of crop Public nuisance Public nuisance Commercial loss Loss in workers health	M N M N M	T T T T T
Post Construction Phase			
Security checking of pipeline route Inadequate periodic monitoring Leakages & Line breaks Natural Gas Emission	Disturbance to social life and wildlife loss to ecology and economy Nuisance to people and animal and loss to ecology & economy. Enhancement of GHG	N M M to S N	T T T T

Note: *N = Negligible, M = Moderate, S = Severe, T = Temporary, P = Permanent. - = None.*

7.3 Analysis of Impacts and Suggested Mitigation Measures

7.3.1 Air Quality

During construction, the principal air quality impacts will arise from dust generation from excavation of soil, pipe laying and vehicle movement. Heavy vehicles may cause smoke emissions, but these impacts are local and temporary.

Mitigation

- Excavated materials, stockpiles and haul roads shall be dampened with water during dry ambient conditions;
- Vehicle speed restrictions shall be imposed to reduce dust generation and dispersion;
- Transport vehicles shall not be overloaded, and
- Visual inspections of equipment and vehicles shall be conducted on a regular basis to ensure no excessive emissions of black smoke.

7.3.2 Natural Gas Emission

Natural gas leakage is a Green House Gas (GHG) emissions issue, and needs to be looked at appropriately. Though, in general it is expected that there would be no leakage from this pipeline other than from some form of accident, which of course, is hoped to be avoided. In the upstream and in the distribution network there is leakage, but the transmission network as a whole appears to be better run by GTCL and this pipeline will connect with the A-B pipeline which is also relatively new. So for GTCL, its GHG emissions may be considered to be miniscule.

Mitigation

Exercising better operational control and due monitoring of the pipeline with well planned pro-active and prompt re-active maintenance will be contributively reduce gas leakage from the pipeline and the regulating and metering stations.

Any scheduled venting, purging or controlled release of gas to atmosphere in operational & maintenance purposes must be with due prior communication with the neighbourhood community to avoid any panic or confusion in the locality.

Due surveillance of the pipeline system along with monitoring of the soundness of the corrosion prevention mechanisms applied to the pipeline will enhance the pipeline life and thereby mitigate the leakage emission from the same to a great extent at the same time a better measuring techniques has to be developed to find out how much gas is leaking from the system in known situations.

7.3.3 Socio-Economic

In view of the fact that permanent acquisition of land and securing / ensuring a minimum safe distance is essentially required for laying the gas pipeline and sitting the metering and control stations as per Gas and Mineral Safety Rules (1991 as amended 2003) and Acquisition & Requisition of Immoveable Property Ordinance of 1982 of the country, it is unavoidable that the project execution has to cause an impact on the people, trees & structures falling on the alignment.

The basic and primary socio-economic impact of execution of the project as such, is the one to be felt by the PAP, whose land, homestead, trees, structures and / or job/business is either temporarily or permanently affected and there fore may call for due compensation / resettlement as a measure for mitigation. Similarly, its socio-economic impact will also be felt at the local and national level. Successful construction of gas transmission pipeline through the designated area will contribute significantly to the economic growth at the national level.

The pipeline will cross large tracts of rivers and wetlands. It may be apprehended that construction in those areas may interfere with fish cultivation and breeding of fish which is the staple source of protein for Bangladeshis. Further, construction of pipeline across the rivers may have impact on the navigation system of the area.

In fact, one fish pond has been identified on the route, and due compensation will be made to the PAP and since the pipeline will be laid in the dry season, the pipeline construction activities will not impact the fish breeding environment. Further, River crossings would be done by Horizontal Directional Drilling method with drilling pad and staging area being a few dozen meters from the actual river, no impact is expected on the river navigation as well. These factors have been further elaborated in Chapter –9 on environmental management and monitoring plan.

The potential impact on the socio-economic condition at the local level will generate primarily from the employment of labour during construction activities. The gas transmission pipeline construction

companies will engage several local people, thus creating employment opportunities as well as business opportunities for their goods and services.

On the other hand, the influx of outsiders may also cause some disruption to the social structure of the local people. GTCL will seek to minimize this impact by introducing a Code of Behaviour (to be agreed with the local communities). Potential impacts will be temporary and minor. Increased spending in the local economy by outsiders will be a positive impact, although for a period of short duration only.

In depth discussion of these issues and mitigation/ compensation/ re-settlement measures as per GOB regulations & WB OP 4.12 guidelines have been recorded at the Resettlement Action Plan (RAP) report (ESHIA Vol.-2)prepared for GTCL.

Mitigation

- Procedures for liaison with local people to be established before commencement of the construction work. GTCL must clearly explain to local people about the need for the project for both the country and regional contexts;
- GTCL must reassure the public about compliance with environmental impact mitigation measures and safety measures prepared for local communities;
- Local communities must be consulted before commencing any future development projects in or near their community;
- Large concentrations of housing for construction labourers should be avoided;
- Staff to be recruited locally where feasible. GTCL shall encourage contractor to employ local people during construction work.
- Public relations programs with local communities should be continually maintained to advise on risks and safety;
- High standards of project operation, environmental impact mitigation measures and safety procedures must be maintained at all times;
- Establish good relationships with local communities and help support their community activities;
- To ensure adequate compensation to the project affected people as per the law of the country and as per guidelines contained in the WB OP 4.12.
- Representatives from local communities should be allowed to join the committee to ensure justice and transparency.
- WB OP4.01 guidelines on Cultural issues as applicable for the project shall also have to be adhered to.
- Pipeline construction activities will be during dry season to avoid any impact on agriculture or fish farming and fish breeding.
- River crossings will be done by Horizontal Directional Drilling method so that there is no impact is there on the river navigation.

7.3.4 Noise and Vibration

The movement of vehicles, Lorries, and construction equipment will produce noise and vibration during the construction stage. This impact will be minor and of short duration at any particular location along the route.

Mitigation

- Selecting 'quiet' working methods and use of low noise equipment must be specified in construction contract tender documents;
- Construction activities should not take place at nighttimes. If this is absolutely unavoidable, the contractor shall advise/ consult with local community leaders, and

- Local community should be consulted beforehand and reach an agreement over appropriate timing for noisy activities.

7.3.5 Land and Soil

Construction of a gas transmission pipeline requires trench digging along ROW, grading of roads and land. The impact of such changes, if not appropriately mitigated, could result in severe erosion, silting and impairment of water quality in nearby drainage channels and waterways, fragmenting of habitat and loss of existing ecological resources.

Mitigation

- For mitigation measures to be effective, technical specifications as well as management procedures for their design, implementation, supervision and checking must be in place prior to commencement of onsite works;
- Develop an appropriate and comprehensive reinstatement and site clearance plan ;
- Strict supervision shall be maintained to ensure that a minimum area required for construction activities are cleared;
- Avoid earth work during rainy season, as appropriate;
- Clearing operations shall not interfere or obstruct natural watercourses and man-made drainage systems;
- During construction, excavated soil should be stored in designated areas. Topsoil shall be stored separately, and
- In case of following the existing road, the road has to be strengthened where necessary.

7.3.6 River Crossing

Minimum clearance to be maintained between the bored hole and river bottom during Horizontal Directional Drilling (HDD) activities shall be seven meters or as specified by design consideration. The location of the HDD head shall be monitored at all times and corrective measures implemented when this clearance is less than specified. Special care has to be taken for appropriate reinstatements at both the Horizontal Directional Drilling pad and Drill bit out let sites so far as protection of both banks of the river is concerned. Further, adequate measures are also essential in disposal of drilling fluids and others chemicals and lube oil-wastes generated during the HDD operation.

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 shall drain excess water from the spoil area to minimize erosion.

7.3.7 Surface and Groundwater

The potential impacts on local hydrology are principally those of altered drainage patterns as a result of onsite construction and earthwork activities. The proposed route will cross a number of natural streams and canals, which may be affected if proper mitigation measures are not taken.

Mitigation

- Surface drainage shall be controlled to divert surface runoff away from the construction area;
- Completed areas should be restored/ re-vegetated as soon as practicable;

- Strict supervision should be maintained to avoid blockage of natural creeks during the construction period, and
- Containment of sanitary waste should be adequately disposed off to avoid surface and ground water contamination.

7.3.8 Floral and Faunal

Roadside vegetation will be destroyed for clearing the proposed project area. Soil covering plants will be destroyed after such type of activities. These types of activities will create soil erosion in the project area. This will be of short term and vegetation will recover within a season.

Mitigations

- Should clear the ROW as minimum as possible;
- Big tree cutting should be kept at a minimum stage, and
- Re-vegetation of the exposed part has to be done as early as possible just after completion of the project.

7.4 Summary of Findings

The findings of the preliminary assessment indicate that the project activities do not present any significant adverse impact on the environment. The potential short-term impacts are largely minor and can be mitigated.

It may be clearly stated in here that, plot to plot survey has revealed that, the pipeline will not go through any protected forest or reserved natural habitat area or affect any cultural property any where along the strip alignment of the pipeline and its associated construction sites. However, it is expected that socially sensitive area like grave yards, cremation grounds etc if any, is identified during route marking would be taken in to consideration for strictly avoiding in the final design of the pipeline system.

It has been identified that 561 trees of the PAP in their private land will be there on the pipeline alignment and will be cut and removed to facilitate the construction activities. The owners will be duly compensated as per provisions outlined in the RAP document.

Besides that, some more trees along the public roads and stream or river crossing sites may be affected as well and when specifically identified during execution of works, due permission (s) /clearances has to be obtained by GTCL from the local authorities concerned.

Though any prior permission is not required to be submitted with the EIA doc for Environmental clearance from DOE, usually DOE includes its general condition that, the project proponent has to obtain necessary permission from authorities concerned in respect passing through or affecting the public properties e.g. roads, rivers, canals, stream or tress etc.

Impacts that do occur will be amenable to ongoing implementation of remedial/ mitigation measures. However, the detailed Environmental Management and Monitoring Plan that has been prepared and placed at Chapter-9 of this report has to be adhered to in implementing the project. Though this has been based on the exhaustive study conducted for identifying the significant and potential impacts and respective mitigation measures have been delineated there in, it will still remain as a living part of this EIA report and shall have to be subsequently up dated as the physical progress of the work will be progressing at site and as deemed necessary.

CHAPTER-08

ANALYSIS AND DESCRIPTION OF THE MITIGATION MEASURES

Chapter - 08

ANALYSIS AND DESCRIPTION OF THE MITIGATION MEASURES

8.1 Introduction

The major objective of impact mitigation is to plan and design the proposed project to minimize negative impacts relating to environmental, biological and social issues while maximizing benefits from the project. As part of the goals and objectives of impact assessment, it is necessary to identify mitigation measures to avoid, minimize or improve those negative impacts likely to occur.

There are some likely negative impacts relating to environmental and socio-economic aspects from the project. Presented in this Chapter are aspects that are minimized or avoided by changing project design. In addition, there are specifically targeted measures that can be performed to balance losses from negative impacts.

However, the major impact of execution of the project is mainly involved with the project affected persons, his homestead, trees & structures, crop land and some times means of livelihood or business. So the mitigation measures to comfort his losses of different nature and dimensions including even the need for resettlement has to follow according to the law of the land and the WB guidelines OP 4.12 as applicable for implementation of such projects. These impacts and compensatory issues have been taken care of in details in the RAP (ESHIA Vol.-2).

8.2 Mitigation Measure of Project Impacts

Table-8.1 summarizes specific mitigation measures for potential negative impacts as a result of the construction of the proposed gas pipeline project.

Table 8.1: Analysis and Description Mitigation Measures

Source of Impacts	Type of Impacts	Mitigation Measures
Preparatory Activities		
• Clearing vegetation • Excavation of earth • Filling lowlands • Land occupation • Sewage of kitchen waste disposal • Movement of heavy vehicles • Non-routine accidental spillages	**Air** • Emission of dust • Emission of greenhouse gas • Emission of heat	• selecting short and direct routes for all traffic; • wetting onsite areas • vegetation clearance during dry weather periods; • maintaining generator engines and other heavy duty engines in good repair, to reduce exhaust emissions; • Good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions).

Source of Impacts	Type of Impacts	Mitigation Measures
	Noise and Vibration • Disturbance to general amenity • Disturbance to religious performance	• traffic to and from the site to be controlled with respect to routing of vehicles and timing of vehicle movements (i.e. working hours); • site activities during preparatory construction works will, to the extent practicable, be limited to day time working • equipment will be maintained in good working order and, where appropriate, acoustic hoods will be provided; • Taking maximum advantage of shielding provided by onsite structures and offsite natural features (trees, etc) to minimize noise levels at offsite receptor locations.
	Land • Change in land use • Soil erosion and sedimentation • Soil stability and compactness • Loss of soil fertility	• appropriate engineering of slopes to prevent slumping, slippage and erosion; • restoration of disturbed soil to its original use or to an approved use; • re-vegetation of barren surfaces; • adopting erosion control and soil stabilization measures; • installing (and maintaining for the duration of the Horizontal Directional Drilling campaign) adequate runoff channels and carefully monitoring should be there to prevent polluting the local drainage channels and to prevent flooding, inundation and silting;
	Groundwater • Reduction in recharge potential • Contamination	• Domestic sewage will be treated in a septic tank and the treated effluent will be released into an adjoining leach field. • Environment friendly water based will be selected for the HDD and appropriate drainage system will be set around the rig and mud tank area to contain potentially contaminated surface drainage if any, for on-site treatment prior to offsite discharge. • Surface drains will be adequately graded, kept debris-free and will be routed to a suitable location so as to prevent silting, flooding and inundation. • Preparation of a waste management plan to achieve reuse, reclamation and recycling of materials as far as practicable.;
	Biodiversity • Loss of species diversity • Increase in poaching • Loss of species due to disposal of petroleum oil lubricants and toxic refuse	• vegetation clearance will be minimized; • the site will be fenced and site access will be strictly controlled; • Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition.

Source of Impacts	Type of Impacts	Mitigation Measures
	Socio-Economic • Resource use • Employment • Income • Property value • Induced development • Traffic movement • Health	• employment of local labor as much as possible; • planning adequate drinking water and sanitary facilities to meet the needs of the labor force (while ensuring that established resources are adequately preserved for local communities); • providing adequate sewage treatment, drainage control and effluent disposal facilities so as not to impair local surface water bodies and groundwater resources; • maintaining effective community liaison throughout the Horizontal Directional Drilling campaign to minimize disruption in local communities; • safe traffic movement to avoid accidents: introducing appropriate traffic signs and markers; • Providing sufficient notification to nearby villages of the intended onset of well testing operations.
Construction Phase: Pipeline Construction Special Crossing: Roads Railway, Streams, and Canals River Crossing (HDD) Preparing Mud Fluids Returning Drilling Fluid Waste materials from Thrust Boring operations Metering and regulating station		
• Physical presence of rig • Atmosphere emissions • Drilling mud • Noise from generators • Noise from Horizontal Directional Drilling of river • Chemical spills • Fire and explosion • Surface drainage • Flare pit construction	**Air** • Emission of dust • Emission of heat	• maintaining generator engines and other heavy duty engines in good condition, to reduce exhaust emissions; • Good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions).
	Noise and Vibration • Disturbance to general amenity • Disturbance to religious performance	• equipment will be maintained in good working order and, where appropriate, acoustic hoods will be provided; • taking maximum advantage of shielding provided by onsite structures and offsite natural features (trees, etc) to minimize noise levels at offsite receptor locations.
	Land • Change in land use • Soil erosion and sedimentation • Soil stability and compactness • Loss of soil fertility	• restoration of disturbed soil to its original use or to an approved use; • installing (and maintaining for the duration of the Horizontal Directional Drilling campaign) adequate run-on and runoff drainage channels to prevent flooding, inundation and silting; • good housekeeping during mixing of mud chemicals; • Provision of a test separator and flare system sufficient to prevent accidental releases during pipeline pigging, purging test and commissioning etc.

Source of Impacts	Type of Impacts	Mitigation Measures
	Groundwater • Reduction in recharge potential • Contamination	• Drilling fluid used will be managed through bioremediation and applied to irrigable land; • Monitoring routine discharges to ensure conformance with Bangladesh standards. • The facilities shall be designed and operated to ensure that the risks of accidental releases and spills of environmentally hazardous compounds are minimized
	Biodiversity • Loss of Species diversity • Damage to habitat • Loss of species due to disposal of petroleum oil lubricants and toxic refuse	• vegetation clearance will be minimized; • the site will be fenced and site access will be strictly controlled; • Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition.
	Socio-Economic • Resource use • Income • Property value • Induced development	• employment of local people as much as possible; • Providing adequate fencing to safeguard communities from risks posed by project activities; • Public relations programs with local communities should be continually maintained to advise on risks and safety • High standards of project operation, environmental impact mitigation measures and safety procedures must be maintained at all times • Establish good relationships with local communities and help to support their community activities
	Cultural and Archeological Sites • Religious and Cultural sites • Recreation and aesthetic s	• Local community should be consulted beforehand and reach an agreement over appropriate timing for noisy activities • will be protected by working on the existing ROW or if necessary by acquiring temporarily working space on the opposite side of the ROW
Operation Phase	• Variety of adverse effects • Long term national environmental and economic • Hazardous type wastes can pose serious environmental and health / safety hazards	• High standards of project operation, environmental impact mitigation measures and safety procedures must be maintained at all times • During operation some problem may occur. So, necessary precautionary measures are required for protection • Ensure that air emissions from the project site comply with standards • Ensure that the noise level around the project complies with standards • An inspection and maintenance (I&M) program should be implemented • Hazardous wastes shall be managed in accordance with the requirements of the concerned authority as stated above

8.2.1 Air Quality

Mitigation

Preparatory Phase

- selecting short and direct routes for all traffic;
- wetting onsite areas
- vegetation clearance during dry weather periods;
- maintaining generator engines and other heavy duty engines in good repair, to reduce exhaust emissions;
- good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions

Construction phase

- maintaining generator engines and other heavy duty engines in good condition, to reduce exhaust emissions;
- Good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions).

Operation & Maintenance Phase

- Check leakage and reduce fugitive emission of gas from the pipeline system.
- Exercise careful and minimum venting & purging of gas
- Maintain generator and other machine and equipment in good condition to operate with low exhaust particularly at the Regulating & Metering Station locations.

8.2.2 Mitigation Plan for Land Use

Preparatory Phase

Survey

A soil and land use survey including final route marking should be carried out at an appropriate level of detail along the proposed route of pipeline during the project planning phase, and an appropriate soil conservation plan developed. The survey is also aimed to identify wildlife passage ways which cross the proposed pipeline alignment.

Planning and Design

Pipelines should be designed to cause the minimum possible dislocation of services and loss of productive land area. Careful delineation of the selected route should also aim to avoid sensitive locations, if any and to cross services without causing a loss of utility.

Construction phase

- Restoration of disturbed soil to its original use or to an approved use;
- Installing and maintaining for the duration of the grading, trenching, dredging along the ROW and horizontal directional drilling operation at river crossings etc. adequate alternative pathways and drainage / irrigation canals to reduce inconvenience to the PAP and members of the locality.
- Good housekeeping during mixing of mud chemicals;
- Effluent discharges, particularly during pigging , purging dewatering and drilling from the worksites including HDD operations should be carefully monitored to prevent polluting the runoff drainage channels and to prevent flooding, inundation and silting;

- Adequate provision has to be retained in the scope of works of the EPC contractor for such mitigation measures at required locations of the rural roads, canals and river crossing as indicated in the segment wise maps and tables placed in the baseline condition capter-4.

Operational Phase

Monitoring routine discharges from the pipeline and the Metering and regulating stations are to be ensured conformance with Bangladesh standards.

The facilities shall be designed and operated to ensure that the risks of accidental releases and spills of environmentally hazardous compounds are minimized.

Maintenance- Adherence to good maintenance practice will minimize losses through leakage from transmission pipelines.

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.

8.2.3 Mitigation plan for Noise and Vibration

- Equipment will be maintained in good working order and, where appropriate, acoustic hoods will be provided;
- Taking maximum advantage of shielding provided by onsite structures and offsite natural features (trees, etc) to minimize noise levels at offsite receptor location

8.2.4 Soil Erosion and Fertility Control Plan

Preparatory phase

- Appropriate engineering of slopes to prevent slumping, slippage and erosion;
- Restoration of disturbed soil to its original use or to an approved use;
- Adopting erosion control and soil stabilization measures;
- Installing adequate run-on and runoff drainage channels to prevent flooding, inundation and silting;

Construction phase

- 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,
- 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.
- Erosion of soil takes place at a high rate 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.
- 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 Horizontal Directional Drilling (HDD) activities shall be seven meters or as specified by design consideration. The location of the HDD head shall be monitored at all times and corrective measures implemented when this clearance is less than specified. Special care has to be taken for appropriate reinstatements at both the HDD pad and Drill bit out let sites so far as protection of

both banks of the river is concerned. Further, adequate measures are also essential in disposal of drilling fluids and other chemicals, lube oils and wastes generated during the HDD operation

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.

8.2.5 Surface and Ground Water- Mitigation Plans

Potable water

Water provided at the site for workers installing the pipeline and for the engineers and administrative support must meet the drinking water standards established by DoE. If local ground water is the source of drinking water, it shall have to be chlorinated.

Oil Spill Plan

Equipment maintenance areas shall have proper house cleaning procedures. Oil, grease, and chemical spill shall be cleaned up as they occur. An area specified for oil, lubricants and chemicals shall be set aside.

Waste Disposal Plan

Used oil and spilled oil shall be collected and recycled. Contaminated soils, paints, solvent or other chemicals etc. shall be collected and disposed of in an approved waste disposal site. Solid waste shall be collected and disposed of in an approved solid waste facility.

Sanitary latrines shall be provided at each construction camp and waste disposed of through designing and constructing an appropriate septic system.

Water resources

Horizontal directional drilling is a trench-less technology, otherwise known as HDD. The ability to navigate a drill rod undergrounds for extended distances at one time without disruption of the water resources like fish and other property. Horizontal Directional Drilling is assisted with a supply of water based and environmentally safe drilling fluid. This technology of horizontal directional drilling enables to track and steer the drill head with the utmost precision around and under water, wet lands that may be located below or above ground. The result of horizontal directional drilling is a greater degree of precision in placing the pipeline under the river belt without impacting the environment and the surrounding area. So there is no scope to create any impact on water resource.

8.2.6 Mitigation Plans for Biodiversity

Preparatory phase

- Vegetation clearance will be minimized;
- The site will be fenced and site access will be strictly controlled;
- Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition.

Construction phase

- Vegetation clearance will be minimized;
- The site will be fenced and site access will be strictly controlled;
- Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition.
- Natural fish production will be protected, to the extent possible, by controlling water pollution caused by sanitary and solid waste, oil, grease, paint, solvent and other chemicals and scheduling work when fish are not breeding.

8.2.7 Mitigation plan for Historical and Archaeological Resources

No mosques, temples, graves and graveyards have been identified during will be protected by working on the existing ROW or if necessary by acquiring temporarily working space on the opposite side of the ROW. Equipment operators will be instructed to be especially careful not to damage the mosques, temples, graves and graveyards.

8.2.8 Mitigation plan for Socioeconomic Impact

Mitigation Measures

Compensation: Following completion of pipeline construction, the land owners normally regain the use of the land for agriculture, although it remains the properly of the GTCL. The compensation payment which the land owners receive is thus an additional benefit, or positive impact, although they have lost the asset value of the land.

Loss of Land: compensation for property is a common measure and GTCL has to implement the RAP as per provision of the GOB rules and the provision of the WB OP 4.12.

Loss of Income: Mitigation Measures for the families affected by income loss due to gas development projects are usually entitled to have credit, training and necessary market assistance to start alternative income generating activities. But it has been observed that a very few number of 911 PAP would be losing over 20 % of their landed properties along a strip alignment and none of them are tenants as would hardly be needing relocation. Only 17 privately own structures, 561 Trees, 1 pond and 1 number of poultry farm being affected; their owners will be duly compensated.

Adverse impact on the poor- Usually, the mitigating measures include training in skills, access to credit assistance with market intelligence and marketing. However, it has appeared from the RAP study that the number of seriously affected households, women headed households etc are so nominal that special grants during continuation of the project in addition to the compensation payment by the CDC, would perhaps help them restoring their lively hood.

8.2.9 Budget for Mitigation and Monitoring Measures

Budget for monitoring of the environmental impacts have been outlined in the **Table-9.5**, **Table-9.6** and **Table-9.7** in the EMP chapter-9 of this report, the summary of which is placed in **Table-8.2.**The summary of the aforementioned estimated budget is reproduced in **Table-8.2** indicating that an average estimated budget figure of Tk.3.653 million would be required for implementing the EMP of the project.

It may be mentioned here that implementation of mitigation measures as detailed in the EMP has to be appropriately retained in the scope of works of the EPC contractor and GTCL has to consider in their cost estimate and accordingly the Pipeline Consulting Group will incorporate these in the bid docs for the EPC contractors.

Table- 8.2: Summary of Estimated Budget for Environmental Monitoring.

Item	Break down of Estimated Environmental Monitoring Budget			Total (Tk.)
	Monthly monitoring during construction and operation if outsourced by the EPC or by GTCL.	The price of different environmental monitoring equipments	Cost estimate for training during construction and operational phase	
Estimated Environmental Monitoring Budget	1, 031, 600.00	1, 821,500.00	800, 000.00	**3,653,100.00**

An estimated budget for RAP implementation has been given in **Table-8.3, Table-8.4** and **Table-8.5** with a summary of estimated budget is given in **Table-8.6** of the **RAP** (ESIA Vol.-1), which are based on claimed values of the PAP, Government values collected from respective Sub-Register offices and LA sections of the District Administration, different govt. offices like Agriculture, Public Works Department etc. and market values collected during focus group discussion and verified form knowledgeable local elites.

Some of these data has been provided by NSO of GTCL and are placed in the appendix of the same RAP report. The resettlement cost estimate includes all costs regarding resettlement preparation, compensation for land and structures, trees etc including relocation. Further details including miscellaneous considerations taken in to account in preparing the estimated budget has been out lined in the RAP doc. referred to above.

Table- 8.6: Summary of Estimated Budget for RAP

Item	Based on			Average (Tk.}
	Clamed Value (Tk.)	Govt. Value (Tk.)	Market (Tk.) Value	
Estimated Compensation Budget	8,33,45,520.58	14,36,29,367.8	23,61,16,160.6	15,43,63,683

The summary of the aforementioned estimated budget is reproduced in **Table-8.6 which** indicates that an average estimated compensation figure of Tk.154.36 million would be required for implementing the RAP of the project.

CHAPTER-09

ENVIRONMENT MANAGEMENT PLAN

Chapter - 09

ENVIRONMENT MANAGEMENT PLAN

9.1 General

The gas pipeline construction activities involve earth works, trenching, welding, laying, special crossings, pigging, purging, testing and commissioning including but not limited to handling of equipments and materials. These activities have both positive and negative impacts on various components of the environment and socio-economic conditions. The 60 km high pressure Bakhrabad-Siddhirganj (BKB-SG) gas transmission pipeline of GTCL is no exception to it.

However, as experienced in execution of pipeline projects of similar dimension and magnitude in identical terrain and climatic conditions, the environmental impacts are generally of short duration and minor in nature except in certain items of work and at some operational components of the pipeline system. To be more specific, pipeline special crossings at roads & highways and rivers, pigging, purging, dewatering etc items of work and operation of City Gate Station (CGS)/ Regulating & Metering Stations (RMS) are usually of important environmental concerns.

But due to adoption of advanced pipeline construction technologies, replacing open-cut & draglines by Thrust Boring Method (TBM) and Horizontal Directional Drilling (HDD) in road and river crossings respectively, such impacts would be significantly reduced in pipeline construction activities under this project. Similarly, through selection of less noise, vibration and obnoxious emission producing equipments with due mitigation measures, the severity of the environmental impacts in the CGS & RMS plants of the project are expected to be at a minimum level though.

9.2 Development of the EMP

- The pre-construction activities of the project has already achieved a good deal of progress since quite some past with commencement of route survey for selection of ROW alignment and site clearance accorded by DOE on the basis of Initial Environmental Examination (IEE). Therefore, the Environmental Management Plan (EMP) under the Environmental Impact Assessment (EIA) is now virtually required for the construction and post-construction i.e. operation & maintenance phases only. Based on the recommendation of the IEE, the EMP would now be developed to identify the issues in detail and incorporate measures to minimize and/or offset **adverse environmental impacts resulting from the project.**

- In doing so, the results of the studies on Environmental baseline condition, Socio-economic, Biological resource and Land use surveys were carefully reviewed. Environmental components and sub-components were identified and their magnitude and duration of impacts were examined. In preparing this EMP, the TOR of GTCL, the guidelines of DOE and the World Bank OP 4.01 on Environmental Assessment together with OP 4.11 on Physical Cultural Resources have been basically followed. Further, since the project execution involves Involuntary Resettlement, World Bank OP 4.12 has also been taken in to consideration in delineating certain specific impacts as well. The functional components of the EMP are described in the following sections.

9.3 Identification of Pipeline Alignment

Having due consideration of the route selection factors as out lined in section 6.1 and examining configuration of different options, details of comparative analysis of the physical features at Table-6.1 and findings at section 6.4, GTCL have selected the alignment of the ROW. As it appeared from the observations of GTCL that the route firmed up by them employing their surveyor National Survey Organization (NSO) has been having less physical obstructions and shorter in length. Hence the project may be implemented with minimum cost and impact on the environment in comparison to other alternative ones. Accordingly, further details of environmental base line conditions including other surveys needed for the EMP have been conducted latest in January, 2008, In this exercise, entire 60 km strip alignment has been covered in 12 segments of 5 km each from BKB to SG as shown in **Figure-9.1** for collecting updated environmental and socio-economic data from plot to plot as affected by the project

9.4 Project Affected Physical Features

Details of the 1443 plots containing the assets of the PAP and the public and the communities along the strip including environmental and demographic features have been taken in to account. Summary of these data has been placed below in **Table-9.1** Pipeline in most of the segments will be passing through low lying agricultural land and no where it would encroach any protected forest area.* **Table-9.2** shows the Total Acquisition and Requisition Govt. Land (Muradnagar, Daudkandi, Gozaria, Sonargaon, Bondor). **Table-9.1** has revealed that the habitats are mostly in segments in 0-5, 25-30 & 55-60 km ones.

(*so no permission would be needed from the forest department)

Table-9.1: Summary of Segment wise Land Structure and Tree Loser PAP

Sl. No.	Segment (km)	Losing Structure, Land & Trees (Category- 1)	Losing Structure & Land (Category- 2)	Losing Land & Trees (Category- 3)	Losing Land Only (Category- 4)	Total
1	0-5	3	-	4	90	97
2	5-10	-	-	5	54	59
3	10-15	-	-	1	105	106
4	15-20	-	-	2	106	108
5	20-25	-	-	3	94	97
6	25-30	5	-	1	69	75
7	30-35	-	2	-	51	53
8	35-40	-	-	2	48	50
9	40-45	-	-	-	94	94
10	45-50	1	1	1	67	70
11	50-55	-	-	1	42	43
12	55-60	1	5	7	46	59
	Total:	**10**	**8**	**27**	**866**	**911**

Since the latest survey has been undertaken in dry season it was difficult to identify the wetlands in particular. However, several maps as placed at Figures – C, D, E, F, G, H and I include maps of the proposed routes of the pipeline indicating general regional geology, digital elevation, seismic zones, river system, land type and soil type in and around the project area and in some cases for the alternative routes as well. Additionally, 3 more segment wise maps in larger scale has been placed at Figures - X, Y & Z showing strip of pipeline and displayed the

physical features e.g. wetlands, roads, rivers, khals etc as well to be crossed by the pipeline with possible prominence.

As discussed with GTCL , they have plans of studying the soil bearing capacity and working out bouncy etc in getting their pipelines designed by their consultants and finding out the sat-on-weight / concrete coating requirements in crossing the wet lands. This will be done with ultimate aim of not only ensuring the integrity of the pipeline system, but also minimizing the safety hazards and adverse impact on the environment in the long run.

It may be reiterated in here that no Common Property Resources e.g. mosques, eating joints and rest places, tube well, schools etc have been falling along the route, within the 23 meter strip of ROW to be acquired / requisitioned in the pipeline ROW except a part of a privately owned pond at plot No.121 Mouza North Nasaruddin Upazilla Daudkandi in segment km 25-30.

Considering the structures & trees to be of too small indentations to be appropriately dotted, these have been provided in details in the data sheets and tables at RAP (ESIA Vol.-2) doc. including the one above at Table – 9.1 of this report

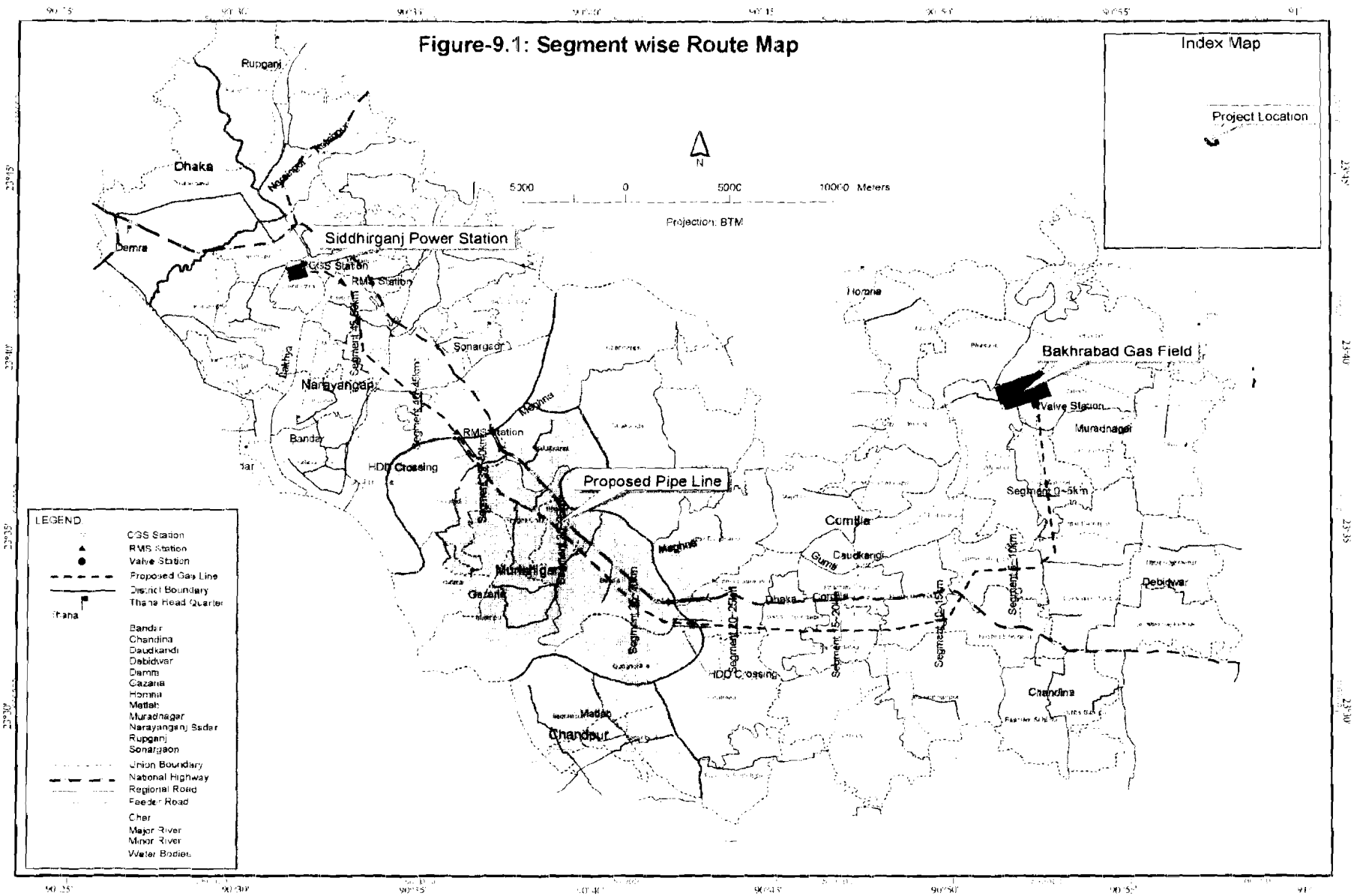


Figure-9.1: Segment wise Route Map
Index Map
Project Location
Projection: BTM
5000 0 5000 10000 Meters
Rupganj
Dhaka
Demra
Siddhirganj Power Station
CGS Station
RMS Station
Narayanganj
Sonargaon
Bandar
HDD Crossing
Proposed Pipe Line
Homna
Bakhrabad Gas Field
Valve Station
Muradnagar
Comilla
Daudkandi
Debidwar
Chandina
Matlab
Chandpur
LEGEND
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Ssdar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

Table-9.2: Total Acquisition and Requisition Govt. Land (Muradnagar, Daudkandi, Gozaria, Sonargaon, Bondor)

Name of the Upazila	Acqusition Land (in Acre)	Acquisiition Govt. Land	Requisition Land (Right) in acre	Requision Land (Left) in acre	Right in acre (Govt. Land)	Left in acre (Govt. Land)
Muradnagar	20.9427	0.3869	16.8809	24.343	0.3902	0.3638
Daudkandi	36.3043	0.6102	42.583	28.4632	0.7204	0.5125
Munshiganj	3658.378	1.1146	27.925	1506.4208	0.6243	1.1167
Sonargaon	10.9132	0.631	13.482	9.1101	1.1228	0.8846
Bondar	14.168	0.714	15.541	10.3823	0.7648	0.7185
Total:		**3.4567**			**3.6225**	**3.5961**

9.5 Scope of EMP

EMP would encompass the obligation of GTC Land its EPC contractor for good developed activities and will include the following measures:

(a) The measures will be taken during different phases of the project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels.

(b) A monitoring plan is recommended and will be periodically assessed for effectiveness of the management / mitigation measures. The contractor will prepare necessary maps to show the specific locations of environmental concerns and would also indicate environmental monitoring points.

(d) Currently GTCL does not have any corporate environmental guidelines except for the Environment Safety Management System (ESMS) of PB and therefore, the EPC contractor will follow the same as well as their own corporate guidelines / rules along with relevant guidelines of WB and DOE as applicable.

Environmental management and monitoring activities so accomplished for the project will be reflected in the quarterly and other reports of GTCL to be submitted to the World Bank and DOE .

9.6 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 Owner's Engineer 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 details of his assignment is given below:

ES will assist the Team Leader of the Owner's Engineer of GTCL 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 fulfil the requirement of the laws, regulations and guidelines of WB and GOB. He will also assist GTCL to prepare the semi-annual monitoring reports, fulfilling the aforementioned requirements, to be submitted to WB.

9.7 Organizational 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:

(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 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 review each of the project activity performed by themselves, by their contractors including EPC contractor and then would make his choice(s) of remedial action.

