

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

52 MW POWER PLANT PROJECT AT JANGALIA, COMILLA, BANGLADESH

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INITIAL ENVIRONMENTAL EXAMINATION (IEE)
AND
INITIAL POVERTY AND SOCIAL IMPACT ASSESSMENT (IPSA) REPORT ON
Proposed 52.2 MW Power Plant at Jangalia, Comilla



Submission to: Lakdhanavi Bangla Power Limited (LBPL)

Final Report

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Prepared by



BANGLADESH CENTRE FOR ADVANCED STUDIES

House 10, Road 16A, Gulshan-1, Dhaka-1212, Bangladesh

Tel: (880-2) 8851237, 8851986, 8852217, 8852904; Fax: (880-2) 8851417

E-mail: info@bcas.net Website: www.bcas.net

TABLE OF CONTENTS

Executive Summary	xi
Chapter- 1	
1. Introduction	1
1.1 Background of the Project	1
1.2 Power and HFO/Gas Purchase Agreement	1
1.3 Land Lease Agreements	2
1.4 Extend of the study	4
1.5 Project Area	3
1.6 Nature and Objective of the Study	3
1.7 The specific objectives of this study	3
1.8 The broad objectives of the study	3
1.9 Scope of Work	4
1.10 Methodology	4
1.11 Limitation of the Study	6
1.12 The EIA Team	6
1.13 Acknowledgement	6
Chapter-2	
2. Policy, Legal and Administrative Framework	7
2.1 Bangladesh Environmental Policy, Regulations, and Guidelines	7
2.2 National Environmental Policy, 1992	7
2.3 National Environment Management Action Plan (NEMAP), 1995	7
2.4 The Environment Conservation Act, 1995	8
2.5 Environment Conservation Rules, 1997	8
2.6 The EIA Guidelines for Industry, 1997	9
2.7 Environmental and Social Requirements of the Asian Development Bank	10
2.8 Institutional Arrangements	14
2.9 Time Frames	14
2.10 Time Frames for Legal Procedure and Appeal	14
2.11 Framework for Leasing of Government (Khas) Agricultural Land	15
Chapter-3	
3. Description of the Project Site	16
3.1 Type and Category of the Project	16
3.2 Rationale of the Project	16
3.3 The Project Site	16
3.4 Surrounding of the Project	16
3.5 Project details of Project Area	17
3.6 Major Landuse and main occupations	22
3.7 Transportation and road network	23
3.8 The Air Shed of the project area	25
3.9 Suitability of the Site	26
3.10 The Access Road to the power plant	29
3.11 Technology and Major Components of the Project	31
3.12 Key details of the equipments	32
3.13 Power Generation Process	33
3.14 Generating Set and Engine	38
3.15 Electrical Systems	38
3.16 Natural Gas Conditioning System	38
3.17 Water Supply System	38
3.18 Waste Water Management	39
3.19 Civil Construction	39

3.19.1	Site Preparation	39
3.19.2	Piling	39
3.19.3	Foundations	39
3.19.4	Drainage	40
3.19.5	Power Station Buildings	40
3.19.6	Sub-station	40
3.19.7	Site Fencing	40
 Chapter-4		
4.	Environmental and Social baseline Condition	41
4.1	Physical resources	41
4.2	The Project Site	41
4.3	Topography	41
4.4	Topography, Soil and Geology	44
4.5	Meteorology	46
4.6	Ambient Air Quality	47
4.7	Wind roses for 52.2 MW Power Plant at Jangalia, Comilla	50
4.7.1	Site selection for background pollution level data collection	54
4.8	Ambient Noise Quality	54
4.8.1	Geology and Seismicity	55
4.8.2	Hydrology	57
4.9	Biological Environmental: Vegetation and Floral Diversity	59
4.9.1	Socio-economic Environment: Baseline Condition of Infrastructure	64
4.9.2	Administrative Areas	64
4.9.3	Demographic Characteristics, utilities and occupational status	64
4.9.4	Transportation and road network	65
4.9.5	Road Transport	65
4.9.6	Land use: Coverage of Survey Area	66
 Chapter-5		
5.	Anticipated Environmental Impacts and Mitigation Measures	69
5.1	Environmental impacts	69
5.1.1	Environmental Impacts during Pre-operation Phase	69
5.1.2	Anticipated Impacts	69
5.1.3	Impact on Environmental Resources	69
5.1.4	Impacts on ecological Resources	73
5.1.5	Socio-economic Impacts	73
5.1.6	Waste Generation and Disposal	75
5.1.7	Labour Accommodation and Associated Utilities	76
5.1.8	Environmental Impacts during Operation Phase	76
5.1.9	Impact on Air quality	76
5.1.10	Background	78
5.1.11	Modeling Methodology	78
5.1.12	Noise Modeling calculation	87
5.1.13	Noise Modeling Results	88
5.1.14	Environmental Impacts during Decommissioning Phase	91
5.2	Beneficial impacts and enhancement	91
5.2.1	Beneficial Impacts and Enhancement during Pre-operation Phase	91
5.2.2	Beneficial Impacts and Enhancement during Operation Phase	91
5.2.3	Beneficial Impacts and Enhancement during Decommissioning Phase	91
5.3	Occupational health and safety impacts	92
5.3.1	Exposure to Electro Magnetic Field	92
5.3.2	Heat	92
5.3.3	Noise	92
5.3.4	Fire and Explosion Hazards	92
5.3.5	General Safety	92

Chapter-6

6. Analysis of Alternatives	93
6.1 'No Project' Alternative	93
6.1.1 Analysis of Technology and Fuel Alternatives	93
6.1.2 Analysis of Site Alternatives	93
6.1.3 Location and Area of Available Land	94
6.1.4 Distance from Major Infrastructure	97
6.1.5 Vulnerability to Natural Calamity	98
6.1.6 Environmental and social safeguard aspects	100
6.1.7 Comparative Valuation of the Proposed Sites	100

Chapter-7

7. Information Disclosure, Consultation and Participation	101
7.1 Information disclosure process	101
7.2 Consultation and Participation Mechanism	101
7.2.1 Stakeholders' Participation	102
7.2.2 Affected Communities	103
7.2.3 Local Government	104
7.2.4 Non Governmental Organizations	104
7.3 Issue Raised by Stakeholders' and Response of LBPL	105
7.4 The Results of Consultations and Concerns Raised	105
7.5 Information disclosure process	107

Chapter-8

8. Grievance Redress Mechanism	111
8.1 Grievance redress mechanism	111
8.2 Stakeholder engagement plan	111
8.3 Resources and responsibilities	112
8.3.1 Plant Level Resource and Responsibilities	112
8.3.2 Corporate Level Resource and Responsibilities	112
8.4 Reporting	113
8.4.1 Internal Reporting	113
8.4.2 External Reporting	113

Chapter-9

9. Socio-economic Study and IPSA Report	114
9.1 Socio economic study	114
9.2 Initial Poverty and Social Impact Assessment (IPSA)	135

Chapter-10

10. Environmental Management Plan	140
10.1 Environmental management plan	140
10.1.1 Pre-operation Phase	140
10.1.2 Operation Phase	142
10.1.3 Post-operation Phase	146

Chapter-11

11. Institutional Arrangements and Environmental Monitoring	147
11.1 Institutional requirement	147
11.1.1 Environmental and Social Monitoring Unit	147
11.1.2 Composition of Environmental and Social Monitoring Unit	147
11.1.3 Environmental Training	148
11.2 Environmental monitoring	148
11.2.1 Environmental Monitoring Parameters	149
11.3 Environmental monitoring and management budget	150
11.4 Financial Arrangement for Environmental Monitoring and Management	151
11.5 Environmental Monitoring and Management Reporting	151

Chapter-12	
12. Emergency Response and Disaster Management	152
Chapter-13	
13. Conclusion	154
Chapter-14	
14. Rapid environmental assessment checklist	156
References	160

Annexure
Annex 1-14

List of Table

Table 3.1: List of Machineries & their key details for 50.2 MW Power Plant at Jangalia, Comila	40
Table 3.2: Project component	40
Table 4.1: Villages with Mouza in the Vicinity of the proposed project	41
Table 4.2: Annual maximum and minimum temperature in the Project area	46
Table 4.3: Monthly average rainfall in the project area	47
Table 4.4: Average monthly relative humidity of the Project area	47
Table 4.5: Average monthly relative humidity of the Project area	47
Table 4.6: Ambient air quality analysis (Data provided is average of data collection over 7 days)	49
Table 4.7: The suggested directions of measurement points	54
Table 4.8: Average 8 hourly sound	55
Table 4.9: Seismic Zoning of Bangladesh	55
Table 4.10: Comparison of Surface water quality (limited parameters) of the nearby canal	57
Table 4.11: Ground water quality (limited parameters) around the Project vicinity	59
Table 4.12: Aquatic flora in the project area	59
Table 4.13: Showing the Aquatic Fauna and Aquatic Birds	60
Table 4.14: Showing the Terrestrial Flora	60
Table 4.15: Showing the Terrestrial Fauna	61
Table 4.16: Available forest in the project area	61
Table 4.17: Comilla-Laksam Road Traffic Survey (Study period 28 October 2013) at plant site	66
Table 4.18: 6pm- 6am Traffic Survey at Plant Site (During Night Time)	66
Table 4.19: Present Land use Pattern of Surveyed Areas	67
Table 5.1: Average Leq identified as requisite to protect the public health and welfare with	70
Table 5.2: OSHA noise exposure limits for the work environment	71
Table 5.3: Summary of the exhaust specifications and stack parameters	77
Table 5.4: National Ambient Air Quality Standards (NAAQS) for Bangladesh	77
Table 5.5: Standards of noise level	89
Table 5.6: Noise Levels at Locations in the Vicinity of the Site	89
Table 6.1: Comparison of sites with respect to location and area	94
Table 6.2: Comparison of sites with respect to topography and land use pattern	97
Table 6.3: Comparison of sites with respect to distance from major infrastructure	97
Table 6.4: Land price of short-listed sites	100
Table 7.1: Outcomes of the consultations with the Project Affected People	107
Table 7.2: List of Stakeholders for information dissemination and disclosure	108
Table 8.1: Stakeholder engagement plan	111
Table 8.2: Contact detail of resource persons	112
Table 9.1: Average Family Size and Sex Ratio of Household Members by Study Area	116
Table 9.2: Sex Distribution of Household Members by Study Area	116

Table 10.1: Potential impacts and mitigation measures at pre-operation phase	141
Table 10.2: Potential impacts and mitigation measures at operation phase	143
Table 10.3: Potential impacts and mitigation measures at decommissioning phase	146
Table 11.1: Monitoring parameters and frequency of monitoring during trial run	149
Table 11.2: Monitoring parameters and frequency of monitoring during operation phase	150
Table 11.3: An annual tentative budget for environmental monitoring (operation phase)	151
Table 11.4: Reporting schedule	151

List of Map

Map 3.1: Proposed project site of the plant	18
Map 3.2: Road network around the 5 km buffer zone area from power plant site	19
Map 3.3: Current landuse pattern and road distance of the power plant	22
Map 3.4: Location distance from Dhaka to Comilla of the power plant	24
Map 3.5: Air-shed area and Road network map within 5km of the power plant	25
Map 3.6: Existing Power Grid Network in Bangladesh (August 2011)	27
Map 4.1: Topography over the Mouza Map of the proposed power plant	43
Map 4.2: Physiographical Map of Bangladesh	45
Map 4.3: Site selection for background pollution level data collection	53
Map 4.4: Seismic Zone of Bangladesh	56
Map 4.5: Ground Water Zoning Map of Bangladesh	58
Map 4.6: Master Plan of Comilla City Corporation	68
Map 5.1: Emission contour map showing the NO ₂ concentration (24 hour average) at	79
Map 5.2: Emission contour map showing the NO ₂ concentration (annual average)	80
Map 5.3: SO ₂ Concentration Contour Map for LBPL	81
Map 5.4: SO ₂ Concentration profile for LBPL	82
Map 5.5: NO ₂ concentration and contour map for natural gas	85
Map 5.6: PM ₁₀ concentration and contour map for natural gas	86
Map 5.7: The map described the noise concentration around 500m of the plant site	88
Map 6.1: Three alternative sites are showing in the map	95
Map 6.2: Natural Hazard Risk Map of Bangladesh prepared by OCHA	99

List of Figure

Figure 2.1: Process of EIA Approval and ECC at DOE	10
Figure 3.1: Satellite image of the proposed project site with alternative (1 km radius)	20
Figure 3.2: Satellite image of the proposed project (5 km radius)	21
Figure 3.3: Existing, Under-construction and Planned Power Grid Network of Bangladesh	28
Figure 3.4: A Process flow diagram for the power plant	34
Figure 3.5: Process flow diagram of the Project	35
Figure 4.1: Physiographical feature of Bangladesh	44
Figure 4.2: Wind rose for January 2012	51
Figure 4.3: Wind rose for April 2012	51
Figure 4.4: Wind rose for July 2012	52
Figure 4.5: Wind rose for October 2012	52
Figure 4.6: Baseline Noise Level Data at Project Site (Day and Night)	54
Figure 9.1: Poverty rate (Percentage of the population below the upper poverty line)	139

List of Photos

Photo 3.1: Approved Access Road inside the PGCB Substation	29
Photo 3.2: Small water body in the site	30
Photo 3.3: Fallow land in the site	30
Photo 3.4: An initial view of the Project site	30

Photo 3.5:	30 feet wide road in the project site	30
Photo 3.6:	Rail way crossing beside the power plant	30
Photo 3.7:	Nearby wetland	30
Photo-4.1:	Respirable Dust Sampler for SPM, PM10, SO2, NOx measurement	48
Photo-4.2:	Carbon Monoxide meter for CO measurement	49
Photo 4.3:	Water Hyacinth and Tal palm trees near the proposed project site	62
Photo 4.4:	Terrestrial flora (tree) close to the project site	62
Photo 4.5:	Terrestrial flora (herb) close to the project site	62
Photo 4.6:	Terrestrial fauna close to the project site	63
Photo 4.7:	Ducks and poultry are rearing in the household	63
Photo 4.8:	Road Transport in the Vicinity of the Site	65
Photo 4.9:	Intercity Train crossing the project site	65
Photo 6.1:	Site view for the alternative plant site 2	96
Photo 6.2:	Site view for the alternative plant site 2	96
Photo 6.3:	Site view for the alternative plant site	97
Photo 7.1:	Consultation with the adjacent villagers	103
Photo 7.2:	Consultation at Jangalia Market Area who can be indirectly affected	103
Photo 7.3:	Consultation at Upazila Parishad	104
Photo 7.4:	Consultation at Upazila Parishad	104
Photo 7.5:	Consultation meeting at City Corporation	104
Photo 7.6:	Consultation meeting with ASA NGO	104
Photo 7.7:	Consultation with Comilla Victoria College	105
Photo 7.8:	Consultation meeting with land owner	105
Photo 9.1:	Field Enumerator at the Respondent	115

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
BCAS	Bangladesh Centre for Advanced Studies
AQMP	Air Quality Modeling Project
BEZ	Bio-ecological zones
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD	Bio-Chemical Oxygen Demand
BPDB	Bangladesh Power Development Board
BPC	Bangladesh Petroleum Corporation
BWDB	Bangladesh Water Development Board
COD	Chemical Oxygen Demand
DOE	Department of Environment
DSC	Design and Supervision Consultant
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
ECR	Environment Conservation Rules
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECNEC	Executive Committee of the National Economic Council
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESMU	Environmental and Social Monitoring Unit
FGD	Focus Group Discussions
FI	Financial Intermediary
GOB	Government of Bangladesh
GSB	Geological Survey of Bangladesh
Ha	Hector
IA	Implementing Agency
IDCOL	Infrastructure Development Company Limited
IEE	Initial Environmental Examination
IPSA	Initial Poverty and Social Impact Assessment
KII	Key Informant Interview
NGO	Non-Governmental Organization
NO _x	Oxides of Nitrogen
OSHA	Occupational Safety and Health Administration
OHSAS	Occupational Health and Safety Advisory Services
PCBs	Poly-chlorinated biphenyls
PM	Particulate matter
PMO	Project Management Office
PPA	Power Purchase Agreement
PPM	Parts Per Million
PRIME	Plume Rise Model Enhancement
LBPL	Regent Energy and power Limited
RRA	Rapid Rural Appraisals
SO ₂	Sulfur di Oxide
SPM	Suspended Particulate Matters
TDS	Total Dissolved Solid
ToR	Term of Reference
TSS	Total Suspended Solid
US EPA	United States Environmental Protection Agency

GLOSSARY

Adverse impact: An impact that is considered undesirable.

Ambient air: Surrounding air.

Aquatic: Growing or living in or near water.

Bangla: Bengali language.

Baseline (or existing) conditions: The ‘baseline’ essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed.

Bazar: Market.

Beel: A ‘back swamp’ or depression.

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

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

Char: Newly accreted land, 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.

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

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

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

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

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

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

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

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

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

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

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

Khal: Small Channel, canal.

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

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

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

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

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

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

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

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

Upazila: Sub-district name.

Zila: Bengali word of district.

EXECUTIVE SUMMARY

Lakdhanavi Bangla Power Limited (LBPL) has been awarded to develop and operate an independent power plant project through a competitive bidding process. The power plant will be a dual fuel internal combustion generators with capacity of 52.2 MW. The Power Plant will be located at Jangalia, Comilla Sadar South, Comilla District. For financial assistance LBPL will arrange the project financing from different financial agencies internationally and IDCOL in Bangladesh.

According to the Environmental Conservation Rules, 1997 of Bangladesh Government, industrial projects have been categorized into four classes—Green, Orange A, Orange B and Red. For power plants the Red category is applicable for clearance from the Department of Environment in Bangladesh (DOE). For availing funding from IDCOL the IEE falls under category B. The study has followed the ADB's Safeguard Policy Statement (SPS 2009)

As a part of environmental compliance, there is a requirement for preparation of an Initial Environmental Examination (IEE) report. Accordingly, this IEE report has been prepared based on the guidelines of Department of Environment (DOE), Government of Bangladesh (GOB) and Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS, 2009). Based on this a site clearance has been issued by the DOE.

An Environmental Impact Assessment (EIA) has been prepared as the TOR provided by the DOE and have been submitted for the issuance of Environment Clearance. In order to avail financing from IDCOL the requirement is to prepare an IEE following the ADB SPS guidelines of 2009.

The project site comprises about 3.0 acres of land. This land has been requisitioned from the private land owners by following the required regulations of Bangladesh Government through willing buyer-willing seller arrangement by the Government of Bangladesh and leased it to BPDB who leased it to the sponsors of the project LBPL. During the survey the land was found vacant. Therefore, for this project no resettlement action plan was required.

An analysis was carried out on the selection of the site. Three other possible sites were taken into consideration. From the analysis it was revealed that the proposed plant site was the best option primarily due to its close proximity to the BPDB substation connected with the national grid and access roads availability and good infrastructure.

The baseline survey for the proposed site was carried out for air quality, noise, physical environment, biodiversity, deep ground water and surface ground water testing and house hold socio-economic and an IPSEA study. The major environmental problems due to air pollution and noise generation was given utmost attention as the plant location is in a mixed zone comprising of commercial and rural area with settlements close to the plant. For both air and noise baseline data were collected through measurements at different locations and different distances.

A detailed analysis of the major pollutants was carried out. In combination with the baseline air quality and on the information of the engine's data sheet and specifications using an air dispersion modelling (ISC3P) of USEPA has been carried out. It was found that the annual concentrations of the SO_x, NO_x and PM₁₀ were within the limits set by the DOE and IFC.

The other major concern is the noise generated due to the project activities during construction and operation period of the project. Based on the noise data available from engine manufacturers and the baseline data collected a noise modelling was carried out using an International Energy Agency (IEA) recommended model. The modelling results show that if the noise control measures proposed by the sponsors the noise level for even the nearest households and commercial activities will be within the limits set by DOE and IFC standards.

A baseline survey the natural environment was carried out including flora and fauna. This was found to be typical to the flood plains of Bangladesh. Since only 3.0 acres of land will be used by the proposed project there will be no significant impact on the natural environment.

Quantitative measurements were done for both for ground water and surface water in the immediate vicinity of the proposed power plant. Water will be used as cooling water and domestic purposes and waste water generated will be treated before discharged in the environment through a drainage system and will comply with the DOE standards. The waste water will be primarily oily water. The power plant will have closed circuit cooling water system. Therefore the quantity if waste water quantity will not be high. The wastewater will be oily and it eill be treated in waste water treatment plant before discharge, the quality of the discharge water be within the standards set by DOE and IFC.

Occupational Health and Safety issues have been addressed in the report. Apart from the national standards LBPL has to comply with the IFC EHS guideline for thermal power plants.

Bangladesh is enriched with cultural diversities. According to International Work Group for Indigenous Affairs (IWGIA), there are about 3 million indigenous people in Bangladesh belonging to 45 ethnic groups (Source: Statistical Year book, 2012 of IWGIA). But the habitat of no indigenous community has been recorded in Jangalia, Comilla. So, it can be said that LBPL Project has no potentiality to adversely affect the rights of indigenous community.

As a part of the IEE, public consultation was accomplished through house hold survey, Focussed Group Discussion (FGD) and Key Informant Interviews. The objective of the consultation process was to share the views of the respondents about the LBPL project. Most of the respondents showed positive response to the Project due to the high demand for power. But they requested to the concerned authority that the generated power should at first be used to meet the local demand. Then the remaining power can be supplied to other regions through national grid. In addition, they have also requested to provide employment opportunities to local people at different phases of the Project development. There were some negative concerns about the noise levels which have been clarified by BCAS during the consultations. The only environmental concerns were the possibility of high levels of noise and water pollution. They wanted assurances that noise air pollution abatement measures are taken in designing the power plant.

Bangladesh is enriched with cultural diversities. According to International Work Group for Indigenous Affairs (IWGIA), there are about 3 million indigenous people in Bangladesh belonging to 45 ethnic groups (Source: Statistical Year book, 2012 of IWGIA). But the habitat of no indigenous community has been recorded in Jangalia, Comilla. So, it can be said that LBPL Project has no potentiality to adversely affect the rights of indigenous community

LBPL is considering the environmental and social compliance issues with due importance. For addressing all kinds of tentative environmental and social impacts, it is suggested to establish an Environmental and Social Monitoring Unit (ESMU) under the organogram of the Project Company. It is the responsibility of the ESMU to implement environmental management plan (EMP) as well as to ensure satisfactory environmental monitoring and compliance on a regular basis according to the approved schedule of the DOE or any other applicable guidelines. EHS Plan based EMP with detail standard operational procedure, Grievance Redress Mechanism, Stakeholder Engagement Plan, Emergency Response Plan and Disaster Management Plan have to be prepared by the project sponsors before starting the construction work.

In general there will be no major environmental and social impacts due to the project if the recommended mitigation steps mentioned in this report are implemented by the project sponsors.

Chapter-1

INTRODUCTION

1.1 Background of the Project

Bangladesh has seen remarkable growth in electricity generation over the last five years. The generation capacity has risen around 4000MW in 2008 to almost 10,000 MW in 2014. As there is an annual increase in demand from the industrial and commercial sectors and there is needed for providing electricity access to almost 50% households without access as yet the need for more electricity generation will exist for the coming years. .

The policy of the Government of Bangladesh ('GoB') has been to ensure extension and stabilization of the power sector, through both public and private sector undertakings, toward not only meeting the existing power deficiency throughout the country but also ensuring unhindered power provision in view of the projected future demand.

The Government of Bangladesh (GoB) has declared its vision 2021 to provide electricity for all. Power Sector Master Plan 2010 (PSMP-2010) has been undertaken to accommodate the govt.'s vision 2021, According to PSMP study the electricity demand would be 34,000 MW by the year 2030. The aggregated investments for the development of the generation, transmission and related facilities are found to be at Taka 4.8 trillion (US\$ 69.5 billion). The annual average of the investment amounts to Tk. 241 billion (US\$ 3.5 billion). The government fully recognizes the fact that public sector investment alone is not sufficient to achieve its target and has aimed at mobilizing resources from the private sector investments.

Accordingly, GoB has approved a number of rental and IPP project to be established and will operate by private entrepreneurs under (Special act) Law 2010 and accordingly formed a committee vide memo no. 99/2009/1169, dated 29/11/2010 for implementation of the plan adopted by Power Division, Ministry of Power, Energy and Mineral Resources (MPEMR), Government of Bangladesh..

BPDB floated an IPP tender in 2010 for the project, for selection of a sponsor for implementation of a 50 ±10% MW dual fuel fired power project on build own and operate (BOO) Basis at Jangalia, Comilla Sadar South, Comilla, Bangladesh.

A group of bidders participated in the bid and all of them were prequalified. Subsequently, the technical proposals were considered and all the pre-qualified bidders were found sound on technical grounds. But in case of tariff, Lakdhanavi Bangla Power Limited were found to be lowest and served a letter of Intent to establish this plant and subsequently a Letter of Intent ("LOI") was issued to them on 29 November 2010.

The Project will construct, operate and maintain a 52.2 MW dual fuel (HFO and natural gas) power plant at Jangalia, Comilla on Build, Own and Operate (BOO) basis. Bangladesh Power Development Board (BPDB) will purchase the electricity generated from the Project under a 15- year Power Purchase Agreement (PPA). The Project is expected to go into commercial operation within 15 months from the date of signing of PPA with BPDB.

For establishing the Project BPDB has provided an area of about 3.0 acres of land at Jangalia Mouza under the jurisdiction of Comilla City Corporation, Comilla district. During site visit, the site was found to have a satisfactory ambient condition for a power plant project of this size. The site is about 3.5 kilometers from the centre of Comilla city and within 1 kilometer of the Dhaka-Chittagong highway. In North of the proposed plant there are residential area, PGCB sub- station in the South side, residential area in the West side, and on the East side there are office of the Power Development Board(PDB)

Project Implementation Agreement

The Implementation Agreement (IA) of the project was executed on 2013. Parties to the IA had been (i) the Project Company(s), i.e. the LBPL in relation to the 52.2 MW Power plant project (ii) the Government of Bangladesh (GoB); and (iii) the Bangladesh Power Development Board (BPDB). The IA became effective from the date of signing and will continue in full force and effect until the last day of the Power Purchase Agreement unless extended or terminated earlier as per the provisions of IA.

1.2 Power and HFO/Gas Purchase Agreement

The Power Purchase Agreements (PPAs) for 52.2 MW Jangalia power plant were signed on October 30, 2013, between BPDB and LBPL. Under the terms of the PPAs, LBPL agree to maintain the power plants and deliver electric energy produced at the power plants exclusively to BPDB. In turn, BPDB agrees to purchase from LBPL the Net Energy Output.

The People's Republic of Bangladesh represented by the Power Division, Ministry of Power, Energy and Mineral Resources (MPEMR) accords its approval on the Levelized Tariff Charge (LTC) and grants its permission to LBPL to design, finance, insurance, construct, own, Commission, operate and maintain (the "Project") a 52.2 MW (at Reference Site Condition), Dual Fuel power generating facility at Comilla hereinafter referred to as the "Facility".

The facility will have a net electric power generating capacity of 52.2 MW. Net Dependable capacity and net energy output from the facility will be sold under the Power Purchase Agreement, hereinafter referred to as the PPA", The LBPL formed by the Sponsor shall be solely responsible for the development and completion of the project and development of the necessary related facilities.

1.3 Land Lease Agreements

The Land Lease Agreements (LLAs) for LBPL were signed on October 30, 2013. BPDB, through an agreement with BPDB, Government of Bangladesh, obtained title to a parcel of land comprising approximately 3.00 acres at Jangalia in Doiara Mouza under 22 No. Ward of Camilla City Corporation earlier acquired by the Government of Bangladesh. GOB completed the acquisition procedure and leased the land to BPDB who again lease the land to the Project sponsors for the implementation and operation of the Project. Detailed of the Land lease Agreement will be provided as Annexure in the final draft.

1.4 Extent of the Study

Bangladesh Environmental Conservation Rules (ECR, 1997) and ADB Safeguards Policy Statement, 2009 require that the environmental and social impacts of development projects are identified and assessed as part of the planning and design process. Based on the magnitude of potential adverse impacts, mitigation measures are to be planned before starting the implementation of the project. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

Bangladesh Centre for Advanced Studies (BCAS) will carry out Initial Environmental Examination (IEE) and detailed Environmental Impact Assessment (EIA) to comply with DOE Guidelines as well as the SPS 2009 of the ADB for the proposed IPP 52.5 MW Dual Fuel Power Plant project in Comilla, on BOO basis.

1.5 Project Area

It is already mentioned that the project site is located at Jangalia, Comilla Sadar South, Mouza-Doiara, J.L No. 103, Sheet No. 1, and District- Comilla, Bangladesh

1.6 Nature and Objective of the Study

The study has been based on the environmental and socio-economic perspectives of the project site and that of the area within a 7.5km radius and 1km respectively of the site (herein referred to as the 'air shed' of the project and/or the 'command area radius') and the impacts of the project upon the existing environmental and socio-economic system pertaining to the project area.

1.7 The specific objectives of this study are to-

- support LBPL to meet all sorts environmental compliances of DOE and ADB
- support LBPL to meet all sorts social compliances of DOE and ADB.

1.8 The broad objectives of the study are:

Broad objective of this study is to provide a basis for detailed assessment of the identified environmental and socio-economic impacts of the proposed power plant project and, thereafter, to undertake mitigation measures toward minimizing adverse impacts and measures to enhance beneficial impacts, formulate environmental management and monitoring plans and plans for addressing health and safety issues.

- to assess the environmental and socio-economic impacts of the proposed project;

- to identify and engage with stakeholders to understand their views about the project and understand their expectations and concerns, and to incorporate these appropriately in the management plans;
- to suggest mitigation measures for minimizing adverse impacts and enhancement measures of beneficial impacts; and
- to formulate environmental and social management and monitoring plans and plans for addressing occupational and community health and safety issues.

1.9 Scope of Work

The area falling within 1 km distance from the proposed site has been considered as the study area for conducting detailed studies. The scope of the Initial Environmental Examination (IEE) as the following:

- a brief description of the project;
- a detailed characterization of the existing environment within the area of 1 km radius from the project site for environmental components viz. air, noise, water, land, soil, biological and socio-economic aspects;
- prediction and evaluation of positive and negative impacts that may result from the proposed power plant project;
- consideration of alternatives;
- undertaking public consultation and disclosure of project-related information;
- grievance redress mechanism;
- formulation of an environmental management plan (EMP) to eliminate or minimize the adverse impacts of the project on the surrounding environment and affected communities;
- preparing occupational health and safety as well as Disaster Management Plan (DMP) to minimize any accident or emergency situation; and
- to propose plans for post project monitoring, ongoing consultation and disclosure, EMP implementation, and institutional arrangement/organizational arrangement.
- Obtaining approval of the lending financial institutions, viz., the Asian Development Bank, IDCOL;
- Obtaining Environmental Clearance Certificate

1.10 Methodology

Based on the above Scope of Work, the study built upon the baseline survey carried out by BCAS as Environment and Social Consultant for the Initial Environmental Examination (IEE) during October 2013. The IEE exercise resulted in a stand-alone report together with a schedule devised by and as per the requirement of DOE.

This IEE and IPSA have been carried out as a follow up study of IEE and is based on the primary data generated during the period from October to November 2013. Secondary data was obtained from various sources and field visits. Several field visits had been undertaken to

the project location with a view to updating the findings of the baseline study carried out by BCAS. During the study period the following steps were followed:

1. Confirmation of survey/monitoring data in the baseline study and IEE carried out by BCAS during generating primary data;
2. Understanding the technical aspects of the proposed power plants through secondary literature and consultations
3. Identification of potential environmental impacts and evaluating the consequences through using a checklist method;
4. Identification of impacts was undertaken using Checklist Matrix and Issues forecasting tabular methods;
5. Review of the adequacy and efficiency of proposed mitigation measures for the proposed power plant project through public consultations;
6. Development of an Environmental Management Plan (EMP) for possible mitigation/enhancing measures, respectively, for negative and beneficial impacts;
7. Suggestion of mitigation measures for residual impacts;
8. Completion of a comprehensive social impact assessment through primary data collection;
9. Primary data collection from 30% of the total households within 1 km radius of the project area included in the baseline study carried out by BCAS and 100% census survey based on a prepared questionnaire. The criteria for choosing 30% of households within 1 km radius of the project site is judgmental based on the expected picture required for the specific study. Additionally, since the area is in a mixed commercial cum rural zone the number of household are and business institutions are numerous in numbers. However, in choosing the households a mix of rural and commercial households were chosen. A number of Focus Group Discussions (FGDs) with the different categories of stakeholders were held including women;
10. Formulation of a monitoring plan for both environmental and social issues. The plan will include the state of the alternative resettlement in terms of their tenure of compensated agricultural activities and provided alternative homesteads. This will be done through primary data collection with emphasis on the tenure of the settlement and the state of the displaced persons livelihood;
11. Detailed survey work was undertaken throughout the high impact zone (0.6km radius), and low impact zone (0.4km radius) of the project air-shed to inform the preparation of the land use map. During the mapping exercise, in-depth consultations with local stakeholders were carried out to aide accurate identification of suitable plots. Use of maps and also utilization of the historic maps was undertaken for identifying the plots and ground level. Field verification was undertaken by the team leader after the field data collection. Updated GIS version was applied to finalize the land use map; and

The following Primary Data was obtained during the IEE processes:

- Socio-Economic survey data;
- Baseline air quality data;
- Baseline noise data (day and night time);
- Groundwater data from deep and shallow tube wells;
- Road Traffic data were collected from the plant site
- Surface Water data

This IEE report has been prepared with the following documents:

- Asian Development Bank (ADB), *Safeguard Policy Statement*, June 2009;
- Department of Environment (DOE), Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, *EIA Guidelines for Mix zone Industrial and residential*, June 1997.
- EHS guidelines for thermal power plants IFC.

1.11 Limitation of the Study

The IPSA and IEE as well as the data collected for inclusion in the IEE study has been conducted within a limited time frame due to the requirement of the project to go into commercial operation within 15 months under the PPA. However, the IEE has been prepared with an emphasis to cover all important environmental impacts and formulate pragmatic recommendations for mitigating any adverse environmental impacts.

1.12 The EIA Team

The IEE & IEE Team comprises of the following:

1. Dr. Moinul Islam Sharif, EIA Expert	Team Leader
2. Dr. M. Eusuf, Air Dispersion Modeling Expert	Member
3. Mr. Osman Goni Shawkat, Sociologist	Project Coordinator
4. Dr. J. C. Shaha, Air Quality Monitoring Expert	Member
5. Mr. Shaker Ali, Noise Modeling Expert	Member
6. Ms. Ismot Ara, GIS and Mapping Expert	Member
7. Mr. Moniruzzaman, Field Surveyor	Member
8. Mr. ZH Khan, Field Surveyor	Member

1.13 Acknowledgement

In preparing the EIA, various stakeholders were consulted. It comprises a number of government agencies, Comilla City Corporation, NGOs, Financing organizations, Bangladesh Power Development Board (BPDB), Bangladesh Meteorological Department (BMD), Soil Resource Development Institute (SRDI), Bangladesh Bureau of Statistics (BBS), Bangladesh Water Development Board (BWDB), Department of Environment (DOE), Comilla and Chittagong, Victoria College, Comilla, Department of Agriculture Extension (DAE), Department of Roads and Highways, Bakhrabad Gas Distribution Company Limited, Fire Service and Civil Defense office, and Bangladesh Agricultural Development Corporation etc. The EIA team is grateful to these stakeholders for their contribution to enrich the EIA report and present the accurate the data in the concern section of the report.

Chapter-2

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Regulatory requirements in relation to the protection and conservation of the environment and various environmental resources, as well as the protection of the social environment from adverse impacts associated with project activities have been set out by the Government of Bangladesh (GoB) as well as the Asian Development Bank (ADB). These requirements are summarized below.

2.1 Bangladesh Environmental Policy, Regulations, and Guidelines

2.1.1 National Environmental Policy, 1992

The Bangladesh National Environmental Policy, approved in May 1992, sets out the basic framework for environmental action together with a set of broad sectoral action guidelines. Key elements of the Policy are:

- Maintaining ecological balance and ensuring sustainable development of the country through protection and conservation of the environment;
- Protecting the country from natural disasters;
- Identifying and regulating all activities that pollute and destroy the environment;
- Ensuring environment-friendly development in all sectors;
- Ensuring sustainable and environmentally sound management of the natural resources; and
- Maintaining active association, as far as possible, with all international initiatives related to environment.

The Policy, *inter alia*, seeks to ensure that transport systems, including roads and inland waterways, do not pollute the environment or degrade resources. The Policy states that an Environmental Impact Assessment (EIA) should be conducted before projects commence.

2.1.2 National Environment Management Action 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 during the period 1995 to 2005, and sets out the framework through which various decisions, plans, legislative measures, rules and regulations toward safeguarding the environment and natural resources including those of biological diversities are to be implemented. NEMAP was developed based on the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;

- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural environment;
- Conservation of habitats and bio-diversity;
- Promotion of sustainable development; and
- Improvement of the quality of life of the people.

To this end, it has grouped all the relevant necessary actions under four headings: institutional, sectoral, location-specific and long-term issues. The *institutional* aspects reflect the need for inter-sectoral cooperation to tackle environmental problems that need new and appropriate institutional mechanisms at national and local levels. The *sectoral* aspects reflect the way the Ministries and agencies are organized and make it easier to identify the agency to carry out the recommended actions. The *location-specific* aspect focuses on particularly acute environmental problems at local levels that need to be addressed on a priority basis. The *long-term* issues include environmental degradation of such degree that it might become more serious and threatening than they seem to be if their cognizance is not immediately taken.

According to the NEMAP, the GoB environmental policy makes specific statements on energy and fuel, including the aim to “*Reduce and discourage the use of those fuels that pollute the environment and encourage the use of fuels that are environmentally sound and less harmful.*”

2.1.3 The Environment Conservation Act, 1995 (subsequent amendments in 2000 and 2002)

The provisions of the Act authorize the Director General (DG) of Department of Environment to undertake any activity he deems fit and necessary to conserve and enhance the quality of environment and to control, prevent and mitigate pollution. The main highlights of the act are:

- Declaration of Ecologically Critical Areas;
- Obtaining Environmental Clearance Certificate;
- Regulation with respect to vehicles emitting smoke harmful for the environment;
- Regulation of development activities from an environmental perspective;
- Promulgation of standards for quality of air, water, noise, and soils for different areas and for different purposes;
- Promulgation of acceptable limits for discharging and emitting waste; and
- Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment.

2.1.4 Environment Conservation Rules, 1997 (subsequent amendments in 2002 and 2003)

The Environment Conservation Rules, 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. These Rules provide for, *inter alia*, the following:

- The national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- Categorization of industries, development projects and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load;
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities; and
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

Depending upon location, size and severity of pollution loads, projects/activities have been classified in the Environmental Conservation Rules (ECRs) into four categories:

1. Green
2. Orange A
3. Orange B
4. Red

The corresponding category related to power plants and associated infrastructure (e.g. the construction of a natural gas pipeline from the nearest distribution point to the power plant) is included under:

Schedule-1, Red Category:

- Item 6: power plants; and
- Item 64: includes construction/LBPL extension of natural gas pipelines.

The Rules also incorporate “inclusion lists” of projects requiring varying degrees of environmental investigation e.g. all new projects under the ‘red’ category generally will require a two-step assessment procedure. Firstly, an Initial Environmental Examination (IEE) will be required for site clearance, and secondly, if warranted, a full Environmental Impact Assessment (EIA) for technical clearance. This IEE has been carried out following the previous IEE of the project and also on the basis of the Terms of Reference (ToR) for the EIA (in Annex 12), which were approved by DOE, in accordance with the requirements of the ECRs, toward obtaining an ‘Environmental Clearance Certificate’ for the proposed project.

2.1.5 The EIA Guidelines for Industry, 1997

The EIA Guidelines is a handbook comprising procedures for preparing an EIA and for reviewing an EIA for the benefit of the development partners, EIA Consultants, reviewers, and academics. While preparing these guidelines, the present environmental status as well as the need for rapid economic development of Bangladesh has been considered. These considerations have essentially resulted in simpler procedures to be followed for preparing and/or reviewing an EIA.

The process for EIA approval and obtaining an Environmental Clearance Certificate (ECC) from the DOE is illustrated in Figure 2.1 below.

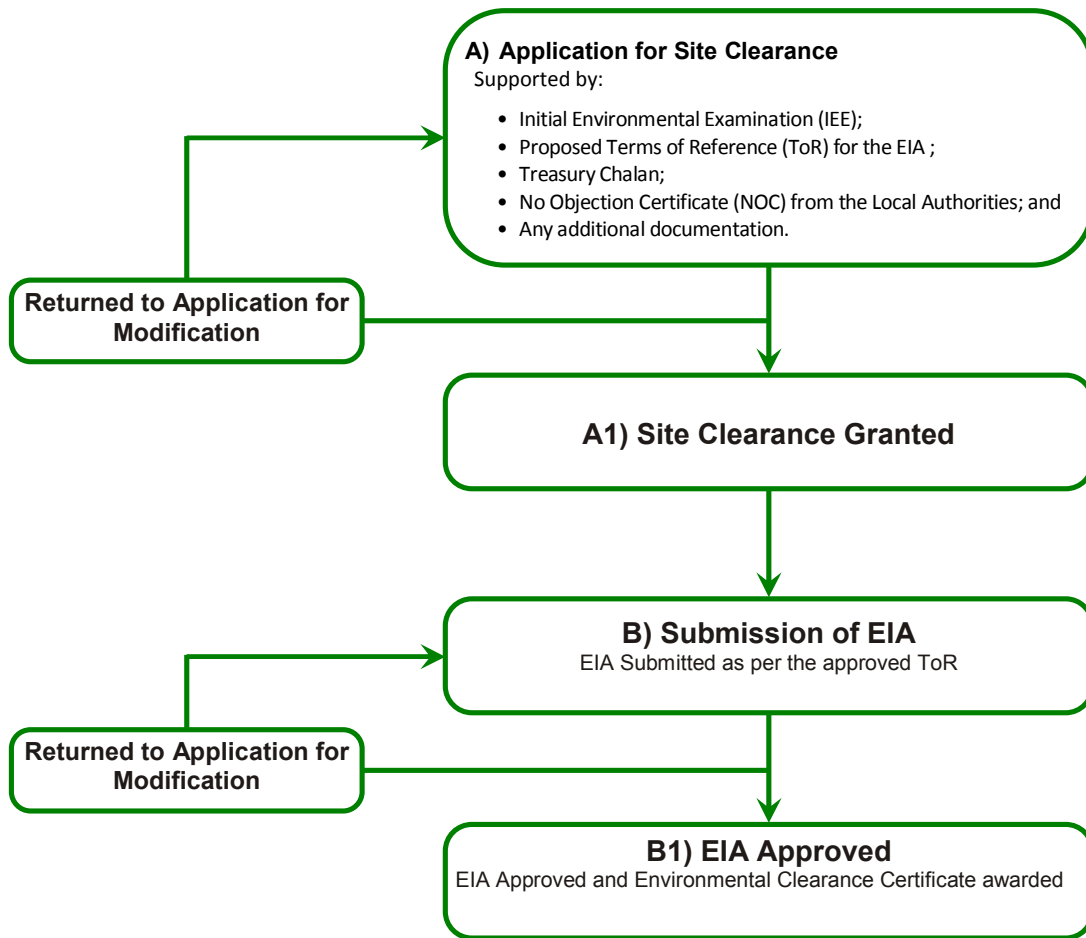


Figure 2.1: Process of EIA Approval and ECC at DOE

Application for Environmental Clearance at A requires 60 working days to reach A1 with Site Clearance. Submission at B of EIA as per ToR approved at AI needs another 90 working days to reach B1 with EIA approval and Environmental Clearance Certificate (*60 working days for EIA approval and 30 working days for ECC after the applicant/project sponsor completes the formalities as specified in the EIA approval letter and reports to DOE*). ECC issued through such a process remains valid for 1 (one) year, after which renewal is necessary. *During stages between A and A1 and between B and B1, observations are made and the applicant may be asked for modification of his/her information/data/reports submitted to DOE for necessary clearance.*

2.2 Environmental and Social Requirements of the Asian Development Bank

The Asian Development Bank (ADB) Safeguard Policy Statement ('the SPS') 2009 sets out the requirements for ADB's operations to undertake an environmental assessment for projects funded by the bank. The goal of the SPS is to promote the sustainability of project outcomes through protecting the environment and people from potential adverse impacts. The overall objectives of the SPS are to:

- i. avoid adverse impacts of projects on the environment and affected people, where possible;
- ii. minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is impossible; and
- iii. help borrowers/clients strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

The SPS sets out the ADB policy objectives, scope and triggers, and principles for following three key safeguard areas:

- i. Environmental Safeguards;
- ii. Involuntary Resettlement Safeguards along with those vis-à-vis Land Acquisition; and
- iii. Indigenous Peoples Safeguards.

ADB implements the SPS through the safeguard review procedures as outlined in Section F1/OP of its Operation Manual (OM) and the documents cited therein. However, the third area of the above three areas is beyond the scope of IEE consideration for this particular project (LBPL) as the project area DOEs not involve any *indigenous peoples*¹.

According to ADB Operation Manual activated since 2010, a proposed project is assigned to one of the following categories depending on the significance of the *potential environmental impacts and risks*:

Category A – a proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

Category B – a proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

Category C – a proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

Category FI – a proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary (*refer to paragraphs 53–58, Safeguard Review Procedures, Operational Procedures, ADB Operations Manual*).

¹ As defined by the Asian Development Bank policy on Indigenous Peoples, April 1998.

A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Each proposed project is scrutinized as to its type, location, scale, sensitivity and the magnitude of its potential environmental impacts. The level of detail and comprehensiveness of the EIA or IEE are commensurate with the significance of the potential impacts and risks.

The proposed 52.2 MW Power plant project falls under Category B according to ADB environmental categorization of projects, as the potential exists for significant adverse environmental impacts but there are no irreversible impacts and environmental and social impacts of the proposed project can be mitigated which is not the case in Category A projects. Therefore, for the proposed project an Initial Environmental Examination (IEE) including an EMP will be required.

The IEE must include an Environmental Management Plan (EMP) that outlines specific mitigation measures, environmental monitoring requirements, and related institutional arrangements, including budget requirements. Loan agreements include specific environmental covenants that describe environmental requirements, including the EMP. The provisions for the EMP must also be fully reflected in the project administration memorandums. To ensure proper and timely implementation of the EMP and adherence to the agreed environmental covenants,

With regards socio-economic impacts, ADB screens all projects to determine whether or not they involve Involuntary Resettlement or have potential impacts on Indigenous Peoples. A project's involuntary resettlement category is determined by the category of its most sensitive component in terms of involuntary resettlement impacts. The Involuntary Resettlement Impacts of an ADB-supported project are considered significant if "...200 or more persons experience *major impacts*, which are defined as (i) *being physically displaced from housing*, or (ii) *losing 10% or more of their productive assets (income generating)*." The level of detail and comprehensiveness of the Resettlement Action Plan (RAP) are commensurate with the significance of the potential impacts and risks. A proposed project is assigned to one of the following categories depending on the significance of the probable involuntary resettlement impacts:

2.3 Land Acquisition Procedures in Bangladesh

Land acquisition requires interaction between, on the one hand, the Requiring Body (RB), which usually is a national infrastructure development agency, such as the Water Development Board, Power Development Board, Bakhrabad Gas Distribution Company Limited, etc., and, on the other hand, the Acquiring Body (AB), which normally is the Ministry of Land. The Ministry of Land usually delegates its authority to the Deputy Commissioner or the Divisional Commissioner, depending on the magnitude of the land taking, or other considerations. The division of responsibilities between the RB and the AB consists in that the RB provides the technical input and the AB the legal input in the land acquisition process. The Requiring Body must ensure that the Project, for which the land must be acquired, is approved by the competent authorities and that funds are available. The RB must also justify the need for land and other property on the basis of field surveys, including detailed engineering design, and must prepare all necessary documents required for decision making. At this stage, the AB undertakes to process the land acquisition case.

The procedural aspects of land acquisition begin when the RB submits an application to the Deputy Commissioner with a request to acquire land for a specific public purpose. The procedures for dealing with land acquisition matters are laid out in a Government Memorandum, dated October, 1985. With respect to proposals in the water resources sector, additional guidelines are issued by the Water Development Board. The proposal must contain the following items:

- A Proforma indicating the amount of land required, a timetable for the acquisition of land and a purpose for which the land is to be acquired;
- A Layout Plan, which shows the location of the Project in Annex 2;
- A Land Schedule, showing the classification of the land and the ownership of the plots to be acquired (refer to Land Lease Agreement);
- A Certificate of Minimum Requirement, issued by the Requiring Body, stating that the quantity of land proposed for acquisition is the absolute minimum for a proper implementation of the Project (refer to Land Lease Agreement); and
- Administrative Approval, comprising a copy of the approved Proforma.

After receiving the proposal, the DC will arrange for field verifications jointly with the staff of the Requiring Body. This includes a classification of the land to be acquired and an identification of trees and standing crops, which are involved.

The Requiring Body's application is then submitted to the appropriate Land Acquisition Committee. After clearance by the LAC, the DC issues the preliminary notice and, if required, hears objections against the proposed acquisition. If there is no objection, and if the area is less than ten standard bighas, the DC may give the formal approval for land acquisition. If there are objections, and if the area is greater than ten standard bighas, the DC submits the application to the Commissioner or the Ministry of Land for final approval. The DC's submission shall include the clearance by the relevant LAC, a report on the objection petitions, and information on the likely number of households to be affected.

After the final approval of the President, Commissioner/Deputy Commissioner (as the case may be), the case is referred back to the DC for the assessment of compensation and the identification of the owners of the plots to be acquired. With the final approval to acquire the land, the RB must place the required funds for payment of compensation with the DC. If the RB fails to do that within one year of the date of final approval, all proceedings shall stand abated and a declaration to that effect by the DC will be published in the Official Gazette.

Compensation is paid by the DC's office. There are no specific rules on where and in what form compensation should be paid. Normally, smaller amounts appear to be paid in cash, whereas larger amounts are paid by cheques to persons who are identified by the Chairman or members of the Union Parishad or by gazetted officers. In the event the rightful owner of the land cannot be found, or there is a conflict over ownership, or the distribution of compensation, funds are deposited in the Public Account.

In the event the owner of the land DOES not accept the award of compensation, the person can go for Arbitration according to the provisions of the 1982 Ordinance. After payment of compensation, the ownership of the land is formally transferred to the Requiring Body by

mutation in 'dmini of the RB in the government's revenue record, which is maintained at the concerned Thana Land Office. The transfer also is published in the Government Gazette.

2.3.1 Institutional Arrangements

The administrative set up for land acquisition has two tiers under the Ministry of Land Administration. At the Division level, there is an Additional Commissioner dealing with land administration under the Commissioner. At the district level, there is an Additional Deputy Commissioner in charge of land administration. Under him, there is at least one Land Acquisition Officer and several Assistant Land Acquisition Officers. The number of officers depends on the size of the District. Non-gazette officers in the land administration include Kanungos and surveyors.

