ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR DRILLING OF WELL AT SUNETRA GAS FIELD

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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR DRILLING OF WELL AT SUNETRA GAS FIELD

A Project

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Candidate's Declaration

It is hereby declared that this project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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Recommendation of the board of Examiners

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Dedication

This thesis is affectionately dedicated

To

My beloved Parents

Invocation of who might be sources for the blessings of Allah in completion of this study

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ABSTRACT

For any Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE) is the prerequisite condition. If it suggests furthering clear assessment then EIA is must for that case. The IEE & EIA are the requirements of Department of Environment (DOE) for issuing the site clearance and environmental clearance respectively for the project. For any red category project EIA is mandatory. This EIA report has been prepared as per Terms of Reference (TOR) and the guidelines of DOE for exploratory well drilling project at the newly discovered Sunetra Structure.

In general, Drilling has temporary environmental impact compared to that of the other industrial projects. Among other topics, identification of potential impacts with mitigation measures, and an Environment Management Plan is included may be achieved through use of best management practices as well as mitigation procedures and controls which will have minimum adverse impacts on the environment. This project is focusing on the real condition of the area, the people who will be affected and how the mitigation measures should be applied. It is also disseminating the findings from public consultations, expectations of the people, economic development and potential negative impacts etc. This EIA report is introducing the natural physical resources available in the project area, present status and location, project components and phase etc. EIA report is also suggesting the Emergency Response and Disaster Management Plan, Environment Safety Management System Process, Health, Environment and Safety Management Plan, Environmental Monitoring parameters measurement cost etc.

Reconnaissance and follow-up site visits were made and information was collected on baseline conditions and the stakeholders' response on preset questionnaires/ checklist as per DOE guideline. Public awareness campaign was also made through key informant interview. Other environmental and socio-economic, agro-climatic and meteorological data were collected from DOE and concerned authorities and other IEE & EIA reports of relevance.

It can be said that the drilling project will maintain standard quality of implementation of the programmed with due consideration to standing rules and regulations. The project may be considered viable from the environmental point of view and therefore be considered for implementation by appropriate authorities. It has been recommended that, environmental clearance may be issued in favor of Sunetra Structure for execution of the project as scheduled.

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List of Abbreviations

ADB Asian Development Bank

AER Agro-Ecological Region

AQM Air Quality Management

BAPEX Bangladesh Petroleum Exploration and Production Company Limited

BBS Bangladesh Bureau of Statistics

BCAS Bangladesh Centre for Advance Studies

BMD Bangladesh Meteorological Department

BWDB Bangladesh Water Development Board

CGS City Gate Station

DAE Department of Agricultural Extension

DOE Department of Environment

DOF Department of Fisheries

EGA 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

GSDP Gas Sector Development Programmed

IEC Important Environmental Component

IEE Initial Environmental Examination

IUCN International Union for Conservation of Nature

LGED Local Government Engineering Department

NDT Non Destructive Testing

NGO Non-governmental Organization

NWMP National Water Management Plan

PAP Project Affected Person

TBS Town Border Station

TOR Terms of Reference

LIST OF DEFINITIONS

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.

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

Biological diversity: The variety of life forms, the different plants, animals and microorganisms, 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, 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 remove 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, piciculture and industries.

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

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

Negative impact: Negative change from the existing situation due to the project.

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

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

Stakeholders: Those who may be potentially affected by a proposal e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project can 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 for district.

CHAPTER-1

INTRODUCTION

At the time of this project, Sunetra was under exploration. It is not yet been declared as a gas field. Therefore it is more appropriate to call it Sunetra structure. In this report, despite the title, it will be denigrated as Sunetra structure. The Sunetra Structure is in the intermediate position of Netrakona and Sunamgonj Districts. Drilling work will be done by BAPEX under Petrobangla. For any environmental assessment Initial Environmental Examination (IEE) is the prerequisite condition. If it suggests furthering clear assessment then Environmental Impacts Assessment (EIA) is must for that case. The IEE & EIA are the requirements of Department of Environment (DOE) for issuing the site clearance and environmental clearance respectively for the project. Accordingly, this Environmental Impact Assessment (EIA) report has been prepared as per Terms of Reference (TOR) and the guidelines of Department of Environment (DOE) for industrial projects of red category.

In general, Drilling has temporary environmental impact compared to that of the other industrial projects. Among other topics, identification of potential impacts with mitigation measures, an Environment Management Plan is also included herein to indicate management action on the implementation of mitigation measures. This may be achieved through use of best management practices as well as mitigation procedures and controls which will have minimum adverse impacts on the environment.

This Environmental Impact Assessment (EIA) report contains an assessment of the existing environment. The purpose was to identify the key environment resources of the project area and an assessment of the impacts, which might result from the drilling and operation of the project. This EIA report has identified the environmental impacts due to proposed intervention, described existing baseline condition and identified important environmental components and potential impacts. An outline has also been prepared for mitigation measures of potential negative impacts and enhancement of positive environmental impacts including preparation an outline management plan. Policy and legal considerations affecting the execution and operation of the project have also been discussed in this report.

This project about EIA is focusing the real condition of the area, the people who will be affected and how the mitigation measures should be applied. It is also disseminating the findings from public consultations, expectations of the people, economic development and potential negative impacts etc.

This EIA report is introducing the natural physical resources available in the project area, present status and location, project components and phase etc.

EIA report is also suggesting the Emergency Response and Disaster Management Plan, Environment Safety Management System Process, Health, Environment and Safety Management Plan, Environmental Monitoring Parameters measurement cost etc.

1.1 Objectives

The objectives of the project are:

1. To know who, how and to what extent will be affected during the drilling time of sunetra Structure.
2. To know what sorts of mitigation measures would be taken for the sake of the affected people.
3. To know the actual environmental condition of the proposed area.

1.2 Methodology

This report is made with reconnaissance and follow-up site visits and gathered information on baseline conditions and the stakeholders' response on preset questionnaires/ checklist as per DOE guideline. Public awareness campaign was also made through key Informant Interview (KII). Other environmental and socio-economic, agro-climatic and meteorological data etc. were collected from DOE and concerned authorities and other IEE & EIA reports of relevance.

During the process the following steps were followed:

- Collection of available information relating to study from BAPEX;
- Detailed understanding of the scope of the activities evolved on the surrounding environment;
- Collection of data on environmental, social, health and natural resource component parameters of the project area;
- Collection and review of reports and references;
- 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 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;
- Identified sources of environmental and biodiversity degradation and social disturbances of significance;
- Consulted the local community in the project area through a public consultation process;
- Presented an outline of an Environmental Management Plan (EMP) for future mitigation measures of environmental, biological, social and health issues; and
- Prepared the EIA report.

CHAPTER -2

LEGAL AND POLICY CONSIDERATIONS

This chapter is introducing different sorts of policy and considerations that is needed for the entire project. All types of national policies, strategies, plans, and legislative acts and regulations which are inevitable to protect the environment, human health and safety etc. have been presented in the appendix. The international treaties and conventions related to protection of terrestrial and coastal ecosystems are also included in the appendix.

2.1 Policy consideration

Here, a corporate policy (Health, Safety and Environment) of BAPEX is considered as a high standard of practice though a process of continuous improvement. [1] It is also mentionable that the adoption of international codes and standards should be maintained at every stage of the project work.

BAPEX standards are mentioned bellow:

1. Ensure that all operations comply with applicable health, safety and environmental laws and regulations.
2. Implements controls to protect all personnel involved in activities to prevent pollution and to protect bio-diversity.
3. Provide health safety and environment training to employees and actively promote awareness of health, safety and environment issues.
4. Ensure that contractors are aware of their policies and standards.
5. Foster a culture where accidents, incidents and near misses are reported and investigated.
6. Monitor performance and conduct regular audits to ensure controls are effective and that health, safety and environmental aspirations are being achieved.
7. Set objectives and targets for improving health, safety and environmental performance and monitor and report openly on performance.
8. Ensure that a high priority is placed on emergency preparedness.
9. Work with government and regularity bodies in the formulation or improvement of laws, polices, regulations and procedures aimed at protecting health safety and the environment.
10. Consult with a respond to the other stakeholders on health, safety and environmental performance.

2.2 Compliance of the project environment legal requirements

Drilling should be planed for implementation following all relevant rules and regulations. The following is the salient features related with regulatory issues. [2]

1. No conserved land and forest will be affected.
2. No wild life habitat will be affected.
3. No residual impact on the environment.
4. No persistent generation of pollutants for air. Some CO2 will be generated during testing.
5. No impact on water and there is no effluent.
6. No internationally important sites of bio-diversity will be affected.
7. No archaeological and historical will be affected.
8. The drilling will be carried out on acquired land to be duly compensated according to existing law of the country.

These rules and regulations should be strictly followed by the competent authorities, vendors, stakeholders and employees. It would be pretty good for the country to monitor the project with legislative regulatory in supply of gas to the national gas grid and help industrialization supporting the industrial policy of the government and improve the economy of the country.

CHAPTER-3

PROJECT DESCRIPTION

3.1 Present status

Sunetra Structure is in intermediate position of the districts of Sunamgonj and Netrakona. BAPEX has a plan of drilling one well and after getting fruitful output it will take further action of drilling more. At present the existing flora and fauna, the physiographic and topographic situation, over all land patterns, socio-economic status etc of the project area is favorable to BAPEX. Country's demand for natural gas is increasing day by day which was over 2400 MMCFD during 2011-2012. Current energy policy and the development plans are focused to reduce import of petroleum products and thereby pressure on the foreign exchange through exploration, production and marketing of natural gas. The main objective of Sunetra project is to increase gas production to meet the high demand of natural gas.

3.2 Project category

According to the department of environment guidelines, Sunetra Structure falls under category "B" and needed initial Environmental Examination (IEE) only. As per criteria of DOE, the project falls under RED category and hence requires Environmental Impact Assessment (EIA). However, the project has some environmental impacts but is of lesser degree which will be revealed at subsequent chapters.