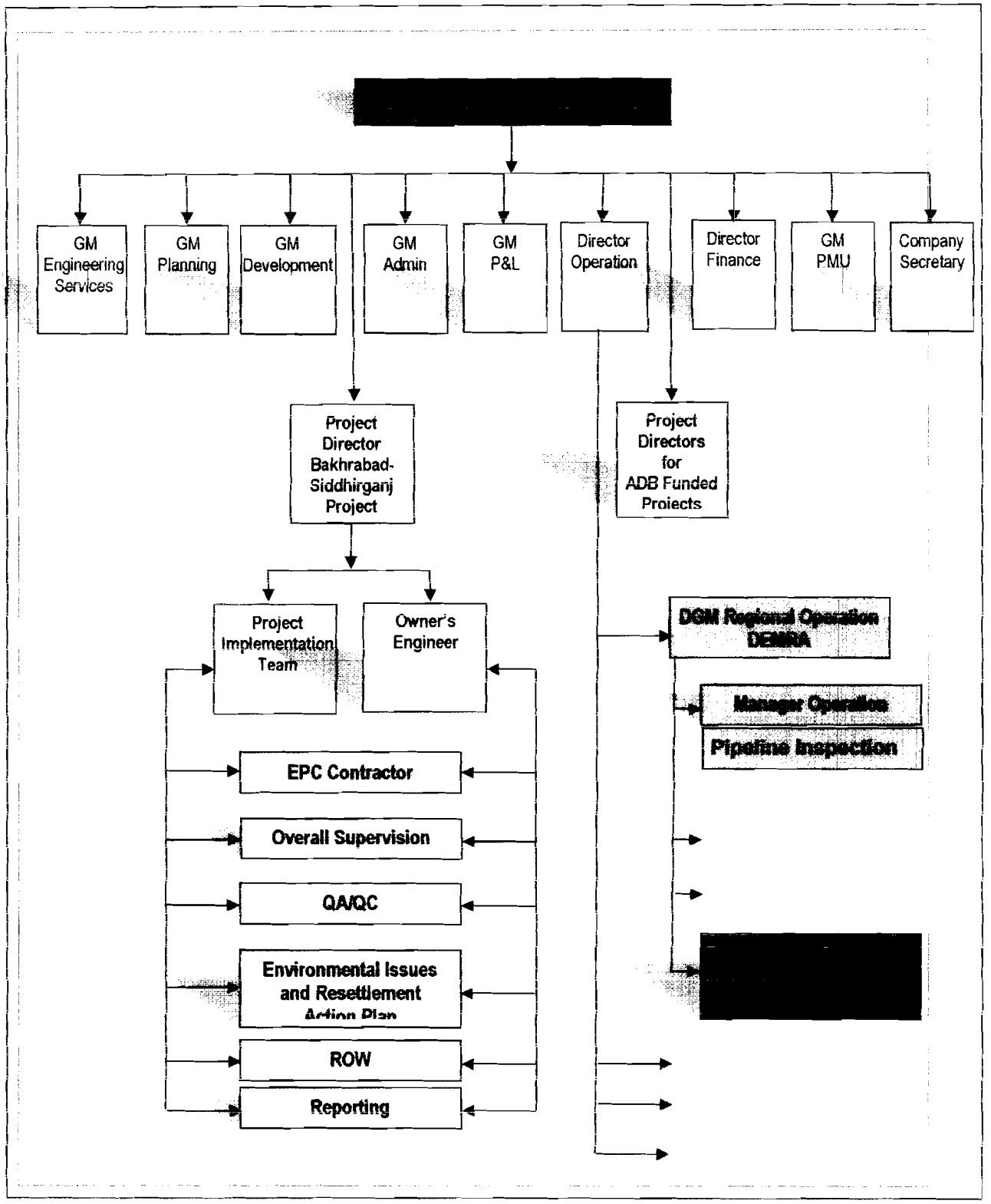
2. This process will continue in GTCL until all procedures have an assigned responsible person who will assure that the procedure is implemented. In many cases, several people will be accountable for implementation of a procedure. For example, at the pipeline construction sites and at supporting field camps more than one person would be responsible for fulfilling the procedure regarding correct waste management.

(b) 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 exiting organizational set-up of GTCL is given in Figure-9.2 and based on the same, the institutional arrangement designed for EMP of the BKB-SG Gas Transmission Pipeline project has been shown in **Figure-9.2** reflecting the inter-linkages between GTCL Technical Staff, the EPC Contractor and the Environmental Specialist of the Owner's Engineer so far as implementation, supervision and monitoring of the EAS issues are concerned.

Figure-9.2: Existing Organizational Set-up of GTCL



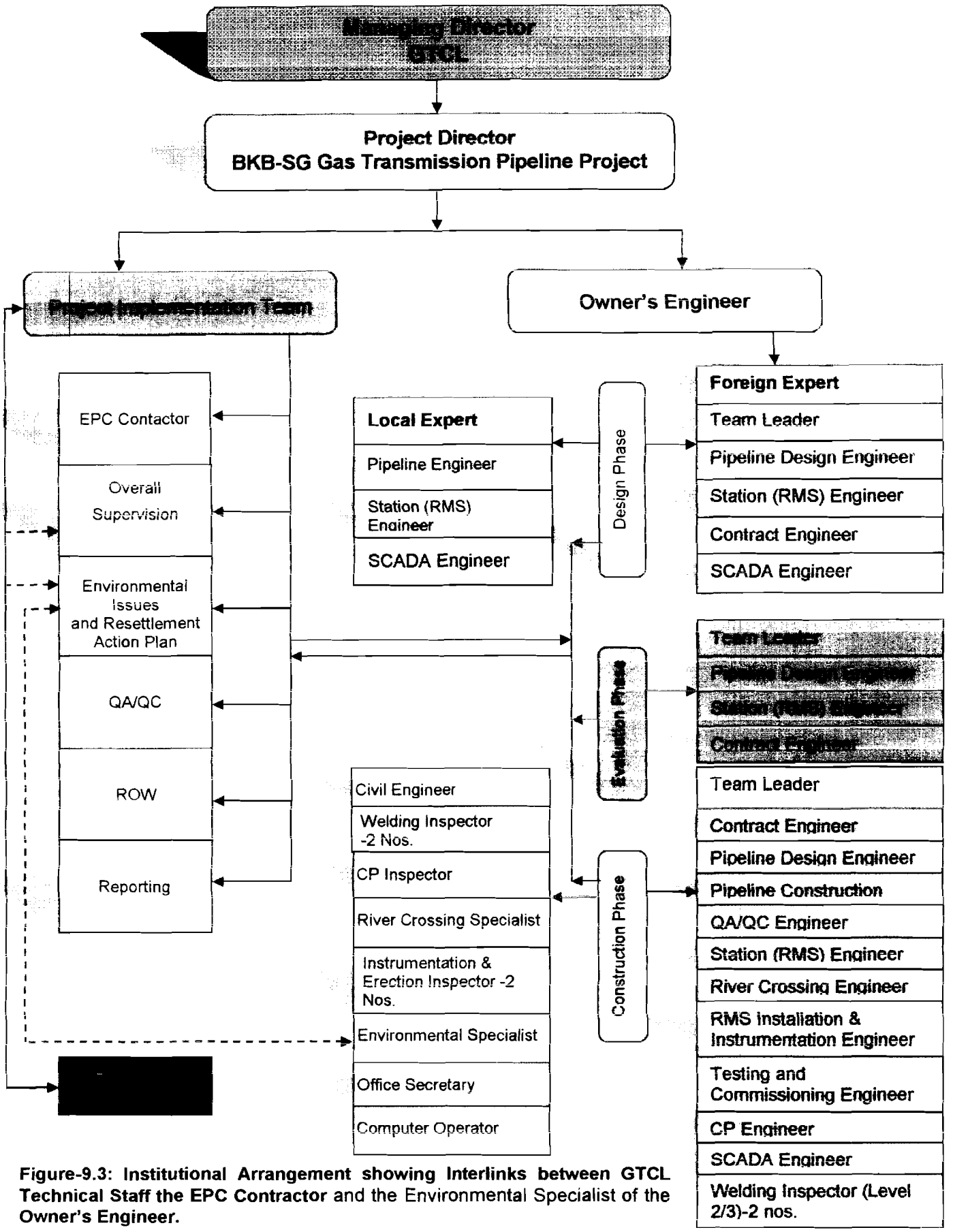


Figure-9.3: Institutional Arrangement showing Interlinks between GTCL Technical Staff the EPC Contractor and the Environmental Specialist of the **Owner's Engineer.**

(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 Owner's Engineer supported by the Technical staff of GTCL.

Mitigation/ Enhancement Measures

The EMP prepared for this project forms the basis of environmental management actions from the part of GTCL authority and often may need modification or up-gradation because of changes in the pipeline system operation or factual pollution load/environmental problems detected afterwards. GTCL authority may also need fleshing out/ re-cast the suggested outline of the EMP laid down in this report at their option / at the recommendation of the ES

The Environmental Management Plan will be implemented according to the Management action and responsibility parameters, mentioned in **Table-9.3**. A comprehensive summary of the main environmental issues related to the project has been considered in this table and has been place below:

Table-9.3: Management Actions and Responsibilities

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi-lities
Pre- Construction phase			
Occasional road blockage due to survey and vehicular movements etc. Dust & emission from such movement of traffic will also have impact on the local people. Such disturbance will continue up to commencement of preliminary works for construction of the pipeline in route marking, grading and construction of site camps and approach roads etc	Pre-construction activities for the gas transmission lines and facilities will have temporary blockage at some road crossings which are used by local people. Spreading of dust and exhaust due to movement of traffic. Therefore, alternate path ways for the road blocks and controlled movement of vehicles including sprinkling water would be necessary to minimize the sufferings of the affected local people.	Arrangement of alternate path ways for the road blocks and controlled movement of vehicles including sprinkling water would be made by GTCL / Survey Organization (SO) / Engineering, Procurement & Construction Contractor (EPC). This has to be supervised and monitored by the Environmental Specialist (ES) of Owner's Engineer (OE)	GTCL / ES of OE
Improper selection of camp site & in appropriate	Currently disturbed areas such as nearby schools or mosques should be considered in preference	The EMR shall consider soil aeration upon completion of the	

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
restoration will lead to soil disturbance and as such enhance soil erosion.	to previously undisturbed areas for the field camp site. This will reduce the soil erosion and compaction issues as they are already highly trafficked areas. If a previously undisturbed area must be used for camp establishment, any removal of vegetation in the process shall be discouraged. Due to the density of people, number of vehicles and generally highly trafficked areas, it is anticipated that the soil will become highly compacted in the field camps.	campsites demobilization. To further reduce the potential for soil erosion and compaction, areas shall be designated and marked for specific purposes within the campsite, as per the following: ▯ vehicle parking ▯ walkways ▯ food preparation areas ▯ eating / social areas ▯ ablutions units ▯ tents ▯ office area ▯ equipment storage ▯ hazardous material storage If any infrastructure is removed or modified in any way during camp mobilization and establishment, it must be returned to its previous state upon camp demobilization.	
Potential impacts of field camps on surface and groundwater is the concern of contamination of surface and groundwater with sanitary waste. Inappropriate locations of toilets and the sanitary waste if not treated properly; there are the potential that water sources used by neighboring villages will be affected. This may affect not only water used for drinking but also irrigation water sources.	Toilets pits in the field camp area should be dug in an area away from food preparation and living areas. They should conform, as far as is practicable, to ecological sanitation methods. All staff shall make use of the ablutions only where facilities are provided.	The EMR shall monitor such measures as well as any odors as a routine procedure to ensure impacts on adjacent properties are not significant.	
The project activities will produce a variety of waste products, the vast majority of which will be produced at the field camps.	As there are no facilities within the project sites which allow disposal of wastes in accordance with international best practice requirements, a Waste Management Plan will be formulated in accordance with sustainable development principles and the Government of Bangladesh's legislative requirements. It will aim to reduce the use of resources and the discharge of wastes. To achieve this, measures to reduce, re-use and recycle all waste products will form its core objective. The Plan will identify waste streams likely to be generated, and detail storage and handling procedures, together with methods for re-use or disposal.	The minimum mitigation measures shall be implemented as part of this Waste Management Plan and will be regularly monitored by the EMR.	

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
Maintenance of worker safety standards is an important aspect of camp site management before starting construction.	During the pre- project activities, there is the potential for health and safety problems to occur. Measures will however be implemented to minimize any illness or injury to staff or the general public. These include: ☑ Necessary preventive and precautionary arrangements should be made to guard against any accidents; ☑ Site camps should be well protected and sufficient numbers of portable fire extinguishers should be placed in accessible places in the camp as preventive measure; ☑ If possible the camp should be located near surface water storage for pumping during emergency. There should also be an accessible road to the camp to support a vehicle of the Fire Service Office caring at least 4400 liters of water .	☑ Proper training and supervision arrangements should be implemented by the project management and the EPC contractor an the residents / crew should be under strict instruction to follow all relevant health and safety procedures to avoid any potential injury or mishap. ☑ Adequate fire safety in camps should be monitored at all times.	
Construction Phase			
Impacts due to movement of heavy vehicles, equipment and hauling of line pipe & other construction materials causing occasional road blockage, spreading of dust & damaging the public roads having impact on local environment and the people.	Contractors to follow the terms of the contract on mitigation measures and act in an environmentally responsive manner through providing alternative pathways for the passers by and local traffic sprinkling water on the roads, promptly reinstating the road damages if any.	Description of the works to indicate that GTCL views environmental matters to be of considerable importance and that the contract will be administered accordingly. Briefing of appointed contractors/Supervisor y Officials on mobilization, regarding sensitive environmental matters and reinforcement of advice regarding contract administration; contracts to be administered accordingly.	GTCL to include in the contract and supervise EPC to comply ES to monitor
Potential impact of River crossings, bank erosion, navigation and fish breeding.	River crossings are to be done by horizontal Directional Drilling (HDD) method to reduce damage to river banks, to avoid obstruction to navigational traffic movement and any interference to fish breeding. Adequate bank protection measures to be there at both drill pad and exit ends to prevent erosion.	Relevant provision of HDD	
Loss of houses or other permanent structures/trees associated with	Options for reducing tree felling to be investigated.	Appropriate designs to be prepared which minimize the need for	GTCL

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
construction activities of the project.	Alignment to be adjusted to avoid permanent houses or significant trees wherever this is feasible. Construction contracts to make provision for penalty for damages of the above.	tree felling Large trees and structures of religious or cultural significance lying along the alignment if any not to be damaged or felled has to be identified on route maps.. Inclusion of appropriate clause in construction contracts & EPC to follow. Monitoring of compliance during construction and appropriate administration of contracts	ES EPC
Erosion of pipeline / Valve Station/ CGS-RMS site borrow pit leading to deterioration of the surrounding land with long-term adverse effects on economic benefits	Earthworks specifications to include provision for placing grass turfs on all earthworks slopes, and refilling the borrow pit, if any as soon as possible after the work is completed.	Sensitive sites to be identified; options for protection measures to be investigated and suitable measures to be incorporated in project designs and construction specifications with inclusion in the contract Monitoring of compliance during construction.	GTCL ES EPC
Contractor's workforce presence increasing pressure on already strained local medical services, food staff, drinking water and other community facilities	Contractors to provide own suitably equipped and staffed site/ emergency medical facilities and arrange for their own provisions of food and drinking water etc and avoiding community conflict including possible influx of sex workers.	Inclusion of appropriate clause in EPC contracts for provision of medical and other service facilities. External workers should have medical checkups prior to commencing work to minimize the potential of communicable disease to the local area. Monitoring of compliance of the contracts and	GTCL EPC OE

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
		maintaining good community relationship as long as base camps are in the locality.	
Incomplete post-use clearance and reinstatement of base camp and other temporary work sites, leading to loss of land productivity or additional costs for landowners to reinstate land	Contractor to prepare site restoration plans for approval, prior to abandonment, and to implement such plans fully	Inclusion of appropriate clause in contracts All temporary works sites to be notified by the contractor, prior to use. All sites to be photographed to provide a record of pre-use state and brought back to same condition after the work. Monitoring of compliance during construction and appropriate administration of contracts	GTCL EPC ES
Pollution of land, groundwater and surface water arising from sanitary and other wastes and spillages	Contractors to prepare for approval detailed site environmental plans for the base camps and other work sites, which make adequate provision for safe disposal of all wastes, and prevention of spillages, leakage of polluting materials etc. Also to cleanup & reclaim the land and pay due compensation to the affected ones.	Inclusion of appropriate clauses in construction contracts. Contractor to act accordingly. Monitoring of compliance during construction and appropriate administration of contracts.	GTCL / Department of Environme nt (DOE) EPC ES
Noise, vibration & emission of smoke resulting from operation of the welding generators, Side booms, Trenchers Bending Machines and Trailers etc will have impact on local environment.	Though the presence of such operation and its impact would last for a limited time until the spread moves to the next section, due caution is to be exercised in selecting more environment friendly machineries & equipments and keeping them in good operating condition.	Such indications should be included in the contract and the contractor is to follow meticulously. Proper supervision & monitoring would help to minimizing these impacts.	GTCL EPC ES
Noise made by crews at work sites and at camps	The level of noise made by crews working at sites shall be kept to a minimum. Loud voices,	EPC contract will contain specific	GTCL

Potential Impacts	Enhancement/mitigation measures	Management actions	Executive responsibi -lities
and from vehicle and vehicle horns will impact rural localities & habitats.	shouting, singing, banging sticks together or hitting the trunks of trees shall not be permitted whilst working or in the camps. Vehicle and vehicle horn usage shall be kept to a minimum when driving through the rural roads to further minimize the impact upon the local people and the wildlife habitats.	mentioning of these issues and has to be duly implemented and monitored at sites by GTCL and ES	EPC ES
Radiation hazards due to performing x-ray & gamma ray radiography in conducting NDT of pipeline welding joints.	Being an essential element in maintaining quality control and integrity of the pipeline system, due caution in works, storage and disposal of isotopes done only by skilled professionals.	Contract should include details of NDT procedures including routine monitoring of radiation levels of the radiographers using film badges checked through the organizations like AEC.	GTCL AEC EPC ES & QA/QC
Irrigation canals, natural steams, river banks and similar other physical infrastructure affected by the project activities.	Alternate drainage facilities to be provided for irrigation water to pass through with temporary facilities for naval traffic. Drainage system, canal banks etc so damaged should be promptly reinstated back.	Contracts should have adequate in- built provision for alternate drainage facilities and restoration actions including erosion protection etc and maintaining the same through out the duration of the project activities.	GTCL Department of Environme nt (DOE) EPC ES
Discharges from pipeline dewatering following hydrostatic testing may contain undesirable waste materials and impact on surface water and surrounding soil	Due provision should be there to allow controlled disposal of these discharges upon appropriate monitoring of the quality and level of contents that may contaminate the water & soil so affected .	Contract would contain guide line & specification for this and the EPC contractor is to follow accordingly. Due supervision & monitoring will be exercised to minimize the impact.	GTCL EPC ES
The vast majority of waste products will be produced at the base & field camps during field operations. Non-hazardous wastes produced during the field operations are likely to include: - Oils and grease; - Machinery parts and tires; - Sewage; - Food; and - Paper and plastic.	Project staff shall not throw away any waste product, solid, liquid or otherwise, whilst en route during operations. All waste products (solid, liquid and wooden stakes) shall be carried out by the crew during project activities and disposed of appropriately at the field camp or other suitable waste receptacle. Consequently food waste must not be disposed of on the site, but should be held inappropriate containers for correct disposal at a later time. Consideration should be given to contributing food waste to local compost production facilities, if available. Hazardous wastes may include: II Batteries;	Contract would contain guide line & specification for this and the EPC contractor is to follow accordingly. Due supervision & monitoring will be exercised to minimize the impact.	GTCL DOE EPC ES

Potential Impacts	Enhancement/mitigation measures	Management actions	Executive responsibi -lities
If stored and disposed of incorrectly, these wastes have the potential to cause physical and chemical contamination of in-situ soils and watercourses. The visual aesthetics of areas surrounding waste dumps may also be adversely affected as they are inherently unsightly, and may produce unpleasant odors. Many solid waste products produce toxic fumes upon heating/burning, causing possible harm to those in the nearby vicinity and decreasing the air quality	II Cleaning chemicals; and II Brake fluid, paint & solvents etc. Due to their nature, these materials have a high risk of causing human and / or environmental harm if they are not disposed of in accordance with best practice requirements. Solid waste materials shall also not be thrown out on site. All waste generated whilst crews are in the field must be carried back to the field camp for appropriate disposal. Visible receptacles for recyclable and non-recyclable litter shall be placed around the camps, with clear signposting of what is considered recyclable waste. Solid waste materials shall also not be burnt, as a method of disposal.		
As discussed previously, the inappropriate disposal of liquid wastes can have a detrimental effect on the surrounding waterways and groundwater.	DOE states the effluent limits for the discharge of liquid waste to surface waters, sewers and agricultural lands. These discharge limits are consistent with WB guidelines for liquid effluents discharged to inland waters for pH, biological oxygen demand (BOD), oil and grease, heavy metals and phenol compounds. WB Guidelines propose a 50 mg/L limit for Total Suspended Solids (TSS), whereas DOE specifies a limit of 150 mg/L.. In accordance with these guidelines, no machinery or vehicle maintenance is to be carried out on site. Machinery maintenance must be conducted in a designated maintenance workshop to ensure there is not an accidental spill of any hazardous liquids, such as oil or petroleum.	Waste Management Plan will be developed in accordance with DOE's legislative requirements and standards. EMR will monitor that all effluent released during the project operations must comply with these discharge standards.	GTCL DOE EPC ES
Improper management of Borrow pits, if dug for pipeline, valve station and RMS site and top soils are not preserved and restored properly will have adverse impact on the surrounding soil and the environment.	It was revealed from the discussion with GTCL that, in order to avoid procurement of additional land and to eliminate borrow pit / slope maintenance / restoration problems, all valve station and RMS site etc. will be filled in and developed by carried earth. The top-soil from pipeline trenches will be stockpiled during construction in order to conserve the fertile layer of the soil, which must be restored in consultation with the community upon completion of construction works.	Adequate provisions will be retained in the EPC contract accordingly including a specific guideline for top soil storage and restoration should be provided there of. The EPC contractor will be responsible for doing the job as per standard specification contained in their contract with GTCL. This will be supervised and monitored by the ES of the Engineer designate of the project.	GTCL EPC ES

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
Loss of 561 trees of the PAP as well as those belonging to the State including road side vegetation along the ROW will have negative impact on the environment unless appropriate measures for compensatory forestation are taken and to ensure that these plans are implemented before completion of the project.	In consideration of the fact that for maintaining integrity of the pipeline so built, no tree removed from the acquisitioned strip of 8 meter ROW can be replanted. However, as a measure for compensatory forestation and to ensure these plans are implemented before completion of the project, a budgetary estimate of BDT 200,000 has been retained for distribution of 10,000 sapling @ Tk. 20 each in the Resettlement Action Plan. This plan will cover not only the 561 trees belonging to PAP but also those belonging to the State including road side vegetation and the neighbourhood community.	GTCL will implement the plan not only to safe guard the environment but also with the intention of discharging corporate social responsibility in providing host area facility as well.	GTCL ES
The management actions to mitigate impacts related to river bank erosion and disruptions to fish breeding during HDD at River crossings.	Mitigating actions required to prevent the river bank erosion and adverse impacts on fishes during drilling operations will be as follows: Any erosion caused by human traffic or drilling works has to be repaired prior to project completion, with a priority focus on areas with steeper slopes due to the increased risk of landslip and erosion in the banks. If boats are required to gain access to drilling area, boat traveling speeds shall be kept to a minimum to reduce the occurrence of bank erosion. Drilling mud ponds are to be reinstated with appropriate indigenous vegetation upon project completion, if they have not been done so naturally, at the discretion of the EMR.	Appropriate bank protection design specification for each section of the river banks of every river to be crossed by HDD will be provided to the EPC contractor by GTCL to prevent the river bank erosion	GTCL EPC ES
Minimization of impacts due to trenching on river beds and on aquatic life and river water flows during lean season, when trenching is proposed.	HDD crossing does not involve any trenching in the river bed since the pipe line crosses the river along minimum of 20 feet below the bed of the river so crossed. Hence, any aquatic life, fish breeding or river traffic is not impacted due to HDD crossing operations. The contamination of groundwater with any contaminants is not a serious concern during the drilling process, as a water source typically used is not an external one other than the river being crossed in the area. The source of water used during drilling is to come from a clean and natural source and in alignment with this, the drilling locations shall be at least 100 meters from existing groundwater wells to ensure that the drinking water source for nearby communities is not impacted.	All source water points required for Drilling has to be assessed by the site EMR. No water is to be drawn from source points that are considered to be polluted, contaminated or environmentally sensitive. This includes shallow and/or small non-flowing water bodies and important wetlands.	GTCL EPC ES
Uncontrolled escape of sediment including unsafe disposal of drilling fluids and lube oil waste during HDD will have adverse impact on surrounding soil and water bodies.	The movement and escape of sediment including unsafe disposal of drilling fluids and lube oil waste from HDD crossing sites within the project ROW must be controlled to reduce the potentially adverse effects upon the water quality of nearby water bodies, both within and adjacent to the immediate gas pipeline project area. This will be achieved by digging a pond of 15mX10mX2.5 m size as required for storage /	Adequate provisions will be retained in the EPC contract accordingly including a specific guideline for disposal of drilling fluids and lube oil waste during HDD	GTCL DOE EPC

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
	disposal of drilling fluid which are water based mud and as such bio-degradable. Such ponds are dug in the additionally requisitioned area for each crossing site as this will reduce the amount of mud escape during the drilling process. The excavated material will be placed immediately adjacent to the pond and, once the HDD is over and pipeline has been laid, these will be replaced into the pond to discourage sediment from entering nearby water bodies.	should be provided there of. The EPC contractor will be responsible for doing the job as per standard specification contained in their contract with GTCL. This will be supervised and monitored by the ES of the Engineer designate of the project.	ES
Adequate occupational safety & health has a potential impact on the project.	☎ There is potential for health and safety problems to occur during the project Activities. Measures will however be implemented to minimize any illness or injury to staff or the general public, so that ☎ Necessary preventive and precautionary arrangements are Made to guard against any accidents; training, instruction and supervision arrangements should be continued so that no accidents occur and the working crew will be under strict instruction to follow all relevant health and safety procedures to avoid any potential injury or mishap ☎ Before the pressure testing & commissioning , the Chief Inspector of Explosives and the Fire Service & Civil Defense Office should be formally informed ☎ Preventive security measures should be taken against any public mobilization at the camp and other work places; and ☎ An emergency response plan will be there for action during any potential contingent events.	Occupational safety & health issues are to be continuously monitored and liaison has to be maintained with the relevant authorities for necessary as and when needed.	GTCL EPC ES
Proposed route will cross a number of natural streams and canals, which has potential to adversely impact local hydrology	In order to mitigate the potential impacts on local hydrology as the proposed pipe line will cross a number of natural streams and rivers, the necessary measures will include: ☮ Diversion of any waterways or water bodies shall not be permitted during any part of field operations, including the establishment of field camps; ☮ Field operations are to be conducted during the dry season; ☮ HDD points shall be located at least 100 meters from existing groundwater wells; ☮ When crossing rivers or streams, crews shall use existing crossing points where possible; ☮ When crossing shallow rivers or streams, crews shall walk in single file across the stream and embankments to reduce diffuse pollution; ☮ Any structures built to cross water bodies will be removed upon completion of the work and the	Mitigation measures will be implemented and monitored to reduce potential impacts to surface and groundwater sources to appropriate levels. Diversion of any waterways or water bodies shall not be permitted without consultation with the community concerned and providing alternative arrangement in fulfilling the necessity of water used in the locality for house hold / irrigation purposes during any	GTCL EPC ES

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibilities
	area reinstated to its pre-existing state. Whilst creating a temporary crossing structure may have less of an impact on the water body, methods used during construction can still contribute to increased sedimentation in the river and can negatively impact the structure and vegetation on the associated banks. Consequently the building of any temporary crossing structures should be done in consultation with the Environmental Management Representative (EMR) and will be removed upon completion of the work and the area reinstated to its previous state ☹ No liquid waste (for example, oils, cleaning chemicals, brake fluid, etc) is to be discharged into the local area or streams encountered during operations. Again, this would result in both surface and groundwater contamination, especially when the liquid waste is hazardous. Populations of aquatic fauna and flora have the potential to be severely harmed if a hazardous liquid waste is discharged into the waterways. ☹ Poles used during survey operations shall not be soaked in any hazardous chemicals; These chemicals have the potential to leach into the surrounding groundwater, resulting in groundwater contamination for the area. ☹ Source water used during the drilling process is to come from a clean and natural source and groundwater shall not to be used. This is to be assessed by the EMR prior to any abstraction taking place; ☹ Measures should be implemented to control the movement and escape of sediment from discrete areas within the project site to reduce potential adverse effects upon the project area. ☹ Measures should be implemented to control the movement and escape of sediment, from discrete areas within the project site to reduce potential adverse effects upon the water quality of nearby water bodies, both within and adjacent to the project area; ☹ Waterways shall not be altered for the establishment of the campsite; ☹ Containment of sanitary waste should be adequately disposed of to avoid surface and groundwater contamination; and ☹ The above mitigation measures to reduce the potential impacts on surface and groundwater must be implemented stringently whilst working in the project areas.	part of the field operations, including the establishment of field camps. Survey Poles shall not be soaked in any hazardous chemicals. No liquid waste is to be discharged without proper treatment into the local area or streams encountered during operations; These chemicals have the potential to leach into the surrounding groundwater, resulting in ground water contamination for the area. When crossing shallow rivers, khals or streams, the pipe line crew shall walk in single file across the stream and embankments to reduce diffuse pollution. The crew shall use existing crossing points where possible to further reduce this potential impact. Any structures built to cross water bodies will be built in consultation with the EMR and removed upon completion of the work and the area reinstated to its previous state; The suggested mitigation measures must be implemented by the EPC contractor stringently and duly monitored by GTCL and the ES i.e. EMR whilst working in the project areas.	
Operation & Maintenance Phase			
Pollution of land, and surface water arising from discharge of wastes and spillages of condensates etc from pipeline, valve stations/ scraper traps and	In general, such pipeline system operations does not involve any substantial impact on environment in view of the fact that the entire pipe lines remain buried at a depth of 1 meter under ground except at some strategic locations like valve stations/ scraper traps and	Effective implementation of the recommended EMP during all activities involving O&M. Providing phase wise	GTCL DOE

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
CGS / RMS plant operation sites, particularly control stations, scraper traps and valve stations etc.	at CGS / RMS sites. So discharge and wastes, if any are only localized in these exceptional components of the system. As experienced, the quantum of such discharges is also not of any significant issue as long as operational practice of good standing is adopted. Mitigation measures usually followed are to keep the entire pipeline under round the clock vigilance by the patrolmen walking along the route finding, if there is any encroachment, leakage or rupture, monitoring effluent discharges from the aforesaid strategic sites to be of acceptable level before draining out in natural canals and streams and safe handling, storage, transport and disposal of condensates to nearest depot of Bangladesh Petroleum Corporation for due Fractionation / Blending/Marketing	training to its EM and O & M Engineers & Technicians. Monitoring of safe house keeping, proper use & maintenance of PPE at work place, maintaining testing laboratory or out sourcing effluent /emission testing services, fire fighting , first aid, emergency response centers and communication link with Operations HQ round the clock. Immediate repair / replacement of leakage / ruptured pipeline and remedies for the malfunctioning parts / equipment of valve stations/ scraper traps and at CGS / RMS.	EPC until the period of warranty and then GTCL
Human safety	Proper restrictive measures have to be taken for movement of people and the working crew in and around the operational sites to prevent any accident causing injury or loss of life.	Human safety is an important issue and has to be monitored in all stages of operation as stated above..	GTCL EPC until warranty period
Effects on human hearing: Potential to cause hearing impairment from the use of air horns, vehicles, generators and other equipment	Equipment should be selected on a low noise basis. Operation of noisy equipment should be minimized. All operating personnel are to use appropriate personal protective equipment (PPE)	Effects on human hearing should be kept at minimum. Appropriate personnel protective equipment (PPE) has to be provided. Use of same has to be ensured with arrangement of adequate training on use and maintenance of the same in good condition as mentioned above and due replacement when called for.	GTCL and O & M contractor, if appointed.
Handling, storage, transport and disposal of all hazardous materials have	As experienced, hazardous materials are rarely in use in operations of any such gas transmission system except some chemicals	Stringent management and monitoring measures has to be	GTCL / DOE / AEC

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibl -lities
impact to soils or ground / surface water as a result of leakages or spills during use.	like odorants, battery fluids etc at CGS / RMS plants and the radioactive isotopes which are occasionally used / hired for NDT in pipeline O & M purposes. These are to be carefully handled, transported only in properly signed vehicles equipped with appropriate emergency equipments and stored in specially designed storage warehouses maintaining adequate safety distances around. Any disposal requirement of such materials calls for assistance from specially competent authorities life fire brigades, DOE and Atomic Energy Commission (AEC) etc.	exercised in handling, storage, transport or disposal of all hazardous materials. Further these have tob done employing specially trained professionals.	
Potentials for impact to safety or human health as a result of contact, ingestion or inhalation of hazardous materials	Relevant staff to be appropriately trained on the use, storage, handling and transport of hazardous materials. First aid facilities to be available on site and with field teams at all times.	Safety management procedure and guide lines and manuals to be present and accessible to all staff. All staff to be formally notified of their location and use.	GTCL / DOE
Risk to the biophysical environment due to con tact with hazardous materials or arising from habitat contamination	Storage facilities to be of an appropriate standard for the level of hazard presented by substance. This includes appropriate access control.	Records to be kept of all hazardous materials present on site at all times. Appropriate emergency response equipment to be available wherever hazardous materials are used.	GTCL / DOE/ AEC
Occupational injuries/ traffic emissions	Potential to cause injuries through the operation of vehicles and equipment. Education of all staff members on risks in and around the project operational sites and rotating & stationary equipment. All appropriate personnel protective equipment (PPE) to be used	First aid kit to be kept with staff in the field and trained personnel to be on hand PPE should be provided at all work places and usability has to be inspected for replacement when felt necessary. Training to be organized for proper use and maintenance of PPE.	GTCL
Air pollution and chemical emissions	Potential for air quality impacts in the local area, as stated earlier, is usually insignificant along the pipeline route except at any accidental leakage or rupture in the pipeline or uncontrolled release of gas in the valve stations/ scraper traps etc including release of gas from relief blows and SOx NOx, CO, etc.	Equipment should be selected on a low emissions basis Operation of vehicles that may disturb with spreading of dust should be minimized.	GTCL

Potential Impacts	Enhancement/ mitigation measures	Management actions	Executive responsibi -lities
	from exhausts from generators, water bath heaters etc. at CGS / RMS sites that may affect the health of working crew and local residents	Speed limit should be applied to reduce dust disturbance. O & M has to be carried out through trained & skilled personnel under close supervision & monitoring of the professionals.	
Fugitive emission of gas from the pipeline system	Natural gas leakage is a GHG issue and needs top taken in to consideration. Though there is hardly any leakage expected from this transmission system as well of GTCL except from some form of accident, continuous servlliance, regular system maintenance and prompt replacement of malfunctioning spares in the CGS/ RMS etc would reduce/ stop the quantum of leakages if any.	GTCL will organize due servlliance, regular system maintenance and prompt replacement of malfunctioning spares etc under supervision of trained and skilled professionals , particularly after taking over from the EPC contractor upon completion of the warranty period.	GTCL EPC until warranty period. ES
Impacts created through the presence of migrant workers, if any during strategic or critical operation and maintenance works for example, on stream intelligence pigging of the pipeline and overhauling of the stations etc.	Appropriate actions should be taken to reduce the impact of increased stress on local food and clean water supplies, or potential for introduction of communicable disease to the local habitats. as well as increased chance of cultural conflict .	External workers should be provided with adequate supplies of food &drinking water and prior medical checkups for minimizing potential of communicable disease. Good neighbour hood relationship and contributions for uplifting community facilities and local cultural, communication and education infrastructure.	GTCL

9.8 Health, Environment & Safety Management Plan

The gas transmission pipeline design is always aimed at avoiding or minimizing impacts on the environment wherever practicable and GTCL would reflect this particular concept in this project too. GTCL would ensure implementation of mitigation measures to reduce negative environmental impacts on Health, Environment and Safety, and would ensure protection of health and safety. The Operation Management System (OMS) provides a delivery mechanism to address potential adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for project activities.

9.9 Environmental Management Costs

Basically environmental management costs depend on the precise nature and extent of work,, monitoring requirement and the nature and scope of institutional strengthening and environmental training. As experienced in executing different projects of similar dimension and magnitude and as opined by GTCL management during discussions with them, the environmental impact of execution of this project does not necessarily call for application of any substantial monitoring arrangements and tools for measuring the qualities of different environmental elements impacted during the construction and operation phases.

Still then, it has been agreed with the GTCL management that they will, at the recommendation of ES, outsource undertaking the monitoring activities to a vendor who can do the monitoring periodically as and when deemed fit. Accordingly, for reference purpose, estimated cost for outsourcing monthly environmental monitoring during construction and operation phase is given in **Table-9.4:** and the estimated cost for procurement of new equipments for environmental monitoring have been given in **Table-9.5**. The unit cost shown is on the basis of the report of BUET, 2007. * The parameters with asterisk marks may be applicable for tests within or in the vicinity of the SG CGS/RMS site.

Table-9.4: Estimated outsourcing cost for monthly environmental monitoring during construction and operation phases.

Sl No.	Items	Number	Per Unit Sample Cost (Tk.)	Total Cost (Tk.)
	Construction Phase			
1	Ambient air	PM_{10} = 10	10,000/-	100,000/-
2	Drinking water	2	15,000/-	30,000/-
3	Noise level	20	10,000/-	200,000/-
4	Process waste dumping	10	5,000/-	50,000/-
	Total cost for one time sample during construction phase			**380,000/-**
	Operational Phase			
1	Meteorological data collection (Met office real cost of data-2008)	01 (as and when required)	6600/-	6600/-
2*	Atmospheric emissions	SOx, NO_x CH4 and Temp. (01)	30,000/-	30,000/-
3*	Ambient air (Three district at different locations)	(10)	20,000/-	200,000/-

Sl No.	Items	Number	Per Unit Sample Cost (Tk.)	Total Cost (Tk.)
4*	Ambient air	PM_{10} (10)	10,000/-	100,000/-
5*	Noise level	20	10,000/-	200,000/-
6	Drinking water	01	15,000/-	15,000/-
7	Process waste dumping	10	5,000/-	50,000/-
Total cost during operation phase				**601,000/-**
Grand total cost				**9,81,000/-**

Table-9.5: The price of different environmental monitoring equipments.

Sl. No.	Description	Qty	Unit Price TK	Total Price TK
01	Fine Particulate Sampler(required during construction phase only) Envirotech, India, APM 550.	01	4,75,000.00	4,75,000.00
02	Extra spares & consumables (Optional)			
i)	GF/A Filter paper, (100 discs).	01	7,800.00	7,800.00
	Sub Total (A)			**4,82,800.00**
03	BOD Incubator	01	3,30,000.00	
	Sub Total (B)			**3,30,000.00**
04	SOx NOx, CO, etc. Analyzer.	01	5,50,000.00	
	Sub Total (C)			**5,50,000.00**
	Grand Total (A+B+C)			**BD Tk. =13,62,800.00**

The training for the specific officer(s) is an integral part for successful completion of this project. To operate the in-house monitoring activities, low profile specialized training will be required and the estimated cost of training has been summarized in **Table - 9.6**.