2.3.2 Time Frames

Time Frame for Payment of Compensation

The following are time frames relevant to the payment of compensation:

- a) Payment of compensation must be made before the authority takes possession of the property (Ordinance of 1982).
- b) Compensation must be paid or deposited within a period of one year from the date of final decision of acquisition by the DC. All proceedings shall stand abated on the expiry of that period (Ordinance of 1982).
- c) Persons with an interest or right over the property to be acquired have 10 days in the 1989 Act and 15 days in the 1982 Ordinance to submit claims for compensation.
- d) The 1989 (Emergency) Act provides for quicker compensation by introducing the concept of 'provisional compensation' which is to be determined within 10 days of the order of acquisition. Land can be acquired on payment of provisional compensation. However, the final compensation is to be determined within three months from the date of acquisition.

2.3.3 Time Frames for Legal Procedure and Appeal

The following are time frames applying to the legal process:

- a) The aggrieved party may raise objection in writing against the decision of acquisition within 15 days from the date of serving the notice of acquisition. It may take about a month to make a final decision.
- b) If a land owner is dissatisfied with the amount of compensation offered, he may apply for arbitration to an Arbitrator not less than the level of a Subordinate Judge within 45 days of the award.
- c) Subject to the decision of the arbitration, either party may appeal against the decision to the Arbitration Appellate Tribunal within the stipulated period allowed by the court.

2.3.4 Framework for Leasing of Government (Khas) Agricultural Land

The rules for managing and leasing Government-owned (khas) land are framed in two notifications in the Bangladesh Gazette: (1) Notification: Bhumo/Sho-8/Kha-jo-bo/46/84/261, Bangladesh Gazette Extra Edition, May 12, 1997, pp 1527-1536; and (2) Notification: Shuno/Sho-4/Kri-kha-jo--bo-1/98-264, Bangladesh Gazette, September 15, 1998.

Under these regulations, the Government leases cultivable agricultural land in the rural areas to landless farming households. The allotments cannot be more than one acre, except in the southern districts where up to 1.5 acres of char land² can be allotted. A landless family is defined as one that works in agriculture and may own a homestead, but has no arable land of its own.

The regulations provide for a three-tiered structure, with Committees for the Management and Leasing of Khas Land at the National, District, and Thana levels (police station and sub-district level administration which covers Upazila/sub-district levels). While the upper committees have oversight and appeal functions, the key operations occur at the Thana level. The Thana Committee for the Management and Leasing of Khas Land is charged with recovering Khas land that is out of Government management, dividing it into plots, and informing the population in the mouza (a village where land owners pay land tax to the Government) about the leasing programme. Once applications have been submitted and the fee of one Taka paid by the applicants, the committee vets the applicants, collates a priority list and passes its recommendations to the District level committee. Applicants have 30 days to make an appeal in relation to the composition of the list. Normally, the District committee finalizes the list of land lease beneficiaries (allottees). However, in case of disputes, the National level committee examines the circumstances and makes the final determination.

The actual leasing of the land is carried out under the jurisdiction of Assistant Commissioner for Land at the Thana Level, where leaseholders are required to sign a lease agreement. The lease is for the number of years stipulated by the Thana Committee for the Management and Leasing of Khas Land. Normally, rural agricultural or homestead land is leased on a temporary basis for a period of 3 years. There are instances, however, where land lease can be extended for 15 years, whereupon the lease becomes 'permanent' to last for 99 years. Upon retirement, disability or death of a leaseholder, the transfer of the lease is allowed only to their descendants. The leaseholders pay a small annual fee to the Government of Tk 5/per decimal. No land tax is collected in Bangladesh on any agricultural land up to 8.25 acres.

The current reworking of the leasing system in the regulations of 1997 and 1998 is not meant to cover Khas land leased under previous rules. It covers only that Khas which has been occupied illegally or has been out of government management control for some other reason.

The Government has the right to cancel leases allocated and to recover the land, if that is required for a public purpose. All Khas land that is held under a long-term lease (99 years), if recovered by the Government before the expiry of a lease, is compensated on a premise as if the leaseholder were the owner of the land. There is no provision for the payment of compensation in the event of the involuntary resumption of temporary leases. Under requirements of the 1982 Ordinance, the administration is liable to pay for the loss of standing crops to leaseholders cultivating on the Government-owned Khas land.

² Char Land - riverine sand and silt landmasses.

Chapter-3

DESCRIPTION OF THE PROJECT SITE

3.1 Type and Category of the Project

As mentioned earlier, according to ADB SPS, 2009 and ADB Environmental Assessment Guidelines 2003, the project will fall under category-B, which requires IEE study.

3.2 Rationale of the Project

Electricity is a key ingredient for the socio-economic development of a country. With a view to attaining 7% growth in GDP, the Government of Bangladesh (GoB) has placed highest priority to the electricity generation. Currently, the country's average power generation capacity is about 10,000 MW. According to the Power Sector Master Plan 2010, demand for electricity would be about 10,283 MW in 2015, 17,304 MW in 2020 and 25,199 MW in 2025 respectively. With a view to the above, the GoB has adopted a plan to add about 11,606 MW electricity to the grid within 2015 of which 7,240 MW is expected to be generated in the private sector.

Accordingly, the GoB has awarded a number of power projects to the private sector i.e. rental, quick rental power projects to address short-term power crisis and independent power producer projects to meet long-term power demand. The proposed project is one of the government initiatives to be established by private sector. It has been awarded as an Independent Power Producer (IPP) for a term of 15 years.

3.3 The Project Site

The proposed site of the 52.2MW power plant is located adjacent to the Substation of PGCB at Jangalia, at 91° 25' 73" E longitude and 23° 25' 27" N latitude. The site is located approximately 3 km to the south of the Comilla City Corporation office. The project site is approximately 145 km south-west of Chittagong (the Divisional Headquarter) and approximately 105 km north-west of capital city Dhaka. Administratively, the site is located in the 22 no. Doiara Ward of Comilla Sadar South under Comilla City Corporation (refer to Maps 3.1 to 3.4). The proposed power plant will be served by natural gas and Furnace Oil from the Bakhgrabad gas field and BPC respectively, The gas field is located about 20 km to the north east of the power plant.

3.4 Surrounding of the Project:

Details of areas surrounding the proposed project site are as under:

1. East: Rail line, 100m wide pacca road, commercial establishment and settlement
2. South: Sub-station of PGCB
3. North: Agricultural land, wetland and settlement area
4. West: Agricultural land, wetland and settlement area

3.5 Project details of Project Area:

The particulars pertaining to the proposed project area is shown in the Land lease Agreement between LBPL and BPDB and is shown in Annex 4

The Project area consists of the following primary components:

- i. Development of the site for the 52.2 MW Power Plant at Jangalia Comilla project;
- ii. Development of a 15m access road to connect the power plant to the Comilla – Laksam Highway as per agreement between LBPL and BPDB.
- iv. Gas Pipeline from existing pipeline along the road approximately 50m from the plant site. There is no provision for getting gas supply for LBPL for the present moment and hence no right of way has been yet fixed by Bakhrabad Gas Distribution Company Limited (BGDCL) under the Ministry on Mineral and Energy Resources of the GOB.

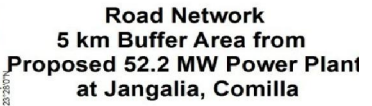
The proposed site to the 52.2MW Jangalia Power Plant of LBPL occupies an area of approximately 3.0 acres which includes a construction ‘lay-down’ area in the northern section of the site. An aerial photograph of the proposed project site is included in Map 3.1, 3.2 and the layout of the site is presented in Annex 2 and the Satellite image of the proposed project 1 km radius and 5km radius is given in Figure 3.1 and 3.2 in below.

Comilla is bordered by Brahmanbaria and Narayanganj Districts to the north, Noakhali and Feni Districts to the South, Tripura of India to the East, and Munshiganj and Chandpur Districts to the West.

Location of Proposed 52.2 MW Power Plant at Jangalia, Comilla



Map 3.1: proposed project site of the plant



Map 3.2: Road network around the 5 km buffer zone area from power plant site

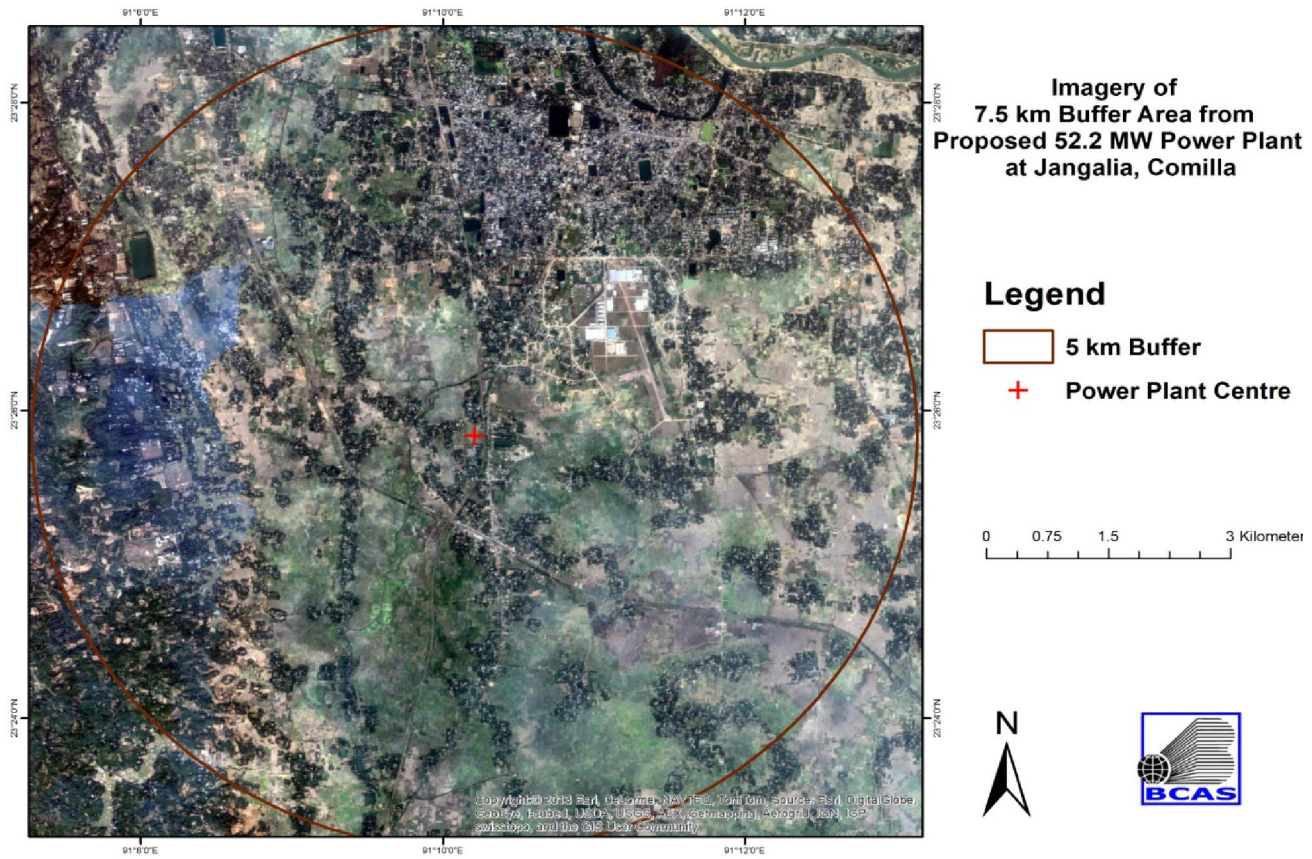


Figure: 3.1: Satellite image of the proposed project site

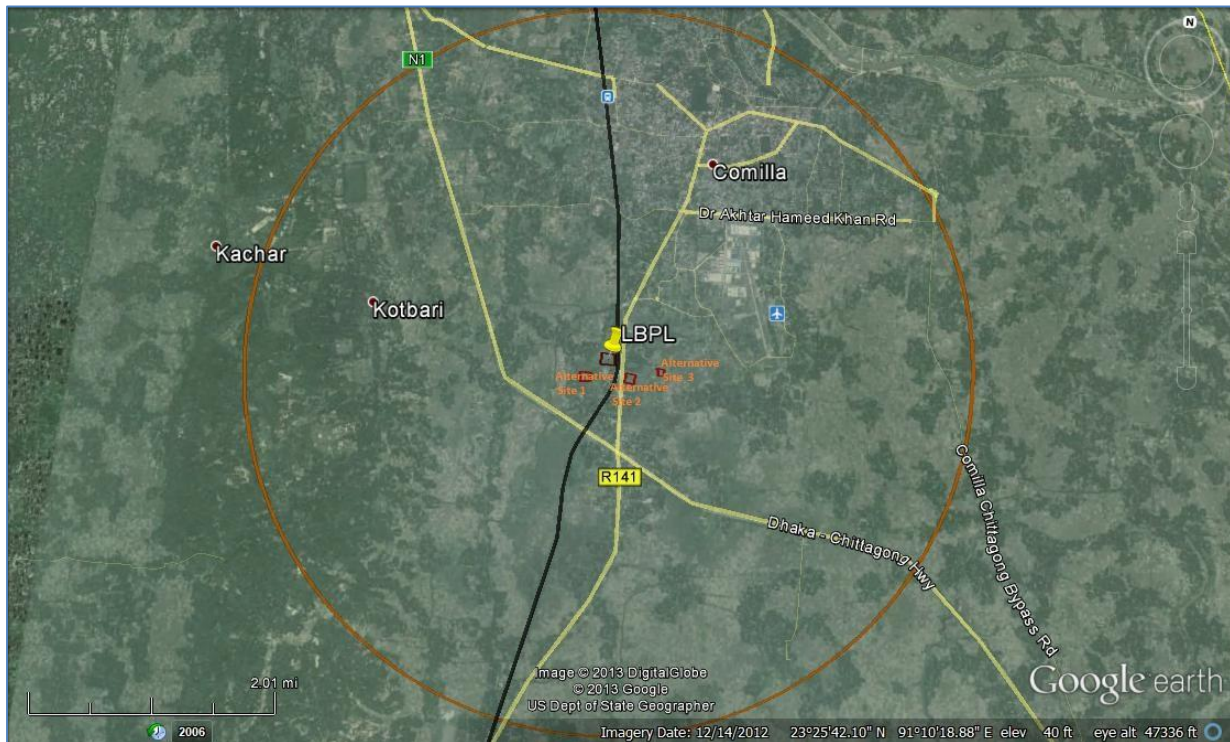
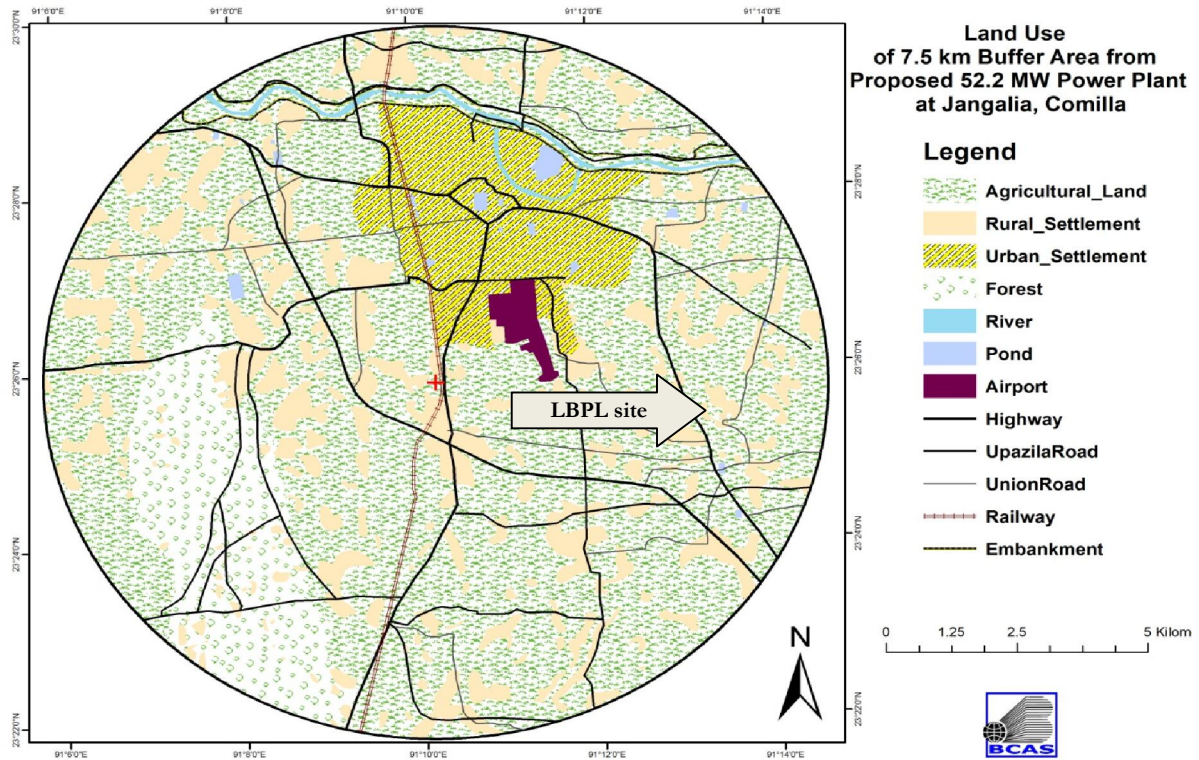


Figure 3.2: Satellite image of the proposed project site with alternative sites

3.6 Major Land use and main occupations:

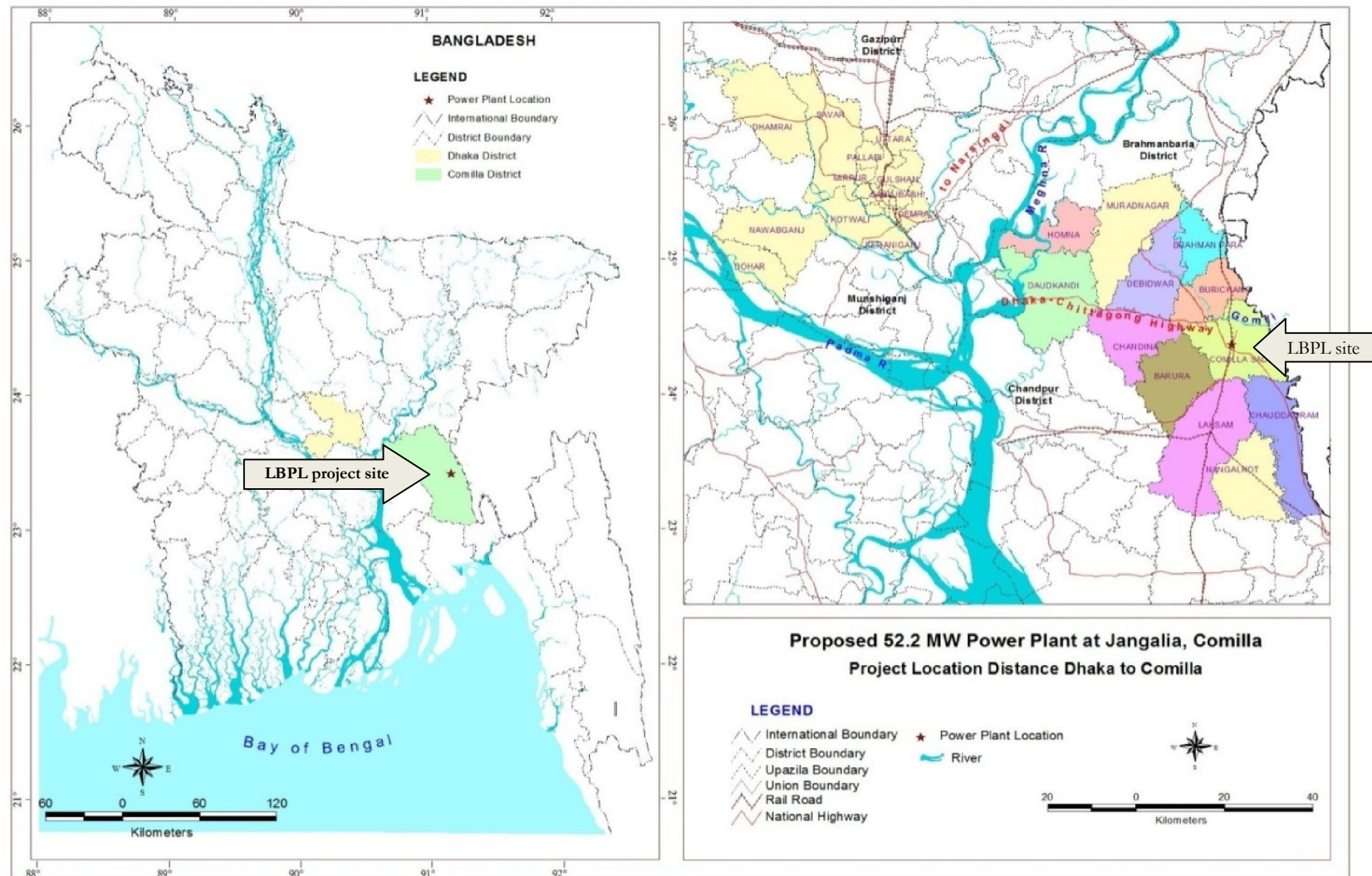
As per BBS the main occupations within the Comilla City Corporation are as follows: Agriculture 43.28%, Commerce 11.6%, Service 10.78%, Transport 3.36%, Agricultural labourer 15.89%, Wage labourer 2.46%, Construction 1.03%, Others; 11.6%. (*Source: AE office of Comilla Sadar Dakkin*). The Land use type and land use pattern within 5 kilometers of the project site is shown in Map 3.3.



Map 3.3: Current landuse pattern of the project site

3.7 Transportation and Road Network:

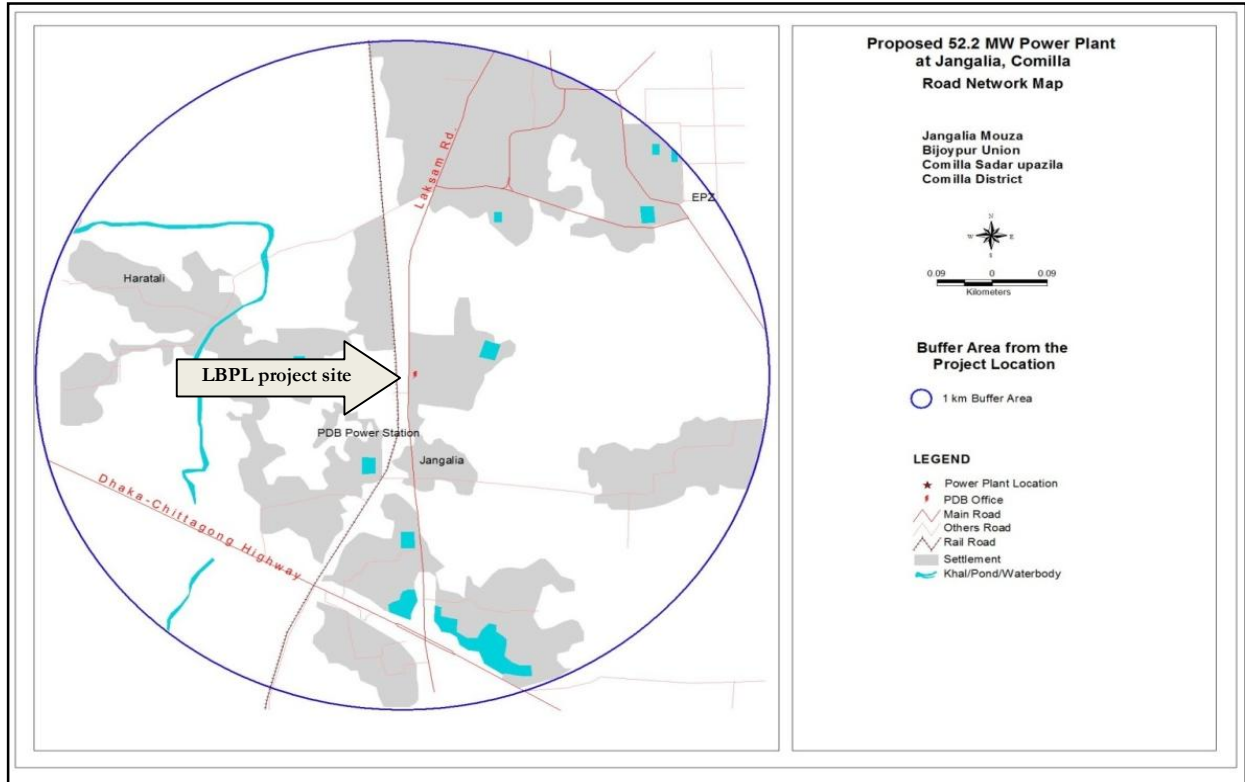
Comilla is the transit point between Dhaka-Chittagong Routes. Comilla is known as the hub of Road Communication of Eastern part of Bangladesh and has good communication network. One of the oldest highways of the Indian Sub-Continent, 'The Grand Trunk Road' has approached through the City. Comilla can be travelled by Railway. The trains have to travel 197 Kilometers and takes over 3 hours to reach Comilla from Dhaka. On the other hand it is about 100 Kilometers from Dhaka by road and takes about two hours to reach Comilla. Long distance from Dhaka to Comilla are depicted in the following Map 3.4



Map 3.4: Location distance from Dhaka to Comilla

3.8 The Air Shed of the project area:

The air shed for the project has been considered a radius of 5 kilometers. The impacts on environment and social issues this air shed will be considered. An air shed area of 7.5 kms radius of the project is showing in the following Map 3.5.



Map 3.5: Air-shed area and Road network map within 5km of the power plant

3.9 Suitability of the Site

While selecting a site for thermal power plant project, some aspects need to be considered. In the following section, the site of LBPL is evaluated based on these aspects:

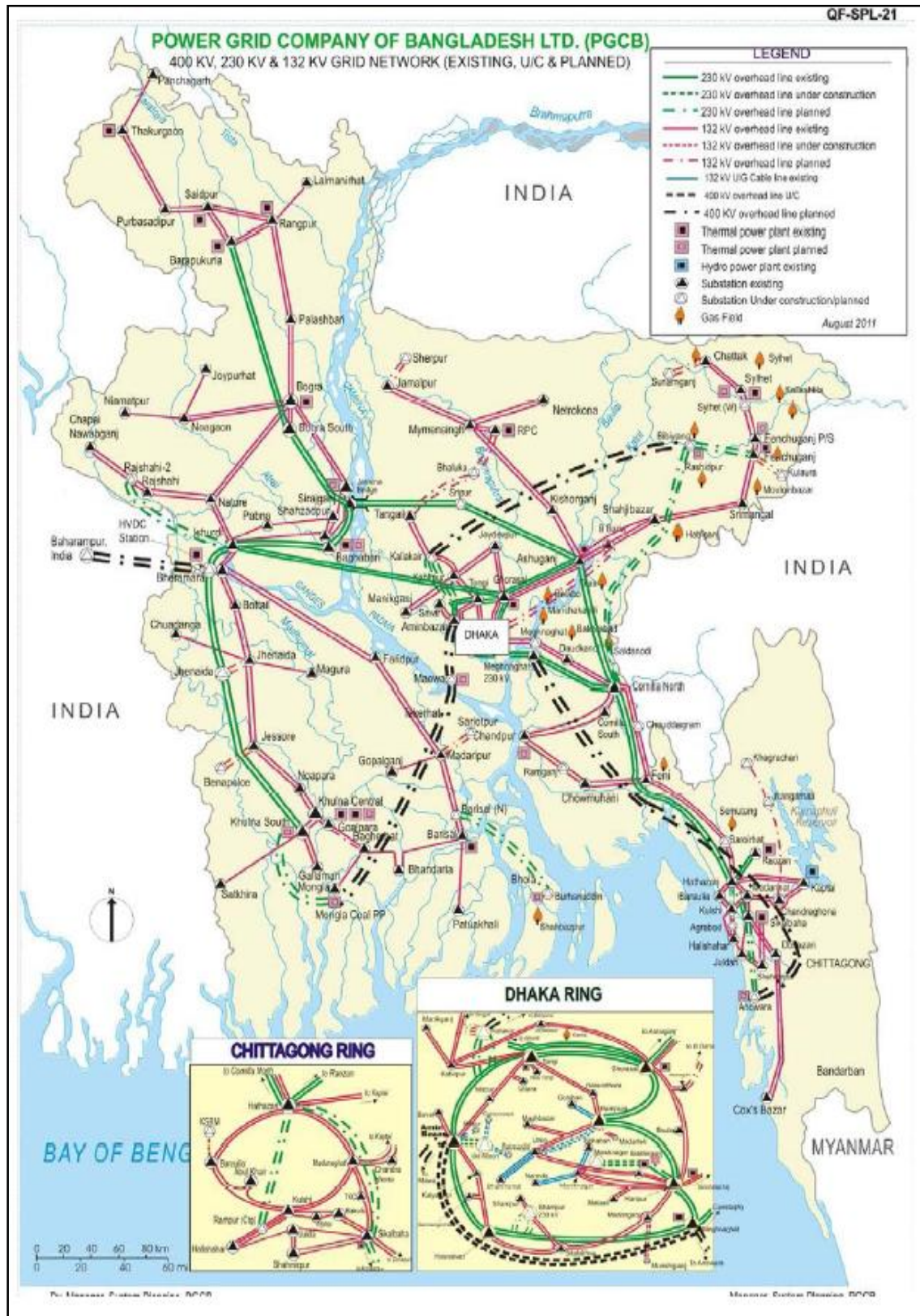
Accessibility: Accessibility is an important parameter for a power plant project. A power plant project usually involves movement of heavy vehicles for various purposes. The LBPL site has been found to have a satisfactory accessibility. Access to the site is by either the Dhaka to Chittagong Highway or the Dhaka to Chittagong Railway. A 15 feet wide link road has connected the site with the Comilla - Laksam Highway.

Environmental considerations: All power plant design, regardless of the type of power plant, must be in accordance with the rules and regulations of national authority. LBPL is committed to comply with all applicable national and international standards. Moreover, the ambient condition of the site is suitable for the proposed power plant project. This has been discussed in the Analysis of Alternatives section.

Water supply: Water supply should be adequate to meet present and future plant requirements. The supply may be available from a local municipal or privately owned system, or it may be necessary to utilize surface and sub-surface sources. To meet the required water demand, LBPL has planned to set up two deep tube-wells with a capacity of 2 m³/hour each. The cooling water system is of basic radiator type design with closed cooling water circuit requiring negligible amount of make-up water (Annex 2). Maximum amount of water required is estimated to be around 20m³/day including both process & service water requirement. The main process water requirement is for makeup of steam generation system and consumption is estimated to be around 7.5 m³/day. The remaining amount is for human usage, washing, cleaning, plantation and emergency usage.

Wastewater Disposal System: On-site effluent disposal system will be installed to treat and dispose of project effluents. Ultimately all effluents including wastewater treatment system (WTS) effluent, boiler blow down, treated sewerage, oily drains, and chemical spillage will be discharged after treatment in the wastewater treatment Plant.

Transmission and interconnection: The generated electricity of the LBPL plant will be transmitted through the nearby PGCB sub-station requiring an interconnection line of approximately 50 meters. The interconnection line will be handed over to PGCB after commissioning and subsequently, PGCB will operate and maintain the equipment of the bay. LBPL will install, operate and maintain separate 230 kV synchronizing breaker at the high voltage side of the step-up transformer and also construct the connecting lines for connection as mentioned above. The existing Power Grid network of Bangladesh is showing in the following **Map 3.6**, and a figure of **3.3** Existing, Under-construction and Planned Power Grid Network of Bangladesh.



Map 3.6: Existing Power Grid Network in Bangladesh

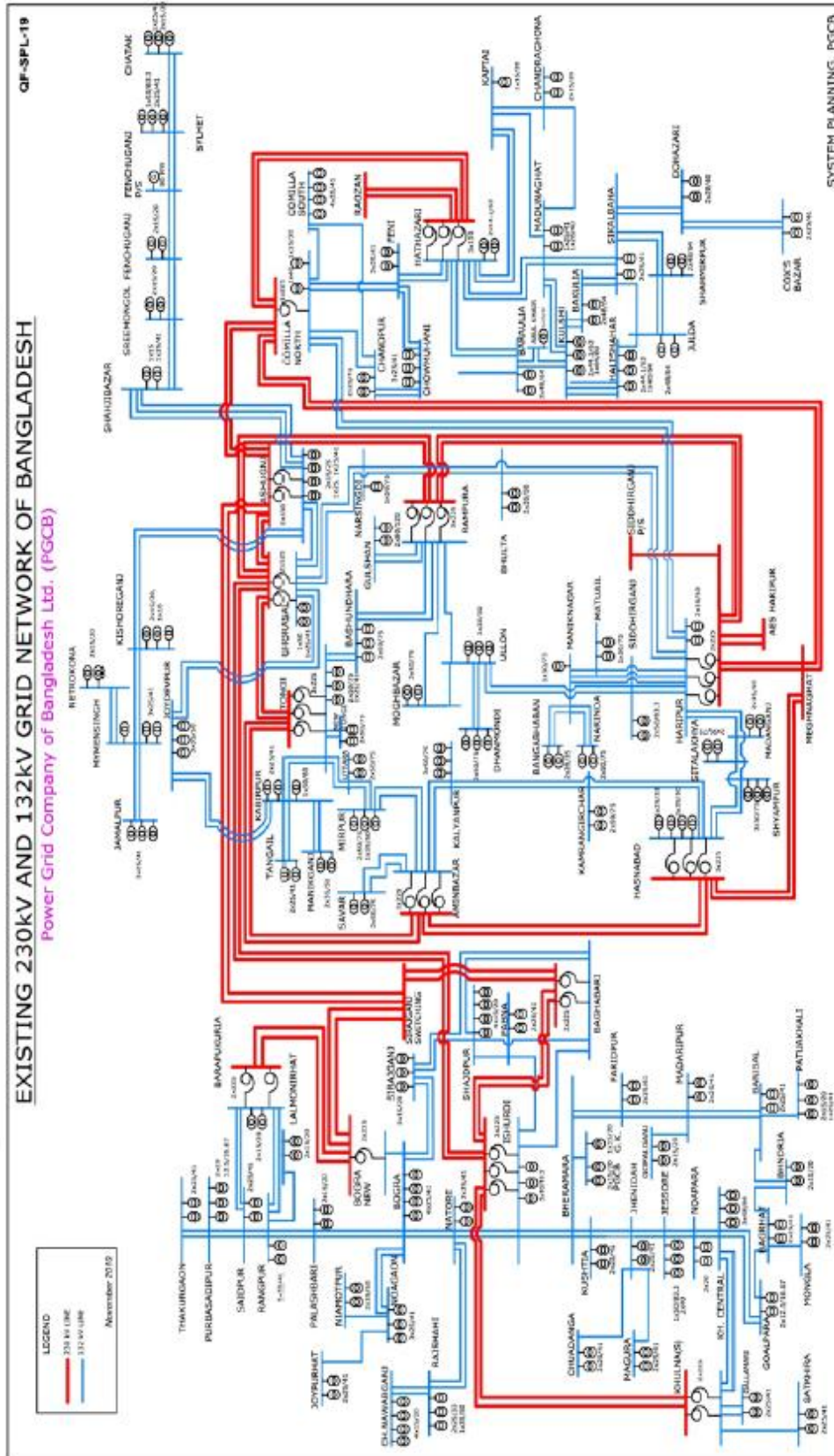


Figure 3.3: Existing, Under-construction and Planned Power Grid Network of Bangladesh

3.10 The Access Road to the power plant

Vehicular access to the project site will be provided by the development of a 20 m access road to connect the main power plant to the Comilla–Laksam Road.

The route of the access road will be from the east-west boundary of the site and head southwards passing through PGCB sub- station connecting with the Comilla–Laksum road.

As detailed design of the infrastructure of the Power Plant done by LBPL of the road will comprise a bitumen-paved road built to the following design criteria:

- Overall width shall be 15.0 m
- The elevation of the access road embankment shall be at a minimum 2 meter
- Road lighting shall be required;
- Road markings and signs shall be provided in accordance with the requirements of Bangladesh Highways Authority and Bangladesh Railway Authority.

A chain-link security fence shall be provided along both sides of the access road. A partial view of the access road which will be used for the LBPL project purposes is seen in the following Photos 3.1



Photo 3.1: Approved and existing Access Road from Comilla-Laksham highway to the PGCB Substation

Fuel supply arrangements: LBPL has signed an Agreement with Bangladesh Petroleum Corporation (BPC) for supply of Heavy Furnace Oil (HFO). The HFO will be supplied to the Plant Site by tanker.

The natural gas supply system of Bakhrabad in the Jangalia Power Station (GPS) would be used for the supply of natural gas to the proposed LBPL plant. A gas pipeline of 0.5 kilometers has to be laid from flunk line along the Comilla-Laksham Road. A gas metering station will be installed at an appropriate location which will be decided by Bakhrabad Gas Fields Company Limited (BGFCL). One of the enlisted contractors of Bakhrabad will implement the pipeline installation assignment.

Some salient features of the Project site and its surroundings are shown in the following photos 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, The contour map of the project area is shown in Annex 8.



Photo 3.2: Small water body in the site



Photo 3.3: Fallow land in the site



Photo 3.4: An initial view of the Project site



Photo 3.5: 30 feet wide road in the project site



Photo 3.6: Rail way crossing beside the power plant



Photo 3.7: Nearby wetland

3.11 Technology and Major Components of the Project

The proposed dual fuel power plant which can use either HFO or natural gas consist of Six (6) numbers of Wartsila made 20V32GD Engines, each coupled with aABB made AMG 1210M (or equivalent) of11.155MVA(8.9 MW) Generators. Electrical power is generated at 11 kV. 6 Internal Combustion engines with a combined gross capacity of average Engine generator units are connected to a 11kV Bus and is fed to a 70MVA 132/11kV generator step up transformer.

52.2 MW depending on the type of fuel being used (HFO or Natural gas). During the initial phase of the operation it is expected that HFO will be used and subsequently converted into dual fuel based when gas becomes available. The project sponsors have chosen Wartsila Engine having the following specifications: Table 3.1 shows the specifications of the machineries and equipment:

Radiator cooling system will be installed and therefore there will be no need to extract cooling water from surface water. The stack height will be determined through air dispersion modeling recommended by USEPA Detailed Environment Impact Assessment (EIA) of the project have been carried out after obtaining the site clearance certificate from the Department of Environment. The modeling exercise have been taken into account the following parameters specifically USEPA approved ISC3P model which is acceptable for point source emission will be used in modeling the air dispersion patterns taking into consideration the baseline air quality and air quality after the project goes into operation. The detailed technical specifications of the machinery and equipment is shown in Annexx11

Table 3.1: List of Machineries & their key details for 52.2 MW Power Plant at Jangalia, Comila

S N.	Component	Manufacturer/ Country	Model / type
1	Reciprocating Engine	WARTSILA / FINLAND	W20V32GD
2	Generator	ABB / GERMANY (or equivalent)	AMG 1120 M
3	Control system	WARTSILA / FINLAND	WOIS
4	Main Step-up Transformer	4 JSHP / INDIA (or Equivalent)	Oil Immersed ONAF
5	Station Transformer	LTL / Sri Lanka	Oil Immersed ONAN
6	HV Switchgear	ABB / INDIA (or Equivalent)	Outdoor
7	Medium Voltage Switchgear	ABB / Czech republic (or Equivalent)	Uni Gear ZS1
8	Low Voltage Switchgear	KIK8 / Sri Lanka (or Equivalent)	Indoor
9	Rectifiers	Reputed supplier from China / India	Indoor
10	Battery system	Reputed supplier from China/India	Lead acid
11	Power Cables	Reputed supplier from Srilanka/China	XLPE/PVC insulated
12	Air compressors	Dalgakiran/Turkey (for equivalent)	Reciprocating & Screw Type
13	Fuel Treatment Plant	Westphalia/Germany (or Equivalent)	Centrifugal Separators
14	EOT Cranes	DEMAG/Germany (or equivalent)	Centrifugal Separators
15	Aux & Ex gas Boiler	Aalborg/Finland	Overhead Crane(Electric)
16	Sludge Treatment Plant	JOWA AB/Sweden	Combined Chemical & Mechanical Type
17	BOP Pumps	Kraal/Austria (or Equivalent)	Screw Type

Significant amount of noise & heat is generated mainly by the Engine Generator Sets. These are enclosed in an acoustically designed noise attenuated forced ventilated building.

This building consists of 100mm thick rock wool panel walls with density of 100 kg/m³. 100mm thick Rock Wool (density 100 kg/m³) walls are capable to absorb most of the noise generation from the engines. Moreover, vibration absorbent spring pads will be used at the bed of all power generation units to prevent the vibration.

To reduce noise from engine exhaust stack, it is equipped with an exhaust silencer with noise attenuation of 35dB (A) and similarly the noise generated in intake air path will be reduced by an intake air silencer.

Therefore the noise at the plant boundary will meet the following criteria while the noise level 1m away from engines is 85 dB(A).

- At site Boundary : 75 dB(A) in Day time and 70 dB(A) in Night time
- At 100m from major equipment: 75 dBA.

Power house building is equipped with forced draft ventilation fans to supply adequate amount of ventilation air (>222m³/s) in desired directions, and the air exhaust will be through the roof monitor located at 13m above ground. Total heat generation from each engine will be around 630 kW and accordingly the temperature rise in air exhausted (at 13m height) through roof monitor will be less than 15 °C.

3.12 Key details of the equipments:

1. Stack Height: 42 meter
2. Effective Stack Height 30 meter

(According to Good Engineering Practices (GEP), the required equation for the stack height is;
 $H_g = H + 1.5L$, Where, H_g =Stack Height, H =Height of the structure, L =Width or height (whichever is less). By measurement, $H=12m$, $W=14m$, Distance=150m. Therefore, $H_g=12+1.5 \times 12=30m$, i.e designed stack height of 42 m is acceptable according to GEP)

3. Design Stack diameter: 1.1m each. (There are 6 chimneys/flues separately for each engine, which are supported by a common steel Structure.)
4. Exit gas velocity: HFO Operation: Flue gas exit velocity of 27m/s at a temperature of 240 ± 15 °C in 2 engines' chimneys with Waste Heat Recovery Boilers and it is 32m/s at a temperature of 335 ± 15 °C in other 4 engines' chimneys.
5. Fuel consumption per unit power production: 8850.58BTU/KWH
6. Mass of pollutant emission per unit power production:g/kWh: 47.37g/KWH
7. Mass of pollutant emission per unit time g/sec:
(NO_x: 260grams/second, SO_x 401.92 grams/second and, CO: 18.40 grams/second)
8. Emission control system used if any: Low emission in built in generator set

Fuel Treatment Plant

Fuel treatment System consists of 2 Nos. of centrifuge type separators with capacity 15,400 Litres/hr each designed for treatment of Heavy Fuel Oil with Viscosity 180 cSt (at 50°C), Max. Density 1010 kg/m³ (at 15°C) and Heavier solids content than oil up to max. 4% (V/V). Fuel Separation Temperature is 98°C and the discharge pressure is 1.5 – 2 kg/cm².

Free Water Removal capability: Up to 2000 (0.2%) v/v ppm from initial of around 15000 ppm (1.5%) v/v in single pass.

Particle removal capability: Up to ISO Class 18/15 of 4406 or heavier metallic solids than oil of size up to 5 micron will be removed.

Fuel Storage

Fuel storage tanks are atmospheric tanks designed according to API 650; the Standard for Welded Steel Tanks for Oil Storage. As specified there, sufficiently sized vents, filling & draining provisions, access ladders & manholes provisions are included. In addition, both mechanical & electronic level indicators/switches, temperature gauges, thermostats & heaters and valves are provided. Tanks are painted with epoxy primer & 3 layers of polyurethane paints against weathering and they are electrically grounded to avoid electrical/lightening hazards. All the tanks are surrounded by a sufficiently sized common dyke wall to avoid undesired spread of oil which could be happened due to an accidental oil spillage. Below is the list of fuel storage tanks along with their capacities.