3.3 Use of natural resources

The basic natural resources to be used for the drilling project are water, petroleum, oil, lubricants. Water is required for cooling the equipments and other machines and preparation and circulation of mud during drilling time. The water will be required for drinking and domestic use of the performers. Deep tube wells already exist in the respective sites and the quality of the same is meeting the minimum criteria for drinking purposes. Electricity will be required for fueling the engines and operation and maintenance of various equipments machinery and transport.

3.4 Project location

The first exploratory well in the Sunetra Structure will be drilled at Dharmopasha Thana under Sunamgonj District. The drill pad is to be located by the Kodalia river.

3.5 Project components and phase

The major components of the projects are stipulated as follows:

1. Drilling, process plant location and pipe line route survey;
2. Land acquisition and requisition plan;
3. No objection certificate from District Controller;
4. Site clearance from DOE;
5. Detail drawing and design;
6. Possession of land from District Controller;
7. Procurement of materials;
8. Temporary storage;
9. Construction of civil Engineering structures including drill pad;
10. Fire fighting;
11. Equipment and vehicle mobilization;
12. Drilling of wells;
13. Production testing and commissioning of wells;
14. Construction of process plant and pipeline;
15. Testing and commissioning of pipeline and process plant; and
16. Reinstatement and cleaning of work sites.

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

3.6 Pre-construction phase.

Activities for pre-construction phase are described below. [3]

Drilling location and pipeline route survey

The drilling location and tentative route of the gas gathering pipeline have been identified. A number of factors (site, water source, soil quality) should to be taken into consideration in selecting these components. After that, a detailed survey work is to be carried out around the location and along the entire route according to the activity schedule.

Land acquisition and requisition plan

Land acquisition and requisition plan depend on some criteria of selection and for the selection of the fore going locations and the pipeline right of way, a plan will be submitted to the DC's Office for formalities.

NOCs from DCs

As a pre-requisite for submitting application to DOE for IEE & EIA of this integrated project, NOCs from local authorities are to be obtained by Sunetra Structure authority, BAPEX. These NOCs are usually issued by the concerned Deputy Commissioners of the respective districts in which the project activities will be performed.

Clearance from DOE

To obtain site clearance from DOE, the authority has to submit an IEE report. This will contain the scope of the work of the project with necessary papers including prescribed fees depending on cost of project and clearance from local authority. After acceptance of IEE report, DOE is expected to issue site clearance within 30 days of the date of submission. There after an EIA report will have to be prepared with incorporation of response to the comments of DOE. These have to be submitted to DOE along with photocopy of Bank Chalan and other documents including NOCs from authorities. DOE will issue environmental clearance subject to fulfillment of all necessary requirements by BAPEX. This process may require a maximum time of 60 days. It is mentioned that after acceptance of IEE report by DOE, BAPEX can start site development/ preparatory works at the respective project sites.

Detail drawing and design

Drilling must conform to different codes, standards and specifications including Bangladesh mineral gas safety rules of 1991 (as amended in 2003). Environmental factors that may affect the location and routing or design of pipeline include population density, historic buildings, water bodies, graveyards, parks, and religious institutions. These aspects will be taken into consideration before finalization of all relevant design.

Possession of land from District Controllers

Possession of land for drilling of well has to be obtained by BAPEX. Through placing requisition to respective DCs who will process and forward for future approval of the concerned ministry should take a consideration. When approved, DCs will place compensation estimate to BAPEX and upon receipt of same, possession of land will be handed over to BAPEX. Such possession would be for temporary requisition and permanent acquisition. The possession of requisitioned land under former condition will be returned to the owners after completion of the project and the later one will be retained by BAPEX for its subsequent operational activities of the project facilities.

Procurement of materials

BAPEX will procure adequate number of transport for supervision and routine work of the project. Office furniture, machinery, accessories and project materials etc will be procured following purchase procedures as applicable under GOB guidelines.

Temporary storage and pile yard

A temporary storage and pile yard to facilitate construction activities will be established for easy access from the main road. The main Pile yard will store rig components, process plant elements, pipes, machinery, and equipment and shall be located in a designated area at Netrakona.

Construction of Civil Engineering structures including drill pad

These will be constructed as per design and specification and should be mentioned as per schedule to start up main project activities. However, construction of some of the foundations and structures will continue to progress until completion of the project.

Fire fighting

Adequate fire fighting facilities with fire extinguishers, sand buckets, etc. will be established. Apart from Company's mechanized fire fighting arrangements, the nearest local fire stations will also be appraised of the project activity so that their help could be obtained when necessary.

Equipment and Vehicle Mobilization

An adequate number of supervision vehicles will be acquired prior to start of work. Equipment and machinery will be documented and their current condition should be evaluated to ensure proper working condition prior to start-up of the project. The rig and its essential units and components, cranes, grader, dozer, side booms, trenching machine, excavators, welding machines, compressors, water pumps, dump trucks and other associated machinery, tools and equipment will be inspected routinely.

3.7 Construction phase

Construction phase starts when preliminary preparations are completed, the drilling, fabrication, erection and construction phase start. Major activities of this phase include, preparation of work site areas, rig foundation, establishing the process plant structures, pipeline route and determining the amount of right of way necessary for actual digging, trenching, pipeline construction, testing and commissioning. [4] These activities will be scheduled sequentially to maximize efficiency and to ensure the completion of the total project preferably within the dry working season. Some of the drilling and construction activities and their completion methodologies will require special attention. The main activities to be taken into consideration are as follows:

Manpower engagement

Man power for drilling will be conducted using both mechanized equipment and manual labor where necessary. The major activities would require a number of skilled, semi-skilled and unskilled workers to be employed. The professionals from BAPEX will carry out overall supervision at all phases of the work. Expert engineers, geologists and consultants including supervisors and inspectors both from home and abroad will be involved with the project along with other personnel. They will monitor and report on the activities to the respected offices regularly.

3.8 Natural physical resources

Air

Ambient air quality defines the air pollution present in the ambient atmosphere of substances, generally resulting from the activity of man in sufficient concentration.
Threshold limit for air pollution materials are given below: [5]

Lead : 500 to 1500 microgram per m^3
Nitrogen oxide : 100 microgram per m^3
SO_2 : 100 micrograms per m^3

Monitoring of ambient air quality is a recent phenomenon in Bangladesh. In August 1989, the Department of Environment stated air quality monitoring only in Dhaka at various places. It is observed that, Sunetra Structure area air is fresh and having no air-polluting object. It can be concluded that the air quality in the project area is good and the air is not harmful to the environment.

Water

Water quality characterization must take into consideration the following

- The distributions, dynamics of chemicals in the aqueous phase;
- Accumulation and release of chemicals by the aquatic phase;
- Accumulation and release by bottom deposits; and
- Inputs from land and atmosphere, air-borne contaminants and land runoffs.

The water bodies in and around the project were identified. There are many ponds, canals and rivers in and around the project area.

3.9 Pollution Control Issues

It is important to consider immediate, short time impacts as well as long term, indirect and commutative impacts from separate but linked operations.
The drilling rigs and support equipment are to be moved by land and water and include drilling rig, mud handling equipment, power generators, cementing equipment, POL and water tanks. The support camp is self-contained and generally provides work force accommodation, canteen facilities, communication, vehicle maintenance, fuel handling and storage areas and provision for collection, treatment and disposal of wastes including drilling mud and drill cuttings. Drilling and drilling operation are generally conducted round the clock and drilling fluid and mud is continuously circulated. Well tests are subsequently conducted to establish flow rates and formation pressure. These tests may generate oil, gas and formation water. Open rock formations are sealed with cement plugs to prevent upward migration of fluids.

Intensity of these activities can produce a variety of affects which vary with time and distance from the drilling site. The resulting impact of the drilling can introduce contaminants into aquatic environment apart from causing significant alternation to existing water courses and drainage patterns leading to changes in vegetations and wild life.
The principal aqueous waste streams are

- Produced water
- Drilling and well treatment fluid Process,
- Wash and drainage water
- Sewerage and domestic waste and
- Operational discharges, leakage and accidental releases.

The impacts on air quality from drilling activity depend on both air Pollution and emission of atmospheric condition. There are many sources of emission:

- Flaring, venting and purging stack gases including black smoke emissions.
- Combustion process such as diesel engine and generators.
- Fire protection system
- Road traffic causing exhaust gases and road dust dispersal.
- Fugitive gas losses

Noise can arise from drilling including operation of heavy vehicles and machines. Such noise not only affects human but also wild life. In addition, drilling activities can reduce the historic, cultural and recreational values of the project region by physical and visual intrusion of drilling site testing and production facilities but all these are of very temporary in nature.

CHAPTER-4

BASELINE EXISTING ENVIRONMENT

4.1 Introduction

Baseline data on environment is important to understand existing physical, biological, cultural, economic 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.

1. To recognize potential environmental impacts of the preset condition and enable mitigation measures to be identified.
2. To provide a base line against which environmental conditions in the future project may be measured 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

In this study, the project area covering Sunetra Structure is comprised of Village: Gabi, Post office: Salbros, Dharmopasa Thana under Sunamgong district. The total length of the pipeline route would cross mostly the private agricultural lands, ponds and canals including the tributaries of major Kodalia river.

4.3 Topography

The Structure is mainly flat alluvial flood plain surrounded by plains with somewhat steeper topography. The field is about 24 feet above Mean Sea Level (MSL). The area is vulnerable to river floods.

4.4 Climate and rain water

The project area is under the typical monsoon climate prevailing in the country. It has three main seasons.

Summer/pre-monsoon	-	March to May
Rainy season/monsoon	-	June to October
Winter season	-	November to February

The summer (hot and dry) is interrupted by occasional heavy rainfall and storms. The rainy season is also hot and humid having about 90 percent of the annual rainfall. During this period the rivers and waterways flood major portions of the project area. The winter is predominantly cool and dry. Total annual rainfall occurring in the area is about 2563 mm. [6] Seasonal distribution is much skewed. It appears that about 84% of the total annual rainfall occurs during this monsoon period.