Table-9.6: Cost estimate for training during construction and operational phase

Items	Number (per year)	Per Unit Cost (Taka)	Total Cost (per Year) (Tk.)
Safety and occupational health	02	200,000/-	400,000/-
Environmental management system	02	200,000/-	400,000/-
Total :			**800,000/-**

9.10 Environmental Monitoring Plan

Technical Aspects

The technical aspects would include the parameters to be monitored, methods of measurement, location or area to be covered and frequency and duration of monitoring. The parameters and selected indicators must cover the potential impacts identified in the environmental studies and

placed in the foregoing sections. The location, frequency and duration of measurements as deemed essentially necessary should be such that the data obtained are representative and sufficient to arrive at a definite conclusion regarding magnitude and trend of impacts.

Materials, Supplies and Equipment

GTCL will take care about the fact that the materials, supplies, equipment and personnel requirements are largely guided by technical aspects of monitoring and such requirements thus, largely control the budget of the monitoring program too.

Monitoring Activities, Indicators and Parameters

Environmental monitoring requires a set of indicators that could be conveniently measured, assessed and evaluated periodically to establish trends of impacts. These indicators may be independent or may be functionally related. The well defined physical-chemical, ecological, human interest and Socio-economic indicators including mutual relationship among the indicators should be well understood.

9.10.1 Monitoring Parameters

The typical environmental monitoring parameters applicable for this BKB-SG Gas Transmission Pipeline Project and its associated facilities are briefly described in this section.

9.11 Pre-Construction Phase

9.11.1 Road Blockage & Disturbance from Traffic

Road blockage due to survey and vehicular movements etc including spreading of dust & emission from such movement of traffic will have impact on the local people. Such disturbance will continue during route marking, grading and construction of site camps and approach roads etc.

Arrangement for alternate path ways for the road blocks and controlled movement of vehicles including sprinkling water would be necessary to minimize the sufferings of the affected local people. Unhindered flow of irrigation water has also to be maintained through placing appropriate conduits as and where necessary.

This has to be supervised and monitored by GTCL and the Environmental Specialist (ES).

9.11.2 Presence of Survey Team and Migrant Workers

Impacts created through the presence of survey team and other migrant workers should be mitigated through employment of local labour in numbers as much as practicable. Appropriate actions should also be taken to reduce the impact of increased stress on local food and clean water including avoidance of social conflict. Potential for panic in the minds of men & women folks of different ages due to unusual movement of heavy vehicular movement and presence of stranger migrant officials and working crew including emissions and dust in the locality are also to be the points of concern to monitor and mitigate in the interest of smooth execution of the project.

Arrangement of peaceful co-existence with support from neighbourhood communities has to be made for the work force through continued public consultation. External workers should have

medical checkups to minimize the prevalence or potential for introduction of any communicable disease to the local area.

9.11.3 Restoration and Protection Measures for Physical Features

The process of video recording, taken from a moving vehicle / walking along the ROW which would show both the alignment margins and all nearby structures of the Project Affected Persons (PAP) has been recommended to check fraudulent compensation claims later on . This would also include the public utility features like roads, irrigation canals, banks of rivers and natural streams etc. so that any such local features existing in the video would help identifying any damage done during construction after the date of the recording and to appropriately bringing these back to pre-project condition and restoration and protection measures are taken accordingly.

9.12 Construction Phase

9.12.1 Erosion

It was identified that unstable slopes, particularly at the stream crossings, earthen portion of RHD & LGED roads, river banks etc will have erosion and consequently increase sedimentation in the nearby wetlands. Careful monitoring will be required to estimate both erosion and silting impacts.

9.12.2 Air Quality Monitoring

It was identified that the negative impact on air quality would mostly come from dust emissions by the movement of heavy vehicles during construction and gaseous emissions during operations. Dust load on the nearby homesteads and plants is an indicator of dust pollution in the air. Mitigation measures suggested earlier will successfully offset these negative impacts. Monitoring suspended particles load in the atmosphere of the construction sites should be periodically measured to comply with the air quality standard.

Measurement of air quality parameters e.g., NO_X, CO, PM_{10}, $PM_{2.5}$ (if required) and temperature will be carried out during the construction period in accordance with the monitoring plan presented in the **Table-9.5**. Measurement will be carried out at locations which are sensitive with respect to air quality, near the school and residence and other vulnerable locations. The number of locations for monitoring shall be agreed by the ES, GTCL.

9.12.3 Noise Monitoring

There shall be use of moderate to high noise making equipment e.g Horizontal Directional Drilling rig, Thrust Boring Machines, compressors, welding machines, small generators and movement of vehicles. Placement of power generator units inside soundproof rooms, selection of lower noise making equipment / use of muffler may be helpful to protect the school children from the noise wherever practicable and regulating the use of hydraulic horns should be monitored for compliance.

The noise level at the construction site would be kept within DOE's permissible limit so that higher noise level does not affect human health and the wildlife within the close vicinity of the project area. Since most of the ROW is in paddy fields, it expected that, except for the rural and sub-urban habitats, the noise so created during construction will be of the concern for the working crew at sites and therefore they will have to be provided with respective PPE for using at the work sites.

9.12.4 Emission

In general, a good number of diesel cranes, side booms, trenchers, backhoes, pipe trailers, pipe bending machines, thrust boring machines etc besides diesel welding machines, generators, forklift, general transports and miscellaneous tractor-trailers will be used in each spread on site These machineries and equipment must be maintained in good working order and emission from these vehicles and equipment to atmosphere would be properly maintained to ensure that their emissions will be kept within WB and DOE standard.

9.12.5 Health and Safety Monitoring

Periodic checks of health and safety measures for construction labourer and other project personnel shall be performed. First aid and medical services shall be available. Particular attention has to be paid to the radiation exposed level of the crew engaged in carrying out Non-Destructive Test involving Gamma / X-ray radiation.

9.12.6 Water Quality Monitoring

Drinking water quality monitoring: Drinking water quality will be monitored during the construction phase. Care has to be taken so that excess water is not produced and waste water is not drained from any of this project sites in to the natural stream without due monitoring of the water quality as per standard set thereof.

Ground water quality monitoring: Usually there fewer chance of contamination of ground water due to impact of execution of the project . Still then, groundwater quality monitoring shall be done at regular basis even through out the operational life of the pipeline system, particularly near the CGS/RMS sites.

9.12.7 Waste Management

Records of generated process wastes, if any, will be kept separately according to the WB and DOE's guideline. Chain of custody for hazardous waste and for process non-hazardous waste will be maintained. The schematic flow chart is shown below. This flow chart will also be used during the operation phase with certain changes whenever deemed necessary.

The present project activities will involve establishment of camps, transport, site development and construction and operation of the pipeline and the plants. For each activity, various types and quantity of wastes will be generated. The EPC contractor, owner's engineer and the ES will prepare a comprehensive list of waste types, sources and plans to manage all of these wastes in an environmentally friendly manner. The major sources are identified as:

- Camp waste
- Construction & operation waste

The EPC contractors will implement wastes segregation strategy as a first step of their waste management program where the hazardous and non-hazardous materials will be separated out following the waste management flow diagram as shown in **Figure-9.4**. The non-hazardous materials will then be further sorted out into bio-degradable and non-biodegradable groups. and then disposed off in a manner as applicable

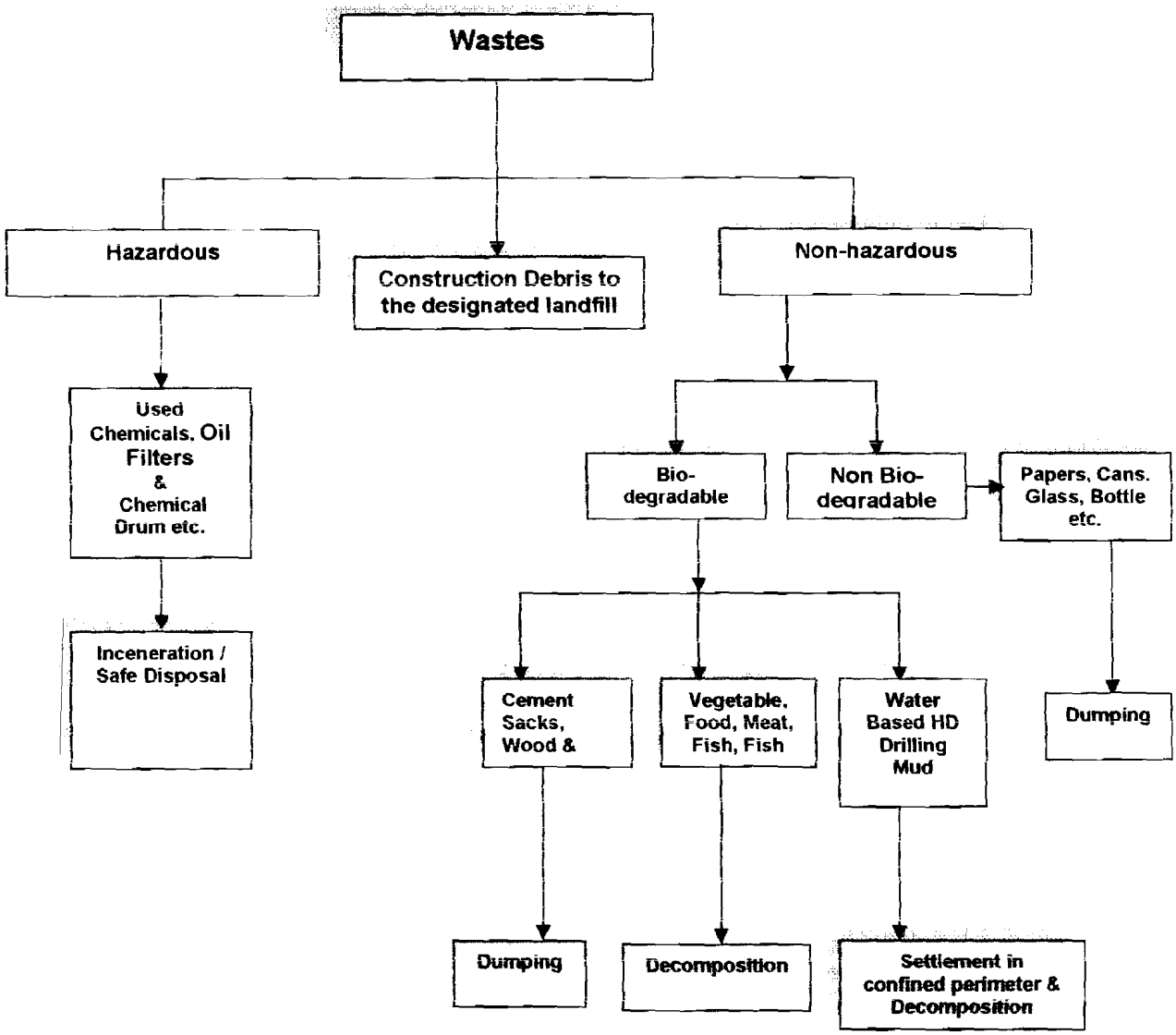


Figure-9.4: Waste Management flow diagram for the EPC contractor to be followed up to segregation.

9.12.8 Camp Waste Management

The EPC contractor will prepare a list of all identified source and types of wastes that would be generated in their campsite (**Table 9.7**) and is committed to minimize waste generation as much as possible. Though other work sites are mostly in remote locations, Siddhirganj is a well communicated area where municipal waste disposal facilities are available therefore, the EPC contractor will facilitate the corporation authority to collect, manage, treat and dispose off the wastes on their own initiative.

Table- 9.7: Types and sources of domestic wastes

Type of wastes	Main components	Potential constituents of the released wastes
Drainage	Bathing water, Rainwater	Trace amount of oil and grease, soap
Emission	Construction equipment, vehicles, cranes etc.	Emission of smokes, CO, CO2 etc.
Domestic sewage	Biodegradable organic matter	Semi-solids, used detergent, coli form bacteria
Domestic refuse	Garbage, packing materials, paper, batteries, paper bags, cartoon, plastic, plastic bottles, cans, wrappers, organic waste, waste, glass bottles etc.	Plastic, organic waste, batteries, glasses
Kitchen waste	Waste vegetable, wastes during processing of vegetables, waste food, soap and detergent, fishes scales, meat's scales and wastes etc produced in kitchen	Protein, bio-degradable organic matters
Washroom	Bathing and water	Soap, detergent, trace amount of oil and grease

The EPC contractor will follow regulations and guidelines for wastewater discharges into surrounding waterways. Liquid wastes that could damage the environment will never be released or allowed to drain directly into a watercourse. The campsites have to be provided with septic tank with closed sewage systems.

9.12.9 Construction and operation Waste Management

The principal industrial wastes arising from construction and operation are domestic waste, some solid and liquid wastes filter cartridges, various discarded chemical products, empty drums, pipe dope buckets, household types trash, discarded chemicals, wood pallets, lime, cement and mud sacks. A list of typical wastes types and sources are shown in table 9.3 & 9.4.

9.12.10 Hazardous Material Handling and Storage

During construction of the gas transmission pipeline and erection & fabrication of plants, commercially available chemicals (paints, thinners etc) will be used and stored in the construction area. Hence small amount of unused or spent chemicals (used paints, motor oils) will be generated. The lead acid batteries used in the project contain lead, sulphuric acid and several kinds of plastics and are hazardous to human health. Therefore the ideal place to store used lead acid batteries is inside an acid resistant sealed container to minimize the risk of an accidental spillage

Drilling mud will also be discharged from HDD crossing sites. Water based bio-degradable mud has to be selected for use in all such HDD at all the 5 river crossings of the project. These will never be discharged in the rivers and will be allowed to be stored and decomposed in trenches specially dug in nearby locations.

The following set of typical storage guidelines will be adopted:

The storage place will be protected from

- rain and storm water, this place will also be provided with a good shed.
- any sources of heat hazards, will have a ground cover and an exhaust ventilation system in order to avoid gas accumulation

The storage place will have a restricted access and be identified as a hazardous material storing place. Any other lead materials which may eventually arise, such as plumbing, should be conveniently packaged and stored in accordance with its characteristics

The work sites, plant areas and the store premises will be provided with fire protection and fire fighting equipment. These equipments will be installed, tested and maintained in accordance with the manufacturer's guidelines. It has to be ensured that a procedure for dealing with emergencies is in place, implemented, maintained and communicated to persons on the premises who may be affected by or respond to an emergency.

Ignition sources in hazardous areas will not be allowed. The facility staff will be trained and equipped with personal protective gear such as rubber gloves, boots, hard hats, apron or splash suit and a face shield with safety glasses or goggles, as per corporate safety guidelines.

Safe access within and to and from the work sites will be ensured. Unauthorized access and activities will be prevented. These measures will reduce the chances of accidents and facilities a safe environment for the workers, the staff and the plants.
The EPC contractor will reduce the quantity and toxicity during construction and operation of the project in the first place thus the impact and cost of environmentally acceptable disposal will be reduced. The proposed approaches for this are:

- Use of best-available technologies to minimize environmental degradation;
- Proper disposal of hazardous and non-hazardous solid and liquids;
- Minimization of water use in kitchen and worker camp;
- Monitoring and maintaining chain of custody for the disposal wastes and construction debris;
- Monthly environmental reporting to the concern authorities;

Disruption of Road Traffic:

Disruption of road traffic should be monitored to ensure the compliance of mitigation measures. Alternate temporary access ways for movement of vans and rickshaws and the members of public with their pet animals should be monitored.

Besides the above specific monitoring aspects for operations, laboratory tests for specific sampling locations should be conducted. A tentative list of parameters to be measured, sample number, sampling frequency is already provided in foregoing section.

Post construction monitoring:

Post-construction monitoring is limited to a number of impact parameters for the project. It is expected that there may remain a few residual impacts after implementing the mitigation measures and Environmental Management Plan. Some of these impacts may include soil pollution or drainage congestion / water logging. Of these, soil pollution may originate from improper handling of oils, grease, lubricants and solvents associated with left over debris from construction activities. This will not be of a great concern if normal precautions are taken. Drainage congestion / water logging may not occur if adequate monitoring is performed on drainage facilities and corrective measures applied, particularly in reinstatement of roads, restoration of bank protection at canal, stream & river crossing sites etc. However, monitoring will be necessary during post-construction period of the project. This can be performed by local staff of GTCL who can take corrective actions.

Implementation Schedule

The monitoring and evaluation of construction related impacts would continue throughout implementation of the project. GTCL will implement the monitoring plan through reinforcement of its existing environmental monitoring setup.

Operational Phase:

Meteorological measurements

Seasonal meteorological monitoring data will be collected from the Meteorological office of Agargaon, Dhaka to monitor the wind direction and speed, temperature, humidity and precipitation as and when is required for the above ground installations of the project at the CGS / RMS sites.

Atmospheric emissions monitoring

The impact of the emission from the machineries & equipment to atmosphere in a particular locality except at the area surrounding the aboveground control stations would be negligible. The continuous monitoring of emission of CO, SO_2, NO_x, PM_{10}, oxygen content and temperature of flue gases will be carried out around the plant sites and up to impact zone.

The DOE may be requested to monitor the illegal emission of gases and dust from the surrounding areas of the proposed regulating and metering station plants which will facilitate to operate these plants smoothly.

Drinking water quality monitoring

Drinking water quality will be monitored during the operation phase. During operation phase excess water will not be produced, and waste water will not be drained from this project sites in to the natural stream.

River water monitoring

The proposed gas transmission pipeline and plant operation activities are hardly expected to be a contributor to the deterioration of water quality of the Sitalakhya, Old Brahmaputra, Meghna, Kajla, and Gomuti-Meghna rivers, Still then, water quality monitoring may be conducted during operational period through testing every year preferably during March – May and October – December and as and when required.

Noise level monitoring

Indoor noise levels in the generator facilities along with the outdoor noise will be monitored regularly. The noise level drops along the distance and with barriers therefore the convenient temporary noise barrier and indigenous tree plantation will be taken place to protect the neighbourhoods from the noise. The noise level during operation on site would be kept within DOE's permissible limit.

9.12.11 Monitoring Schedule

The following tables provide a summary of the monitoring schedule for the construction and operational phases of the proposed gas transmission pipeline and the plants (**Table 9.8**).

Table-9.8: Monitoring plan during construction and operation phase of the project.

Issue	Parameters	Monitoring Frequency	Resource Required and Responsibility
Construction Phase			
Ambient air quality	NO_X, CO, Temperature, PM_{10} and $PM_{2.5}$ (if required)	Once in every month (or as per DOE's reporting obligation)	-This monitoring will be done by the EPC contractor. ES and GTCL will supervise
River water	Water temp., DO, Oil and Grease and heavy metals (if required)	Once in every month if required (It is not the part of regular environmental monitoring)	-Monitoring at this stage is the obligation of the contractor. -GTCL and ES will supervise the monitoring process at this stage.
Drinking water	Physical parameter: - colour, turbidity, Chemical parameters: - pH, nitrate, alkalinity, total hardness, calcium hardness, arsenic, Iron (Fe), Cl, Mn, Al, Arsenic, Biological parameters: - total-coli form, faecal-coli form,	Once in every month (If the workers use drinking water from the contractors supply source)	-The contractor will monitor the drinking water parameter. - GTCL and ES will supervise the monitoring process at this stage.
Soil quality	Soil quality will be monitored. Agricultural soil may be tested by the SRDI.	As and when is required. If any adverse report/information is found	The contractor will be responsible for cleaning and reclamation in case of accidental spillage. By the supervision of GTCL the soil may be tested from SRDI laboratory in Dhaka.

Issue	Parameters	Monitoring Frequency	Resource Required and Responsibility
Noise level	Noise at different locations	Once in every month and as and when required.	EPC will be responsible for monitoring.- GTCL with ES will supervise
Process waste	Solid / liquid wastes	Wastes will be collected and disposed of regularly.	The EPC contractor will do, GTCL With ES will supervise and advise.
Operation and Maintenance Phase			
Meteorological measurements	Wind direction and speed, temperature, humidity and precipitation.	Monitoring data from the Meteorological Dept.. of Dhaka office	EPC contractor will monitor until warrantee and GTCL. with ES will supervise. Then GTCL
Atmospheric emissions	CO, SO_2, NO_x,CH_4 PM_{10}, oxygen content and temperature	Once in a month or as advised by ES	-EPC r will monitor during their tenure and GTCL with ES will supervise. After taking,over, GTCL will monitor operation of this WB project through outsourcing for easuring NOx, CO, $CH_{,4,}PM_{10}$ and $PM_{2.5}$
River water	Water temp., DO, Oil and Grease and heavy metals (if required))	Once in every month if required (It is not the part of regular environmental monitoring)	--EPC r will monitor during their tenure and GTCL with ES will supervise. After taking,over, GTCL will monitor operation of this WB project through outsourcing. .
Drinking water	Physical parameter: - color, turbidity, Chemical parameters: - pH, nitrate, alkalinity, total hardness, calcium hardness, arsenic, Iron (Fe), Cl, Mn, Al, arsenic, Biological parameters: - total coliform, faecal coliform,	Once in every month (If the workers use drinking water from the contractors supply source)	-EPC contractor will monitor during their tenure and GTCL with ES will supervise. After full taken over of the Project, GTCL will monitor those parameters.

Issue	Parameters	Monitoring Frequency	Resource Required and Responsibility
Soil quality	-Soil will be monitored. -Agricultural soil may be tested by the SRDI.	-As and when required. -If any adverse report/information is found	-EPC contractor will monitor during their tenure and GTCL with ES will supervise. After full taking over of the Project, GTCL will monitor. Soil parameters may be tested from SRDI laboratory in Dhaka.
Noise level	Noise at different locations	Once in every month and as and when required.	-EPC contractor will monitor during their tenure and GTCL will supervise. After full taking over of the Project, GTCL will monitor the noise level through their internal arrangement.
Process waste	Solid / liquid wastes	Wastes will be collected and disposed on daily basis and as and when required.	-EPC contractor will monitor during their tenure and GTCL with ES will supervise. After full taking over of the Project, GTCL will monitor the noise level through their internal arrangement.

Note: *Actual monitoring time and location will be decided by GTCL and the ES during construction and operation phase for compliance by the EPC contractor until their tenure..*

9.12.12 Reporting

Reports of the monitoring data, both during construction and operation phases, will be submitted to the Department of Environment (DOE) on regular basis as per instruction of clearance clauses of DOE. Copies of same would be required for WB as well.

Table-9.9: The Tentative Plan for Environmental Reporting

Particulars	Frequency/ Stage	Responsible Agency
Construction Phase		
Initial review	Before start of work	EPC Contractors in consultation with ES will prepare an inception report on procedure of environmental monitoring and management for the project and GTCL will review.
Environmental Monitoring Report	Monthly	Contractor will prepare the report for GTCL This report will be ultimately forwarded to the DOE, WB.
Specific Problems and Solutions	As and when required	Project Director / ES may raise (if found), that need to be resolved by the contractor.

Particulars	Frequency/ Stage	Responsible Agency
Mid-term Review: • review of activities • possible modification to procedure and/or overall plan	- Approximate mid-way of the project	ES will review and prepare a report, which will be reviewed by GTCL
Final Review : • review of program • recommendation for similar future program Completion Report:	- Towards the end of the project - At the time of Commissioning	-Owners engineer and ES will review and prepare a report, which will be reviewed by GTCL -The EPC contractor will prepare and will forwarded to ES /GTCL, for ultimately forwarding to the DOE, WB.
Operation and Maintenance Phase		
Environmental Monitoring Report	Monthly	ES with the help of concerned officials of GTCL for forwarding to DOE,. GTCL with ES will be on overall supervision and will comply with their reporting obligation.

9.13 Safety and Hazard Mitigation Plan

Safety Management System

Safety is an integral part of GTCL's operation and therefore, it is part of the company's philosophy to protect employees, contractors, property, the environment and the public too. By fulfilling safety responsibilities, employees will share the benefits of a safe work place. Listed below are the important features, which need proper attention of company management.

General Safety Procedure (GSP)

The Project Director should periodically review the safety policy and take actions accordingly including updating of same. The *Gas Safety Rules 1991 (Amendment 2003)* shall be followed for the implementation of the project. Detailed rules and procedures identifying company and legislative requirements and expectations must be communicated to employees and contractors.

Standard Operating Procedure

To determine compliance with safety and hazard issues while performing a task, efforts should be made to ensure the following:

- Ensure that employees affected by these tasks participate in the development of safe work procedures;
- Ensure that employees are involved in the maintenance of safe work procedures;
- Arrange safety training for all concerned employees on safe work procedures and refresher training there after;
- Where practical, observe employees performing critical tasks to ensure Review records and to ensure that employees receive training on hazardous work procedures, codes and practices; and
- That they follow the operating procedures and general safety.
- Arrangement for periodic training of the supervisory and operating officials related to specific job responsibility in batches may be made with professional institutions like Directorate of

Continuing Education (DCE) of BUET, Bangladesh Petroleum Institute (BPI)., Engineering Staff College (ESC) of IEB, Industrial Safety Board of Bangladesh (ISBB) of IEB, Bangladesh Society for Non Destructive Testing (BSNDT) etc on different aspects of occupational health, safety and environmental management.

Safety Orientation and Training

Initial safety training is one of the most important aspects of any safety program. Employees and contractors must receive some level of basic training, specific to the facility and nature of the job. It must be ensured that appropriate orientation is given to: Employees, Contractors, Sub-contractors and Visitors.

The orientation shall also include a review of the following:

- Company safety policy and procedures;
- Specific job hazards;
- Safety precautions;
- Job responsibilities;
- Regulatory requirements;
- Company enforcement policy; and
- Worker's right-to-know and authority to refuse unsafe work.

Reporting Incidents and Accidents

As stated earlier, construction and operation activities under the project have to comply with the legal elements of both national and international standards, legislation, codes of practice, design specifications and best practices Accidents and near-miss incidents shall be investigated to determine what caused the problem and what action is required to prevent a recurrence.

Personnel Protective Equipment (PPE)

It should be assessed to determine what personal protective and safety equipment is needed and the equipment must be made available. A maintenance schedule must be developed for PPE and employees must be trained in fitting, care, maintenance and use of PPE.

Prevention, Control and Mitigation Plan

Safety is only a precautionary measure. Incidents and accidents cannot be entirely avoided or prevented. There is also no guarantee that an accident will not happen even if all measures are taken to stop the incident or accident. Specific mitigation and preventive measures would depend on the particular types of hazards expected to happen in a given work situation. **Table-9.10** lists some general preventive and mitigation measures and most of these will be applicable in this project too:

Table-9.10: Safety Hazard: Mitigation Control Measures

Sl. No.	Event	Prevention, Control and Mitigation Measures	
1.	General Instruction for Workers	1.	Personal and continuous visual supervision of the worker who is not competent to perform the job
		2.	Workers to be conversant on the general safety procedures
		3.	Workers must be confident that they have adequate training on handling unsafe or hazardous material
2.	Maintenance of Equipment	1.	Employer shall ensure that all equipment used on a work site is maintained in standard condition

Sl. No.	Event	Prevention, Control and Mitigation Measures	
		2.	Will perform the function for which it is intended or was designed
		3.	Is of adequate strength for that purpose
		4.	Is free from potential defects
3.	Traffic Hazard	1.	Where there is a danger to workers from traffic, the employer shall take appropriate measures to ensure that the workers are protected from traffic hazards
		2.	Ensure that workers who are on foot and who are exposed to traffic hazards on travelled rural roads wear reflective vests or alternative clothing that is cleanly distinguished
		3.	Where the operator of vehicle does not have a clear view of the path to be travelled on a work site, he shall not proceed until he receives a signal from a designated signaller who has a clear view of the path to be travelled
4.	Illumination	1.	Ensure that illumination at a work site is sufficient to enable work to be done safely
		2.	Where failure of the normal lighting system would endanger workers, the employer shall ensure that emergency lighting is available that will generate sufficient dependable illumination to enable the workers to: ➢ Leave the work site in safety; ➢ Initiate emergency shut down procedures; and ➢ Restore normal lighting.
5.	Housekeeping	1.	Ensure that each work site is clean and free from stepping and tripping hazards
		2.	Waste and other debris or materials do not accumulate around equipment, endangering workers
6.	Falling Hazards	1.	Ensure that where it is possible for a worker to fall through a vertical distance, the worker is protected from the falling by: ➢ A guard rail around the work area; ➢ A safety net; or ➢ A fall arresting device.
7.	Overhead Power Lines	1.	Ensure that no worker approaches, no equipment is operated and no worker shall approach or operate equipment under a live overhead power line
8.	Sanitary Facilities & Drinking Water	1.	Ensure that an adequate supply of drinking fluids is available at the work site
		2.	Ensure that work site is provided with toilet facilities in accordance with the requirement of general health protection guidelines
9.	Wearing Proper Clothing	1.	Ensure that where there is a possibility that a worker or worker's clothing might come in to contact with moving parts of machinery, the worker: ➢ Wears close-fitting clothing; ➢ Confines or cuts short his head and facial hair; and ➢ Avoids wearing jewellery or other similar items.
10.	Head Protection	1.	Ensure that during the work process adequate alternative means of protecting the worker's head is in place

Sl. No.	Event	Prevention, Control and Mitigation Measures	
11.	Eye Protection	1.	Where there is a danger of injury to or irritation of a worker's eyes, his employer shall ensure that the worker wears properly fitting eye protective equipment
12.	Foot Protection	1.	Where there is a danger of injury to a worker's feet, ensure that the worker wears safety footwear that is appropriate to the nature of the hazard associated with particular work activities and conditions
13.	Respiratory Protective Equipment	1.	Where the worker is exposed to hazardous chemicals, gases, gums, vapours, or particulates, appropriate respiratory protective equipment have to be supplied
14.	Transportation of Worker	1.	A worker in a vehicle shall not allow any part of his body to protrude from the vehicle where this action creates or may create danger to the worker
		2.	A worker shall ensure that no equipment or materials for which he is responsible is carried in the compartment of a vehicle in which another worker is travelling unless it is so placed and secured as to prevent injury to himself and other workers
15.	Cranes and Similar Hoists	1.	Ensure that a crane is equipped with an effective warning device
		2.	Is readily accessible to the operator
		3.	When design or operation of a crane is such that the crane may fall or flip backwards because of the return movement of the boom, the crane must be fitted with: ➢ Positive boom stops in accordance with the manufacture's specifications; and ➢ A boom stop limit device to prevent the boom from being drawn back beyond a pre-determined safe boom angle.
16.	Excavations		Before the worker begins working in the trenches and closer to the wall or bank than the depth of the excavation, the employer shall ensure that the worker will be protected from cave ins or sliding materials by: ➢ The cutting back of the walls of the excavation to reduce the height of the remaining vertical walls; ➢ The installation of temporary protective structures (e.g. shoring); ➢ A combination of cutting back of the walls and the installation of temporary protective structures; ➢ The spoil earth is kept at a distance of at least 1m from the edge of the excavation; and ➢ When the workers are carrying out an excavation in the vicinity of an overhead power line, ensure that the work is carried out in a manner that will not reduce original support provided for the power line poles.
17.	Trenching	1.	Ensure that proper shoring, stringers and bracing are used
		2.	Dewatering if water seeps or accumulates in the trench
		3.	Heavy equipment to be kept at a safe distance so that the trench does not collapse
18.	Welding	1.	Welding to be performed observing all requirement of API standard 1104

Sl. No.	Event	Prevention, Control and Mitigation Measures	
		2.	Although qualified through certification, all welders must undergo tests
19.	Testing & Commissioning	1.	Mobilize testing equipment at site
		2.	Ensure that the test equipment is in good condition
		3.	Ensure other equipment and facility conforms to the approved specification of test.
		4.	Public notice to be served before testing & commissioning
20.	NDT	1.	All radiation safety measures are to be ensured during performing NDT inspections particularly using X-ray or Gamma ray Radiography.

9.14 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.

CHAPTER-10

EMERGENCY RESPONSE AND DISASTER MANAGEMENT PLAN

Chapter - 10

EMERGENCY RESPONSE AND DISASTER MANAGEMENT PLAN

10.1 Emergency Response 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:

1. People
2. Property
3. Environment

Keeping these priorities in mind, the six steps described bellow 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 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 requires 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.

10.1.1 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 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 / neighbourhood 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.

10.2 Emergency Response Planning

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 and 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 centres, 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 parishads (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.

10.3 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.

10.3.1 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.

10.3.2 Chemical Hazards

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

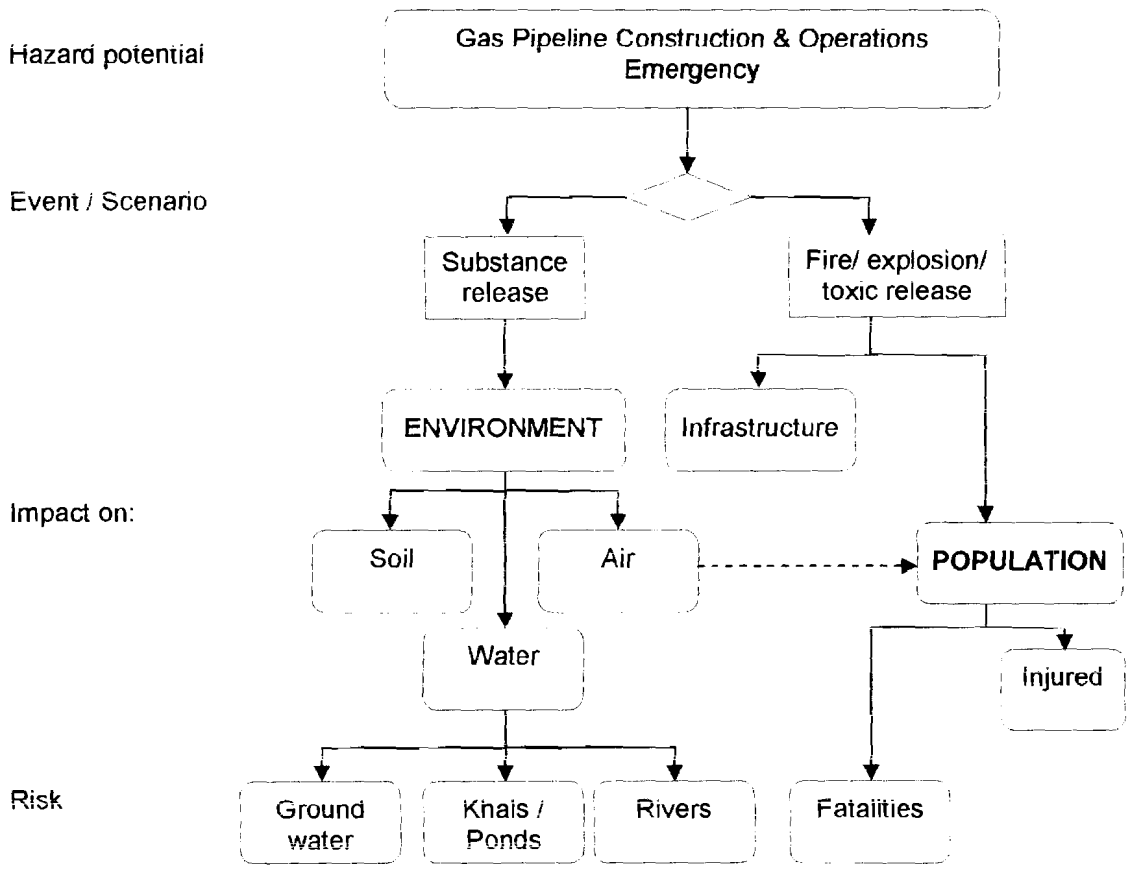
>Oxygen Deficiency
>Combustibility
>Flammability
>Flash Point
>Gas / Vapour Explosions
>Corrosiveness and
>Reactivity

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 can not 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 BKB-SG high pressure gas transmission system. A schematic presentation on event / scenario, impact & risk involved in gas pipeline construction & operations emergency is presented at Figure -10.

Figure-10: A schematic presentation on event / scenario, impact & risk involved in gas pipeline construction & operations emergency



10.3 Specialized Equipment

All relevant emergency equipment should be maintained on site throughout the project. This includes items such as fire extinguishers/hoses self-contained breathing apparatus (SCBA) and personal protective gear, anti-venom serum etc.

The hazardous materials section of the local fire brigade has emergency response units with specialized equipment that would be appropriate for an explosion incident response. All local brigades should be checked for their ability to respond to certain incidents and should be notified of the operations taking place.

10.4 Training

It is critical that emergency responders have a clear understanding of the potential problems that exist as a result of an emergency situation, that they pre-plan for such an event, and have hands-on training prior to initial response to an actual incident. In-house training programs should be held by the company and designated first responders to test their capabilities.

Response teams have to be assembled, both on a company and community cooperative basis to deal with potential emergency situations. A 2-day training program that includes two field exercises would be effective for the attendees to gain hands-on training in coping with incidents typical of the gas pipeline construction and operations.

Training is an integral part of a preventive strategy. The training will be provided to manager environment, supervisors and technicians and related staff who are responsible for health, safety and environmental monitoring activities.

The following issues will be addressed in training of the managers, staff and workers:

- Workers will be trained to understand the environmental monitoring issues and parameters,
- Concern officers and staff will be trained how to monitor and operation of the environmental monitoring equipments
- Arrange workplace consultation on noise control
- Workers will participate in training and contribute to the noise management strategy
- Persons likely to be exposed to risks will be provided with information and instruction in safety procedures associated with the plant at the work place.
- Relevant health and safety information will be provided to persons involved in installation and commissioning, use and testing of the plant.
- Information on emergency procedures relating to the plant will be displayed in a manner that can be readily observed by persons who may be affected by the operation of the plant.
- Training will be provided to use fire fighting equipment as and when is necessary.
- Facility staff will be trained in the safety procedures those are to be implemented during unloading, transfer and storage of hazardous materials.