- Diesel Storage Tank – 100m³
- HFO Storage Tanks – 2 x 2500m³
- HFO Buffer Tank – 55m³, HFO Day Tank – 100m³

3.13 Power Generation Process

The technology to be used for power generation of 52.2MW power plant will be based mainly on reciprocating engines. The fuel will be natural gas and HFO. There will be 6 reciprocating engines of 8.9 MW each to be coupled with alternator to generate electricity. A preliminary process flow diagram and fuel circulating system is given in Figure 3.4 below

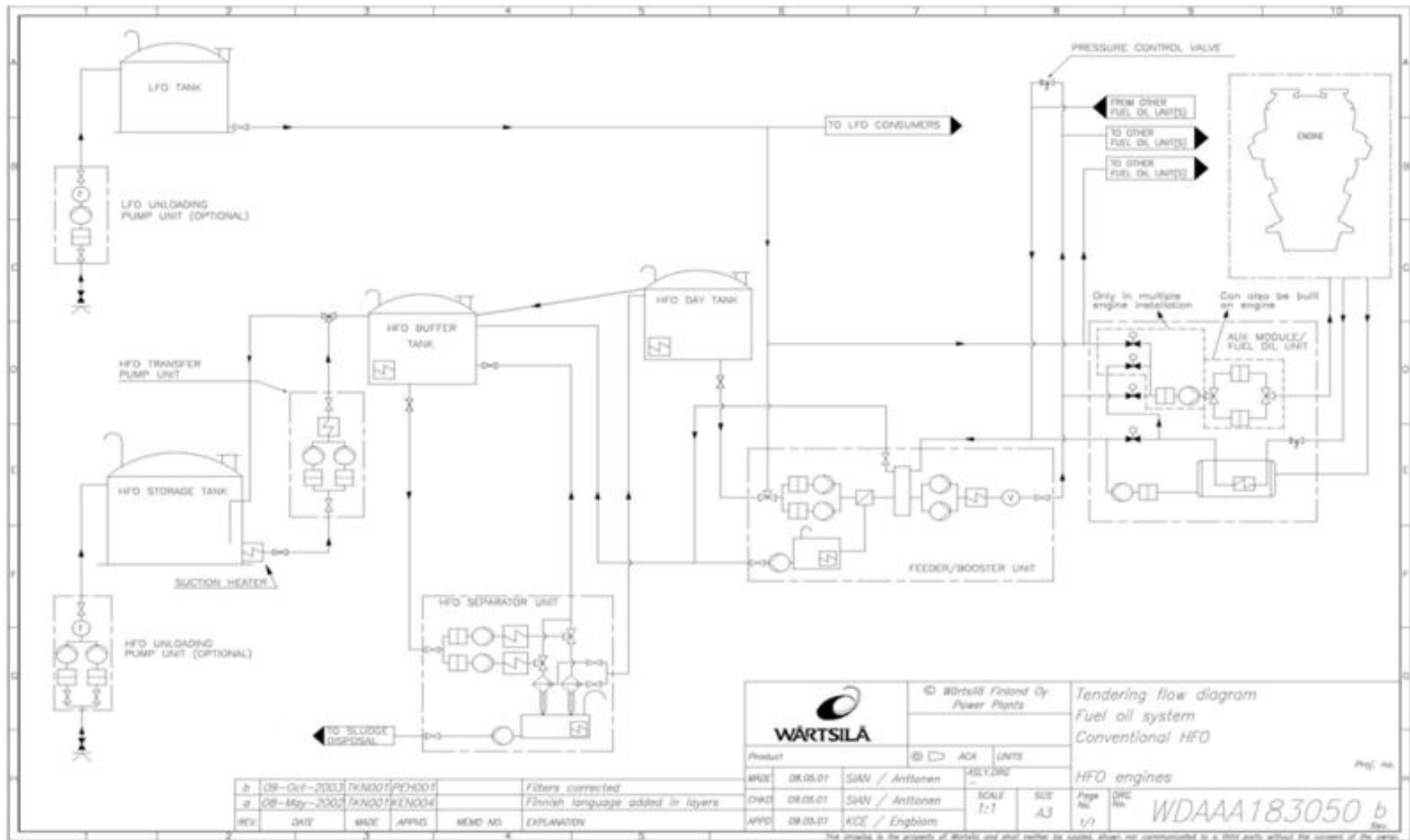
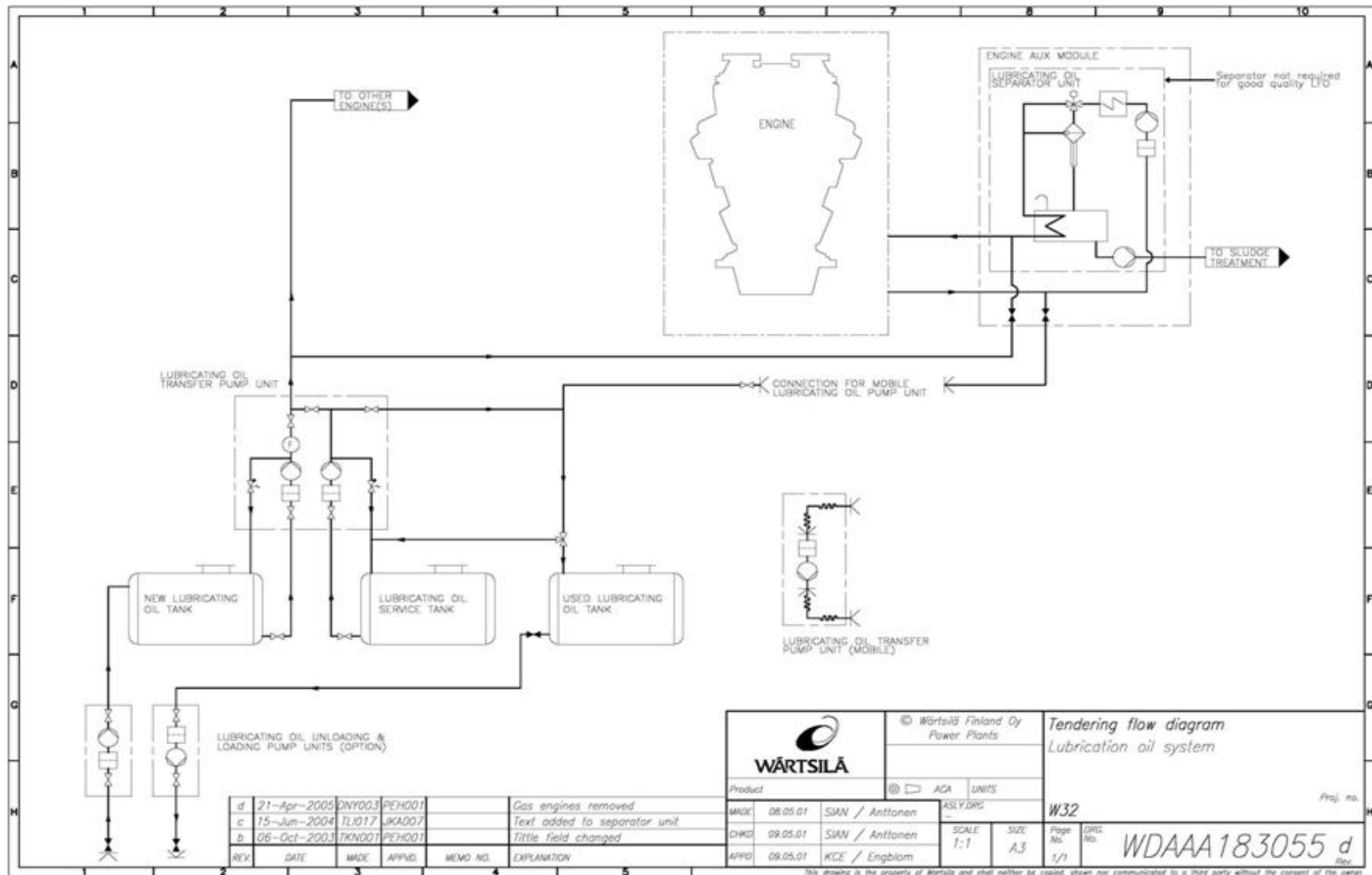
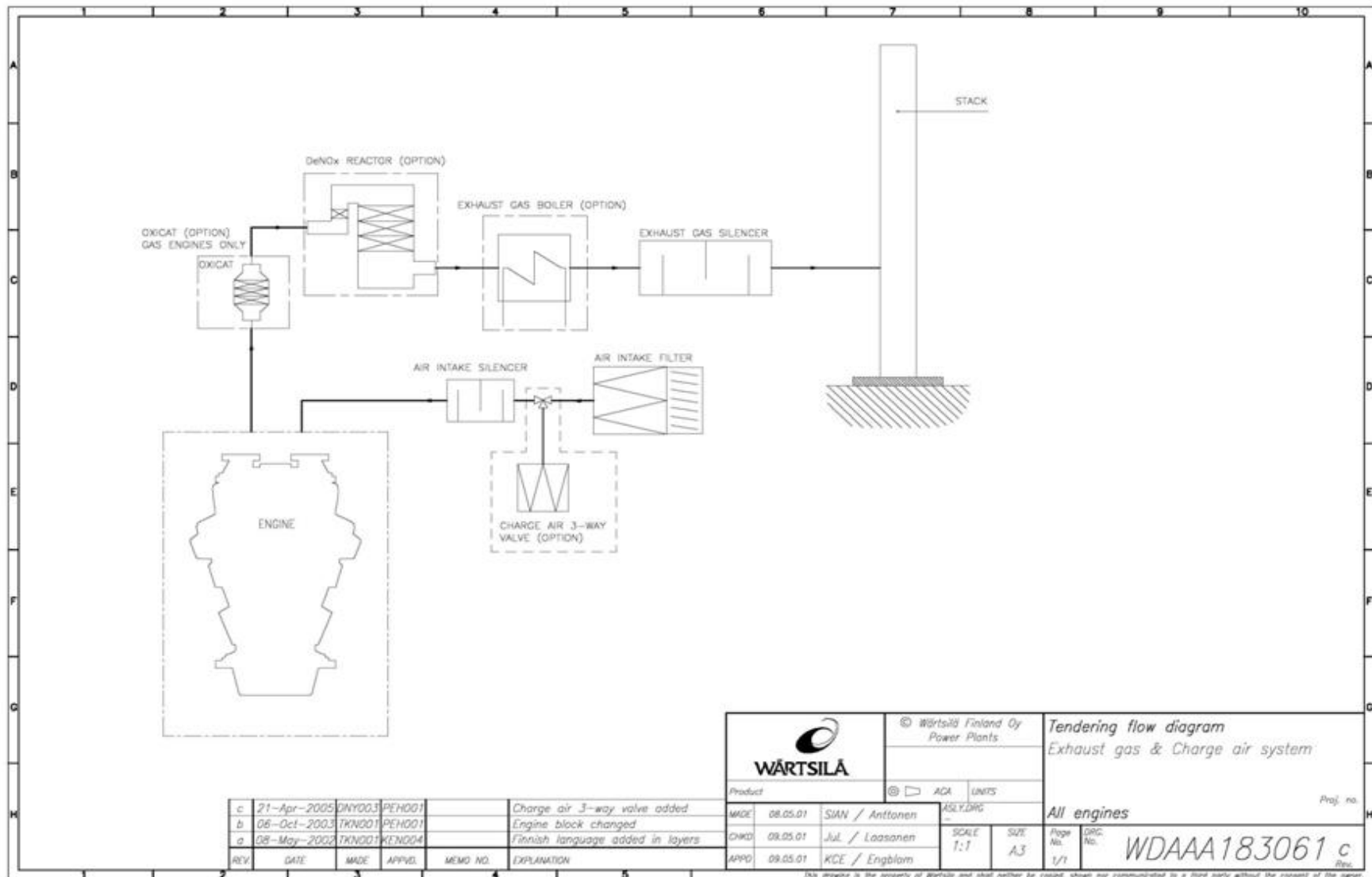
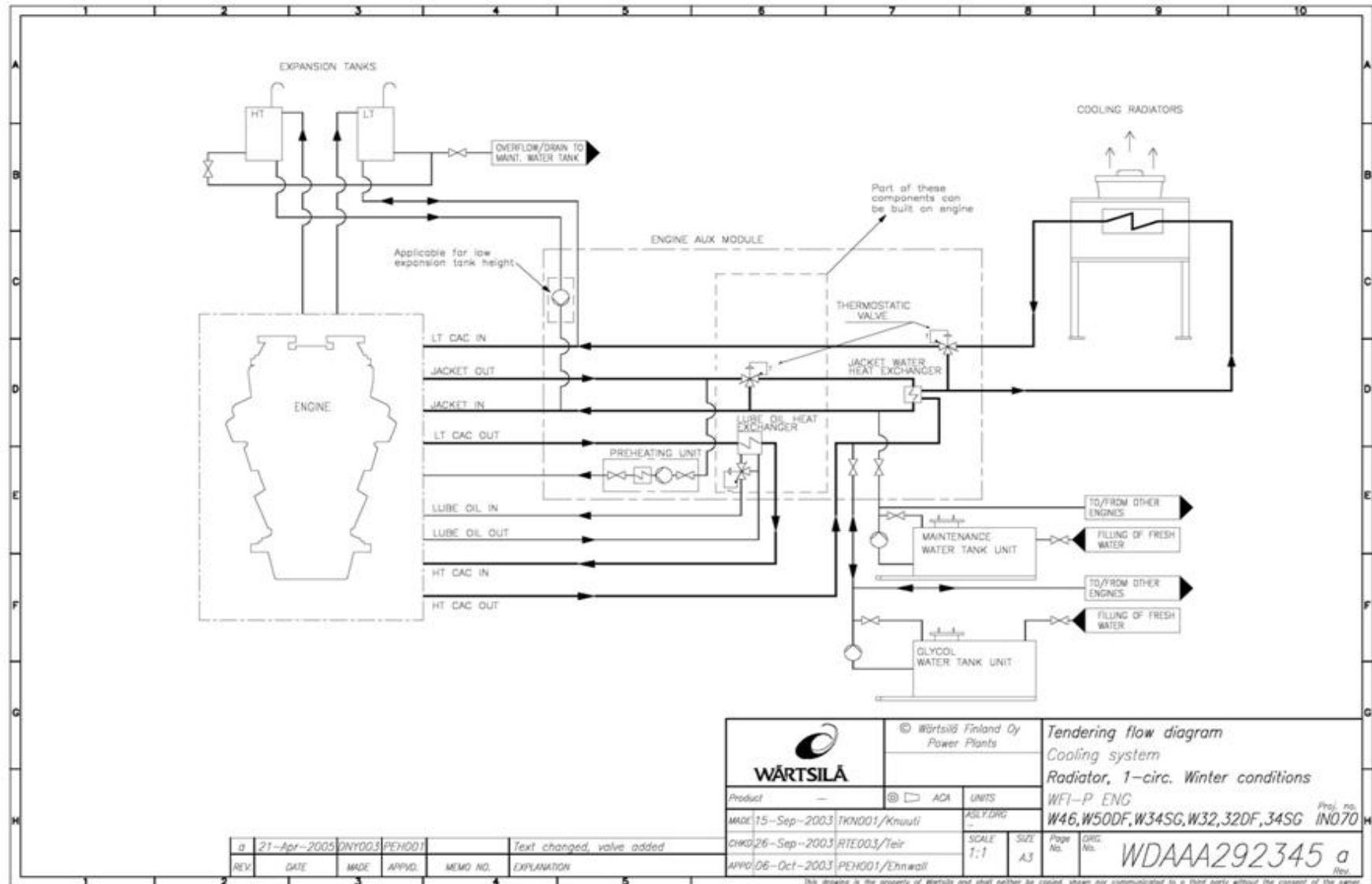


Figure 3.4: A Process flow diagram for the proposed power plant







3.14 Generating Set and Engine

The engine is the four strokes, lean burn, pre chamber, spark ignited, port injected, trunk piston, turbocharged and intercooled design. The engine has a fully microprocessor based control system. In the Feasibility Report the technical specifications of reciprocating engine and generator have been provided. (Pls. see detailed in Annex 1)

3.15 Electrical Systems

The power plant is to be controlled and supervised from the Wartsila WOIS Interface System. All actions necessary for the normal operation, such as start and stop of the generating sets, load increase and load reduction are activated and supervised via the Wartsila WOIS workstation, using a mouse, keyboard and display. The operator can also supervise key data from the plant such as various temperatures and pressures as well as measurements of electrical variables such as generator output, voltage and frequency. The Wartsila WOIS workstation also includes an alarm matrix printer and a hardcopy laser printer.

3.16 Natural Gas Conditioning System

From an agreed Terminal Point located in the Titas Gas Compound (downstream of the fiscal metering/pressures regulation provided by Bakhrabad a 10" diameter sized single gas pipeline will be routed via the existing pipe bridge structures to the power station gas conditioning system. The natural gas conditioning system will be located in a fenced compound within the power station and shall include but not be limited to the provision of the following equipment:

- Incoming gas emergency shutdown valve
- On-line analysis facilities (to determine the fuel gas heating value etc.),
- Filter/separators
- Pressure reduction/trimming streams
- Gas condensate collection and disposal
- Unit metering (including flow computer)
- Inert gas purge system
- Interconnecting piping and valves

3.17 Water Supply System

The water supply for the Plant has been planned to be extracted from the ground water through deep tube well. The discharge of the intake pumps shall be piped to the water storage tank. The water storage tanks shall be located in elevated positions in order to provide sufficient head to distribute the water and should conform in every way to the statutory water supply bylaws and associated requirements. All necessary piping, valves etc shall be provided to distribute the water. The water system shall provide for the feed to the miscellaneous cooling, flushing, landscape watering and road cleaning as well as for drinking and household

services. This tank should also have a dedicated reserve for the fire protection system and the tank connections shall be arranged such that during normal operation this reserve cannot be drawn down. The cooling water system is of basic radiator type design with closed cooling water circuit (Refer Annex 6). The same amount of water quantity is circulated through the heated components (heat exchangers) and then the heated water is again passed through the radiators in order to cool down water. This closed cycle circulation repeats and hence the amount of makeup for cooling water system is negligible. Maximum amount of water required is estimated to be around 20m³/day including both process & service water requirement. The main process water requirement is for makeup of steam generation system and consumption is estimated to be around 7.5 m³/day. The remaining amount is for human usage, washing, cleaning, plantation and emergency usage

3.18 Waste Water Management

Oily water will be generated in the waste water. A waste water treatment plant will be needed to bring the quality of the waste water discharged within the acceptable limit set by the DOE.

This will be constructed in parallel with power plant other construction work & will be available for operation since the plant initial operation. The system design is briefly described in Chapter 2.

3.19 Civil Construction

3.19.1 Site Preparation

Site preparation would comprise the land filling of 1.5 meters and compaction of 3.0 acres of land. Prior to construction, a 300mm thick carpet of crushed stone should be spread in the lay-down areas and on the working surface.

3.19.2 Piling

The proposed power plant is being founded on piles. The piles could be bored, augured or driven and the type will depend upon the geotechnical data available. However given the close location of existing generating plant it is anticipated that the piles will be of a type which could be installed with the minimum of disturbance to existing equipment. This would imply bored or augured piles rather than driven types. Design load tests should be made on test piles for design purposes (design piles). Design piles are normally loaded until the failure of the bearing soil as an aid to the pile design in similar conditions.

3.19.3 Foundations

Foundations should be designed to British Standard Code of Practice BS 8004 or equivalent Bangladesh National Building Code 2006. The design of foundations for all structures and equipment are to be such that differential and total settlements or other movements should not exceed acceptable limits and ensure safe and maintenance free operation of the plant. Detail design parameters for the civil works would be provided by the relevant consultant. The nature of the filling material and the construction techniques used should be such that the less heavily loaded equipment and the buildings may be founded on rafts or spread footings.

3.19.4 Drainage

It is recommended that the storm water and sewage system should be separate and should be designed in accordance with BS EN 752 Parts 1 to 4 "Drain and sewer systems outside buildings". Manhole and chamber covers should be heavy duty throughout.

The capacity of the surface water drainage system should be sufficient to deal with a storm return period of 1 in 5 years. The surface water drainage should include all necessary gutters, down pipes, gullies, traps, catch pits, manholes etc. The quality of the discharge shall be in compliance with the required statutory limits and standards of Bangladesh.

3.19.5 Power Station Buildings

The dimension of all the buildings should be such as to provide adequate space for the safe installation and proper operation and maintenance of the plant and its equipment. In particular required space should be provided immediately in front of, behind and beside all items of the plant. It is recommended that the floors should be constructed in reinforced concrete and designed to accommodate all foreseeable static and dynamic loads. They should be provided with surface finish appropriate for their intended usage and properly drained bounded areas should be provided wherever necessary to contain accidental spillage of oil or other harmful liquids. The design of all buildings must ensure that noise, vibration and temperature levels are within permissible limit.

3.19.6 Sub-station

As the power plant is located adjacent to the PGCB substation, there is no requirement of a separate substation for this project.

3.19.7 Site Fencing

A security fence should be provided around the permanent boundary of the site that should be 3 m high above the site formation level. Gates should be fabricated from galvanized steel and as a minimum provide the same level of security as the perimeter fence. All gates should be provided with suitable locking devices. The project components are presented in the following Table 3.2.

Table 3.2: Project component

Sl. No.	Component
1	Site Preparation
2	Civil construction including approach road
3	Power station erection of machinery and equipment
4	Waste Treatment and drainage
5	Boundary wall
6	Gas pipeline

Chapter-4

ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

4.1 Physical Resources

Physical environmental resources include topography, soil and geological condition etc. It also includes meteorological condition, ambient air and noise quality. Seismicity, hydrology and biological aspects are also some important components under physical resources. In the following sections, this aspect in the Project area is discussed.

4.2 The project site

Administratively, the site is located in the village of Doiara in 22 No. Doiara Ward of Comilla City Corporation under Comilla district. A number of villages are located in close proximity of the proposed power plant and the gas pipeline. The distance and direction of the villages, relative to the proposed power plant are presented in Table 4.1.

Table 4.1: Villages with Mouza in the Vicinity of the proposed project

Power Plant					
District	Upazila	Mouza	Village	Distance (km)	Direction
Comilla	Comilla Sadar South	Doiara	Durgapur	1.0.	North side
			Laxmipur	1.0	South West side
			Kachua	0.60	East side
			Sree Ballabpur	1.20	East side
			Sree Monthapur	1.10	East side
			Uttar Rampur	1.20	South east side
			Hirapur	1.30	South West side
			Mostapur	1.25	South West side
			Gopinathpur	1.0	East side
			Doiara	0.50	South West side
			Boro Durgapur	0.60	South West side
		Ramnagar	Ramnagar	0.50	North East side
			Jangalia	0.50	North side
			Sathkora	1.20	South East side
			Asrabpur	1.10	South East side

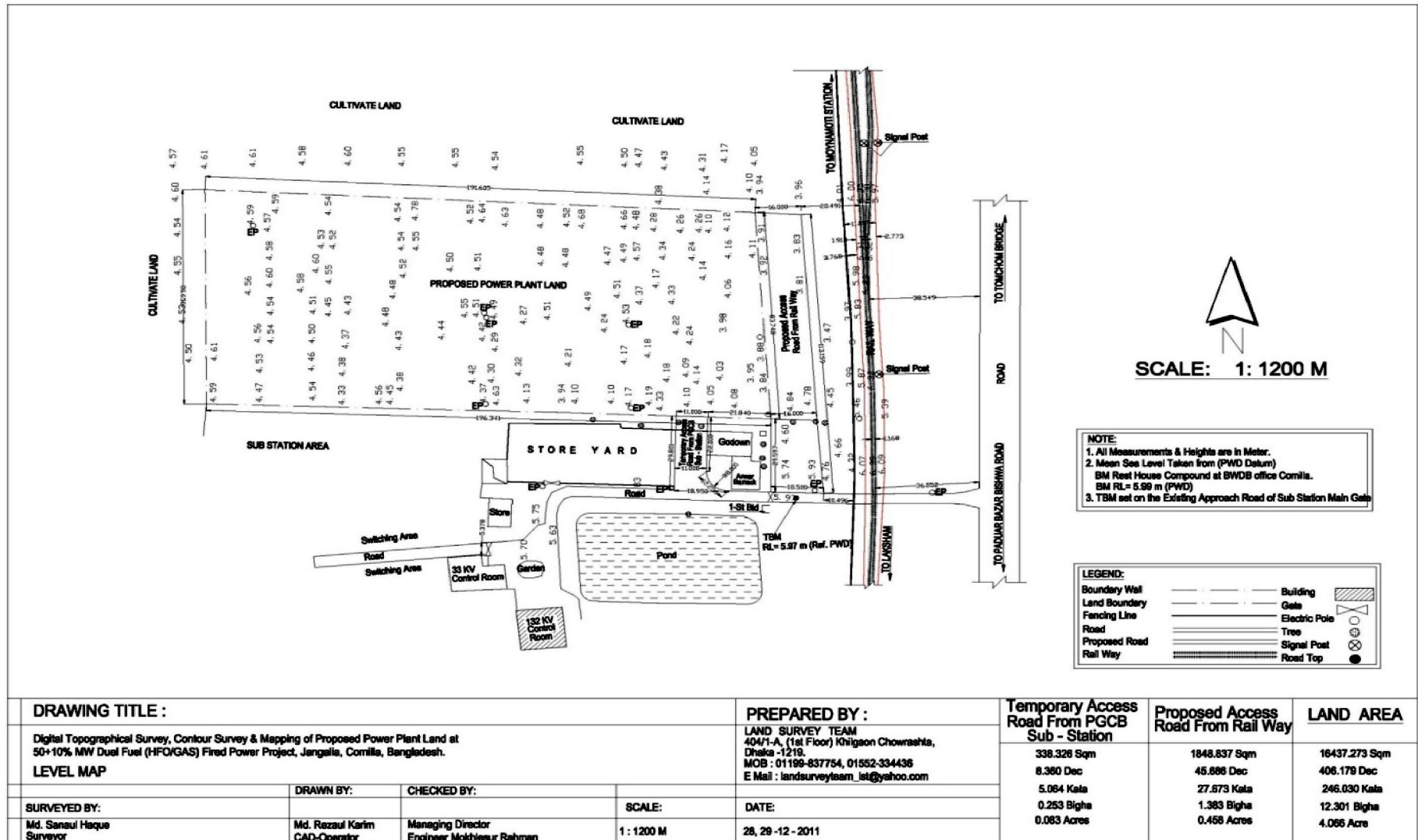
4.3 Topography

Topography is a configuration of a land surface including its relief and contours, the distribution of mountains and valleys, the patterns of rivers, and all other natural features that produce the landscape. Although Bangladesh is a small country, it has considerable topographic diversity.

There are three distinctive natural features in Bangladesh:

- a broad alluvial plain subject to frequent flooding;
- a slightly elevated relatively older plain;
- a small hill region drained by fast flowing rivers.

The land within the 5 km project command area radius is part of the Gumti floodplain with almost no annual deposition of new sediment and is composed of older and more developed soil. The landscape is gently undulating and nearly flat. The physiography of Bangladesh indicating the Project Site is shown in Map 4.1 The main soils consist of grey silty to loamy top soils along with black structured grey-silty to clayey sub-soils. The project command area comprises agricultural land, homestead land, dykes, Concrete road, Semi concrete road, mud roads, the River Gumti, and its principal tributaries, i.e. the Meghna, the Daleshsari, the vicinity of the project site. The topography of the project site is shown in Annex 8.



Map 4.1: Topography and Contour over the Mouza Map of the proposed power plant

4.4 Topography, Soil and Geology

Topography is a configuration of a land surface including its relief and contours, the distribution of mountains and valleys, the patterns of rivers, and all other natural features that produce the landscape. Although Bangladesh is a small country, it has considerable topographic diversity.

There are three distinctive natural features in Bangladesh:

- a broad alluvial plain subject to frequent flooding;
- a slightly elevated relatively older plain;
- a small hill region drained by fast flowing rivers.

Physiographical features are shown in the following figure 4.1 and in the Map 4.2

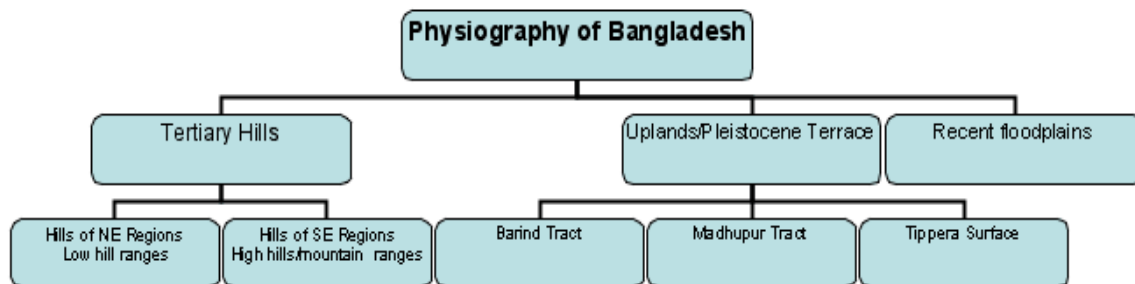
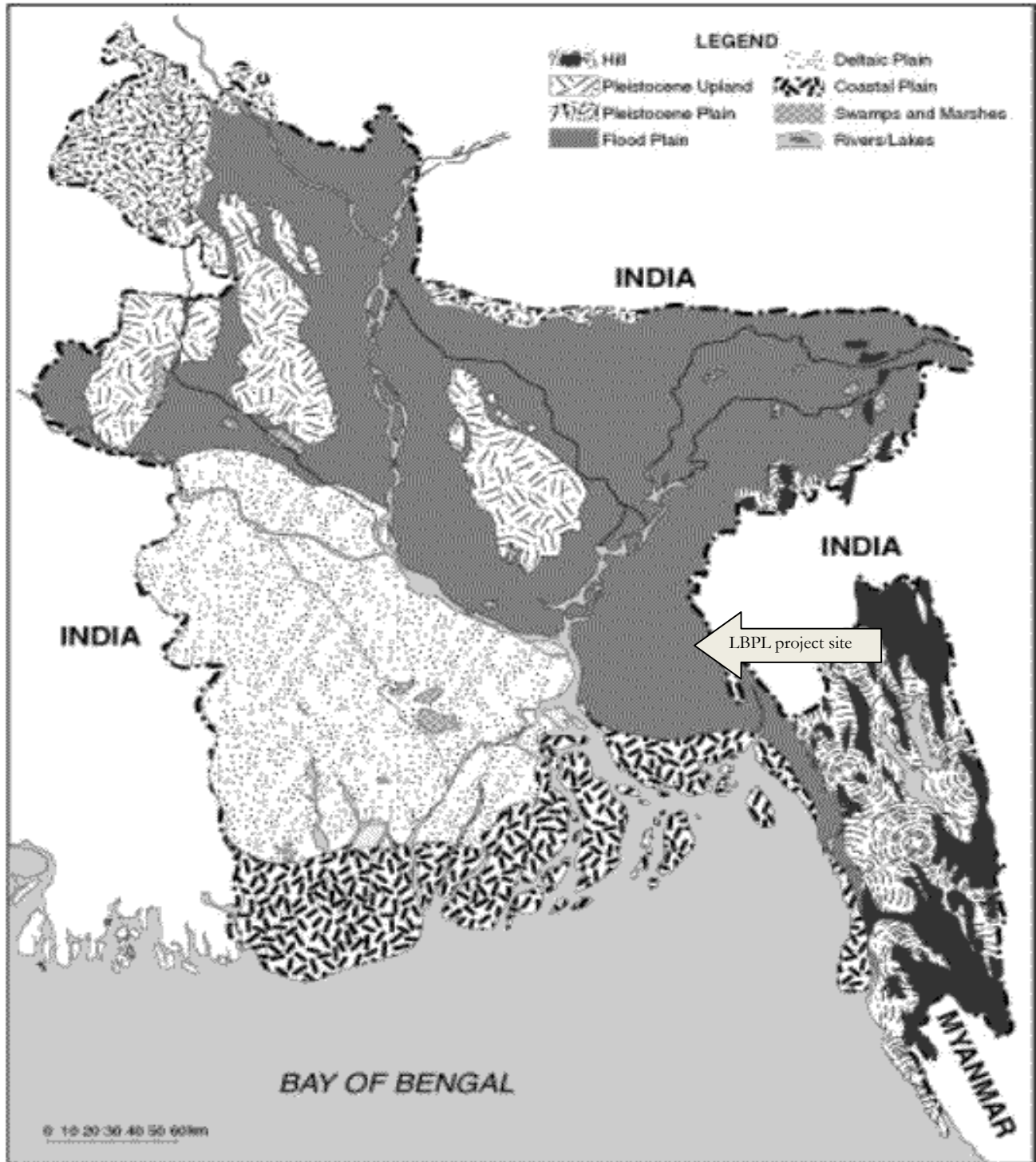


Figure 4.1: Physiographical feature of Bangladesh



Map 4.2: Physiological Map of Bangladesh

Based on the aforesaid classification, the topography of Comilla has been fallen into the AEZ-22 in Northern and Eastern Piedmont Plains Tract under the Pleistocene Terrace.

Most of the area of Bangladesh is a vast, low-lying alluvial plain, sloping gently to the south and southeast. According to Bangladesh Agricultural Research Council's Agro-Ecological Zoning Map of Bangladesh, the proposed project area falls in the Old Brahmaputra-Meghna Floodplain. This region comprises of the area of Brahmaputra sediments. It has a complex relief of broad and narrow ridges, inter-ridge depressions, partially in filled cut-off channels and basins.

This area is occupied by permeable silt loam to silty clay loam soils on the ridges and impermeable clays in the basins which are neutral to slightly acidic in reaction. General soil types include predominantly Grey Floodplain soils. Organic matter content is low in ridges and moderate in basins.

Proposed project site belongs to the Lower Meghna River Floodplain area of the National Classification. General soil characteristics of this unit are silt loams on ridges; silty clay loams in depressions. There are minor areas of Calcareous Alluvium and both Calcareous and Non-calcareous Grey Floodplain Soils. The physiographic map of Bangladesh is shown in Map 4.2.

4.5 Meteorology

Comilla is the sub-tropical monsoon climate type of Bangladesh. The dominant seasons are the monsoon or wet season (from mid June to mid October); the winter or cold season (from October to the end of February); and the summer or hot season (from March to the end of May, when temperature can go about to 40°C. The south-west monsoon lasts approximately from June to September and producing the main rainy season. More than 90% of the annual rainfall occurs during this period. The nearest Meteorological Station is Chandpur, therefore the climatic data of Chandpur have been considered for this region. The following sections show the monthly and annual figures of the climatic data collected by the Meteorological Station of Chandpur in the year of 2007-2012.

Temperature

By analyzing the data of temperature in the year of 2008 to 2012 collected from Bangladesh Meteorological Department (BMD), it is found that the monthly maximum temperature was 39.8°C in April, 2010 and the minimum temperature was 7.3°C in January, 2012 as is presented in Table 4.2.

Table 4.2: Annual maximum and minimum temperature in the Project area

Year	Maximum Temperature		Minimum Temperature	
	Month	Temperature (°C)	Month	Temperature (°C)
2008	May	38.5	Jan	9.8
2009	April	37.9	Jan	10.7
2010	April	39.8	Jan	11.9
2011	April	38.0	Jan	9.7
2012	Sep	36.2	Jan	7.3

Source: BMD

Rainfall

The rainfall follows the general climate pattern with the highest rainfall in the summer with aduration of June to September and minimum rainfall during November to March. Table 4.4 presents average monthly rainfall for the period of 2008-2012. According to the Table 4.3, the highest (753 mm) rainfall was observed in July, 2008.

Table 4.3: Monthly average rainfall in the project area

Year	Rainfall in mm											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2008	0	30	11	163	185	668	753	505	179	320	111	0
2009	23	56	45	91	205	577	563	319	279	227	0	0
2010	1	1	43	14	168	170	676	482	298	74	4	0
2011	0	48	22	37	177	308	167	340	169	174	0	81
2012	0	0	20	123	235	314	356	409	207	112	0	0

Source: BMD

Relative Humidity

The average annual humidity is about 70%. The trend of humidity is toward declining. Based on the data of 2008-2012, the lowest monthly mean humidity was recorded in March, 2010 (about 53%) and the highest humidity was recorded in July, 2008 (about 84%). The following **Table 4.4** depicts the monthly and annual average humidity data with a time period of 2008-2012.

Table 4.4: Average monthly relative humidity of the Project area

Year	Monthly mean humidity (humidity in %)												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2008	68	68	54	69	70	81	84	80	80	78	77	78	73
2009	69	61	67	64	70	80	83	81	81	77	69	79	73
2010	72	55	53	66	72	74	80	82	81	73	66	69	70
2011	71	56	59	67	71	79	77	78	79	74	68	66	70
2012	69	54	57	64	76	80	79	82	77	73	67	73	70

Source: BMD

Wind Speed

Monthly prevailing wind speed and direction in Knots of Dhaka for the period of 2008-2012 are presented in **Table 4.5**. According to the given data, the maximum wind speed was 5.6 knot/hour in 2008 but the minimum wind speed was 2.0 knot/hour in 2012.

Table 4.5: Average monthly relative humidity of the Project area

Year	Maximum wind speed (knot/hour)			Minimum wind speed (knot/hour)		
	Month	Wind speed	Direction	Month	Wind speed	Direction
2008	Nov	5.5	N-E	Jan	2.9	N-W
2009	Oct	5.6	N-E	August	2.8	N-E
2010	July	4.3	S-E	Oct	2.3	E
2011	April	4.1	S	Oct	2.1	N-E
2012	March	3.8	S	Oct	2.0	N-W

Source: BMD

4.6 Ambient Air Quality

Air quality at the project site is typical of a rural environment. Ambient pollutant concentrations are relatively low to practically non-existent. Suspended particulate matter (SPM) increases intermittently in areas where winds pick up dust over unpaved roads and exposed surfaces. The primary sources of emissions, however, are traffic-derived emissions from the Dhaka-Chittagong National Highway and the district road from Comilla-Laksam running in a north- South direction approximately 1.5 km to the East-west of the project site at its nearest point.

A survey of the ambient air quality was undertaken in the vicinity of the project site in October 2013 to determine pollutant concentrations after the monsoon. The survey undertaken in October used five sampling locations situated to the north, south, east, west and Central point of the project site.

For the air quality measurements use was made of a high volume sampler for the particulate matters and continuous separate Sox, NOx and CO monitors. For particulate matters special filters were used. The filter papers were accurately weighed and placed in the air intake duct. The filter paper was taken out after every eight hours and weighed again from the difference in initial weight and the final weight was recorded and the calculations of the concentrations were done from the total volume air intake during that period. The air sampling equipment and instruments are shown in the photos:



Photo-4.1: Respirable Dust Sampler for SPM, PM₁₀, SO₂, NOx measurement



Photo-4.2: Carbon Monoxide meter

The air quality data as collected from the proposed plant site is given in **Table 4.6**. It shows the ambient air quality in terms of 6 major indicators SPM, PM 10, PM 2.5, NO_x, SO_x and CO.

Table 4.6: Ambient air quality analysis (Data provided is average of data collection over 7 days)

SN	Location	Ambient Air Pollutants Concentration in $\mu\text{g}/\text{m}^3$					
		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	CO $\mu\text{g}/\text{m}^3$
01	Concentration at South side near the project boundary area.(900m) 91°10'13.09"E 23°25'45.35"N	85.28	55.06	39.41	1.79	31.34	15.0
02	Concentration at Central point of site 91°10'4.19"E 23°25'49.99"N	83.77	41.02	37.21	1.60	17.01	NF
03	Concentration at West side near the project boundary area.(150m) 91°10'9.51"E	145.82	66.23	35.50	1.92	18.90	32.0

SN	Location	Ambient Air Pollutants Concentration in $\mu\text{g}/\text{m}^3$					
		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	CO $\mu\text{g}/\text{m}^3$
	23°25'55.15"N						
04	Concentration at North side near the project boundary area.(1000m) 91°10'19.47"E 23°25'48.64"N	114.87	63.48	41.35	1.49	9.03	37.0
05	Concentration at East side near the project boundary area.(110m) 91°10'10.47"E 23°25'43.32"N	80.44	43.69	38.50	2.39	31.36	20.4
IFC air quality standard on $\mu\text{g}/\text{m}^3$ (Annual)			75		200	125	
Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Geake	Jacob & Hochheiser	CO Meter Indicator tube
Instruments Used for data collection		Respirable Dust Sampler Envirotech APM 460 NL	Respirable Dust Sampler Envirotech APM 460 NL	Respirable Dust Sampler Envirotech APM 460 NL	Gaseous Sampling Attachment Envirotech APM 411 TE with Respirable Dust Sampler Envirotech APM 460 NL	Gaseous Sampling Attachment Envirotech APM 411 TE with Respirable Dust Sampler Envirotech APM 460 NL	Digital Instrument AE. 14343 Taiwan

Source: ECL Lab (measured on 05.09. 2013 by Respirable Dust Sampler of ECL)

4.7 Wind roses for 52.2 MW Power Plant at Jangalia, Comilla

A **wind rose** gives a very succinct but information-laden view of how wind speed and direction are typically distributed at a particular location. Presented in a circular format, the wind rose shows the frequency of winds blowing from particular directions. The length of each "spoke" around the circle is related to the frequency of time that the wind blows from a particular direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. The wind roses shown here contain additional information, in that each spoke is broken down into discrete frequency categories that show the percentage of time that winds blow from a particular direction **and** at certain speed ranges. All wind roses shown here use 16 cardinal directions, such as north (N), NNE, NE, etc.

The wind roses for four different months are shown in the Figures 4.2to Figure 4.5 for the months January, April, July and October.

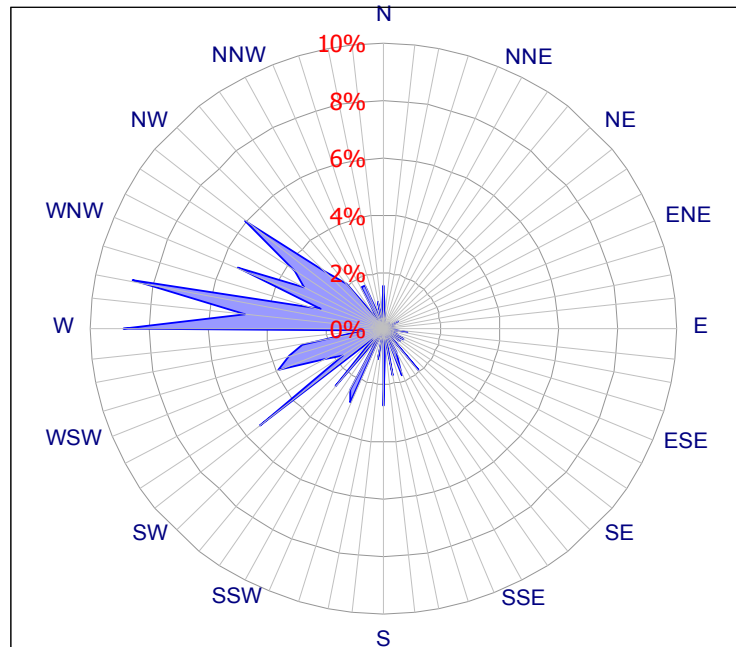


Figure 4.2

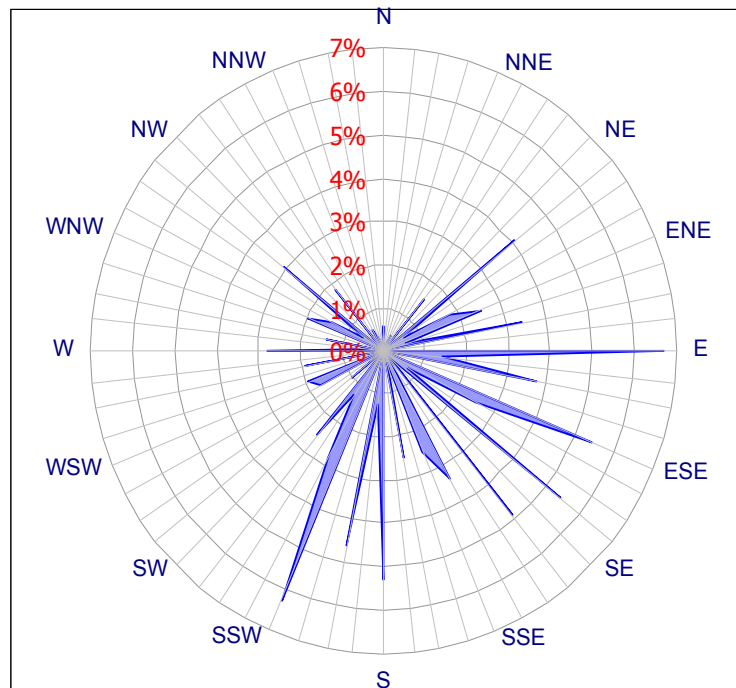


Figure 4.3

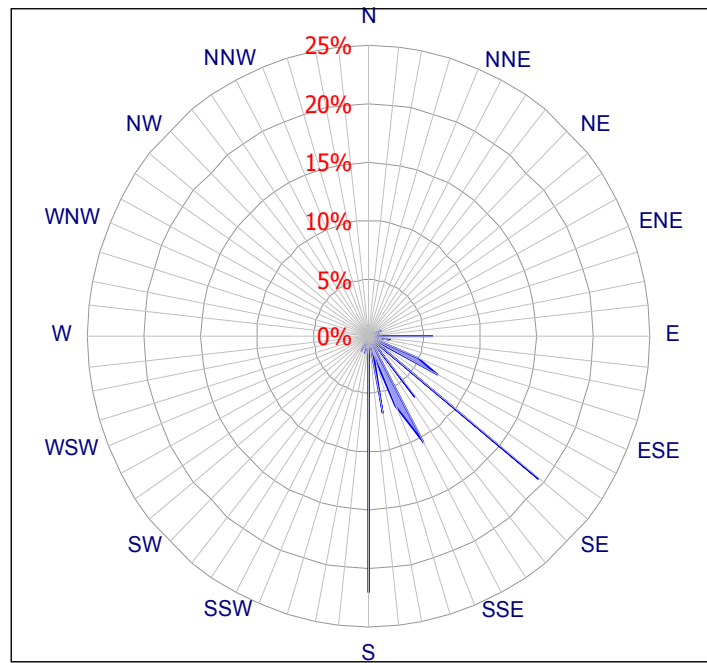


Figure 4.4

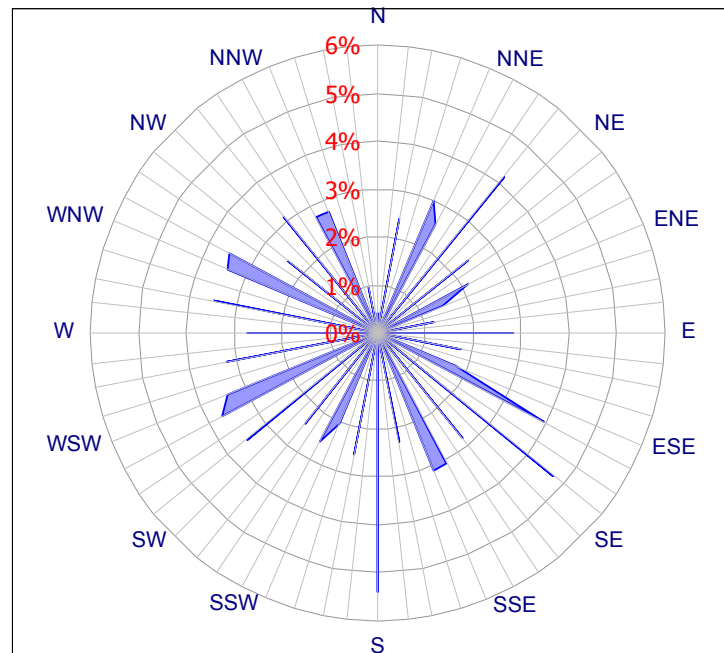
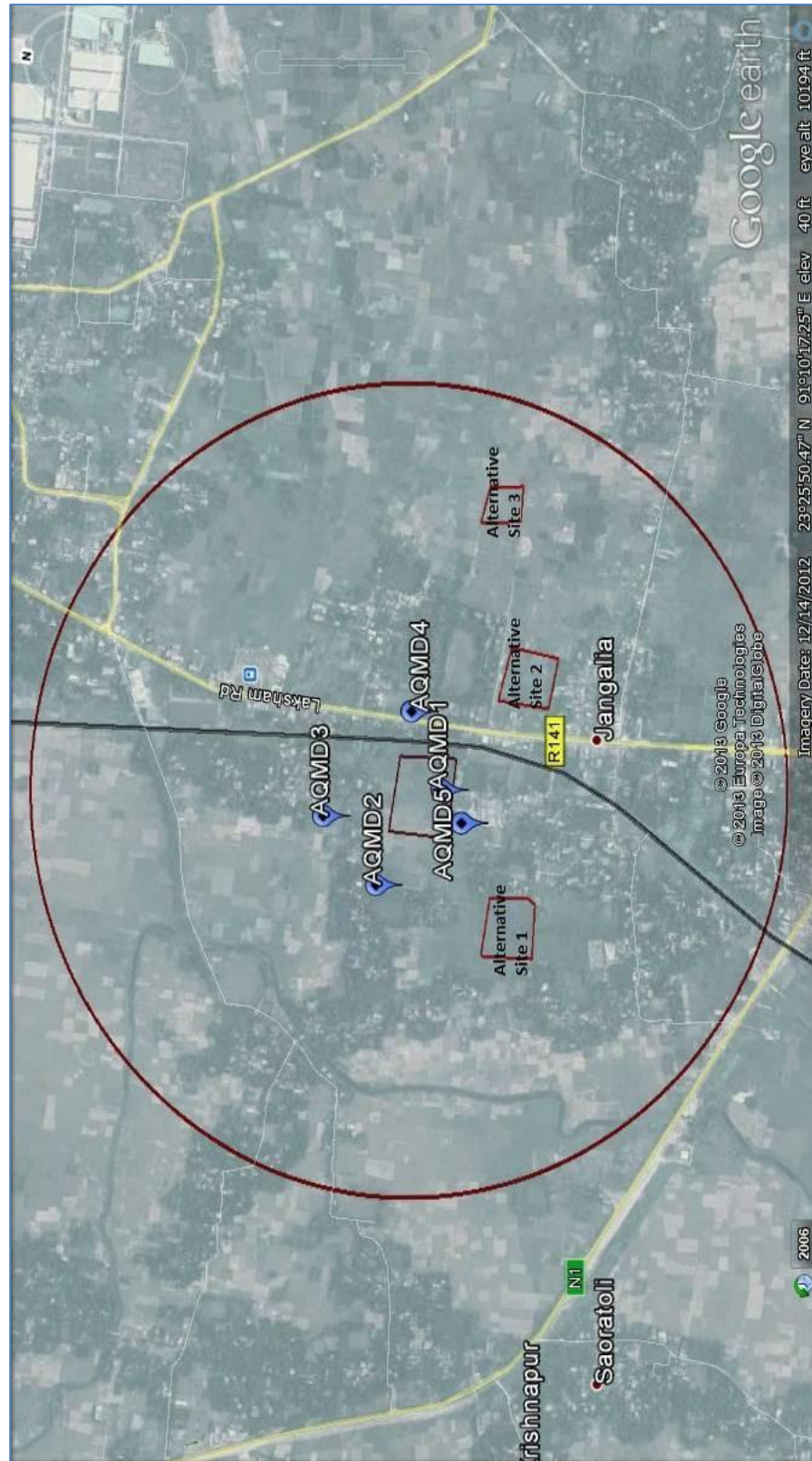


Figure 4.5

The following map 4.3 shows the location of alternative sites and the locations of background air quality monitoring.



Map 4.3: Site selection for background pollution level data collection

4.7.1 Site selection for background pollution level data collection

Four (4) wind roses, 1 each for the month of January, April, July and October 2012 are given in Figures 4.1-4.4 respectively. In the month of January, wind blows mostly from the West and North-West direction. In the month of April, wind mostly comes from the East and South, South west. In July, wind mostly goes from the direction between the East and the South and in October, wind blows practically from all directions.

The Wind rose digram Figure 4.4 for the month of October, when the baseline data for the air quality was carried out it was found that frequencies of wind blowing from all directions were uniform and therefore the collection of air quality data collection were done in all four directions at varying distances from the centre of the plant site and one within the boundary of the plant site.

Table 4.7: The suggested directions of measurement points with distance

SN	Sample collection point	Distance in meters
1	Plant site (boundary point)	105
2	North side of the power plant	223
3	South side of the power plant	208
4	East side of the power plant	207
5	West side of the power plant	175

4.8 Ambient Noise Quality

The Project site is found to have ambient noise level with a range of 39-84 dBA at different time of the day. There was 24 hours noise monitoring at 5 locations in the project site, which has been provided as Annex 8. Based on this data, 24 hours ambient noise data have been presented in the following Figure 4.6 and 4.7

The ambient noise data seems to be high. But actually the ambient noise level is about 30-50 dBA. Because the Project area is a rural type of area having no significant noise source within 500m radius.

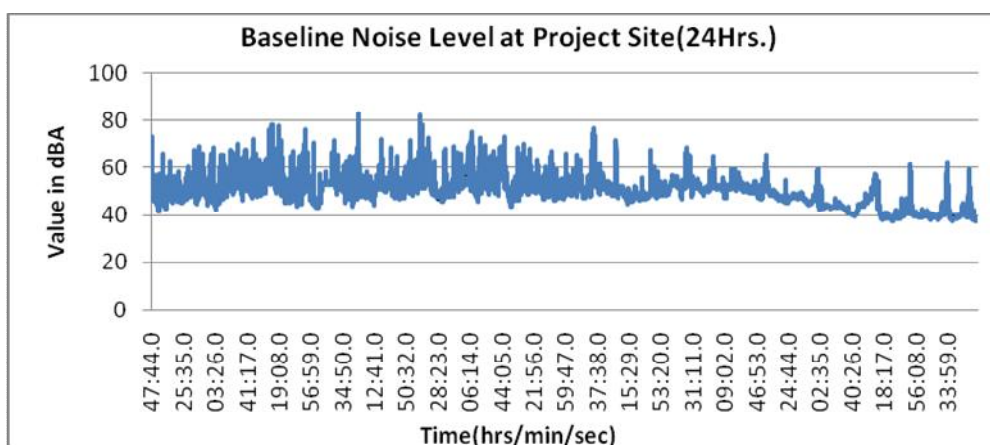
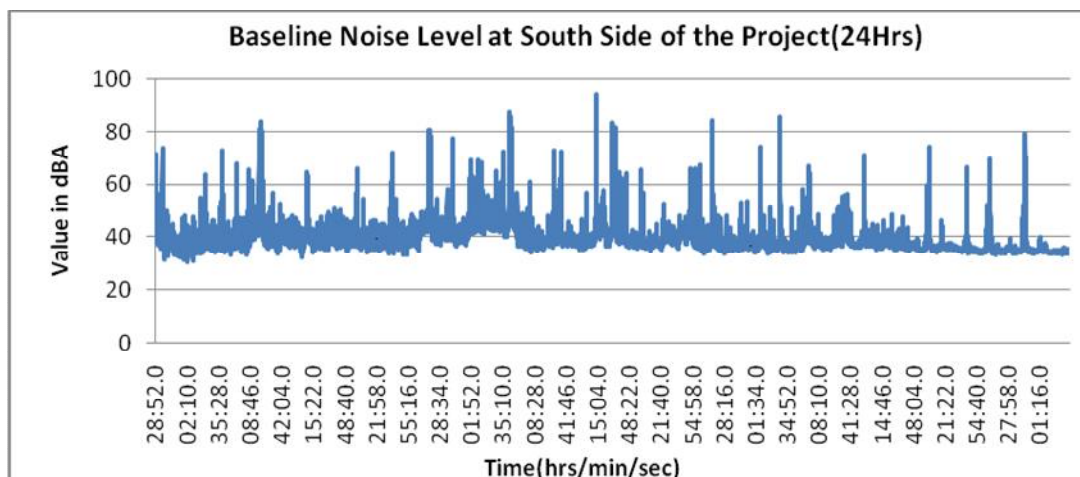


Figure 4.6: Baseline Noise Level Data at Project Site (Day and Night)



The above figures show that noise level data varies place to place along with the time and distance. The noise level data was measured at 5 locations ([Annex 8](#)) during mid- October 28th and 29th of October 2013. The baseline noise level of the plant site in Fig.4.6 has been measured as Minimum level 37.5, Maximum level 56.7 and the average is 46.75 dBA. The periodic peaks in sound level recorded is due to trains passing through the sampling area. The frequency of traffic sound of the plant location in near the highway and the railway tracks. Table 4.8 shows 8 hourly averages from the continuous recording noise data

Table 4.8: Average 8 hourly sound from 6 A.M October 29th 2013 to 6 A.M 30th October 2013.