4.4 Temperature and Humidity

Temperature in the project area varies between 33 degree Celsius during April-May to 12 degree Celsius during January-February with an average of 28.5 degree Celsius which is close to the national average of 25 degree Celsius. [7]

The long-term temperature data of the Structure is collected from the nearest meteorological station of the proposed project area of Netrakona. The average low temperature occurring in December is 12.03 degree Celsius, while the average high temperature is 33.9 degree Celsius occurring in April. The extreme low temperature may be 5 degree Celsius in January and the extreme high temperature may be 41.7 degree Celsius occurring in April and May.

In the project area, the relative humidity is the lowest in January to March (74%) and from April there is a steady increase till July (87%).[8]

4.6 Air quality

The DOE does not have any regular air quality -monitoring program outside Dhaka for measuring ambient air quantity or emissions. As a result there are no official air quality data for the project area. However, air quantity will not be a major environmental concern associated with Drilling, Process plant installations and pipeline construction works and subsequent production of natural gas. Local air quality would be impaired through improper facility operation and flaring activities. Improper flaring can be prevented through the implementation of standardized environmental operating procedure in Structures operation.

4.7 Ambient 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 severe 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 rule, noise level should not exceed 75 dB in the daytime and 70 dB at night. Hearing protection should be provided to workers where noise level exceeded 80 dB. [9] At present there is no base line data in any of the gas process plants operating in the Structure. Table 4.1 presents noise level standards of Bangladesh. The data show that for sensitive areas ambient noise level is much higher than the allowable limits.

Table-4.1 Bangladesh Standard of Noise Level

Category	Name of the area	Day	Night
A	Silent zone	45 dB	30 dB
B	Residential area	50 dB	40 dB
C	Mixed area (basically residential and together used for commercial and industrial purposes)	60 dB	50 dB
D	Commercial area	70 dB	6O dB
E	Industrial area	75 dB	70 dB

[Source: Schedule 4, Rule -12, Environment Conservation rules 1997, (page 3127, Bangladesh Gazette, 28 August 1997)]

4.8 General soil type

Food and Agricultural Organization (FAO) conducted a number of surveys in the sixties and developed a detailed soil classification of Bangladesh which is now used for various purposes. The FAO classification presents a series of 20 Soil classes of Bangladesh. [10] The numbers used for the soil tracts in the following test is corresponding to the numbers showing 20 groups and is roughly self-explanatory.

1. Black Terri soils**.**
2. Non calcareous brown Floodplain Soils (dominant) and Grey Floodplain Soils.
3. Grey Floodplain Soils (dominant) and non Calcareous Brown Floodplain Soils.
4. Grey Floodplain Soils, Non saline phase.
5. Grey Floodplain soils, Saline Phase.
6. Grey Floodplain Soils and Non Calcareous Dark Grey.
7. Non Calcareous Dark Grey Floodplain Soils.
8. Acid Basin Clays.
9. Grey Floodplain Soils.
10. Calcareous Dark Grey Floodplain Soils and Calcareous Brown Floodplain Soils.
11. Pea.
12. Acid Sulphate Soils.
13. Non-calcareous Alluvium.
14. Calcareous Alluvium.
15. Red-brown Terrace Soils.
16. Grey Terrace Soils.
17. Deep Red-Brown Terrace Soils.
18. Grey Terrace Soils.
19. Grey Piedmont Soils and Grey Floodplain Soils.
20. Brown Hill Soils.

The project survey area falls in the soil group 4, 6, 7 and 15, comprises grey flood plain soil non-saline phase to grey floodplain soils and non calcareous dark Grey in the area .Following is the Description of soil Tracts.

4.8 Soil fertility

Dark grey loamy soil is on old flood plain ridges and clay in basins. The area is subjected to periodic flooding and sediment deposition, which adds fertility for crop production.

4.9 Land use

The land is generally open and flat, dominated only by small village communities. The land is predominantly used for agriculture and fisheries.
Most agricultural plots are less than one acre and these plots, farmers tend to grow one or two crops every year. Therefore, village farm land will show some variety of crops in any season, but most of the land will show the following predominant cropping pattern.

Summer –Aus rice
Fall - Aman rice
Winter - Boro rice

Besides mango, banana and jackfruits are grown on the higher strips of land around villages and along roads and embankments in the North East side of the Structure.
A verity of additional crops is grown depending on elevation topography and soils. Numerous small flowering plants grow in the ditches and among the tree groves.

4.10 Present cropping practice

According to the soil resources use, the cultivable lands of the surveyed area may be classified into several groups, which are single crop, double crop, triple crop, yearly crop etc. These are dependent on the different type of land: medium high land, medium low land, low land and very low land. Wheat is grown in medium high land; rice is grown in medium low land where as jute is grown in low land and sugar cane is grown in very low land.

4.11 Geology and Hydrogeology

The surface soil is alluvial Clay topped with organic soil. Between the clay and the gas bearing strata, the geology is mostly sandstone. The aquifer is from 100 feet to 400 feet thick, but the lower portion is not usable, due to high salinity.

4.12 Surface water

In the project area, the surface water sources consist of Kodalia river and its tributaries. Surface water is used for irrigation, drinking water for domestic animals, bathing, fish cultivation and possibly as potable water in some locations.

The project area is neither significantly industrialized nor urbanized, and therefore surface water bodies do not receive much industrial or urban waste water. Agricultural activities are increasing with the use of chemical fertilizers and pesticides. The run off from these agricultural fields as well as domestic waste may contribute to surface water pollution. Available information from field survey suggests that the surface water quality is deteriorating with time. The water samples were collected from Kodalia river and analyzed in the laboratory of Rural Power Company Limited at mymensingh. Results are shown in Table 4.2

Table: 4.2: Surface Water quality analysis in the study area

River	Alkanity	pH	Conductivity (us/cm)	TDS (mg/L)	BOD (mg/L)	COD (mg/L)	Cl (mg/L)	TS (mg/L)	TSS (mg/L)
Kodalia	35	6.90	217	50	13	27	0.5	52	21

TDS Total Dissolved Solid
BOD Biological Oxygen Demand
COD Chemical Oxyzen Demand
Cl Chlorine
TS Total Solid
TSS Total Suspended Solid

4.13 Ground water

The ground water table fluctuation indicates the recharge and discharge of the ground water. Highest water level occurs during the month of August-September when the aquifer recharges fully and the lowest ground water level occurs during April-May goes to natural discharge and ground water use for domestic and irrigation purposes. Like other parts of the country, ground water is a stable source of water for various activities including irrigation, domestic purpose and industrial applications in the project area.

4.14 Seismicity

The seismicity of Bangladesh indicates the present knowledge of faulting and other structural behaviors of the region. Earthquake events in the shelf-zone are random and follow the occurrence of the surface faults. Bangladesh has been divided into three generalized seismic Zones. Zone-1, Zone- 2 and Zone-3. [11]

Zone-l comprising the northern and eastern region of Bangladesh is the most active zone basic seismic co-efficient of 0.06. The project area is under the Zone-1. Zone-2 represents the region of recent uplift Pleistocene and blocks of the western extension of the folded belt with moderate seismic co-efficient 0.05. Zone-3 is seismically quiet zone with estimated basic seismic coefficient of 0.04.

4.15 River System

The rivers that lie within the vicinity of project area are mainly Kodalia and its tributaries and a number of canals and ponds that contain run off from adjacent areas.

4.16 Agro-ecological zones

Bangladesh has been divided into 30 Agro-Ecological Zones (AEZ). The project area covers the agro-ecological zone 26.

4.17.1 Biological environment

This section describes the floral and faunal diversity of the project area. After visiting the project area to collect first hand data and information (both primary and secondary) to prepare the EIA report. This assessment was earned out between September- December 2011, Varieties of plant species and wild animals have been identified arid recorded during the survey. Every species which plays an important role in its natural community and ecosystem and removal of that species is likely to have adverse impact. Bio-habitat of the study area may be divided into major types terrestrial and wetland habitat.

4.17.2 Terrestrial habitat

Terrestrial flora

Mainly the home stead regions, roadsides, village groves, playgrounds and high cultivated lands human being as well as wildlife use these flora species for different purposes. They play an important role in the socio-economic and ecological balance. Result of a field survey of the Project area is shown in table 4.3

Table: 4.3 Terrestrial Flora Status

Serial No.	Local Name	English Name	Status
1	Am gas	Mango tree	Common
2	Kathal gas	Jack fruit tree	Common
3	Kala gas	Banana tree	Common
4	Supari gas	Betel nut tree	Fairly common
5	Lichu gas	Litchi tree	Fairly common
6	Tezpata gas	Dried leaves tree	Fairly common
7	Lebu gas	Lemon tree	Fairly common
8	Kamranga gas	Star fruit tree	Fairly common
9	Peara gas	Guava tree	Fairly common
10	Amloki gas	Enola tree	Fairly common
11	Jalpai gas	Olive tree	Rare
12	Kamla gas	Orange tree	Rare
13	Tal gas	Palm tree	Rare
14	Anarosh gas	Pineapple tree	Rare

[Source: field survey database]

Terrestrial fauna

Wild life that fully depends on the terrestrial eco systems for life, shelter, food and breeding is called terrestrial fauna. A number of terrestrial fauna species have been identified during the assessment in the project area and are shown bellow:

Table: 4.4: Terrestrial Fauna Reptiles Status

Serial No.	Local name	English Name	Status
1	Gokhra	King cobra	Common
2	Dhura shap	Trinket snake	Common
3	Matia shap	Common krait	Common
4	Tiktiki	Lizard	Common
5	Daraish Shap	Bioccelate cobra	Fairly common
6	Kassap	Turtle	Fairly common
7	Kari kata	Green pit viper	Rare
8	Gui Shap	Keel back snake	Rare

[Source: field survey database]

3. Terrestrial fauna mammals: In the project area some Mammals are common like Bat, Rat, Jackal etc. Fox is fairly common. In Bangladesh Mongoose is common in remote area but in the project area it is rare. Mammals are listed in table 4.5

Table 4.5: Terrestrial Fauna Mammals status

Serial No.	Local name	English Name	Status
1	Badur	Bat	Common
2	Idur	Rat	Common
3	Shial	Jackal	Common
4	Chika	White rat	Common
5	Bagdasha	Wild cat	Fairly common
6	Khekshial	Fox	Fairly common
7	Beji	Mongoose	Rare

[Source: field survey database]

4. Terrestrial Fauna Birds: In the project area House sparrow, Crow, Doel is common and these sorts of Birds are also common in all over the Bangladesh. King fisher and Owl are fairly common. Vulture and Parrot are rare.