10.5 Safety Orientation

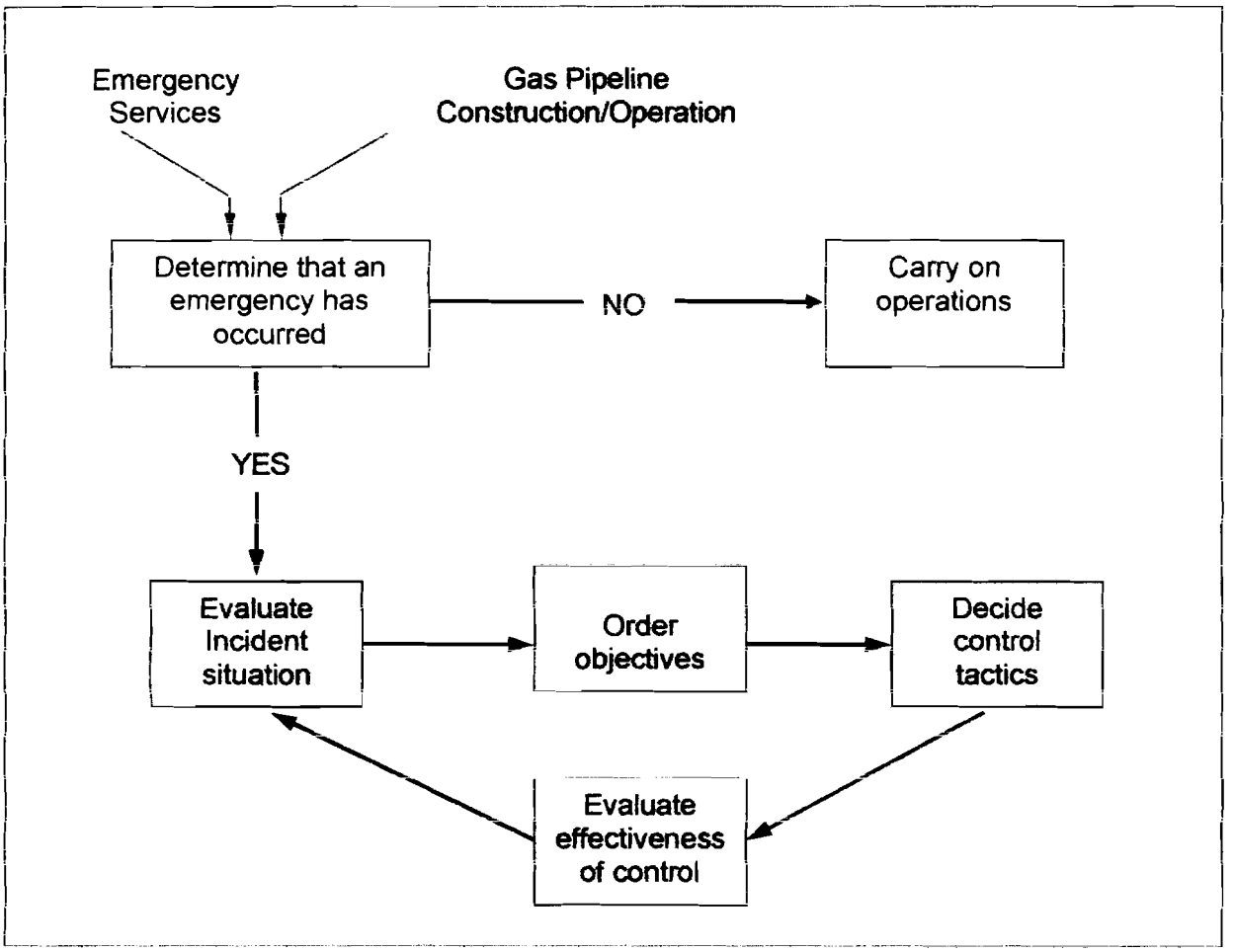
Initial safety orientation is one of the most important aspects of any safety program. Employees and contractors must receive some level of basic training, specific to the facility and nature of the job. It must be ensured that appropriate orientation is given to all employees, contractors, sub-contractors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

The orientation shall also include a review of the following:

- Company safety policy and procedures;
- Specific job hazards;
- Safety precautions;
- Job responsibilities;
- Regulatory requirements;
- Company enforcement policy; and
- Worker's right-to-know and authority to refuse unsafe work.

10.6 Approach to Emergency Response

Figure-10.1: Illustrates an example system approach to gas pipeline construction & operations.



For this project emergency response systems should be in place to deal with dangerous goods uncontrolled releases spills, natural calamities fires burns and injuries There are to be trained emergency response teams specific contingency plans and incidence specific equipment packages in place to cope with these types of an emergency Should an incident occur immediate action must be taken to mitigate the impacts

In order to minimize the possibility of injury to the responders and others it is important that emergency responders follow a specific sequence of actions as stepped out in the preceding paragraphs

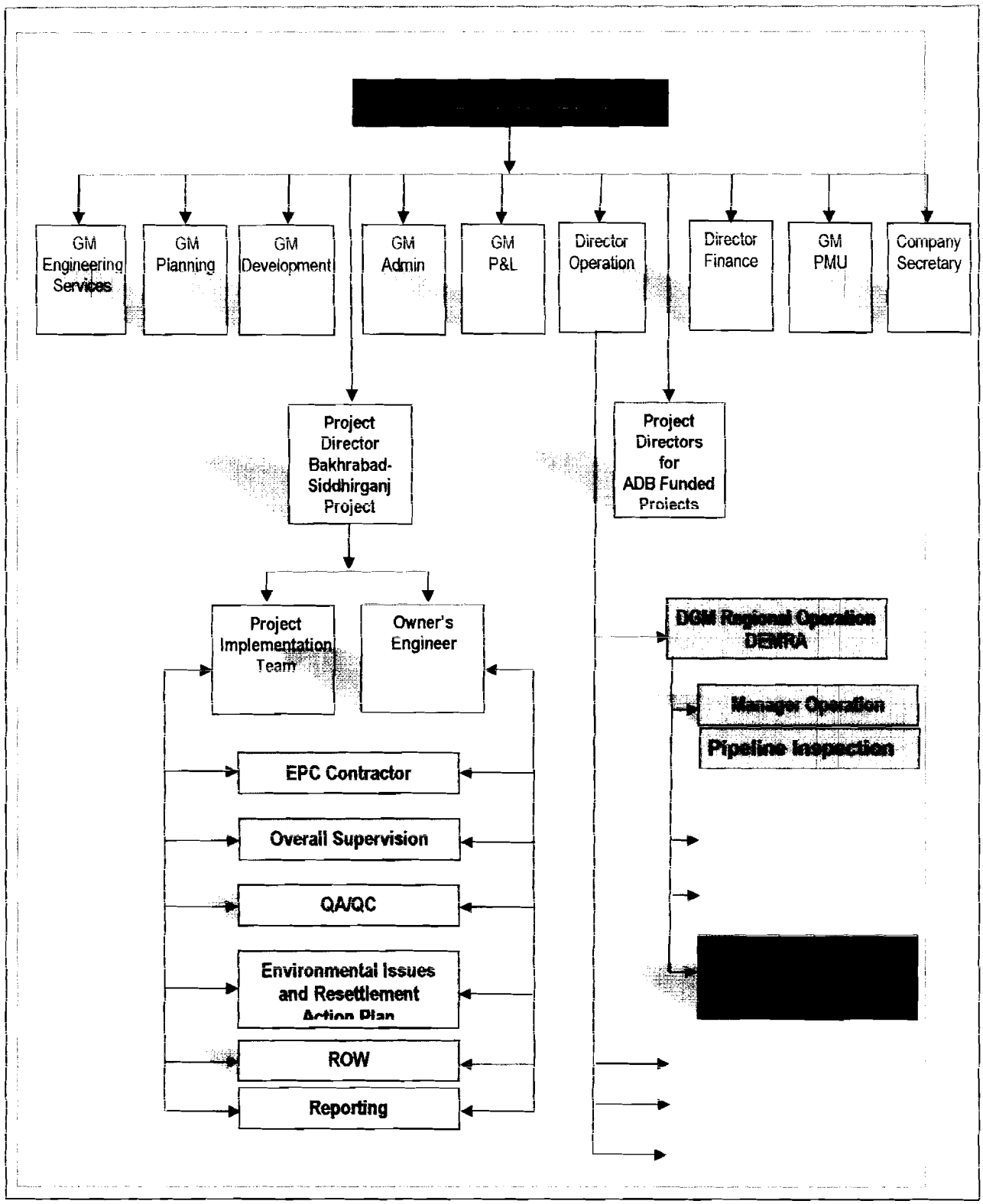


Figure- 10.2: Existing Organizational Set- Up of GTCL

10.7 Guidelines for Disaster Management

10.7.1 Introduction

Disaster management is a four step exercise:

- the design and planning stage,
- the plant operating stage,
- the short and important stage when disaster actually occurs, and
- the recovery stage.

It is imperative that all safety precautions are rigorously implemented so as to avoid any kind of accidental occurrence in the first place. At the design stage, this includes incorporating items of basic engineering planning and design for safety into all processes and providing suitable safety margins for equipment as per the various safety codes and standards in practice.

At the operation stage, disaster management is mainly preventative in nature, through the use of appropriate personal protective equipment and safe work procedures.

The disaster stage has the greatest potential for being mismanaged due to the typically somewhat chaotic and unplanned nature of the event. It is at this stage that pre-planning becomes critical.

10.7.2 Disaster Management & Gas Pipeline Construction & Operation

Safe operating procedures should be laid down and followed to ensure safety, optimum operation and economy A safety audit should be undertaken periodically in conjunction with a training program. Furthermore, all accidents, however minor, should be investigated and reported in order to provide direct feedback to the operational planning mechanisms

The risk and reliability assessment studies carried "but at the: design stage should be periodically reviewed and updated in the light of any actual experiences. This is because most of the available data on failure rates" and similar parameters used in these computations are generally based on US or' European experience, not on those within Bangladesh.

During the operational phase access to work sites should be denied to unauthorized persons. Regular preventive maintenance and inspection procedures must be implemented and regular certification of high pressure equipment should be obtained.

These factors if implemented correctly will significantly reduce the possibility for a catastrophic event occurring.

10.7.3 Level of Incidents

In the event of a disaster at any location within the workplace, the area affected can be classified in the following four classes:

Level-I	Operator level
Level-II	Local/community level
Level-III	Regional/National level
Level-IV	International level

Only Level-I and Level-II class of incidents or accidents will applicable within the proposed Gas pipeline Project. Level-I, disasters may be the result of fires, explosions, oil spillages and spontaneous ignition of inflammable materials. This may affect persons working in and around moving machinery, other plant and various sites which have been mentioned as potential hazard areas.

Level-II disasters may happen due to sabotage or complete failure of all automatic control/warning systems, catastrophic failure of fuel oil storage tanks, chemical release or explosion. Transportation (road and rail) accidents could occur anywhere within or outside the complex and thus present additional problems of access and loss of time in taking remedial measures.

10.7.4 Incidents/Accident Investigation & Reporting System

Major disasters are often preceded by a string of minor incidents which are ignored, neglected or not fully understood. Therefore, a routine system should be enforced to ensure that all accidents are investigated and reported to the plant supervisors in a specified format such as the following:

- Description of incident or episode;
- Immediate cause;
- Background on the factors that might have made the incident possible;
- What form of energy release or toxic substance was involved?
- What was done to prevent accident (who responded and how)
- What effect did it produce on the immediate and surrounding environment?
- What repercussions did the incident have (loss of life damage to equipment and buildings) and
- Cost estimates of damage done and repairs needed.

Registers of all incidents should be kept and should be analyzed on a regular basis (at least monthly) to identify trends or patterns in incident occurrence In particular cases this may prevent significant chronic incidents or single-event events that are the result of an accumulation of either physically hazardous materials or substances, or operational complacency.

10.7.5 Preparedness

Having taken all the preventative measures, a Disaster Management Team (DMT) should be established which would be responsible for preparing a specific Disaster Management Plan for the project The team should meet at regular intervals to update the Disaster Management Plan based on accident data and any changes to support agencies The team should also undertake trial runs in order to be fully prepared and to improve upon the communication links response time and other critical factors.

10.7.6 Response

i. Set up Disaster Control Room

In the unlikely event of a disaster a Disaster Control Room (DCR) should be set up. The responsible officers of Disaster Control Group will assemble in the DCR and formulate control procedures as part of the contingency plans.

The DCR should have links with all site operations and an officer should man the DCR at all times. On receiving information about an accident, the officer should inform the Disaster Controller (DC) and/or other coordinators immediately.

ii. Casualty Services

The Head of casualty services will be the Medical Officer whose functions include securing provision of:

- First Aid service to first aid patients on the spot.

10.7.7 Resources and Implementation

The environmental parameters will be monitored during the construction and operational phases along with the monitoring schedule have been presented in the previous sections. The contractor will be responsible for carrying out the monitoring during the construction phase (in accordance with table no. 9.5) under the direct guidance and instruction of the Manager, Environment as mentioned in this chapter. The contractor will submit monitoring results to GTCL office on a monthly basis, and accordingly the reports will be consulted with PD and ultimately report will be forwarded to the DOE and other concerned department and World Bank office.

During operation phase, and after full taken over by the GTCL, the environmental monitoring of this pipeline system will be carried out by the EMU, GTCL through its own staff and equipment if available, or can be out sourced to a laboratory. But during turnkey period monitoring work will be carried out by the contractor.

Potentially significant impact during both the construction and operation phase will be properly addressed through adaptation of the proposed mitigation and enhancement measures outlined in the Table 9.1. The environmental monitoring chapter and the corporate environmental monitoring procedures shall be included as an integral part of the contract document of those proposed power plant project.

Environmental Management Unit headed by Manager Environment, GTCL corporate office will coordinate the whole process of environmental monitoring with the help of officers working in different sectors of the Gas Transmission Grid and ultimately the environmental monitoring of whole network system including the BKB - SG pipeline will be conducted by the EMU unit with in puts from the ES of PCG and the owner's engineer.

11.1 Occupational Health and Safety (OHS)

In work place 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 (EPC) contractor will be obliged to follow the Bangladesh (DOE) and World Bank Group's EHS policy which is available on IFC website.

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.

11.1.1 General Requirements

Bangladesh Labour Law encompasses the related occupational health and safety obligations under the Labour Law 2006. The labour law itself is a huge volume. So to avoid this volume of papers,

only the labour law has been referenced in this chapter. The labour laws could have been included in review of law chapter of EIA. 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-10.1** This law is commonly followed in Bangladesh by employer, in case of non-compliance there may have some problem during labour dealing.

11.1.2 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 plant equipment, (ii) operation of the pipeline system including the plants and associated facilities etc.

Table-10.1: General requirements for workers' health and safety according to the labour law 2006 (Bangladesh).

Issues	Requirements
Health and Hygiene	• Cleanliness • Ventilation and temperature • Dust and fumes • Disposal of wastes and effluents • Overcrowding • Illumination • Latrines and urinals • Spittoons and dustbins
Safety	• 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	• Owner's responsibility for compensation • Amount of compensation • Report on fatal accident and treatment • Compensation on contract and contract registration • Appeal
Dust and Fumes	• 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	• 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	• 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	• 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	• Provided and maintained first aid facility • One for every one hundred and fifty workers • Shall be kept with a responsible trained person who shall be available during the working hours

Issues	Requirements
	• 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	• 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	• 16 occupational diseases modifiable to the Chief Inspector of Factories: 1. lead poisoning 2. lead tetraethyl poisoning 3. phosphorous poisoning 4. mercury poisoning 5. manganese poisoning 6. arsenic poisoning 7. poisoning by nitrous fume 8. carbon disulfide poisoning 9. benzene poisoning 10. chrome ulceration 11. anthrax 12. silicosis 13. poisoning by halogens 14. primary epithetliomatous cancer of the skin 15. toxic anaemia 16. pathological manifestation due to radium or x-rays
Compensation	• If personal injury is caused to workmen by accident arising in the course of employment, employer shall be liable to act according to labour law 2006. 36 occupational diseases for compensation payable • Monthly payment as compensation for temporary disablement are: 1. Compensation should be paid for the period of disablement or for one year whichever period is shorter 2. Such compensation shall be paid at the rate of full monthly wages for the first two months 3. 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 4. 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 5. International/ national (which ever 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

11.1.3 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.

11.1.4 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.

11.1.5 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 along with the consultation of 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 including 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 me made accessible during construction and operation work.

11.1.6 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 ranged from 90 dBA to 110 dBA, which 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 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.

11.1.7 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 be maintained for the proposed project in following the corporate guidelines of the contractors and the owners.

11.1.8 Pipeline and Plants Construction

A person with control of a construction project or control of construction work 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.

11.1.9 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.

11.1.10 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.

11.1.11 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.

12.1 Storage Facilities for Chemicals, Fuel, Oil and Grease

12.1.1 Oil Storage Facilities

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

Conceptual storage facilities are shown in **Figure-10.2 & 10.3**. The bermed or banded area would be big enough to hold 1.5 times the volume of the largest tank in the storage facility in the event of spill or leak. The containment berm will have a mechanism to separate out rainwater and treatment of oil contaminated water.

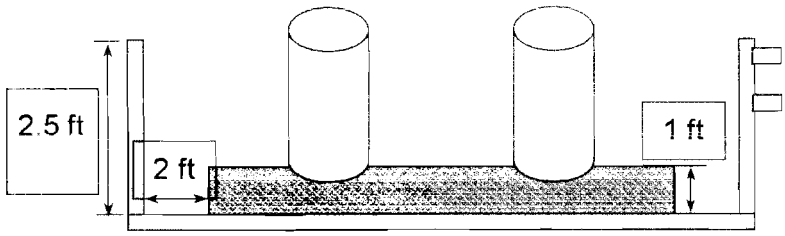


Figure-10.2: Bermed Containment facility

The EPC 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 EPC 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 EPC 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 EPC 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.

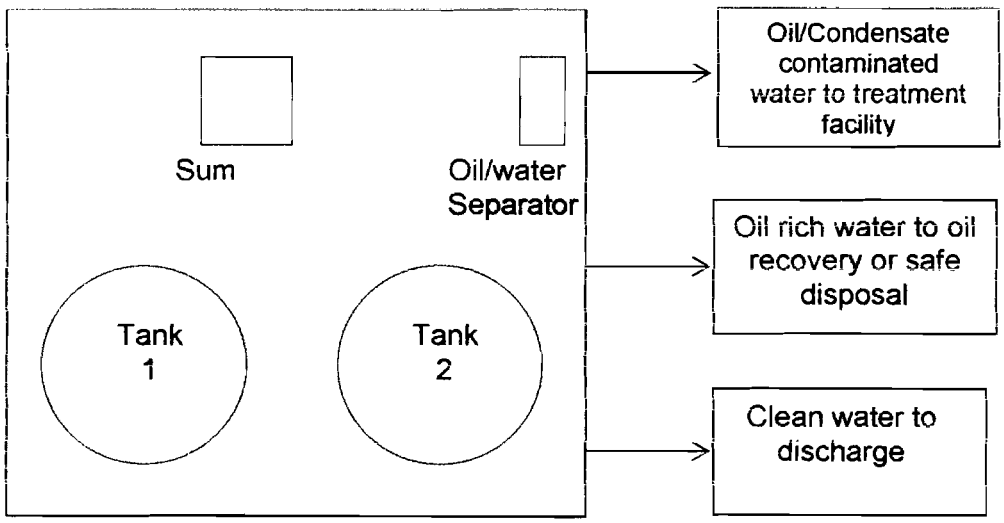


Figure-10.3: Conceptual drawing for the separation of spillage

12.1.2 Oil /Condensate Leaks and Drainage Systems

The main fuel is natural gas so there would not be any big types of oil spillage. To maintain a good industrial practice the EPC 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 EPC 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.

13.1 House Keeping

The EPC and subsequently GTCL or its O&M contractor engaged, if any, will maintain housekeeping practice to ensure safe working environment for the workers where waste generation and environmental damage will be minimized. The house keeping will include the following:

- Chemical usage
- Erosion minimization
- Emission reduction
- Segregated waste handling
- Periodic chain of custody inspection

CHAPTER-11

CONCLUSIONS AND RECOMMENDATIONS

Chapter - II

CONCLUSIONS AND RECOMMENDATIONS

11.1 General

The EIA of the proposed BKB-SG 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. Simultaneously, the project being financed by the World Bank, EIA in terms of ESIA is also the requirement of the World Bank as ESHIA Vol.-1 so far as EA is concerned.

Accordingly, this has also been prepared basically following the EA and Cultural Recourses related WB guidelines OP 4.01 & OP 4.11. Further, since and Involuntary Resettlement is involved in executing this project, WB guidelines OP 4.12 has also been closely taken in to consideration in addition to the aforementioned ECA '95 and ECR '97 of the DOE. As such, this EIA (ESHIA Vol.-1.) report is intended for submission to the DOE as well as to the World Bank 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 substantial resettlement, restoration and mitigation measures had to be delineated in the Resettlement Action Plan prepared as per requirement of the WB.

This has been done basically following the Involuntary Resettlement guidelines OP 4.12 of the WB coupled with the Acquisition and Requisition of Immovable Properties Ordinance (ARIPO) 1982, its subsequent amendments in 1993 & 1994 and the Acquisition of Immovable Properties Manual 1997 of GOB and the TOR of GTCL. This document has been separately submitted to WB & GTCL as RAP Report (ESIA Vol.-2) in March, 2008.

Though effort has been made to present these 2 reports 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.

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 centres 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 and the World Bank etc, is strictly complied with.

It is also recommended that pre-execution consultation with the projected persons, communities and the concerned government agencies be made by GTCL and the EPC contractor to inform them of projected activities and schedules.

All necessary permissions be obtained by GTCL well in advance from the concerned authorities i.e. RHD, LGED, BIWTA etc particularly for the 5 River crossing, I Highway

crossing and respective rural roads and canal crossings. The conditions set forth in the permissions there of, if any, should be duly complied with.

All recommendations within the Environmental Management Plan 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;
- 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 their 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.

Apart from 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, fire fighting 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 College8 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 appropriate restoration after completion of the project.
- A good community relationship may be developed to meet any exigency situation together with them. Strategic alliance should also be firmed up with fire-brigade, local administration, and health centres etc nearest to the project sites for ensuring prompt support in the hour of need, if any.
- Solid waste will be generated during the construction period from pipeline excavation and refuse from construction camps. The solid refuse from the construction camps should be stored in the designated containers and disposed of in a sanitary manner.
- 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 programme to be implemented before completing the project and continue through out its operation.
- In addition to the one as recommended above, a compensatory forestation program has been included in the Resettlement Action Plan with provision of distribution of 10,000 saplings. This will cover not only the 561 trees belonging to PAP but also those belonging to the State including road side vegetation and the neighbourhood community. As a corporate social responsibility, GTCL has to arrange for implementation of same before completion of the project.
- 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.
- The major issue 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 561 trees to 39 PAP, 17 structure owner PAP and all the 911 land owning PAP including I business losing PAP affected by their assets taken (permanent and temporary) for the project as per provision of GOB and that of WB as provided at its guidelines OP 4.12.
- Though none of the indigenous group member or squatters could be identified as PAP in the area along the strip alignment except 62 share croppers / tenants, they should be duly compensated for and brought under skill development training, microfinance etc of RAP 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
- The eligible female headed HH and some more vulnerable PAP losing over 20% of their assets are to be specially treated by the CDC and the GRC of the RAP implementation teams for due income restoration program including resolving of dispute if any with other PAP, so that EPC contractor can smoothly progress with the work.
- 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.

- Though the anticipated impacts are mostly of short duration and relatively minor in nature, all efforts have to be maintained to keep monitoring such impacts and taking prompt mitigation measures as far as practicable.

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.

Accordingly, following specific recommendations made in the relevant chapters of both RAP and this EIA document, GTCL being in the over all management of the project, has to decide as to how it organizes itself in getting the mitigation measures are implemented and monitored efficiently, on time and within budget.

Recapitulating the recommendations made in the EMP, it is presumed that GTCL will have an organizational structure of it's own as placed in the chapter on EMP, GTCL will be assisted in supervision by an Owner's Engineer, who in turn will be supported by the Environmental Specialist, a member of the Pipeline Consulting Group being appointed by GTCL They will over see and ensure that the parts of the jobs of GTCL & its EPC 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 EPC contractor so that they make provision for it and reflect in their financial bid.

The EPC 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.

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

LIST OF THE FIGURES

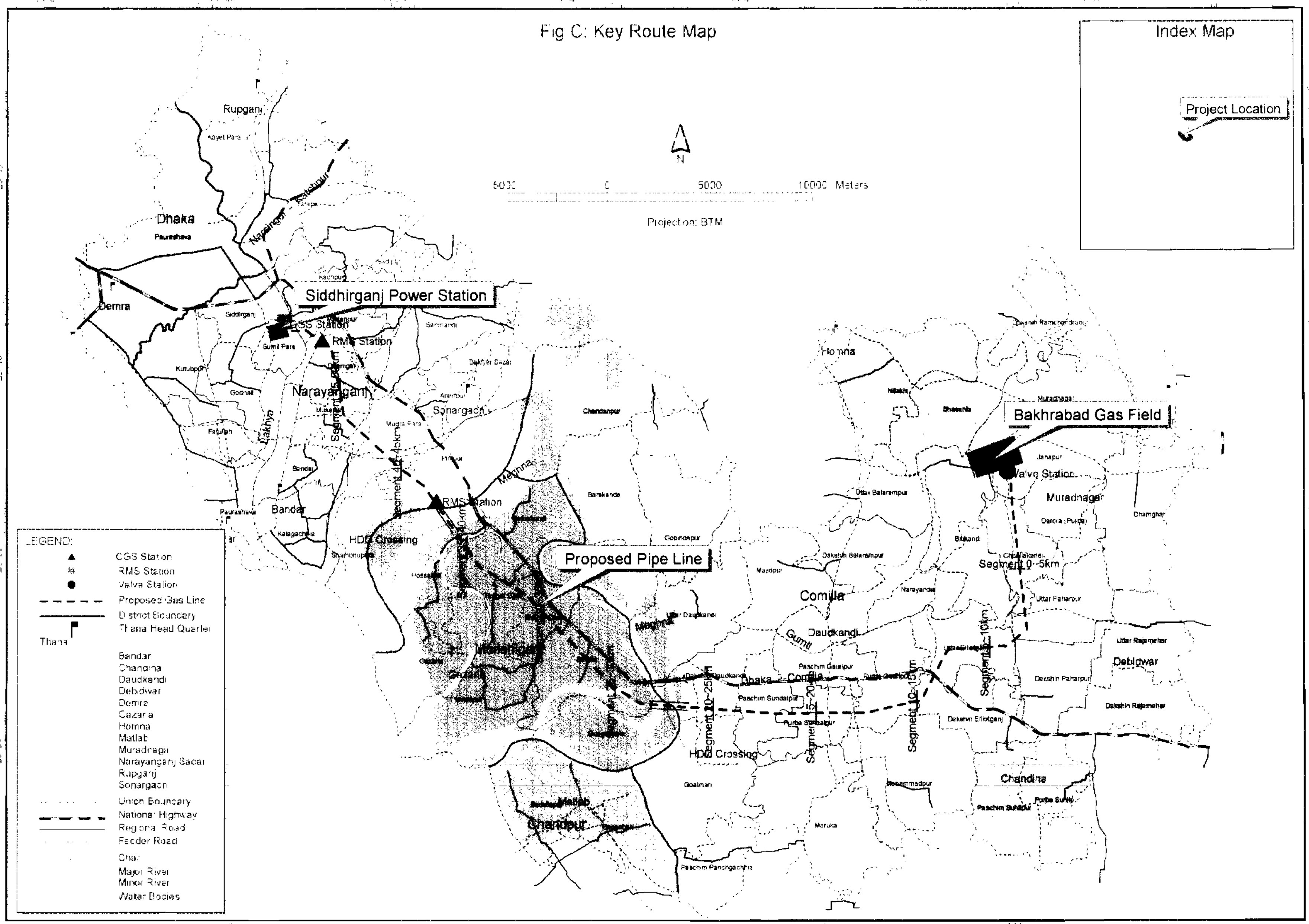


Fig C: Key Route Map
Index Map
Project Location
N
5000
0
5000
10000 Meters
Projection: BTM
Siddhirganj Power Station
CGS Station
RMS Station
Bakhrabad Gas Field
Valve Station
Proposed Pipe Line
HDD Crossing
Segment 0~5km
Segment 20~25km
Dhaka
Demra
Rupganj
Narayanganj
Sonargaon
Bandar
Comilla
Daudkandi
Gumti
Muradnagar
Debidwar
Chandina
Homna
Matlab
Chandpur
Meghna
Lakhya
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Sadar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

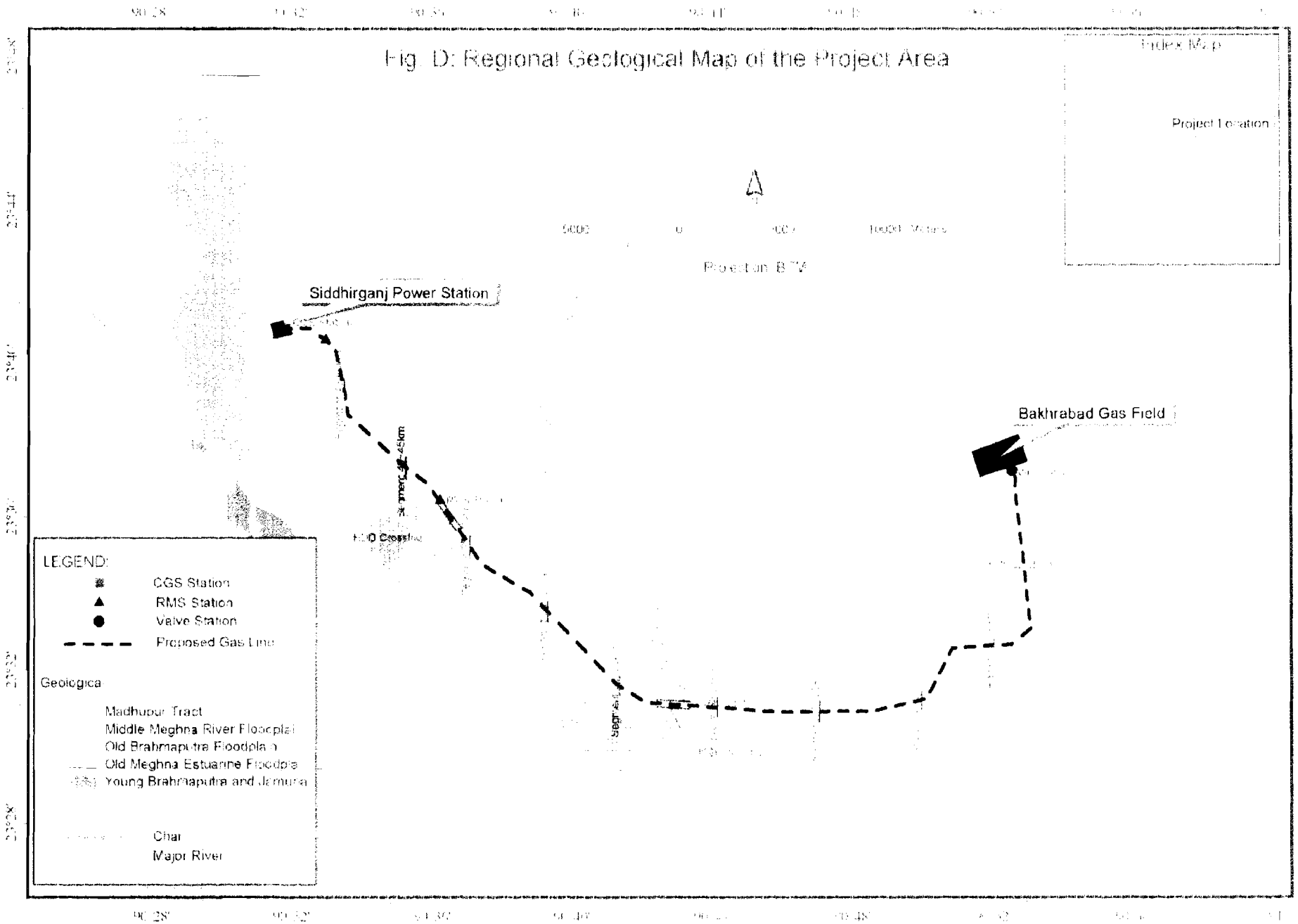


Fig. D: Regional Geological Map of the Project Area
Index Map
Project Location
Siddhirganj Power Station
Bakhrabad Gas Field
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
Geological
Madhupur Tract
Middle Meghna River Floodplain
Old Brahmaputra Floodplain
Old Meghna Estuarine Floodplain
Young Brahmaputra and Jamuna
Char
Major River

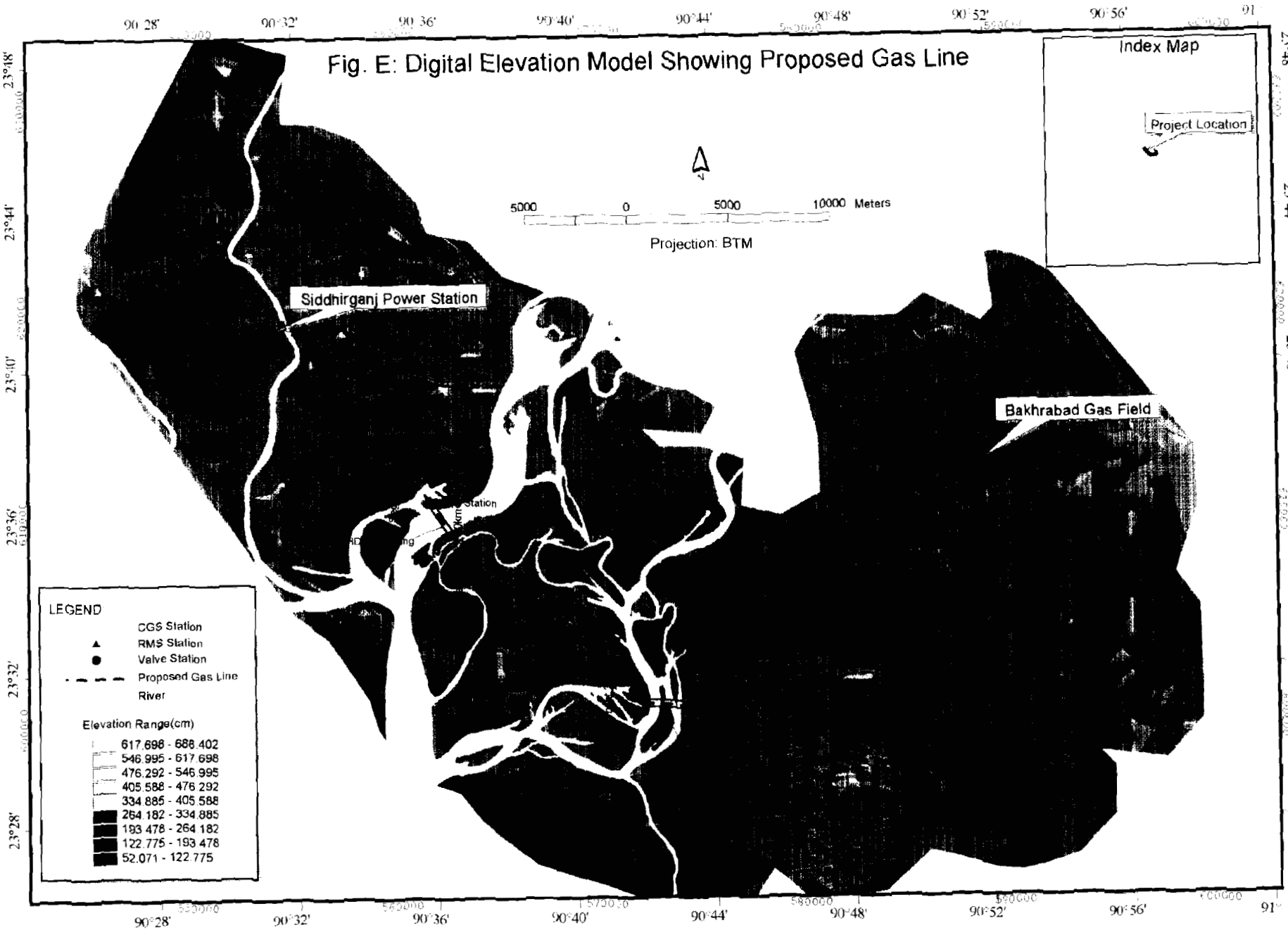
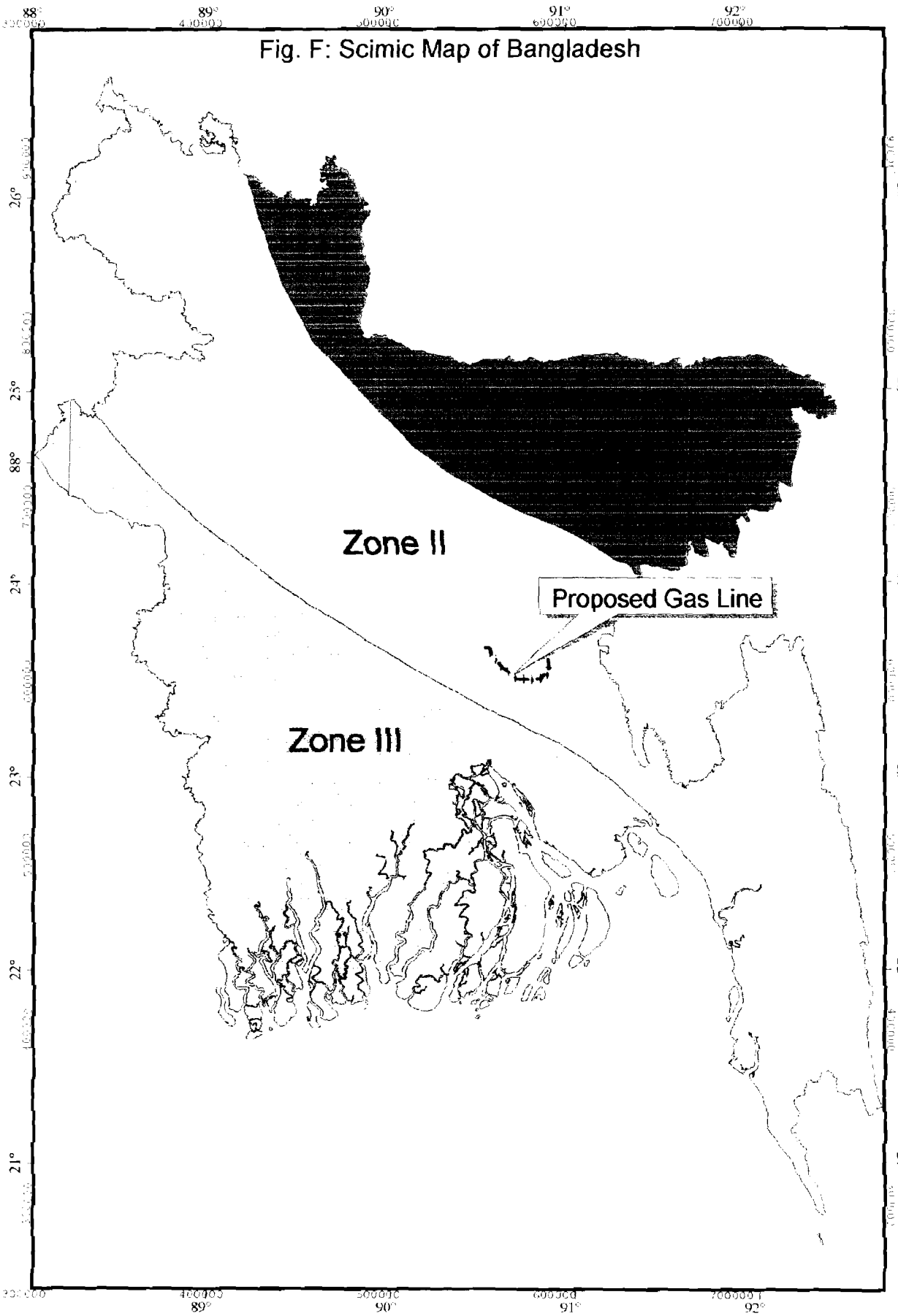