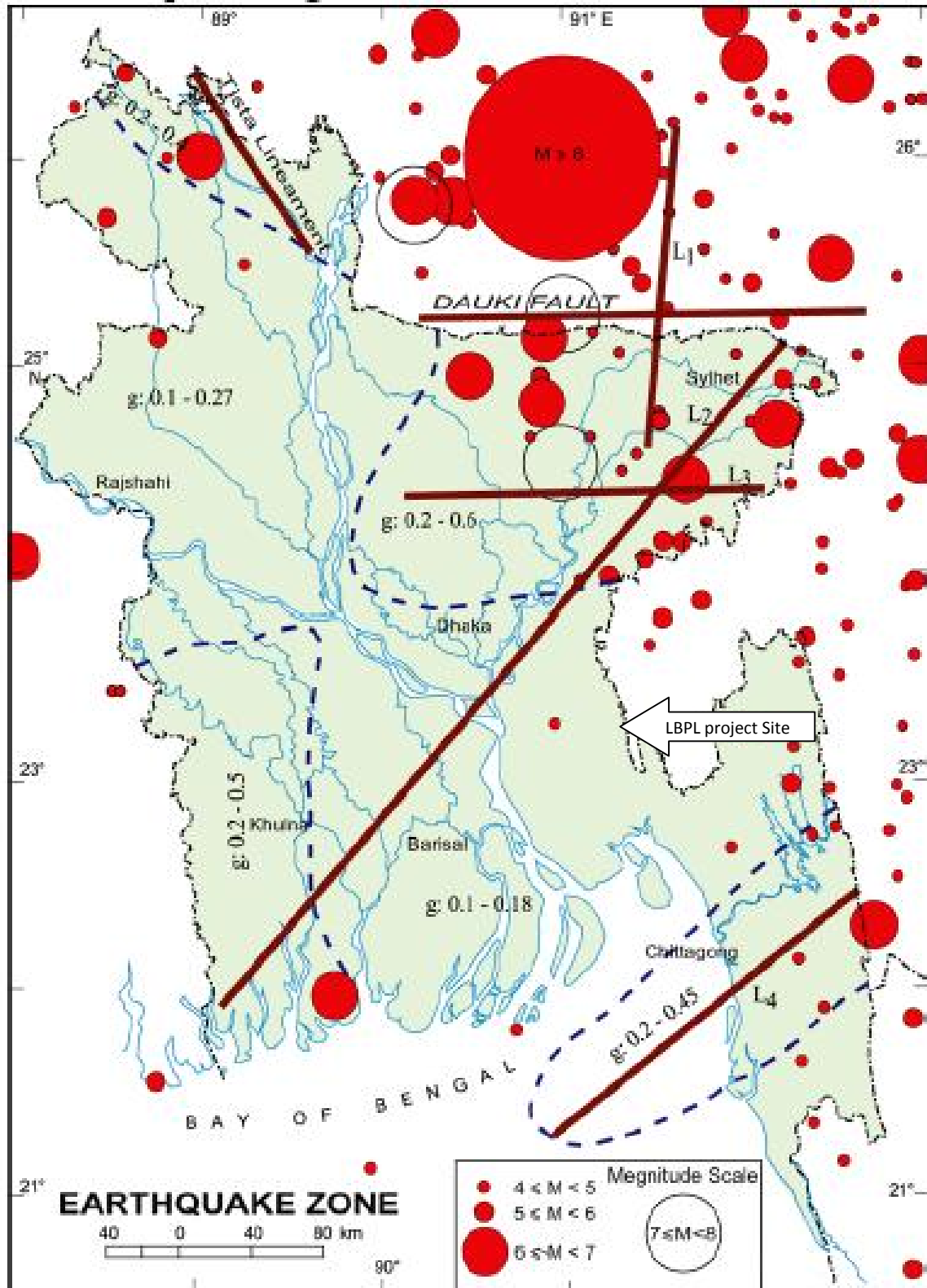
1 st	2 nd	3 rd
8 hours (average dBA) 6A.M to 2P.M.	8 hours(average dBA) 2P.M. to 10P.M.	8hours(average dBA) 10P.M.to 6A.M.
37.23	42.34	38.746

4.8.1 Geology and Seismicity

Bangladesh has been classified into three seismic zones as is shown in **Figure 4.4**, where Zone-I the most severe and Zone-III the least impact. The project area falls in Zone-II, which means that there is considerable risk regarding earthquake. Lalmai, Barind, Madhupur Tracts, Dhaka, Comilla, Noakhali and eastern part of Chittagong Folded Belt. This area is less prone to earthquake compare to northern part of Bangladesh. The seismic zones of Bangladesh has been provided in **Table 4.9** and Map 4.4.

Table 4.9: Seismic Zoning of Bangladesh

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



Map 4.4: Seismic Zone of Bangladesh

4.8.2 Hydrology

There are two broad components of hydrology-surface water and ground water. In the following sections the quality of surface and ground water is discussed in consideration of some specific parameters.

Surface Water Features in the Vicinity of the Site

Surface water samples were obtained from a canal adjacent to the site and the other sample was collected from a River. The test result of these two samples is presented in the following **Table 4.10**.

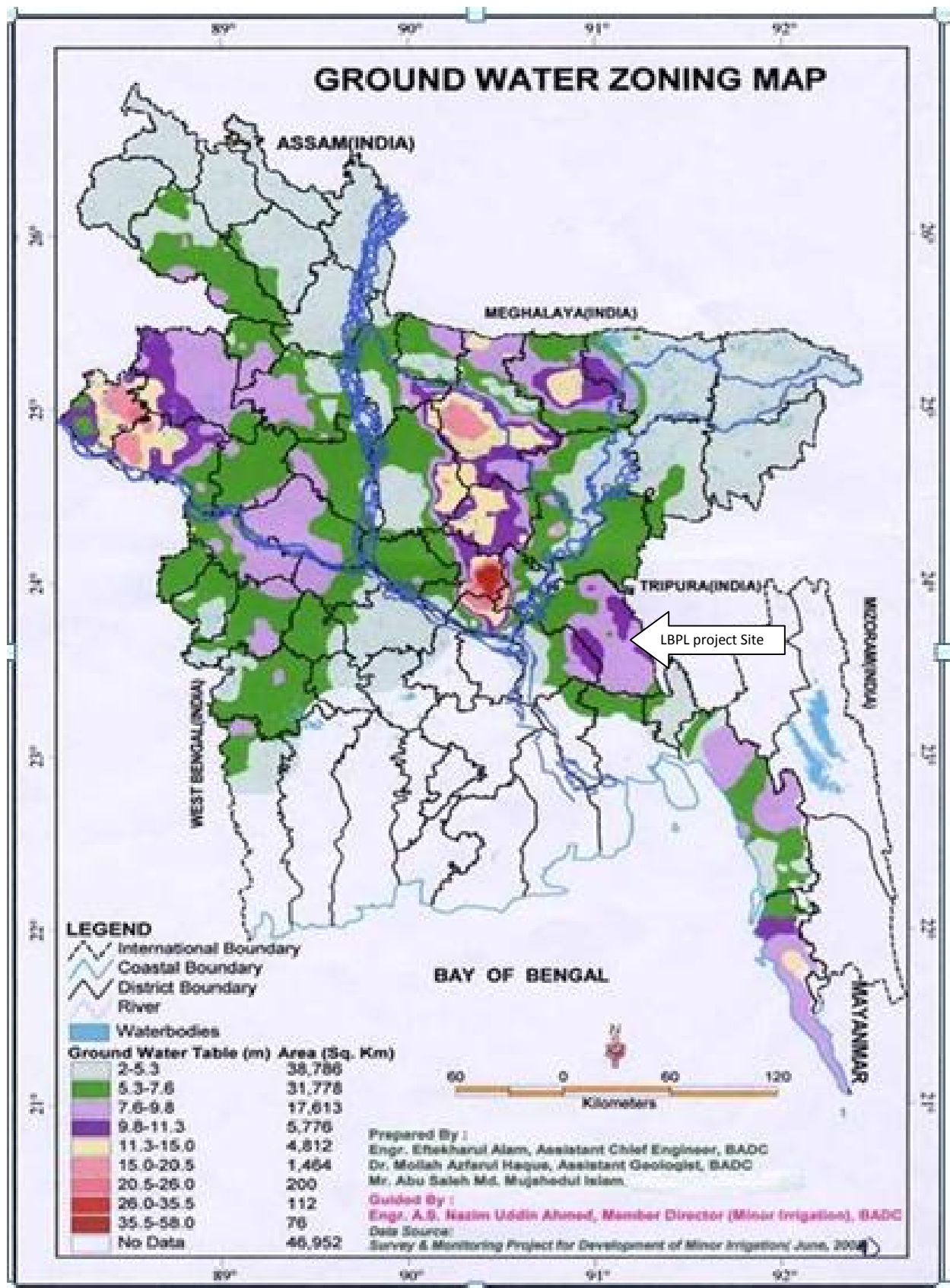
Table 4.10: Comparison of Surface water quality (limited parameters) of the nearby canal and the water of river

Parameter	Units	Water collected from a nearby canal	Water of the River	Bangladesh Standard for Inland Surface Water
pH at 24.5°C	mg/L	7.8	6.9	6.0 - 9.0
TDS	mg/L	170.0	180.0	2100
Suspended Solid	mg/L	67.0	58.0	150
DO	mg/L	6.4	5.9	4.5 – 8.0
BOD at 20°C	mg/L	2.0	2.4	50
Arsenic	mg/L	< 0.01	< 0.005	0.05
COD	mg/L	8.0	12.0	200
Manganese	mg/L	< 0.05	0.098	5
Phosphate	mg/L	0.52	1.39	-
Phosphorus	mg/L	0.55	0.45	1
Conductivity	µS/cm	160	64.3	-

Source: ECL Lab (water collected on 15.10. 2013 and tested on 22.10.2013)

Ground Water Features in the Vicinity of the Site

Ground water level exists at a moderate (generally below 8.0 m) depth, which is being recharged mainly by infiltration of rainwater. According to Bangladesh Water Development Board the ground water level of Comilla is about 6.5 m from mean sea level (MSL). The ground water zoning map is shown in Map 4.5.



Map 4.5: Ground Water Zoning Map of Bangladesh

As with other parts of the country, there is a good availability of groundwater that is being used by hand pumps for drinking and domestic purposes. To determine quality of ground water, water sample was collected from the tube well of the existing plant of the company and analyzed for different parameters. The results shows that all the parameters remain within the allowable limit of drinking water value as per as Environmental Quality Standards for Bangladesh. The parameters which have been analyzed during this study are presented below in **Table 4.11**.

Table 4.11: Ground water quality (limited parameters) around the Project vicinity

Parameter	Units	Value	Bangladesh Standard For Inland Surface Water
pH at 26.9°C	mg/L	7.1	6.0 - 9.0
TDS	mg/L	90.0	1000
Iron	mg/L	0.8	(0.3 – 1.0)
Alkalinity	mg/L	78.0	-
Hardness	mg/L	68.0	(200 – 500)
Chloride	mg/L	16.4	(150 – 600)
TSS	mg/L	4.8	10
COD	mg/L	11.7	NS
BOD	mg/L	5.5	NS
Arsenic	mg/L	0.050	0.05
Conductivity	μS/cm	696	NS

Source: ECL Lab (water collected on 15.10. 2013 and tested on 23.10.2013)

4.9 Biological Environmental: Vegetation and Floral Diversity

Human intervention and extension of the settlement areas have a compounding effect resulting in a rapid depletion of the natural resources in the project area. The following macro ecosystem types are found in the area: cultivated land, roadside vegetation, exotic wood plantation, local species, homestead vegetation and wetland areas.

Aquatic Flora

While most of the aquatic plant species of the Project area is subject to seasonal water level fluctuations, the abundance of wetlands supports a wide variety of aquatic biota. The common aquatic plants are listed in **Table 4.12**.

Table 4.12: Aquatic flora in the project area

Sl. No.	Local Name	Scientific Name
1.	Helencha	Enhydro fluctuans
2.	Kalmi	Ipomoea aquatica
3.	Dhol Kalmi	Ipomoea fistulosa
4.	Kochuripana	Eichorina crassipes
5.	Shapla	Nymphaea nouchali
6.	Duckweed	Spiredella sp.
7.	Khudi pana	Lemna minor
8.	Topa pana	Pistia stratiotes
9.	Hogla	Typha angustata

Aquatic Fauna

Fish is the most important aquatic fauna of the Project area, along with other groups. The aquatic fauna includes Prawns (*Macrobrachium* spp.) crabs, snails etc. invertebrates and a number of species of fish are listed in the Table 4.13 in bellow:

Table 4.13: Showing the Aquatic Fauna and Aquatic Birds

Sl. No.	Local Name	Scientific Name
1.	Kolabang	<i>Rana tigrina</i>
2.	Guishap	<i>Varanus bengalensis</i>
3.	Matia sap	<i>Enhydryis enhydryis</i>
Aquatic birds		
1.	Pancowri	<i>Phalacrocorax carto</i>
2.	Kanibok	<i>Ardeola grayii</i>
3.	Sadabok	<i>Egretta garzetta</i>
4.	Borobok	<i>Egretta alba</i>
5.	Machranga	<i>Halcyon pileata</i>
6.	Dahuk	<i>Gallicrex cinerea</i>
7.	Kadakhosa	<i>Gallinagro stenura</i>
8.	Balimash	<i>Dendrocygna javanica</i>
9.	Chakha	<i>Tadorna ferruginea</i>

Terrestrial Flora

In addition to the aquatic macrophytes mentioned earlier, there are few natural types of vegetation listed in Table 4.14 below:

Table 4.14: Showing the Terrestrial Flora

Sl. No.	Local Name	Scientific Name
1.	Dubla gash	<i>Cynodon dactylon</i>
2.	Hargoza	<i>Acanthus illicifolius</i>
3.	Telakachu	<i>Coccinea cordifolia</i>
4.	Bet	<i>Calamus sp</i>
5.	Akanda	<i>Calotropis procera</i>
6.	Nishinda	<i>Vitex negundo</i>
7.	Tulshi	<i>Ocimum canum</i>
8.	Venna	<i>Ricinus communes</i>
9.	Babla	<i>Acacia nilotica</i>
10.	Dumur	<i>Ficus sp</i>
11.	Gab	<i>Diospyros peregrina</i>

Terrestrial Fauna

Wild mammals are relatively scarce in the Project area. The available amphibians are listed in Table 4.15 below:

Table 4.15: Showing the Terrestrial Fauna

Sl. No.	Local Name	Scientific Name
1.	Toad	Bufo melanostictus
2.	bull frog	Rang tigrina
Common reptiles		
1	Wall lizard	Hemidactylus flaviviridis
2	Roofed turtle	Kachuga tecta
3	Spotted tortoise	Lissemys punctata
4	Gharia	Gavialis gangeticus
5	Water snake	Enhydris enhydris
6	Dora sap	Xenochrophis piscator
7	Darajgap	Ptyas mucosus
Aquatic birds/ common arboreal/ terrestrial birds		
1	Back kite	Milvus migrants
2	Black Wing kite	Elanus caeruleus
3	Kestrel	Falco tinnunculus
4	Ring dove	Streptopelia decaocto
5	Magpie robin	Copsychus saularis
6	Red-vented bulbul	Pycnonotus jocosus
7	House crow	Corvus splendens
8	House sparrow	Passer domestica

Refer to IUCN red list

Forests

Only homestead forests and social forest by plantation on embankment and roadsides are visible in the project area. There are no major forests within 7kms of the project site. The available forests are listed in the following Table 4.16, besides these, some pictorial views on Flora, Fauna and wild life and available animals of the plant site are presented in this section below:

Table 4.16: Available forest in the project area

Sl. No.	Local Name	Scientific Name
1.	Akashmoni	Acacia moniliformis
2.	Mahogany	Suritenia mahogany
3.	Shishu	Dalbergia shishu
4.	Babla	Acacia nilotica
5.	White koro	Albizia procera
6	Betel nut	Areca catechu
7	Nim	Azadirachta indica
8	Tal palm	Borassus flabellifo



Photo 4.3: Water Hyacinth and Tal palm trees near the proposed project site



Photo 4.4: Terrestrial flora (**tree**) close to the project site



Photo 4.5: Terrestrial flora (**herb**) close to the project site



Photo 4.6: Terrestrial fauna close to the project site



Photo 4.7: Ducks and poultry are rearing in the household

4.9.1 Socio-economic Environment: Baseline Condition of Infrastructure

To assess the baseline socio-economic condition in the project area relevant stakeholders including respective officials of Comilla City Corporation, Local Government and public representatives, and key informants were met. As a source of secondary data, Bangladesh Bureau of Statistics (BBS), Banglapedia, concerned books and periodicals were also consulted. The socio economic information has been taken within the area of one Kilometer radius from the project site.

4.9.2 Administrative Areas

Comilla is bordered by Brahmanbaria and Narayanganj districts to the north, Noakhali and Feni districts to the south, Tripura of India to the east, and Munshiganj and Chandpur districts to the west.

Area: 3085.17 Square Km.

23°1"to 24°-11" North Latitude and 90°-34" to 91°-22" East Longitude. Tropic of Cancer has crossed Comilla Major rivers passing through Comilla include Meghna, Gomoti, Kakri, and Little Feni.



4.9.3 Demographic Characteristics, utilities and occupational status

Comilla (Town) stands on the bank of the Gumti River. It consists of 18 Wards and 46 Mahallas. It has an area of 11.47 Sq Km and a population of 168378; Male 52.56%, Female 47.44%. Literacy rate among the town people is 60.3%.

Major Landuse and main occupations:

The major different occupations in Comilla district population are Agriculture 43.28%, Commerce 11.6%, Service 10.78%, Transport 3.36%, Agricultural Labourer 15.89%, Wage Labourer 2.46%, Construction 1.03%, and Others 11.6%. (Source: Community Series BBS)

4.9.4 Transportation and road network:

Comilla is the transit point between Dhaka-Chittagong Routes. Comilla is known as the hub of Road Communication of Eastern part of Bangladesh and has good communication network. One of the oldest highways of the Indian Sub-Continent, 'The Grand Trunk Road' has approached through the City. Comilla can be travelled by Railway. The trains have to travel 197 Kilometers and takes over 3 hours to reach Comilla from Dhaka. On the other hand it is about 100 Kilometers from Dhaka by road and takes about two hours to reach Comilla.



Photo 4.8: Road transport in the vicinity of the site



Photo 4.9: Intercity train crossing the project site

4.9.5 Road Transport

A road traffic survey was undertaken between 6 .0 am and 6.0 pm on October 28, 2013, and the results are present in Table 4.17. The survey was undertaken during day and night time. Huge amount of Auto Rickshaws and CNG automobiles passing through the project area. This road always remains busy with different types of vehicles. The survey found about 5772 vehicle running in day time and 2026 vehicle running in night time. Detailed in the following table:

Table 4.17: Comilla-Laksam Road Traffic Survey (Study period 28 October 2013) at plant site

Road Vehicle Type	7-8 am	8-9 am	9-10 am	10-11 am	11-12 am	12-1 pm	1-2 pm	2-3 pm	3-4 pm	4-5 pm	5-6 pm	6-7 pm	Total
Direction of Travel: Up/Down													
Bus	25	58	50	37	39	66	82	80	68	68	60	72	705
CNG automobiles	30	186	189	162	214	192	125	105	279	200	109	124	1915
Battery driven auto rickshaw	2	1	5	7	3	-	4	2	2	1	2	2	31
Truck	15	13	14	23	19	32	16	17	12	11	11	3	186
Pickup van	8	20	11	40	21	22	34	16	41	26	30	28	297
Container	1	1	1	1	1	-	1	2	1	-	-	-	9
Private car / Micro	6	48	42	89	80	70	63	46	43	106	57	59	709
Cover van	16	13	33	43	24	15	20	15	15	8	10	35	247
Motor cycle	7	24	49	84	88	58	121	52	55	53	30	20	641
Tempo	6	32	18	30	30	21	18	17	6	10	0	9	207
Others(Auto car)	22	121	87	84	10	75	100	76	113	90	30	17	825
Daily Total :													5772
<i>BCAS Road Traffic Survey, October 2013</i>													

Table 4.18: 6pm- 6am Traffic Survey at Plant Site (During Night Time)

Road Vehicle Type	6 - 7 pm	7- 8 pm	8 - 9 pm	9 - 10 pm	10-11 pm	11-12 pm	12 - 1 am	1-2 am	2 - 3 am	3 - 4 am	4 - 5 am	5 - 6 am	6.7 am	Total
Direction of Travel: Up/Down														
Bus	56	57	60	50	35	30	19	12	10	10	8	21	18	386
CNG automobiles	168	125	121	98	72	42	37	6	12	11	14	17	19	742
Battery driven auto rickshaw	1	2	3	5	6	3	5	3	2	4	5	6	7	52
Truck	8	5	6	1	2	4	7	6	11	7	3	4	3	67
Pickup van	21	20	11	15	11	13	9	4	3	5	7	7	8	134
Container	-	2	-	-	2	1	3	-	2	-	1	1	-	12
Private car / Micro	41	38	29	19	12	7	2	1	2	3	2	6	5	167
Cover van	17	14	16	9	2	5	6	2	1	-	1	1	5	79
Motor cycle	35	30	21	27	19	10	6	3	3	1	1	2	10	168
Tempo	30	12	19	20	12	6	2	1	2	4	3	2	4	117
Others(Auto car)	3	15	19	20	12	6	2	2	3	5	4	5	6	102
Daily Total :														2026
BCAS Road Traffic Survey, October 2013														

The main purpose of the survey was to assess the times when the heavy equipment should be carried during the construction period of the project. The time suggested for this is between 9P.M to 6 A.M. every day.

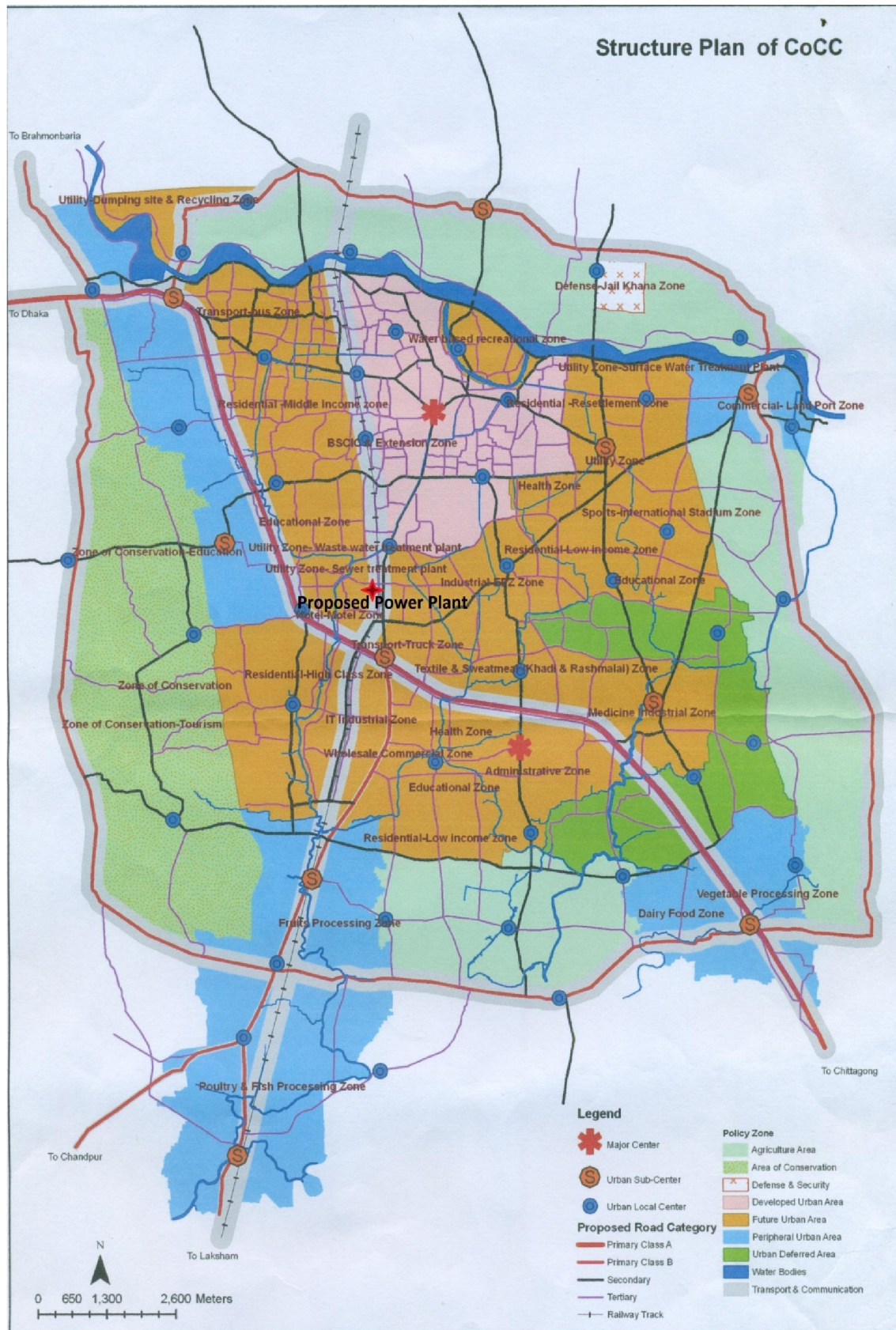
9.6 Land use: Coverage of Survey Area

A survey was carried out in the plant site and its surroundings on all sides of 1 km area including the access road area in high impact zone, 5km in air shed area. There considered the rivers, brick roads, mud roads, shops, religious institutes, educational institutions, agricultural lands, the proposed power plant, access road and other environmentally

significant features occupying space on the ground. Detail land use type is given in Table 4.19.

Table 4.19: Present Land use Pattern of Surveyed Areas

Landuse Pattern	Number	% of Total
Agricultural lands	-	40%
Settlement area	-	50%
Power plant site (Acquired land)	-	2.5%
Canals, Ponds, Beels, etc.	-	5%
Road (earthen/Semi pacca)	-	2%
Proposed approach road	-	0.2%



Map 4.6: Master Plan of Comilla City Corporation

Chapter-5

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Environmental Impacts

A prepared an Environmental Assessment Checklist for power plant found in the Environmental Assessment Guidelines 2003 was used to screen the proposed Project for determining the tentative environmental impact through this IEE.

The environmental impacts of the power plant can be divided into three phases:

- a. Pre-operation phase
- b. Operation Phase
- c. Post-operation phase or decommissioning phase

5.1.1 Environmental Impacts during Pre-operation Phase

The major activities during the pre-operation phase of the proposed power plant include mobilization equipment, materials and personnel; site preparation, civil construction and electro-mechanical installation/erection etc. The impacts on environment from various activities during construction phase of the Project have been described in the following sections.

5.1.2 Anticipated Impacts

Impact on Topography

During construction of the proposed Project, the topography of the Project site will change due to leveling of uneven site as well as land filling to increase the height. The filling will involve raising the 3 acres of the project site by 1.5-2.0 meters. There will be some loss of biodiversity because of filling. Therefore the restoration of the lost biodiversity will have to done by the project sponsors. The restoration steps will be covered in the chapter on mitigation and Environment Management Plan.

Impact on Micro-Climate

The Project involves no deforestation and/or removal of significant vegetation. So, the significant increase of local temperature is not anticipated, impact on climate is not anticipated. Plantation of trees is recommended along the boundary walls of the project.

5.1.3 Impact on Environmental Resources

Impact on Air quality

During the construction phase of the proposed power plant, the important sources of emissions would include those being generated from the operations of construction equipment and machineries, vehicles carrying construction materials to the site and taking construction debris out of the site. If construction equipment, such as stone (aggregate) crushers are used at the site, this may result in significant emission of particulate matter

during its operation. Since construction of the proposed power plant is likely to involve significant earthworks, increase in particulate matters in air from wind-blown dust is also a concern. Moreover, SO_x and NO_x generated from the construction equipments will marginally affect local air quality at the site which will be transitory in nature.

As mitigation measure, construction materials at the site should be properly covered while hauled and stored. Access roads are to be properly cleaned and water sprayed in order to minimize concentration of dust in air. Vehicle movement to and from the site should be properly managed to ensure that it does not significantly aggravate the traffic problem and air pollution. In addition, sprinkling of water during excavation is to be practiced as it reduces the dust emission to a greater extent.

Impact on Noise Levels

During construction phase, high to medium level of noise shall be generated. The major sources of noise pollution are construction activities, movement of vehicles transporting the construction material and equipment to the site during construction phase. Noise may cause mild to severe impact on human nervous system, if exposed to sustained high level of noise exposure. The physical and psychological impacts of over exposure to high level of noise may be annoyance, speech interference, sleep deprivation, performance degradation and hearing loss. Accordingly, the Bangladesh Standard for noise level is 75 dBA at daytime and 70 dBA at night (ECR, 1997) for industrial projects in mixed zone (commercial cum industrial). Table 5.1 shows the average Leq identified as requisite to protect the public health and welfare with an adequate margin of safety as per USEPA Guidelines.

Table 5.1: Average Leq identified as requisite to protect the public health and welfare with an adequate margin of safety

Place	Measure	Indoor (dBA)		Outdoor (dBA)	
		Activity interference	Hearing loss consideration	Activity interference	Hearing loss consideration
Residential with outside space and farm residences	Ldn	45		55	
	Leq(24)		70		70
Residential with outside space	Ldn	45			
	Leq(24)		70		
Commercial	Leq(24)	(a)	70	(a)	70
Inside transportation	Leq(24)	(a)	70		
Industrial	Leq(24)(d)	(a)	70	(a)	70
Hospital	Ldn	45		55	
	Leq(24)		70		70
Educational	Leq(24)	45		55	
	Leq(24)(d)		70		70
Recreational areas	Leq(24)	(a)	70	(a)	70
Farmland and general unpopulated land	Leq(24)			(a)	70

(Source: US EPA, 2001)

Note:

- (a) Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.
- (b) Explanation of identified level of hearing loss: The exposure period that results in hearing loss at the identified level is a period of 40 years.

As mitigation measure the major work of construction is expected to be carried out during the day time. All vehicles shall be maintained and monitored to confirm the noise level within the prescribed limit. In addition, vehicle horn shall be restricted. Even after that if require, construction activity shall be restricted from 6 p.m. to 9 a.m. The noise pollution is a significant issue to consider for the construction worker but it will have negligible impact to the surrounding locality as it is not situated in close proximity of the Project site. But for protecting the permanent hearing loss of construction workers, it is to be ensured that they are not exposed for a prolonged period. Because most of these equipment produce high level of noise at close range and exposure to high level of noise for a long period in most cases results into permanent hearing loss. LBPL has to follow the OSHA guideline for exposure to specific noise levels for human beings as is provide in the following Table 5.2. Moreover, a rotational work plan is advised for the workers and operators of these equipments.

Table 5.2: OSHA noise exposure limits for the work environment

Noise (dBA)	Permissible Exposure (hours and minutes)
85	16 hrs
90	8 hrs
96	3 hrs 30 min
102	1 hr 30 min
108	40 min
115	15 min
121	6 min
127	3 min
130	1 min

Source: Marsh, 1991, p. 322

Note: Exposure above or below the 90 dBA limit has been 'time weighted' to give what OSHA believes are equivalent risks to a 90 dBA eight-hour exposure.

Impact due to Gas Transmission

It is already mentioned that LBPL will use natural gas as to be supplied by BGTDCCL. The gas transmission line will be around 100m and the entire pipeline would be laid through the side of Comilla-Laksam Road partially owned by Roads and Highway Department (RHD). The pipeline would be laid at the side of the road alignment at approximately 1.5m deep from the surface. There is a chance of creating traffic congestion and blockage of local drainage if the construction work properly not managed.

The LBPL will subcontract the assignment of gas transmission line to a BGTDCCL enlisted contractor, which is expected to be regularly monitored by the respective officials of BGTDCCL. The width of the gas pipeline trench is about 18"-24".

The traffic movement of the Comilla-Laksham road is not very high, nevertheless, the construction of pipeline would be done during less traffic movement time and special care would be taken to the passersby and local traffic for their easy passage on the remaining part of the road. Since the trench would not be kept empty long time and the excavated soil would

be kept aside to refill the trench after the pipe laying, there is minimal possibility of blocking local drainage during the pipeline construction. The LBPL authority will restore the pipeline construction alignment area to give the original shape of landscape after laying the pipeline.

Impact of HFO

HFO will be procured from Bangladesh Petroleum Corporation (BPC) by Tanker Lorries. The takers will unload the HFO into the storage tanks of the project. There may be spillages during the unloading operation. Adequate preventive measures will be needed to ensure that no spillage of HFO will take place into the surrounding environment.

Impact on Surface Water Quality

The construction and operation of the proposed Project will not have any major impact on the surface and ground water quality in the Project area. Contamination to water bodies may result due to oil spilling during construction activities and/or surface runoff from the construction site to the nearby water body. Turbidity levels of the immediate water body may increase, if the surface runoff from the power plant cannot be controlled.

Adequate drinking water facilities, sanitary facilities and drainage in the temporary shed of the construction workers should be provided to avoid the surface water pollution. Provision for adequate washing and toilet facilities with septic tanks and appropriate refuse collection and disposal system should be made obligatory.

Oil & Oily water is generated during power plant regular operations such as cleaning work, fuel tanks water draining & maintenance activities. Further there may be un-expected situations such as leaking or oil spillage due to breakdowns. In average the maximum amount of Oily Water generation is 3,000 Litres/Day and this figure depends on numerous plant operations parameters & fuel quality. Oily water collection & treatment system in the power plant is designed to route so generated oil & water safely to the nearest oily water collection pit in order to minimize the unwanted oil spreading & risks of hazard. Thereafter, the oily water collected in collection pits will be further processed in order to separate oil & water so as to prepare it for safe disposal in accordance with local environmental regulations.

Oily water collection pits will be located at various locations in plant premises, in order to cater the entire power plant oily water collection requirement. Oily water collected in those pits will be pumped in to the oily water buffer tank, which is kept heated for better gravitational separation of oil & water. At the next step, oily water mixture discharged at buffer tank's lower level is sent through an Oily Water Settling Tank, where the oil skimming operation & gravitational settling further takes place. Skimmed oil will be pumped in to the sludge tank.

Separated oily water by settling process, is then pumped in to a sophisticated Oily Water Treatment unit (Capacity 16,000 Litres/Day) with the proven technology of combine chemical & mechanical treatment (Refer Annex to 3). This unit is capable of separating even the emulsified oil & water perfectly by use of combined demulsifying & timer controlled gravitational separation process.

After this process the separated water (oil content less than 10 ppm) will be discharged to the storm water drainage system. Separated oil will be collected in the sludge tank (55m³ Capacity; sufficient to store sludge generation of 2.5months) and subsequently this wet sludge will be sold to licensed parties having kilns, incinerators or boilers in order to burn them in compliance with environmental regulations. Estimated average daily sludge generation will be only 0.35% of HFO consumption (Max.750 Litres/Day), which will vary with plant operations parameters & fuel quality.

Impact on Ground Water Quality

Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. Reducing spilling at the construction site will minimize the chances of leaching chemicals to the ground water. Adequate treatment facilities at the power plant should be provided as stated above to avoid ground water pollution.

5.1.4 Impact on Ecological Resources

Impact on Terrestrial Ecology

There is no designated wildlife sanctuary, wetland or reserve forest in the close vicinity of the proposed power plant. The Project DOES not associate with any type of disturbance to terrestrial ecology.

Impact on Wild Life

The faunal species in the study area is mainly of those associated with manmade habitat. As there are no wild life that faces extinction (Reference IUCN Red List) in the project area, no adverse impact on wild life is expected. As the project will not have any high tension transmission line the possibilities of electrification of birds will be none.

Impact on Aquatic Ecology

Aquatic ecology can be affected due to surface runoff. There are chances of surface runoff during construction activity to adjacent water body. The surface runoff should be routed to the sedimentation pond to avoid the river water pollution.

5.1.5 Socio-economic Impacts

The impacts of the Project activities during construction phase on important socio-economic parameters are summarized as follows:

Occupational Health and Safety Impacts

Implementation of Occupational Health and Safety Programme as outlined in the IFC EHS guidelines for thermal power plants to address all aspects of workers health and safety in relation to the construction and operation period of the project. The projects will notify local clinics and hospitals before commencement of construction works, Job specific medicals for all employees. EHS training and safety induction for all employees and 6 monthly updates. First aid kits and trained first aid practitioners on-site at all times. Access restrictions (barriers and signage) will be used to prevent unauthorized access to the project site.

Preparation of an EHS Plan for approval by LBPL including:

- EHS Policy and Objectives;
- Appointment of qualified EHS specialist(s) who will be on-site throughout the construction project;
- Project EHS rules;
- Details of how rules and updates (if required) will be communicated to workers
- Identification and risk assessment of hazardous activities and high risk areas;
- Safe working methods for hazardous activities;
- Ensure all personnel are provided with all required Personal Protective Equipment (PPE) for the environment they are in and the tasks they are performing;
- Implementation of a Lock-out Tag-out program; and
- Reporting and investigation procedure for all severe and minor accidents, and near misses.

Ensuring all subcontractors (if any) sign and agree to the site EHS Plan. Provide training for all subcontractors to ensure site procedures are fully understood and complied with.

Resettlement and Rehabilitation

It is already said that BPDB has acquired 3.0 acres of land for the Project settled down the price with land owner in earlier. During site visit and baseline data collection, the site was found almost vacant with limited agricultural activities. So, there is no issue of resettlement or rehabilitation. The agricultural activities were basically accomplished by share cropping arrangement. From the BPDB, LBPL owned the land through “willing seller-willing buyer” arrangement by following the respective legal requirements of Bangladesh Government. So, there is no issue of compensation. The share croppers in the acquired area have been identified and provisions as per ADB acceptable budgetary provisions will be made as compensation.

Indigenous People and Cultural Sites

No inhabitant of indigenous people has been recorded within the low and high impact zones of the project site. In addition, as there are no archaeological, historical or culturally important sites around the Project site, the impacts on these sites are not envisaged.

Traffic, Transport and Road Safety

Road traffic flows to and from the Project site is likely to increase during the construction phase due to increased movement of vehicles carrying construction materials, equipment and machinery, and personnel. During the construction phase, traffic disturbance needs to be minimized by avoiding high-density areas, proper traffic signs, ensuring proper access roads and avoiding road blockage.

In addition, there is a potential risk of being adversely affected during carrying of engines. In general, the design load for the feeder road with the 25feet width of carriage way is considered about 10-12 Ton. But the weight of each engine is about 130 Ton. The engine will be carried by trailer having 72 wheels spreading over about 50 feet length. So, it is understood that the 130 Ton load will be distributed through 72 wheels, where the load of each will be less than 10 tons as has been mentioned in the following.

In order to minimize the risk due to increase traffic of heavy Lorries and trucks it is recommended that the movements should be done in the night time but with care.

5.1.6 Waste Generation and Disposal

Construction Debris, Waste and House- keeping Arrangement

Project construction activities will result in generation of considerable amount of inert solid wastes, including lumber, excess concrete, metal and glass scrap, and empty containers used for non-hazardous substances. Management of these wastes will be the responsibility of the EPC Contractors as recommended in the EMP section of this report. Typical management practice includes proper temporary storage of waste and debris, and housekeeping of work areas. No part of this construction waste should be mixed with the domestic solid waste. Separation of saleable solid waste through screening process and dispose to the secondary users can be mitigation measures. Rest of the insignificant waste shall be disposed in a safe manner.

Solid Waste

The solid wastes of domestic nature generated mainly in the labor sheds should be collected and stored separately (i.e., without mixing it with construction waste/debris) in appropriate containers within the construction site. The solid wastes should be disposed of away from the site (e.g., in a municipal landfill/waste dumping ground) outside the complex, at the responsibility of the EPC Contractor. Apply the waste hierarchy and reduce, reuse or recycle wastes wherever possible.

Segregate wastes by types and provide appropriate waste containers for the storage of all waste streams. Provide a specific area for the storage of solid hazardous wastes (i.e. batteries, fluorescent lighting tubes, used oil filters, aerosol cans etc.). Prohibit the burning of wastes.

Arrange a waste removal contract and schedule at least weekly waste collections to prevent the build-up of waste materials. Select an appropriate waste contractors to ensure appropriate disposal methods are applied according to the waste stream and ensure the contractors plans to dispose the the waste. For assessing quantity of solid waste (of domestic nature) to be generated at the construction site, a generation rate of 0.22 kg of fecal matter per day per person may be used (source: <http://large.stanford.edu/courses/2010/ph240/cook2/>).

Liquid waste/waste water

The human wastes at the labor sheds should be appropriately disposed of through construction of sanitary latrines connected to appropriately designed septic tank system (consisting of septic tank and soaking pit). For this purpose, a wastewater generation rate of 50 litres per capita per day may be assumed. However, sufficient septic tanks and soak pits should be built to take care of 50 to 100 workers during the construction phase. These should be designed to ensure that the ground water table is protected. .

Wastewater generated from different construction activities is not likely to be significant in volume. Disposal of such waste water may be carried out by draining them in the municipal drainage system.

5.1.7 Labour Accommodation and Associated Utilities

Accommodation Facility

Bangladesh has ratified key International Labour Organisation (ILO) conventions, to ensure the work conditions are reasonable and safe, and employees are free from any form of discrimination.

Bangladesh Labor Law 2006 and subsequent amendment in 2013 and World Bank as well as IFC EHS guidelines will be met. Most of the workers will be from the local sources and will not require accommodation at plant site. During erection of machinery and equipment of the power plant the local erection contractors will provide accommodation in the adjoining areas. However, the security guards and administrators needs to be provided with accommodation at the plant site. The facilities must be of adequate nature with water supply and sanitation facilities.

5.1.8 Environmental Impacts during Operation Phase

Emission from the engine and generator stack may affect the ambient air quality. The combustion of fossil fuels for power generation results in emission of gaseous pollutants to the atmosphere. As the proposed power plant would be fired with natural gas and HFO, the potential pollutants are oxides of nitrogen (NO_x), sulphur di-oxides (SO_x), Carbon monoxide (CO) and carbon dioxide (CO_2). Each of these pollutants has been considered to ensure the Bangladesh Emission Standards and, where appropriate, the required emission control techniques would be incorporated into the mitigation measures.

5.1.9 Impact on Air quality

Emission from the engine and generator stack may affect the ambient air quality. Unburned gases from the engine operation may affect the air quality. The situation aggravates when gas contains high percentage of impurities like sulfur, hydrocarbon, etc. The high temperature of flue gases also impacts the air quality in terms of thermal pollution. The combustion of fossil fuels for power Generation inevitably results in emission of gaseous pollutants to the atmosphere. Each of these pollutants is examined below to ensure the Bangladesh emission limit. But in case of unavailability of national standards, best practices like IFC standards has been followed.

Emission of sulfur dioxide (SO_2)

The emissions of SO_2 are dependent on the sulfur content of the gas. The Sulphur content of the last consignment of HFO obtained from the BPC was 3.5%. This value was used in the air quality dispersion modeling in this assessment.

Emission of Nitrogen Oxides (NO_x)

An effect on ambient air quality has been assessed based on preliminary air quality modeling results. An advanced air emission dispersion modeling was conducted for preliminary environmental impact assessment for the proposed power plant at Jangalia, Comilla. In the study, the NO_2 emissions for the reciprocating gas engine system discharged through stack were modeled to obtain maximum possible downward concentration. USEPA certified ISC3P view model was used to estimate emission concentration from the plant. The exhaust specifications and stack parameters for the proposed reciprocating gas engine is used as input

to ISC3P model. The individual engine stack data was used as point source of NO₂ SO₂ emission as per engine design has been considered for air dispersion modeling. The parameters and corresponding values are summarized in the Table 5.3.

Table 5.3: Summary of the exhaust specifications and stack parameters

Parameters	Values
Stack height	42 m
Design Stack diameter (m)	1.1 meter
Stack gas exit velocity (m/s)	
2 Engines with Exhaust Gas Boilers	27m/s
Other 4 Engines with no Exhaust Gas Boilers	32m/s
Exhaust temperature	240 +(-) 15 °C 335+(-) 15 °C
2 Engines with Exhaust Gas Boilers	
Other 4 Engines with no Exhaust Gas Boilers	
NO ₂ emission rate as NO ₂ (mg/ Nm ³)	1460
SO ₂ emission rate (mg/ Nm ³)	2200
Ambient temperature (K)	305
PM 10 (mg/ Nm ³)	100

The modeling was conducted for the 6 individual engines releasing gaseous emission as point source with simple terrain using USEPA ISC3P view version model. The model assumes the stack tip downwash with receptors on flat terrain and no flagpole receptor heights. The NO₂ concentration contour have been analysed with 1000 m interval with a radius of 7500m from the point source. The NO₂ concentration contour of annual average of maximum concentration has been analysed.

Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS) for Bangladesh is given in Table 5.4.

Table 5.4: National Ambient Air Quality Standards (NAAQS) for Bangladesh

Pollutant	Objectives	Averaging period
Carbon Monoxide (CO)	10 mg/m ³	8 hours(a)
	40 mg/m ³	1 hours(a)
Lead (Pb)	0.5 µg/m ³	Annual
Nitrogen Dioxide (NO ₂)	100 µg/m ³	Annual
Particulates of ~10µm (PM ₁₀)	50 µg/m ³	Annual (b)
	150 µg/m ³	24 hours (c)
Particulates of ~2.5µm (PM _{2.5})	15 µg/m ³	Annual
	65 µg/m ³	24 hours
Ozone (O ₃)	235 µg/m ³	1 hours (d)
	157 µg/m ³	8 hours
Sulphur Dioxide (SO ₂)	80 µg/m ³	Annual
	365 µg/m ³	24 hours (a)
Notes:		
(a) Not to be exceeded more than once per year;		
(b) The objective is attained when the annual arithmetic mean is less than or equal to 50 µg/m ³ ;		
(c) The objective is attained when the expected number of days per calendar year with a 24-hour average of 150 µg/m ³ is equal to or less than 1; and		
(d) The objective is attained when the expected number of days per calendar year with the maximum hourly average of 235 µg/m ³ is equal to or less than 1 (Source: AQMP, DOE).		

Air Quality Monitoring and Modeling Results

During the pre-construction (land raising and development) and construction phases, potential air quality impacts include exhaust from heavy equipment and generator sets, and fugitive dust in the immediate vicinity of the project site or haul route. Impacts are likely to be localised and relatively short-term in nature.

To assess potential impacts during the operational phase, the Industrial Source Complex (ISC3P) dispersion model was used. The ISC3P model is an improved version of the ISCST3 model of the US Environmental Protection Agency (EPA) containing two special features of the Plume Rise Enhancement Model (PRIME). The two features are:

1. Enhanced plume dispersion coefficients due to the turbulent wake;
2. Reduced plume rise caused by a combination of the descending streamlines in the lee of the building and the increased entrainment in the wake.

It was therefore selected as an appropriate model for this assessment. This model is therefore suited to a wide range of applications. Whilst AERMOD is the preferred dispersion mode of the EPA, calculations used in the AERMOD model rely on a large suite of meteorological parameters and DOEs not work well with supplemental, off-site information. Therefore, given the relatively limited suite of meteorological data available in Bangladesh, it was concluded that available meteorological data was not of sufficient quantity or quality to perform dispersion modeling in the newer AERMOD model. ISC3P requires a smaller suite of meteorological data inputs, can be used to assess concentrations from several types of sources associated with industrial source complexes, can account for building downwash, urban or rural dispersion coefficients, flat or elevated terrain, and averaging periods from

5.1.10 Background

Air dispersion modeling was completed to predict ground level concentrations (GLCs) of pollutants, including NO_x, CO, PM₁₀, for the required averaging period across the modeled domain (a 7.5 km × 7.5 km grid around the stacks). The predicted GLCs were assessed in isolation and also the cumulative impact of emissions from the proposed power plants and from the background values recorded in the project area between March and October 2011.

5.1.11 Modeling Methodology

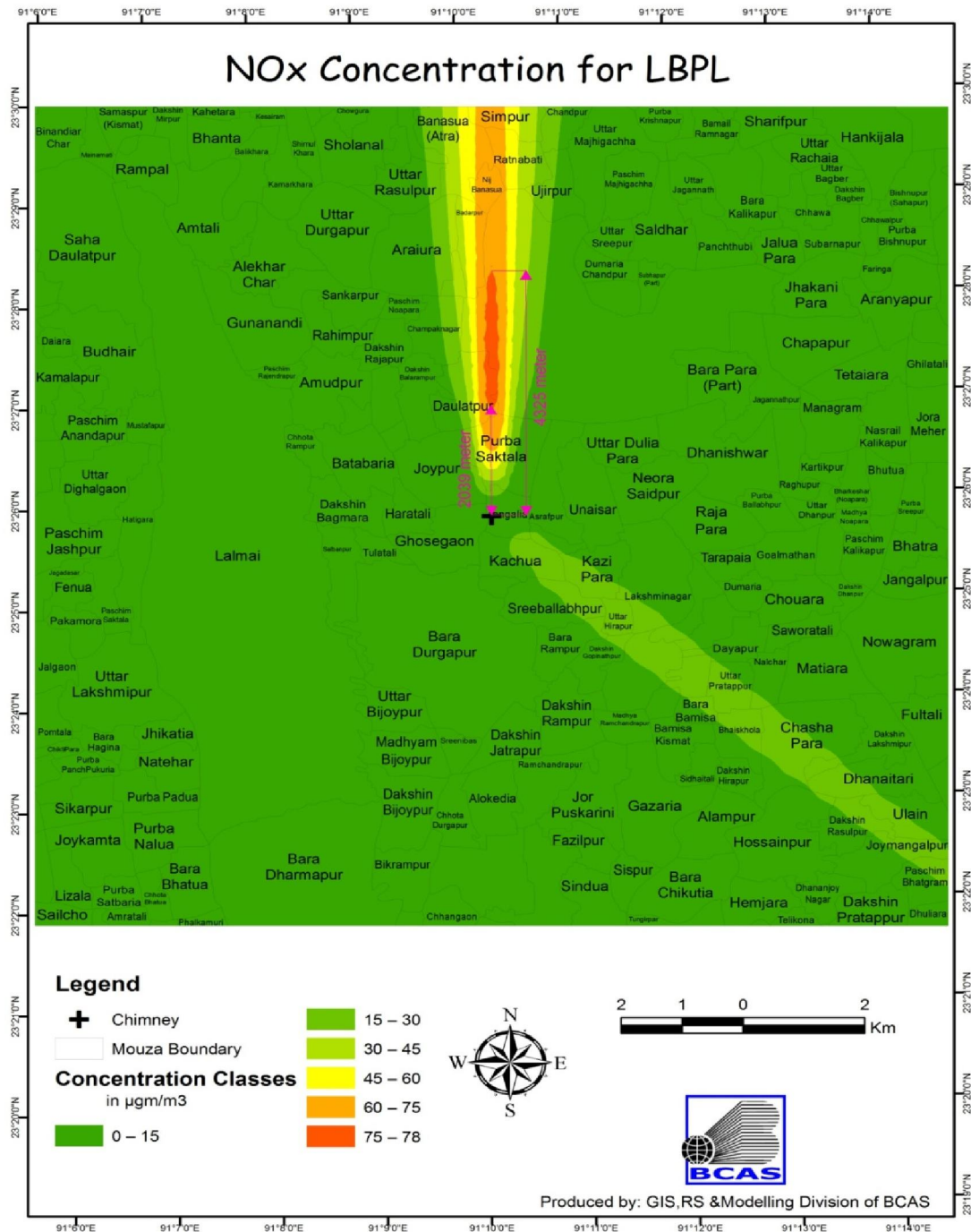
ISC3P was used with the following setup:

- a) A model domain of 7.5 km by 7.5 km centred on the stack (0.0, 0.0) and 500 m grid spacing's using Cartesian Co-ordinates. The second stack was selected 500 m to the north of the first stack.
- b) Assumption of no terrain as the site surrounding the proposed plant is essentially flat with no hilly areas.
- c) A surface roughness length of 0.1m was used to account for the primary flows of concern across relatively flat areas.
- d) Building wake effects were not included as the height of the nearest buildings was not sufficient to influence emissions.
- e) Mixing heights were estimated by putting local surface atmospheric data in the CSIRO Mixing Height Model.