Table 4.5: Terrestrial Fauna Birds Status

Serial No.	Local Name	English Name	Status
1	Choroi	House sparrow	Common
2	Doyel	Doel	Common
3	Kak	Crow	Common
4	Bagari	Cormorant	Common
5	Ghughu	Dove	Common
6	Kokil	Cuckoo	Common
7	Shalik	Indian myna	Common
8	Machranga	King fisher	Fairly Common
9	Pecha	Owl	Fairly Common
10	Shakun	Vulture	Rare
11	Tia	Parrot	Rare

[Source: field survey database]

4.18: Wetland Fauna

The wildlife that fully or partially depend on water reserves such as river, canal and pond etc. for life, shelter, nesting, breading and reproduction 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. In the survey area there are two major types of wetlands namely permanent wetland (rivers. Tributaries, canals and ponds) and seasonal wetlands (agricultural lands during flood).

4.18.1 Fisheries

Two hundred and fifty species of fresh water fish have been identified in Bangladesh. The most important species is Hilsa followed by Carps, Catfish, and Prawns. Bangladesh has the highest rate production per unit area (4075kg/sq km) and fish, accounts for 71% of animal protein intake. It is estimated that 73% of rural household undertake some sort of fishing in the course of a year. Average fish production from pond is 750 kg/ha. [12] In this project site fish production is almost similar to national average but fish is usually produced in the rivers and wetlands and is cultured in fish farms. It has been reported by Bangladesh Centre of Advanced Studies that fresh water fish production has declined significantly due to over fishing, pollution and construction of hydraulic structure Natural reproduction of fish is tightly bared and linked to cycle of annual flooding.

4.18.2 Endangered and Vulnerable species

According to the field survey report, five species were in endangered while five species were in Vulnerable category has shown in Table 4.7.

Table 4.7: Endangered and Vulnerable Species

Category	Endangered		Vulnerable	
	Local Name	English Name	Local Name	English Name
Amphibian	Jhi Jhi Bang	Bull frog	Sona Bang	Golden frog
Reptiles	Gokhra	King cobra	Gui Shap	Keel back snake
Mammals	Khkshial	Fox	Khatash	Wild cat
Birds	Machraga,	King fisher	Pecha,	Owl
	Shakun	Vulture	Kath Thokra	Wood pecker

[Source: field survey database]

4.19 Economic development

The reviewed information of the Five Year Plan (1990-95) was incorporated in the fifth five Year Plan (1997-2002). In this respect, it was mentioned in the FFYP (1997-2002) that there was marked change in the structure of the economy in Bangladesh. The shares of the manufacturing and services sectors went up further and the agricultural sector declined in line with its historical trend. The share of agriculture sector went down to 32.77 percent 1994/95 from 41.77 percent in 1984/85 In spite of these shifts, the economy continued to be dominated by agriculture. It remained susceptible to natural hazards. However, increasing trend was seen from 1984/85 to 1994/95 in other sectors like industry (9.86% to 11.36%), electricity, gas and natural resource (58% to 1.86%), construction (5.53% to 6.33%), transport and communication (11.22% to 12.17%), trade and other services (19.2% to 22.98%) and public services (3.25% to 5.06%).[13] In line with this, the FFYP aimed to put Bangladesh a path of self-sustaining growth for improvement of socio-economic condition of the people. The economic development in the project area is remarkable; it was observed that Sunetra has already brought substantial change in economic condition of this area. There is also possibility of gas based employment opportunity which will help in further increasing economic development in the project area.

4.20.1 Socio-economic profile of the project area

This section is intended to highlight the socio-economic scenario of the project area and its vicinity. It covers demographic and socio-economic characteristics of the project inhabitants. It is prepared on the basis of primary and secondary sources of data. I have collected data on population density, household size and other available utility services. These are briefly described below.

4.20.2 Socio -economic status

Socio economic profile of the project area based on the data available with the primary and secondary sources is presented here.

4.20.2.1 Demographic characteristics of Sunetra area

A review of the demography of the project area will help to understand the characteristics of the people living inside villages around the structure. This section presents an analysis of some selected characteristics of the inhabitants of the district, including population by gender, population density and gender ratio.
Distribution of the population by gender, population density and gender ratio in the Project - affected villages is presented in Table 4.8

Table 4.8: Population Distribution of the Project Area by Household size, Total Population and Literacy Rate

Village Name	Household	population			Literacy (7 years) in percentage		
		Total	Male	Female	Average	Male	Female
Gabi	400	2050	1050	1000	63.26	65.03	61.46
Siram	725	4100	2100	2000	60.06	59.14	61 .01
Sorsem	802	5125	2625	2500	46.82	47 .39	45.7
Bahir kandha	750	3075	1575	1500	54.4	57.2	51.6

[Source: Compiled from Population Census 2011, National Series, Union Statistics, Bangladesh Bureau of Statistics]

There are 105 males for every 100 females in the project- affected union. The gender ratio 1.05 of the project-affected union is more or less similar to the national average, which is 1.06

4.20.2.2 Distribution of age of population, household size and head

The distribution of the household members by age is important in order to know the dependence ratio. Generally members between 14 years and 65 years of age are treated as in the working age. In this area 56.1 percent of the household members are in working age group (15-56), their dependence ratio is 44.56 (Table 4.9).
Table 4.9: Distribution of Household Members by age

Age Group	Percentage
0-4	11
5-9	11.5
10-14	10.5
15-17	9.5
16-34	21
35-54	18
55-65	11
65+	7.5
Total	100

[Source: Population Census 2001, Preliminary Report, Bangladesh Bureau of Statistics]

The household size, however, is 5.9 in the project area and this is almost similar to Sunamgonj District, average of 5.9 and higher to the national average household size of 4.8.

4.20.2.3 Educational status of the area

The literacy rate of the project area is 45.5 % about 42.1 % of members excluding 12.9 % children in the sample households are illiterate and provided by BBS. Among the literate, 13.0% of the population only can read and write. In addition, 12.5 % attained primary education and 9.6 % attained secondary education. The remaining 8.4 % have attained education at higher secondary level, graduate/post graduate or equivalent make only 5.2 % of the population. The literacy rate of the area is lower than the national literacy rate 65.0 % as reported by BBS in 2011. **[13]** It is also support by FGD data, which states the literacy rate as 35 to 45% and literacy rate of male and female members is almost equally distributed. (Table-4.10)

Table: 4.10 Distributions of Household Members by Education

Level of Education	Percentage
Children (up to 4 years)	12.9
Illiterate	21.3
Only able to read	14.8
Able to read & write	13.0
Primary	12.5
Secondary	9.6
Higher Secondary	8.4
Graduate	5.2
Post Graduate	2.3
Total	100

[Source: Population Census 2011, Preliminary Report, Bangladesh Bureau of Statistics]

4.20.2.4 Occupational structure of the area

Occupation indicates source of income from work as well as social status. Table 4.11 presents the main household occupation. Findings depicted that the household working is the main activity and than agricultural farming and business but there are lots of people whom are not working. The remaining is involved in service, transportation and construction. The households with unemployed person having no sources of income are dependent on others and seek job.

Table 4.11 Population 10 years and main Occupational Activity of the four village

Activities	Village Name				Total
	Gabi	Siram	Sorsem	Bahir kandha	
Total Population	2050	4100	5125	3075	14350
Not working	818	1430	2139	427	4814
Looking for work	51	106	235	31	423
Household work	545	1106	1559	785	3995
Agriculture	94	543	1550	446	2633
Industry	0	0	05	0	05
Water, Electricity and Gas	0	3	4	2	09
Construction	30	113	67	35	245
Transportation	45	138	160	2	345
Hotel and Restaurant	35	9	1	0	45
Business	256	299	529	56	1140
Government Service	11	61	37	8	117
Others activities	216	372	965	114	1667

[Source: Population Census 2011, Preliminary Report, Bangladesh Bureau of Statistics]

Households with physically retarded/crippled persons

The proportion of physically or psychologically handicapped people is 0.5 %.

Housing condition

All of the surveyed households have houses of their own. About 83.5 % of the houses are found to have roof made of tin sheet, about 7 % are found to have roof made with concrete and the rest are made with thatch.

4.20.2.5 Physical facilities of the households

Electricity
Electricity supply is available in 75% Household in the project area.

Water facilities for household use

Tube-well is the main source of domestic water including drinking and cooking for all households.

Latrine facilities
About 95% of the households in project area use sanitary ring slab/pit Latrine. Latrines having septic tank is used by only 4.2% households of the union

Table 4.12 Household in dwelling unit by source of drinking water, toilet facility, electricity connection and ownership of agricultural land

Source	Village Name			
	Gabi	Siram	Sorsem	Bahir kandha
Tao (small pond)	9	22	8	3
Tube well	494	630	1139	453
Well	3	47	111	2
Pond	10	25	40	47
Others	1	66	49	37
Electricity connection	455	729	1345	199
Own agriculture land	157	500	907	354

[Source: field survey database]

Cooking fuel

Most of the households (95.0%) use wood as the cooking fuel. Besides they use leaves, cow dung, husk etc. Considering per month average market price of the cooking fuel used by per household is Tk. 700-800. But most of them collect it from here and there free of cost. A very few (5.3 %) of the households use LP gas for cooking. All the people of these villages urged for distribution of pipeline gas into the villages at a reduced price than national rates as they have largest gas collecting plant in their area. They feel deprived for not getting pipeline gas in their villages.