Fig. E: Digital Elevation Model Showing Proposed Gas Line
Index Map
Project Location
5000 0 5000 10000 Meters
Projection: BTM
Siddhirganj Power Station
Bakhrabad Gas Field
LEGEND
CGS Station
RMS Station
Valve Station
Proposed Gas Line
River
Elevation Range(cm)
617.698 - 688.402
546.995 - 617.698
476.292 - 546.995
405.588 - 476.292
334.885 - 405.588
264.182 - 334.885
193.478 - 264.182
122.775 - 193.478
52.071 - 122.775
90°28'
90°32'
90°36'
90°40'
90°44'
90°48'
90°52'
90°56'
91°
23°48'
23°44'
23°40'
23°36'
23°32'
23°28'

Fig. F: Scimic Map of Bangladesh



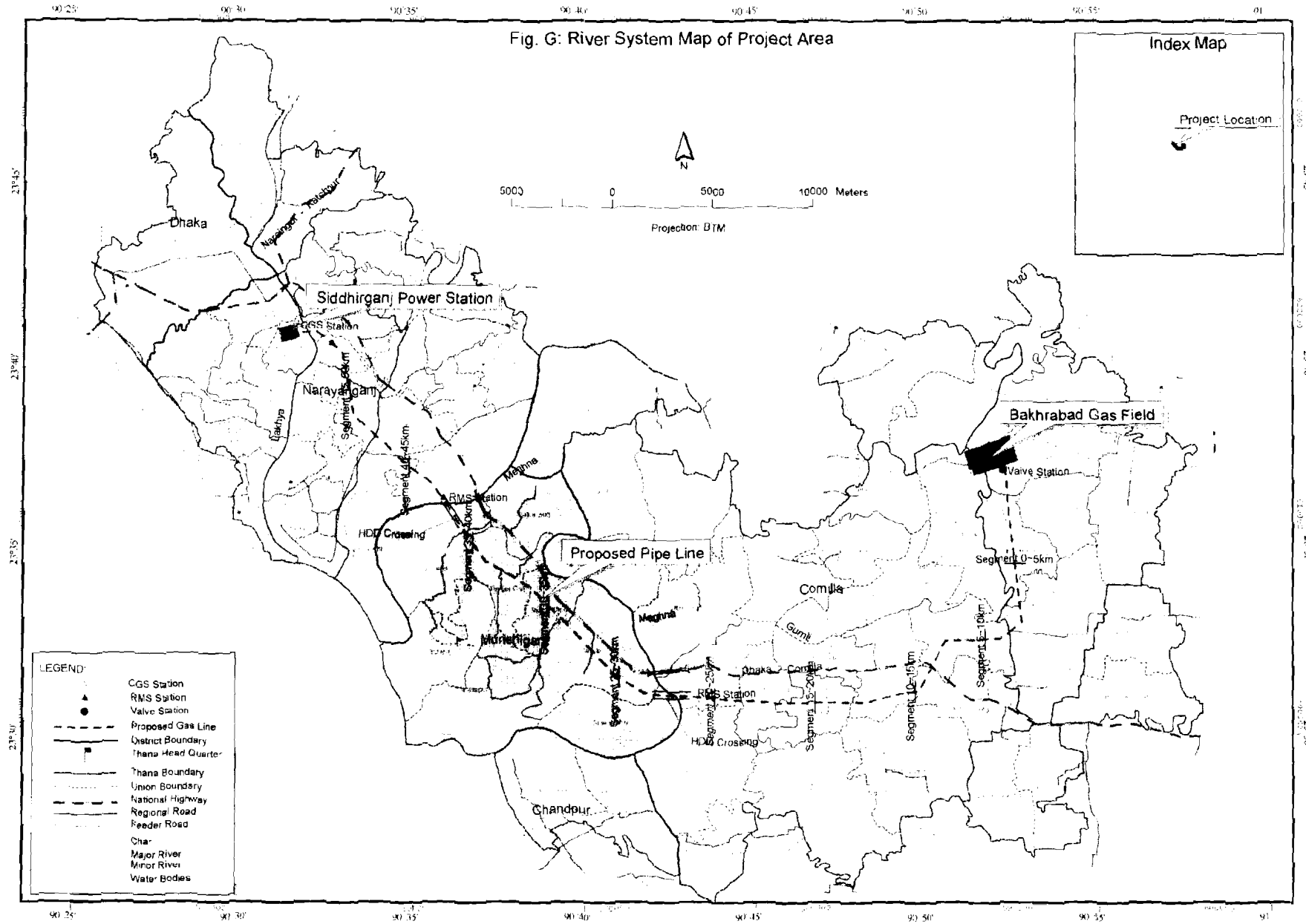


Fig. G: River System Map of Project Area
Index Map
Project Location
N
5000 0 5000 10000 Meters
Projection: BTM
Siddhirganj Power Station
CGS Station
Narayanganj
Dhaka
Nayanagar - Tolarbur
Lakhya
Segment 0-5km
Segment 10-45km
RMS Station
Meghna
HDD Crossing
Proposed Pipe Line
Bakhrabad Gas Field
Valve Station
Segment 0-5km
Comilla
Gumti
Meghna
Dhaka - Comilla
RMS Station
HDD Crossing
Segment 1-25km
Segment 1-20km
Segment 10-15km
Segment 5-10km
Chandpur
LEGEND
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana Boundary
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

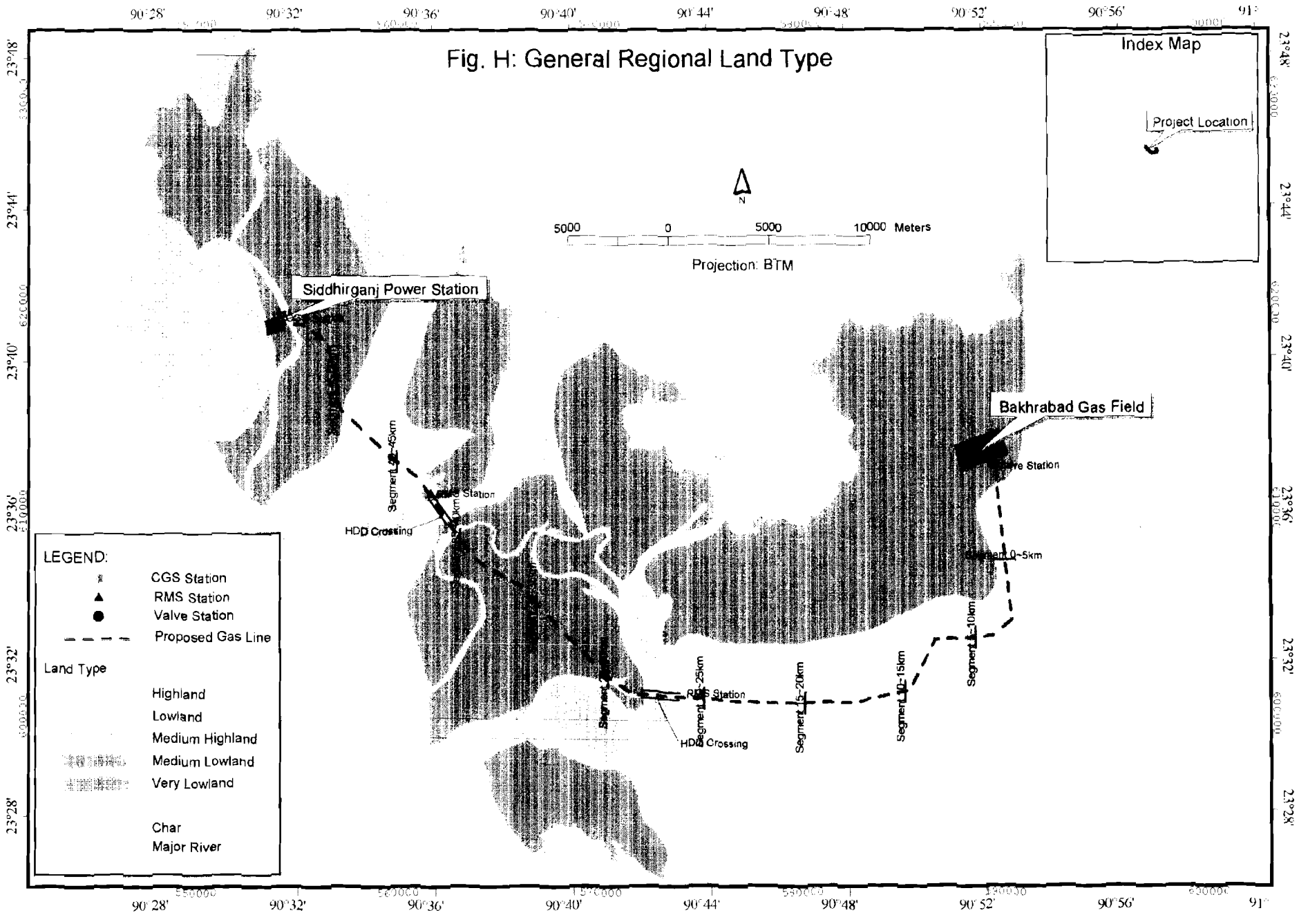


Fig. H: General Regional Land Type
Index Map
Project Location
N
5000 0 5000 10000 Meters
Projection: BTM
Siddhirganj Power Station
Bakhrabad Gas Field
HDD Crossing
HDD Crossing
RMS Station
Segment 0~5km
Segment 5~10km
Segment 10~15km
Segment 15~20km
Segment 20~25km
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
Land Type
Highland
Lowland
Medium Highland
Medium Lowland
Very Lowland
Char
Major River

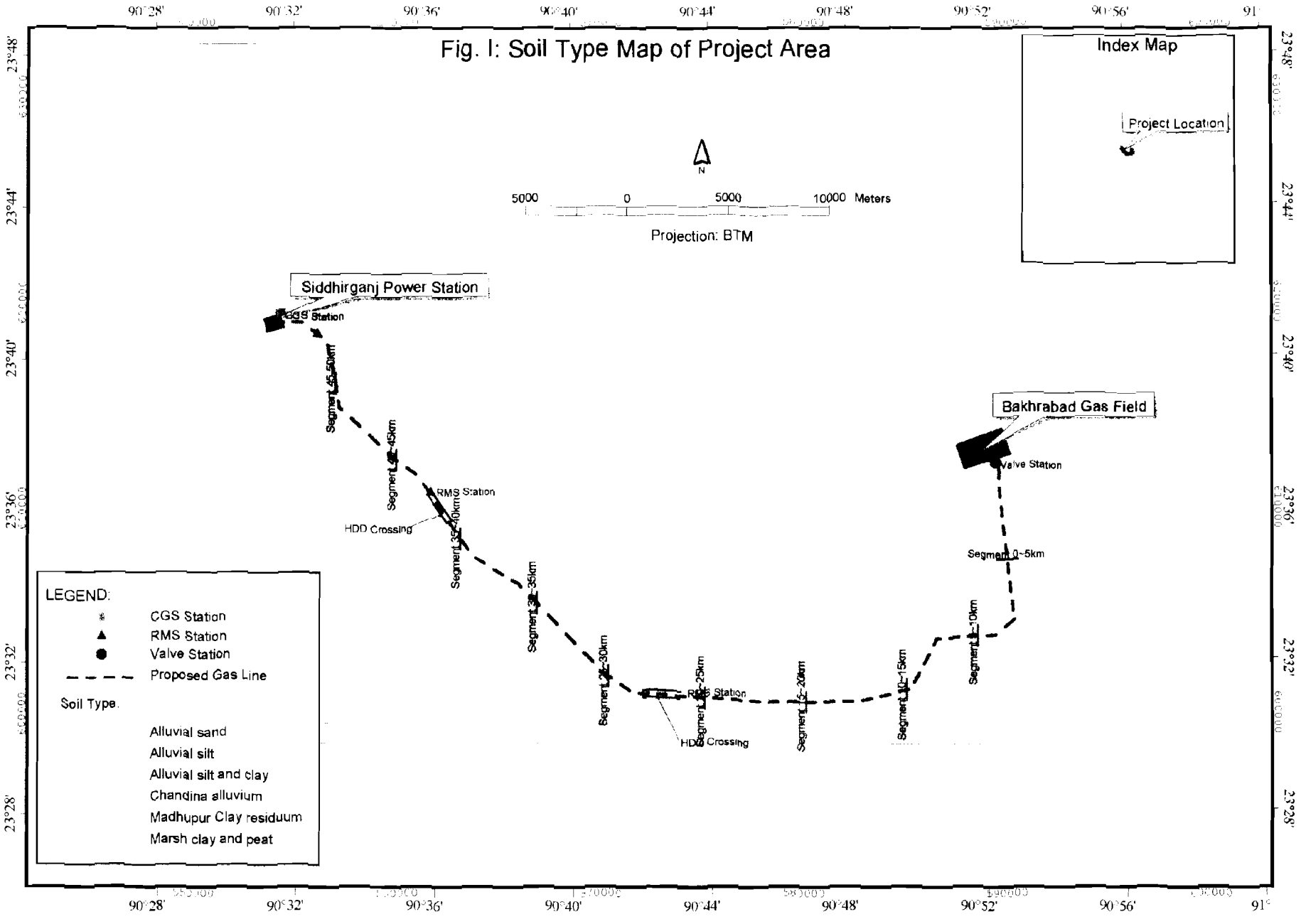


Fig. I: Soil Type Map of Project Area
Index Map
Project Location
N
5000 0 5000 10000 Meters
Projection: BTM
Siddhirganj Power Station
CGS Station
Bakhrabad Gas Field
Valve Station
RMS Station
HDD Crossing
Segment 0~5km
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
Soil Type.
Alluvial sand
Alluvial silt
Alluvial silt and clay
Chandina alluvium
Madhupur Clay residuum
Marsh clay and peat

Fig. J: Alternative Route for the Pipeline

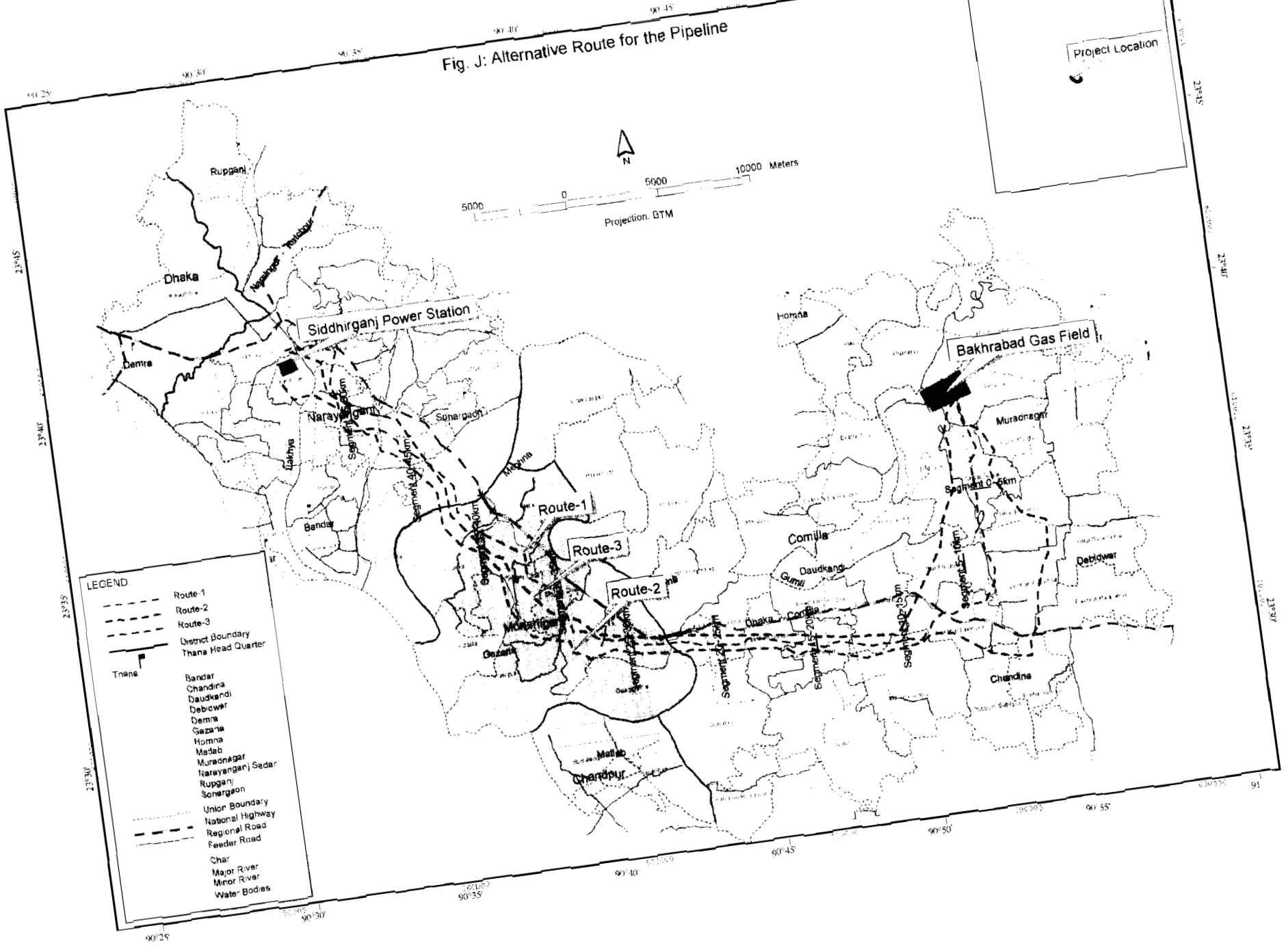


Figure-X

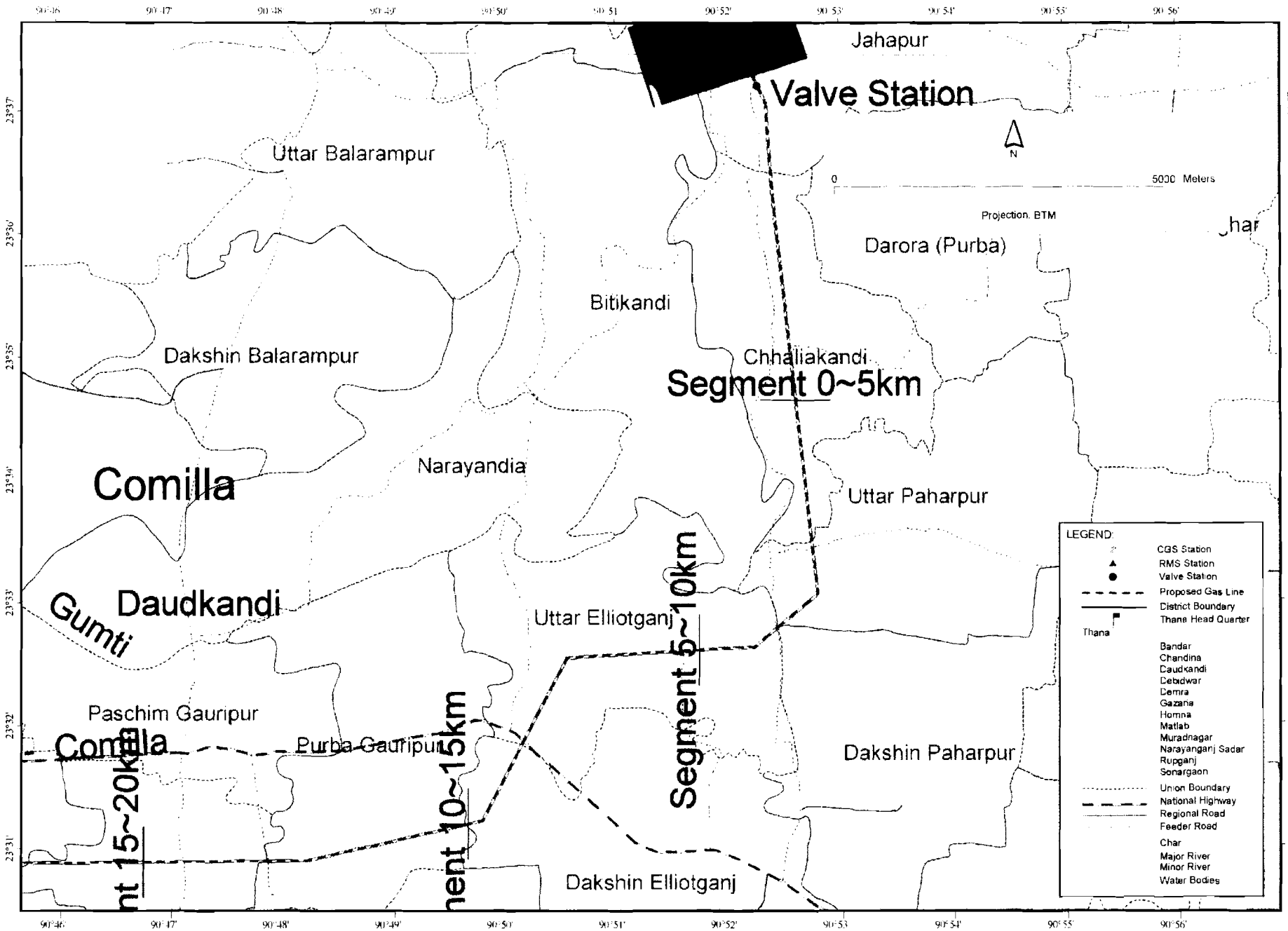

Jahapur
Valve Station
N
0
5000 Meters
Projection: BTM
Uttar Balarampur
Darora (Purba)
Bitikandi
Dakshin Balarampur
Chhaliakandi
Segment 0~5km
Narayandia
Comilla
Uttar Paharpur
Daudkandi
Gumti
Uttar Elliotganj
Segment 5~10km
Paschim Gauripur
Comilla
Purba Gauripur
Dakshin Paharpur
nt 15~20km
ment 10~15km
Dakshin Elliotganj
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Sadar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

Figure-Y

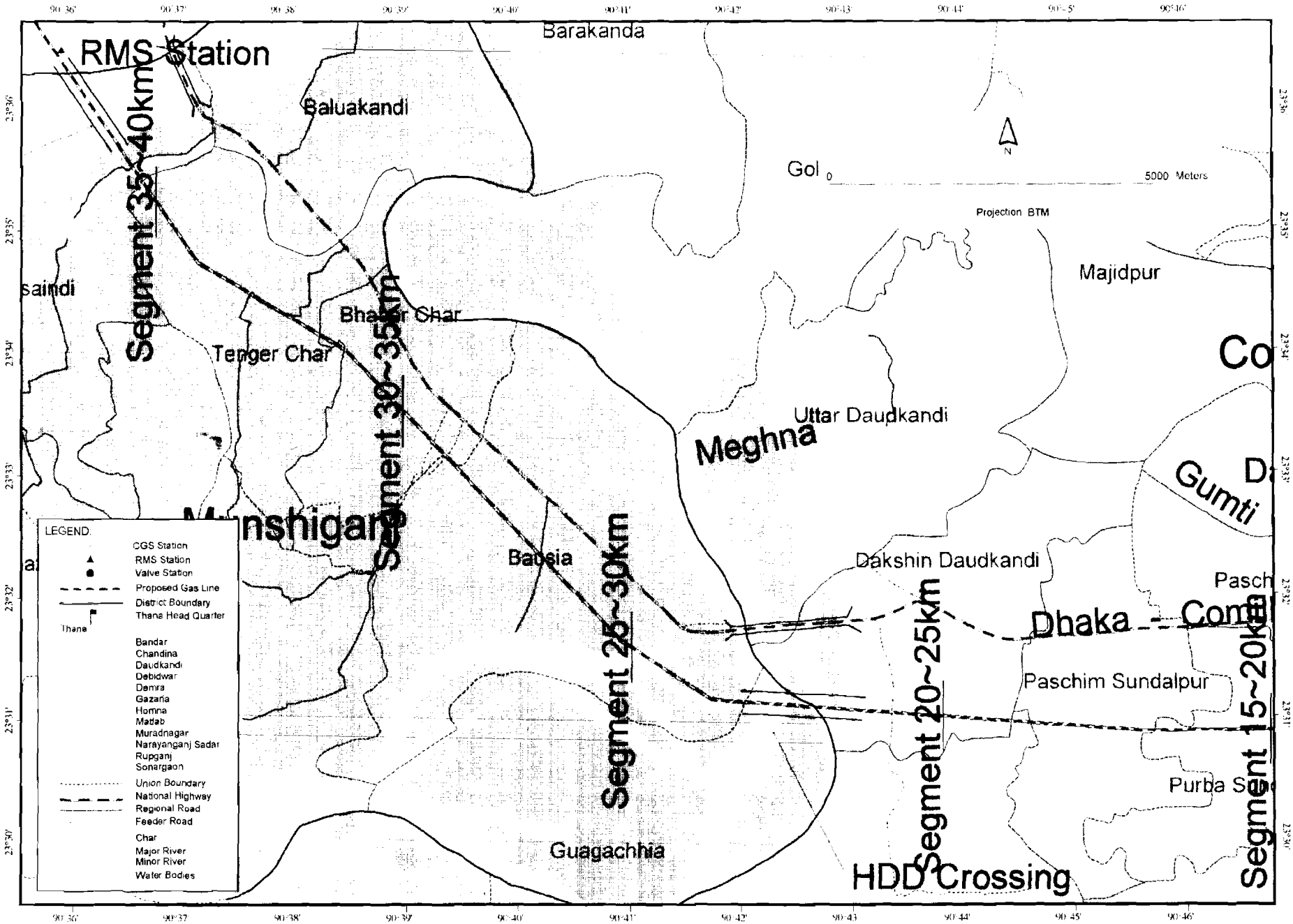
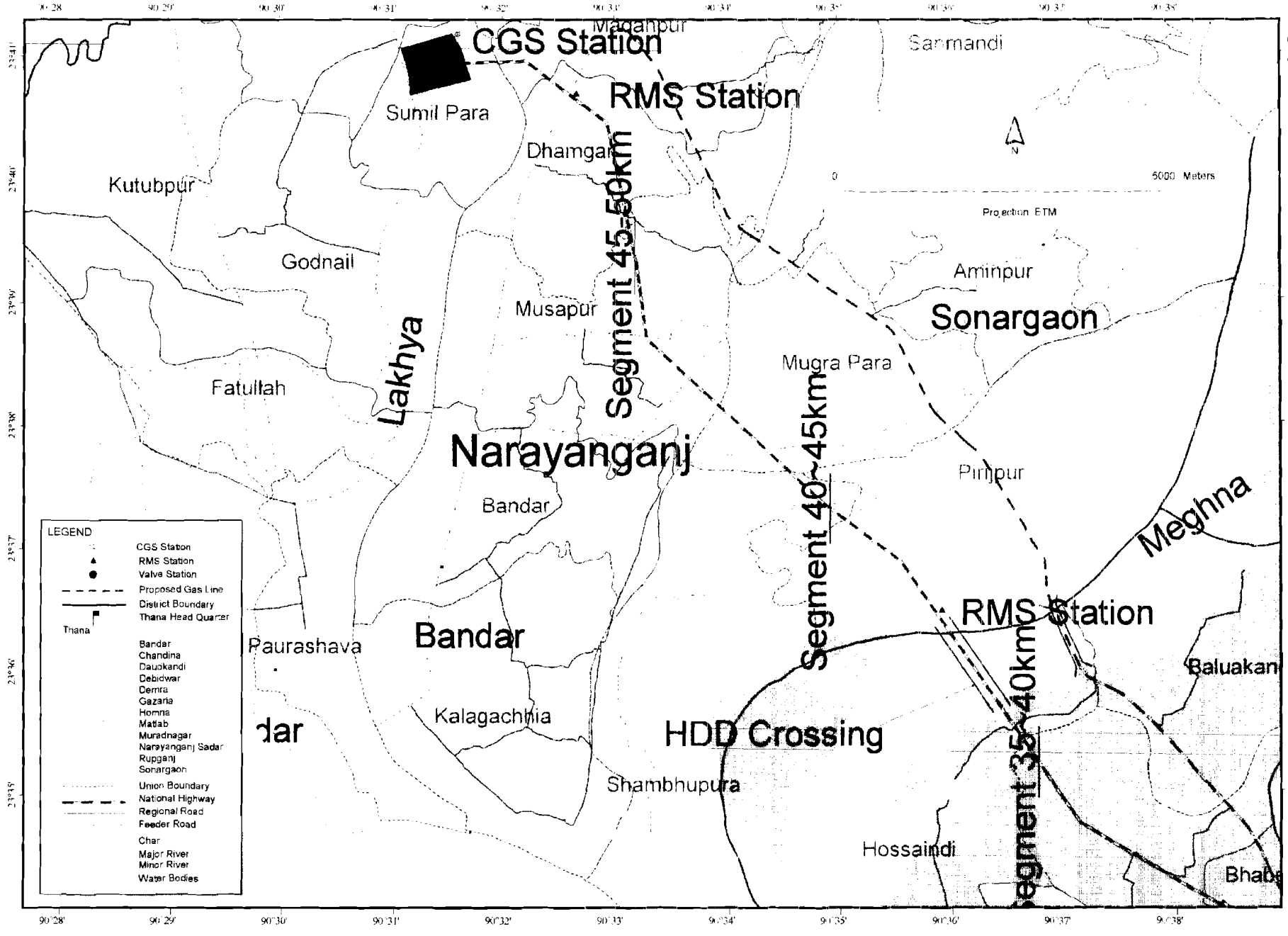

RMS Station
Barakanda
Baluakandi
Segment 35~40km
Segment 30~35km
Segment 25~30km
Segment 20~25km
Segment 15~20km
Gol
0
5000 Meters
Projection BTM
Majidpur
Bhabar Char
Tenger Char
Uttar Daudkandi
Meghna
Gumti
Babeia
Dakshin Daudkandi
Dhaka
Paschim Sundalpur
Purba Su
Guagachhia
HDD Crossing
LEGEND
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Sadar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

Figure-Z


CGS Station
RMS Station
Sumil Para
Dhamgar
Kutubpur
Godnail
Lakhya
Segment 45-50km
Musapur
Fatullah
Narayanganj
Bandar
Segment 40-45km
Mugra Para
Aminpur
Sonargaon
Pirijpur
Meghna
RMS Station
Baluakan
Paurashava
Bandar
Kalagachhia
HDD Crossing
Shambhupura
Segment 35-40km
Hossaindi
Sannandi
0
5000 Meters
Projection: ETM
LEGEND
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Sadar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

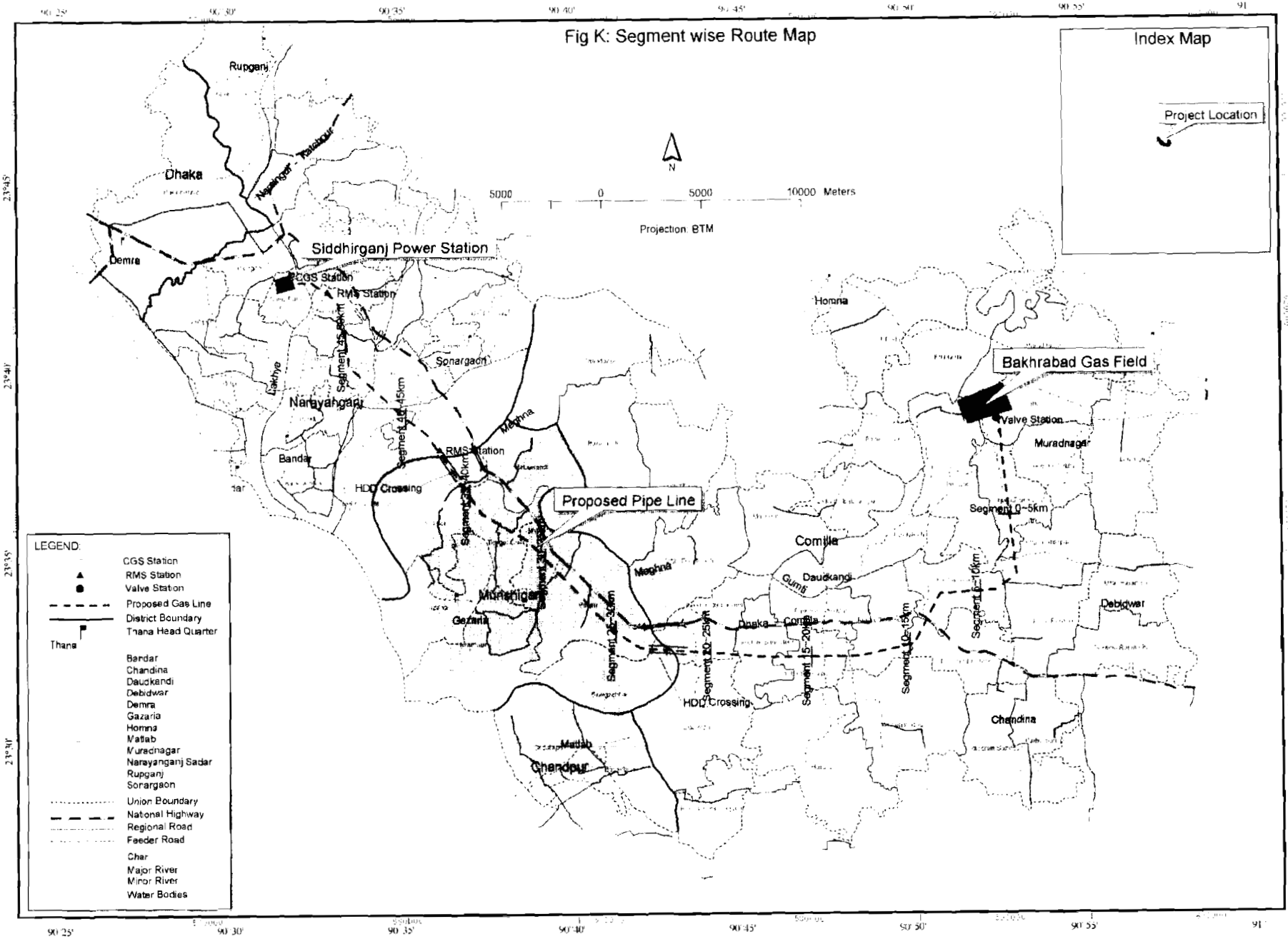


Fig K: Segment wise Route Map
Index Map
Project Location
N
5000 0 5000 10000 Meters
Projection: BTM
Siddhirganj Power Station
CGS Station
RMS Station
Bakhrabad Gas Field
Valve Station
Proposed Pipe Line
HDD Crossing
Segment 0~5km
Segment 5~10km
Segment 10~15km
Segment 15~20km
Segment 20~25km
Segment 25~30km
Segment 30~35km
Segment 35~40km
Segment 40~45km
Dhaka
Demra
Rupganj
Narayanganj
Sonargaon
Bandar
Meghna
Homna
Muradnagar
Comilla
Daudkandi
Gumti
Debidwar
Chandina
Meghna
Gazaria
Munshiganj
Matlab
Chandpur
LEGEND:
CGS Station
RMS Station
Valve Station
Proposed Gas Line
District Boundary
Thana Head Quarter
Thana
Bandar
Chandina
Daudkandi
Debidwar
Demra
Gazaria
Homna
Matlab
Muradnagar
Narayanganj Sadar
Rupganj
Sonargaon
Union Boundary
National Highway
Regional Road
Feeder Road
Char
Major River
Minor River
Water Bodies

ANNEXES

ANNEX-01

STATISTICAL ANALYSIS OF DEMOGRAPHIC, SOCIO-ECONOMIC AND COMMUNITY HEALTH DATA

Annex-1

Table-4.2: Bangladesh Standard of Noise Level

Sl. No.	Area Category	Standards Values (all values in dBA)	
		Day	Night
Ka	Silent zone	45	30
Kha	Residential area	50	40
Ga	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
Gha	Commercial area	70	60
Umma	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.