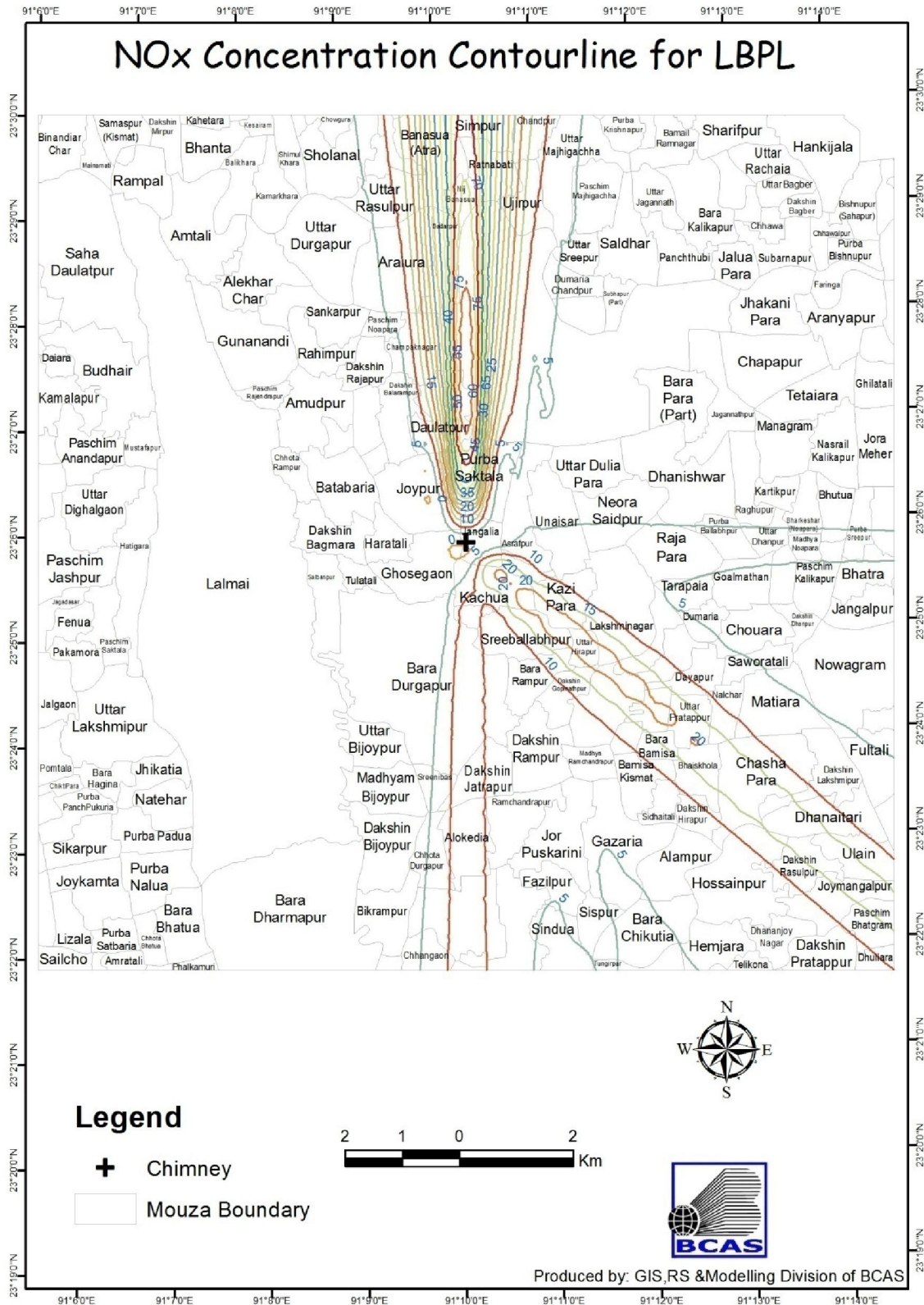
The Site meteorological data were the same as those used in 2011 obtained from the Comilla Metrological Department.

Modeling Results:

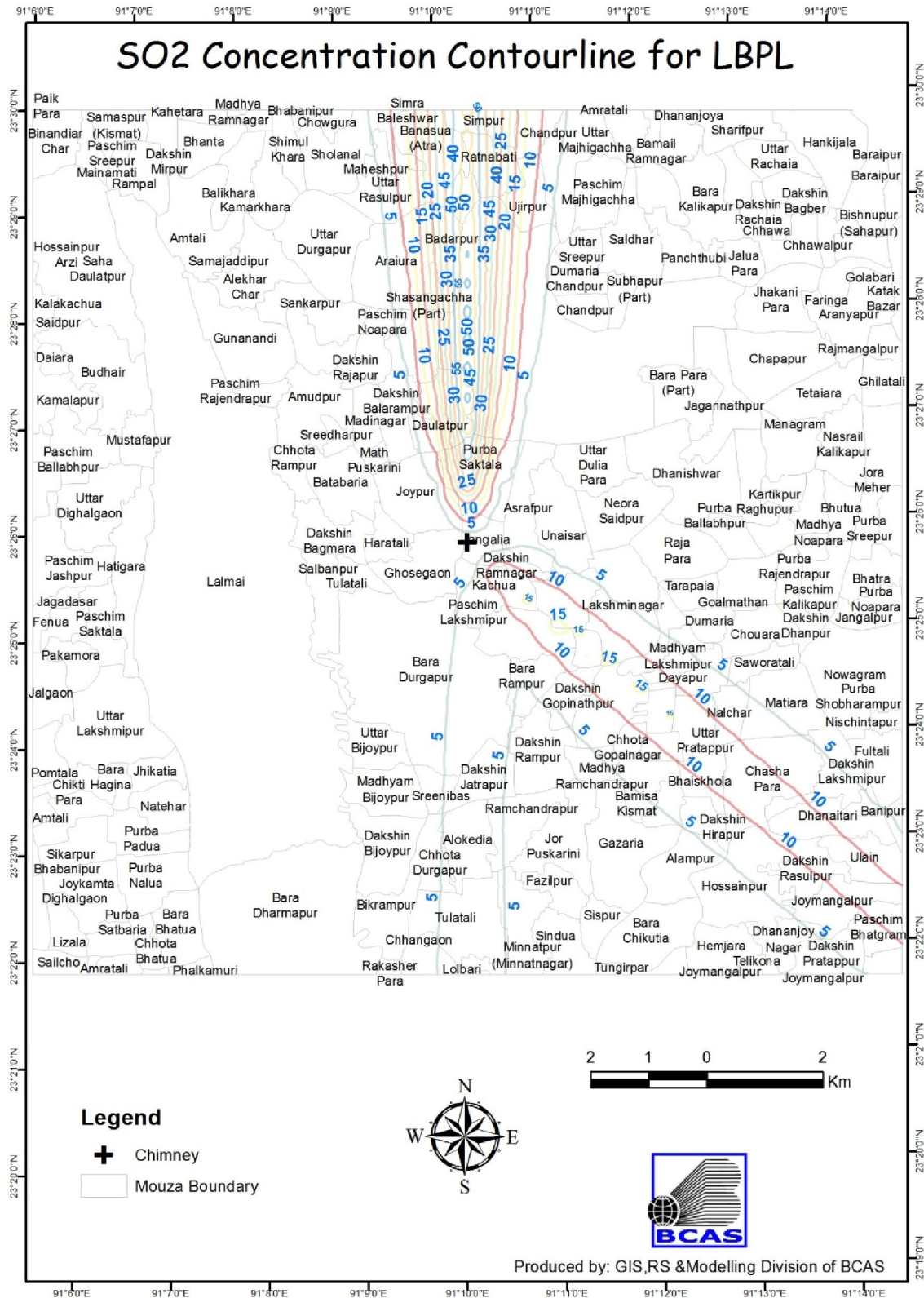
The emission contour maps of the proposed project at 24 hour, 1 hour and annual average of NO₂ and Sox concentration have been presented through Map 5.1, 5.2, 5.3 and in Map 5.4 respectively.



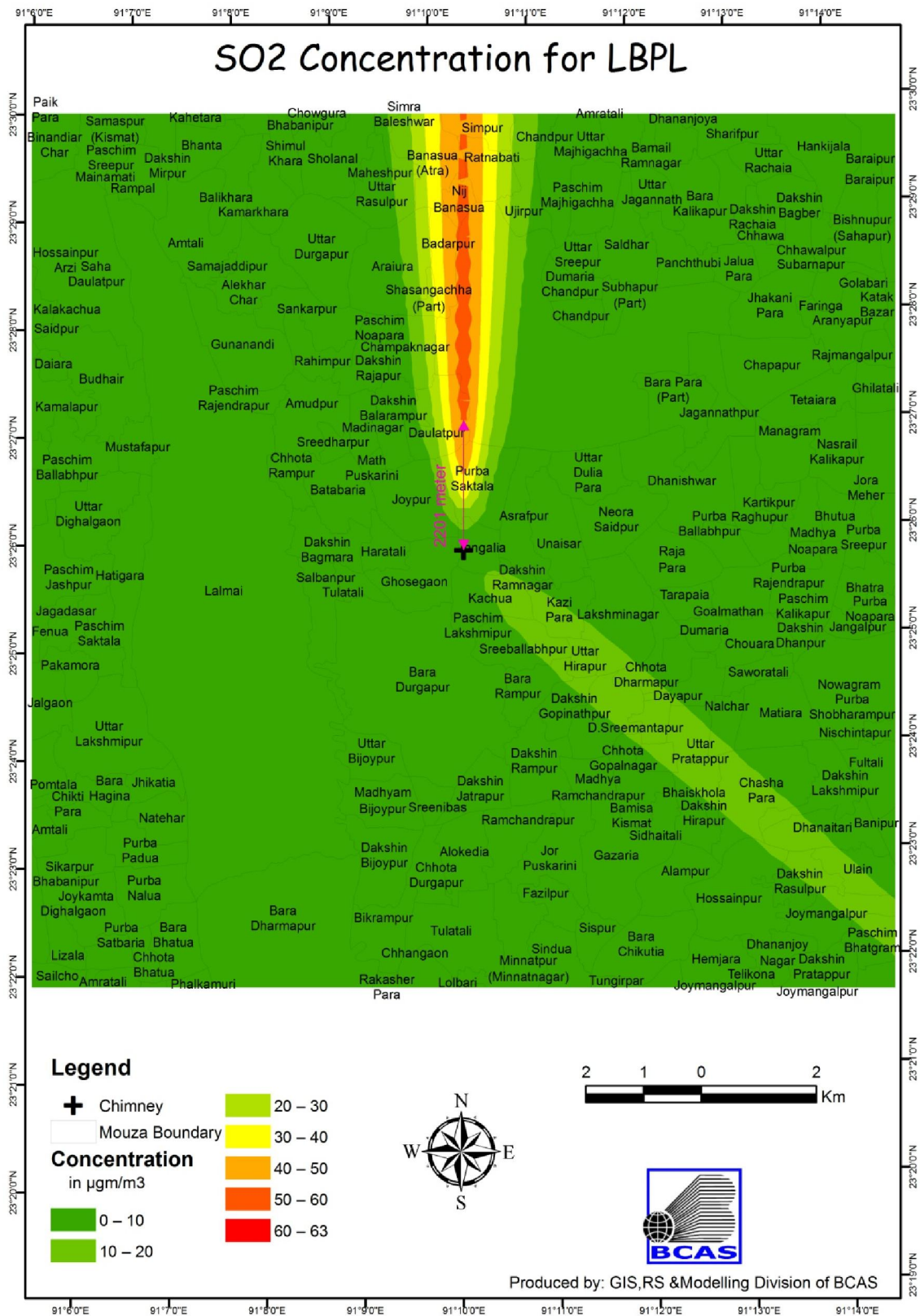
Map 5.1: Emission contour map showing the NO₂ concentration (24 hour average) HFO at 7.5km surrounding the project location



Map 5.2: Emission contour map showing the NO₂ concentration (annual average) for HFO at 5 km surrounding the project location



Map 5.3: SO_x Concentration Contour Map for HFO



Map 5.4: SO₂ Concentration profile for HFO

Isopleths

An isopleth map generalizes and simplifies data with a continuous distribution. It shows the data as a third dimension on a map, thus isopleth maps are more common for mapping pollutant concentrations, surface elevations, amounts of precipitation, atmospheric pressure, and numerous other measurements that can be viewed as a third dimension.

The third dimension is shown by a series of lines called isopleths which connect points of equal value. The isopleth interval is the difference in value between two adjacent isopleths.

Map 5.2 shows the isopleths of annual average NO_x concentrations including background values based on HFO. The pollutants are driven mostly towards the north and some towards the south-east directions. The maximum concentration of 76.95 µg/m³ is obtained at a distance of 3000m towards the north of the stack. Similar is the case with SO₂ (Map 5.3) showing a maximum concentration of 63.9 µg/m³ at a distance of 3000m towards the north of the stack.

The same pattern is shown also in the case pollutants based on natural gas operation (Maps 5.5 and 5.6) i.e. the pollutants are driven mostly towards the north. The maximum total concentration (including the background values) are 36.7 µg.m³ (NO_x) and 43.36 µg/m³ (PM10).

The same pattern for all the pollutants are the result of the use of same meteorological data for the modeling.

Concentration of SO₂ and NO_x from Chimney to different direction in microgram for cubic meter on annual basis

a. North direction

Distance in meters	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
SO ₂ µg/m ³	16.0	42.5	55.0	61.4	63.1	63.2	62.5	61.7	60.5	59.4
NO _x µg/m ³	21.0	53.3	68.4	76.2	78.3	78.5	77.6	76.7	75.2	73.8

b. South direction

Distance in meters	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
SO ₂ µg/m ³	1.8	7.5	8.1	9.0	9.4	9.7	9.9	10.1	10.2	10.2
NO _x µg/m ³	3.7	10.7	11.4	12.4	13.0	13.3	13.6	13.8	13.9	13.9

c. West direction

Distance in meters	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
SO ₂ µg/m ³	0.1	0.7	0.9	1.1	1.3	1.5	1.6	1.8	1.8	1.9
NO _x µg/m ³	1.7	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.8	3.8

d. East direction

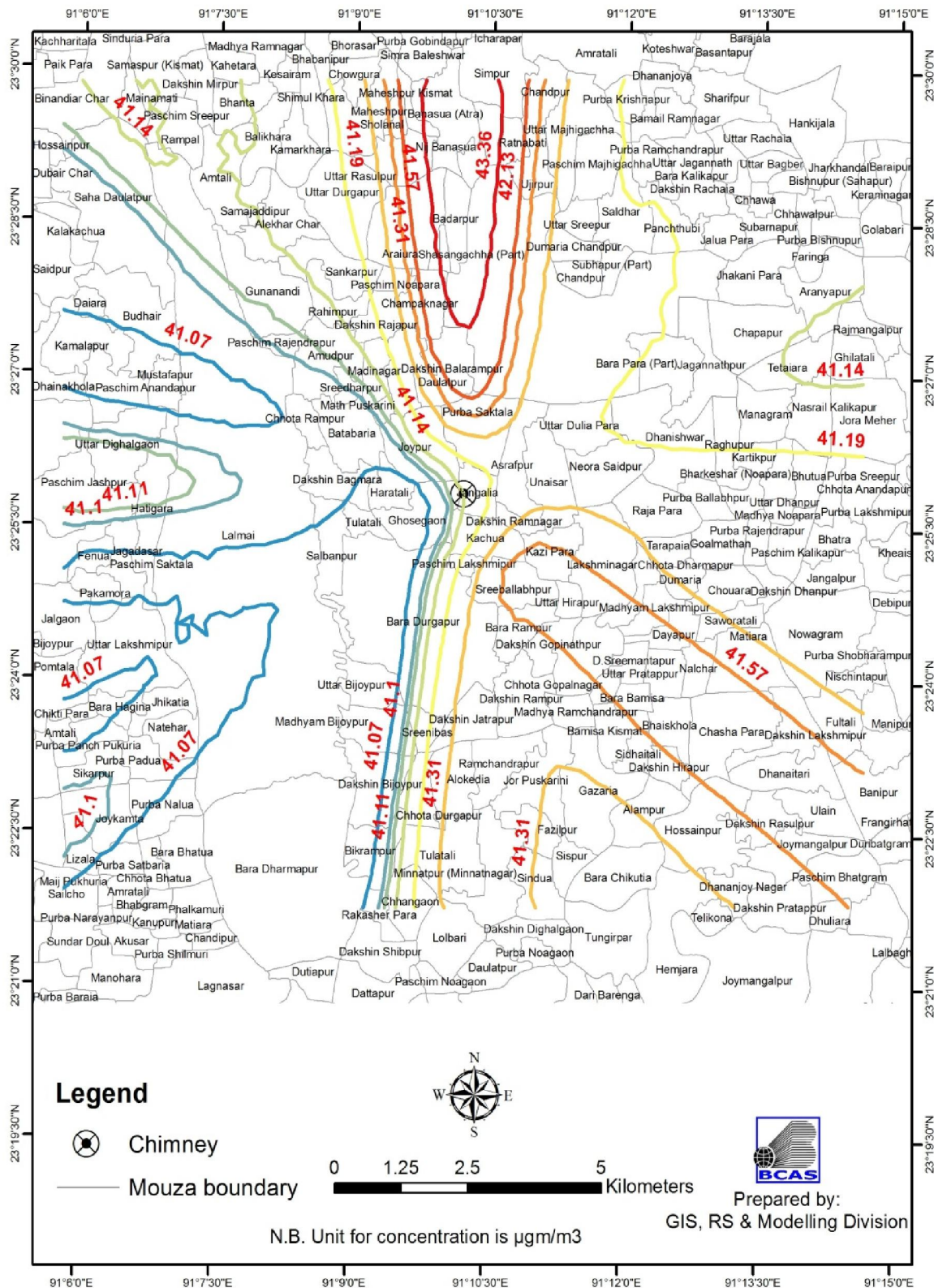
Distance in meters	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
SO ₂ µg/m ³	0.9	4.0	4.0	4.1	4.1	4.1	4.0	3.9	3.8	3.8
NO _x µg/m ³	2.6	6.4	6.3	6.5	6.5	6.4	6.4	6.3	6.2	6.1

The above Tables a, b, c and d indicates that the concentration of both NO₂ and SO₂ are the highest at the northern side of the plant because of the wind direction at this time of the year. In the northern side the highest concentration of SO₂ and NO₂ is below both the standard limit set by DOE and IFC on an annual basis.

The maximum 1 hourly ground level concentration of NO₂ will be 3.23 micro gram per cubic meter at a distance approximately 4000 meter from the stack location and the maximum 1 hourly ground level concentration of SO₂ will be 2.63 micro gram per cubic meter at an approximate distance of 3000 meters from the stack location which are well below the IFC standards (200 micro gram per cubic meter for NO₂ and SO₂ below the Bangladesh NAQS

The stack height as per design of 42 meters is adequate as per the modeling which is shown in Annex 4 which indicates that the stack height of 42.0 meters will be adequate. The stack would be connected with a silencer to prevent the noise from the engine. The stack heights have been designed to facilitate undisturbed and free dispersion of the emitted air pollutants. Exhaust gas sample extraction facilities shall be installed for emission monitoring on each stack. The General Arrangement Drawing (GAD) is shown in Annex 10

PM10 Concentration Contourline for LBPL



Map 5.6: PM10 concentration and contour map for natural gas

Impact due to Liquid Discharge

The plant is not assumed to generate any process effluent from the production process. The power plant will have a radiator cooling system where small amount of water will be required as makeup water. In addition, small amount of water will also be used for occupational floor, equipment washing and for domestic purposes. This wash water will not contain significant amount of pollution, which may impact the surface water quality. This has been explained in details in Chapter 5 and in Annex 5

The domestic liquid waste will be disposed through a septic tank with a soak pit. The project will have planned drainage system to discharge the surface runoff. The surface drainage network would be connected with an interceptor prior to discharge through natural water. The interceptor will trap all oily matter present in the water.

Noise, Vibration and Heat Generation Mitigation

It has been conservatively assumed that the source of noise at the plant location is 85 dBA. It is recommended that the noise level be kept at that value by using sophisticated by sophisticated acoustic power house building design so as to minimize the noise up to standard. The noise will be dispersed to the surrounding atmosphere to certain extent.

To reduce the effect of noise, 100mm thick Rock Wool (density 100 kg/m³) walls are capable to absorb most of the noise generation from the engines. Moreover, vibration pad should also be used at the bed of all power generation units to prevent the vibration.

The LBPL will be established in mixed commercial and rural settings which fall under the mixed area zone category of Bangladesh standard. The noise modeling report is shown in the following Map 5.5

5.1.12 Noise Modeling calculation

The noise modeling is based upon the method documented by the International Energy Agency. It is a simple model which assumes spherical spreading from a point source either in free space (spherical) or over a reflective plane (hemi-spherical). For this case, spherical spreading has been used because sound wave is propagating uniformly in all directions and the crests and troughs of the sound waves can be pictured as spheres centered on the source location. The total noise from each turbine is logarithmically added according to the formulae given below:

$$L_{A_s} = 10 \log_{10} (10^{L_{A_s}/10}) \text{ dBA}$$

Where: L_A = Sound Source 1 (i.e. LBPL power plant)

The model presents a 'worst-case scenario' as it DOES not take into account factors which would reduce noise propagation, such as:

- Uneven topography
- Large obstructions in the propagation path, e.g. barriers etc
- Refraction of noise, e.g. due to atmospheric effects such as temperature inversion
- Wind speed or direction effects
- Any change in the propagation with changing frequency

- The noise level is conservatively assumed to be 85 dB

The mathematical formula for the noise model is shown below:

$$L_P = L_W - 10\log_{10}(2m^2) - ar$$

$$L_P = L_W - 10\log_{10}(4m^2) - ar$$

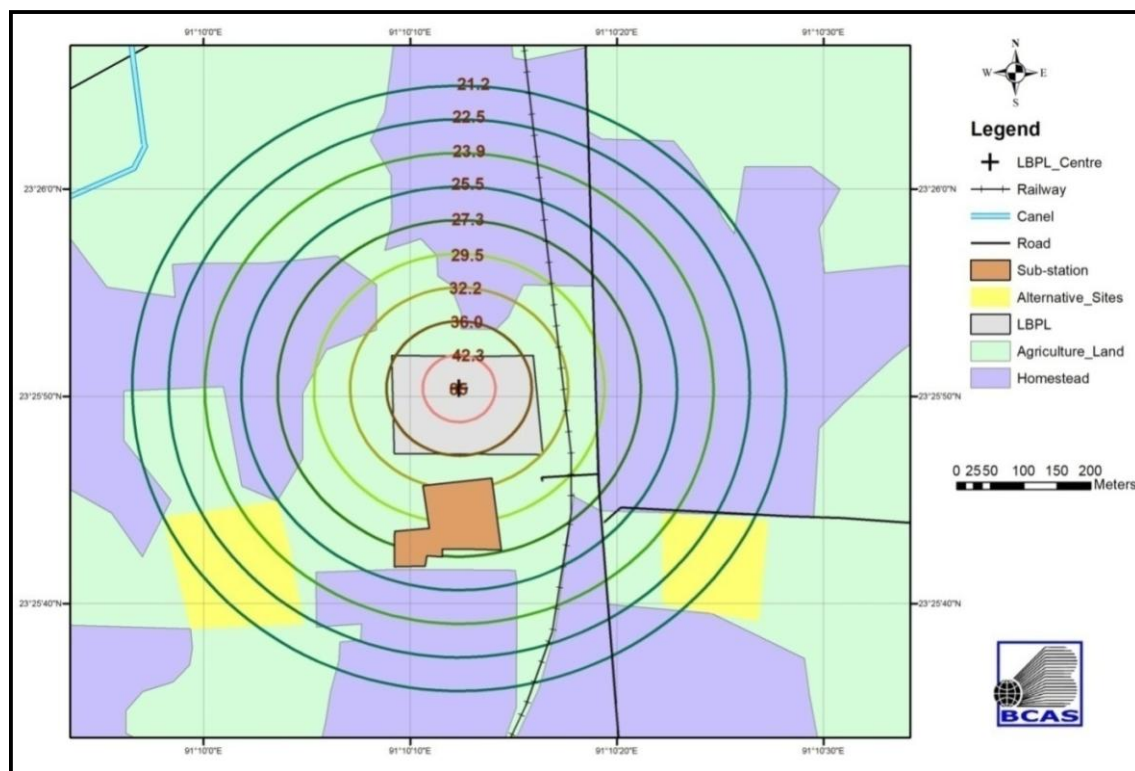
Where: r is the distance from source to receiver;

a is the absorption due to the atmosphere (dB/m), which is most commonly used as 0.005dB/m;

L_W the sound power level of the turbine; and

L_P the output sound power level of the turbine at different radius away from the source.

Graphic User Interface (GUI) software was built based upon the model using MATLAB programming language for enhancement in calculation and analysis. The screenshot for and the sample MATLAB code is given in Map 5.7.



Map 5.7: The map described the noise concentration around 500m of the plant site

5.1.13 Noise Modeling Results

At 85 dB noise input (for each Engine), the predicted noise output is as follows:

Radius (m)	1	50	100	150	200	250	300	350	400	450
Output Sound power level in dB	85	42.3	36.0	32.2	29.5	27.3	25.5	23.9	22.5	21.2

The relationship between the adjacent area and noise level in terms of stacks in two rows are presented in the following Figure 5.4. However, there are few homestead at the north side, west and south-west side of the project within the 100m radius of the proposed project where the noise contribution from the project would be around 28 dBA.

The ambient noise standard of IFC and Bangladesh Government is mentioned in the following Table 5.5.

Table 5.5: Standards of noise level

Standard	Zone	Day time dBA	Night time dBA
World Bank EHS Guideline 2007	Residential, institutional, educational	55	45
	Industrial, commercial	70	70
Bangladesh ECR, 1997	Mixed area	60	50
	Commercial	70	60
	Industrial	75	70

Table 5.6: The combined noise levels at locations in the Vicinity of the Site based on modeling at various distances from the plant location

Location	Approximate distance from the Source (m)	NIGHT dB(A)			DAY dB(A)		
		Baseline	Source Sound (estimated from simulation)	Combined effect	Baseline	Source Sound (estimated from simulation)	Combined effect
Plant site (east boundary point)	105	41.2	29.33	42.75	47.06	29.33	48.46
North side of the power plant	223	37.3	18.91	38.57	43.76	18.91	44.93
South side of the power plant	208	41.3	28.07	42.74	48.23	18.07	49.48
East side of the power plant	207	42.4	37.60	44.04	49.65	25.90	50.06
West side of the power plant	175	37.5	26.23	38.91	37.41	26.23	38.82

Table 5.6 shows the combined effect of the resultant sound at various points where the baseline noise levels were measured. The combined effect is a sum of the baseline value and log of modeling results at various distances from the source of the noise the four directions during night time and day time

Based on the results in Table 5.6, it is clear that the proposed power plant at Jangalia, Comilla will have a negligible impact on the noise environment at the nearest sensitive receptors. Such an increase is considered to be negligible and is complying with IFC guidelines. Furthermore, the model presents a ‘worst-case scenario’ as it DOES not take into account factors (listed in the model description above) which would reduce noise propagation.

Solid waste

During operation phase, solid waste will be generated from production process i.e. oil filter, air filter, scrap tires, batteries, other wastes of maintenance workshop and from kitchen and Project personnel daily uses. Improper disposal of solid waste may interrupt the drainage system as well as may pollute the surface water body.

LBPL has to confirm the compliance of good house-keeping policy and procedure. Personnel should be trained accordingly. Two separate waste bins should be placed to collect the daily waste as organic and inorganic. All plastic materials would sale to DOE enlisted secondary users for recycling. Biodegradable waste could be compost and later use as fertilizer.

It is already mentioned that LBPL is found to consider the waste management issue with due importance. Already they have introduced a number of dustbins including the approach of separating the waste at source.

Liquid waste and lube oil disposal

Main liquid waste of the proposed power plant seems to be lube oil. So, there is possibility of oil spillage during the following incidences:

- oil spill during unloading from tankers;
- leakage from storage tanks;
- leakage from transfer pipes;
- leakage from machines during operation; and
- oil spill during maintenance of machines.

Spillage of oil will be collected in a tank and pass through three tanks and finally it will be sold out to DOE designated vendors. LBPL will not procure poly-chlorinated biphenyls (PCBs) transformer oil. Pure hydrocarbon mineral oil will be used for transformers, current transformers, potential transformers and capacitors under the project which will not have any adverse environmental impacts. Separated oily waste will be collected and disposed of in compliance with ECR, 1997.

Sanitary waste-water

Sanitary wastewater will be generated from the office and dormitory building, which will be treated by septic tank connected with soak pit. LBPL has informed that they will arrange septic tank and soak pit by considering the required standards for 100 persons.

Water

The cooling arrangement of the proposed power plant is closed circuit. From under-ground the required make-up water will be pumped and cooling the system and recycle. So no waste water will be generated from the power plant due to cooling purpose.

For better drainage, a box culvert has already been constructed to ensure satisfactory drainage. In addition, LBPL has planned to construct drainage around the Project site with connection to the local canal to avoid any impending water logging.

5.1.14 Environmental Impacts during Decommissioning Phase

The major environmental impacts during post-operation or decommissioning phase of a thermal power plant are noise and vibration; solid waste generation and leakage of spent lube-oil and other raw materials; dust generation; and risk of human health and property. Required measures are to be adopted to mitigate adverse impacts of these aspects. As the demolition workers are likely to lead to significant deterioration of the acoustic environment, carrying out the demolition work at day time can be a mitigation measure. In case of waste and leakage of spent lube-oil and other raw materials, LBPL has to make sure proper collection and disposal. To address the dust generation due to demolition work, watering in bare area can be an option. For mitigating the risk of human health and property damage, vehicles as are to be used in demolition work, have to be operated with due care.

5.2 Beneficial Impacts and Enhancement

5.2.1 Beneficial Impacts and Enhancement during Pre-operation Phase

During construction phase, the Plant will create job opportunities for skilled, semi-skilled and un-skilled workers. In addition, the construction site will facilitate temporary localized business like supply of goods and services. Although labour recruitment is under the jurisdiction of EPC Contractor who is solely responsible for deploying required personnel, LBPL is expected to pursue them to engage local people as many as possible.

5.2.2 Beneficial Impacts and Enhancement during Operation Phase

The important positive impact of the power plant would be generation of electricity, which will reduce gap between supply and demand of electricity. The other important positive impacts of the plant operation will be employment for about 50-70 skilled and semi-skilled workforce. In this regard, it is expected that LBPL will try to consider deploying local people as many as possible.

5.2.3 Beneficial Impacts and Enhancement during Decommissioning Phase

Due to demolition work, there will be temporary employment opportunity for local people as well as outside expert. LBPL will earn salvage value by selling the scrap materials. In addition, the project site can be used as an industrial estate for a new industrial venture because it would be enriched with the basic utilities and infrastructures.

5.3 Occupational Health and Safety Impact

Occupational health and safety risks and mitigation measures during construction, operations are similar to those of other large industrial facilities. According to Environment, Health and Safety (EHS) Guidelines of IFC, the major occupational health and safety issues relevant with the Project are as follows:

5.3.1 Exposure to Electro Magnetic Field

In a power plant, the workers have a high exposure to electro-magnetic field (EMF) than the general public due to working in proximity to electric power generators, equipment and connecting high-voltage transmission lines. LBPL has planned to provide earthing network around the generator room. Mesh system is expected to be used as safety measure.

5.3.2 Heat

Occupational exposure to heat occurs during operation and maintenance of combustion units, pipes and related hot equipment. Recommended prevention and control measures to address heat exposure at power plant include:

- regular inspection and maintenance of pressure vessels and piping;
- provision of adequate ventilation in work areas to reduce heat and humidity.

5.3.3 Noise

Noise sources in power plant are the gas generators and auxiliaries, gas engines, fans and duct work; compressors etc. As mitigation measures LBPL has to think for:

- provision of sound-insulated control room with noise level as is permitted in ECR, 1997;
- design of generators to meet applicable noise levels.

5.3.4 Fire and Explosion Hazards

The daily activities of power plant include store, transfer and use large quantities of fuels; therefore, careful handling is necessary to mitigate fire and explosion risks. To avoid the risk of fire and explosion hazard, LBPL has to arrange sufficient number of fire protection equipments like buckets, fire extinguishers, fire water tank should be provided for emergency needs. At the site, the safety and emergency manual should be accessible to all employees.

5.3.5 General Safety

To reduce the risk of health hazards, LBPL has planned to provide personal protective equipments like safety gloves, helmet, mufflers etc. during construction period and during the maintenance work while the plant is in operation.

Chapter-6

ANALYSIS OF ALTERNATIVES

6.1 ‘No Project’ Alternative

From physical and environmental points of view, the ‘do-nothing’ is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. But the ‘without project alternative’ is not acceptable since this will strongly reduce the potential for socio-economic development of the country. In spite of having greater potentiality, the industrial growth is retarded mainly due to inadequacy of electricity facility.

So, it is concluded that the ‘No build’ alternative is unacceptable, and the potential socio-economic benefits of implementation of such project far outweigh the adverse impacts, all of which can be controlled and minimized to an allowable level.

6.1.1 Analysis of Technology and Fuel Alternatives

In October 26, 2010 BPDB issued a request for proposal mentioning the relevant technical, financial and commercial aspects. *Under Section 2: Project information and scope*, it has been clearly mentioned that the Projects sponsor has to use reciprocating engine and has to use Comilla PGCB 230/133 kV substation. In addition, it is clearly mentioned that the fuel of the power plant will be dual fuel typed by using natural gas and HFO. So, there is no scope for LBPL to think for alternative technology and fuel. Since at the moment there is no new gas connection available the power plant will be run on HFO until gas is available.

6.1.2 Analysis of Site Alternatives

Analysis of site alternatives (AoA) facilitates to justify the need for starting, stopping, or continuing of selection of a site for a particular project. They are done because decision makers need reliable, objective assessments of the options for providing required capabilities. AoA identifies potentially viable solutions and provide comparative cost, effectiveness, and risk assessments of each solution to a baseline; this baseline is typically the current operating system.

It is already mentioned that while identification of project site for a power plant project, some parameters are taken into consideration like:

- i) availability of evacuation line,
- ii) availability of land,
- iii) fuel transport facility through sea and
- iv) Infrastructure facility (road, telecommunication, etc).

Taking all these into consideration the best possible site for the project is at the proposed location.

6.1.3 Location and Area of Available Land

During visit, information about physical location of the sites was collected from local people as well as representatives of LBPL. To assess the geographic location a GPS receiver was used. Based on the available information, physical location, geographic location and proposed area of the project site are depicted in **Table 6.1**.

Table 6.1: Comparison of sites with respect to location and area

Site	Physical Location			Geographic location		Area in acre
	Mouza	Municipality	Ward	Latitude	Longitude	
Site-1	Doiyara	Comilla	22	23° 25' 40.60" N	91°10'1.42"E	5
Site-2	Doiyara	Comilla	22	23° 25' 41.65" N	91°10'23.22"E	6
Site-3	Doiyara	Comilla	22	23° 25' 45.38" N	91°10'37.95"E	5



Map 6.1: Three alternative sites view for the alternative plant mentioned in the above image



Photo 6.1: Site view for the alternative plant site 1



Photo 6.2: Site view for the alternative plant site 2



Photo 6.3: Site view for the alternative plant site 3

Table 6.2: Comparison of sites with respect to topography and land use pattern

Location	Topography	Land use pattern
Site-1	- The site is basically a plain terrain. - The site requires about 8-9 feet land filling. - The overall shape of the site is rectangular making it more suitable for a power plant.	- Wetland for aquatic life - Agricultural activities
Site-2	- The site is basically a plain terrain. - The site requires about 5-6 feet land filling. - The overall shape of the site is rectangular making it more suitable for a power plant.	Comprehensive agricultural activity
Site-3	- The site has moderate a plain terrain - There are some natural wetlands in the site - The site requires about 5-7 feet land filling	Agricultural activity

6.1.4 Distance from Major Infrastructure

While selecting a power plant site, distance from major infrastructure is important consideration. Because construction of transmission line requires considerable amount of financial involvement and sophisticated technology. As the proposed project will be a furnace oil based power plant, proximity to oil storage facility is also a major issue to delve with. In the following **Table 6.3**, the sites are evaluated based on distance from some important infrastructures.

Table 6.3: Comparison of sites with respect to distance from major infrastructure

Sl. No	Major Infrastructure	Approx Areal Distance from Site (km)		
		Site-1	Site-2	Site-3
1	PGCB substation	2.0	.5	1
2	PDB office	2.0	.75	1
3	Comilla bus stand	3.75	1	1.5
4	Comilla jute store	3.0	12.0	1.75
5	LGED office	4.0	2.0	3.75
6	Upazila parishad office	3.0	1.0	1.75
7	Gas source	1.75	1.0	1.5
8	Bus stand Laksham	1.25	1.25	1.0
9	Gumati river	5.25	4.25	3.0

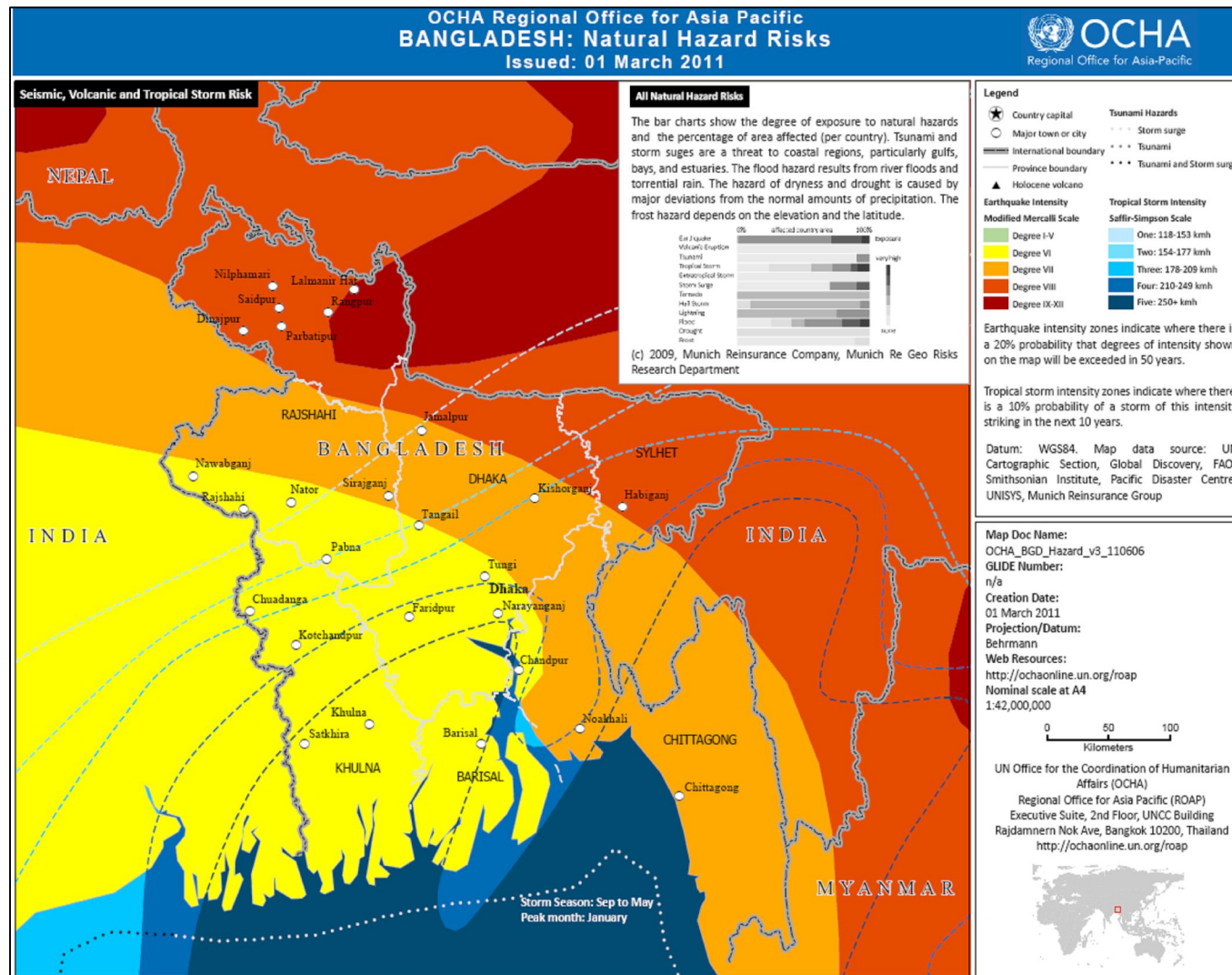
Source: BCAS field representative

The analysis shows that even the alternative locations size and area is adequate for the proposed power plant but for the following reasons the proposed by the sponsors seems to be the most advantageous and suitable.

- Close proximity to the PGCB substation
- No natural wetlands will not be disturbed
- Close proximity to the main road for transportation of construction equipments and HFO during operation
- Proximity to natural gas pipeline
- Land filling requirement will be less

6.1.5 Vulnerability to Natural Calamity

According to the earthquake zoning of Bangladesh the three sites have fallen under Zone II, which means that the sites have moderate risk of earthquake. On March 1, 2011 UN Office for the Co-ordination of Humanitarian Affairs (OCHA) published a composite map of vulnerability to natural calamity for Bangladesh. According to this map, the sites have less significant risk associated with Tsunami and storm surge. But the tropical storm intensity is about 210 kmh. There is no risk of volcanic eruption for these sites. According to this map earthquake risks for the three sites is Degree VI according to the Modified Mercalli Scale. The following Map 6.2 depicted the Natural Hazard Risk of Bangladesh.



Map 6.2: Natural Hazard Risk Map of Bangladesh prepared by OCHA

6.1.6 Environmental and social safeguard aspects

There are two major components in safeguards aspects. They are environmental and social issues. The baseline environmental and social conditions of all three alternative sites have been found similar. But among the four options including the proposed site, the proposed site seems to be the most suitable because of its proximity to the sub-station and the main gas pipeline.

6.1.7 Comparative Valuation of the Proposed Sites

Land price is dependent on a number of factors. Among this factors accessibility to the site and proximity to major infrastructure are two major factors. Similarly the land rate was found to vary from site to site. The source of this land price is the representative of BCAS. In the following **Table 6.4**, the tentative unit price of three sites is evaluated.

Table 6.4: Land price of short-listed sites

Site	Market price (taka/decimal)
Site-1	350,000
Site-2	500,000
Site-3	400,000

Source: BCAS representative

Chapter-7

INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 Information disclosure process

During preliminary survey the following consultations with relevant stakeholders including the villagers and public had already taken place to disseminate information on the project activities among the project affected persons (PAPs) and individual household survey. The consultation approach was based on a combination of formal, informal meetings and focus group discussions (FGDs). The formal meetings were held through prior notice and invitation including all the PAPs and households, district administration, local administration and other stakeholders in the affected area. The basis for selecting the stakeholders was based on the following criteria:

- Identifying the Project Affected People
- List the PAPs directly impacted due to land acquisition
- List the number of share croppers or impacted in any other way in the acquired land
- Identify the Government agencies connected with the project
- Identify local elites and academicians for their view on the project
- Identify the closest households or commercial institutions of the project site and make them aware of the impacts of the project and note their concerns.
- Identify local NGOs working in the area

The methodology used for the disclosure process was as follows:

- A 100% questionnaire-based census was carried out on the PAPs during which information on the project activities was disseminated and the nature of impact and compensation issues were discussed.
- During the sample-based socio-economic survey which had covered 120 households within the impact zones, dissemination of information on the project activities was also taken and information disclosure carried out.
- Preliminary Informal meetings with various categories of the PAPs and households were completed
- Three formal meetings specifically including all categories of PAPs.
- One large public consultation meeting which will include all the PAPs, representatives from the project impacted areas, district and local administration, as well as other community representatives including prominent local people, lawyers, journalists and academicians.

Stakeholder's Consultation

Stakeholder consultation meeting is an important part of the IEE study. The main objective of the consultation meeting is to apprise the local inhabitants about the Proposed Project and to seek their opinion regarding the tentative impacts. It is a fundamental principle of any environmental assessment study. The inclusion of the feedback of public consultation helps to ensure that the decision making process is equitable and fair and leads to more informed choice and better environmental outcomes. The findings from the public consultations carried out as a part the IEE study were utilized in the development of the EMP, especially in identifying the significant impacts of the proposed project and developing the corresponding mitigation measures.

The objectives of the consultations were as follows:

- dissemination of information about the Project among the stakeholders;
- have a better understanding of existing environmental conditions;
- aware stakeholders to contribute meaningfully to in different phases of project;
- reduce psychological distance between project sponsor and stakeholders;
- ensure the sustainability of the project.

7.2 Consultation and Participation Mechanism

Public consultation has been carried out during different activities in the Project cycle, using different techniques such as public meeting, small group meeting, informal meeting as per environmental social and procedures of BCAS. During such consultations the public was informed about the project in general and in particular about the following:

1. Finalization of the Project plan.
2. Lakdhanavi Bangla Power Company Limited (LBPL) design standards in relation to the applicable international standards.
3. Health Impacts and their mitigation as part of the Environmental Management Plan (EMP).
4. Measures taken to avoid public utilities and other social infrastructure such as school, hospital, roads, etc as well as to generate employment opportunities, and assist with the development of a small enterprise.
5. Other impacts associated with Right Way of Alignment (RoW) for gas pipeline connection if necessary, Access Road with an approach to minimize and mitigate the effects.
6. Land Acquisition details, proposed compensation packages and policies.
7. Any other compensation for any damages associated with the Project development.

7.2.1 Stakeholders' Participation

A series of public discussion activities were undertaken by BCAS. These programmes included rapid appraisal and discussion with the groups of Project Affected People and community leaders.

In conducting the IEE, three types of stakeholders were consulted. In the following sections the consultation process is briefly depicted.

7.2.2 Affected Communities

In general community stakeholders are categorized into two broad categories: directly affected and indirectly affected. Directly affected community stakeholders include people who will have the potentiality to be directly impacted through loss of land, crops and other assets, environmental and social adverse impact due to the project. Indirectly community stakeholders include those people of the project area who have the potentiality to be affected by the project activity at a limited extent.

As a part of discussion with directly impacted stakeholders, there was consultation with both male and female representatives living in adjacent to the Project site as shown in the following photographs. In addition, to get feelings about the indirectly impacted stakeholder, there was a separate consultation at Jangalia Market area. In this consultation, the opinions of all classes of people including businessman, general public were taken. These have been documented in the following photographs.



Photo 7.1: Consultation with the villagers



Photo 7.2: Consultation at Jangalia Market Area who can be indirectly affected

7.2.3 Local Government

According to the local government structure of Bangladesh Government, Jangalia is a Ward under the jurisdiction of Comilla District. The administrative authority of the Ward is the Upazila Parishad. As a part of consultation with local government representative, there were consultations with Mr. Liton Lal Goswami,

Mrs. Sabina Yasmin, Mr. Masumur Rashid, Thana Agriculture Officers as are provided in the following Photos 7.3 and 7.4.



Photo 7.3: Consultation meeting at Upazila Parishad.



Photo 7.4: Consultation meeting at Upazila Parishad

7.2.4 Non Governmental Organizations

There are several non-government organizations (NGOs) working in the project impacted area. The NGOs are both international and local. There are several organizations that seek to coordinate local NGO activities. NGO activities are wide ranging, including agricultural support, health care support, micro credit, family support, environmental advocacy and support to vulnerable groups (elderly, orphans and abandoned children). There are a number of NGOs operating at Jangali and Doiara. Among them Bangladesh Rural Advancement Committee (BRAC), Jagoroni and Association for Social Advancement (ASA) were consulted as they have the higher coverage in terms of area of operation.



Photo 7.5: Consultation meeting at City Corporation



Photo 7.6: Consultation meeting with ASA NGO



Photo 7.7: Consultation with Comilla Victoria College **Photo 7.8:** Consultation meeting with land owner

7.3 Issue Raised by Stakeholders' and Response of LBPL

In the stakeholder consultation, a number of issues were discussed. Among them the major issues are presented as follows with the response of LBPL.

Employment

Jangalia is a semi urban and agricultural area having some commercial shops. The rate of unemployment is very high. As a result, most of the stakeholders requested for providing job opportunities for semi-skilled and unskilled local people. In response, LBPL assured them that maximum unskilled jobs should be allocated to the locals, as are required during construction phase.

Livelihood

During construction an operation phases there will be frequent movement of heavy vehicle to and from the Plant. It can adversely disturb the grazing of livestock and can even result in fatal accident. LBPL will be taken not to disturb the grazing practice and limit the speed of vehicles to avoid accidents.

Access to the household

Difficulty to access to the households (lying east-west to the project) from the paved road, a narrow haring bond road should be built to move to the village. This request comes from the neighbors of the plant site.

7.4 The Results of Consultations and Concerns Raised

The results of the focus group discussions and stakeholder's consultation with project affected persons are detailed in Annex 16 of this Report. The information presented below discusses how concerns raised and recommendations made during the consultation process were addressed.

The following queries were raised by the affected people during Public consultation and informal group meetings:

1. Whether there will be any environmental hazard due to power plant especially noise and air pollution?
2. Whether the local people will be engaged in the plant construction works?
3. Whether the people know about the installation of proposed power plant
4. Whether they will get job or working facilities in the plant site

The following clarifications were provided by and BCAS staff in response to the aforementioned questions:

1. Land acquisition and, compensation related issues for the main plant site is completed. The compensation for land has already been given.
2. Potential impacts on the environment and associated mitigation measures were discussed during all the formal and informal meetings held. The IEE provides detailed description of potential impacts and mitigation and is also supplemented by a comprehensive Environmental Management Plan to ensure the compliance.

3. Skilled and unskilled people from the locality will be engaged in the construction works such as sand supply, filling material supply, general labour and local transportations. This commitment was endorsed by LBPL on several formal meetings. Village electrification will be undertaken by the Power Grid Department of the Government of Bangladesh. The latter will play a principal role in arranging the power supply. Villagers were informed about the government's target to provide electricity to all households in the country by 2020 as per Master plan "Vision 2020" that is being implemented by the Government of Bangladesh.
4. People are conscious about the proposed Project but do not have a clear idea about when the project will commission and when they will get electricity;
5. People will get jobs based on their skills on a priority basis.

Table 7.1 Specific outcomes of the consultations with the PAPs, including actions that have been taken by the Project in response to concerns expressed by the affected people.

Table 7.1: Outcomes of the consultations with the Project Affected People

Purpose	Outcome	Action/ Mitigation
Determine an extent of local support for LBPL	The local people are in favour of the planned work since they believe that this power plant will create employment opportunities and will improve socioeconomic conditions in the locality.	Project sponsor made a commitment in formal meeting with locals to provide employment priority and local community development to ensure economic benefits.
Identify key environmental impacts	The perceived environmental and health impacts associated with sound emission, air quality and waste water were clarified by LBPL and BCAS.	These issues have been identified and examined in the IEE..
Identify key socio-economic impacts in the implementation of LBPL and the expectation of the local people.	All Stakeholders expect obtaining employment at the power plant.	These aspects have been covered in the IEE and LBPL will give priority, as well as through consultations with all the stakeholders.