2.20.2.6 Employment opportunity

In response to questions about non-farm employment opportunities in the area, most of the people of the villages mentioned that they have only scope in engaging as day Labor in seasonal brick field, construction works, etc. or as mason or transport employee. A very few people mentioned that they have some scope of employment in agro-based industries like nursery, poultry, etc.

Table 4-13 Household in Dwelling Unit by Main Source of Income

Main source of income	Village Name			
	Gabi	Siram	Sorsem	Bahir kandha
Agri / Forestry	223	216	439	338
Fishery	1	21	62	2
Agriculture labor	93	113	155	80
Not Agri labor	32	21	132	2
Hand loom	0	6	4	0
Industry	1	6	10	8
Business	176	221	420	29
Hawker	4	11	3	0
Transportation	40	111	111	3
Construction	15	56	23	23
Religious	1	4	2	2
Service	104	156	116	13
Rent	3	1	2	0
Remittance	30	43	51	39
Other main income	91	149	370	112

[Source: Population Census 2011, Preliminary Report, Bangladesh Bureau of Statistics]

4.20.2.7 Social problems

The response raised a lot of issues on existing social problem of the area. Lack of gas supply, lack of drinking water in the interior of the villages due to arsenic contamination into the tube wells (12.7%), lack of sanitation facilities (54.3%), were identified as the main problems. Communication inside the villages is poor, almost all roads are walking path.

Table 4.14 Distribution of Identified Existing Social Problems in the Area

Social Problems	As a percentage
Lack of pipeline gas supply	100
Lack of sanitation facilities	54.3
Lack of good communication inside the villages	49.2
Land dispute	9.9
Lack of drinking water interior of the villages (arsenic contamination)	12.7
Unemployment (excluding Household work)	39.0
Shortage of educated people	12.4
Social conflict	36.2
Others	13.9

[Source: field survey database]

4.20.2.8 Gender situation

Women of this Salboros area are very much similar in tradition as other parts of Bangladesh. Most of them are housewives and very few of them are engaged in income generating activities. Among the income earners most of them are employed as teachers, NGO workers etc. Poor women are engaged in selling labor in others' houses, grinding spices inside houses for hotel and poultry rearing etc. Some NGOs and co-operative societies work in the area where only poor women can be members. They are involved with BRAC, ASA, Proshika, Grameen Bank, Adarsha Samabaya Samity, etc. They receive loan from these and invest in the small business. It should be mentioned here that though this is conservative area but women are not prohibited to take part in income generating activities. Women of this area face repression in case of not giving dowry to their respective husbands.

4.20.2.9 Quality of life values

Literacy rate, occupation, land holding, water and sanitation facilities, etc. described in the previous sections of this chapter are the determinants of quality of life of the households. It is observed in the project area that large number of people is farmers and majority (55.1%) of them is landless farmers. Urbanization is reflected on using sanitary latrine (70.5%) and electricity (90.0%) All the households use tube wells for drinking water. It is expected that the successful implementation of the project will generate scope of trading as well as employment opportunity. The supply of gas to the domestic houses, if done after the completion of the project, will be a benefit from the project intervention as wood is the main source of fuel for cooking at present.

4.20.2.10 Aesthetic values, recreational resources and development

The aesthetic values of the area have been increased due to recent construction of office and small residential buildings within the Structure areas.

Historical/Archaeological relics

There are no historical /archaeological relics in the project area

4.20.2.11 Cultural value

People of two religions (Muslims 85% and Hindus 15%) live in their own community following their own tradition without facing any major problems despite very marginal number of Hindus. The points of cohesion of the Muslim people are Eid, Friday prayers, Marriage Ceremonies and Burial occasion. On the other hand, the point of cohesion in the Hindu community is Worship, Funeral and other Hindu festivals. Both of the Hindus and Muslims take part in each other's marriage ceremonies. Moreover, in some other points both religious group meet in the same place i.e. sports ground, village fair and in any developmental work of the area. Women of the project area irrespective of religions are adhering to the restriction of religion.

4.20.2.12 Institution, social organization and public health

According to the villagers, various types of non-farm employment in non-govt organizations, transportation. Construction works, labor selling in brickfield, Structure, shoe making small Industries, nursery and poultry, etc is available here. The people in the project areas have the access (in terms of employment opportunity) to these sectors.
However, there is agricultural labor crisis in peak cropping seasons in the area. The agricultural laborers, therefore, from outside the project areas avail the opportunity to work there. Educational institutions are available in the project area. There are primary, junior and high school, kindergarten school, college, jam-e-mosque and madrasaha remain here.

4.20.2.13 Transportation

The communication network is not good in the Project area as it is far away from any national highway. Only a narrow road runs through it, which is in poor condition.

4.20.2.14 Sunetra Structure area status at a glance

Population density per km square	About 1231
Household size	5.0 persons per household
People by religion	Muslim -85%, Hindu and others- 15%
Land area	Most of area around Structure are cultivable land
Distribution of land by cropping intensity	About 90% produce Boro and other paddy. Rest 10% produce potato, tomato and ground nut.
Major crops	Paddy: Boro, Aman, and Aus. Robi crops: Mustard, Pulses, Vegetables and Potato.
Available trees	Mango, Blackberry, Mahagoni, Bamboo, Rain tree and a small number of jackfruit trees.
Rivers and Canals	One river with several canals in the affected area.
Occupation	Maximum people are economically solvent mostly due to remittances. About 20% household have one or more family member working abroad. Farmer 55%, Business 5%, Service 20%, Labor 20%
Local industry	There are two brickfields, some small poultry farms and about 10 seasonal aqua culture farms using crop land.
Utility and services - Electricity - Water - Gas - Telecommunication - Medical facility	Electricity: Though it is very remote part of the country, yet about 75% households have access to electricity from REB. Rest 25% use kerosene for lighting purpose. House hold water use: About 90% household drink tube well water and 10% drink river water. For household washing about 60% use river and pond water. Most of the household have their own pond as this area is very low lying. Cooking fuel: About 80% household use firewood, cow dung and agricultural refuses for cooking. Gas is not available in this area. Telecommunication: Grameen phone network is available in this area. Medical facility: There is only one community clinic in this area.

CHAPTER-5

PUBLIC CONSULTATION

5.1 Introduction

Social and environmental factors for successful implementation of the proposed project, a plan is made to undertake a comprehensive process of public consultation and environmental investigation. Feedback from the consultation process will play a vital role in social and environmental programs. The purpose of consultation is to inform local inhabitants/primary stakeholders to make them aware of the project and to gather their opinion/suggestions about the proposed development program as well as to incorporate their suggestions during project planning and implementation stage.

5.2 Methodology

As part of the EIA process, group discussion with stakeholders were organized and conducted to record views and opinions of the stakeholders were recorded. Participants in these consultation meetings included elected representatives, local leaders, women groups, representatives of professional groups like agriculturist, businessmen, etc In addition, a number of Key Informant Interviews were earned out with selected key individuals. For uniformity and clarity in conducting the public consultation meetings, a checklist as devised by the participant to comprehend the issue' easier that they could participate in the discussions more effectively and express their opinions and views objectively. This participatory approach was well accepted by all the participants. During the public consultations, social, environmental as well as cross-cutting issues were discussed, including potential impacts of the project, activities on environmental and social parameters, identification of sensitive issues, risks, and potential threats from the project.

Public consultant's checklist [14]

- Location of consultation
- Name and occupation
- 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

5.3 Findings from public consultations

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.

1. Agricultural products including vegetation may be affected. Due compensation of which should be paid on the spot to the affected people.
2. Assembly of people during project activities may damage crops and other trees.
3. Noise pollution from vehicles and equipment at the project sites may cause disturbance for human beings and wild life.
4. Compensation for land as per government rule would not be a fair compensate to the affected person as it is far below prevailing market rate.
5. There will be increased soil erosion particularly on the river banks, which should be addressed properly.
6. 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.
7. Movement of vehicles may affect movement of people, especially women, children and disabled persons from one place to another.
8. Air pollution due to dust and gaseous emission should be controlled.
9. Environmental pollution through sanitation and waste materials as well as other social nuisance should be controlled.

5.4 Expectations of the people

- Local people should be employed in different activities of the project on a priority basis;
- Local businessmen/ contractors should be engaged in different phases of the project for construction and development on a priority basis;
- Compensation payment in any form, if any, should be properly and promptly distributed, so that the actual affected persons get their fair shares and in right time.

CHAPTER-6

IDENTIFICATION, ANALYSIS AND MITIGATION OF POTENTIAL IMPACTS

This chapter identifies and evaluates the potential impacts associated with the drilling of new wells. Impact identification and risk ranking requires an examination of interactions between Important Environmental Components (lECs) and project activities. A number of lECs have been identified basically based on ADB and DOE guidelines, additional reference document of donor exercise and prior professional experience.

6.1 Identification of impacts

Table-6.1 shows the various project activities, potential negative impacts and risk ranking (Severity versus duration) of potential negative impact of the proposed project.
In reviewing impacts, this section addresses the following issues

- Air Quality;
- Noise and Vibration;
- Surface Water Quality;
- Groundwater Quality,
- Soil Resources;
- Land Erosion;
- Seismology;
- Biodiversity;
- Land Use;
- Transportation / Traffic**;** and
- Other Social Aspects.