Table: 4.3 Divisions and Zilawise Distribution of Agriculture Land Types

Division	Zila	Cultivation Land						Uncultivable Land			
		High Land	Medium High Land	Medium Low Land	Low Land	Very Low Land	Total	Settlement	Pond & Water Body	River	Total
											In Sq. Km.
Dhaka	Narayanganj	6347	10828	12886	10153	1868	42082	7471	117	6794	14382
	Munshiganj	4355	6430	26801	22849	5869	66304	10056	615	18525	29196
											In Ha.
Chittagong	Comilla	8555	109887	81779	44876	709	245806	52588	434	6189	59211

Source: *Soil Resource Department Institute (SRDI), Ministry of Agriculture, 2002*

Table-4.5: Aquatic flora

Sl. No.	Local Name	Scientific Name	Status
1.	Dholkalmi	*Ipomoea fistulosa*	Common
2.	Muthagas	*Cyperus spp*	Common
3.	Kachuripana	*Elchhornis*	Common
4.	Hoggal	*Typha elephantinaRoxb*	Common
5.	Sheola	*Biysca octandra*	Common
6.	Shapla	*Nymphaea nouchali Burm,f*	Common
7.	Ghagra	*Xanthium indicum*	F. Common
8.	Khudi Kachuripana	*Lemna Spp*	F. Common
9.	Padmaphul	*Schumanntanthus dichosomus*	F. Common
10.	Kalmi	*Ipomoea albo.L*	F. Common
11.	Shalook	*Nymphaea nouchali burm*	F. Common
12.	Jal Padma	*Nelumbo nucifera gaertn*	F. Common
13.	Bishkatali	*Polygonum sp*	Rare
14.	Hizal	*Baringtonia acutangula*	Rare
15.	Kharjara	*Litsea monopetala*	Rare
16.	Keorali	*Hydrilla verticillata*	Rare

Note: F = Fairly

Table-4.6: Terrestrial Planted Flora

Sl. No.	Local Name	Scientific Name	Status
1.	Tezpata	*Cinnamomum tamala (Nees)*	Common
2.	Amgas	*Melia agedarach*	Common
3.	Kathal	*Artocarpus heterophutlus*	Common
4.	Supari	*Areca catechu*	Common
5.	Lichu	*Litchi chinenesis Sonn.*	Common
6.	Khezur	*Phoenix sylvestria (L)*	Common
7.	Satni	*Alstonia acholaris Br.*	Common
8.	Kalagas	*Mysa spp.*	Common
9.	Lebu	*Citrus aurantifolia*	Common
10.	Bel	*Aegle maronelos*	Common
11.	Peara	*Psidium guajava*	Common
12.	Narikel	*Cocos nucifera*	Common
13.	Jambura	*Citrus grandis*	F. Common
14.	Tetul	*Tamarindus indicus*	F. Common
15.	Lukluki	*Flacourtia jangomas*	F. Common
16.	Jalpai	*Elacocarpus roustus*	Rare
17.	Tal	*Borrasus flabellifera L.*	Rare
18.	Kamla	*Citrus reticulata Blanco*	Rare
19.	Anarosh	*Ananas sativus*	Rare

Note: F = Fairly

Table-4.7a: Terrestrial Fauna Reptiles

Sl. No.	Local Name	Scientific Name	Status
1.	Anjila	*Mabuya carinata*	Common
2.	Dhura Shap	*Amphiesma stolata*	Common
3.	Matia Shap	*Atretium schistosum*	Common
4.	Tiktiki	*Hemidactylus brooke*	Common
5.	Kari Katta	*Kachugotectum*	Common
6.	Daraish Shap	*Ptyas mucosus*	F. Common
7.	Gokhra	*Naja lutra*	F. Common
8.	Kassap	*Chitra idica*	F. Common
9.	Gui Shap	*Varanus nubulosus*	Rare

***Note**: F = Fairly*

Table-4.7b: Terrestrial Fauna Mammals

Sl. No.	Local Name	Scientific Name	Status
1.	Babur	*Pteropus giganteus*	Common
2.	Idur	*Mus musculus*	Common
3.	Shial	*Vulpes bengalensis*	Common
4.	Chika	*Pipistrellus. Sp*	Common
5.	Bagdash	*Viverra zibetha*	F. Common
6.	Khekshial	*Canes aureas*	F. Common
7.	Beji	*Herpestes*	Rare

Note: **F = Fairly**

Table-4.7c: Terrestrial Fauna Birds

Sl. No.	Local Name	Scientific Name	Status
1.	Choroi	*Passer domesticus*	Common
2.	Doyel	*Opsychus sularis*	Common
3.	Kak	*Carvus splendens*	Common
4.	Bagari	*Emberiza spodocephala*	Common
5.	Ghugho	*Streptapelia Orientalis*	Common
6.	Shalik	*Stuma contra*	Common
7.	Kokil	*Eudynanmus scolopacea*	Common
8.	Bok	*Ardea alba*	Common
9.	Tuntuni	*Orthotomus sutorius*	Common
10.	Badur	*Pteropus giganteus*	Common
11.	Chil	*Milvus migrans*	F. Common
12.	Machranga	*Helcyon smyrrensis*	F. Common
13.	Tota	*Psittacula aleandari*	F. Common
14.	Haludpakhi	*Oriolus xanthornus*	F. Common
15.	Katthokra	*Picus canus*	F. Common
16.	Pecha	*Tyto alba*	Rare
17.	Shakun	*Gyps bengalensis*	Rare
18.	Tia	*Psittacula Krameri*	Rare

Note: F = Fairly

Table-4.8 Population and Demographic Characteristics Surrounding the Project Area

District	Munshiganj	Narayanganj		Comilla	
Upzila	Gazaria	Sonargaon	Bandar	Daudkandi	Muradnagar
Area Sq. km	130.92	171.66	55.84	326.96	339
Union/ Ward	8	11	9	32	22
Mouza/ Mahalla	114	355	127	301	158
Village	129	485	156	400	305
Total Household	26500	60800	52500	81340	82700
Size of H/H	5.1	5	4.7	5.5	5.6
Population					
Both Sex	137660	305640	250360	450180	467320
Male	69820	157660	128840	222980	231360
Female	67840	147980	121520	227200	235960
Sex Ratio (M/F)	102.92	106.54	106.02	98.14	98.05
Literacy 7+ years	55.1	46.63	53.4	43.03	35.21
Population 18+ years	74780	164100	143540	233540	223020
Density (Sq. Km)	981	1526	3807	1219	1231

Sources: *1. Population Census 2001, National report (Provisional), July 2003, BBS*
Banglapedia, National Encyclopaedia of Bangladesh, Asiatic Society of Bangladesh, March2003

Table-4.9: Statement on Demographic Statistics along the Route

Munshigonj

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
Munshigonj	Gozaria	Hosendi	Hosendi	699	473	2646	1343	1303	33.4
	Do	Do	Vabanipur	137	219	1356	687	669	37.2
	Do	Do	Lashkardi	96	200	1097	578	519	24.6
	Do	Bhaberchar	Umeder Kandi	175	102	606	294	312	48.9
	Do	Do	Lakhipura	284	672	3844	1979	1865	35.8

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
	Do	Do	Chatalipur	282	206	1212	610	602	43.1
	Do	Do	Sree Nagar	829	710	4054	2028	2026	59.8
	Do	Baushia	Baushia	585	450	2813	1411	1402	46.6
	Do	Do	Char Baushia	2052	1404	8349	4343	4006	23.0
	Do	Do	Middle Bausia	835	265	1539	760	779	43.1
	Do	Do	Porachak	304	437	2428	1205	1223	19.7
	Do	Do	Suchak	327	357	2033	1083	950	17.2
	Do	Tengar Char	Vaterchar	906	592	3406	1707	1699	32.2
	Do	Do	Tengar Char	617	666	4112	2141	2071	33.4

Narayangonj

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
Narayangonj	Sonargaon	Pirojpur	Asharir Char	306	134	818	422	396	19.2
	Do	Do	Char Ramjan	1180	562	4301	2545	1756	26.1
	Do	Do	Dudhghata	378	558	3394	1700	1694	19.6
	Do	Do	Nangalergaon	213	376	2331	1190	1141	29.2
	Do	Do	Menikhali	101	74	399	202	197	28.8
	Do	Mugra Para	Ashrafdi	92	69	429	216	213	6.5
	Do	Do	Vairabdi	86	136	751	383	368	30.9
	Do	Do	Kabilgonj	35	177	1066	550	516	35.8
	Do	Do	Sukurdi	33	45	257	137	120	37.5

Narayangonj

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
Narayangonj	Bondor	Dhamgar	Amoir	222	236	1354	667	687	40.2
	Do	Do	Kewdhala	416	410	2291	1219	1072	24.0
		Muspur	Baligaon	73	148	802	426	376	38.6
		Do	Boropara	728	909	5047	2593	2454	35.3
		Do	Kantol	262	346	1792	928	864	31.9
		Do	Srirampur	174	334	1825	893	932	33.8
		Modanpur	Bagnanagar	25	31	213	118	95	49.1
		Do	Bangashashon	51	85	478	276	202	56.5
		Do	Fulor	178	196	996	538	458	31.7
		Do	Haripur	82	184	1027	660	367	56.7
		Do	Monohargharbag	251	499	2597	1364	1233	46.0
		Do	Mridhabari	56	165	873	473	400	65.2

Comilla

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
Comilla	Muradnagar	Paharpur	Vitipach Pukuria	79	60	274	155	119	42.1
	Do	Dak. Paharpur	Babutipara	1318	1322	6676	3312	3364	31.5
	Do	Jahapur	Baraikuri	362	539	3076	1480	1596	21.4
	Do	Do	Gangatia	116	218	1336	688	648	31.4
	Do	Do	Jahapur	756	680	3539	1833	1706	26.8
	Do	Saliakandi	Saliakandi	844	788	4192	2086	2106	26.9
	Do	Do	Dakkhin Ampal	323	332	1673	844	829	31.4
	Do	Do	Uttar Ampal	788	572	2962	1475	1487	23.9
	Do	Darora	Kajiatol	1545	1417	7849	3953	3896	26.4
	Do	Dak. Paharpur	Narsingpur	119	93	495	226	269	4.1
	Do	Do	Daira	572	456	2668	1319	1349	31.2

Comilla

District	Thana/ Upazila	Union/ Ward	Mauza	Area in Acres	Households	Population			Literacy Rate (%)
						Total	Male	Female	
Comilla	Daudkandi	Purba Gauripur	Itakhola						
		Do	Ratanpur	261	179	910	436	474	27.0
		Do	Jinglatoli	1010	845	5317	2691	2626	38.3
		Goalmari	Sendi	230	208	1288	623	665	38.8
		Dak. Eliotgonj	Bitman	224	134	751	382	369	18.2
		Do	Malikhil	663	509	3041	1567	1474	25.0
		Do	Putiabasra	679	538	3268	1644	1624	42.4
		Do	Tamta	500	608	3544	1838	1706	22.2
		Uttar Eliotgonj	Bashkhola	308	246	1581	822	759	29.4
		Purba Sundalpur	Candipasha	83	55	301	157	144	33.8
		Do	Ichapur	512	453	2748	1345	1403	37.0
		Do	Jagerchandi Pasha	79	92	486	245	241	46.6
		Do	Rangashimulia	179	181	1122	576	546	13.7
		Do	Tinchita	243	244	1615	809	806	29.2
		Dak. Daudkandi	Dak. Gazipur	111	85	538	268	270	47.1
		Do	Kazirkot	136	118	716	362	354	30.0
		Do	Daulatdi	151	207	1229	625	604	21.5
		Do	Uttar Gazipur	256	84	549	265	284	41.6
		Do	Uttar Nasardi	230	260	1700	915	785	29.0
		Uttar Daudkandi	Gangaprashad	655	365	2235	1119	1116	14.6

Table-5.1.1: Summary of Segment wise Land Structure and Tree Losers

Sl. No.	Segment (km)	Losing Structure, Land & Trees (Category- 1)	Losing Structure & Land (Category- 2)	Losing Land & Trees (Category- 3)	Losing Land Only (Category- 4)	Total
1	0-5	3	-	4	90	97
2	5-10	-	-	5	54	59
3	10-15	-	-	1	105	106
4	15-20	-	-	2	106	108
5	20-25	-	-	3	94	97
6	25-30	5	-	1	69	75
7	30-35	-	2	-	51	53
8	35-40	-	-	2	48	50
9	40-45	-	-	-	94	94
10	45-50	1	1	1	67	70
11	50-55	-	-	1	42	43
12	55-60	1	5	7	46	59
	Total:	10	8	27	866	911

Table-4.11a: Details of Road etc -Muradnagar, Comilla

Sl. No.	Name of Mouza	Length/ Meter	Acquisition (Decimal)	Requisition (Decimal)	Remarks
	Bakhrabad Gas Field	185.00	1480.00	2775.000	
1	Gangutia	4.573	36.584	68.595	Pucca Road
2	Gangutia	36.585	292.680	548.775	Pucca Road
3	Gangutia	4.573	36.584	68.595	Pucca Road
4	Gangutia	3.658	29.264	54.870	Katcha Road
5	Jahapur-1	6.097	48.776	91.455	Eliatganj-Bakhrabad Road
6	Jahapur-2	7.622	60.976	114.330	Katch Road
7	Jahapur-2	9.146	73.168	137.190	Khal
8	Bariakuri	6.097	48.776	91.455	Katcha Road
9	Kajiatol	7.621	60.968	114.315	Katcha Road
10	Kajiatol	30.487	243.896	457.305	Khal
11	Kajiatol	3.658	29.264	54.870	Katcha Road
12	Dakhin Ampal	10.760	86.080	161.400	Katcha Road
13	Saliakandi-2	12.195	97.560	182.925	Katcha Road
14	Saliakandi-3	25.914	207.312	388.710	Khal
15	Viti Panchpukuria-1	3.658	29.264	54.870	Halot
16	Viti Panchpukuria	3.658	29.264	54.870	Katch Road
17	Viti Panchpukuria-1	15.243	121.944	228.645	Pucca Road Paharpur
18	Viti Panchpukuria-2	6.097	48.776	91.455	Khal
19	Viti Panchpukuria-2	4.573	36.584	68.595	Khal
20	Viti Panchpukuria-2	5.487	43.896	82.305	Khal

Table-4.11b: Details of Road etc Daudkandi, Comilla

Sl. No.	Name of Mouza	Plot No.	Length/ Meter	Acquisition (Decimal	Requisition (Decimal	Remarks
1	Baskhola-1		9.776	78.208	146.640	Eliatgonj-Bakhrabad Road
2	Baskhola-1		33.536	268.288	503.040	Eliatgonj Khal
3	Tamta-1	121	15.243	121.944	228.645	Khal/ Katcha Road
4	Putia Bashor-2	1558-60	39.634	317.072	594.510	Dhaka-Chittagong Highway Road
5	Putia Bashor-2		4.573	36.584	68.595	Katch Road
6	Ratanpur-1	1837	6.097	48.776	91.455	Khal
7	Jinglatali-2	1697	3.048	24.384	45.720	Katcha Road
8	Jinglatali-2	1231	9.146	73.168	137.190	Khal
9	Jinglatali-2	1176	9.146	73.168	137.190	Katcha Road
10	Jinglatali-2	117	22.865	182.920	342.975	Gouripur Chasar Road
11	Tinchita-1	127	9.146	73.168	137.190	Khal/Katcha Road
12	Ishapura-1	400	24.390	195.120	365.850	Khal/ Gouripur Motlab Pucca Road
13	Ishapura-1		4.573	36.584	68.595	Katcha Road
14	Sundalpur-1		12.195	97.560	182.925	Sundal Bazar Road
15	Sundalpur-1	131	15.243	121.944	228.645	Katcha Road/ Khal
16	Dakhin Gazipur-1	60	9.146	73.168	137.190	Khal
17	Daulatdi		15.243	121.944	228.645	Hurainpur Pucca Road/ Khal
18	Uttar Nasaruddin-1	22	24.390	195.120	365.850	Katcha Road/ Khal
19			1727.000	13816.000	25905.000	Gomti-Meghna River Crossing

Table-4.11c: Details of Road etc.-Gozaria, Munshigonj

Sl. No.	Name of Mouza	Plot No.	Length/ Meter	Acquisition (Decimal)	Requisition (Decimal)	Remarks
1	Char Baushia-3		6.097	48.776	91.455	Pucca Road
2	Char Baushia-3	7572	7.621	60.968	114.315	Khal
3	Char Baushia-3		42.682	341.456	640.230	Khal
4	Sochak-1		6.097	48.776	91.455	Katcha Road
5	Sochak-1		9.146	73.168	137.190	Khal
6	Sochak-1		7.621	60.968	114.315	Halot
7	Porarchak-1		6.097	48.776	91.455	Pucca Road
8	Boushia-2		6.097	48.776	91.455	Khal
9	Middle Boushia-1		7.621	60.968	114.315	Khal
10	Lakhipura-1		9.146	73.168	137.190	Bhaberchar Pucca Road
11	Lakhipura-1	682	12.195	97.560	182.925	Khal
12	Sreenagar-1		4.573	36.584	68.595	Kalimullah College Road
13	Choto Alipura-1		4.573	36.584	68.595	Khal
14	Umeder Kandi-1		4.573	36.584	68.595	Halot
15	Umeder Kandi-1		7.621	60.968	114.315	Anarpura Road
16	Umeder Kandi-1		10.670	85.360	160.050	Halot
17	Umeder Kandi-1		4.573	36.584	68.595	Khal
18	Bhater Char-2	1143	4.573	36.584	68.595	Khal
19	Bhater Char-2	283	21.341	170.728	320.115	Bhater Char Khal
20	Tengar Char-3		4.573	36.584	68.595	Katcha Road
21	Hoshendi-1	6	12.195	97.560	182.925	Halot
22	Hoshendi-1	661	74.695	597.560	1120.425	Hoshendi Khal
23	Loskardi-1		96.036	768.288	1440.540	Kajla River crossing
24	Bhabanipur-1		13.719	109.752	205.785	Hoshendi Bazar Road
25	Bhabanipur-1		19.817	158.536	297.255	Khal
26	Meghna River Crossing		1287.000	10296.000	19305.000	Meghna River

Table-4.11d: Details of Road etc.-Sonargaon, Narayanganj

Sl. No.	Name of Mouza	Plot No.	Length/ Meter	Acquisition (Decimal)	Requisition (Decimal)	Remarks
	Char Ramjan		770.000	6160.000	11550.000	Meghnaghat Power Station
1	Asharar Char-2	1144	210.365	1682.920	3155.475	Ashariar Char Khal-1
2	Asharar Char-2		126.524	1012.192	1897.860	Ashariar Char Khal-1
3	Dudghata-1		6.459	51.672	96.885	Dudghat Pucca Road
4	Mongolergaon-1	1	30.480	243.840	457.200	Pucca Road
5	Menikhali-1	403	30.480	243.840	457.200	Menikhali Khal
6	Menikhali-1		18.292	146.336	274.380	Mugrapara Road
7	Menikhali-1		12.196	97.568	182.940	Khal
8	Bhairabdi-1	74	9.146	73.168	137.190	Khal
9	Vatipara-1	8	13.719	109.752	205.785	Khal
10			243.902	1951.216	3658.530	Old Brahmaputra River

Table-4.11e: Details of Road etc.-Bondor, Narayanganj

Sl. No.	Name of Mouza	Plot No.	Length/ Meter	Acquisition (Decimal)	Requisition (Decimal	Remarks
1	Sree Rampur-1		7.621	60.968	114.315	Katcha Road
2	Baropara-2	2934	12.195	97.560	182.925	Langalband Pucca Road
3	Baropara-2		15.243	121.944	228.645	Pucca Road
4	Baropara-1	540	9.146	73.168	137.190	Khal
5	Baropara-1	136	9.146	73.168	137.190	Khal
6	Amur-1	568	7.621	60.968	114.315	Khal
7	Amur-1	304	12.195	97.560	182.925	Katcha Road/ Khal
8	Kewdala-3	38	7.621	60.968	114.315	Kewdala Pucca Road
9	Fulor-1	294-95	73.170	585.360	1097.550	Madanganj Pucca Road
10	Bagnayanagar-1	61	12.195	97.560	182.925	Khal
11	Bangashasan		15.240	121.920	228.600	PDB Sub-Station Road
12	Haripur	21,23,27	196.000	1568.000	2940.000	Haripur Sub-Station Area
13	Haripur		264.000	2112.00	3960.000	Sitalakhya River
14	Siddhirganj Sub-Station		162.000	1296.00	2430.00	Siddhirganj Sub-Station Area

Table-4.12: Composition of the Household Members

Household Surveyed	H/H No.	%
Male Headed Household	906	99.45
Female Headed Household	5	0.55
Total	**911**	**100%**

Table-4.13: Age and Sex Distribution of the affected Household Members

Age Group	Male	%	Female	%	Total	%
1-4	212	8.94	235	11.34	447	10.06
5-9	251	10.58	216	10.42	467	10.51
10-14	304	12.82	247	11.92	551	12.40
15-19	202	8.52	173	8.35	375	8.44
20-49	1035	43.63	990	47.78	2025	45.57
50-60	275	11.59	174	8.40	449	10.10
Above 60	93	3.92	37	1.79	130	2.93
Total	**2372**	**100**	**2072**	**100**	**4444**	**100**

Table-4.14: Distribution of the Households by Their Religion

Religion	No. of Households	% of Households
Islam	879	96.49
Hindu	32	3.51
Christian	0	0.00
Buddhist	0	0.00
Total	**911**	**100.00**

Table-4.15: Educational Status of the Household Members

Educational status	Male	%	Female	%	Total	%
Illiterate	300	12.65	306	14.77	606	13.64
Can read only	130	5.48	117	5.65	247	5.56
Can read & Write	104	4.38	135	6.52	239	5.38
Children <4 years	217	9.15	238	11.49	455	10.24
Primary (Class I-V)	617	26.01	639	30.84	1256	28.26
Secondary (VI-X)	587	24.75	483	23.31	1070	24.08
SSC Equivalent	221	9.32	93	4.49	314	7.07
HSC Equivalent	92	3.88	28	1.35	120	2.70
HSC +	49	2.07	12	0.58	61	1.37
Graduate	41	1.73	5	0.24	46	1.04
Masters +	9	0.38	8	0.39	17	0.38
Others	5	0.21	8	0.39	13	0.29
Total	**2372**	**100**	**2072**	**100**	**4444**	**100**

Table-4.16: Occupations of the Household Members

Occupation	Male	%	Female	%	Total	%
Farmers	409	17.24	6	0.29	415	9.34
Fishermen	7	0.30	3	0.14	10	0.23
Agricultural Labour	31	1.31	3	0.14	34	0.77
Non-agricultural Labour	58	2.45	3	0.14	61	1.37
Service	168	7.08	7	0.34	175	3.94
Business	409	17.24	2	0.10	411	9.25
Small Trade	77	3.25	2	0.10	79	1.78
Households Works	17	0.72	1174	56.66	1191	26.80
Student	617	26.01	495	23.89	1112	25.02
Children (< 5 years)	236	9.95	257	12.40	493	11.09
Retired/Disable	48	2.02	32	1.54	80	1.80
Unemployment	96	4.05	64	3.09	160	3.60
Overseas Work	175	7.38	6	0.29	181	4.07
Others	24	1.01	18	0.87	42	0.95
Total	**2372**	**100.00**	**2072**	**100.00**	**4444**	**100.00**

Table-4.17: Monthly Income Pattern of the affected Households

Income Level	No. Of Household	% of Income
Up to Tk. 1000	3	0
Tk. 1001 – Tk. 2000	0	0
Tk. 2001 – Tk. 3000	6	1
Tk. 3001 – Tk. 5000	154	17
Tk. 5001 – Tk. 7500	215	24
Tk. 7501 – Tk. 10000	224	25
Tk. 10001 – Tk. 15000	183	20
Tk. 15001 – Tk. 20000	76	8
Tk. 20001 and Above	50	5
Total	**911**	**100**

Table-4.18: Residential House Pattern

House Ownership	No. of Households	% of Households
Katcha	636	69.81
Semi Pucca	235	25.80
Pucca	37	4.06
Others	3	0.33
Total:	**911**	**100.00**

Table-4.19: Sources and Use of Water

Type of Sources	Drinking No. H/H	(%) H/H	Cooking/ Washing No. H/H	(%) H/H	Bathing No. H/H	(%) H/H	Cattle Washing No. H/H	(%) H/H
Tube well	881	96.71	783	85.95	462	50.71	10	1.61
Deep Well	29	3.18	26	2.85	14	1.54	1	0.16
Supply Water	1	0.11	1	0.11	6	0.66	0	0.00
Well	0	0.00	0	0.00	0	0.00	2	0.32
Pond	0	0.00	101	11.09	426	46.76	378	60.87
Khal / River	0	0.00	0	0.00	3	0.33	230	37.04
Total	**911**	**100.00**	**911**	**100**	**911**	**100**	**621**	**100**

Table-4.20: Types of Latrines Used by the affected Households

Type of Latrines Used	No. of Households	% of Households
Sanitary	578	63.45
Pit	282	30.95
Hanging	35	3.84
Open Place	11	1.21
Others	5	0.55
Total:	**911**	**100.00**

Table-4.21: Main Health Service Facilities of the Area

Source	Peoples Coverage	%
Facilities from Govt. Hospital	345	14.47
Facilities from Private Hospital	96	4.03
Union Health Clinic	293	12.29
NGO Clinic	11	0.46
Private Doctor	548	22.98
Pharmacy	441	18.49
Quack	651	27.30
Total Sample Household	**2385**	**100.00**

Table-5.1: Details of Participants and their Classification in Different Public Consultation Sites during Stage-1 Field Survey along the Route between June, 2007 & July, 2007

Sl. No.	Date	Places	Affected HH & Focus Group/ Local People	GTCL/ NSO Professionals	BETS Professionals	Total
1	29-06-2007	Vati Para, Sonargaon	7	1	5	13
2	01-07-2007	Bhabar Char, Munshigonj	7	1	5	13
3	01-07-2007	Bausia, Munshigonj	7	1	5	11
4	02-07-2007	Bausia, Munshigonj	7	1	5	8
5	05-07-2007	Daudkandi, Comilla	7	1	5	13
6	06-07-2007	Muradnagar, Comilla	7	1	5	12
7	04-07-2007	Daudkandi, Comilla	7	1	5	12
8	07-07-2007	Muradnagar, Comilla	8	1	5	14
9	08-07-2007	Muradnagar, Comilla	8	1	5	14

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Table-5.2: Focus Group Discussion at Vatipara, Sonargaon

Date: 29.06.2007 **Interviewer:** Md. Ahsan Kabir **Venue:** Vatipara, Sonargaon

Sl. No.	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
1	Kazi Nazrul Islam S/o Sattar Mia Vatipara, Sonargaon	Student	We want compensation and we want gas.
2	Shamim Mia S/o. Shajahan Vill. Vatipara P.o. Mograpara Thana : Sonargaon	Service	General public will incur less fuel cost if they get gas.
3	Md. Masum S/o. Late Tara Mia	Service	We shall co-operate if we are either properly compensated or able to secure good advantages.
4.	Humayun Kabir S/o. Farid Uddin	Business	Want rehabilitation.
5	Kazi Sabur Mia S/o. Late, Karim Mia	Retired	We will co-operate for the benefit of the people.
6.	Md. Samol S/o. Motahar	Service	Gas has to be provided in our area at the first instance.
7	Md. Masum S/o. Late Md. Motaleb	Business	Gas price has to be reduced. Proper compensation has to be given

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Table-5.3: Focus Group Discussion at Bhaber Char, Munshiganj

Date: 01.07.2007 **Interviewer:** Md. Ahsan Kabir **Venue:** Bhaber Char, Munshiganj

Sl No	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
1	Md. Mogibur Rahman S/o Late Hazi Nawab Ali Vill- Choto Alipura P.o. Bhaber Char Dist. Munshiganj	Farmer	We will co-operate provided we are benefited.
2	Md. Bazlur Rahman S/o Late Shiraj Uddin	Business	No problem if duly compensated for.
3	Md. Abu Bakar Siddique S/o Late Lalmia Mridha	Retired	Will co-operate if we find it right upon discussion among 10 of us.
4.	Hafeez Md. Nazrul Islam S/o Md. Eakub Ali Alipura Islamia Atimikhana Madrasha	Service	It would be better if gas line goes through this area.
5	Firoz Ahmed S/o Hazi Monir Hossain Bepari Poikhar par, Vober Char	Service	We shall be benefited if gas pipeline passes through that area.
6.	Ali Ahmed S/o Late Chan Mia Ali pura	Farmer	It will be good for use is gas line
7	Md. Azgor Khan S/o Late Mulovi Afser Uddin Ali Pur, Gozaria.	Business	Fuel cost of the public will be reduced.

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Table-5.4: Focus Group Discussion at Gozaria, Munshiganj

Date: 01.07.2007 **Interviewer:** Md. Nurul Haque **Venue:** Gozaria, Munshiganj

Sl No	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
1	Md. Shajahan S/o Late Ali Hossain Vill-Shuchok Union- Baoshia Gozaria, Munshiganj	Service	Advantage: General public will be benefited with passing of gas line. Gas will be used in cooking and in running the Industries. Economic and employment situation will be eased. Disadvantage: Disturbance during pipeline laying.
2	Md. Ali Hazi S/o Late Abdul Kadir Vill-Shuchok Union-Baoshia, Gozaria, Munshiganj	UP Member	Gas is a natural and economic resource of the country. This will create opportunity for cooking and running industries.
3	Md. Mozaffor Ali Bepari S/o Late Sahed Ali Bepari Poracok, Baoshia		Gas line will create opportunity for cooking. Gas line will not harm
4.	Md. Shorif Hossain S/o Late Nurul Islam Porachok, Gopibari Mohalla	Imam of Mosque	Gas pipe line will be beneficial to the country and its population.
5	Hazi Abdul Malek S/o Late Kalai Prodhan Porachok, Baoshia, Baoshia		Gas will be helpful and there shall not be any significant inconvenience.
6.	Mst. Tahmina Akhter H/o Engineer Hasan Jahangir Porachok, Baoshia	Service	Gas line will bring benefit for the people. They will get the opportunity for cooking with gas.
7	Jillur Rahman S/o Siraj Mia Porachok, Baoshia, Purba para	Service	Cooking and industries will run on gas. Employment problems will be solved.

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Table-5.5: Focus Group Discussion at Gozaria, Munshiganj

Date: 02.07.2007 **Interviewer:** Md. Nurul Haque **Venue:** Gozaria, Munshiganj

Sl No	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
1	Md. Nazrul Islam S/o Harun or-Rashid Vill- Porachok, Baoshia, Gozaria, Munshiganj		Gas line will bring advantages to the locality. There will be no disadvantage.
2	Mst. Shahida H/o Abdul Mannan Porachok, Baoshia, Gozaria, Munshiganj	UP Member	Gas line will be of advantage to cooking. Economy will develop. There will not be any disadvantage.
3	Shohidullah Sarker S/o Late Rustom Ali Sarker Porachok, Baoshia, Gozaria, Munshiganj		Gas line is a development work of the country. This will help improving social & economic conditions.
4.	Md. Abdul Malek Porachok, Baoshia Gozaria, Munshiganj	Service	Gas line will be of advantage to the local people. I do not think there will be any disadvantage.
5	Md. Kamal Hossain S/o Md. Sona Mia Char Baoshia Modhom Kandi		Those persons will be exclusively losers, whose housing will be damaged by the gas line. But other than them, none of the locality will be affected by the gas line.
6.	Md. Mosarrof Hossain S/o Late Abdus Samad Porachok, Baoshia		It there is no gas, industries will not run. Country will also suffer from non-development
7	Abdur Rahim S/o Late Abdul Jolil Porachok, Baoshia		Setting up of industries will help solving employment problem. Gas will create employment opportunities for the people.

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Table-5.6: Focus Group Discussion at Daudkandi, Comilla

Date: 05/07/2007 **Interviewer:** Md. Abdul Mojid **Venue:** Daudkandi, Comilla

Sl. No.	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
01.	Md. Nuruzzaman Khan S/o: Md. Abdul Karim Khan Vill: Chakamkhola Post: Chargoala, Daudkandi, Comilla	Teacher	Gas is a valuable asset. We should use this gas in proper way.
02.	Khandaker Shahajahan Vill: Dash Para Post; Dash Para, Daudkandi, Comilla	Teacher	We have to work keeping in mind that there is no damage to this unlimited asset.
03.	Khandaker Abul Bashar Vill: Chakamkhola Post: Chargoala, Daudkandi, Comilla	Teacher	Work has to progress so that no accident happens in future.
04.	Noormohammad Bhuiya Vill: Teenpara Post: Barokota Post: Chargoala, Daudkandi, Comilla	Teacher	Opportunity should be given to use gas as a fuel in the industries.
05.	Md. Shamsul Hoque Talukdar Vill: Sundarpur Dashpara Post: Chargoala, Daudkandi, Comilla	Business	Gas has to be provided in this locality for burning as a fuel.
06.	Md. Moju Mia S/o.: Late Gafur Mia Vill: Sundarpur Dashpara Post: Chargoala, Daudkandi, Comilla	Business	There may be temporary loss in laying the line but this will bring in more profit.
07.	Md. Shaejuddin S/o.: Kopiluddin Vill: Jaigir, Daudkandi, Comilla	Farmer	Leveling and filling of the undulated ground has to be done after the laying of the gas line

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Table-5.7: Focus Group Discussion at Muradnagar, Comilla

Date: 06/07/2007 **Interviewer:** Md. Abdul Mojid **Venue:** Muradnagar, Comilla

Sl. No.	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
01.	Md. Kamal Hossain S/o: Late Aminul Vill: Bakhrabad Post: Jahapur P/s. Muradnagar, Dist: Comilla	Driver	In the opinion of the respectable persons that this is a good endeavor. This will bring benefit to the country when commissioned. Even an industry may grow up in the locality. This is a good side of gas and the bad side is that when gas line is built, it will affect the land, crop field, house and homestead of the people though there will be benefits too.
02.	Md. Zakir Hossain S/o. Shahabuddin Vill: Bakhrabad Post: Jahapur, Muradnagar, Dist: Comilla	Business	
03.	Md. Shiraj S/o: Late Lal Mia Vill: Bakhrabad Post: Jahapur, Muradnagar, Dist: Comilla	Business	
04.	Md. Kashem S/o.: Kadam Ali Vill: Bakhrabad Post: Jahapur, Muradnagar, Dist: Comilla		
05.	Md. Edris Member S/o.: Fajlur Rahman Vill: Bakhrabad Post: Jahapur, Muradnagar, Dist: Comilla	Business	
06.	Md. Mokter Hossain S/o.: Late Syed Ali Vill: Bakhrabad, Post: Jahapur P/s. Muradnagar, Dist: Comilla	Farmer	
07.	Md. Abul Kalam S/o.: Rahomat Ali Vill: Bakhrabad, Post: Jahapur, Muradnagar, Dist: Comilla	Service	

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Table-5.8: Focus Group Discussion at Daudkandi, Comilla

Date: 04.07.2007 **Interviewer:** Md. Abdul Mozid **Venue:** Daudkandi, Comilla

Sl No	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
1	Anoar Hossain S/o Pantob Ali Vill- Tamta P.o Eliatganj Thana – Daudkandi Dist. Comilla	Business	Gas line is a development work. It will bring in well fare for the country and the people. There will not be any disadvantage.
2	Tajul Islam S/o Late Akkas Vill Atiakhola P.o Nagarbar Thana – Daudkandi Dist. Comilla	Business	Gas will facilitate our cooking. Everyone will be benefited. There will not be any problem.
3	Abdul Aowal Sikder S/o Munsur Ali Sikder Vill- Tamta P.o Eliatganj Thana – Daudkandi Dist. Comilla	Farmer	Gas line is needed for the development of the country. Economic problem may be solved by availing this opportunity.
4.	Md. Abad Mia S/o Abdul Jolil Vill- Tamta P.o Eliatganj Thana – Daudkandi Dist. Comilla	Farmer	Gas line would be very good. There won't be any problem.
5	Md. Alauddin S/o Md. Late Shahadat Vill- Tamta P.o Eliatganj Thana – Daudkandi Dist. Comilla	Business	Cooking will be done by gas. Shall generate employment opportunity for women.
6.	Md. Jakir Member S/o Late Roson Ali Vill- Tamta P.o Eliatganj Thana – Daudkandi Dist. Comilla	Business	Price of land will increase with gas line passing through. There will be no disadvantage
7	Md. Kuddus Sikder S/o Late Kadim Sikder		Gas is a natural resource. It is very essential for us. There will not be any problem.

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Table-5.9: Focus Group Discussion at Muradnagar, Comilla

Date: 07/07/2007 **Interviewer:** Md. Rejaul Karim **Venue:** Muradnagar, Comilla

Sl. No.	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
01.	Md. Monir Hossain S/o: Fajlur Rahman Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Service	It is in the opinion of the inhabitants of the locality and the respectable gentlemen that this is a good endeavor. Some said that gas line will damage our farms, houses and fellow lands, but still then it will bring in benefits too. There will be Mills and Industries in rural areas due to availability of gas. Gas will be used for the domestic purpose too.
02.	Md. Joynal Abedin S/o. Late Akkas Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Service	
03.	Md. Amir Hossain S/o: Abdus Samad Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Business	
04.	Md. Akter Hossain S/o.: Late Nawab Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Business	
05.	Md. Humayun Kabir S/o.: Abdul Motin Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Business	
06.	Md. Md. Shah Alam S/o.: Late Md. Rahman Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Service	
07.	Md. Harun-or-Rashid S/o.: Late Khorshed Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Farmer	
08.	Md. Abdul Jalil S/o.: Late Moti Mia Vill: Bakhrabad Post: Zohapur P/s. Muradnagar Dist: Comilla	Business	

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Table-5.10: Focus Group Discussion at Muradnagar, Comilla

Date: 08/07/2007 **Interviewer:** Md. Rejaul Karim **Venue:** Muradnagar, Comilla

Sl. No.	Name and Address of Key Informants	Profession	Issues Discussed/ Suggestion
01.	Md. Bazlu Mia S/o: Late Akbar Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Farmer	It is opined by the distinguished persons that, it is a good job. It is a good sign of having a gas line and the bad side of this is that it would damage the farm lands and the house of the public while it will benefit them too.
02.	Kuddus Mia S/o. Late Mahar Ali Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Non farmer	
03.	Md. Alam S/o: Late Rawshan Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Business	
04.	Md. Taed Member S/o.: Late Abed Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Business	
05.	Md. Jalil Member S/o.: Ardop Ali Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Farmer	
06.	Md. Mizan S/o.: Late Shiraj Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Grocer	
07.	Md. Ruhul Amin S/o.: Arob Ali Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Business	
08.	Md. Halim S/o.: Renu Mia Vill: Daliakandi Post: Daliakandi P/s. Muradnagar Dist: Comilla	Driver	

Table-5.11: Focus Group Discussion Summary

Sl. No.	Date	Place	Participants										Opinion Expressed
			Student	Service	Business	Farmer	UP Member	Imam	Teacher	Driver	Grocer	Total	
1	29/06/2007	Vatipara, Sonargaon	1	4	2							7	**Requested For:** Proper compensation has to be given. Opportunity should be given to use gas as a fuel in the industries. Some of them wanted rehabilitation. Gas has to be provided in these localities for burning as a fuel. Gas price has to be reduced. Shall co-operate if they are either properly compensated or secure good advantages.
2	01/07/2007	Bhaberchar, Munshiganj		3	2	2						7	**Comments:** Those persons will be exclusively losers, whose housing will be damaged by the gas line. But other than them, none of the locality will be affected by the gas line.
3	01/07/2007	Baoshia, Munshiganj		3	1	1	1	1				7	Price of land will increase with gas line passing through. There will be no disadvantage
4	02/07/2007	Baoshia, Munshiganj		1	4	1	1					7	Shall generate employment opportunity for women.
5	05/07/2007	Daudkandi, Comilla			2	1			4			7	Gas line is needed for the development of the country. Economic problem may be solved by availing this opportunity.
6	06/07/2007	Muradnagar, Comilla		1	3	2				1		7	There may be temporary loss in laying the line but this will bring in more profit.
7	04/07/2007	Daudkandi, Comilla			4	3						7	Gas line is a development work of the country. This will help improving social & economic conditions.
8	07/07/2007	Muradnagar, Comilla		3	4	1						8	Gas line will be of advantage to the local people. There will not be any disadvantage
9	08/07/2007	Muradnagar, Comilla			3	3				1	1	8	Setting up of industries will help solving employment problem. Gas will create employment opportunities for the people.
Total:			1	15	20	10	2	1	4	2	1	56	**Suggestions:** Leveling and filling of the undulated ground has to be done after the laying of the gas line. Work has to progress so that no accident happens in future.

Table-5.12: Public Consultations

Project Name	Issues Discussed	Issue Raised	Suggestions
Bakhrabad-Siddhirganj Gas Transmission Pipeline	Impact of construction of high pressure Gas Transmission pipeline	- Build up new Industrious	- New industry will develop upon proper installation of gas pipeline.
		- Reduce Unemployment	- Labour should be taken from that locality.
		- Social & Economic development	- Living status will be high.
		- Land & property damage	- Due compensation to be paid according to the latest approval price list.
		- Crop damage	- Due compensation to be paid on the spot
		- Fruit trees damage	- Due compensation to be paid on the spot
		- Gas availability	- Discuss with superior person of the locality
		- Compensation assessment	- Compensation assessment by DC and local leader
		- Affect to private forest	- Try to avoid reserve forest
		- Fish breeding	- Must avoid breeding time
		- Affected Homestead	- Due Compensation to be given
		- Pollution of air and surface water	- Monitoring shall be adopted
		- Sanitary problem	- Sanitary system should be developed during gas pipeline installation.