7.5 Information disclosure process

Public disclosure is a continuous process. LBPL has initiated the process through the IEE study.

During the IEE preparation process BCAS undertook several Stakeholder Consultations. The public consultations conducted to date have thoroughly covered the issues related to environmental and social issues which allowed all proposed measures to be developed with sufficient input from the affected stakeholders, using the mechanism of participatory, inclusive and informed consultation.

In this process, and in addition to the environmental studies, a socio-economic study was undertaken through the questionnaire-based survey over the same impact zone of 5 kilometer radius from the project site. The stakeholder's consultations took place in October and November 2013. During this period the participation was ensured through assistance from the local administration, local politicians and other community leaders. Personal communication with all the major groups to attend these meetings was undertaken by BCAS. This was effective due to the neutrality of BCAS.

The following table shows the type of stakeholders consulted during this period.

Table 7.2: List of Stakeholders for information dissemination and disclosure

Sl. no	Stakeholder	Issues and concerns discussed
1.	District Administration a) TNO b) Upazila Chairman c) Ward Counselor (Consultation date: 10 th January 2014)	The District Administration and the elected member of the local Government were of the general opinion that the project will abate the power crisis in area to great extent. The group was of the opinion that LBPL should employ as many people as possible from the locality during the construction phase and the operation phase
2.	Farmers living within 2km radius of the project location	FGD was held with the group in the area during socio-economic survey. The people's concerns were recorded on the household level. One formal meeting took place to discuss all issues/impacts resulting from the project. During the surveys the environmental issues were communicated to the stakeholders. The major concern was the environmental aspect of the project and how it may affect their lives.
3.	Women Group (Consultation date: October-November 2013)	FGD was held with the women group during the socio-economic survey. They were of the opinion that during such project implementation in the past their family members were not employed especially during the construction period.
4.	Business community (Consultation date: October-November 2013)	In the FGD with this community they expressed optimism about the project in terms of continuous electricity supply this project may contribute to improve their Business community productivity. However they expressed their concerns about the environmental concerns as the location of the plant is just outside the city of Comilla.
5.	NGO's (Consultation date: October-November 2013)	This group was present during the formal consultation meeting. Meaningful community development for the people in the affected areas was demanded.
6.	Local Elite, Journalists, School Teachers (Consultation date: October-November 2013)	This group generally expressed optimism for the potential of improved electricity access to the households in the area for poverty alleviation. However, there were concerns about the environmental impact aspects of the project and that proper mitigation steps must be ensured.
7.	Comilla City Corporation (January 2014)	• There is no drainage system beside the proposed power plant at Jangalia of City Corporation • According to our city plan this zone is considered as mixed(commercial and residential) zone • Such kind of power plant will help to develop the national economy and will develop our socio economic condition • Power crisis is very much acute in our country, therefore we appreciate the entrepreneur who has taken this initiation Interview were conducted with the following personnel: 1. Engineer Rafikul Islam Executive Engineer Comilla City Corporation(CoCC) Cell: 01913-150505 2. Md. Abdul Malek Ansary Ward Councilor, 22 No. Ward Comilla City Corporation Cell No.: 01711322669 3. Sheikh Md. Nurulla Executive Engineer Comilla City Corporation

Sl. no	Stakeholder	Issues and concerns discussed
		Cell No.: 01711152297 4. Mrs. Tamana Binte Rahman Town Planner Comilla City Corporation Cell No. : 01716 480249 Email: tamanna2003@gmail.com
8.	Bakhrabad Gas Distribution Company Limited (January 2014)	Now -a -days the gas crisis is very high even in Comilla city corporation area because of, the EPZ expended the industrial zone every day by day which is run by the gas only. Therefore, further allotment of a new industry depends on gas which will not get the gas connection in future. Contact person : Mr. Jashim Uddin, GM Planning, Bakhrabad Gas Distribution Company Limited.
9.	Comilla Victoria College (January 2014)	It is good news to set up a power plant in Comilla. Many people will get job facilities and it will contribute the national economy I think it will not impact the surrounding environment and health. If sound pollution become high than you should take mitigation measures. Contact persons as below: Md. Mosarraf Hossain Bhiyan Associate Professor Sociology department, Comilla Victoria University College Cell No.: 01819-416536 Md. Asaduzzaman Assistant Professor Sociology Department, Comilla Victoria University College Cell No.: 01711-106836 Tapan Bhattacharjee Assistant Professor Sociology Department, Comilla Victoria University College Cell No.: 01711-985892 Md. Mafizul Islam Associate Professor English Department, Comilla Victoria University College Cell No.: 01711-985892
10.	Bangladesh Power Development Board(BPDB), Comilla (January 2014)	Government is trying to increase electricity production and set up more power plants in this country. To face the power crisis, government is going to purchase electricity from India and Nepal and invited the private sector to setup more power plants. Such kind of power plant will help to develop the national economy. Contact person: 1. Engineer Mrinal Kanti Sen Executive Engineer, PDB, Comilla Cell No.: 2. Sheikh Kawsar Masum Sub Divisional Engineer PDB, Comilla Cell no.: 018411-21234, 01711-866737 3. Mr. Akhter Hossain Divisional Accountant PDB, Comilla Cell No.: 01716-575738

Sl. no	Stakeholder	Issues and concerns discussed
		4. Mr. Shafikur Rahman Sub Assistant Engineer PDB, Comilla Cell No.: 01558321035
11.	Bangladesh Agricultural Extension (BAE) (January 2014)	Bangladesh Agricultural Extension Department The discussion was held on the land use type of the area. The land use map which was prepared for this project by BCAS was shared and they agreed on the accuracy on the map. Additionally, they were of the opinion that more irrigation pumps could be electrified due to power generation in the proposed plan. 1. Liton Lal Goswami Assistant Agricultural Extension Officer Comilla Upazilla Sadar South Cell No.: 01912-926151 2. Mrs. Sabina Yasmin AEO Comilla Upazilla Sadar Dakkin Cell No. : 01819477984 3. Mr. Masumur Rashid SADPO Comilla Sadar Dakkin Cell No.: 01558-3027709 4. Mr. Ayub Mondal Upazil Agriculture Officer Comilla Upazila Sadar Dakkin Cell: 01818-865179
12.	Fire Service and Civil Defense of Comilla Sadar Dakkin (January 2014)	Fire disaster can be occurred in any industry. We always keep our force ready to move to any place. Never had we faced any power plant disaster but we will consider your plant safety in top priority. They are willing to provide training on fire prevention to the staff of LBPL. Contact Person: 1. Mr. Rezaul Karim Station Officer Fire Service and Civil Defense Department Comilla Upazilla Sadar Dakkin Cell No.: 01720-810848 2. Md. Jashim Uddin Leader Fire Service and Civil Defense Department Comilla Upazilla Sadar Dakkin Cell No.: 01745-666930 3. Md. Alamin Fireman Fire Service and Civil Defense Department Comilla Upazilla Sadar Dakkin Cell No.: 01727-934898 and Station Number: 01556-410510

Chapter-8

GRIEVANCE REDRESS MECHANISM

8.1 Grievance Redress Mechanism

The objective of a grievance redress procedure is to ensure all comments and complaints of any stakeholder, including local/regional authorities, residents of nearby residential areas, LBPL employees and other interested parties, are acknowledged and responded to within a reasonable timeframe.

LBPL will accept all comments and complaints associated with the project. The comments and complaints will be summarized and listed in a Complaints/Comments Log Book. Any person or organization may send comments and/or complaints in person or via post, email or facsimile using the contact information.

All comments and complaints will be responded to either verbally or in writing, in accordance with preferred method of communication specified by the complaint in the Comments and Complaints Form. All grievances will be registered and acknowledged within 5 days and responded to within 20 working days. LBPL will keep a grievance log and report on grievance management, as part of half-yearly project progress reports, available at LBPL website and on request at the plant office

8.2 Stakeholders Engagement Plan

LBPL stakeholder's engagement will take place in a variety of contexts, and using a range of vehicles. Against this background, engagement will include consultation, joint planning, capacity building, partnerships, community-based monitoring and reporting. **Table 8.1** presents the scope and duration of existing and planned stakeholder engagement initiatives.

Table 8.1: Stakeholder engagement plan

Engagement vehicle	Stakeholders Involved	Engagement Tools	Duration of Initiatives	Frequency of structured meeting/consultation
Public liaison Committee	All stakeholders in the project impacted (direct and indirect) area	Interaction between Stakeholder Liaison Officer, LBPL and representatives of stakeholders.	Life time of the project	Half-yearly
Community Development Plan	Communities in the project impacted area	Stakeholder Liaison Officer, LBPL	Life time of the project	Half-yearly
Community Health Safety Plan	Communities in the project impacted area	Stakeholder Liaison Officer, LBPL	Life time of the project	Quarterly
Corporate Communication Programme	All stakeholders	Corporate Communication Manager, LBPL	Life time of the project	Half-yearly
Grievance Management Mechanism	Directly/indirectly affected stakeholders	Stakeholder Liaison Officer and Corporate Communication Manager, LBPL and representatives of stakeholders.	Life time of the project	Quarterly

8.3 Resources and Responsibilities

To ensure proper caring on grievances raised by stakeholders the resource and responsibilities to be allocated in two levels as are mentioned in the following sections:

8.3.1 Plant Level Resource and Responsibilities

Management of LBPL will have dedicated persons to play the role of Stakeholder's Liaison Officer at Plant site. He will have the overall responsibility for handling the consultation and information disclosure process, including:

- Organization of consultation process,
- Communication with identified stakeholder groups
- Collecting and processing comments/complaints,
- Responding to any such comments and complaints, and
- Depending on the nature of a comment/complaint, some comments/complaints will be provided to the appropriate person in the company for a response.

8.3.2 Corporate Level Resource and Responsibilities

As a senior representative of LBPL will play the role as required at the corporate level in dealing with addressing stakeholder's consultation. He is expected to review the findings/observations forwarded to plant level and who will be responsible for implementing the decisions.

Table 8.2: Contact detail of resource persons

Level	Name of the person and tentative title	Phone	e-mail
Plant level	Mr. N. Sivakumar Stakeholder's Liaison Officer	8802-8410330	nskumar@lakdhanavi.net
Corporate level	Mr. A.B Siddique, Corporate Communication Manager	8802-8418513	absiddique1954@gmail.com

8.4 Reporting

There is requirement of two tiers reporting as are discussed briefly in the following section.

8.4.1 Internal Reporting

Local reporting relevant to the stakeholder's engagement will be undertaken under the corporate Communication Programme. At a corporate level, implementation of stakeholder's engagement plan will be reported in Annual Reports and in other relevant corporate documentation.

Management reporting on the stakeholder's engagement will take place through the Stakeholder's Liaison Officer. The Corporate Communication Manager will receive a quarterly report on engagement activities.

8.4.2 External Reporting

External Reporting means the reporting requirement for external client including funding agency, government and other regulatory bodies and so on. LBPL will provide stakeholders Engagement Report to

them according to the requirement of them. Corporate Communication Manager is expected to manage the external reporting requirement also.

Chapter-9

SOCIO-ECONOMIC STUDY AND IPSA REPORT

9.1: Socio economic study

In order to assess the baseline conditions of the population living within the air-shed of 5 kilometers from the Project site, a socio-economic questionnaire survey of 120 families was carried out. The 120 families represent a sample of the total households which were covered by the baseline survey carried out by BCAS during October-November 2013.

Study Methodology

The methodology for the social baseline study included different methods and tools, as follows:

- Collection of Secondary Data through literature survey;
- Sample-based household survey of 120 HHs;
- Focus Group Discussions (FGD) with day labourers, women groups and the land owners who have lost the land to the power plant project; and
- Consultations with project affected persons, representatives of the local elite, local government, local administration and chairman of the local union parishad (the local government administration and members of the Union parishad).

Secondary data on demographic and socioeconomic issues of the study area have been collected from various sources including the population census of Bangladesh Bureau of Statistics (BBS) and from Upazila level offices and Ward Council.

Household Survey

For the purposes of the household survey, the overall impact area of the Project was divided into two zones, namely: high impact zone and low impact zone. The geographical area within a radius of 1km to 5km from the power plant site has been defined as the low impact zone and the area within 1 km radius is considered as high impact zone. The HH baseline survey was carried out in the high impact zone.



Photo 9.1: Field Enumerator at the Respondent Premises

Coverage of the survey

Altogether 13 villages have been covered by the survey of which 8 villages are from high impact zone, 5 villages from the low impact zone. 72 households are considered from high impact zone, and the rest are from low impact zone, amounting in total to 120 households surveyed in all the impact areas.

The complete lists of all households located in 13 villages have been prepared to generate sampling frame of the study population. The sampling frame has enumerated from the households of 13 villages. Based on the sampling frame, a total of 120 households have been randomly selected from the study villages. Each sample household has been interviewed by a Field Investigator and data/ information has been gathered from the sample households using a questionnaire (refer to Annex 12).

Data Processing and Analysis

Survey data have been processed and analyzed using SPSS package programme. Statistical outputs such as one way and two-way tables and descriptive statistics including mean, median, and percentage have been calculated for interpretation of results obtained from survey data.

Introduction:

For the purposes of the household survey, the overall impact area of the Project was divided into two zones, namely: high impact zone (0.6km) and low impact zone (0.4km). The geographical area within a radius of 1 km from the power plant site has been defined as the impact area. 72 households are considered from high impact zone and 47 households are from low impact zone amounting in total to 119 households surveyed in all the impact areas.

Detailed Household survey results in the project area are given below:

Socio-Demographic Characteristic of the Project Area

i) Household size and Sex-ratio

According to the household survey, the average household size is 5.5 (i.e. the average number of persons per household). The average household size ranges from 5.5 in the high impact zone to 5.6 in the low impact zone (Table-9.1). Overall, the average household size in the Project area is higher than the national average household size which is 4.9 persons (BBS, 2006).

Table 9.1: Average Family Size and Sex Ratio of Household Members by Study Area

Study Area	Average Family Size (number)	Sex Ratio
High	5.5	113.9
Low	5.6	116.4
All	5.6	114.9

Males and females constitute 53.5% and 46.5% respectively of the population in the study area. The average sex-ratio in the project area is 114.9, which indicates prevalence of male population in the study area. The national sex-ratio was found to be 103 according to the population census of 2001. The sex-ratios do not reflect any significant variations among the two impact zones covered by the survey (Table-9.2).

Table 9.2: Sex Distribution of Household Members by Study Area

Study Area	Percentage		
	Male	Female	Total
High	53.2	46.8	100.0
Low	53.8	46.2	100.0
All	53.5	46.5	100.0

ii) Age Distribution of the Population

Age distribution of the population obtained from survey data shows that 3.5% of the population is children (0-4 years), 21.8% are adolescents in the 5-14 years old group, 35.4% are 15-30 years of age, 22.6% are of age 31-45, 10.2% are of age 46-60 and the remaining 6.5% are above 60 years. The age structure of the population is marked by more or less a similar pattern in the three impact zones under the study area (Table-9.3).

Table 9.3: Age Distribution of Household Members by Study Area

Age Group (Year)	Percentage		
	High	Low	All
Up to 4	3.5	3.4	3.5
5-14	21.0	23.1	21.8
15-30	35.8	34.8	35.4
31-45	20.5	25.8	22.6
46-60	12.2	7.2	10.2
Above 60	7.0	5.7	6.5
Total	100.0	100.0	100.0

iii) Educational Status

1.1% of the population in the study area is illiterate. 9.0% of the population can sign their name, although they can neither read nor write. The population having primary level education (upto 5 years of schooling) and secondary level education (up to 10 years of schooling) are 25.9% and 32.5% respectively. Based on the data collected from the socio-economic survey, 18.5% of the population has a Secondary School Certificate (SSC) and higher academic attainment. It has been found that 5.7% of population has higher academic degrees in the high impact zone (refer to Table-9.4).

Table 9.4: Educational Status of Household Members by Study Area

Educational Status	Percentage		
	High	Low	All
Illiterate	1.6	0.4	1.1
Can sign only	9.1	8.8	9.0
Primary	28.3	21.9	25.9
Secondary	30.1	36.2	32.5
S.S.C and equivalent	15.8	22.8	18.5
H.S.C and equivalent	9.4	9.2	9.3
Degree and above	5.7	0.7	3.7
Total	100.0	100.0	100.0

iv) Occupation and Employment

People in the villages surveyed are engaged in different types of primary and secondary occupations such as farming, wage labour, business, services (governmental and non-governmental), fishing, household work, overseas employment, carpenter/ blacksmith, rickshaw/ van driving etc. The survey reveals that the highest percentage (26.6%) of the workforce are engaged in household work (such as cooking, cleaning and other general domestic activities) followed by other occupations including agriculture/farming (1.0%), business (14.4%), overseas employment (2.1%), and services (9.4%). However, other occupations such as carpenter, blacksmith, and handicrafts constitute a smaller section of the working population which is 2.5. Students comprise 40.4% of the population in the study area. Apart from academic activities (students), farming, household work, and wage labour constitute the main occupations in all the impact zones (Table-9.5).

Table 9.5: Primary Occupation of Household Members by Study Area

Primary Occupation	Percentage		
	High	Low	All
Service	11.3	6.4	9.4
Business	12.7	17.0	14.4
Agriculture	1.3	0.4	1.0
Household work	26.7	26.4	26.6
Work in abroad	2.7	1.3	2.1
All type of mistri	2.2	1.3	1.8
Driving	1.6	2.1	1.8
Student	38.5	43.4	40.4
Others	3.0	1.7	2.5
Total	100.0	100.0	100.0

v) Land Use pattern:

Agricultural cultivable land accounts for 35.7% in the Project area. A small area is occupied by fallow land. There is no mineral concession or forest reserve in a close vicinity of the plant site.

Populated area comprises 56.3% of the surveyed area and consists of homesteads and vegetation predominantly represented by indigenous fruit-bearing trees. Each homestead has a subsistence garden where seasonal vegetables and spices are grown for the purposes of domestic consumption (Table-9.6).

Table 9.6: Percentage Distribution of Land by Different Use pattern

Pattern	Study Area		
	High	Low	All
Homestead	55.9	57.0	56.3
General garden/bamboo bushes	0.2	-	0.1
Agricultural land	31.9	42.2	35.7
Pond/Ditch	12.0	0.8	7.9
Total	100.0	100.0	100.0

According to the household survey, about 8.4% of household land is allocated for the cultivation of crops. Other types of household land use include: 85.5% for homestead, 5.3% and 0.08% for pond/ditches and general garden respectively. The proportion of household land occupied by bushes/jungles and fallow land is relatively small (Table-9.7).

Table 9.7: Percentage Distribution of Households Surveyed by Different Uses Pattern of Land

Pattern	Study Area		
	High	Low	All
Homestead	82.8	90.0	85.5
General garden/bamboo bushes	1.2	-	0.8
Agricultural land	8.6	8.0	8.4
Pond/Ditch	7.4	2.0	5.3
Total	100.0	100.0	100.0

The land use patterns among the different impact zones are very different. 82.8% households have homestead land in the high impact zone and 90% have homestead land in low impact zone respectively (Table-9.7). There are only 8.6% households that have agricultural land in the high impact zone.

vi) Household Land Ownership

According to the survey, the average size of land plot owned per household is 12.0 decimal in the Project area. There is a wide variation in the size of household land plots among the different impact zones. It is 11.1 decimals in low impact area and 12.5 decimals in high impact area. See details in Table-9.8.

Table 9.8: Average Land Size of Households Surveyed by Study Area

Study Area	Average Land Size (decimal)	Standard Deviation (decimal)
High	12.5	16.1
Low	11.1	18.0
All	12.0	16.8

vii) Share-cropping/Leasing of Land

The survey reveals that share-out agricultural land is 66.7 decimal and 70.0 decimal share-in agricultural lands for cultivation. The average leasing-out agricultural land has been found to be 59.2 decimal respectively in the study area (Table-9.9).

Table 9.9: Average Land Size by Share Cropping/Leasing Land of Households

Type of Land	Decimal					
	High		Low		All	
	Average	Std. Deviation	Average	Std. Deviation	Average	Std. Deviation
Share in	80.0	-	60.0	-	70.0	14.1
Share out	66.7	23.1	66.7	35.0	66.7	30.0
Lease in	-	-	-	-	-	-
Lease out	66.0	35.8	52.4	18.7	59.2	27.8

The Table-10 shows that 9.3% households (i.e. the total share-in and share-out figures) are engaged in share cropping with 1.7% are involved in share-in and 7.6% are in share-out. 8.4% households are engaged in leasing-out of land. 1.4% households from the high impact zone and 2.1% households from the low impact zone are engaged in share in. 6.9% households from the high impact zone engaged in leasing in of land (Table-9.10).

Table 9.10: Percentage Distribution of Households by Share Cropping/Leasing Land

Type of Land	Percentage		
	High	Low	All
Share in	1.4	2.1	1.7
Share out	4.2	12.8	7.6
Lease in	-	-	-
Lease out	6.9	10.6	8.4

viii) Sources of Irrigation

Different crops are grown with irrigation water from various natural water sources including canals, beels (lakes), ponds and rivers. Boro paddy is the dominant crop grown with irrigation water. Beels and rivers are the main sources of irrigation. Beels and rivers have the percentage of sources of irrigation water for 66.7% households during Aman. River, khal (canal), pond are used as a source of irrigation by relatively small percentages of the households. Rain water well covers 100% of the irrigation water for the dry season crop such as Boro.

Meanwhile, beels and rivers contribute 25.0% during Aman season in the high impact zone (Table-9.11).

Table 9.11: Percentage Distribution of Households Surveyed by Source of Irrigation by Type of Crops

Crops	Source
-------	--------

	High		Low		All	
	River/khal/ pond/beel	Rain water	River/khal/ pond/beel	Rain water	River/khal/ pond/beel	Rain water
Aus	-	-	-	-	-	-
Aman	25.0	75.0	50.0	50.0	33.3	66.7
Boro	-	100.0	-	-	-	100.0

Table 9.12: Average Irrigation Land Size of Households by Rabi /Kharif Crops

Crops	Average Irrigation Land Size (decimal)					
	High		Low		All	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Aus	-	-	-	-	-	-
Aman	-	-	-	-	-	-
Boro	80.0	-	-	-	80.0	-

It is found from the household survey that an average of 80.0 decimal of the Boro crop land is under irrigation. Irrigation is more extensive in the case of Rabi crops (dry season) than the kharif season (Table-9.12).

ix) Household Income and Expenditure

According to the survey, average annual income per household is Taka 239,365 in the study area. Average annual household income differs among the different impact zones. It is Taka 240,118 in high impact zone followed by Taka 238,211 in the low impact zone. See details in Table-9.13. The average annual expenditure per household is Taka 179,815 for the three impact zones.

Table 9.13: Average Annual Income and Expenditure Per Household by Study Area

Study Area	Average Annual Income Per Household (Tk.)	Average Annual Expenditure Per Household (Tk.)
High	240118	181116
Low	238211	177823
All	239365 (US\$ 2992)	179815 (US\$ 2248)

x) Sources of Household Income

The survey reveals that households derive their income from multiple sources including agricultural crops (rice and wheat), wage/salary-based occupations, business, livestock, remittances, etc.

Service is one of the major sources of livelihood accounting for 26.1% of household income in the study area, preceded by the largest income source – business - that contributes 51.8% to household income. Other sources are foreign remittance, wage labour and others contributing 6.3%, 2.3% and 2.5% respectively to household income.

The contribution of different sources to household income is marked by notable variations among the impact zones. Business, for example, contributes to more than 45.0% in the high impact zone. The contribution of services to household income varies between 31.0% and 18.4% in the high and low impact area respectively (Table-9.14).

Table 9.14: Percentage of Annual Income of Households from Different Sources

Source	Percentage		
	High	Low	All

Source	Percentage		
	High	Low	All
Rice/Wheat production	0.3	0.6	0.4
Service	31.0	18.4	26.1
Business	45.0	62.3	51.8
Livestock	1.5	0.5	1.0
Local remittance	0.5	0.5	0.5
Foreign remittance	8.2	3.4	6.3
All type of mistri	2.1	2.5	2.3
Driving	3.6	5.5	4.4
House rent	3.2	2.7	3.0
Tractor rent	1.3	2.4	1.7
Others	3.3	1.2	2.5
Total	100.0	100.0	100.0

xi) Income Distribution

The distribution of household income as obtained from the survey; reflect that about 0.8% of households in the study area have annual household incomes of around Taka 50,000. For 59.7% households the average annual household income is above Taka 200,000. 40.3% households belong to the average income range from Taka 50,000 to Taka 200,000. Among the different impact zones, high income households (above Taka 200,000 per year) are numerous in the low impact areas.

61.7% households in low impact area and 58.3% households in high impact area have average annual income of more than Taka 200,000. 38.3% of households in low impact area have an average income of less than Taka 200,000 (Table-9.15).

Table 9.15: Percentage Distribution of Households Surveyed by Total Annual Income

Total Annual Income (Tk)	Study Area		
	High	Low	All
Up to 50000	1 (1.4)	-	1 (0.8)
50000-100000	2 (2.8)	2 (4.3)	4 (3.4)
100000-150000	12 (16.7)	8 (17.0)	20 (16.8)
150000-200000	15 (20.8)	8 (17.0)	23 (19.3)
200000-250000	17 (23.6)	8 (17.0)	25 (21.0)
250000-300000	9 (12.5)	13 (27.7)	22 (18.5)
300000-350000	8 (11.1)	4 (8.5)	12 (10.1)
350000+	8 (11.1)	4 (8.5)	12 (10.1)
Total	72 (100.0)	47 (100.0)	119 (100.0)

Note: Figures within parentheses represent percentages

xii) Household Expenditure

Field survey shows the distribution of households incurring expenditure for different purposes such as food, clothing, education, health care, etc. Health care/medicines constitute the main cost item for the 98.3% households in the study area, followed by purchasing rice and wheat which is the predominant expenditure

for 100% households in all impact zones. 100% households also spend on purchasing fish, 100% households spend on buying pulses and 100% households expense accounts for meat. Vegetable/fruits also cover 100% households and 98.3% of household expenditure is for milk/eggs. 100% households in the study area spend on clothing, and 100% households pay mobile bills in the study area. 85.7% household's pay for the education facility, 100% households expend on the transport, 100.0% households spend on social entertainment and 52.9% households spend money on house construction/repairing. 98.3% households spend on the electricity/lighting and 23.5% households spend money on kerosene whereas 98.3% households pay out for fuel wood/straw/cow dung/biogas. In the study area, 5.0% of households retain waged labourers and 28.6% households expend for livestock forage and 31.1% households spend on other facilities. 33.6% of the households in the area have annual expenditure which exceeds Taka 200,000 (Table-9.16).

Table 9.16: Percentage Distribution of Households Surveyed by Total Annual Expenditure

Total Annual Expenditure (Tk)	Study Area		
	High	Low	All
Up to 50000	5 (6.9)	3 (6.4)	8 (6.7)
50000-100000	-	-	-
100000-150000	16 (22.2)	13 (27.7)	29 (24.4)
150000-200000	30 (41.7)	12 (25.5)	42 (35.3)
200000-250000	13 (18.1)	16 (34.0)	29 (24.4)
250000-300000	5 (6.9)	3 (6.4)	8 (6.7)
300000-350000	1 (1.4)	-	1 (0.8)
350000+	2 (2.8)	-	2 (1.7)
Total	72 (100.0)	47 (100.0)	119 (100.0)

Note: Figures within parentheses represent percentages

xiii) Economic Status

The analysis of the households' economic situation has been focused on accessibility and affordability of food, clothing, educational facilities, medical facilities, transport facilities etc.

With respect to availability of food, it is considered "satisfactory" by 64.7% of the households under the survey. Food availability is considered good by only 31.1% of the households and it is found unsatisfactory by another 4.2% of the households in the study area. The situation with respect to clothing is similar to that of food. As for housing /accommodation facilities, they are found satisfactory by 74.8% of the respondents, at the same time, 13.4% found them good and 11.8% of the respondents found them unsatisfactory. Educational facilities are considered good, satisfactory and unsatisfactory by 2.7%, 91.8% and 5.5% of the respondents, respectively. Medical facilities are quite small and generally considered unsatisfactory by the second highest percentage (29.4%) of the respondents, followed by entertainment facilities which are considered unsatisfactory by 30.8% of the respondents in the study area. However, transportation facilities were scored as satisfactory by 88.2% of the respondents, while 11.8% considered them as unsatisfactory respectively (Table-9.17). Among the two impact zones, medical facilities are considered unsatisfactory by the highest percentage of the respondents (27.7%) in the low impact area.

Table 9.17: Economic Status of Households (All)

Sector	Percentage			
	Good	Satisfactory	Unsatisfactory	Total
Food availability	31.1	64.7	4.2	100.0
Clothing	17.7	77.3	5.0	100.0
Accommodation/houses	13.4	74.8	11.8	100.0
Educational facilities	2.7	91.8	5.5	100.0
Medical facilities	1.7	68.9	29.4	100.0
Transport facilities	-	88.2	11.8	100.0
Entertainment	1.7	67.5	30.8	100.0

xiv) Household Ownership of Livestock

Households in the study area are engaged in the rearing of different types of livestock and poultry to support their livelihoods and income. Majority of the households (16.8%) in the study area own one or more cows. Rearing of poultry birds is practiced by 68.9% households. Other types of livestock are owned by relatively few households. Goat rearing, for example, has been reported by 4.2% households. Only a small number of households keep pigeons (19.3%).

Of the two impact zones, rearing cows and poultry is more prevalent in the high impact. Rearing cow and poultry has been reported by 19.4% and 69.4% households respectively in the high impact zone. This is shown in Table 9.18.

Table 9.18: Percentage Distribution of Households Surveyed Having Different Livestock by Study Area

Livestock	Study Area		
	High (n=72)	Low (n=47)	All (N=119)
Cow	19.4	12.8	16.8
Goat	6.9	-	4.2
Duck/Poultry	69.4	68.1	68.9
Pigeon	20.8	17.0	19.3

xv) Involvement with NGOs/CBOs

About 13.4% households in the study area are involved with non-governmental and community-based organizations (NGOs/CBOs) through various activities, predominantly such as soft loans/ micro-credits. Among the two impact zones, around 12.5% of the households are involved with NGOs in the high impact zone whereas 14.9% in the low impact zone (Table-9.20).

Table 9.20: Percentage Distribution of Households Surveyed Having Family Member Involvement in NGOs/CBO

Study Area	Yes	No	Total
High	9 (12.5)	63 (87.5)	72 (100.0)
Low	7 (14.9)	40 (85.1)	47 (100.0)
All	16 (13.4)	103 (86.6)	119 (100.0)

Note: Figures within parentheses represent percentages

xvi) Household Access to Credit Facilities

The survey shows that 27.3% households have taken loan from the bank. NGOs are the major source of crediting in terms of the number of loan recipients. Of the total number of household that had access to credit, 31.8% have received loan from NGOs, 2.3% from money lenders and 38.6% from relatives (Table-9.21).

Table 9.21: Percentage Distribution of Households Surveyed by Sources of Loan

Sources of Loan	Study Area		
	High	Low	All
Bank	28.0	26.3	27.3
NGOs	32.0	31.6	31.8
Money lender	4.0	-	2.3
Relatives	36.0	42.1	38.6
Total	100.0	100.0	100.0

xvii) Household Stock of Durable Assets

Households, to a various extent, possess different assets and appliances such as bicycle, car, motorcycle, furniture, refrigerator, television, radio, computer, boat, tube-well, power tiller-tractors, water lifting pump, VCD, fishing net etc.

The survey shows that 96.6% households possess furniture. However, 96.6% have at least a mobile set and T.V. is owned by 98.3%. Bicycle, motor cycle and computer are possessed by 14.3%, 25.2% and 16.8% households. Besides, radio and refrigerator are owned by 1.7% and 70.6% households respectively.

Households having a power tiller/tractor are 6.7% in the project area. 67.2% of the households possess a tube-well in their back yard. This is shown in Table 9.22.

Table 9.22: Percentage Distribution of Households Having Different Durable Assets

Assets	High (n=72)	Low (n=47)	All (N=119)
Bicycle	15.3	12.8	14.3
Motorcycle	23.6	27.7	25.2
Furniture	95.8	97.9	96.6
Refrigerator	66.7	80.8	70.6
T.V	98.6	97.9	98.3
Radio	1.4	2.1	1.7
Computer	16.7	17.0	16.8
Mobile set	94.4	100.0	96.6
Power tiller/Tractor	4.2	10.6	6.7
Tube well	66.7	68.1	67.2
Fan	5.5	10.6	7.6
Others	4.2	6.4	5.0

xviii) Housing Structures

Housing structures in the project impact area are of different types in terms of construction materials used. Most of the housings (48.3% HH) are built from tin-roof with brick wall and brick floor. Housings with tin roof, tin wall and brick floor come next accounting for 18.3% of all HHs. 15.7% of the structures comprise tin-roof with tin wall and earthen floor. Besides, buildings account for 14.7% of the HHs which are generally owned by the groups with better economic status. Thatched structures constitute 2.0% of all housings in the Project impact area (Table-9.23).

Table 9.23: Percentage Distribution of Households Surveyed by Housing Structure

Housing Structure	Study Area		
	High	Low	All
Building	13.9	15.9	14.7
Brick floor+brick wall+tin roof	46.1	51.2	48.3
Brick floor+tin wall+tin roof	19.1	17.1	18.3
Earthen floor+tin wall+tin roof	18.3	12.2	15.7
Earthen floor+thatch wall+tin roof	1.7	2.4	2.0
Others	0.9	1.2	1.0
Total	100.0	100.0	100.0

Despite some variations, housing structures are predominantly of similar types in the two impact areas. Buildings constitute 15.9% of the structures in low impact area, 13.9% in the high impact area.

Household Energy Use

i) Energy for cooking

Households in the study area use different biomass resources including one or more of wood, tree branches, tree leaf, straw, dung etc for cooking purposes by the same household (HH). The percentage distribution of households using different biomass resources are: tree leaf (5.7%), tree branches (7.1%), wood (8.6%) and cow

dung (1.4%). The survey also reveals that the 76.5% and 0.7% of households use natural gas (LPG) and kerosene for cooking respectively.

Of the two impact areas, natural gas is used by the highest percentage of the households, in the high impact area (67.8%) and low impact area (92.0%). The percentage of the households using wood as a fuel is around 12.2% in the high impact area (Table-9.24).

Table 9.24: Percentage Distribution of Households Surveyed by Type of Fuel Used for Cooking

Type of Fuel	Study Area		
	High	Low	All
Natural gas	67.8	92.0	76.5
Wood	12.2	2.0	8.6
Tree branches	10.0	2.0	7.1
Tree leaf	7.8	2.0	5.7
Dung	1.1	2.0	1.4
Kerosene	1.1	-	0.7
Total	100.0	100.0	100.0

ii) Availability of Biomass Resources

The supply of biomass especially for cooking is increasingly constrained in the study area. According to the survey, supply of fuel wood is considered insufficient by 83.3% of the households while it is found to be sufficient by 16.7%. Availability of tree leaf, tree branches and dung are considered insufficient by 100% of the households. The supply of natural gas as fuel sources are considered sufficient by 69.4% of the households (Table-9.25).

Table 9.25: Percentage Distribution of Households Surveyed Showing Adequacy of Fuel Supply by type of Fuel for Cooking (All)

Type of Fuel	Adequacy of Fuel Supply		
	Sufficient	In-sufficient	Total
Wood	16.7	83.3	100.0
Tree branches	-	100.0	100.0
Tree leaf	-	100.0	100.0
Dung	-	100.0	100.0
Kerosene	-	100.0	100.0
Natural gas	69.4	30.6	100.0

iii) Energy for Household Lighting

Households depend on different energy sources for lighting, including kerosene, electricity, candle etc. Use of kerosene for lighting has been reported by 65.5% of the households in the study area. Electricity and candles are being used by 97.5% and 95.8% of the households, respectively (Table-9.26). About 74.8% households have charge light for lighting purposes. It is evident from the survey that a high percentage of the electrified households also use kerosene and candles for lighting as load shedding is a very common phenomenon in the study area.

Table 9.26: Percentage Distribution of Households Surveyed by Sources of Lighting

Sources of Lighting	Study Area		
	High (n=72)	Low (n=47)	All (N=119)
Electricity	95.8	100.0	97.5

Kerosene	58.3	76.6	65.5
Candle	95.8	95.7	95.8
Charge light	77.8	70.2	74.8

Survey of Environmental Issues

Environmental problems that are perceived by the respondents in the study area includes flash floods, diseases, poor sanitation, arsenic contamination of ground water, river bank erosion, water pollution, sedimentation of water bodies etc.

According to the survey, the most pressing problem is diseases in terms of the percentages of responses. Diseases have been mentioned by 57.1% followed by health and sanitation (18.5%), over population (2.5%), and arsenic contamination of ground water (0.8%). Besides, noise pollution, industrial pollution, water pollution has also been mentioned by 89.9%, 22.7% and 97.5% respectively. Other problems such as air pollution, burning fuel, trees and agricultural residues, deforestation have been mentioned with relatively low percentages (Table-9.27).

Table 9.27: Percentage Distribution of Households Surveyed Showing the Status of Environmental Problem (All)

	Status of Environmental Problem				
	No problem	Severe	Moderate	Low	Total
Water pollution	2.5	-	-	97.5	100.0
Air pollution	12.6	-	-	87.4	100.0
Industrial pollution	77.3	-	-	22.7	100.0
Burning fuel, trees and agriculture residue	74.8	-	-	25.2	100.0
Over population	16.8	-	2.5	80.7	100.0
Deforestation	99.2	-	-	0.8	100.0
River/canal bank erosion	100.0	-	-	-	100.0
Land erosion	100.0	-	-	-	100.0
Flash floods	100.0	-	-	-	100.0
Arsenic contamination	98.4	-	0.8	0.8	100.0
Sedimentation of water bodies	100.0	-	-	-	100.0
Health and sanitation problem	3.3	-	18.5	78.2	100.0
Disease	1.7	-	57.1	41.2	100.0
Noise pollution	10.1	-	-	89.9	100.0

With regard to the intensity of environmental problems, over population is categorized as a “moderate problem” by most of the respondents (4.2%) in the study area while it is viewed as “low problem” and “no problem” by 75.0% and 20.8% of the respondents respectively in the high impact zone.

Diseases are considered as “no problem” by 2.8%, “low problem” by 40.3% and “moderate problem” by 56.9% of the respondents.

Other environmental issues such as arsenic contamination and health and sanitation problem are considered as “moderate problem” by 1.4% and 25.0% of the respondents respectively (Table-9.28).

Table 9.28: Percentage Distribution of Households Surveyed Showing the Status of Environmental Problem (High)

	Status of Environmental Problem				
	No problem	Severe	Moderate	Low	Total
Water pollution	4.2	-	-	95.8	100.0

Air pollution	16.7	-	-	83.3	100.0
Industrial pollution	88.9	-	-	11.1	100.0
Burning fuel, trees and agriculture residue	75.0	-	-	25.0	100.0
Over population	20.8	-	4.2	75.0	100.0
Deforestation	98.6	-	-	1.4	100.0
River/canal bank erosion	100.0	-	-	-	100.0
Land erosion	100.0	-	-	-	100.0
Flash floods	100.0	-	-	-	100.0
Arsenic contamination	98.6	-	1.4	-	100.0
Sedimentation of water bodies	100.0	-	-	-	100.0
Health and sanitation problem	5.6	-	25.0	69.4	100.0
Disease	2.8	-	56.9	40.3	100.0
Noise pollution	13.9	-	-	86.1	100.0

Sources of Water Pollution

Respondents attribute water pollution to different sources including human waste, water transport, animal waste, siltation etc. Industrial waste has been identified by 15.1% of the respondents as a source of water pollution; other sources identified as low by the respondents include human waste (86.6%) and pollution from urban waste is 0.8% (Table-9.29).

Table 9.29: Percentage Distribution of Households Surveyed for Status of Water Pollution (All)

Source	Status of Water Pollution Problem				
	No problem	Severe	Moderate	Low	Total
Industrial waste	84.9	-	-	15.1	100.0
Human waste	13.4	-	-	86.6	100.0
Water transport	100.0	-	-	-	100.0
Chemical feature/personnel	100.0	-	-	-	100.0
Siltation	100.0	-	-	-	100.0
Animal waste	100.0	-	-	-	100.0
Pollution from up stream	100.0	-	-	-	100.0
Urban waste	99.2	-	-	0.8	100.0

Sources of Noise Pollution

Although noise pollution is not a widely mentioned problem in the study area, some respondents have attributed noise pollution to different types of vehicles that ply over the roads in the study area. 2.5% of the respondents attributed noise pollution to vehicles as moderate; construction work was identified as low problem by 21.8% respondents whereas 24.4% mentioned large-scale industries as the sources of noise pollution (Table-9.30).

Table 9.30: Percentage Distribution of Households Surveyed for Status of Noise Pollution Problem (All)

Source	Status of Noise Pollution Problem				
	No problem	Severe	Moderate	Low	Total
Vehicles	5.9	-	2.5	91.6	100.0
Big industries	100.0	-	-	-	100.0
Small industries	75.6	-	-	24.4	100.0
Construction work	78.2	-	-	21.8	100.0
Households sources (Generator)	100.0	-	-	-	100.0
Power supply (irrigation engine)	100.0	-	-	-	100.0
Commercial areas	100.0	-	-	-	100.0
Gas field	100.0	-	-	-	100.0

Sources of Air Pollution

Various sources which contribute to air pollution, identified as low problem by the respondents, include open defecation (49.6%), burning of fuel (29.4%), construction work (31.9%), brick field (0.8%) and vehicles (84.1%) (Table-9.31).

Table 9.31: Percentage Distribution of Households Surveyed for Status of Air Pollution Problem (All)

Source	Status of Air Pollution Problem				
	No problem	Severe	Moderate	Low	Total
Brick field	99.2	-	-	0.8	100.0
Vehicles	13.4	-	2.5	84.1	100.0
Construction work	68.1	-	-	31.9	100.0
Small industries	75.6	-	-	24.4	100.0
Big industries	100.0	-	-	-	100.0
Diesel engine	100.0	-	-	-	100.0
Commercial areas	100.0	-	-	-	100.0
Gas field	100.0	-	-	-	100.0
Burning fuel, trees and agriculture residue	70.6	-	-	29.4	100.0
Open defecation	50.4	-	-	49.6	100.0

Respondents' Awareness and Perception about the Proposed Comilla Power Project

i) Respondents' Awareness about the Project

The survey reveals that 100% respondents in the study area are generally aware and have heard of the project. The people received information about the project from the local Upazila office (local administrative office). However, most of the people have been aware about the project through the officers from the Bangladesh Power Development Board (BPDB). This is shown in Table 9.32.

Table 9.32: Percentage Distribution of Households having knowledge about the Proposed Comilla Power Project

Study Area	Yes	No	Total
High	72 (100.0)	-	72 (100.0)
Low	47 (100.0)	-	47 (100.0)
All	119 (100.0)	-	119 (100.0)

Note: Figures within parentheses represent percentages

ii) Project Affected People

The sample survey of households in the Project impact area that 70.6% households included in the sample survey will be significantly affected by the project. The remaining 29.4% households were not expected to be exposed to any negative impacts (Table-9.33).

Losses would primarily be incurred by the affected households due to acquisition of existing crop land for the power plant. The affected groups include owners of crop land, share croppers, lease holders, agricultural wage earners etc.

Table 9.33: Percentage Distribution of Households Surveyed Personally Affected due to the Project

Study Area	Yes	No	Total
High	53 (73.6)	19 (26.4)	72 (100.0)
Low	31 (66.0)	16 (34.0)	47 (100.0)
All	84 (70.6)	35 (29.4)	119 (100.0)

Note: Figures within parentheses represent percentages

iii) Respondents' awareness and perception of environmental aspects of the Project

Respondents' awareness and perception of environmental aspects of the project was assessed through specific questions during the survey. The environmental aspects covered in the questionnaire included: pollution and its sources (air, noise, water and industrial), arsenic contamination and its effects, health and sanitation issues and perceived environmental problems due to implementation of the project.

Although a separate public consultation was not held in relation to these aspects, it was carried out during the questionnaire survey as part of the social impact assessment throughout the entire study. It allowed meaningful consultation with affected people and other concerned stakeholders, facilitated their informed and gender inclusive participation; and was responsive to the needs of disadvantaged and vulnerable groups.

iv) Perceived Positive Impacts of the Project

Respondents also perceived that various benefits were expected to result from the implementation of the project. These benefits, as perceived by the respondents, include; creation of employment opportunity, access to electricity, access to roads, enhanced socio-economic conditions, availability of water for irrigation from the river through channels, overall national development, and reliable supply of electricity in the area.

According to the survey, creation of employment opportunities is perceived as a beneficial effect of the project 52.9% of the respondents. The implementation of the project will lead to national development, according to the opinion of 63.9% of the respondents. Enhanced socio-economic activities, access to road infrastructure, and reliable supply of electricity in the local area have been mentioned as positive outcomes of the project by 46.2%, 80.7% and 93.3% of the respondents respectively (Table-9.34). The project will also contribute to the business facilities and 65.5% of the respondents perceived that this demand is expected to be met as a result of the construction of power plants.

Table 9.34: Percentage Distribution of Households Surveyed Expecting Positive Impacts of Power Plant Project

Positive Impact	Study Area		
	High (n=72)	Low (n=47)	All (N=119)
More employment opportunity	61.1	40.4	52.9
Access to electricity	70.8	66.0	68.9
Access to infrastructure road	83.3	76.6	80.7
More local socio economic activities	55.5	31.9	46.2
Availability of irrigation water	1.4	-	0.8
National development	65.3	61.7	63.9
Reliable supply of electricity in the area	95.8	89.4	93.3
Business facilities	63.9	68.1	65.5
To build school/madrassa	52.8	40.4	47.9
To build college	72.2	63.8	68.9
To build technical school	19.4	17.0	18.5

To build health centre	44.4	27.7	37.8
Hospital	83.3	83.0	83.2
Community centre	37.5	34.0	36.1

v) *Expectation for Assistance from the Government/Project to Mitigate Losses*

In general, the Project Affected People have expressed their willingness to get assistance/help from the government and the Project sponsors as part of mitigation of the possible losses due to the project implementation. 30.0% of the households surveyed expect to gain employment at the power plant. 2.5% of the respondents would like the provision of health care (hospitals or doctor) in their area. 7.5% of the respondents would like to receive opportunities for business, whereas 10.0% expressed their wishes to receive better compensation for their land and crops (Table-9.35).

The respondents have expressed the need for various types of assistance from the government and the project. To mitigate their losses and restore livelihoods, creation of job opportunities by the Project has been given priority by the highest percentage of the survey respondents.

Table 9.35: Percentage Distribution of Households for different helps from the government or the project to make up the loss

Different Helps	Study Area		
	High	Low	All
To get accurate price	19.0	-	10.0
To manage job	19.1	42.1	30.0
Give opportunities for business	9.5	5.3	7.5
Supply electricity without load shedding	9.5	-	5.0
Build technical college/school/ college	4.8	15.8	10.0
To make road in pucca/repair road	19.0	10.5	15.0
Setup power plant without coal	14.3	5.3	10.0
Setup power plant in base of gas	4.8	10.5	7.5
Keep environment without pollution	-	5.3	2.5
Build hospital	-	5.2	2.5
Total	100.0	100.0	100.0

Morbidity in the Study Area

The survey has dealt with information on illnesses as experienced by the study population during the last twelve months. It has been found from the survey that the incidence of cold fever is very common among the study population. Cold fever responses came from more than 31.2% of all HH during the last year preceding the survey. Other diseases include diarrhoea 17.5%, gastric/ulcer 25.7%, skin diseases 1.0%, blood pressure 3.8% and jaundice (Hepatitis B) 7.9%. Cold fever responses came from around 30.6% of people in the low impact area and 31.6% in the high impact area (Table-9.36).

Table 9.36: Percentage Distribution of Households Surveyed for Affected People by Different Diseases

Name of Disease	Study Area		
	High	Low	All
Cold fever	31.6	30.6	31.2
Gastric/Ulcer	25.9	25.4	25.7
Diarrhea	17.1	18.2	17.5
Skin disease	1.3	0.6	1.0
Jaundice	6.6	9.7	7.9

Typhoid	7.0	5.2	6.3
Chicken Pox	1.8	4.5	2.9
Blood pressure	4.4	3.2	3.8
Diabetes	2.2	2.6	2.4
Others	2.1	-	1.3
Total	100.0	100.0	100.0

vi) Sources of Treatment

For the purpose of medical treatment, people in the study area depend on different sources including private practitioner, upazilla health complex, village physician, pharmacy, homeopath, kabiraj (traditional herbal physician) etc. The survey shows that pharmacy is the main source of treatment for 47.6% of the HH in the study area. Other sources of medical treatment services are private practitioner (28.9%), Upazila health complex (7.3%), kabiraj (15.0%) and others account 0.8% in the study area (Table-9.37).

Table 9.37: Percentage Distribution of Households Surveyed by Source of Treatment

Source of Treatment	Study Area		
	High	Low	All
No treatment	0.7	-	0.7
Medicine shop	50.0	44.2	47.6
Upazila health complex	7.0	7.7	7.3
Private practitioner doctor	29.6	27.9	28.9
Kabiraj	12.0	19.2	15.0
Others	0.7	1.0	0.8
Total	100.0	100.0	100.0

Pharmacy is the main source of medical aid in the high impact area which accounts 50.0%, while private practitioner doctor (27.9%) is the main source of treatment in the low impact zone. 0.7% of the people affected by illnesses has not received any treatment from any of the sources mentioned (Table-9.37).

vii) School Days Lost Due to Ailments

Many students in the study area fail to attend school due to various ailments. The survey reveals that each student, on average, has lost 29.4 school days during the past year. The number of annual school days lost is more for girls (19.4) than boys (17.4). The two impact areas are marked by a little variation in terms of school days lost per student during the last one year.

The average number of school days lost annually due to illness in the high impact area is 32.6 (Table-9.38)

Table 9.38: Average Annual School Days Lost due to Illness

Family Member	Average Annual School Days Lost due to Illness		
	High	Low	All
Boys	19.5	14.6	17.4
Girls	22.7	14.9	19.4
Both	32.6	24.8	29.4

The average number of working days lost due to illness is 26.5 per year. The loss of working days for male and female are 19.1 and 11.5 a year respectively. The loss of working days by males in the high impact area is 22.3, whereas it is 14.3 in the low impact area (Table-9.39).

Table 9.39: Average Annual Working Days Lost due to Illness

Family Member	Average Working Days Lost due to Illness		
	High	Low	All
Male	22.3	14.3	19.1
Female	13.6	9.1	11.5
Both	29.8	21.4	26.5

Conclusion:

This survey report gives a more in-depth insight into the urban population. The population is larger in the survey area, with the percentage of children being less in number as compared to the percentage being in the adolescent and old age group. The educational status in this area is much better than areas in the rural setting. There is a higher population of students who have achieved the higher secondary certificate. The primary occupation of the area comprises of business, services and overseas employment. Agricultural practices are minimal as compared to rural areas though they have better irrigation facilities. The household income is higher in the urban area as compared to rural areas. Likewise, the household expenditure in this area is more. Majority of the expenditure includes food, clothing, education and healthcare. The economic status of the people is far better than those living in the rural areas. The housing structure is better; availability of food, clothing, medicine, transport facilities is also very good. They also have better access to amenities and infrastructure such as sanitation, market, bus stand, school, drinking water etc. The health condition of the study area is far better than the rural area population. They suffer from fewer diseases and they have better accessibility to medicine facilities. The households in the study area have more access to electricity and also to natural gas along with other sources.