Table-6.1: 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 Loss of trees and structure	 M M M	 P T P
Construction Phase			
Dust emission from excavated soil Dust emission from movement of Vehicle Emission of smoke from vehicles, generators compressors and other stationary and rotating equipment and machinery	Air quality Public nuisance Air pollution Air pollution	 M N N	 T T T
Noise from vehicles and above equipment and Machinery	Noise and Vibration Nuisance to local people, Live stock 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 leveling. Mixing fertile top soil with unfertile subsoil. Discharge of toxic wastes. Movement of heavy vehicles and equipment.	Soil Resources Erosion Loss of fertility Soil degradation due to pollution Soil compaction	 M M M M	 T T T T
Discharge of drilling fluids. Excavation of soil. Clearance of vegetation. Movement of vehicle. Noise from construction and erection. Equipment and the rig and its associated stationary and rotating machinery.	Biodiversity Loss of natural vegetation loss of plants obstruction to traffic Nuisance to people and animals	 M M N M	 P P T T
Excavation of land. Movement of heavy vehicles and equipment. Solid waste disposal. Interference with navigation/fisheries. Protection of workers' health and safety. Production testing and flaring from completed wells and purging, testing and commissioning of process plant, pipeline and ancillary facilities.	Other Social Aspects Loss of crop Public nuisance public nuisance Commercial loss Loss workers health	 M N M M M	 T T T T T

Table: 6.1 continues

Post Construction Phase	potential negative impacts	severity	duration
Security checking of pipeline route. Inadequate periodic monitoring Leakages and line breaks. Discharge from operation and maintenance	Disturbance to social life and wildlife Loss to Ecology and Economy Nuisance to people, animal and loss to Ecology and Economy.	N M S	T T T
Note: N = Negligible, M= Moderate, S= Severe, T= Temporary, P = Permanent.			

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[Source: EIA report for drilling of wells at Titas and Bakhrabad Structures]

6.2.1 Effects during drilling

The Environmental impacts on drilling operation may occur as a result of obstruction, debris discharges, accidents spillage of condensates, chemical discharges and physical disturbances to the surrounding areas. In addition, there is some potential risk for serve accidents. All of these need to be considered while assessing the environmental impact of Gas production. Three major sources of soil and water potation can be identified from operations these are i) drilling mud ii) produced water and iii) production of chemicals. [15]

I) Drilling mud

The major discharges associated with the drilling / drilling operations is drilling mud. Drill mud are used to cool and lubricate the drill bit, to remove rock chippings from the well and most importantly, to maintain safety during drilling by assisting in maintaining well pressure control.

Drill mud is particles of crushed sedimentary rock produced by the action of the drill which penetrate into the substrata. The drilling mud is contaminated which after treatment are discharged into a pit known as mud pit.
The Mud pump used in the drilling operation pumps the mud down the drill string through the bit and then carries the drill cuttings through the annuals between drill pipe and borehole back to the surface.

Drilling mud contains a base liquid (either oil, water or a synthetic material), bentonite and a variety of chemicals which are added to the mud for achieving the desired properties, These chemicals may include: viscosifers, emulsifiers, biocides, lubricants, wetting agents, corrosion inhabitants, surfactants, detergents, caustic soda (NaOH), Salts (NaCI, CaCl, KCI) and organic polymers.

ii) Produced water

In addition to natural gas structures may produce considerable quantities of water. At the production field the formation water will be separated from the gas. This separated water which also contains hydrocarbons and chemicals from the reservoir and chemicals injected during productions is called production water. Production water is generally, after simple treatment discharged into the pond. Over time, as Structure matures the amount of water produced with the gas often increases as the amount of gas produced decrease.

Produced water is principally salt solution and most of them are concentrated in water. Based on available analysis, metal may be present in substantially higher concentrations too. These include Barium (Ba), Beryllium (Be) Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Nickel (Ni, Silver (Ag) and Zinc (Zn).

iii) Production of chemicals

Chemical used in the gas production process includes biocides, corrosion inhibitors, scale inhibitors and gas treatments. Elevated Cd and Hg levels have been recorded for waters in active gas production area. Some surfactant is known to disrupt endocrine function in freshwater fish and may affect breeding of the fishes.

6.3 Analysis of impacts and suggested mitigation measures

6.3.1 Air quality

The existing air quality in the region of the Structure will be dominated by relief blows and purged gas including emissions from generators, engines and vehicle traffic of the project site may affect the environment. There are no significant industrial sites in the immediate vicinity of the proposed project site. However, moderate level of emission will occur from various types of equipment used during drilling operations.

Diesel generator on the rig, during drilling operation releases COx, SOx and NOx. An atmospheric emission consists mainly of exhaust from diesel engines supplying power to meet rig requirements. These emissions may contain small amounts of sulphur dioxide (depending upon fuel sulphur content) and exhaust smoke. Some unburned hydrocarbons may also be released, depending on the flare tip efficiency. Exhausts may be released from the ancillary equipment of the rig.

During drilling, installation and construction, the principal air quality impacts will arise from dust generation from excavation of soil, pipe laying and vehicle movement. Stationary and rotating machinery of drilling rig and heavy vehicles may cause smoke emissions, but the impacts are local and temporary.

Mitigation

- Machinery equipment deployed in drilling and plant installation operations shall be routinely inspected and maintained in good running condition;
- Excavate 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;
- Visual inspections of equipment and vehicles shall be conducted on a regular basis to ensure no excessive emissions of black smoke; and
- Road is made of pitch and brick.

6.3.2 Water Quality

Surface water quality may be affected by washing and rainfall from the plant. Sewerage discharge may come from construction area or residential area or office area.

The amount of sewage discharge depends on the number of personnel at the camp or construction site. The expected level of sewage discharge from the proposed work should be minimal due to limited number of personnel working at the site.

During well testing solid rock may be produced with the well effluent. In case of significant sand production, the well testing will be curtailed to ensure that the volume of sands can be handled effectively for subsequent disposal.

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;
- Containment of sanitary waste should be adequately disposed off to avoid surface and ground water contamination;
- Adequate provision has to be retained for the treatment and disposal of drill cuttings, drilling fluids and other chemicals and lube oil wastes generated during drilling, testing and commissioning stage.

6.3.3 Socio-economic

The socio-economic impact of the project will be felt at the local and national level. That is to say, the successful implementation of this project in the areas will contribute significantly to the economic growth both at the local and the national level. The potential impact on the socio-economic condition at the local lever will be generated primarily from the employment of labor during the project activities.

All contractors working for the project will engage 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 cause some disruption to the social structure of the local people. Company will seek to minimize this impact by introducing a Code of behavior in consultation with the local communities. Potential impacts will be temporary and minor in nature increased spending in the local economy by outsiders will be a positive impact, although for a period of short duration only.

Mitigation:

- Procedures for liaison with local people to be established before commencement of the works. Company should clearly explain to local people about the need for the project both the country and regional contexts;

- Company should also reassure the public about compliance with environmental impact, mitigation measures and safely measures prepared for local communities;

- Local communities must be consulted before commencing and future development projects in or near their community;

- Large concentrations of housing for construction laborers should be avoided;

- Staffs are to be recruited locally where company shall encourage contractor to employ local people during construction work;

- Public relations programs with local communities should be continuously maintained to advice on risks and safety. It is particularly important lo appraise them about the preparations taken to meet any eventualities in course of drilling, construction and testing and commissioning stages;

- 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

- Representatives from local communities should be allowed to join the committee to ensure justice and transparency.

6.3.4 Noise and Vibration

The movement of vehicles and construction equipment and heavy machinery at the rig site will produce noise and vibration during the drilling and construction stages. This impact will be minor in nature and of short duration at the rig and the process plant site and at any particular location along the pipeline-drilling route.

Mitigation

- Selecting quiet working methods and use of low noise equipment must be specified in drilling, plant erection and construction tender documents;

- Except for unavoidable situation for drilling operations, the project activities should not take place at night time. 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.

6.3.5 Land and Soil

Construction of rig and drill pad foundation, process plant structures and digging of ditches at rig base along the Right of Way (ROW) is very important. The impact of such changes could result in severe erosion and Impairment of wafer quality in nearby drainage channels and waterways, fragmentation 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 done 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. Top soil shall be stored separately; and

- In case of the following existing road, the road has to be strengthened where necessary.

6.3.6 River crossing

Trenching and backfilling operations at steam tributaries and crossings shall be conducted.
During the dry season when river elevations and flow are at their lowest. The location of the crossing head shall be monitored at all times and corrective measures should be implemented, when the specified clearance between the river bottom and the pipe depth is less. 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 of 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.

6.3.7 Flora and Fauna

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.

Mitigation

Should clear the ROW as minimum as possible with minimum cutting of big trees, and
Re- vegetate the exposed part as early as possible just after completion of the project.
Take up proper plantations to compensate for the loss of flora and fauna during the works.

6. 3.8 Drilling waste management

Drilling operations result in a variety of wastes. Sludge from vessels, Tanks, and drilling operations deposited to pits may cause ground water contamination if not properly contained.

Sumps construction, size or positioning may lead to unnecessary spills or overflows of drill fluids.

If spills are not contained, the soil surface water and groundwater may be damaged. Pits excavated in areas of disturbed or porous soils may result in contaminated shallow ground water resources through leaching. Usually, drilling wastes are dumped in pits near drilling sites.

Proper management of toxic drilling chemicals is to practice to treat and reclaim drilling sumps at the well sites.

Drilling fluids may contaminate local surface and groundwater, and soils. Accidental discharges spills of NGL may cause water and soil contamination and fire hazards.

Hydrocarbons and produced waters associated with gases directed to the flare pit may result localized contaminated ground water.

Use of existing facilities will be promoted wherever possible to minimize land loss. Drilling fluids during well refurbishment at well sites will be contained and not discharged to the surrounding environment.

Hydrocarbon liquids from gas production will be discharged only to lined ponds or tanks that will be beamed to prevent spread. All fuels will be treated similarly.

A spill and leak prevention program will be implemented to ensure that the leaks are minimized and any releases cleaned as rapidly as possible. Spill and emergency response plans will be developed as part of the management system.

Guidelines will also be developed for contractors to follow for the protection of surface water and groundwater during drilling, well drilling, and pipeline & plant construction and operation. The guideline will include site development, site maintenance, and waste management, site cleanup and safety.

6.3.8.1 Impact of drilling discharges

Company proposes to utilize non-toxic, biodegradable, water based drilling mud in their drilling program. Only in exceptional circumstances, such as a stuck drill pipe, will there be the need for the use of oil base mud.

All fluids and cuttings will be returned lo the rig, where the cuttings will be passed through a comprehensive solids control system. This allows the mud to be separated from the cuttings for recirculation before the cuttings are discharged overboard. Initiative may also be there to employ a mud saver on the drill floor to prevent excessive losses lo the drains system.