Table-5.13: Details of Participants and their Classification in Different Public Consultation Sites during Stage-2 Plot to Plot Field Survey along the route between December 2007 & January 2008

Date	Places	Total				Total
		Land, House & Tree Owners	Focus Group/ Local People	GTCL/ NSO Professionals	BETS Professionals	
27-12-2007	Gangutia Jahapur Boroyakuri Kazirtol	98	2	1	4	104
28-12-2007	Uttar Ampal Dakkhin Ampal Saliakandi Viti Panchpukuris	61	5	1	5	72
29-12-2007 30-12-2007	Narshingpur Doyara Babatipara Baskhola Tamta, Bitmen	91	7	2	3	103
31-12-2007	Potia Bashra Malikhil Ratanpur Zinglatoli	122	3	1	3	128
01-01-2008 02-01-2008	Tinsita Etakhola Isapur Ranga Semulia Chandipasha Zagir Chandipasha Sundolpur	96	2	2	4	104
03-01-2008 04-01-2008	Sendi South Gazipur	74	2	2	2	80

Date	Places	Total				Total
		Land, House & Tree Owners	Focus Group/ Local People	GTCL/ NSO Professionals	BETS Professionals	
	Kazir Court Daulatdi North Nasaruddin					
05-01-2008	Ganga Prashad Char Char Baushia Porarchak Baushia	51	3	1	2	56
06-01-2008 07-01-2008	Middle Baushia Baushia Lakhipur Sree Nagar Chatalipur Umederkandi	51	3	1	3	58
08-01-2008 09-01-2008	Vater Char Tangar Char Hosendi Chaliakandi Vabanipur	94	4	1	3	102
10-01-2008	Asrariar Char Asrafdi Bhairabdi Char Ramjan Dhudhghata Gudarughat Kabilgonj Menikhali Monggolergaon	70	2	1	3	76
11-01-2008	Sukurdi Srirampur Baligaon Baro para	38	2	1	2	43
12-01-2008	Amoir Bagnanagar Bangashason Chapatoli Fulor Horipur Kantoi Kewdhala	65	3	2	2	72

Table-5.14: Different Types of Unconditional/ Conditional Response to Acquisition/ Requisition Received from Land and Structure losing PAP

Agreed without any Condition	Proper Payment	Payment in Cash	Payment Through Bank	Payment of Double the loss	Land for Land	Misc. other Conditions	Total
363	**198**	**162**	**21**	**100**	**49**	**18**	**911**

Table-5.15: Details of PAP Requested Compensation in the form of Land for Land

Sl. No.	Segment	Plot No.	Acquisition (dec.)	Requisition (dec.)
1	0-5	300	1	2
2	0-5	223	3	6
3	0-5	31, 32	4	8
4	0-5	462	3	5
5	0-5	461	3	6
6	0-5	876	4	6
7	0-5	880, 881	2	4
8	0-5	883	1	2
9	0-5	884	2	3

Sl. No.	Segment	Plot No.	Acquisition (dec.)	Requisition (dec.)
10	0-5	885, 886	2	3
11	0-5	898, 899	3	5
12	0-5	12	3	5
13	0-5	39	2	4
14	0-5	376	2	4
15	0-5	16	3	6
	Sub-Total		**38**	**69**
16	5-10	91	2	3
17	5-10	1177, 1178	1	2
18	5-10	1214, 1215	2	4
19	5-10	1250, 1254	3	4
20	5-10	191, 195	3	7
21	5-10	1202, 981	4	6
	Sub-Total		**15**	**26**
22	10-15	248, 249	1	2
23	10-15	447, 449	2	3
24	10-15	450	3	5
25	10-15	440	3	4
26	10-15	442	2	4
27	10-15	334	5	6
28	10-15	330	6	10
29	10-15	409	3	7
	Sub-Total		**25**	**41**
30	20-25	100, 119	10	15
31	20-25	8, 4	3	5
32	20-25	80, 81	1	2
	Sub-Total		**14**	**22**
33	25-30	189, 193	5	7
34	25-30	242	4	5
35	25-30	243	4	6
36	25-30	194	3	4
37	25-30	152	3	4
	Sub-Total		**19**	**26**
38	40-45	140, 144	2	3
39	40-45	34, 35	2	3
	Sub-Total		**4**	**6**
40	45-50	161	2	3
41	45-50	125	4	5
42	45-50	182	2	3
43	45-50	457	2	4
44	45-50	455	3	4
45	45-50	163	2	4
	Sub-Total		**15**	**23**
46	50-55	156	5	8
47	50-55	201	2	3
48	50-55	478	2	4
49	50-55	2299	2	3
	Sub-Total		**11**	**18**
	Grand-Total:		**141**	**231**

Table-5.16: Miscellaneous Other Conditions Cited by the 18 Land and Structure Losing PAPs.

Q. No.	Plot No.	Mouza	Upazila	Others
14	293	Gangutia	Muradnagar	If provided with job
146	879	Jahapur	Muradnagar	If provided with job
154	524,525	Jahapur	Muradnagar	Direct payment of compensation
693	572	Boroikuri	Muradnagar	Homestead for Homestead
694	572	Boroikuri	Muradnagar	Homestead for Homestead
44	106,111,112	Kajirtol	Muradnagar	Direct payment of compensation
53	323,324	Kajirtol	Muradnagar	If provided with job
71	772	Kajirtol	Muradnagar	Payment should made without Any hassle

Q. No.	Plot No.	Mouza	Upazila	Others
76	464	Kajirtol	Muradnagar	Payment should made without Any hassle
58	297,298	Kajirtol	Muradnagar	If provided with job
59	67,38	Kajirtol	Muradnagar	Direct payment of compensation
70	774	Kajirtol	Muradnagar	Homestead for Homestead
45	73	Kajirtol	Muradnagar	Payment should be made before starting the work
169	785,786,790	Viti Pachpukuria	Muradnagar	If provided with job
484	529	Ratanpur	Daudkandi	Direct payment of compensation
682	8201,8197,8191	Char Bausia	Gazaria	There will be no loss if line is laid along the Govt. land
683	8133,8137	Char Bausia	Gazaria	There will be no loss if line is laid along the Govt. land
726	204,217,218	Dhudghata	Sonargaon	If provided with job

Table-5.17: Summary of PAP Response to Gas pipeline Construction

Comments	H/H No.	%
Positive without any condition	363	39.84
Positive on conditions of proper compensation, providing job etc	548	60.15
Alternate suggestion	2	00.01
Negative	0	0.00
Total	**911**	**100.00**

Table- 8.3: Estimated Budget Based on Market Values

Cost Item	Market Amount (Taka)	Payment Project
1. Replacement value of land (12393.23 decimal) (12393.23x@Tk .23600 /decimal) budget for acquisition	292480228	Rest as grant
2. Compensation for affected structure (18 Structure) i) Cost of structure	6355765	Rest as grant
3. Compensation for trees (561 trees): Tk. 631686 iv) Income loss for fruit@10%as grant lump sum amount: Tk.63168.60	694854.60	Rest as grant
4.1 Compensation for Standing crops (land under acquisition). Total land: 12393.23 decimal (12393.23xTk 1200):	14871876	Rest as grant
4.2 Renting of requisition land 24099.79 x Tk 1200 :	28919748	
6. Stamp & additional grant @ 20% on land price	584960.5	Grant
8. Cost of NGO Services (Lump sum amount), if required	5,000,000.00	-
Total:	348907432	
9. Incidental charge i) 20% on estimated cost :	697814.8642	-
10. Administrative Cost @ 20%	697814.8642	
Grand Total:	**351000876.6**	

ANNEX-02

QUESTIONNAIRES

বাখরাবাদ-সিদ্ধিরগঞ্জ গ্যাস সঞ্চালন পাইপ লাইন প্রকল্পের আর্থ-সামাজিক, পরিবেশ ও পূনর্বাসন সম্পর্কিত জরিপ প্রশ্নপত্র।

ক্রমিক নং: .....

আর্থ-সামাজিক প্রশ্নাবলী

১.০ সাধারণ খানা পরিচিতি : _____

১.১ উত্তর দাতার নাম : _____

১.২ পিতা/স্বামীর নাম : _____

১.৩ গ্রাম : _____

১.৪ মৌজা : _____

১.৫ ইউনিয়ন : _____

১.৬ উপজেলা : _____

১.৭ জেলা :

১.৮ ধর্ম : ইসলাম [১] হিন্দু [২] খ্রিষ্টান [৩] বৌদ্ধ [৪] অন্যান্য [৫]

২.০ **খানার সদস্যদের তথ্যাবলী ঃ**

২.১ পরিবারের মোট সদস্য : পুরুষ _____ মহিলা _____ মোট _____

২.২ খানার তথ্য (খানার প্রধান থেকে শুরু), কোড ব্যবহার করতে হবে।

ক্রমিক নং	খানার প্রধানের সাথে সম্পর্ক	বৈবাহিক অবস্থা	বয়স	লিঙ্গ	শিক্ষা	প্রধান পেশা	গৌণ পেশা	প্রধান কাজের স্থান
১.	খানার প্রধান							
২.								
৩.								
৪.								
৫.								
৬.								
৭.								
৮.								
৯.								
১০.								

কোডিং পদ্ধতি ঃ

সম্পর্ক	
খানা প্রধান	= ১
স্বামী/স্ত্রী	= ২
পুত্র/কন্যা	= ৩
পিতা/মাতা	= ৪
ভাই/বোন	= ৫
পুত্রবধূ/জামাতা	= ৬
শ্বশুর/শাশুরী	= ৭
পারিবারিক সাহায্যকারী	= ৮
নাতি/নাতনী	= ৯
অন্যান্য	= ১০

পেশা	
কৃষক	= ১
জেলে	= ২
কৃষি মজুর	= ৩
অকৃষি দিন মজুর	= ৪
চাকরী	= ৫
ব্যবসা	= ৬
ক্ষুদ্র ব্যবসা	= ৭
গৃহস্থালীর কাজ	= ৮
ছাত্র	= ৯
শিশু (৫ বছরের কম)	= ১০
অবসরপ্রাপ্ত/পঙ্গু	= ১১
বেকার	= ১২
বিদেশে অবস্থানরত	= ১৩
অন্যান্য	= ১৪

শিক্ষা	
নিরক্ষর	= ৯৯
শুধুমাত্র পড়তে পারে	= ৯১
পড়তে ও লিখতে পারে	= ৯২
শিশু (৪ বছরের নীচে	= ১
প্রাথমিক (১ম-৫ম শ্রেণী)	= ২
মাধ্যমিক (৬ষ্ঠ-১০ম শ্রেণী)	= ৩
এস.এস.সি./সমমান	= ৪
এইচ.এস.সি/সমমান	= ৫
এইচ.এস.সির উপরে	= ৬
স্নাতক	= ৭
মাষ্টর্স ও তদোর্ধ	= ৮
অন্যান্য	= ৯

প্রধান কাজের স্থান	
গ্রাম	= ১
ইউনিয়ন	= ২
উপজেলা	= ৩
জেলা	= ৪
অন্য জেলা	= ৫
বিদেশে	= ৬

লিঙ্গ	
পুরুষ	= ১
মহিলা	= ২

বৈবাহিক অবস্থা	
বিবাহিত	= ১
অবিবাহিত	= ২
বিধবা	= ৩
বিপত্নীক	= ৪
তালাকপ্রাপ্ত	= ৫
বিচ্ছিন্ন	= ৬
অন্যান্য	= ৭

৩.০ খানার সম্পদ তথ্যাবলী

৩.১ বসত বাড়ীর ধরণ: [১] নিজের [২] ভাড়া [৩] অন্যান্য

৩.২ বসতবাড়ীর প্রকার: [১] কাঁচা [২] আংশিক পাকা [৩] পাকা [৪] অন্যান্য

৩.৩ ছাদের ধরণ: [১] খর/ছন [২] টাইলস [৩] টিন [৪] পাকা

৩.৪ খানার মোট জমির পরিমান (শতাংশ)ঃ বসতবাড়ি _____ জমি _____ মোটঃ _____

৩.৫ বৈদ্যুতিক সুবিধা: [১] আছে [২] নেই

৩.৬ রান্নার জ্বালানী: [১] পাইপ গ্যাস [২] সিলিন্ডার গ্যাস [৩] কেরোসিন ষ্টোভ

[৪] বিদ্যুৎ [৫] লাকড়ী/পাতা/কৃষিজ উচ্ছিষ্ট [৬] গোবর [৭] অন্যান্য

৪.০ পানি সরবরাহ এবং পয়ঃনিস্কাশন:

৪.১ পানির উৎস ঃ

ব্যবহারের ধরণ	অগভীর নলকূপ	গভীর নলকূপ	পানির সরবরাহ	পাতকুয়া	পুকুর	খাল/নদী খাল/নদীর নাম
খাওয়া						
রান্না, ধোয়া						
গোছল						
গরু ছাগল ধোয়া						

৪.২ নিজের কি টিউবওয়েল আছে ? হ্যাঁ, কাজ করে: _____ অকেজো _____ নাই _____

৪.৩ যদি নিজের কোন টিউবওয়েল না থাকে তাহলে নিকটবর্তী টিউবওয়েল কত দূরে? _____ ফুট

৪.৪ আপনার টিউবওয়েলের পানি কি আর্সেনিকমুক্ত ? হ্যাঁ [১] না [২] পরীক্ষাকৃত নহে [৩]

৪.৫ আপনি/আপনার পরিবার কি ধরণের পায়খানা ব্যবহার করে?

[১] স্যানিটারী [২] পিট [৩] ঝুলন্ত [৪] খোলা জায়গা [৫] অন্যান্য

৪.৬ পায়খানার পর কিভাবে হাত ধৌত করেন ?

[১] শুধু পানি [২] সাবান [৩] ছাই [৪] মাটি [৫] অন্যান্য

৫.০ স্বাস্থ্য তথ্যঃ

৫.১ প্রধান রোগ (গত দুই বছরে আপনার পরিবারের কোন সদস্য রোগে ভুগে থাকলে)

রোগ কোড	চিকিৎসা কোড

[রোগ কোডঃ ডায়রিয়া-১, টাইফয়েড-২, আমাশয়/পেটের অসুখ-৩, জন্ডিস (কুমলি)-৪, চর্মরোগ (চুলকানি)-৫, ইনফ্লুয়েঞ্জা/কফ/সর্দি জ্বর-৬, হাঁপানী/শ্বাসকষ্ট-৭, ধনুষ্টংকার-৮, যক্ষা-৯, অন্যান্য-১০, (উল্লেখ করুন ... .)]

[চিকিৎসা কোডঃ গাছ-গাছড়া/কবিরাজ-১, হোমিওপ্যাথি-২, পীর/ফকির/তাবিজ/কবজ-৩, গ্রাম্য ডাক্তার/ ফার্মেসী-৪, এম.বি.বি.এস. ডাক্তার/ হাসপাতাল-৫, চিকিৎসা নেইনি-৬, জানিনা/মনে নেই-৭, অন্যান্য-৮, (উল্লেখ করুন .....)]

৫.২ এলাকার প্রধান স্বাস্থ্য সেবাঃ

[১] সরকারী হাসপাতাল [৩] ইউনিয়ন স্বাস্থ্য ক্লিনিক [৫] ভাল ডাক্তার

[২] প্রাইভেট ক্লিনিক [৪] এনজিও ক্লিনিক [৬] ভাল ঔষুধের দোকান

[৭] পল্লী চিকিৎসক

৬.০ কৃষি সংক্রান্ত তথ্যাবলী

৬.১ গত বছরে ফলানো ফসলঃ

ক্রমিক নং	ফসলের নাম	জমির পরিমান (শতাংশ)	ফসলের পরিমান (কেজি)	ক্রমিক নং	ফসলের নাম	জমির পরিমান (শতাংশ)	ফসলের পরিমান (কেজি)
১.	রোপা আমন			১১.	মরিচ		
২.	বোনা আমন			১২.	ধনিয়া		
৩.	আউশ			১৩.	হলুদ		
৪.	উফশী বোরো			১৪.	আদা		
৫.	পাট			১৫.	আখ		
৬.	গোলআলু			১৬.	সরিষা		
৭.	মিষ্টি আলু			১৭.	বাদাম		
৮.	ডাল			১৮.	পান		
৯.	পিয়াঁজ			১৯.	অন্যান্য		
১০.	রসুন						

৬.২ কৃষকের ধরণঃ [১] নিজ জমিতে চাষ [২] নিজ ও অন্যের জমিতে [৩] শুধু জমির মালিক [৪] বর্গা চাষী

৭.০ **গাছপালা/ বাগান**

৭.১ বাড়িতে কি কি ফল গাছ আছে?

ক্রঃ নং	গাছের নাম	সংখ্যা	ক্রঃ নং	গাছের নাম	সংখ্যা	ক্রঃ নং	গাছের নাম	সংখ্যা	ক্রঃ নং	গাছের নাম	সংখ্যা
১.	কলা		৭.	পেয়ারা		১৩.	কুল		১৯.	লেবু	
২.	কাঁঠাল		৮.	কালজাম		১৪.	সোফেদা		২০.	কমলা	
৩.	আম		৯.	জামবুরা		১৫.	আমলকি		২১.	আনারস	
৪.	লিচু		১০.	বেল		১৬.	ডালিম		২২.	অন্যান্য কাঠ	
৫.	পেপেঁ		১১.	কদবেল		১৭.	চালতা		২৪.		
৬.	নারিকেল		১২.	আতা		১৮.	কামরাঙ্গা		২৫.		

৭.২ আপনি কি গত বছর গাছ কর্তন করেছেন? [১] হ্যাঁ [২] না যদি হ্যাঁ, সংখ্যা _____

৭.৩ আপনি কি গত বছর কোন গাছ লাগিয়েছেন? [১] হ্যাঁ [২] না যদি হ্যাঁ সংখ্যা _____

৭.৪ আপনি কি বসতবাড়ির চারপাশে শাকসব্জী চাষ করেছেন? [১] হ্যাঁ [২] না

৭.৫ গত এক বছরে কি কি ধরণের সব্জি/ফল চাষ করেছিলেন (√ দিন)?

১.	লাউ	৯.	চিচিঙ্গা	১৭.	শসা	২৫.	শালগম
২.	কুমড়া	১০.	ধুন্দল	১৮.	শিম	২৬.	কচু
৩.	মিষ্টি কুমড়া	১১.	পুঁই শাক	১৯.	বরবটি	২৭.	উচ্ছে
৪	ডাটা	১২.	লাল শাক	২০.	কাকরুল	২৮.	অন্যান্য (উল্লেখ করুন ---)
৫.	মুলা	১৩.	সজিনা	২১.	টমেটো		
৬.	বেগুন	১৪.	অড়হর	২২.	ফুলকপি		
৭.	পটল	১৫.	ঢেঁড়শ	২৩.	বাধাকপি		
৮.	ঝিঙ্গা	১৬.	ওলকপি	২৪.	গাজর		

৮.০ **অর্থনেতিক তথ্যঃ**

৮.১ আপনার পরিবারে উপার্জনকারীর সংখ্যা: পুরুষ _____ মহিলা _____ মোট _____

৮.২ পরিবাবের গড় মাসিক আয়: _____ টাকা

৮.৩ পরিবাবের গড় মাসিক ব্যয়: _____ টাকা

৮.৪ গত বছর কি আপনার ঋণের প্রয়োজন হয়েছিল? [১] হ্যাঁ [২] না

৮.৫ গত বছরের ঋণের পরিমানঃ _____ টাকা উৎসঃ (১) ব্যাংক (২) এনজিও (৩) অন্যান্য

৮.৬ মোট ঋণের পরিমানঃ _____

৯.০ **পরিবেশ সংক্রান্ত তথ্যাবলী ঃ**

৯.১ আপনার এলাকায় কি কি বন্যপ্রাণী বর্তমানে দেখা যায়?

(হ্যাঁ হলে √দিন, একাধিক উত্তর হতে পারে)

১	অতিথি পাখী	২	দেশী পাখী	৩	সাপ	৪	গুইসাপ	৫	ব্যাঙ
৬	শিয়াল	৭	শূকর	৮	বনবিড়াল	৯	বানর	১০	বেজী
১১	কাঠ বিড়ালী	১২	খোস্তাশ	১৩	খরগোশ	১৪	অন্যান্য _____		

৯.২ আপনার এলাকায় পরিবেশ দূষণ বা পরিবেশ নষ্ট হবার কারণ কি কি?

(১) শিল্প কল করখানার বর্জ্য (২) ইটের ভাটা (৩) বাড়ীর তরল ও কঠিন বর্জ্য (৪) অন্যান্য.....

১০.০ **মৎস্য সম্পদ ঃ**

১০.১ বর্তমানে এইখানে কি কি মাছ পাওয়া যায় ?_____

_____

১০.২ কি কি মাছ আগে বেশী পাওয়া যেত এখন কম পাওয়া যায় ? _____

_____

১০.৩ কি কি মাছ এখন পাওয়া যায় না ? _____

_____

১১.০ **ঐতিহাসিক নিদর্শন/পুরাকীর্তি/সংস্কৃতি ঃ**

১১.১ আপনার এলাকায় কোন আদিবাসী শ্রেণী আছে ? [১] হ্যাঁ [২] না

১১.২ হ্যাঁ হলে আদিবাসী শ্রেনীর নাম ও আনুমানিক সংখ্যা ?

১১.৩ এলাকায় কোন ঐতিহাসিক নিদর্শন অথবা পুরাকীর্তি আছে ? [১] হ্যাঁ [২] না

১১.৪ হ্যাঁ হলে তার নাম ও অবস্থান _____

_____

_____

১১.৫ এলাকায় কোন পুরানা মসজিদ, মন্দির, প্যাগোডা, বৌদ্ধবিহার, গীর্জা, গোরস্থান আছে ?

হ্যাঁ [১] না [২]

১১.৬ থাকলে তার সংখ্যা/নাম/অবস্থান _____

১২.০ **প্রকল্প সংক্রান্ত ঃ**

১২.১ আপনি কি জানেন এ এলাকার উপর দিয়ে গ্যাস পাইপ লাইন যাবে?

হ্যাঁ [১] না [২]

১২.২ আপনার এলাকা দিয়ে গ্যাস পাইপ লাইন গেলে তা কি ভাল হবে বলে মনে করেন?

হ্যাঁ [১] না [২] কারণ.....

১২.৩ পাইপ লাইন বসানোর কাজ কিভাবে করে, সে সম্পর্কে আপনার কি কোন ধারনা আছে?

হ্যাঁ [১] না [২]

১২.৪ প্রকল্পের যে কোন সংশ্লিষ্ট সমস্যা সমাধানে আপনি কি সহযোগিতা প্রদান করবেন? [১] হ্যাঁ [১] না

১২.৫ আপনি কি মনে করেন এই প্রজেক্ট এর কারণে পরিবেশের উপর কোন ক্ষতি প্রভাব পড়বে?

হ্যাঁ [১] না [২]

১২.৬ ক্ষতির ধরণ ঃ

১২.৬.১ কৃষির উপর ?	হ্যাঁ	১	না	২
১২.৬.২ গাছপালার উপর ?	হ্যাঁ	১	না	২
১২.৬.৩ মাছের উপর ?	হ্যাঁ	১	না	২
১২.৬.৪ বনাঞ্চলের উপর ?	হ্যাঁ	১	না	২
১২.৬.৫ গবাদিপশুর উপর ?	হ্যাঁ	১	না	২
১২.৬.৬ বন্য প্রানীর উপর ?	হ্যাঁ	১	না	২
১২.৬.৭ আয় রোজগারের উপর ?	হ্যাঁ	১	না	২
১২.৬.৮ মানুষের চলাচলের উপর ?	হ্যাঁ	১	না	২
১২.৬.৯ যানবাহনের উপর ?	হ্যাঁ	১	না	২
১২.৬.১০ বাড়ি ঘরের উপর ?	হ্যাঁ	১	না	২

১২.৭ আপনার জমির উপর দিয়ে বা বাড়ির কাছে দিয়ে প্রকল্পের কাজ পরিচালিত হলে আপনি কি তা করতে দেবেন?

হ্যাঁ [১] না [২] শর্তসাপেক্ষে [৩]

১২.৭.১ শর্তসাপেক্ষে হলে কি ধরনের শর্ত ?

(ক) উপযুক্ত ক্ষতিপূরন পেলে [১]
(খ) অল্প সময়ের জন্য হলে [২]
(গ) বাড়িঘরের ক্ষতি না করলে [৩]

১২.৮ ক্ষতিপূরনে জন্য আপনার কোন মতামত আছে?

হ্যাঁ [১] না [২]

১২.৮.১ থাকলে তা কি----------

১২.৯ প্রজেক্টের কারণের পরিবেশের উপর ক্ষতিকর প্রভাব কমানোর/দূর করার আপনার কোন পরামর্শ কি আছে?

হ্যাঁ [১] না [২]

১২.৯.১ পরামর্শ থাকলে তা কি? _____

_____

১২.১০ আপনি কি গ্যাস ট্রান্সমিশন কোম্পানী (জিটিসিএল) কে সহযোগিতা দেবেন?

হ্যাঁ [১] না [২]

১২.১০.১ হ্যাঁ হলে, তা কিভাবে? _____

পূনর্বাসন সম্পর্কিত প্রশ্নাবলী
শুধুমাত্র ক্ষতিগ্রস্ত ব্যক্তির জন্য

১৩. ক্ষতিগ্রস্ত ব্যক্তির নাম.....

১৪. ক্ষতিগ্রস্ত ব্যক্তির পিতার নাম.....

১৫. গ্রাম.....১৬. মৌজা.....

১৭. ইউনিয়ন.....১৮. উপজেলা.....১৯. জেলা.....

২০. ক্ষতিগ্রস্থ জমির ধরণ (√) দিন

(ক) জমির ক্ষতি	জমির পরিমান	ক্ষতিগ্রস্ত জমির পরিমান (শত্যাংশ	ক্ষতিগ্রস্ত জমির মোট মূল্য	স্থায়ী/অস্থায়ী (√) দিন
১) ভিটি জমি	জমির পরিমান.....শতাংশ			স্থায়ী/অস্থায়ী
২) কৃষি জমি	জমির পরিমান.....শতাংশ			স্থায়ী/অস্থায়ী
৩) জলাশয়	জমির পরিমান.....শতাংশ			স্থায়ী/অস্থায়ী

(গ) গাছের ক্ষতি *(২১ নং প্রশ্ন দেখুন)*

(ঘ) অবকাঠামোর ক্ষতি

(ঙ) ব্যবসার ক্ষতি

২১. ক্ষতিগ্রস্থ ব্যক্তির জমির মোট পরিমান _____ শতাংশ

২২. ক্ষতিগ্রস্থ জমির পরিমান _____শতাংশ

২৩. ক্ষতিগ্রস্থ জমির ধরণ : (√ দিন)

(১) আবাদী (২) অনাবাদী (৩) পরিত্যক্ত

(৪) জমির দাগ নং..... (৫) মৌজার নামঃ.....

২৪. ক্ষতিগ্রস্থ জমির দাম একর প্রতি _____

২৫. ক্ষতিগ্রস্থ অবকাঠামো থাকলে (ধরণ):_____

		দৈর্ঘ্য ও প্রস্থ্য	- মূল্য
(ক) (১) মেঝে..... (২) দেয়াল.....	(৩) ছাদ	.....	.....
(খ) (১) মেঝে ..... (২) দেয়াল	(৩) ছাদ	.....	.....
(গ) (১) মেঝে..... (২) দেয়াল	(৩) ছাদ	.....	.....

[কোড ঃ (১) কাঁচা (২) টিন (৩) পাকা]

(ক) অবকাঠামো তৈরী হয়েছিল কবে ? (১).....সন (২) .....সন (৩).....সন

(খ) অবকাঠামো তৈরী হয়েছিল কবে ? (১).....সন (২) .....সন (৩).....সন

(গ) অবকাঠামো তৈরী হয়েছিল কবে ? (১).....সন (২) .....সন (৩).....সন

২৬. ফসল ক্ষতিগ্রস্থ হয়ে থাকলে ধরণঃ

২৭. (১) ধান (২) গম (৩) ডাল (৪) সবজি (৫) পান (৬) অন্যান্য

ক) ক্ষতিগ্রস্থ ফসল.....শতাংশ প্রতি উৎপাদন..... মন প্রতি মূল্য.....

খ) ক্ষতিগ্রস্থ ফসল.....শতাংশ প্রতি উৎপাদন..... মন প্রতি মূল্য.....

গ) ক্ষতিগ্রস্থ ফসল.....শতাংশ প্রতি উৎপাদন..... মন প্রতি মূল্য.....

২৮. ক্ষতির পরিমান _____ টাকা

২৯. ব্যবসা ক্ষতিগ্রস্থ হলে ব্যবসার ধরণ : _____

২৯.১ দৈনিক ক্ষতি ☐

২৯.২ মোট মূলধন ☐

৩০. ক্ষতিগ্রস্থ জলাশয় থাকলে _____ মোট ক্ষতি.....শতাংশ

৩১.১ দৈর্ঘ্য ঃ.....(ফুট) প্রস্থ ঃ .....(ফুট)

৩১.২ জলাশয়টিতে মাছের চাষ করা হলে

বিবরণ : _____

_____

৩২. ক্ষতিগ্রস্থ বৃক্ষঃ

গাছের নাম	বড় সংখ্যা	আনুমানিক মূল্য (টাকা)	মাঝারী সংখ্যা	আনুমানিক মূল্য (টাকা)	ছোট সংখ্যা	আনুমানিক মূল্য (টাকা)
মোটঃ						

৩৩. ক্ষতিপূরণ হিসেবে কি চান ?

(ক) জমি

(খ) সঠিক মূল্য

(গ) অন্যান্য _____

৩৪. ক্ষতিপূরণ প্রদান সর্ম্পকে মতামত : (√ দিন)

(ক) প্রদানের জন্য এন.জি.ও দরকার

(খ) সরাসরি জেলা প্রশাসকের কার্যালয় থেকে

(গ) অন্যান্য _____

৩৫. গ্যাস পাইপলাইন সর্ম্পকে মতামত : _____

_____

৩৬. প্রস্তাবিক প্রকল্পের সামাজিক, অর্থনৈতিক সুবিধা আছে কি? ☐ হ্যাঁ ☐ না

বিবরণ : _____

_____

৩৬.১ অর্থনৈতিক প্রতিকূলতা আছে কি? ☐ হ্যাঁ ☐ না ☐

বিবরণ _____

৩৭. ক্ষতিগ্রস্থের ধরণ:

(১) বন (২) পার্ক (৩) অন্যান্য

আয়তন (বর্গফুট): ☐ ☐ ☐

৩৮. অন্যান্য ক্ষতিগ্রস্থ সম্পদ ঃ (সংখ্যা)

(১) কূপ _____ (২) টিউবওয়েল _____ (৩) খাস জমি _____ (শতাংশ)

৩৯. অধিগ্রহণকৃত জমির কোন আইনি জটিলতা আছে কি?

(১) হ্যাঁ ☐ (২) না ☐

থাকলে কেমন _____

৪০. অধিগ্রহণকৃত জমিতে কোন ভাসমান লোক থাকলে তার সংখ্যা _____

৪০.১ বিবরণ দিন _____

৪১. জমি অধিগ্রহণের পূর্বে জমির মালিকের সাথে আলোচনার দরকার আছে কি ?

হ্যাঁ ☐ না ☐

৪২. কোন মসজিদ, সাংস্কৃতিক স্থান অধিগ্রহণ হলে বিবরণ দিন _____

_____

৪৩. মৌজার কোন আদিবাসী এলাকা ক্ষতিগ্রস্থ হয়েছে কি? ☐ হ্যাঁ ☐ না

সংখ্যা _____ জমির পরিমান _____

৪৪. আদিবাসীদের সর্ম্পকে এই প্রজেক্টের প্রভাব সম্পর্কে মন্তব্য করুনঃ

_____

_____

৪৫. শ্রমিকের দৈনিক মজুরী টাকা _____

৪৬. তথ্য সংগ্রহকারীর মতামত (ক্ষতিগ্রস্ত পরিবার প্রধান যদি মহিলা হন তাহলে তার পরিবারের আয় ব্যয় ও পূনর্বাসন সম্পর্কীয় মন্তব্য লিখুন)ঃ

_____

_____

৪৭. এই সাক্ষাতকাল গ্রহণকালে এলাকার কোন গন্যমান্য ব্যক্তির সঙ্গে পরিচিত হইলে তাহার নাম ও ঠিকানাঃ

নাম ঃ.....

ঠিকানা ঃ.....

পদবী ঃ.....

পেশা ঃ.....

সাধারণ মতামত ঃ.....

৪৮. বিশেষ গ্রহনীয় বিষয়ের উল্লেখ/মতামত ঃ .....

.....

.....

.....

তথ্য সংগ্রহকারীর নাম ঃ _____

তথ্য সংগ্রহের তারিখ ঃ _____

স্বাক্ষর ঃ _____ তারিখ ঃ _____

-ঃ ধন্যবাদ ঃ-

ANNEX-03

TERMS OF REFERENCE (TOR)

SECTION-5 : Terms of Reference

TERMS OF REFERENCE (TOR) AND SCOPE OF SERVICES

For

Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) & Resettlement Action Plan (RAP) of Proposed Bakhrabad-Siddhirganj Gas Transmission Pipeline

1.0 Background

Natural Gas is the significant source of commercial energy in Bangladesh and it is the prime mover of national economy. The Government emphasized on expansion of natural gas grid to the less developed areas for promoting extensive industrialization and accelerating balanced regional economic development of the country. Construction of several gas based power plants and industrial as well as commercial unit in Meghnaghat, Haripur, Siddhirganj and Narayanganj areas has resulted in enormous gas demand in that area. In order to help meet the gas demand for production of electricity, the Government of Bangladesh has requested assistance from the International Development Association (IDA) to prepare the proposed Bakhrabad-Siddhirganj Gas Transmission Pipeline Project. Thus, World Bank considered Installation of proposed 30" dia 65 km Bakhrabad-Siddhirganj Gas Transmission Pipeline is inevitable with a view to enhance capacity of Power Transmission grid as well as to meet gas demand of Meghnaghat, Haripur, and Siddhirganj and nearby areas.

The environmental legislation in Bangladesh, particularly, The Environmental Conservation Act,1997(recently amended-Amendment 2000), states that any development project shall require environmental clearance from the Department of Environment (DOE), Ministry of Environment and Forest, Government of the People's Republic of Bangladesh. The proposed Project falls under the "Red Category" as per the Environmental Conservation Rules of 1997, which requires to submit Initial Environmental Examination (IEE) report prior to Environmental Impact Assessment (EIA) report based on previously approved to obtain both Site Clearance and Environmental Clearance from the DOE. On the other hand being one of the World Bank proposed project necessary Social Assessment need to be carried out to prepare Social Assessment report/ Resettlement Action Plan for obtaining necessary clearance from World Bank. Thus, In order to implement the construction of proposed gas transmission pipeline and installation of related stations, the Gas Transmission Company Ltd. is need to conduct Environmental study i.e. IEE, EIA and RAP.

This Terms of Reference is for conducting Environmental study such as Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP) of the proposed 30" dia 65 Km Gas Transmission Pipeline from Bakhrabad to Siddhirganj including stations at Siddhirganj and Meghnaghat and to obtain clearance of DOE and WB as applicable for construction of the proposed pipeline and installation of stations.

2.0 Objective

The overall objectives of this assignment is to conduct Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) & Resettlement Action Plan (RAP) study for the

construction of the above mentioned pipeline including stations in order to assess the biophysical and socio-environmental impact if any, with recommendation of appropriate mitigation plan in the project area and to prepare reports on IEE, EIA & RAP for the Project(s) in accordance with the Environment conservation ACT 1995, The Environmental Conservation Rules 1997 the EIA guideline for Industries, Department of Environment (DOE),Asian Development Bank (ADB) and World Bank operational manual for Environmental assessment & Involuntary Resettlement Action Plan (Rev.April 2004) for submission to DOE and obtaining both Site clearance and Environmental clearance from DOE.

3.0 Project Components

The Project includes construction of high pressure Gas Transmission Pipeline from Bakhrabad to Meghnaghat and installation of two new stations i.e. City Gate Stations (CGS) at Siddhirganj and Town Border Staion(TBS) at Meghnaghat. The alignment of the propos d transmission pipeline has been fixed and location of the staions has been tentatively identified. The detail design of the installation of transmission pipeline and stations are in process.

4.0 The Regulation and Guideline Conduct the assessment

The regulations and guidelines of the Government of Bangladesh as well as the safeguard policies and guidelines of the World Bank shall govern the conduct of this assessment. Among others, they include:

- The laws and regulations of the Government of Bangladesh relevant to environment and social issues related to the project.
- Regional provincial or communal environmental assessment regulations:
- Environmental assessment regulations of any other organization involved in the project.

5.0 Study Area

The study area shall cover the entire area of the project from Bakhrabad to Siddhirganj. The study area shall include all the major facilities associated with the pipelines such as access or maintenance roads, the receiving, dispatch and control stations and the compressor stations or pumps stations, if any.

6.0 Site Visit

The consultant at their own responsibility and risk shall visit and examine the site works and their surroundings, social and physical aspects and to obtain all information that may be necessary for the purpose of execution of study and preparing of reports. Any cost associated with the site visit shall be borne by the consultant. Prior permission may be required in advance for visit to the sensitive sites.

7.0 Scope of work

The Consultant shall work with the scope defined within this "Terms of Reference". The following Steps will be required for conducting IEE, EIA and RAP

7.1 Approach and Methodology

The Consultant shall make necessary studies, investigation, experiment analysis, etc. to prepare reports and to meet the requirement of DOE & World Bank. The Consultant shall review other local and International studies. They shall also work in close coordination with the Local authority, Department of Environment and other concerned agencies. They shall provide necessary assistance in obtaining NOC (no objection certificate) from local authority, presentation of reports to DOE to obtain Site clearance and Environmental clearance.

The consultant shall undertake public consultations, involving all stake holders, throughout the study at relevant stages, to identify environmental issues/concerns relevant to the project including those relating to alignment of the pipeline, address the same in the Environmental Assessment and provide opinion on project design wherever relevant. The consultant shall document all the consultations including the issues raised and actions planned/taken and justifications for no action wherever relevant. The final report should discuss how the public concerns that are raised during different stages of consultations have been considered and addressed in the project.

7.2 Describe the proposed assignment with clear explanation of activities to be carried out to establish the transmission pipeline

Provide information on the following:

- Provide satellite image of proposed alignment;
- Present plans and status of the project;
- Layout of existing gas pipeline network and other utility services network (i.e: DESA,WASA,T&T etc. which one are applicable);
- Provide Project area maps at appropriate scales to illustrate general sting of project-related development sites and ROW's as well as surrounding areas likely to be environmentally and socially affected;
- These maps shall include topographic contours, as available, as well as locations of major surface waters, roads, railways, town centers, parks and reserves, and political boundaries;
- Also provide as available, maps to illustrate existing land use, including industrial, residential, commercial and institutional development, agriculture, etc;
- General layout of facilities at project related sites;
- Pre-construction activities;
- Provide information on the various operational control and safety system that are part of project design.

7.3 Alternative Analysis

The environmental assessment should also include an analysis of alternatives that would examine different alternatives with the objective of minimizing environmental, health, safety and social impacts of the project. The analysis would focus on the following :

- Alternative alignments to avoid/minimize damage to environmentally sensitive areas.
- Alternative sites for associated facilities (to improve public safety as well as to reduce public interference on such facilities).
- Provide opinion on alternative construction technologies.