The environmental issues in the project area are not that severe as compared to rural areas. A very small percentage of the population in the survey area has problems with noise pollution. Pollution of any form is not a problem for the population in the area. The respondents' in the study area are far more aware about the project and they feel that the project will provide them with more employment opportunity. It is seen that the people in rural areas expect compensation for their lands rather than employment. When the average number of school days lost due to illness is compared with the rural population, it is seen that it is higher in the urban areas. Whereas, the number of working days lost is less in semi-urbanized study area than it is in rural areas.

9.2 Initial Poverty and Social Impact Assessment (IPSA)

1. Information on Project site

The 52.2 MW power plant dual fuel (HFO and natural gas) is situated at Jangalia, Comilla Sadar South upazilla under the Ward no. 22 of Comilla Sadar City Corporation in the district of Comilla. The geographical location is 91° 25' 73"E longitude and 23° 25' 27.63"N latitude. In the East, there is a rail line, a 100m wide pacca road, commercial establishment and settlement. The sub-station of the Power Grid Company Limited (PGCB) is in the South. The North and West side consists of agricultural land, wetland and settlement area. The distance from the nearby divisional headquarters in Chittagong is about 150 KM. For the purposes of the household survey, the overall impact area of the Project was divided into two zones, namely: high impact zone (0.6km) and low impact zone (0.4km). The geographical area within a radius of 1 km from the power plant site has been defined as the impact area.

2. Demographic Information

The current population in the project area is about 41000 people (Floating 40% and Permanent 60%). The population has increased over the years.

Table 9.40: The Previous population at least of last 10 years is given below.

Year	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Population (no. of people)	36000	32400	29160	26244	23620	21258	19133	17220	15498	13949

(The above figure made by discussion with Ward Counselor)

The project area is mostly Muslim dominant (about 99.5%) and the rest are Hindus. The number of families/households receiving government relief support as vulnerable group feeding (VGF) or other is 225. The tribal/indigenous composition of the community consists of only 10-12 family.

The occupation in the area comprises of farming, business and service. Majority of the people around 55% have their own business. About 30% of the people are involved in the service sector, 12% and 3% are involved in farming and foreign services respectively. Among the farmers, 25% are independent farmers and the rest 75% are lease holders.

The main income is generated from business about 50%. Foreign remittance and service contributes about 30% and 20% respectively to household income.

3. Existing condition of the Project

The project site has been found as vacant requiring no involuntary resettlement. The GOB has acquired the land after paying compensation as per GOB's Land Acquisition Act 1982.

Table 9.41: The name of land owners and their contact details:

SN.	Name of the farmer and Address	Contact No.
1	Mr. Saiful Amin Kachua Saw Mill Area 22.No Ward, Comilla City Corporation, Comilla Sadar South, Comilla	01711300139
2	Mr. Naser Ahmed Raj Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	01711159396

3	Mr. Mantaj Uddin Ramnagar 21 No. Ward, Jangalia, Comilla City Corporation, Comilla Sadar South, Comilla	01715906016
4	Abdul Halim 21 No. Ward, Jangalia Comilla City Corporation, Comilla Sadar South, Comilla	01715906016
5	Mr. Jahangir Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	01917892609
6	Mr. Sukumar babu Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	01917892609
7	Mrs. Afia Begum Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available
8	Mr. Khokan Mohan Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available
9	Mr. Ali ashraf Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available
10	Mrs. Sirin Sultana 21 No. Ward, Jangalia Comilla City Corporation, Comilla Sadar South	Not Available
11	Mr. Delwar and Associates 21 No. Ward, Jangalia Comilla City Corporation, Comilla Sadar South	Not Available
12	Mr. Abul Mia 21 No. Ward, Jangalia Comilla City Corporation, Comilla Sadar South	Not Available
13	Mr. Babul Hossain 21 No. Ward, Jangalia Comilla City Corporation, Comilla Sadar South	Not Available
15	Mr. Ratan Boumik Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available
16	Mr. Abul Bashar and Associates Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available
17	Mr. Zahirul Islam Doiara, 22 No. Ward Comilla City Corporation, Comilla Sadar South	Not Available

4. Accessibility to medical facility

For the purpose of medical treatment, people in the area depend on different sources including private practitioner, upazilla health complex, village physician, pharmacy, homeopath, kabiraj (traditional herbal physician) etc. The survey shows that pharmacy is the main source of treatment for 47.6% of the HH in the study area. There are 3 community health centres but the availability of the number of qualified doctors is nil. Maternal health care is arranged by the family planning and health centre which involves clinic or traditional midwifery.

5. Access to education

The educational facilities in the area are significantly good. There are 7 Primary school and 4 High schools in the project area. The names of the schools are given below.

Primary Schools

- i. Doiara Govt. Primary school
- ii. PDB Govt. primary school
- iii. Jangalia Govt. Primary school
- iv. Kachua primary school
- v. Sree Monthapur primary school
- vi. Gofinathpur govt. primary school
- vii. Puro Durgapur primary school

High Schools

- i. PDB govt. high school
- ii. Shatcore govt. high school
- iii. Arrabpur govt. Junior high school
- iv. Arrabpur govt. polytechnic school and college

6. Cultural heritage

The Cultural heritage of the project area is a priority. The area has a historic place, an army camp and airport which were used during 2nd World War. Apart from this there is an abandoned army camp. The area DOES not have any famous religious infrastructures, water body, forest or any nearby ecologically critical area (ECA).

7. Poverty Assessment

Poverty is a multi dimensional phenomenon and has many manifestations. It reflects a state of deprivation of people who suffer from food insecurity, poor health, lack of knowledge and skill, poor housing and do not have access to basic services and facilities. Reducing poverty or poverty alleviation is the key development challenge for Bangladesh, a country with a vast proportion of the population living below the poverty line.

In assessing poverty, two approaches – namely direct calorie in-take (DCI) method and cost of basic needs (CBN) method – are generally used for official statistics of the government. The use of CBN method for measuring poverty was introduced through the Household Income and Expenditure Survey (HIES) of 1995/96. DCI method, on the other hand, had already been in use as a measure of poverty. Over the years, the CBN method, has gained greater acceptance as compared with the DCI method. DCI method is based on food in-take only and DOES not take into account non-food consumption. The CBN takes into account both food and non food consumption as a basis of poverty reduction measures.

Under the CBN method, two poverty lines of expenditure/ income are estimated which are upper poverty lines (UPL) and lower poverty line (LPL). The people with consumption expenditure below the UPL are termed as ‘absolute poor’ and those below the LPL are categorized as ‘extreme poor’. The most common measure of poverty is the poverty ratio i.e. the percentage of the population below the poverty line also called the Head Count Ratio (HCR).

Poverty in the impact zone of the power project of Jangalia has been assessed based on the income and expenditure data collected at the household level under the socio-economic survey. As the district wise poverty series for rural is unavailable, the poverty line in Comilla district under Chittagong division from Household Income and Expenditure Survey for the year 2005 and 2010 has been taken as representative for the project impact area. Based on the adjusted poverty line the absolute poverty (population below the upper poverty line) for rural Chittagong division, however, has been adjusted for the year 2010 taking into consideration the general inflation rate.

According to the data available through the Household Income and Expenditure Survey (HIES, 2010) of Bangladesh Bureau of Statistics (BBS), 31.5% of the population were below the upper poverty line (UPL) nationally. The proportion of population below the lower poverty line (LPL) was 17.6 % in the same year (2010). The percentages of both categories declined in 2010 as against those in 2005 and 2000 (Table-40). People categorized as ‘absolute poor’ and ‘extreme poor’ accounted for 40.4% and 19.5% of the country’s population respectively in 2005 (Source: BBS, HIES-2005).

Poverty rates were found to differ across different regions or main administrative divisions of the country. The poverty rate (absolute poverty) in Comilla district under Chittagong administrative unit where the Project is located was 26.4% in 2010. In other words, poverty rate was 5.3% points lower in Chittagong division than that of the national rate. In the year 2000, national poverty rate had been 48.9% compared to 45.7% in the Chittagong division.

Table 9.42: Poverty rate (Percentage of the population below the upper poverty line)

Country/Division	2010	2005	2000
Bangladesh	31.5	40	48.9
Chittagong	26.2	34	45.7

Source: BBS, HIES-2010.

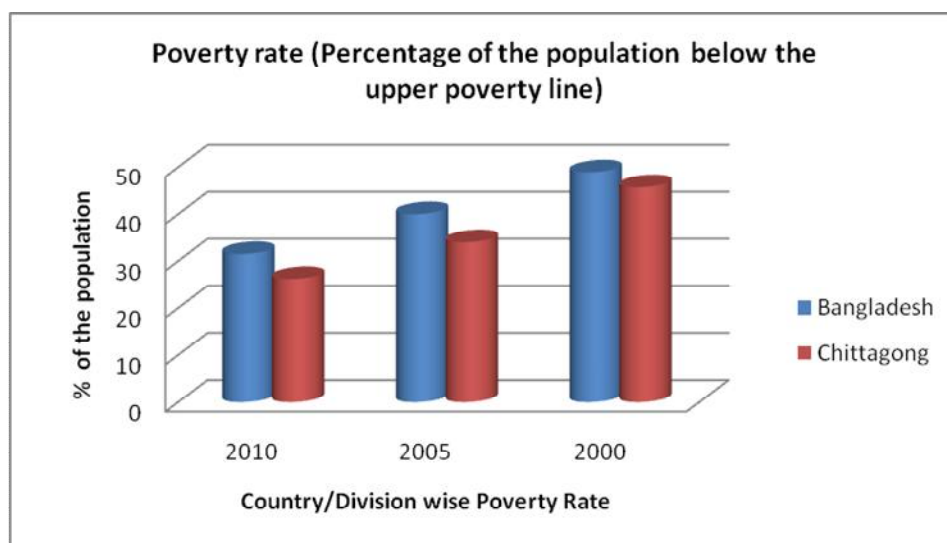


Figure 9.1: Poverty rate (Percentage of the population below the upper poverty line)

It is acknowledged that the compensation to people affected by the Project has to be sufficient to prevent exacerbation of the existing poverty levels.

The socio-economic and poverty assessment carried out within the surveyed area has revealed that the high incidence of poverty prevails among the independent agricultural labourers and the indigenous community with their income being lower than the national average level and as compared with the other communities in the region. The poor landless agricultural labourers affected by the project are entitled to compensation, and compensation for the agricultural labourer has been proposed to ensure a reasonable level of financial safety net. Since the land has been already acquired and handed over to BPDP and who has leased it to LBPL. It has to be assumed that all the compensations has been received by the land owners and daily labourers. There was no evidence of any dissatisfaction during the all the stakeholders meetings held during this study.

The project will make direct contribution to poverty alleviation by creating employment opportunities for local people both during the construction phase and operation phase. Small businesses may grow in and around the power plant. There may indirect impact if PGCB decides to increase electricity access to non electrified households and micro industries. This will increase productive activities and will contribute to better education and health care in household level.

Chapter-10

ENVIRONMENTAL MANAGEMENT PLAN

10.1 Environmental Management Plan

The primary objective of the environmental management plan (EMP) is to record the environmental impacts resulting from the project activities and to ensure implementation of the “mitigation measures” identified earlier in order to reduce adverse impacts and enhance positive impacts from specific project activities. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operation phase of the project.

The EMP should clearly mention:

- the measures to be taken during both construction and operation phases of the Project to eliminate or offset adverse environmental impacts or to reduce them to acceptable levels;
- the actions needed to implement these measures;
- a monitoring plan to assess the effectiveness of the mitigation measures employed.

Environmental management and monitoring activities of the proposed power plant Project could be divided into management and monitoring during:

- Pre-operation phase
- Operation phase
- Post-operation phase

10.1.1 Pre-operation Phase

The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring a regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected. The environmental management during the construction phase should primarily be focused on addressing the possible negative impacts arising from:

- generation and disposal of sewage, solid waste and construction waste;
- increased traffic;
- generation of dust (particulate matter);
- generation of noise.

The environmental management should also focus on enhancing the possible beneficial impacts arising from employment of local workforce for construction works. Table 9.1 summarizes the potentially significant environmental impacts associated with the pre-operation phase, mitigation measures and institutional responsibility.

Table 10.1: Potential impacts and mitigation measures at pre-operation phase

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
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Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
Influx of workers	Generation of sewage and solid waste	- Construction of sanitary latrines and septic tank system - Erecting “no litter” sign, provision of waste bins/cans, where appropriate - Waste minimization, recycle and reuse (as required) - Proper disposal of solid waste	EPC Contractors’ responsibility with LBPL oversight
	Possible spread of disease from workers	- Clean bill of health a condition for employment - Regular medical monitoring of workers	
Transportation of equipment, materials and personnel; storage of materials	Deterioration of air quality from increased vehicular movement, affecting people in the surrounding areas	Keeping vehicles under good condition, with regular checking of vehicle condition to ensure compliance with national standards and EHS guidelines (where applicable)	EPC Contractors’ responsibility with LBPL oversight
	Wind-blown dust from material (e.g. fine aggregate) storage areas	- Watering the access road - Sprinkling and covering stock piles - Covering top of trucks carrying materials to the site and carrying construction debris away from the site	
Site clearance	Topographic change by cutting existing trees, shrubs, herbs, and filling land	- Adopt such type design as is required minimum cutting of trees, shrubs, herbs, and low-land filling - Use waste shrubs, herbs as organic fertilizers - Adopt required measures to prevent waste shrubs, herbs as fuel to cook or for any localized burning purpose.	EPC Contractors’ responsibility with LBPL oversight
Noise from construction equipment operations and maintenance	Noise could exceed the allowable limit and result in hearing loss	- Avoiding, as much as possible, construction equipment producing excessive noise - Avoiding prolonged exposure to noise by workers - Creating a buffer zone by introducing green belt around the Project site - Follow construction scheduling to avoid evening and nighttime disruption	EPC Contractors’ responsibility with LBPL oversight

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
Dust during construction and exhaust gases from construction machinery and vehicles (particulate matter, PM_{2.5}, PM 10, NO_x, SO₂)	Increased SPM, PM 2.5, PM 10, NO _x , SO _x levels at construction sites, and surrounding areas	- Try to avoid using equipment such as stone crushers at site, which produces significant amount of particulate matter - Immediate use of construction spoils as filling materials - Immediate disposal/sale of excavated materials - Continuous watering of bare areas	EPC Contractors' responsibility with LBPL oversight
Fires, explosion and other accidents	Risk of human health and property damage	- Use of personal protective equipments during construction and maintenance. Prepare and implement safety and emergency manual. - Regular inspection of lines for faults prone to accidents. - Provision of fire protection equipments. - Provision of Lightning arrestors	EPC Contractors' responsibility with Environmental and Social Monitoring Unit (ESMU) oversight

10.1.2 Operation Phase

LBPL is fully responsible for overall environmental management during operation phase of the Project. In this regard it is expected that LBPL will establish Environmental and Social Monitoring Unit (ESMU) for ensuring effective environmental and social compliances.

The environmental management during the operation phase should primarily be focused on addressing the following issues:

- emission from the power plant
- generation of noise
- waste generation at the plant

Table 10.2 summarizes the potentially significant environmental impacts during operation phase, the measures needed to eliminate or offset adverse impacts and institutional responsibility.

Table 10.2: Potential impacts and mitigation measures at operation phase

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
Power Plants, Access Road & Transmission Line	Traffic and Transportation	• Prepare a traffic and transportation plan for the construction phase, which includes (but not limited to): • avoid the transportation of materials or machinery during peak traffic periods; • stick to agreed traffic routes, avoiding narrow roads and villages; • enforce local road and river traffic rules; • implementation of a safety program (signage, speed restrictions, lights on trucks, truck load restrictions etc.) within the construction area; • provide training on safe driving; • prevent unauthorised access (i.e. public access) to the construction site; • load trucks in accordance with legal requirements and cover transported materials to prevent them falling off during transit; and • maintain and/or repair any private and public highways that have been damaged by vehicles from the construction site. • Resolve potential river traffic navigation problems and construction of a jetty along the river bank. No significant increase in river traffic volume is anticipated. • A grievance mechanism established as part of a stakeholder engagement plan.	LBPL especially ESMU
Air emission Power generation	Emission from the power plant	• Installation of stack emission monitoring equipment for major pollutants • Planting of indigenous trees around the Project site	ESMU
	Generation of noise from generators and associated sub-stations, which could exceed 70 dB(A) at site boundary	• Locate facility 70–100 m from nearest receptor; • Use walls, fencing, and/or greenbelt to provide partial noise barrier • Provision of critical silencers or generators (if need arises) • Use of ear-muffs and ear-plugs by plant personnel working in the generator and turbine facilities of the plant	ESMU
	Suspended particulate matter (SPM) and PM _{2.5} , PM ₁₀ generation from the engine, which can adversely affect health	▪ Good combustion control, required stack height should also be maintained properly	ESMU
	NOx generation from the engine, which can negatively affect health	▪ Good combustion to maintain the dispersion as per modeling.	ESMU

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
	CO and VOC, which can negatively affect health	Good combustion to control CO, PM 2.5, PM 10, and VOCs;	ESMU
	Electro-magnetic wave or electrical interference, which may result in occupational health risk.	- All equipments should be grounded earthing with mesh system. - Power plant to sub-station should be connected by HT cable. - Power plant & substation site is away from the settlement. - No house is located in the immediate vicinity of the site.	ESMU
Occupational Health and safety	Solid wastes	- Apply the waste hierarchy and reduce, reuse or recycle wastes wherever possible. - Segregate wastes by types and provide appropriate waste containers for the storage of all waste streams. - Provide a specific area for the storage of solid hazardous wastes (i.e. batteries, fluorescent lighting tubes, used oil filters, aerosol cans etc.). - Prohibit the burning of wastes. - Arrange a waste removal contract and schedule at least weekly waste collections to prevent the build-up of waste materials. - Audit waste contractors to ensure appropriate disposal methods are applied according to the waste stream.	ESMU
	Hazardous Materials Management	- Refueling, washing and maintenance of plant and vehicles will be prohibited in the vicinity of water bodies. - Spill kits will be available to contain any accidental release of hazardous materials. - All hazardous materials will be provided with secondary containment.	ESMU
	Risk of human health and property damage	- All necessary safety equipment should be ready at the plant. - Regular training on safety needs to provide.	ESMU
	Human and Sanitary Wastes	- Provision of an appropriate number of toilets and hand-washing points. - Provision of on-site treatment of sanitary wastes. - Training on sanitation practices.	ESMU
	Labour conditions	Bangladesh has ratified key International Labour Organisation (ILO) conventions, to ensure the work conditions are reasonable and safe, and employees are free from any form of discrimination.	ESMU
	Emergency Response (i.e. Fire, Earthquake, Flood etc.)	Appoint a suitably qualified Emergency Coordinator(s). Develop an Emergency Response Plan (ERP), Covering all foreseeable emergencies, for approval by LBPL The ERP will include: - what should be done and who should do it; - what equipment is required and where this will be located; and - staff training requirements and inductions for new workers and site visitors. In addition, the ERP will include: - a method for communication of the ERP to all workers and people arriving on-site;	ESMU

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
		- an emergency contacts document which is maintained up to date; - a review of local emergency services capability and resources. Where they cannot respond to a foreseeable emergency, ensure suitable resources are available at the site and trained/equipped to respond; and - liaison with local emergency services to ensure they are familiar with the site layout and potentially hazardous locations.	
Fires, explosion and other accidents	Risk of human health and property damage	- Use of personal protective equipments during operation and maintenance. - Prepare and implement safety and emergency manual. - Regular inspection of lines for faults prone to accidents. - Provision of fire protection equipments. - Provision of Lightning arrestors	ESMU
Domestic wastewater and sewage	BOD, fecal coliform contamination in groundwater and surface water	Need to provide septic tank with soak pit for treatment of sewage.	ESMU
Wastes oil from Plant (scrap metal, waste, lube oils, spill oil etc)	Potential soil and groundwater contamination	Secure on-site storage, waste sell to the DOE authorized vendor for discharge in a safe place.	ESMU
Public Relations & Stakeholder Engagement		Conduct proactive public relations (PR) exercises consisting of news/information dissemination to increase understanding of the project. The PR will be carried out using local media, leaflets and meetings/seminars on the progress of the project and environmental and social enhancement measures associated with the project. A Public Relations Plan will be prepared by LBPL in order to: - establish clear stakeholder engagement channels. People in the neighbouring villages should have clear lines of communication to SBPCL I & II; - communicate how environmental mitigation measures will be implemented throughout the project; - receive, investigate and address any complaints and/or concerns from all stakeholders.	ESMU

10.1.3 Post-operation Phase

LBPL is fully responsible for overall environmental management during post-operation phase or decommissioning phase of the Project. In this regard it is expected that LBPL will establish Environmental and Social Safeguards Management Unit (ESMU) for ensuring effective environmental and social compliances.

Table 10.3 summarizes the potentially significant environmental impacts during decommissioning phase, the measures needed to eliminate or offset adverse impacts and institutional responsibility.

Table 10.3: Potential impacts and mitigation measures at decommissioning phase

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
The demolition works will lead to significant deterioration of the acoustic environment.	Noise and Vibration	Demolition work is to be carried out only at day time	ESMU
Demolition of the proposed Power Plant will result in generation of solid waste and leakage of spent lube oil and other raw materials.	Solid waste generation and leakage of spent lube oil and other raw materials.	The waste is to be collected and disposed properly.	ESMU
Some dust will be generated during demolition works of the proposed Power Plant.	Dust generation	Continuous watering of bare areas	ESMU
During decommissioning movement of trucks carrying heavy demolition equipment and demolished materials will cause adverse impacts.	Risk of human health and property damage	Vehicle is to be operated with proper care	ESMU

Chapter-11

INSTITUTIONAL ARRANGEMENT AND ENVIRONMENTAL MONITORING

11.1 Institutional Requirements

For ensuring the construction and operation of the power plant according to the required compliance, there should be designated entity/institution or unit. The institution will be fully responsible to maintain the safeguard compliances. LBPL has realized the importance of establishing a separate entity for environmental monitoring and management. So, to maintain the environmental and social compliances, LBPL has planned to establish an individual compliance unit operating under the guidance of Head of Operation. They are planning to name the unit as Environmental and Social Safeguards Management Unit (ESMU). The detail of the ESMU has been discussed in the following sections.

11.1.1 Environmental and Social Safeguards Management Unit

LBPL is in principal obligated to relevant national and international environmental and social compliances and standards. It has informed that it will try to maintain all relevant compliances during construction and operational phases. In doing so, it has planned to form ESMU as is mentioned in the earlier section. The duties of the ESMU will include to:

- ensure environmental and social safeguard compliances;
- coordinate environmental monitoring process;
- act as liaison with the public, local organizations and government;
- ensure and supervise record keeping, data storage for follow-up actions;
- monitor hazardous materials storage and handling;
- promote environmental awareness and safety measures; and
- prepare environmental management and periodic monitoring reports as required by IDCOL, DOE and ADB .

11.1.2 Composition of Environmental and Social Monitoring Unit

The ESMU will be based on three tiers operational mechanism. It will be led by Head of Operation of the power plant. Head of Operation will serve as General Manager (Planning, Administration and Safeguard Compliance). Under his guidance there will be one Compliance Manager, who will be supported by two Compliance Officers. One Compliance Officer will be responsible for all sorts of environmental aspects and standards and another one will be assigned to maintain social and occupational health and safety aspects and standards.

Consulting services will be mobilized as necessary to assist in initial operations, to ensure that the ESMU will be self-sufficient for EMP implementation, submission of progress reports, and preparation of environmental assessment for subsequent construction works. Additional third-party services may be employed by the LBPL as necessary. Qualified and experienced construction contractor will be responsible for implementation of mitigation measures during the construction phase.

To ensure compliance of EHS aspects during the Construction and Operation Phases, LBPL has to prepare a comprehensive EHS Plan including standard operational procedure. In addition, it has to deploy an EHS Officer with following responsibilities:

- Monitor the environmental, health, safety, fire protection and emergency response matters;
- Ensure the compliance of the Department of Environment;
- Ensure the compliance of other external stakeholders;
- Monitor the implementation of the EMP;
- Develop standard operational procedure (SOP) for EHS aspects;
- Conduct safety inspections; provide safety training to promote a safe working environment for the employees.

11.1.3 Environmental Training

Training is an integral part of a preventive strategy. Environmental and disaster management training will be required to ensure proper implementation of effective environmental management and monitoring plan; and disaster management plan. However, training could be organized by ESMU involving relevant staff. As a trainer, competent Consultant can be outsourced. Important training under the spectrum of ESMU needs to include:

- Training on fire fighting;
- Training on environmental regulations and standards;
- Staff training on environmental monitoring;
- Training on environmental health and safety measure.

11.2 Environmental Monitoring

Environmental monitoring is an essential component of environmental management plan, as it provides the basic scenario of the impact of the project on baseline condition. The prime objectives of environmental monitoring are:

- assess the effectiveness of proposed mitigation measures by comparing monitoring result with baseline data/environmental standards;
- identify the extent of environmental impact;
- determine project compliance with regulatory requirements;
- adopt remedial action and further mitigation measures if found to be necessary.

During the Construction Phase, the construction contractor will ensure that activities like land leveling, clearing work, access road construction, putting proper traffic signals etc. have been accomplished properly to minimize the level of impact. This in turn has to be monitored by the Compliance Manager and Compliance Officers of ESMU of the power plant, in operation phase. Preventive maintenance should be carried out to identify and resolve problems related to cooling oil, gaskets, circuit breakers, vibration measurements, and other monitoring activities at regular intervals. Monitoring of oil water separation and sanitary waste treatment should be done periodically to avoid water pollution. Other environmental good

practices include noise abatement, maintaining hygienic conditions, maintenance of fire and safety equipment etc. and clearing of grass should be done periodically and medium height tree plantation around the substation wall should be done at the plant areas.

LBPL should develop a working relationship with the DOE by undertaking a joint monitoring program to monitor ambient air quality and also to assess whether there exists any significant noise problem; or they may exchange data and information or submit periodic report on self monitoring to the DOE or as the situation may require.

The proposed monitoring program should be in compliance with national environmental standards. The importance of this monitoring program is also for ensuring that the plant DOEs not create adverse environmental changes in the area and provide a database of operations and maintenance, which can be utilized if unwarranted complaints are made.

11.2.1 Environmental Monitoring Parameters

Environmental monitoring requires set of parameters that could be conveniently measured, assessed and evaluated periodically to observe the trends of change in base line environmental quality. A list of possible parameters to be tested, sample number and sampling frequency are given in **Table 11.1**.

Table 11.1: Monitoring parameters and frequency of monitoring during trial run

Key parameters to be monitored: (1) Ambient Air Quality			
location	frequency	parameter	submission
At Project site, residential/institutional/commercial areas within 500m outside from plant boundary (4 locations)	Once during trial run	SOx, NOx and CO	Submit to Dhaka Divisional Office of DOE.
Key parameters to be monitored: (2) Noise			
location	frequency	parameter	submission
At four corners of Project boundary, residential/institutional /commercial areas within 100m and 300m outside from plant boundary	Hourly basis for 24 hours during trial run	Limits in dBA	Submit to Dhaka Divisional Office of DOE.

Table 11.2: Monitoring parameters and frequency of monitoring during operation phase

Key parameters to be monitored: (1) Ambient Air Quality			
location	frequency	parameter	submission
At Project site, residential /institutional /commercial areas within 500m outside from plant boundary	Quarterly (routine) analysis	SPM, PM10, PM 2.5, SOx, NOx and CO	Report compilation and quarterly submission to Dhaka Divisional Office of DOE.
Key parameters to be monitored: (2a) Surface Water			
location	frequency	parameter	submission
Project site at Jangalia, Comilla	Bi-annual basis in each year (pre-monsoon and post-monsoon)	pH, Temperature, DO, BOD, COD, TDS, TSS, Oil and grease	Report compilation and yearly submission to Dhaka Divisional Office of DOE.
Key parameters to be monitored: (2b) Ground Water			
location	frequency	parameter	submission
Project site at Jangalia, Comilla	Bi-annual basis in every year (pre-monsoon and post-monsoon)	pH, Temperature, DO, BOD, COD, TDS, Oil and grease	Report compilation and yearly submission to Dhaka Divisional Office of DOE.
Key parameters to be monitored: (3) Noise			
location	frequency	parameter	submission
At four corners of Project boundary, residential/institutional /commercial areas within 100m and 300m outside from plant boundary	Quarterly (routine) analysis (four times in each year)	Limits in dBA	Report compilation and quarterly submission to Dhaka Divisional Office of DOE.

11.3 Environmental Monitoring and Management Budget

Environmental monitoring is conducted to compare the change between baseline condition and after project scenario, by testing some environmental parameters of air, water and noise and in case of necessity soil is tested. ESMU is fully responsible for environmental monitoring as well as implementation of environmental management plan. As testing environmental parameters required sophisticated instruments, it is suggested that ESMU should outsource consulting firm for testing and analyzing environmental parameters. But it will have to be equipped with required instruments gradually by purchasing required instruments. However, a tentative environmental monitoring budget has been proposed in **Table 11.3**. Laboratory analysis fees considered as per monitoring fees format of DOE/private laboratories.

Table 11.3: An annual tentative budget for environmental monitoring (Operation Phase)

Activity	Units	Total Cost (Tk.)
Fire fighting and suppression equipments, training and annual fire safety drill	1 site	150,000
Cost of occupational health and safety equipment	1 site	125,000
Quarterly test of ambient air quality (SPM, SOx, NOx)		75,000
Half yearly test of surface water (pH, Temperature, DO,		75,000

BOD, COD, TDS, Oil and grease)		
Half yearly test of ground water (pH, Temperature, DO, BOD, COD, TDS, Oil and grease)		75,000
Quarterly noise monitoring		25,000
Environmental Training	lump sum	125,000
ESMU Staff's annual salary (3 persons)	lump sum	800,000
Sub Total in Tk.		14,50,000
Contingency (10 %)		145,000
Total in BDT		15,95,000
Note: (Considering USD 1 = Tk. 80.0)		USD 19937.5

11.4 Financial Arrangement for Environmental Monitoring and Management

LBPL will provide the full financial support to Environmental and Social Monitoring Units (ESMU). For ensuring smooth and uninterrupted functioning of ESMU, it is suggested that LBPL will allocate the required fund based on analysis of estimated budget proposed by ESMU early in the every financial year. So, ESMU can run its operation to ensure environmental monitoring as well as implementation of proposed environmental management plan as may cause due to the unavailability of fund.

11.5 Environmental Monitoring and Management Reporting

As a part of environmental and social compliances, LBPL will submit quarterly EHS compliance report of the Project to IDCOL. This report will contain the analysis of testing various environmental parameters during monitoring phase. It will also describe in detail about the status of implementation of environmental management plan. IDCOL will monitor the EHS compliance half-yearly. Based on the findings of half-yearly monitoring, IDCOL will submit annual EHS monitoring report to ADB. The schedule of reporting the monitoring arrangement has been presented in the following **Table 11.4**.

Table 11.4: Reporting schedule

Reporting entity	Frequency of Report	Entity to whom the report will be submitted
LBPL	Quarterly EHS Compliance Report	IDCOL
IDCOL	Annual ESDDR Report based on the findings of half-yearly monitoring of the power plant	ADB

Chapter-12

EMERGENCY RESOPONSE AND DISASTER MANAGEMENT

In normal operation of the plant, when all environmental protection equipment works according to design specification, then there would be no environmental problems for the present plant. Disaster (to certain degree) would be occurred if the environmental protection equipment fails to work at normal condition.

Disaster could also be occurred if any sudden flood, earthquake and fire occur or if the environmental protection equipment fails to work at normal condition. So, appropriate management plan should have to

taken by the project proponent to prevent any un-wanted disaster in the plant. In this regard there should be a provision to stop the ongoing activities immediately during any failure of any equipment as discussed above.

The disaster management plan should consist of preventive measures including, among others, the following:

- when any equipment runs at abnormal situation e.g. if emission level increases than its normal level or if the engines give unwanted noise than normal level;
- when septic tank DOEs not work properly, liquid waste will over flow and will pollute the surroundings;
- all the equipment grounded earthing with mesh system Power plant and substation disconnected by HT cable;
- soil erosion during and after heavy rainfall;
- formulation and strict implementation of safety codes and measures;
- periodic inspection of safety valves and equipment;
- preventive maintenance;
- aware the workers about electric shock;
- electro-magnetic wave or electrical interference;
- declaring the factory a “no smoking zone”
- mock drills by the fire fighting cells/oups;
- provision and inspection of firefighting equipment and fire hydrant system in all the sections;
- proper training of the employees about the importance of codes;
- training the employees and the residents of the surrounding villages about the actions to be taken during an accident, disaster etc.

So, appropriate management plan should have to be taken by the project proponent to prevent any unwanted disaster in the plant. In this regard there should be a provision to stop the production immediately during any process failure as discussed above.

- It is already mentioned that there are four forms of disaster, which can affect LBPL project at any time. These are:
- Sudden Tidal Surge and Cyclone
- Sudden Flooding
- Earth Quake
- Fire

The following specific disaster management plan should consist of preventive measures including, among others, the following:

CYCLONE, SUDDEN TIDAL SURGE AND FLOOD

- As the Project site is only about 5 km away from the Gumti River, there is considerable risk of cyclone and associated tidal surge. In addition, there is significant risk of flash flood as well, which are to be reflected in the planning, designing and construction of the plant.

EARTHQUAKE

- Immediate response team
- Immediate help and arrangement of rescue operation facilities

- Non Structural element should be minimum and properly restrained

FIRE

- Continues monitoring the fire detection system
- Immediate response
- Immediate help and arrangement of rescue operation facilities
- Sprinkler system in whole campus area
- Fire extinguishing System
- Fire hydrant campus
- Auto emergency call system
- Declaring the plant a “no smoking zone”
- Mock drills by the fire fighting cells/groups
- Provision and inspection of fire-fighting equipment and fire hydrant system in all the sections;
- Every 6 months fire drill under the supervision of the local fire office
- Medical centre

There will be a Security Team comprising four trained persons with adequate safety equipment lead by a Maintenance Officer who will keep liaison with Fire Department, Police, Civil Defence etc. The Officer will maintain liaison with Disaster Management Department (DMD)

The Disaster Management Plan as has been discussed in this chapter is basically an indicative discussion. LBPL has to prepare a comprehensive detail Disaster Management Plan by professional Disaster Management Expert.

Chapter-13

CONCLUSION

The environmental impacts of the proposed 52.2 MW dual fuel fired Power Plant at Jangalia, Comilla have been assessed in this document according to ADB and DOE guidelines. The IEE has been prepared through identifying the potential impacts, assessing them and recommending possible mitigation and enhancing measures for negative and positive impacts, respectively. Minimal negative environmental impacts on location, planning, design, construction and operation are anticipated, mostly during construction and operation of the Project. Proper maintenance of the machineries could reduce the emission of air pollutants.

Based on the environmental assessment and surveys conducted for the project, associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the IEE. Adequate provisions should be made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs. The possible environmental impacts caused by the operation of the Project may be the emission of air pollutants from the incomplete burning of fuel.

Other than the impacts due to air emission, spent lubricant oil and tidal surge, there are no environmental issues of sensitive nature, which might have any potential of serious negative effects due to implementation of the Project in this area. Since it is understood that the Project proponent is committed to take necessary steps to address any environmental problems, the selected location of LBPL 52.2 MW Jangalia, Comilla Power Plant is acceptable for the proposed Project.

The findings of this IEE suggests that the Project involves potential but limited environmental impacts to which further careful attention should be given in the operation and maintenance of the Project in order to minimize and offset the adverse effects. The possible negative impacts are not severe, and the adverse impacts if duly addressed, as stated in the EMP, could be minimized without much effort, though they would require attention and positive commitment from the plant management.

As the Project has been categorized as B, it is assumed that the potential adverse impacts can be mitigated if the environmental management plan is properly implemented and environmental monitoring is conducted regularly. Hence, the necessity of conducting detail study by EIA can be avoided.

The location of LBPL 52.2 MW dual fuel fired Jangalia, Comilla Power Plant is environmentally acceptable as has already been mentioned. However, adequate and effective pollution prevention, abatement and control measure, proper and careful operation and maintenance, regular and effective environmental monitoring with adequate staff and budgetary provision, and reporting to DOE should be ensured.

It is expected that LBPL 52.2 MW dual fuel fired Jangalia, Comilla power plant will follow all environmental compatible steps during operation and maintenance by which it sets a positive example as an environment friendly industrial unit, very much within the environmentally acceptable limits all the time.

However, no industrial development can be expected without any adverse impact on environment. The beneficial impacts on the nation as well as human beings would only be meaningful and sustainable development would only be possible, if the adverse effects are minimized through strict maintenance and control measures as adopted and further suggested for this project. All this would need vigilant care and subsequent monetary involvement, and the project authority should take these into consideration.

It is also expected that DOE will do surveillance monitoring of the project performance of the power plant.

Environmental and social benefits of the Project and long-term investment program objectives outweigh the negative impacts. There are benefits stemming from recommended mitigation and enhancement measures, and major improvements in quality of life, income generation and improvement of socio-economic benefit once the Project is in operation.

Chapter 14

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Country/

Project Title:

BPDB IPP Tenders 2010, Project Number P1000478, Quotation Number Q 1001181 AIR, Created by KKO 007, Document creation date October 26, 2010
Development and Operation of a 52.2 MW Dual Fuel Fired Power Plant at Jangalia, Comilla

Sector Division:

Power

Screening questions	Yes	No	Remarks
A. Project sitting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		√	The location of the Project of 52, 2 MW Jangalia Power Plant at Comilla, Comilla Sadar South. In Jangalia, there is no significant cultural heritage site according to local respondents.
▪ Protected area		√	In Jangalia of Comilla, no protected area has been reported.
▪ Wetland	√		The Project site is located about Five kilometers away from Gomuti River.
▪ Mangrove		√	The main mangrove forest in Bangladesh is the Sundarban. In addition to the Sundarban, there are some mangrove forests located at Sandwip in Chittagong Division. But no mangrove forest has been reported in Comilla District.
▪ Estuarine		√	
▪ Buffer zone of protected area		√	
▪ Special area for protecting biodiversity		√	In April 1999, the Director General of the Department of Environment (DOE) officially declared an area of nearly 400 square kilometers as Ecologically Critical Areas (ECAs). The ECAs are distributed into seven separate wetland areas, the sites are Hakaluki Haor, Sonadia Island, St. Martin's Island, and Teknaf Peninsula (including the Cox's Bazar Sea Beach but not the buffer zones), Tanguar Haor, Marjat Baor and outside of Sundarbans Reserved Forest to an extent of 10 km. As Comilla District is not included in the list, the Project is free from constraint applicable to Environmental Conservation Act, 1995.
B. Potential environmental impacts Will the project cause...			
▪ impairment of historical/cultural monuments and other areas, and loss/damage to these sites?		√	No significant historical/cultural monument has been found in Comilla District, where the LBPL project site is located.

Screening questions	Yes	No	Remarks
▪ encroachment into precious ecosystem (e.g. sensitive habitats like protected forest areas or terrestrial wildlife habitats)?		√	No significant terrestrial wildlife habitat has been found in Comilla District where the LBPL project site is located.
▪ dislocation or involuntary resettlement of people?		√	As the Project site is a purchased land of LBPL by complying with the relevant laws and regulations of Bangladesh government, there is no issue of dislocation and involuntary resettlement.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	As the project is a power plant, there is no scope of any disparity for any section of the society. Moreover, poor, women, children, indigenous people-all will be benefitted if there is adequate electricity supply in the national grid.
▪ aesthetic degradation and property value loss due to establishment of plant and ancillary facilities?		√	If the project is properly designed with sufficient landscaping, it can be a visually pleasant structure. In addition, by improving the power shortage situation, the Project will encourage industrialization resulting increase of property value.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	√		The project has no relevancy with radiological hazards. But there is risk of occupational hazard during construction and operation phases of the project. In this regard, LBPL is suggested to adopt required precautionary measures to minimize the risk of chemical, biological or even health hazards.
▪ noise and dust from construction activities?	√		During construction phase, there will be considerable noise and dust. In this regard, in the IEE some mitigation measures have been recommended.
▪ short-term soil erosion and silt runoff due to construction?	√		There is no significant risk of considerable soil erosion as the construction activity is relatively moderate type. Most of the structure will be of steel structure requiring less civil works.
▪ fugitive dust during transportation, unloading, storage, and processing of coal, and polluted runoff from coal storage?	√		The project has no relevancy with coal as it is a natural gas based power plant +HFO
▪ risk of oil spills, which could pollute surface and groundwater and soil?	√		Lube oil can spill and pollute the surface and groundwater and soil, if proper mitigation measures are not adopted.
▪ hazards in gas pipeline operation and gas storage at power plant sites?	√		The Project will use natural gas. So, there is risk associated with the accident of gas pipeline. In this regard, LBPL has to adopt required mitigation measures for preventing the risk of accident.
▪ changes in flow regimes downstream of the water intake due to abstraction for cooling purposes?		√	Surface water will not be used. Only ground water will be used which will not affect the regims.
▪ pollution of water bodies and aquatic ecosystem from wastewater treatment plant for boiler feed, bleed-off from cooling towers, boiler blowdown and wash-water, and effluent from ash pond?	√		To minimize the risk of pollution of water bodies and aquatic ecosystem, LBPL has to adopt appropriate measures.
▪ air pollution from fuel gas discharged into	√		There is risk of minimum level air pollution.

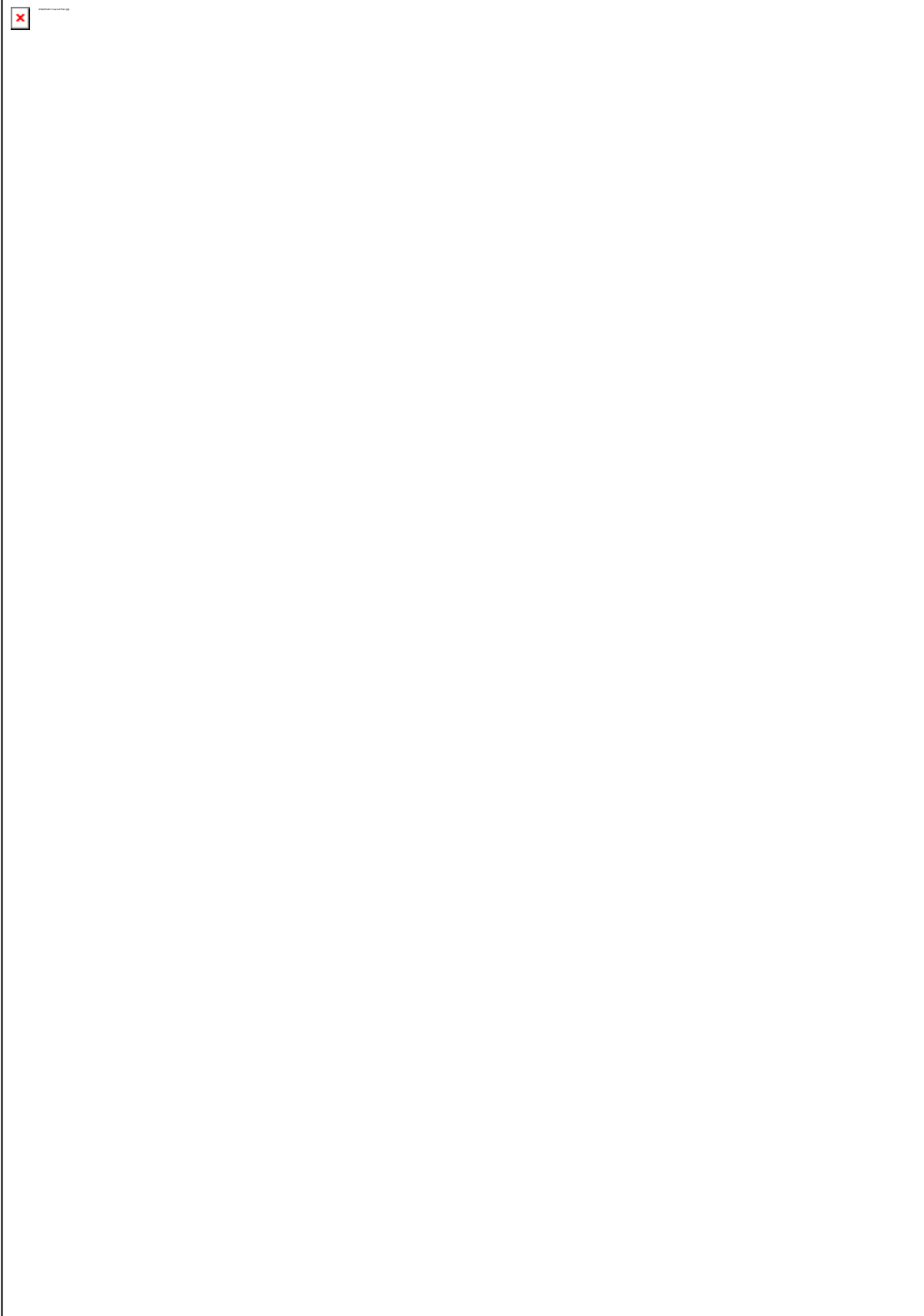
Screening questions	Yes	No	Remarks
the atmosphere?			
▪ public health and safety hazards due to solid waste disposal in sanitary landfills?		√	The Project DOES not seem to have significant relevance with sanitary landfill and associated public health and safety hazard. LBPL will use septic tank to manage the sanitary waste and will dispose it to suitable by following the relevant rules and guidelines.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	The project deals with small scale construction work. So there is minimal scope of population influx and raising associated social problems.
▪ social conflicts if workers from other regions or countries are hired?		√	As the scale of construction and operation work of LBPL project is not very big, there is no need to hire workers from other regions for the project. The work force of Comilla Sadar South Upazila will be sufficient to serve the purpose.
▪ risks community safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	√		During movement of various types of vehicles, there is a issue of traffic safety specially carrying heavy machineries. In this regard, LBPL has to adopt required safety measure.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g. ash pond) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		√	The project is a gas +HFO based power plant having no relevance with ash pond. In addition, the risk of being affected the community with the Project is seemed to be insignificant if proper safety measures are adopted during construction and operation phases of the project.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
▪ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?	√		The project site has moderate risk in case of earth quake hazard. In addition, the risk of tsunami and volcanic eruption are also insignificant. But there is risk of flood and tropical cyclone winds.
▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		√	The project seems to be not large enough to affect the local precipitation, temperature or even salinity.
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	During site visit by BCAS team , such type of socio-economic aspects were not found in Jangalia, Comilla

▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		√	
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References

1. Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS, 2009).
2. BBS (2005): Bangladesh Bureau of Statistics (BBS), Government of People's Republic of Bangladesh.
3. BBS (2006): Bangladesh Population Census, Community Series Zila: Sylhet, Bangladesh Bureau of Statistics (BBS), Planning Division, Ministry of Planning, Government of the Peoples' Republic of Bangladesh.
4. BBS (2006): Bangladesh Population Census, Community Series Zila: Sunamganj, Bangladesh Bureau of Statistics (BBS), Planning Division, Ministry of Planning, Government of the Peoples' Republic of Bangladesh.
5. BBS (2006): Bangladesh Population Census, Community Series Zila: Habiganj, Bangladesh Bureau of Statistics (BBS), Planning Division, Ministry of Planning, Government of the Peoples' Republic of Bangladesh.
6. BBS (2006): Bangladesh Population Census, Community Series Zila: Maulvibazar, Bangladesh Bureau of Statistics (BBS), Planning Division, Ministry of Planning, Government of the Peoples' Republic of Bangladesh.
7. BCAS (1996): Socio-economic Survey in Reedland Forest area, Reedland Afforestation Project in Sylhet Forest Division (Report).
8. BCAS (2005-2006): Bangladesh Centre for Advanced Studies, Information Technology Division.
9. BPDB (2005-2006): Bangladesh Power Development Board, Annual Report. Geoscientific Activities for Mineral Study (2004-2008).
10. GoB (1982): Government of the People's Republic of Bangladesh, Acquisition & Requisition of Immovable Property Ordinance.
11. GoB (1989): Government of the People's Republic of Bangladesh, Property (Emergency) Acquisition Act.
12. GoB (2002): Planning Commission, Government of Bangladesh.
13. Government of East Pakistan (1970): "East Pakistan District gazetteers," SNH Rizvi, edits, East Pakistan Government Press, Dhaka.
14. IFC (2006): International Finance Corporation, Land Acquisition & Involuntary Resettlement Meghnaghat Power Plant EIA Report, 1997.
15. MOF (2006), Bangladesh Economic Review, Economic Adviser's Wing, Finance Division, Ministry of Finance, Government of People's Republic of Bangladesh.
16. NEP (1996): Government of People's Republic of Bangladesh, Ministry of Power Energy and Mineral Resources.
17. Private Communication (2005-2006): Information from Rural Industries
18. Rahman, A. Atiq and Haider R. (1994) Environment and Development in Bangladesh, Vol. 1, University Press Limited, Dhaka.
19. Rashid, Harun er. (1991): Geography of Bangladesh, published by the University Press Limited, Dhaka.
20. WB (2007): The World Bank Operation Manual: Involuntary Resettlement
21. www.adb.org/documents/guidelines/environmental_assessment/environmental_categorization.pdf



PROPOSAL TO DEVELOP A 50±10% MW DUEL-FUEL POWER PROJECT

ON BUILD, OWN AND OPERATE BASIS

AT JANGALIA, COMILLA, BANGLADESH



Technical Specifications

Submitted By

Lakdhanavi Limited

52MW HFO Power Plant, Comilla

**Technical Specification of
50 MW DUAL FUEL,
Power Plant at Jangalia, Comilla, Bangladesh**

By

Lakdhanavi Limited

Contents

0.1	Code & Standards	1
0.2	Basic Technical Information	3
0.3	Detailed Technical Information	4
0.4	Major Equipment supplies	6
0.5	Engine, Generator, Control System Technical Specifications	7
0.6	Electrical Balance of Plant Technical Specification	74
0.7	Mechanical Balance of Plant Technical Specification	80

1.0 Standards and codes used for the project

General Codes and standards Used in the

AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standard Institute
API	American Petroleum Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AFBMA	Anti friction Bearing Manufacturers Association
CRSI	Concrete Reinforcing Steel Institute
DIN	German Standards (Deutsche Institute fur Normung)
EJMA	Expansion Joint Manufacturing Association
EN	European Standards
HEI	Heat Exchanger Institute
ICEA	Insulated Cable Engineers Association
IEC	International Electro-technical Commission
IEEE	Institution of Electrical and Electronic Engineers
ISO	International Standards Organization
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturers Association
OSHA	Occupational Safety and Health Administration
PFI	Pipe Fabrication Institute
SFS	Finish Standards Association

SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
TEMA	Tubular Exchanger Manufacturers Association
UPC	Uniform Plumbing Code
VDE	The Association for Electrical, Electronic & Information Technologies

Specific Standards for Major Equipment

- Engine sets and related Mechanical Equipment
 - Engine test run ISO 15550
 - Vibrations ISO 8528 part 9
 - Design EN 12100
 - Pipe design calculations EN 13480 and DIN 2413
 - Welding EN 1011
 - Stair and platforms ISO
 - Dimensional standards for installation, materials
(pipes, beams, etcetera) DIN, ISO, SFS and EN
 - Vertical tanks API 650 or EN 14015
 - Horizontal tanks EN 12285
 - Pressure equipment PED 97/23/EC
 - Typical material standards DIN, SFS and EN
- Electrical
 - Generator IEC 30034
 - Transformer, oil type IEC 60076
 - MV switchgear IEC 62271
 - LV Switchgear IEC 30439-1
 - Enclosure protection IEC 60529
 - WOIS workstation hardware IEC 60950
 - WOIS workstation software Applicable parts of VDE
3699
 - Earthing network IEEE
 - Control Panels IEC 60439-1
 - PLC software IEC 61131-3
 - Lighting installation IEC and IEEE
 - Fire detection EN 54 and NFPA
 - Protection of structures against lightning IEC 1024

2.0 Basic Technical Information

Short Description of the Power Plant

The Bangladesh Power Development Board (BPDB) invites RFP tenders for development, design, engineering, manufacture, financing, insurance, construction, permitting, completion, testing, commissioning, ownership, operation and maintenance of the Facility and all activities incidental there to of 50±10%MW Dual Fuel Fired Power

Project at specified site conditions along with all support facilities (the Facility) at Comilla, Bangladesh on a Build, Own and Operate (BOO) basis (the Project). As per tender BPDB shall purchase from the our Consortium Company all of the net Dependable Capacity (NDC) of the Facility and all of the Dispatched Net Energy Output, as provided in and in accordance with the terms of the PPA. Proposed 50 MW Dual Fuel fired Engine Power Plant will have 6 numbers of Wartsila made 20V32 Engines, each coupled with aABB made AMG 1200M (or equivalent) of 11.155 MVA (8.9 MW) Generators. Electrical power is generated at 11 kV. Three Engine generator units are connected to a 11 kV Bus and is fed to a 35 MVA 132/11 kV generator step up transformer. Similarly other three engine generator units are also connected to a 11 kV bus and fed to an identical generator step up transformer. Output of the two generator transformers are connected to an outdoor switchyard (Air Insulated Switchyard/AIS). From the AIS, Generated power is dispatched to the Comilla Grid Sub Station along a 132 kV over head transmission line. Power plant station consumption is catered through two 1,400 kVA 11/0.415 kV step down Station Transformers, each connected to a 11 kV MV bus. Plant auxiliary loads are connected to three LV buses of 415 V which are powered by foresaid station transformers and also by an emergency diesel generator which has the black start capability. A DC system including rectifiers and battery banks are installed to cater the plant critical loads and control power. Exhaust gas of the engine sets are used by 2 waste heat recovery boilers to generate steam. The generated steam is used to heat the fuel (HFO) and Lube oil. All the necessary mechanical / electrical BoP such as fuel unloading, handling, storage, treatment systems, water treatment system, fire detection and protection system, cooling system, instrument/service air systems, HVAC system, lighting workshop etc will be installed.