The cuttings discharged are expected lo have a highly variable distribution of particle sizes. This will include a range from coarse gravel, with an approximate size of 20 mm. to fine silts and clays, 0 002 mm to < 1 mm in size. [16]

The effect of fine particles is negligible especially in the study area. The releases from the rig will be insignificant and virtually indistinguishable from the natural environment. Similarly, there will be no detrimental effect upon any species.

Accumulation of coarse gravels and other similar materials will occur relatively close to the wellhead. This will result in to the formation of a cutting pile. Irrespective of any adhering mud, the discharge of drilled material will modify the sediment that it lands on.

In contrast, the toxicity of some chemical components can lead lo the migration or mortality of local fauna and flora, as well as a potential reduction in oxygen levels.

6.3.8.2 Potential impact of aqueous discharges

Aqueous discharges, such as sewage and drainage waters, are also usually released from the drilling site. Their environmental impacts are dependent on various factors, although the dispersion and dilution of effluents that occurs immediately following release is the prime factor in reducing potential impacts.

The behavior of aqueous discharges is most easily described in two stages. These are representatives of the situation close to the discharge point and at long range.

Close to the point of discharge the near-field behavior of the effluent is highly dependent on the discharge density, that is, will it float or sink the flow; rate and the ambient water current.
Normally effluent plumes travel downwards when released in any water column due to their own momentum. This motion provides the initial mixing and dilution of the discharge. Depending on the density of the effluent, it may either continue traveling downwards, or may begin to rise. Continued movement of the effluent facilitates dilution and dispersion.

At long ranges, only the ambient environment can have any real effect on dilutions. These factors are not under the control of operator. A combination of low current speeds and still water surfaces and low wind speeds produces poor dilution and slow dispersion. In such conditions turbulent diffusion and advection are low.

6.3.8.3 Sewage discharge

It has been envisaged that the rig operators will act and monitor in such a standard that the drainages system used for adhering to an operation discharge limit of 15 ppm oil in water for machinery discharges.

Again, good dispersion is expected after release. At maximum discharge levels of 15 ppm oily water there will not be having any significant impact on the environment. [17]

6.3.8.4 Well kicks and Blowouts

An uncontrolled influx of formation fluids to the well bore is considered a well kick. If this uncontrolled influx of formation fluids is not controlled by surface equipment then the fluids can be displaced without losing control, the kick terms into blowout.

There are two types of blowouts:

A surface blowout occurs when formation fluids are flowing uncontrolled into underground zones.

A simple influx of formation fluids into the well bore is not considered a well kick if the surface equipment is not closed to prevent further entry of formation fluids.

CHAPTER-7

ENVIRONMENTAL MANAGEMENT PLAN OUTLINE

Environmental management plan is the prerequisite task for successful execution of schedule work and operation, may have both positive and negative impacts and various components of the environment and socio-economic conditions. An Initial Environmental Examination has been introduced to measure the issues and to minimize adverse impacts resulting from the project. The following surveys have identified the potential positive and negative impacts to develop the Environmental Management Plan (EMP).

- Environmental baseline condition survey
- Socio- economic survey
- Biological resource survey
- Land use survey

This EMP has been done by the help of others books and similar reports. Environmental components and sub-components were identified and their magnitude and duration of impacts were examined. The functional components of the EMP for the project are described in the following sections.

7.2 Organizational Aspects

Each step of the project management consists of a number of organizations, each of which has some specific responsibilities for particular aspects during the pre-construction, construction, operation and maintenance phases. A detailed schedule of management actions requires a specific individual responsibility.
A data base of environmental measurement is very important. The management should take over the responsibility in each step.

- Policy and Leadership
- Continuous Improvement
- Safety and Health
- Risk Management
- Incident Reporting and Investigation
- Emergency Preparedness and Response
- Environmental Protection
- Training and Orientation
- Community Relation
- Regulatory requirements

7.3 Environment safety management system process

According to Environmental Specialist, a systematic operation is established. The steps are listed below. [18]

(a) Specific activities and responsibilities

At all levels of the organization, responsibilities should be assigned as per specialist suggestion. Manager and supervisor of the company will maintain the procedure and make one of three choices:

1. Determines that accountability for fulfilling a particular procedure more appropriately belongs to a higher management level; or

2. Assumes personal responsibility either by (a) taking personal responsibility for fulfilling the procedure or b) delegating responsibility for fulfilling procedure to others in the Organizations; or

3. Pass the procedure along to those that report to him, who will then decide which ones to keep and which to pass on. This process will continue in organization until all procedures have an assigned responsible person who will assure that the procedure is implemented.

(b) Implement the system

Responsible person will develop the approach and the system which the specialist suggests for further procedure implementation. Hereby, training is necessary to support implementation.

(c) Measure, assess and audit progress

Measuring ESMS progress is critical to improving performance, successful ESMS must be a continually improving process. The company ESMS includes several ways that this measuring can be done:

1. Co-worker assessment: A trained co-worker will maintain the procedure which may be fulfilled by a responsible person. Trained co-workers from the same or other facilities with the same or similar responsibilities would conduct the co-worker assessment.

2 Self assessment: Each responsible person assesses his own progress. In this assessment, a simple, Three-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 to be held up as a model for others to emulate.
5. Another way of measuring ESMS performance is monitoring by the Company Environmental Specialist Manager.

7.4 Health, environment and safety management plan

Pipeline has to be designed to avoid or minimize impacts on the environment, wherever it is possible. The Company would ensure the implementation of mitigation measures to reduce negative environmental impacts on Health, Environment and Safety. The Operation Management System (OMS) provides mechanism to address potential adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for project.

7.5 Environmental management costs

At this stage a number of matters have not yet been resolved which have bearing on environmental costs. These include:

a. The precise nature and extent of work.
b. Nature and scope of institutional strengthening and environmental training.

However, company will implement the Environmental Management Plan under the project with the institutional frame work on the company.

7.6 Environmental Monitoring Plan

Technical aspects

The technical aspects incorporated the parameters to be monitored, methods of measurement, location or area to be covered and frequency and duration of monitoring. The parameters must cover the potential impacts, identified in the environmental studies. The methods to be chosen for monitoring parameters should be standard statistical, analytical or relevant cost-effective methods. The location, frequency and duration of measurements should be obtained.

Materials, supplies and equipment

In the budget of the monitoring program, the materials, supplies, equipment and personal requirements should be involved.

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 physical -chemical, ecological, human interest and socio-economic indicators should be well defined and a mutual relationship among the indicators should be well understood. The monitoring program should consider the indicators for the impact assessment reeled to the following issues:

Erosion

It was identified that unstable slopes, particularly al the stream crossing earthen portion of RHD and LGED road, will have erosion and consequently increase sedimentation in the nearby wetlands. Careful monitoring will be required to estimate erosion impacts.

Air quality monitoring

Negative impact on air quality would mostly come from dust emissions by the movement of heavy vehicles during construction and during operations. Mitigation measure will reduce the negative impacts.

Noise monitor

Horizontal Directional Drilling rig, compressors, welding machine, small generators and movement of vehicles make noise as its operation. Placement of power generator units inside sound proof rooms and regulating the use of hydraulic horns should be monitored for compliance.

Health and safety monitoring

Periodic checks of health and safety measures for construction laborer and other project personnel shall be performed. First aid and medical services shall be available.

Water quality monitoring

Ground water quality monitoring shall be done at regular basis. Periodic monitoring of surface water quality at upstream and downstream of nearby watercourse of the project shall be performed.

Disruption of road traffic

- To ensure the compliance of mitigation measures, disruption of road traffic should be monitored;
- Alternate temporary access ways for movement of vans and rickshaws 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 lo be measured, and cost is provided in Table-7.1 **[19]**

Table-7.1: Environmental Monitoring Parameters to be measured

Activities	Parameters	Duration	Total cost
Socio-economic disruption	Living standard	During the entire project	10,000.00 Tk.
Water logging	Visual Inspection	During monsoon period	35,000.00 Tk.
Surface water quality	TDS, COD, BOD, pH, DO, TSS	*2* (During dry and monsoon)	10,000.00 Tk.
Ground water quality	pH, Fe, Mn, As	1 (during dry season)	10,000.00 Tk.
Drinking water	Fe, Mn, As	2 (during dry & monsoon)	5,000.00 Tk.
Soil	Heavy metals, oil and grease	2 (during dry season)	5,000.00 Tk.
Solid waste	Quantity	Continuous	15,000.00 Tk.
Road traffic	Arrangement, safety	Continuous	15,000.00 Tk.
Air	NOx, SOx	2 nos. during construction	25,000.00 Tk.
Noise	Noise Level in dB	2 nos. during Construction	5,000.00 Tk.
Health and safety	Inspection of health and safety of labor.	Continuous	15,000.00 Tk.
Total			1,40,000.00Tk.

[Source: EIA report for drilling of well at Titas and Bakhrabad Structures]

7.7 Safety and Hazard Mitigation Plan

Safety management system

The company has its own safety management and mitigation plan and policy. By fulfilling safety responsibilities, employees will share the benefits of a safe work place. The important features are listed bellow:

General safety procedure

The safety policy should be updated from time to time. The policy should be signed and dated by The Chief Executive Officer; the policy should be discussed with all personnel. The Project Manager should periodically review the policy. The Gas Safety Rules1991 (Amendment 2003) shall be followed for the implementation of the project.

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;

That they follow the operating procedure and general safety.

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.

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.

7.8 Responsibility of the Contractor

Company shall ensure that Contractors will take due responsibility to mitigate these negative impacts. [20]

1. Take reasonable steps to protect the environment;
2. Comply with regulations concerning the execution of work;
3. Familiarizes with legislation and regulations relating to environmental protection that is relevant to their activities;
4. Refers to national environmental quality guidelines;
5. Be responsible for the costs of cleaning up any environmental issue;
6. Maintains sites under their control in a clean and tidy condition;
7. Shall not allow used oil or other petroleum wastes to be used;
8. Be responsible for the provision of adequate sanitary facilities for the construction workforce at construction and camp sites;
9. Takes reasonable measures to minimize dust blow arising from sites under their control by regular watering of soil stockpiles;
10. Be responsible to pay compensation upon the appropriate monetary evaluation applicable to the local market if any damage is incurred.