7.4 Hazard and Risk Assessment

The environmental assessment should also include assessment of various hazards and risks associated with the operation of the gas pipeline and its associated facilities. The consultant shall identify the potential failures (e.g. leaks and raptures in pipelines) in different facilities that could lead to emergencies such as fire and/or explosion. Relevant quantitative models shall be used to evaluate the risks and impacts of such failures under different likely scenarios. Based on the assessment of risks and as per the international best practices, the consultant shall recommend the various preventive measures including the safe distances that need to be maintained while locating pipeline facilities in different land uses. The consultant shall also prepare an emergency response and preparedness plan in order to handle the various emergencies that are identified in the hazard assessment study.

7.5 Public Disclosure

The consultants are to provide support and assistance to the Client in meeting the disclosure requirements, which at the minimum shall meet the Government of Bangladesh and World Bank's policy on public disclosure. The consultants will prepare a plan for in country disclosure, specifying the timing and locations, translate the key documents, such as the Environmental Assessment summary in local language, and help the Client to place all the Environmental Assessment reports in the client's website. The consultants shall prepare a non-technical Environmental Assessment summary Report for public disclosure.

7.6 Description of the Environment and Social Base-line conditions

Collect, evaluate and present baseline up-to-date data on the environmental and social characteristics (air, water and soil quality data) of the impacting area. For ambient conditions, collect historical data, and collect field observations to validate. Include information on any changes anticipated before the project commences. Describe specific natural resources around the project area.

7.6.1 Physical Environments

Depict specific information around the project area on the following:

- Geology (e.g. stratigraphy and structure, seismic history if any of the areas.)
- Topography (e.g. drainage patterns around pipeline construction areas, view-shed around facilities)
- Soils (e.g. bearing capacity of soil, agriculture value, soil cover in residue disposal);
- Climate and meteorology;
- Ambient air quality ,
- Ambient water quality;
- Surface water hydrology;
- Receiving water quality (other major pollution sources in the area, if any);
- Ambient noise (note contribution from major sources, if any);
- Ground water table condition of the study area,
- Significant sources of pollution in the area and prospects for their mitigation.

7.6.2 Biological Environments

- Flora (e.g. types and diversity);
- Fauna (e.g. resident and migratory);
- Rare or endangered species within or in areas adjacent to project-related development sites or ROW's;
- Sensitive habitats; including wetlands, parks or reserves, significant wild lands, forests within or in areas downstream/downgrading of project-related development areas or ROWs; and
- Species of commercial importance in areas affected by the project.

7.6.3 Social Environment (include both present and projected, where appropriate).

- Population (i.e. full time and seasonal);
- Land use (i.e. year-round and seasonal);
- Planned development activities;
- Community structure;
- Employment and labour market;

- Distribution of income, goods and services (If possible, estimate average income for each source for representative family types);
- Recreation;
- Public health;
- Education;
- Cultural properties (e.g. archaeological and historically significant sites);
- Vulnerable groups (i.e; very poor, those without formal title ,household headed by woman, isolated groups, the disabled) and
- Customs, aspirations, and attitudes.

7.7 Legislative and Regulatory Considerations

- Describe the relevant regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection endangered species, sitting, and use control, land acquisition, compensation, etc. at the local, regional, national, and international levels.
- Review GOB's current policies, operational procedure and practices to address and mitigate social issues as well as the World Bank's social safeguard policy, OP 4.12 on Involuntary Resettlement and OP 4.01 on Environmental Assessment.
- Assess the compatibility of the core principles of the Governments' policies with World Bank policies, identify any gaps and suggest measures for policy enhancements where necessary.

7.8 Determination of the Potential Impacts of the Proposed Project

Identify all significant impacts, which the project would incur:

- These would include, among others: changes in the following; emissions and ambient air quality, effluents and ambient water quality, ambient noise, land-use ;
- Impacts due to land acquisition and storage of line pipe material,
- Impacts of the project and their activities on the community's access to social infrastructure- ecologically sensitive areas such as forests, wet lands, national parks, wild life etc.; cultural properties, potable water, health center, schools, irrigation, extension services, markets, roads, sources of credit, government scheme for development, etc. ;
- Assess the impacts from changes brought about by the project on baseline environmental and social conditions;
- Assess the impact on health and safety of public and workers,
- Distinguish between positive and negative impacts, direct and indirect impacts including impacts from possible accidents, and immediate and long-term impacts. Identify impacts, which are unavoidable or irreversible.
- Describe impacts quantitatively, in terms of environmental and social costs and benefit, assigning economic values when feasible.

7.8.1 Impacts during Construction

(i) *Environment Impacts due to*

- Loss of vegetation
- Erosion during installation of pipelines, leading to instability in soils and landslides, resulting in runoff and sedimentation in rivers and streams during construction,
- Disruption of traffic;

- Sanitation facilities;
- Housing facilities for workers;
- Noise;
- Accidental (Fire /explosion or other emergencies);
- Blockage of waterways, channels;
- Soil and Water contamination;
- Workers and public safety during construction;

(ii) *Social Impacts*

- Displacement of people,
- workers and public safety issues,
- Adverse impacts upon income or living standards, due to land acquisition or other activities associated with construction.

The consultant shall identify all relevant environmental impacts performing to the construction stage of the project and evaluate the same.

7.8.2 Impacts during Operations (including maintenance and repair)

(i) *Environmental Impacts due to*

- Alternation of drainage patterns;
- Impacts of condensate or other effluents;
- Invasion of exotic plants due to creation of ROW's;
- Loss of land use and impacts on agriculture and forests;
- Barriers created for human and migratory wildlife;
- Indirect impacts caused by ROW's allowing access to otherwise inaccessible areas;
- Waste disposal from associated facilities/activities such as gas cleaning scrubbing, pipeline maintenance.

(ii) *Social Impacts* caused by operation of the project. Among others, these should include

- Impacts on the local market in change in demand for local services;
- Impacts due to creation of barriers for human and migratory life;
- Access to social infrastructure;
- Impacts on employment;
- Impacts on archaeological sites, historical buildings/heritage;
- Impacts caused by inducting secondary development, such as squatters, within the pipeline ROW;
- Fire and explosion related emergencies;
- Threat to public safety.

7.9 Development of an Environmental and Social Management Plan to mitigate negative impacts

Develop an Environmental and Social Management Plan with feasible and cost-effective measures to prevent or reduce significant negative impacts during construction/installation/ intervention/ post construction/operation stages to acceptable levels.

7.9.1 *Environmental Management Plan(EMP)*

The management plans should contain detailed implementation and monitoring plan along with indicators, disaster management and emergency response plan, risk management, clear

allocation of responsibility among project sponsor, government agencies, and community-based organizations for the implementation and monitoring. It should be prepared in consultation with affected people, public authorities and other stakeholders. Provide the list of time-bound environmental management activities, who will be responsible for that, what would be the cost, who will pay, and where will the money come from etc.

The Consultant shall identify institutional/organizational needs to implement the recommendations of the project EIA and RAP and to propose steps to strengthen or expand, if required. This may extend to new agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance, training and budgeting.

7.9.2 Monitoring Plan

The Consultant should specify the types of monitoring needed for potential environmental impacts during construction and operation. Should contain detailed mitigation measures to address the environmental consequences associated with the project. As in the case of the mitigation plan, requirements should be specific as to what is to be monitored, how and by whom (with clear delineation of responsibilities). The mitigation measures should be for construction/ installation/ intervention/ post construction/ operation phases (including maintenance and repair) of the project. Among other things, this should focus on:

- Treatment and discharge of effluents;
- Control of waste materials;
- Storage and handling of material and equipment
- Odor management
- Improving public safety
- Measures to manage all construction related impacts.

7.9.3 *Social Management Plan*

Should include a Resettlement Action Plan (RAP) to address the adverse impacts on project-affected persons. A proposed outline for required RAP is also contained in Annex - 1.

7.10 Consultation with affected groups

The Environment Impact Assessment (EIA)/Resettlement Action Plan(RAP) process should involve consultation and participation with the affected groups. Prepare a consultation strategy to ensure that all affected people and stakeholders are fully informed about the project, and the views of these people on the consequences of the project are taken into account consideration. Refer to Annex - 2 for a list of key points, which have to be followed during consultation with the affected groups.

7.10 Output

The output of the study will be inception report and IEE, EIA and RAP reports. The Consultant shall submit an inception report and reports on Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP), which is concise and limited to significant environmental and social issues. The main test of the report should focus on findings, conclusions and recommended actions, supported by summaries of data collected and appropriate references. Detailed or uninterrupted data should not be in the main test and should be presented in appendices or a separate volume. Organize the report according the outline below:

1.1 **Inception Report** :The study shall produce an inception report indicating the methodology for study; consultant's initial findings, identified issues and problems, firmed up schedule for completion of work.

.1.2 **IEE Report Structure:**

'cutive Summary

Abbreviation

(i) Introduction
- Project objectives
- Project Components

(ii) Approach and Methodology

(iii) Policy, Legal and Administrative Framework

(iv) Describe the proposed assignment with clear explanation of activities to be carried out to establish the transmission pipeline

(v) Alternative Analysis

(vi) Hazard and Risk Assessment

(vii) Public Disclosure

(viii) Environment (air, water, soil quality)and Social Baseline data of impacting area.

(ix) Identification of significant Environmental Impacts of the project and Evaluation of potential Impacts

(x) Describe the possible Mitigation measures

(xi) Institutional requirement and Environmental Monitoring Program
- Key Indicator parameters, frequency
- Schedule of monitoring
- Institutional arrangements.

(xii) Describe environmental management plan (EMP)

(xiii) Recommendation for EIA with TOR

(xiv) Conclusion, findings and recommendations.

(xv) Appendices

(a) List of Environmental and Social Assessment parameters

(b) Reference-written material used in report preparation

7.11.3 **EIA Report Structure**

The EIA report will follow the structure that is dedicated in the DOE guidelines for Industries in general. However, to be adaptable with the High Pressure Gas Transmission Lines along with Regulating and Metering Stations some modifications are required.

(i) Environmental Base Maps (covering project area and 15km strip around it). These are to show the features described hereunder.

(ii) Description of the Existing Environment

a. Land use

b. Natural Physical Resources (Air, Water, Soil)

c. Natural Biological Resources (including forests)

d. Economic Development

e. Socio-economic Status Quality of Life Values

f. Environmentally Sensitive Areas of Special or Unique Scientific, Socio economic or cultural Value

(iii) Environmental Impacts and Mitigation

a. Major Findings
- Critical issues
- Other issue

b. Detailed Examination of issues related to :
   - o Project Location
   - o Design Criteria
   - o Installation of Equipment and Charge
   - o Survey (recording and analysis)

c. Evaluation of Impacts (in the light of the following)
   - o Environmental Laws and Regulations or Applicable National Criteria
   - o Mitigation Measures for eliminating or reducing significant Impacts
   - o Benefit Cost Ratio
   - o Public Opinion
   - o Residual Impacts

d. Critical Evaluation

(iv) Detail Environmental Management Plan

a. Technical aspects of the Project
   - o Final Design
   - o Construction and operations of pollution control measures (Air, Liquid, Solid)
   - o Reuse/Recycling of wasters
   - o Schedule of Implementation
   - o Estimates of capital and operational costs.

b. Management Organization
   - o Personnel
   - o Resources (equipment, laboratory etc.)
   - o Time bound environmental management activities

c. Environmental Monitoring Program (for Air, Water, Soil, Terrestrial/ aquatic biology), whichever is applicable

c.1 Ambient environmental quality monitoring:
   - Location
   - Parameters
   - Frequency

c.2 Effluent and emissions monitoring
   - Air emission (Parameters and frequency)
   - Noise/Vibration (Parameters and frequency)
   - Treatment and discharge of effluents (location, parameters and frequency)
   - Control of waste materials (Quality and composition of each type of waste and frequency)
   - Storage and handling of material and equipment
   - Odor management

c.3 Monitoring of environmentally significant parameters

(v) Data presentation and submission of reports.

(vi) Estimate of annual costs and source of fund.

7.11.4 Resettlement Action Plan Structure :

Executive Summary
Abbreviation

(i) Introduction
- Project objectives
- Project Components
- General description of the project and identification of the project impact area.

(ii) Approach and Methodology
- Objectives and Scope of the Social Assessment
- Methodology and Tools

(iii) Policies, Regulations and Guidelines
- GOB Land acquisition Act and Regulations
- World Bank Policy 4.12 on Involuntary Resettlement
- Comparison of GOB and World Bank Policies

(iv) Stakeholder Consultation and Identification of Social Impacts
- Rationale
- Methodology
- Stakeholder Analysis and Consultation Strategy
- Social Impacts

(v) Resettlement Action Plan
- Description and objectives
- Socio-Economic Baseline
- Social Impacts and Mitigation arrangements
- Legal framework
- Eligibility Criteria
- Entitlement Policy Matrix
- Organizational Arrangements
- Grievance Redress Mechanism
- Monitoring and Evaluation
- Timetable and Budget

(vi) Consultation with Affected Groups

(vii) List of Reference

(viii) Appendices
- Summary of Consultation
- List of Consultation Participants
- Socio-Economic Household Survey Questionnaire
- Socio-economic and Census Survey
- Record or interagency/forum/consultation meetings (including place and date of meeting and number of participants attend the meeting)

8.0 Consulting team

The study should be carried out with multi-disciplinary team supported by field researchers as specified below:

Sl No.	Position
1.	Team Leader : shall have minimum B.Sc.Engg./ M.S.S/ M.A./M.Com /M.BA. with experience of working as Team Leader in Environmental Study In Gas Sector;
2.	Gas Pipeline Specialist: shall have minimum B.Sc Engineering degree in any discipline with 15 years working experience in Gas Sector including 2 years experience in Pipeline Construction;

3.	Environmental Specialist: shall have minimum Masters degree in Environmental science /Environmental Engineering and/or above degree in relevant field with experience of working as Environmental specialist in Environmental Study related to Gas Infrastructure/Highway/Railway/Power transmission infrastructure/river or waterway embankment;
4.	Geologist/Hydrologist : shall have minimum Masters degree in Geology/Soil Science/Water management and/or above degree in relevant field with experience in environmental study related to Gas Infrastructure/Highway / Railway/ Power transmission infrastructure/river or waterway embankment;
5.	Socio-Economist: shall have minimum Masters degree minimum Masters Degree in Sociology/Economics with experience in environmental study related to Gas Infrastructure/Highway/Railway/Power transmission infrastructure/ river or waterway embankment;
6.	Ecologist: shall have minimum Masters degree minimum Masters Degree in Botany/Zoology with experience in environmental study related to Gas infrastructure/Highway/Railway/Power transmission infrastructure/ river or waterway embankment;
7.	Resettlement specialist: shall have minimum Masters degree minimum Masters Degree in Sociology/Economics with experience in environmental study related to Gas Infrastructure/Highway/Railway/Power transmission infrastructure/ river or waterway embankment and must have knowledge on land administration;
8.	Surveyor : shall have Diploma certificate in survey with experience in environmental study related to Gas Infrastructure/Highway/Railway/ Power transmission infrastructure/ river or waterway embankment;
9.	Data collector cum Field Personnel : shall have minimum S.S.C or equivalent degree in relevant field with experience in environmental study related to Gas Infrastructure/ Highway/ Railway/Power transmission infrastructure/ river or waterway embankment;

9.0 Submission of Reports

The schedule for submission of the reports shall be maintained as follows:

- The Consultant shall submit an inception report within one month of commencement of services;
- The Consultant shall submit the draft IEE report within 60 (sixty) days, from the date of Commencement of services. The Final IEE Report shall be submitted in 10 (ten) copies within 10 (ten) days after approval of Draft IEE.
- The Consultant shall submit the draft RAP report within 90 (ninety) days, from the date of Commencement of services. The Final RAP Report shall be submitted in 10 (ten) copies within 10 (ten) days after approval of Draft RAP.
- The Consultant shall submit the draft EIA report within 120 (one hundred and twenty) days, from the date of Commencement of services. The Final EIA Report shall be submitted in 10 (ten) copies within 10 (ten) days after approval of Draft EIA.

10.0 Clearances

Obtain both Site Clearance and Environmental Clearance for the project from Department of Environment (DOE) by submitting the IEE & EIA reports and other necessary papers as required by DOE. Obtain clearances from World Bank by submitting the IEE, EIA & RAP report.

PROPOSED OULINE FOR RESETTLEMENT ACTION PLAN

01. The General Information on the Project

(a) Brief description of the project and their objectives, which have necessitated land acquisition and need for Resettlement and Relocation.

(b) Brief description of the direct and/or indirect benefit which the project Affected Persons (PAPs) are expected to receive from the Project.

(c) Brief description of the principles has been followed in preparing the RAP.

02. Approach and Methodology

I. The Project Affected Areas

(a) Describe the specific geographic area to be adversely affected by land acquisition and other project-related activities, directly and indirectly and a map of the area.

(b) Describe the adverse impacts of the project and their activities on the community's access to social infrastructure-potable water, health canter, schools, irrigation, extension services, market, roads, sources of credit, government scheme for development etc.

(c) Explain whether or not there are others who live outside the project area, but are dependent on the infrastructure within the project-affected area. If yes, explain the plans made to help these people have access to such infrastructure.

II. The Land and Property Acquisition

(a) Describe the process of land acquisition and the dates for different notifications under different sections and the award under the Land Acquisition Act. Attach a detailed village wise statement of land to be acquired in the area.

(b) List the different types of prosperities-homestead, agricultural land, wells, hand pumps, pump house, crops, trees, etc. to be acquired and explain the basis for calculating compensation for each type.

(c) Details of appeal, if any, pending with courts of law-which court, where, how may field, number of judgments and compliance with judgment (s).

(d) Details of other lands-forest, revenue, panchayat, common lands, etc. acquired by the project, amount of area acquired in hectares under each category of land and the process through which to be acquired.

(e) Details of displacement of people, if any who have been living on these lands and / or cultivating them due to customary and traditional right and also encroachment.

III. The Project Affected Community

(a) Give the village wise demographic profile of the people in the Project Affected Area in accordance with the socio-economic survey.

(b) Give a brief description of the economic conditions of the people on the basis of their resource base-different types of land holding including share cropping, different types of land cultivated, livestock, wage labor, self-employment and employment, if possible with an estimate of average income for each source for representative family types.

(c) Give a social profile of the people.

(d) Explain the socio-economic adverse impact of land acquisition and displacement on the role and impacts of displacement on the role and status of women and your plans to mitigate the impacts.

(e) Give details of other vulnerable groups in the community aged, orphans and disabled, the impacts of displacement on them and your plans to mitigate them.

(f) Give details of people, if any, of the community who will be left behind and their impacts on their access to social infrastructure.

(g) Give details of consultation strategy to ensure that all affected people and stakeholders are fully informed about the project, and the views of these people on the consequences of the project are taken into account consideration.

03. **The Eligibility Criteria**

(a) Define Project Affected Persons (PAPs).

(b) List the different categories of PAPs you have, together with the package of entitlements separately for each one of them.

(c) Explain the basis of your definition of PAPs and their categorization as above and attach a statement showing their number of PAPs under each category.

04. **The "Enabling Legislation" for the right to "Eminent Domain"**

(a) list various Acts of the Government, which have been applied to the project and explain why and how these acts have been used.

(b) list and explain any judgment of any court or law, which is relevant to the project and Relocation and Resettlement of PAPs.

(c) the scope of the power of eminent domain and the nature of compensation associated with it, in terms of both the valuation methodology and the timing of payment.

(a) the applicable legal and administrative procedures, including a description of the remedies available to displaced persons in the judicial process and the normal timeframe for such procedures and any available alternative dispute resolution mechanisms that may be relevant to resettlement under the project.

(b) relevant law (including customary and traditional law) governing land tenure, valuation of assets and losses, compensation and natural resource usage rights, customary personal law related to displacement and environmental laws and social welfare legislation,

(c) laws and regulations relating to the agencies responsible for implementing resettlement activities,

(d) gaps, if any, between local laws covering eminent domain and resettlement and the Bank's resettlement policy and the mechanisms to bridge such gaps and

(e) any legal steps necessary to ensure the effective implementation of resettlement activities under the project including as appropriate a process for recognizing claims to legal rights to land-including claims that derive from customary law and traditional usage.

05. **Participation of Project Affected Persons**

Explain the participation of PAPs and their community groups in:

a Socio-economic study.

b Grievance procedures and appeals mechanism related to all aspects of Resettlement, particularly payment of compensation, definition and categorization of PAPs and their entitlement and

c. Preparation of R&R action plan, implementation and monitoring, including discussions with "host community", choice of resettlement

sites, resettlement site planning, choice of Resettlement options, purchase of common resources and Land Purchase Committee, and the management of common resources and social infrastructure in the resettlement sites.

06. Objective of the Action Plan

(a) State the specific goal/aim of the action plan.

(b) State special objectives, which will help to the goal/aim of the project over a period in a way that they could be measured, monitored and evaluated.

(c) Identify and assess the nature and magnitude of potential social impacts and risks directly and indirectly associated with the project.

(d) Review GOB's current policies, operational procedure and practices to address and mitigate social issues as well as the World Bank's social safeguard policy, OP 4.12 on Involuntary Resettlement and assess the compatibility of the core principles of the Governments' policies with World Bank policies, Identify any gaps and suggest measures for policy enhancements where necessary.

(e) If the project is likely to cause social impacts resulting from relocation, loss of land and shelter, loss of assets or access to assets and loss of income sources or means of livelihood, prepare an appropriate resettlement planning instrument consistent with the World Bank's resettlement policy.

(f) Carry out consultations with key stakeholders, including any people /households likely to be affected by the project etc.

07. The strategy for implementation of the Action Plan

i. State the strategy for implementing the action plan. Is the sole responsibility of the organization, Non-Government Organizations (NGOs), or the joint responsibility of both?

ii. Explain the reason for choosing the NGO, their background, achievements and their specific role in implementing the action plan.

iii. Explain the role of the community/social groups and organizations in implementing the action plan.

iv. Explain the strategy for social development to the community of PAPs particularly women and youth through community organization and training for skills improvement and leadership.

08. The Organizational Arrangements

i. Explain the structure of the organization/group, which responsible for Resettlement and Relocation how it is integrated with the District and State Administration.

ii. Explain the role of implementing agency in oversight of implementation of the RAP.

iii. Explain the role of other local, district and state authorities in implementing the action plan.

iv. Explain how the grievance procedures, appeals mechanism, identification of land, choice of sites and Resettlement options and also PAPs participation in the process of their Relocation and Resettlement are institutionalized and integrated with the organization/group responsible for Relocation and Resettlement.

v. What are the mechanisms for coordinating the implementation of the PAP?

vi. Provide a detailed time bound implementation schedule.

09. Monitoring and Evaluation

i. Explain the arrangements made for regular monitoring of the action plan both by the organization and by an independent outside organization.

ii. State the "milestones" work schedule, etc. setout to monitor and evaluate the achievements of the Action Plan every year. Indicate what the baseline data for later comparison is based on.

iii. List indicators such as availability of social services in resettlement sites restoration of productive systems, increased income, access to developmer infrastructure, women's development and PAP participation, in addition t payments of compensation, provision of land resettlement grants, etc, applicable, so that they can be used for monitoring and evaluation.

10. The Budget

The budget for the Resettlement and Resettlement of Project Affected Persons shou l include the following costs:

(a) Payment of Compensation

- Land
- House sites
- Houses
- Wells
- Trees/crops
- Other immovable properties
- All losers to the project as identified in the policy matrix.

(b) Resettlement

- Purchase and development of resettlement sites
- Civil amenities
- Social infrastructure
- Movement of PAPs
- Transportation of household goods, cattle etc.
- Transit camps including temporary shelters, provision of health care.
- Potable water, food, firewood, fodder etc.
- Resettlement Allowance

(c) Project Management

a. Socio-economic studies and RAPs
b. Training of R&R Personnel
c. Monitoring and Evaluation

(d) Project Administration

- Capital including building, equipment, furniture and vehicles
- Recurring including salaries, stationary, postage, fuel, maintenance equipment and vehicles etc.
- Contingencies

The budget should be prepared in accordance with the schedule of activities and payment as stated in the Work Plan. The sources of funds should also be identified. The provision for taking annual inflation into account should be described. The provision for contingencies should also be explained.

CONSULTATION WITH AFFECTED GROUPS

a. OBJECTIVES

To identify key stakeholders, people affected by the project, vulnerable groups which may be adversely affected by the project and formulate measures in consultation with them to avoid, mitigate or compensate them for any adverse effects.

b. INPUT

Project description report, consultations with the key stakeholders including any people/households likely to be affected, and participation by them in the assessment process.

c. DETAILS

The following task is to be performed to complete the consultation main task:

- Identification of the key stakeholders and consult closely with them on their views about the project and resettlement effects;
- Identification of the vulnerable groups and local NGOs.
- Dissemination of information
- Devise appropriate communication strategies to ensure effective communication of information.
- A formal consultation with the affected groups in reference to the TOR
- Taking views of affected groups and local NGOs fully into account.

d. OUTPUT

Identified key stakeholders, people affected by the project including vulnerable groups, which may be adversely affected by the project and formulated measures to avoid, mitigate or compensate for the adverse effect.

Reporting Requirements

The following schedule shall be maintained for submission of the reports

a) Inception Report

The Consultant shall submit an inception report within one month of commencement of services indicating the methodology for study; consultant's initial findings, identified issues and problems, firmed up schedule for completion of work.

b) IEE Report

The Draft IEE Report shall be prepared in accordance with the Environment Conservation Act 1995, the Environment Conservation Rules 1997, National Environmental Policy 1992,National Sectoral Policy (Petroleum/Industrial etc), Mineral Gas Safety Rule 1991, Land acquisition Rules and Regulations and the EIA Guidelines for Industries, Department of Environment (DOE) and World Bank Operational Manual for Environmental assessment & Involuntary Resettlement Plan (Rev. April 2004) and shall be submitted within 60 (sixty) days, from the date of Commencement of services, in 5 (five) copies, which shall be reviewed by GTCL/WB and the comments shall be forwarded to the firm. The Final IEE Report shall be submitted in 10 (ten) copies within 10 (ten) days after receiving of comments on the Draft IEE.

c) Resettlement Action Plan Report (RAP)

The Draft Resettlement Plan Report shall be prepared in accordance with the Acquisition and Requisition of Property Act 1982 and principals and guidelines provide in World Bank's OP 4.12 on Involuntary Resettlement for land acquisition and planning and implementation of resettlement activities and submitted within 90 (ninety) days from the date of Commencement of services, in 5 (five) copies, which shall be reviewed, by GTCL/WB and the comments shall be forwarded to the firm. The Final RAP Report shall be submitted in 10 (ten) copies within 10 (ten) days after receiving of comments on the Draft RAP.

d) EIA Report

The Draft EIA Report shall be prepared in accordance with Environment Conservation Act 1995, the Environment Conservation Rules 1997, National Environmental Policy 1992,National Sectoral Policy (Petroleum/Industrial etc), Mineral Gas Safety Rule 1991, Land acquisition Rules and Regulations and the EIA Guidelines for Industries, Department of Environment (DOE) and World Bank Operational Manual for Environmental assessment & Involuntary Resettlement Plan (Rev. April 2004)and submitted within 120 (one hundred and twenty) days from the date of Commencement of services, in 5 (five) copies, which shall be reviewed by GTCL/DOE and the comments shall be forwarded to the firm. The Final EIA Report shall be submitted in 10 (ten) copies within 10 (ten) days after receiving of comments on the Draft EIA.

ANNEX-04

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LIST OF REFERENCE

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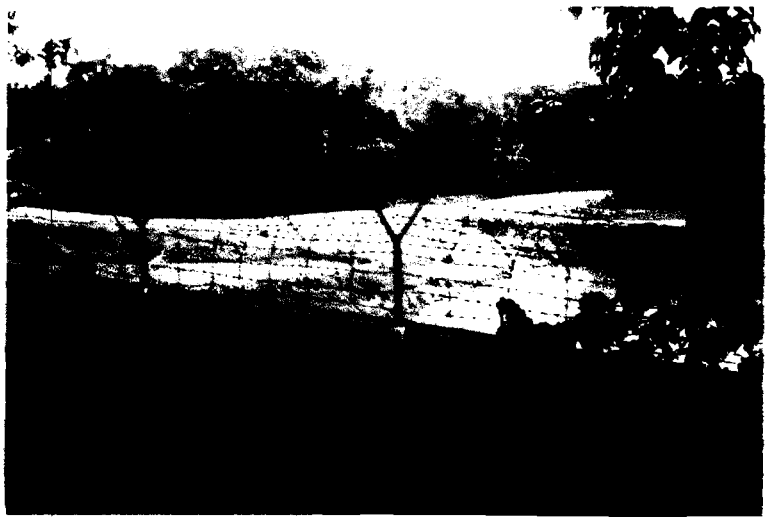
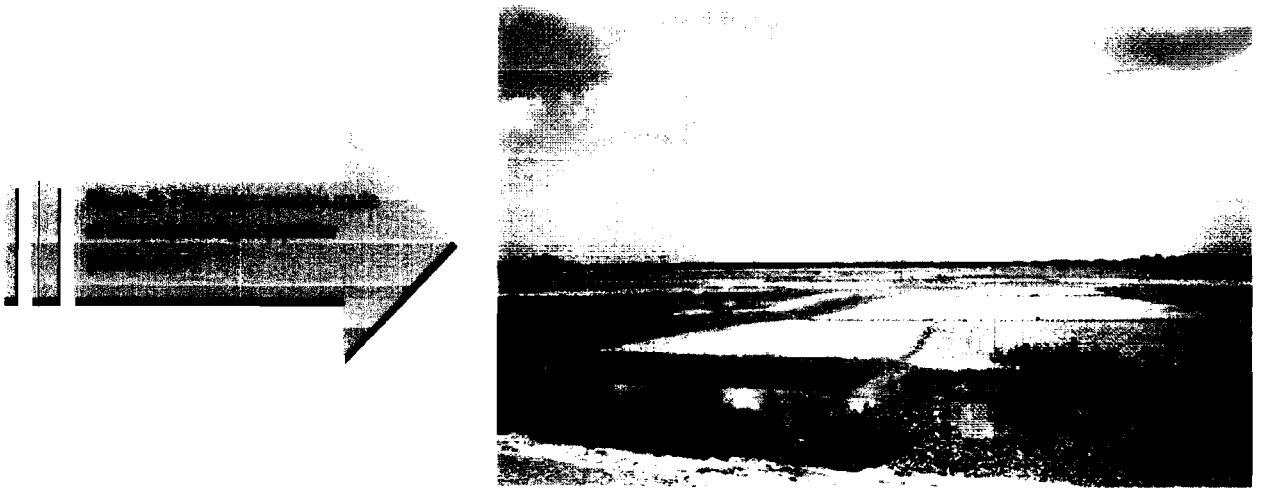
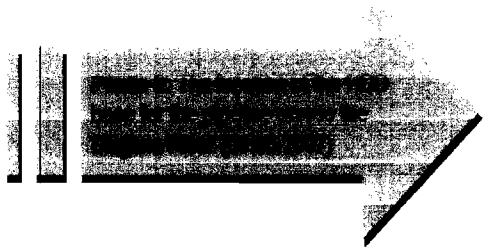
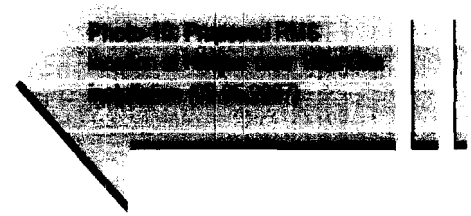
ANNEX-05

PHOTOGRAPHS









ANNEX-06

HANDOUTS

বাখরাবাদ-সিদ্ধিরগঞ্জ গ্যাস সঞ্চালন পাইপ লাইন

অত্র এলাকার গ্যাস সঞ্চালনের ক্ষেত্রে গ্যাস ট্রান্সমিশন কোম্পানী লিঃ এর পরিকল্পনা

পটভূমিঃ

প্রাকৃতিক গ্যাসের সর্বাধিক ব্যবহার নিশ্চিতকরণের মাধ্যমে দেশের সার্বিক আর্থ-সামাজিক উন্নয়নের উপর সরকার বিশেষ গুরুত্ব আরোপ করেছে। উপযুক্ত জ্বালানীর অভাবে মেঘনাঘাট, হরিপুর ও সিদ্ধিরগঞ্জ এলাকায় নতুন বিদ্যুৎ কেন্দ্রসমূহ সহ সংশ্লিষ্ট এলাকায় নতুন শিল্প কারখানায় গ্যাস সংযোগ দারুনভাবে বিঘ্নিত হচ্ছে। মেঘনা সেতু নির্মিত হওয়ায় দেশের দক্ষিণ-পূর্বাঞ্চল বিশেষ করে বিভাগীয় শহর চট্টগ্রাম ও কুমিল্লার সাথে রাজধানী ঢাকা সহ পুর্বাঞ্চলের চমৎকার যোগাযোগ ব্যবস্থা গড়ে উঠেছে। ফলে দেশের বিভিন্ন অঞ্চলে বিশেষ করে ঢাকা মহানগরীসহ পার্শ্ববর্তী এলাকা সমূহে নানাবিধ শিল্প কারখানা গড়ে ওঠার পরিবেশ সৃষ্টি হয়েছে।

সংক্ষিপ্ত বর্ণনাঃ

উল্লেখিত পটভূমির পরিপ্রেক্ষিতে গ্যাস ট্রান্সমিশন কোম্পানী লিঃ প্রস্তাবিত বাখরাবাদ-সিদ্ধিরগঞ্জ ৩০" ব্যাসের ৬০ কিঃমিঃ দীর্ঘ গ্যাস সঞ্চালন পাইপলাইন নির্মাণের পরিকল্পনা গ্রহণ করা হয়েছে। এর মাধ্যমে সিদ্ধিরগঞ্জ ২X১৫০ মেগাওয়াট পিকিং প্লান্ট, ২X১২০ মেগাওয়াট পিকিং প্লান্ট, ২১০ মেগাওয়াট তাপ বিদ্যুৎ কেন্দ্র, প্রস্তাবিত ১X৩৬০ মেগাওয়াট, মেঘনা ঘাট ৪৫০ মেগাওয়াট পর্ব-২, ৪৫০ মেগাওয়াট পর্ব-৩, ৪৫০ মেগাওয়াট পর্ব-৪ বিদ্যুৎ কেন্দ্র সমূহে এবং দেশের মধ্যাঞ্চলে শিল্প, কল-কারখানা, বাণিজ্যিক ও গৃহস্থালী কাজে প্রাকৃতিক গ্যাস সরবরাহ করা যাবে। ফলে শিল্পায়ন, অর্থনৈতিক অবকাঠামো উন্নয়ন, পরিবেশ দূষণরোধসহ শহরকে জাতীয় গ্যাস নেটওয়ার্কের অন্তর্ভূক্তি করা সহ দেশের দক্ষিন-পূর্বাঞ্চল তথা নারায়নগঞ্জ, মুন্সীগঞ্জ ও কুমিল্লায় গ্যাস সরবরাহ সম্ভব হবে। ফলে দেশের দক্ষিন-পূর্বাঞ্চলের শিল্প গ্রাহকসহ জনগণের আর্থ-সামাজিক উন্নয়ন ও বৈদেশিক মুদ্রার সাশ্রয় হবে।

☞ **কি ধরনের অসুবিধা হতে পারে ?**

এই লক্ষ্যে, আপনাদের জানানো যেতে পারে যে, প্রকল্পের বাস্তব কাজ আপনাদের এলাকায় আগামী ২০০৭ ইং সালে জানুয়ারী মাসে শুরু হবে এবং দ্রুত সম্পাদনে ব্যবস্থা নেওয়া হবে। প্রকল্প এলাকার নির্মাণ যত্রপাতি ও গাড়ী আপনার গ্রামের রাস্তা দিয়ে যাতায়াত করবে। এছাড়া পাইপলাইন বসানোর সময় নির্মাণ কমীদের অস্থায়ী ক্যাম্প বা আবাসস্থল থাকবে। তবে ক্যাম্পের কোন কারিগর আপনার গ্রামের ভেতরে প্রবেশ করবেনা এবং শুধুমাত্র তাদের কর্মস্থলের আশেপাশেই তাদের যাতায়াত সীমাবদ্ধ থাকবে। যানবাহনে শব্দ ও ধূলাবালিতে আপনাদের এলাকায় অসুবিধা হবে বৈকি, কিন্তু এটা খুবই সাময়িক কেননা কাজটি দ্রুত সমাপ্তির প্রচেষ্টা নেওয়া হবে।

☞ **পাইপলাইন বসানোর সময় কি সুবিধা হতে পারে ?**

অত্র এলাকার জনসমষ্টি হতে হয়তোবা অস্থায়ী ভিত্তিতে কিছু সংখ্যক লোকের কাজের সুযোগ হতে পারে। প্রকল্পটি বাস্তবায়িত হলে পেট্রোবাংলার আওতাধীন গ্যাসের বিপনন কোম্পানী সমূহ অধিকারভূক্ত এলাকায় বিদ্যুৎ কেন্দ্রসমূহ, কলকারখানা, ও অন্যান্য গ্রাহকদের নিকট গ্যাস সরবরাহের মাধ্যমে ভবিষ্যতে অতিরিক্ত রাজস্ব আয়ে সহায়ক হবে। গ্যাস ভিত্তিক বিদ্যুৎ কেন্দ্র, শিল্প প্রতিষ্ঠান ও উন্নয়ন কেন্দ্র স্থাপিত হওয়ার ফলে নতুন আয় ও মহিলা কর্মকর্তা/ কর্মচারীসহ লোকজনের কর্ম সংস্থানের সুযোগ হবে। ফলে দেশের আর্থিক অবকাঠামোগত উন্নয়ন ঘটবে।

প্রকল্পটি বাস্তবায়নকালে মোট ৬০জন লোকবলের প্রয়োজন হবে। প্রকল্পের বাস্তবায়কালে প্রকল্প ব্যবস্থাপক প্রেষণে, উপ-মহাব্যবস্থাপক, ব্যবস্থাপক, সহকারী প্রকৌশলী, সহকারী ব্যবস্থাপক, কম্পিউটার অপারেটর, ক্যাশিয়ার, গাড়ীচালক, সার্ভেয়ার, এমএলএসএস, নিরাপত্তা প্রহরী ইত্যাদি জনবল প্রকল্প/চুক্তিভিত্তিক নিয়োগের প্রয়োজন হবে। প্রকল্প সমাপ্তির পর পরিচালনকালে ২৬ জন লোকবলের প্রয়োজন হবে।

ANNEX-07

HAZARD REPORT FORM

SAMPLE
HAZARD REPORT FORM

DATE: _____

LOCATION: _____

EQUIPMENT: _____

HAZARD: _____

_____

_____

_____

_____

_____

SIGNATURE: _____

CORRECTIVE ACTION TAKEN: _____

BY WHOM: _____

DATE COMPLETED: _____

BENEFITS(S): _____

COST: _____

ACKNOWLEDGE BY: _____

_____

_____Supervisor

_____Superintendent

_____Safety Supervisor