7.9 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:

1. People
2. Property
3 Environment

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

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

1) Emergency

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

2) Natural disasters

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

3) External factors

- Food poisoning,
- Sabotage, and
- War.

7.10 Six steps in emergency response [21]

Step-1)
a) Determine the potential hazards and take appropriate action to identify the type and qualities of dangerous goods.
b) Determine potential hazards from local conditions such as inclement weather water bodies

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

Step-3)
An assessment of the incident site for any further information on hazards or remedies.

Step-4)
Initiate redress procedure.

Step-5)
Report the incidence procedures and any further assistance required etc to the appropriate company, government and/or land owner.

Step-6)
Take proper steps regarding to hazards to wildlife, other resources and addressing public and media concerns and issues, as applicable.

7.11 Emergency Response Planning

The objective of an Emergency Response Plan (ERP) is to describe the procedures to ensure the health and safety of staff. 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 may be used depending on the particular circumstance, potential incidence rate and the location and number of residents living in the community/ locality in close proximity along the project sites. The scope of the ERP depends on the potential impact of the project activities, complexity of evacuation logistics and proximity to public facilities. A key feature of all plans is the Emergency Planning Zone which defines the area to be evacuated or protected in the event of an emergency. Another fundamental requirement of Emergency Response Planning is that discussions occur with local residents and public within the Emergency Planning Zone and must include any pertinent health factors which must be considered.

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

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

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

7.12 Specialized equipment

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

7.13 Training

In-house training programs should be held by the company and designated first responders to test their capabilities. Response teams have to be assembled both on 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.

7.14 Safety orientation

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

The orientation should include:

- 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.

7.15 Level of incidents

The affected area can be classified the following four classes In the event of a disaster at any Location within the workplace. [22]

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

Only Level-I and Level-II class of incidents or accidents will applicable within the proposed 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/wanting systems.

7.16 Incident/Accident Investigation and Reporting System

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?
- Cost estimates of damage done and repairs need.

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.

7.17 Emergency Response Plans for Oil Field and field Camp

This ERP has been arranged such that each of the anticipated emergencies has an Organization plan, a List of responsibilities and a List of duties. The following site specific Emergency Response Plan (ERP) has been developed to cover specific details for those emergencies which may encountered during drilling, drilling, completion and processing at the Well Fields and field Camps.

Drilling Supervisors have overall operational responsibility on the rig with the Tool Pushers as assistants. Supervisory personnel shall know and understand the Emergency Response plan and their responsibilities and duties.

Level-1

Emergency is a minor Emergency which can be controlled by personnel and facilities, located within the immediate vicinity of the accident/incident site.

Level – 2

This is a serious Emergency which is disruptive but not extensive and forces apportion of company operation to be temporarily suspended or shutdown.

Level -3

This is a disaster Emergency that forces the indefinite shut down of company operations.

CHAPTER -8

CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

It has been identified that over all long term environmental impacts of the Project will be negative. But there are some issues, activities and functions which will directly or indirectly create potential negative impacts to the environment. These impacts from the field survey findings are mentioned bellow:

- The socio-economic negative impacts like Loss of land, Loss of vegetation, Loss of trees and structure are mentionable and permanent due to change in Preconstruction phases (land acquisition, Clearing of access road)

- Air quality is good enough in the Project area. During construction phase change suppose, dust emission from excavated soil, dust emission from movement of vehicle, emission of smoke from vehicles, generators compressors and other stationary and rotating equipment and machinery will be cause of public nuisance but it is negligible and temporary.

- Noise and vibration from vehicles and equipments and machineries can be considered painful for the local people but it is also temporary.

- Surface water quality is good but might be changed with turbidity, sedimentation and water logging due to erosion from disturbed soil and blockage of natural existing creeks but it is also temporary.

- Ground water quality is good and might be changed with contamination of aquifer due to direct discharge of domestic wastes. This potential negative impact is negligible.

- Soil resources might be affected moderately (erosion, loss of fertility, soil degradation due to pollution, soil compaction) from excavation of soil and land leveling, mixing fertile top soil with unfertile subsoil, discharge of toxic wastes, movement of heavy vehicles and equipments. Hopefully, these impacts are impermanent.

- Biodiversity can be considered as permanent and substantial negative impact to the environment:(Loss of natural vegetation, loss of plants , obstruction to traffic, nuisance to people and animals) from the discharge of drilling fluids and other waste, excavation of soil, clearance of vegetation, movement of vehicle, noise from construction and erection.

- Social aspects will be moderately deteriorated with public sufferings due to movement of heavy vehicles and equipments, solid waste disposal, interference with navigation/fisheries, protection of workers' health and safety.

8.2 Recommendations

- To control the air quality: Machinery equipment deployed in drilling should be routinely inspected and maintained in good running condition. Vehicle speed restrictions shall be imposed to reduce dust generation and dispersion. Transport vehicles should 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.

- To control the water quality: Surface drainage should 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. Adequate provision has to be retained for the treatment and disposal of drill cuttings, drilling fluids and other chemicals and lube oil wastes generated during drilling, testing and commissioning stage.

- To reduce noise and vibration: Selecting quiet working methods and use of low noise equipment must be specified in drilling. Except for unavoidable situation for drilling operations, the project activities should not take place at night time. 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.

- To save flora and fauna: Should clear the ROW as minimum as possible with minimum cutting of big trees and re-vegetate the exposed part as early as possible just after completion of the project. Take up proper plantations to compensate for the loss of flora and fauna during the works.

- To recuperate land and soil: For mitigation measures to be effective, technical specifications as well as management procedures for their design, implementation, supervision and checking must be done prior to commencement of onsite works. Develop an appropriate and comprehensive reinstatement and site clearance plan. Avoid earth work during rainy season.

- To retain the socio economic status: Procedures for liaison with local people to be established before commencement of the works. Company should clearly explain to local people about the need for the project both the country and regional contexts. Local communities must be consulted before commencing and future development projects in or near their community. Staffs are to be recruited locally where company shall encourage contractor to employ local people during construction work. To ensure adequate compensation to the project affected people as per the law of the country. Representatives from local communities should be allowed to join the committee to ensure justice and transparency.

List of References

1. Environmental Impact Assessment report for Well 17 & 18, BGFCL, BAPEX.
2. Environmental Impact Assessment report for Well 1 & 5, SEMUTANG, BAPEX.
3. Initial Environmental Examination for construction of gathering line of Moulavibazar Development Well No. 4 and 5 to Gas Processing Plant.(group-2). October, 2004.
4. Rao M.N., Rao H.V.N., "Air Pollution", Tata Mcgraw Hill Publishing Company, New Delhi, 1989.
5. Wizetille, L., Karunaratne, S.A.R., " Air Quality Management, considerations for developing Countries", World Bank Technical paper Number 278(Energy series), The World Bank, Washing ton D.C., USA,1995.
6. Chief Editor: Islam, S., Managing Editor: Miah, S., "BANGLAPEDIA", National Encyclopedia of Bangladesh, Asiatic Society Bangladesh, March 2003.
7. Bangladesh Environment facing the 21st Century by SEHD.
8. BakhtD., "Environmental issues an Energy system in Bangladesh" Report on Environmental management, BUET, April,2003.
9. "EIA guidelines for Industries" Department of Environment , Ministry of Environment and Forest, Government of the Peoples Republic of Bangladesh, june 1997.
10. Bangladesh Soil Resource, Soil Survey Project, Map 4, Technical Report 3, UNDP-FAO
11. 3-D Seismic Survey of Titas and Bakhrabad Structure Project funded by Asian Development Bank, 2006.
12. Biological Zones of Bangladesh, IUCN
13. BBS, The Statistical yearbook of Bangladesh, 2005.
14. Environmental Impact assessment (EIA) report for workover of 8 wells at Titas Habigonj, Narsingdi and Megna Structures, December, 2006
15. Initial Environment Examination Report on PSC Block No. 10 by BETS Limited., 2003.
16. Bakht,D., "Environmental Impact Assessment of natural gas development in Bangladesh" Project Report for the degree M. Engg., Civil Engineering Department, 1998
17. Initial Envionmental Examination (IEE) Reprt on the third gas Development Project by Resource Control Company 1993.

18. ADB, Environmental guidelines for selected Industries and powers development Projects, ADB Manila.1990

19. Canter, L.W.,"Environmental Impact Assessment" Mcgraw Hill Inc. Newyork,1977.

20. Farooque M. Hossain S.R. Laws relating Environment in Bangladesh(BELA), Dhaka. 1996

21. IEE Report on Dhanua –Savar high Pressure Gas Transmission pipeline under Dhaka Clean fuel Project by HCL-2002.

22. IEE Report for RPGCL by House of Consultant Limited.2001

APPENDIX

POLICY AND LEGAL CONSIDERATIONS

Relevant National Policies and Legislation

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. Sunetra Structure (SGF) will 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.

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

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 cabinet.
For sustainable development in the energy sector, the strategy document offered various recommendations but none was there concerning the present specific 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.

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 between 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.

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 last concluded Five Year Plan has had 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 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' 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.

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 pectoral 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).

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.

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 labor 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 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.

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.

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'.

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 addresses the environment and states, to ensure environmentally sound sustainable energy development Programs causing minimum damage to the environment". Seven specific policy recommendations are listed the following three are relevant to the present project:

- Environmental impact assessment should be made mandatory and should constitute use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation.

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.

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."

Environmental Policy (1992)

Bangladesh National Environmental Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sect oral 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/ ElA'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, Conservation of fossil fuel is stressed ,and the need for conducting ElA's before implementation of projects for fuel and mineral resources. 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.

"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.

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.

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

The Bangladesh Environment Conservation Act of 1995 (EGA '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 EGA '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.

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/ ElA's according to categories of industrial and 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

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.