3.0 Detailed Technical Information

3.1	Reciprocating Engine		
	Manufacturer		WARTSILA
	Model No.		20V32GD
	Guaranteed Output at Reference Site Condition (Measured at Generator Terminals)	kW	8,924
	Guaranteed Net Flat Heat Rate at Reference Site Condition (Considering the auxiliary power)	kJ/kWh	8,256
	RPM		750
	Number of cylinder		20
	Year of Manufacture		2012
	Net Fuel consumption	gm/kWh	210.02 g/kWh
	Status of machine		Brand New
	Start up time for hot engine Normal	seconds	30 seconds
	Emergency	seconds	15 seconds
	Start up time for cold engine	seconds	Same as above
3.2	Generator & Accessories		
	Generator (Model)		AMG 1120 M (Or Equivalent)
	Manufacturer		ABB (Or Equivalent)
	Capacity	MVA	11.155
	Rated voltage at generator terminal	kV	11
	Frequency range	Hz	50
	Operating voltage range		90% - 110%
	Operating power factor range		Lag 0.8 Lead 0.95 (at rated V)
	Rated Power factor		lag 0.8

	Insulation class		F
	Type of cooling		Air
	Design standard		IEC 60034
	Efficiency		97.6% at 100% Load
	Reactive capability curve		please refer the attachment
	Short Circuit Ratio		0.53 – 0.59
	Excitation System		
	a. Type		Brushless
	b. Current rating and voltage		Later
3.3	Generator Circuit Breakers		
	Manufacturer		Schneider (Or Equivalent)
	Type/Model		MC Series (Or Equivalent)
	Rated voltage	kV	12 kV
	Rated Frequency	Hz	50
	Continuous Current rating	kVA	630
	Maximum Interrupting current rating	kA	40
	Maximum Interrupting time (cycles)		60 mS
	Maximum closing time (cycles)		71 mS
	BIL rating		75
	Interrupting medium		Vacuum or SF6
3.4	Generator Step up Power Transformers		
	<u>General</u>		
	Quantity		2
	Manufacturer		Crompton Greaves Ltd (or Equivalent)
	Type		Out door

	Applicable Standards		IEC
	<u>Design Data</u>		
	Voltage ratio		132/11 kV
	Maximum Continuous Rating	MVA	35 (ONAF)
	Rated temperature rise	°C	50/55 (Oil/Wdg)
	Basic Insulation Level:		
	a. Of HV winding	kV	650
	b. Of neutral of HV winding	kV	110
	c. Of LV winding	kV	75
	d. Of neutral of LV winding	kV	NA
	Type of tap changer		On Load
	Total power requirements of auxiliary equipment	kW	~3.0
	Power factor		0.8
	Impedance per unit	%	Later
	Insulation class		F
	Type of cooling		ONAN/ONAF
	Type of connection High voltage winding Low voltage winding		HV Open air bushing connection, LV Cable termination Box
	Design standard		IEC 60076
	Vector Group		YNd1
3.5	Black Start Diesel Generator		
	Capacity	kW	200
	Generator voltage	kV	0.4
	Manufacturer		Caterpillar (Or Equivalent)

4.0 Major Equipment Suppliers

Equipment	Manufacturer/Model/type
Reciprocating Engine	WARTSILA/FINLAND

Generator	ABB/GERMANY (Or Equivalent)
Generator Circuit Breakers	SCHNEIDER (Or Equivalent)
Control system	WARTSILA/FINLAND
Generator Step up Transformer	CROMPTON GREAVES LTD/INDIA (Or Equivalent)

TABLE OF CONTENTS

0 General 5

0.1 Executive summary 5

0.2 Type of product 7

0.3 Main data and conditions 8

0.4 Operation media 9

0.5 Special features 13

0.6 Codes and standards 15

A POWER GENERATION EQUIPMENT 17

A1 GENERATING SET 17

A1.1 ENGINE 17

Project Specific notes 24

A1.2 GENERATOR 24

A1.3 BASE FRAME FOR ENGINE AND GENERATOR 26

A1.4 CONNECTIONS 27

A1.5 ENGINE PLATFORMS 27

A2 MECHANICAL AUXILIARY SYSTEMS 28

A2.1 AUXILIARY MODULES 28

A2.2 FUEL SYSTEM 30

A2.2.1 LIGHT FUEL OIL SYSTEM 31

A2.2.3 HEAVY FUEL OIL SYSTEM (designed for a maximum fuel viscosity of 380 cSt at 50 °C) 31

A2.3 LUBRICATING OIL SYSTEM 34

A2.4 COMPRESSED AIR SYSTEM 36

A2.5 COOLING SYSTEM 38

A2.6 CHARGE AIR SYSTEM 39

A2.7 EXHAUST SYSTEM 39

A3 HEAT RECOVERY SYSTEM 40

A3.1 STEAM GENERATION SYSTEM 40

A3.1.1 STEAM GENERATION SYSTEM FOR FUEL HEATING 40

A7 AUTOMATION SYSTEM 43

A7.1 OPERATOR'S STATION 44

A7.2 CONTROL PANELS 47

A7.5 CABLES AND ACCESSORIES 52

A8 ELECTRICAL SYSTEMS 52

A8.1 MAIN SWITCHGEAR (MV SYSTEM) 52

A8.2 STATION SERVICE SYSTEM (LV SYSTEM) 55

A8.3 DC SYSTEM 56

A9 TOOLS 57

C SURVEYS, ENGINEERING AND DOCUMENTATION 58

C2 ENGINEERING 58

C2.1 ENGINEERING MANAGEMENT 58

C2.2 PROCESS ENGINEERING 58

C2.3 MECHANICAL ENGINEERING 58

C2.4 ELECTRICAL ENGINEERING 58

C2.5 CIVIL AND STRUCTURAL ENGINEERING 58

C3 DOCUMENTATION 58

C3.1 CONCEPTUAL DESIGN DOCUMENTS 58

C3.2 BASIC DESIGN DOCUMENTS 59

C3.3 DETAILED DESIGN DOCUMENTS 59

C3.4 CONSTRUCTION AND COMMISSIONING DOCUMENTS 59

C3.6 COMMERCIAL OPERATION DOCUMENTS 59

D TRANSPORTATION (CFR, Chittagong) 61

D1 TRANSPORTATION OF ITEMS SUPPLIED BY WÄRTSILÄ FINLAND 61

D1.1 MATERIAL AND SERVICES FOR LOGISTICS 61

D1.2 COLLECTION TRANSPORT 61

D1.3 MAIN TRANSPORT 61

D1.4 SITE TRANSPORT 61

D2 TRANSPORTATION OF OPTIONAL ITEMS SUPPLIED BY WÄRTSILÄ FINLAND 62

D2.1 MATERIAL FOR LOGISTICS 62

D2.2 COLLECTION TRANSPORT 62

D2.3 MAIN TRANSPORT 62

D2.4 SITE TRANSPORT 63

F PROJECT MANAGEMENT 64

F1 PROJECT MANAGEMENT AT WÄRTSILÄ FINLAND 64

G CONSTRUCTION MANAGEMENT 65

G2 TECHNICAL ASSISTANCE DURING INSTALLATION 65

J COMMISSIONING AND START-UP 66

J2 TECHNICAL ASSISTANCE DURING TESTING AND COMMISSIONING 66

J3 TESTING PROCEDURES 66

J3.1 WORKSHOP TESTS 66

J4 TRAINING 66

J4.2 TRAINING AT SITE 67

0. General

0.1 Executive Summary

General

This technical specification provides the reader with the basic technical data and information required for evaluation of the plant's technical features and performance, as well as Wärtsilä's scope of supply.

The proposed stationary power plant is designed, engineered and will be delivered by Wärtsilä Finland Oy in accordance with this technical specification.

The technical data stated in this document are for guidance and evaluation purpose only, any guaranteed performance data is separately stated in the supply contract.

Design and construction

The essence of the design is simplicity, safety and reliability.

The equipment is designed to prevent accidental contact with moving, hot or tensional parts and to minimise ingress of dust and dirt.

The structure and layout design of the power plant permits access to all parts for inspection, maintenance and repair.

Wärtsilä quality procedures and test and inspection procedures are applied to ensure product quality throughout the design and manufacturing process. Special attention is paid to engine and auxiliary unit testing, as well as inspection and testing of the final installation.

Wärtsilä's quality and environmental management systems fulfil and are certified according to ISO 9001:2000 and ISO 14001:2004.

Main parts and devices like panels, valves, pumps, etc. are marked with engraved name plates indicating their item codes used in Wärtsilä documentation and manuals.

English is used in all documents, correspondence and nameplates.

The SI units of measurement are used in all technical documents.

The design and manufacture of power plant equipment supplied by Wärtsilä Finland Oy is subject to constant review, and due to improvements and optimisation of materials, design and tooling techniques, manufactured equipment may be improved from the specification given below.

Deviations to assumptions made in this specification

If the purchasers requirements, local building codes, zoning requirements, Grid/Interconnection Study, Environmental Impact Assessment, Building Permit Application, Soil investigation, Topographical survey, Contamination evaluation or site Demolition requirements or other random conditions deviate from the assumptions made herein and have an impact on Wärtsilä's scope of supply, the scope of work shall be reviewed and the price adjusted accordingly.

Project Management and Engineering

The delivery of the stationary power plant will be managed by a dedicated Project Team, comprising a Project Manager who has the overall responsibility for the delivery, who is assisted by Project Engineers for the main technical disciplines.

The Project Team is the single point of contact with the purchaser's organisation and has full authority to decide technical and commercial issues related to the project on behalf of Wärtsilä Finland Oy.

Annex 3

Quality of Bakhbrabad Gas in respect of Chemical Composition (in per cent) and Other Particulars

Particulars	Bakhbrabad Gas
Methane (CH ₄)	97.33
Ethane (C ₂ H ₆)	1.72
Propane (C ³ H ₈)	0.35
Iso-butane (iC ₄)	0.08
N-Butane	0.05
C ₅ H ₁₂	0.06
Nitrogen (N ₂)	0.30
Carbon Dioxide (CO ₂)	0.11
Calorific Value; Gross (BTU/SCF)	1031.55
Specific Gravity	0.5720

Annex 4

Household Survey Questionnaire

52.2 MW Jangalia Power Plant at Comilla

Bangladesh Centre for Advanced Studies (BCAS)

Section-1: Identification of the Interviewee

Interview Sl. No.:, Name of Household Head:..... Religion (code):

Father's /Husband's Name: Village: Union:
....., Upazila:, District:

Name of the Respondent:, Relationship with HH. Head:

Strata: High Impact Zone----- Low Impact Zone----

Section-2: Socio-Demographic characteristics

1. Household profile (Start with Head of Household)

SL	Names of the household members	Sex Male=1 Female =2	Relation with HH (code)	Age	Marital Status (code)	Education (code)	Occupation (code)	
							Primary	Secondary
1								
2								
3								
4								
5								
6								

7								
8								
9								
10								
11								
12								
13								
14								

Code of Religion: Muslim – 1, Hindu – 2, Buddhist – 3, Christian – 4, Others (specify)

Marital Status: Married – 1, Unmarried - 2, Divorced – 3, Widower - 4, Widow – 5 Separated – 6, Others (specify) – 6

Education: Illiterate - 1, Can sign only – 2, Primary – 3, Secondary -4, S.S.C and equivalent- 5, H.S.C and equivalent - 6, Degree and above - 7.

Relationship: Father – 1, Mother - 2, Husband – 3, Wife - 4, Son - 5, Son in-law - 6, Daughter – 7, Daughter in-law – 8, Brother - 9, Brother in-law – 10, Sister - 11, Sister in-law – 12, Nephew - 13, Niece -14, Grandson - 15, Granddaughter - 16, Uncle - 17, Aunt -18, Grand father-19, Grand mother-20, Cousin- 21, Others (specify) -22.

Occupation: Agriculture – 1, Wage labor – 2, Household work-3, Work in abroad-4, Fishing – 5, Van /Rickshaw puller – 6, Service – 7, Business – 8, Handicraft – 9, Student – 10, Unemployed – 11, Carpenter\ blacksmith – 12, Others (specify)

2. Amount of Household Own Land by Use Pattern

Land Use Pattern	Area (decimal)	Average sale price (per decimal)
Homestead		
Kitchen garden/Homestead garden		
Horticulture/Nursery		
Agricultural land		
Pond /Ditch		
Market/Hat/Bazar		
Agro-forestry		
Bushes/Jungle		
Fallow land		
Others (Specify)		

3. Share cropping/leasing of land

Type	Decimal	Mode of sharing (by value)
Share-in		
Share-out		
Leasing-in		
Leasing-out		
Others(specify)		

4. Employment Status

Sex of Household Member	Employment (No. of HH. Members)			
	Full-time employment	Part-time employment	Un-employment	Remarks
Male				
Female				
Children				
Others (Specify)				

5. Annual Household Income and Expenditure

Source of income	Annual gross income (TK)	Cash sale income (TK)	HH consumption expenditure Item	Annual cash expenditure (TK)
Rice/Wheat production			Rice/Wheat	
Vegetables			Pulse	
Daily wages			Meat	
Service			Fish	
Business/shop owner			Vegetables and Fruits	
Fruits			Cloths	
Timber and Timber products			House construction/ Repairs	
Fuel wood			Social Entertainment	
Fish			Education	
Livestock			Transport	
Poultry			Health/Medicine	
Handicrafts			Kerosene	

Source of income	Annual gross income (TK)	Cash sale income (TK)	HH consumption expenditure Item	Annual cash expenditure (TK)
Remittance			Electricity/Lighting	
			Fuel wood + straw+ cow dung+ biogas	
			Labor employment	
Others (specify)			Others (Specify)	

6. Economic status of the households

Sectors	Status (code)	Remarks
Food availability		
Clothing		
Accommodation/ houses		
Educational facilities		
Medical facilities		
Transport facilities		
Entertainment		
Others (Specify)		

Status Code: Good = 1, Satisfactory = 2, Unsatisfied = 3.

7. Identify your family problems with duration and intensity (use problem code) you face during crisis.

Factors	Duration (month)	Intensity of the problem	Remarks
Employment Opportunity			
Availability food			
Availability of safe water			
Problems for purchasing cloths			
Problem for treatment			
Problem for children education			
House construction			
Others (Specify)			

Intensity of the problem code: Severe = 1, Moderate = 2, Low= 3, No problem = 4.

8. Involvement of household members involved in NGOs/CBOs

Yes - 1

No - 2

9. If yes, how many persons of your HH are involved in NGOs/CBOs?

Number of persons involved:.....

10. What benefits are you getting from NGOs/CBOs?

Subject	Received Training	Source of fund	Others
Poultry rearing			
Livestock rearing			
Nursery/ Kitchen Gardening			
Handicrafts (specify)			
Pond Fishing			
Small enterprise			
Tailoring			
Fish drying			
Net weaving			
Health, Sanitation and Water supply			
Others (specify)			

11. Did you receive any loan from bank or other sources?

Yes - 1

No - 2

12. If yes, describe your loan receiving status by sources

Sources of loan/facilities	Amount of total loan(TK)	Present of amount loan(TK)	Purpose of loan	No. of loans received
Bank				
NGOs				
Money lender				
Relatives				
Others(specify)				

13. Household Stock of Durable Assets

Assets	No.
Bicycle	
Motorcycle	
Cot/Khat	
Table	
Chair	
Car	
Refrigerator	
T.V.	
Radio	
Computer	
Mobile set	
Boat	
Power tiller /Tractor	
Tube well	
Others (specify)	

14. Housing Structure

Status of Housing	No
Building (Brick floor+ wall + roof)	
Brick floor + tin wall + tin roof	
Earthen floor + tin wall + tin roof	
Earthen floor + thatch wall + tin roof	
Thatch	
Others (specify)	

15. Sources of fuel for cooking

Types	Source			
	Own land	Collect from other land	Common property resources	Market
Wood				
Tree branches				
Tree leaf				
Straw				
Dung				
Bushes				
LPG				
Others(specify)				

16. Status of biomass fuel supply

Types	Status of Supply
Wood	
Tree branches	
Tree leaf	
Straw	
Dung	
Bushes	
Others (specify)	

Status Code: Sufficient -1, Insufficient -2

17. Sources and availability status of lighting (please √)

Sources of lighting	Status of availability	Remarks
Electricity		
Kerosene		
Candle		
Solar PV		
Others (specify)		

Availability status code: Adequate -1: Inadequate – 2 Not available - 3

18. Extent of environmental problems, which affect livelihood (by source and status of problem)

Factors	Status of Problem
Water pollution	
Air pollution	
Industrial pollution	
Burning fuel, trees and agriculture residue	

Over population	
Deforestation	
River/canal bank erosion	
Land erosion	
Flash floods	
Arsenic contamination	
Sedimentation of water bodies	
Health and Sanitation problem	
Disease	
Noise pollution	
Others (specify)	

Environmental problem status code: No problem -1, Low problem -2, Moderate problem -3, Severe problem -4

19 Sources of water pollution and status of problem

Source	Status of Problem
Industrial waste	
Human waste	
Water transport	
Chemical feature/personnel	
Siltation	
Animal waste	
Pollution from upstream	
Urban waste	
Others (specify)	

Water Pollution problem status code: No problem -1, Low problem -2, Moderate problem -3, Severe problem -4

20. Sources of noise pollution and status of problem

Factors	Status of Problem
Vehicles	
Big industries	
Small industries	
Construction work	
Households sources (Generator)	
Power supply(Irrigation engine)	
Commercial areas	
Others (specify)	

Noise Pollution problem status code: No problem -1, Low problem -2, Moderate problem -3, Severe problem -4

21. Sources of air pollution and status of problem

Factors	Status of Problem
Brick field	
Vehicles	
Construction work	
Small Industries	
Big Industries	
Diesel engine	
Commercial areas	
Gas Field	
Burning fuel, trees and agriculture residue	
Open defecation	
Others(specify)	

Air pollution problem status code: No problem -1, Low problem -2, Moderate problem -3, Severe problem -4

Perception about the Jangalia Power Project and its Impact on Household

22. Do you know about the proposed Jangalia Power Project?

Yes – 1

No – 2

23. If yes, would you (your family) be personally affected due to the project ?

Yes – 1

No – 2

24. If yes, identify the Negative Impacts on your family livelihood, economic assets and others.

Expected Negative Impacts/loss items of family	Please (√) appropriate places	Quantity of loss	Amount loss (present value Tk)
Loss of homestead land			
Loss of cultivable land			
Loss of annual crops			
Loss of trees			
Loss of annual fish catch from river			
Employment loss per year			
Income loss per year			

Health loss per year			
Communication problem			
Livestock loss per year			
Noise pollution			
Air pollution			
Water pollution			
Others(specify)			
Business (shop keeper) loss			

25. If your family lose any assts or is negatively impacted by the power project, how will you mitigate the loss?

26. Will you expect any help from government or project to mitigate your loss?

Yes – 1

No – 2

27. If yes, please describe.

28. Expected Positive Impact of the Power Project.

Positive Impact	Please (✓) appropriate places
More employment opportunity	
Access to electricity	
Access to infrastructure road	
More local socio economic activities	
Availability of irrigation water	
National development	
Reliable supply of electricity in the area	
Others(specify)	

29. Health situation of Household Members (During last 1 year)

Name of Diseases	No. of affected members				Source of Treatment	Level of satisfaction with medical treatment
	Male	Female	Children			
			Boy	Girl		
Cold fever						
Skin disease						
Jaundice						
Asthma						
Diarrhoea						
Typhoid						

IEE Final for 52.2 MW Power Plant at Jangalia, Comilla, Bangladesh
January 2014, Prepared by: BCAS

Chicken Pox						
Tuberculosis						
Viral Hepatitis						
Malaria						
Hypertension						
Stroke						
Diabetes						
Others (specify)						

Source of Treatment Code: No treatment =1, Kobiraj = 2, Homeopathy = 3, Medicine Shop = 4, Upazila Health Complex = 5, Private Practitioner Doctor = 6, Village Doctor = 7, Others = 8.

Level of satisfaction with medical treatment: Good = 1, Satisfied = 2, Unsatisfied = 3

Annual School days lost due to illness : Boy: Girls: (persons)

Annual working days lost due to illness : Male: Female: (persons)

Name of the interviewer: Name of the Supervisor:

Remarks: Date of Interview:

Annex 5



Enviro Consultants Ltd.

35/A, (2nd Floor), Monipuripara
Tejgaon, Dhaka-1215, Bangladesh.
Phone : +(88-02) 8141439
Fax : +(88-02) 8141439
Cell : 01713117822, 01715327465
E-mail : ecl@enviroconsultant.org
Web : www.enviroconsultant.org

Ref. EGRL/Ambient Air/1216/2013

Annex 5

Date :

Enviro Quality Laboratory

Test Results of Ambient Air Quality Analysis

Name of the Industry : BCAS
Address of Head Office : House -10, Road-16A, Gulshan-1, Dhaka 1212, Bangladesh

Description of sample : Samples were collected from the selected locations
Sample collector : Collected by ECL Personnel
Sampling date : 3rd October 2013 - 3rd November 2013
Date of analysis : 5th November 2013
Reporting date : 10th November 2013

SN	Location	Ambient Air Pollutants Concentration in $\mu\text{g}/\text{m}^3$					
		SPM	PM ₁₀	PM _{2.5}	SO ₂	NO ₂	CO Mg/m ³
01	Concentration at South side near the project boundary area.(900m) 91°10'13.09"E 23°25'45.35"N	85.28	55.06	39.41	1.79	31.34	10000
02	Concentration at Central point of site 91°10'4.19"E 23°25'49.99"N	83.77	41.02	37.21	1.60	17.01	NF
03	Concentration at West side near the project boundary area.(150m) 91°10'9.51"E 23°25'55.15"N	145.82	66.23	35.50	1.92	18.90	320
04	Concentration at North side near the project boundary area.(1000m) 91°10'19.47"E 23°25'48.64"N	114.87	63.48	41.35	1.49	9.03	370
05	Concentration at East side near the project boundary area.(110m) 91°10'10.47"E 23°25'43.32"N	80.44	43.69	38.50	2.39	31.36	204
DoE, GoB Standard for Industrial and Mixed zone		500	150	65 (24hr) 15 (annual)	120	100	210
Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Geake	Jacob & Hochheiser	CO Meter Indicator tube
Instruments Used for data collection		Respirable Dust Sampler Envirotech APM 460 NL	Respirable Dust Sampler Envirotech APM 460	Respirable Dust Sampler Envirotech APM	Gaseous Sampling Attachment Envirotech APM 411 TE with	Gaseous Sampling Attachment Envirotech APM 411 TE with	Digital Instrument AE. 14343 Taiwan

Source: ECL Lab (measured on 05.09. 2013 by Respirable Dust Sampler of ECL)

Legends:

1. SPM Suspended Particulate Matter
2. NO_x Oxides of Nitrogen
3. SO₂ Sulphur Di-Oxide
4. CO Carbon Monoxide
5. N/A Not Applicable

Gabriel Ripon Peris

(Chemist)



Dr. J.C Saha

(Lab Incharge)



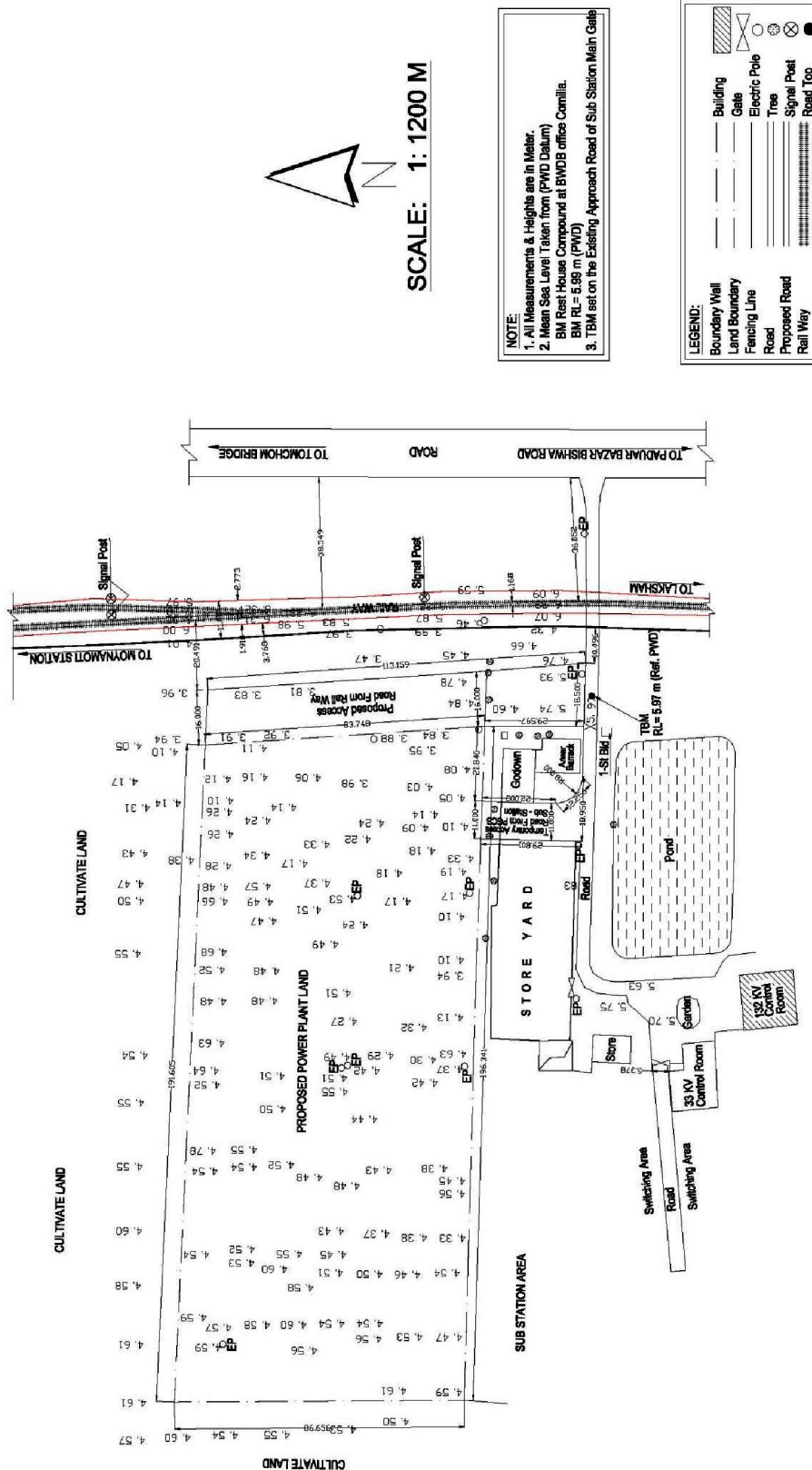
Annex 6

50±10% MW DUAL-FUEL POWER PROJECT

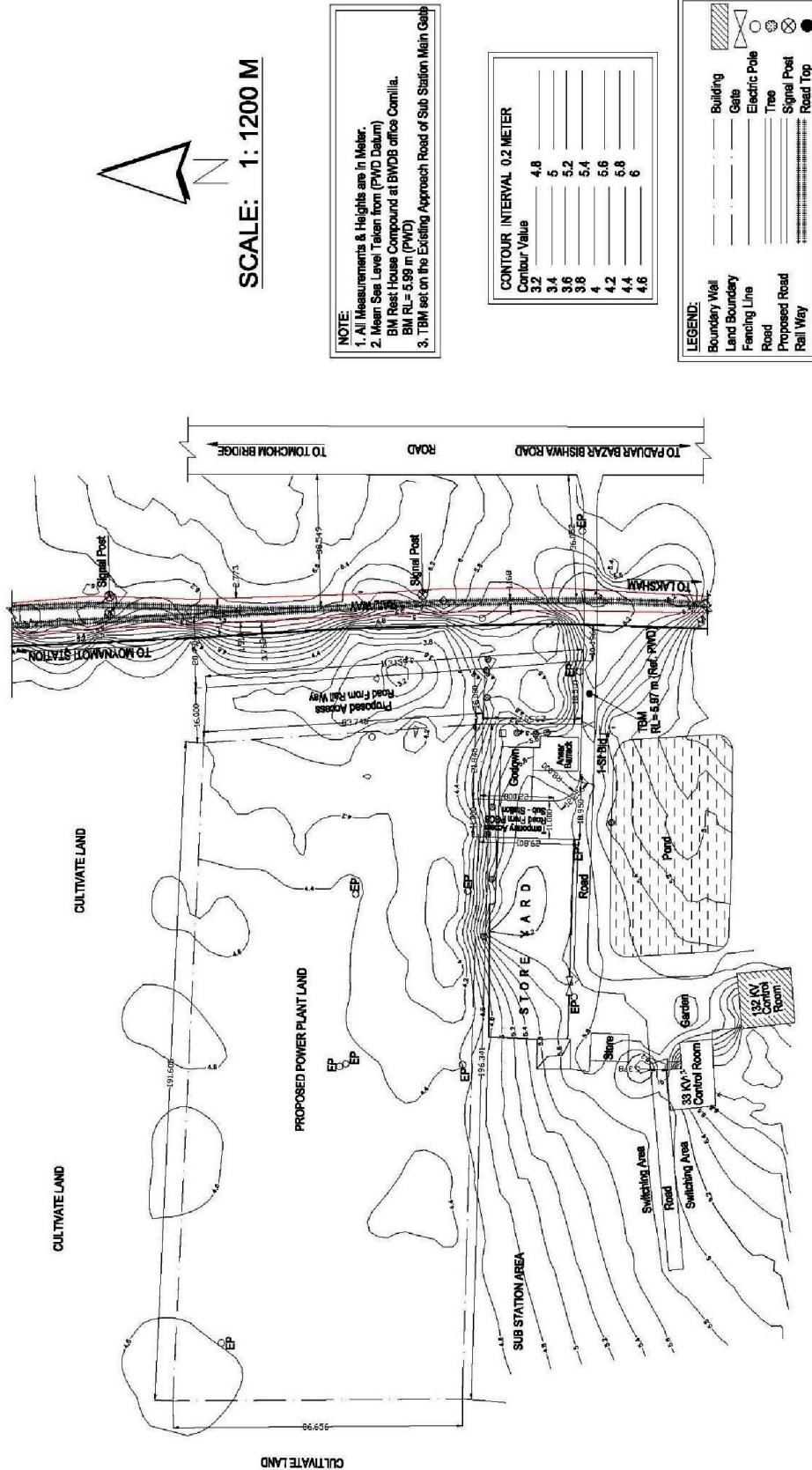
AT COMILLA, BANGLADESH



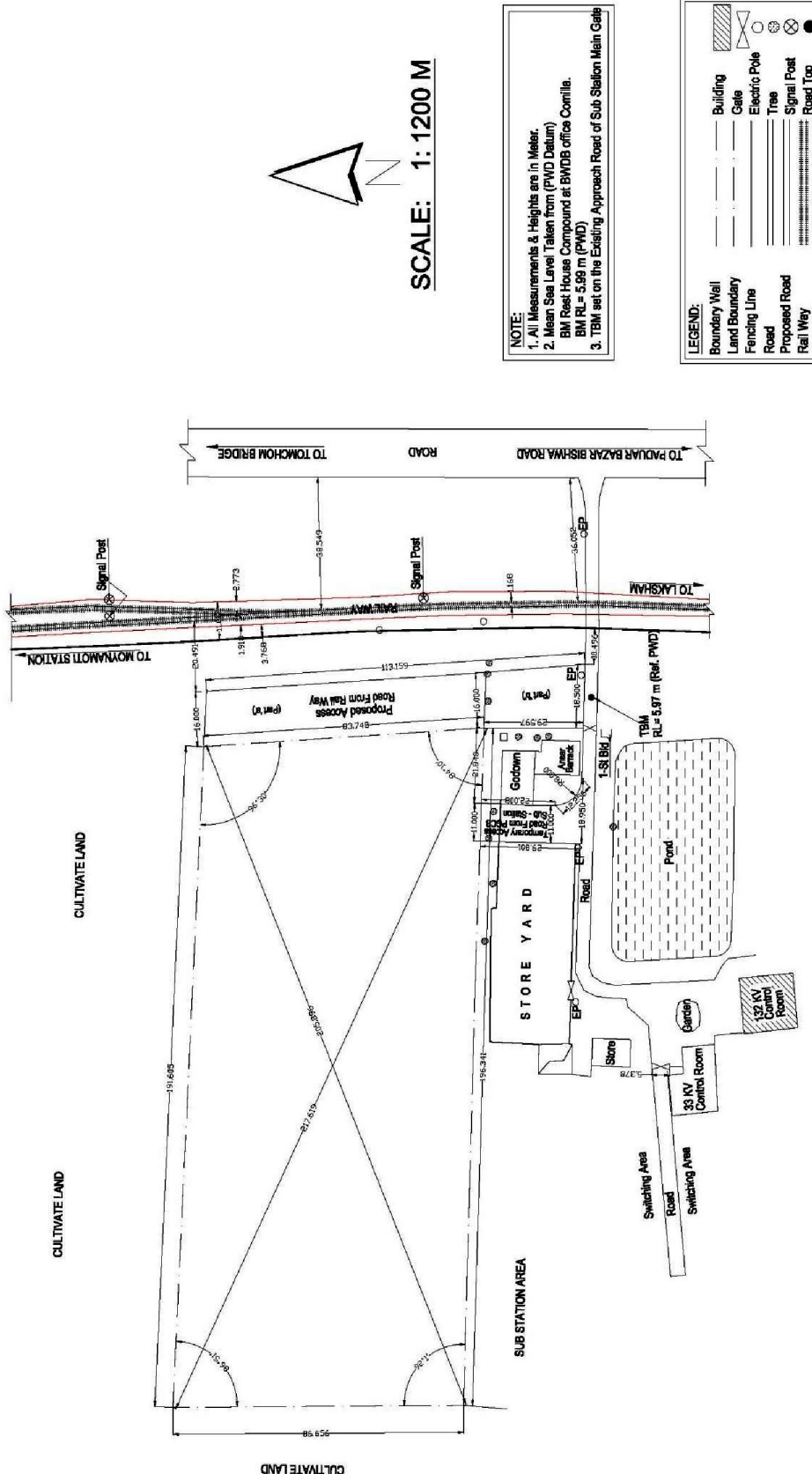
DIGITAL TOPOGRAPHICAL SURVEY, CONTOUR SURVEY & MAPPING OF POWER PLANT LAND



DRAWING TITLE :	PREPARED BY :	Temporary Access Road From PGC Sub - Station	Proposed Access Road From Rail Way	LAND AREA
Digital Topographical Survey, Contour Survey & Mapping of Proposed Power Plant Land at 50+10% MW Dual Fuel (MFOGAS) Fired Power Project, Jangalia, Comilla, Bangladesh.	LAND SURVEY TEAM 404/1-A, (1st Floor) Khilgaon Chowrashta, Dhaka - 1219. MOB : 01189-837754, 01552-334435 E Mail : landsurveyteam_1st@yahoo.com	338.328 Sqm	1948.837 Sqm	16437.273 Sqm
		8.360 Dec	45.686 Dec	406.179 Dec
LEVEL MAP	CHECKED BY:	5.064 Kala	27.673 Kala	246.030 Kala
		0.253 Bigha	1.393 Bigha	12.301 Bigha
SURVEYED BY:	DRAWN BY:	0.083 Acres	0.458 Acres	4.066 Acres
Md. Sanaul Haque Surveyor	Managing Director Engineer Moklesur Rahman	SCALE: 1 : 1200 M	DATE: 28, 28 -12 - 2011	



DRAWING TITLE :		PREPARED BY :		Temporary Access Road From PGCB Sub - Station	Proposed Access Road From Rail Way	LAND AREA
Digital Topographical Survey, Contour Survey & Mapping of Proposed Power Plant Land at 50-10% MW Dual Fuel (HFO/GAS) Fired Power Project, Jangalia, Comilla, Bangladesh.		LAND SURVEY TEAM 404/1-A, (1st Floor) Khilgaon Chowraha, Dhaka -1218. MOB : 01199-837754, 01552-334436 E Mail : landsurveyteam_ist@yahoo.com		338.326 Sqm	1848.337 Sqm	16437.273 Sqm
				8.360 Dec	45.888 Dec	406.179 Dec
CONTOUR MAP		DATE:		5.084 Kala	27.673 Kala	246.030 Kala
SURVEYED BY: Md. Saraul Haque Surveyor		SCALE: 1 : 1200 M		0.253 Bigha	1.383 Bigha	12.301 Bigha
				0.083 Acres	0.458 Acres	4.068 Acre
DRAWN BY:		CHECKED BY:				
Md. Rezaul Karim CAD-Operator		Managing Director Engineer Maktlesur Rahman				



DRAWING TITLE :		PREPARED BY :		Temporary Access Road From PGCB Sub - Station		Proposed Access Road From Rail Way		LAND AREA	
Digital Topographical Survey, Contour Survey & Mapping of Proposed Power Plant Land at 50-10% MW Dual Fuel (HFO/GAS) Fired Power Project, Jangalia, Comilla, Bangladesh.		LAND SURVEY TEAM 404/1-A, (1st Floor) Khigson Chowdhury, Dhaka - 1219 MOB : 01198-837754, 01552-334438 E Mail : landsurveyteam_jal@yahoo.com		338.328 Sqm 8.360 Dec 5.064 Kala 0.253 Bigha 0.083 Acres		1338.583 Sqm 33.077 Dec 20.038 Kala 1.001 Bigha 0.331 Acres		Total 1848.837 Sqm 45.686 Dec 27.673 Kala 1.383 Bigha 0.458 Acres	
DETAILED MAP		CHECKED BY:		DATE:		SCALE:		1 : 1200 M	
SURVEYED BY:		DRAWN BY:		MANAGING DIRECTOR		ENGINEER		RAHMAN	
Md. Sanaul Haque Surveyor		Md. Razaul Karim CAD-Operator		Engineer Moklesur Rahman					

Annex 7

Issue No. 72410-11



No. C-97594

**Office of The Registrar of Joint Stock
Companies & Firms,
(ACT XVIII OF 1994)**

IN THE MATTER OF Max Lanka Power Limited.

*I do hereby certify that pursuant to the provisions of section 11. sub-section (7) Act,
XVIII of 1994 (Companies Act, 1994), and under order of the Government of Bangladesh
conveyed by their Ref. No. X*

Department..... X dated the..... X
X
..... to the address of..... X

the name of: Max Lanka Power Limited.
has this day been changed to: Lakdhanavi Bangla Power Limited.
and that the said Company has been duly incorporated as a Company
under the provision of the said Act.

Dated this Twenty Three day of March two thousand and Twelve



Deputy Registrar,
Joint Stock Companies & Firms,
Bangladesh.

Issue No. 42516-22



Certificate of Incorporation

No. C-97594/11.....

I hereby certify that Max.Lanka.Power.Limited.....

*is this day incorporated under the Companies Act (Act XVIII) of
1994 and that the Company is Limited.*

*Given under my hand at.....Dhaka.....
this.....Eleventh.....day of.....December.....
two thousand.....Eleven.....*



.....
*Deputy Registrar of Joint Stock Companies & Firms,
Bangladesh.*

Issue No. 42523-24



Certificate for Commencement of Business

[Pursuant to section 150 of the Companies Act, 1994]
No. C-97594/11

Max Lanka Power Limited

I hereby certify that the-----

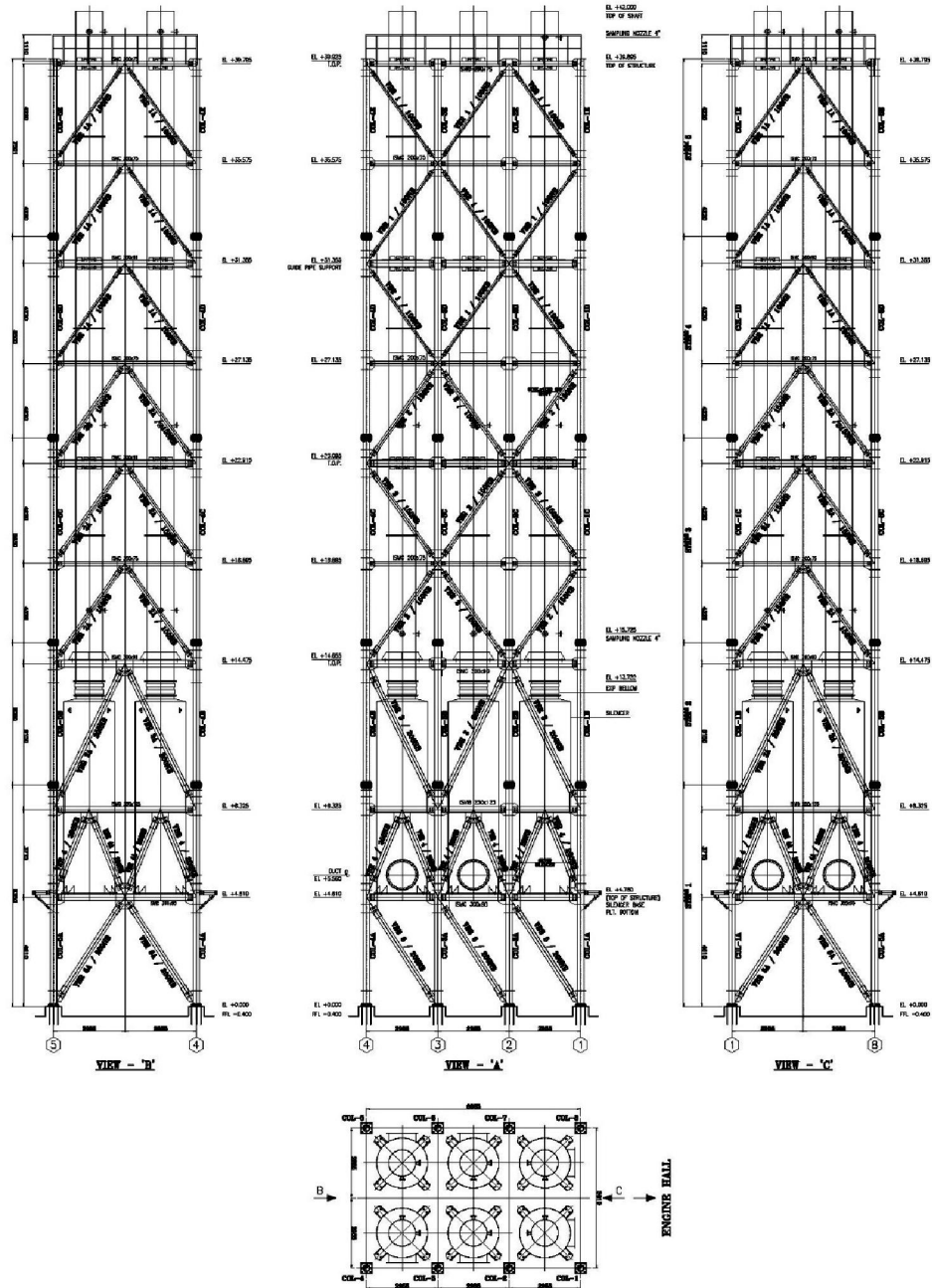
----- Eleventh
which was incorporated under the Companies Act, 1994 on the ----- day of
December 11
-----20-----and which has this day filed a duly verified
declaration in the prescribed form that the conditions of section 150 (a) to (d) of
the said Act, have been complied with, is entitled to commence business.

Given under my hand at ----- DHAKA ----- Eleventh
December ----- this-----
day of ----- two thousand and ----- Eleven -----.

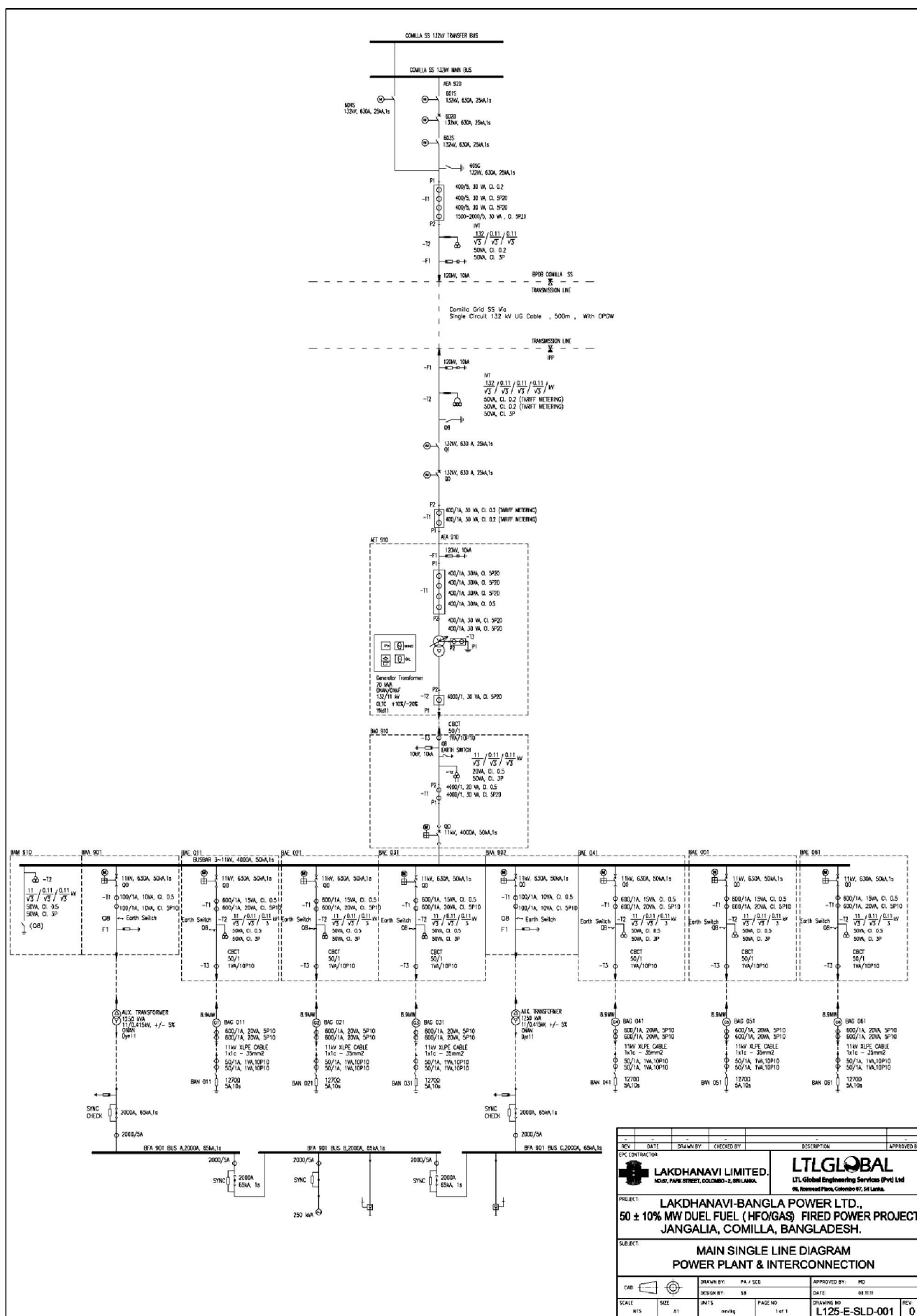


Deputy Registrar of Joint Stock Companies & Firms,
Bangladesh.

Annex 8



REV	DATE	UPON	CHECKED	DESCRIPTION	APPROVED
		BY	BY		BY
EPC CONTRACTOR:				LTLGLOBAL CE, Global Engineering Services (Pvt) Ltd 10, Baranagar, Calcutta-74, India	
 LAKDHANAVI LIMITED. HOUSE, PARK STREET, COLOMBO - 3, SRI LANKA.					
PROJECT: LAKDHANAVI-BANGLA POWER LTD., 50 ± 10% MW DUAL FUEL (HFO/GAS) FIRED POWER PROJECT, JANGALIA, COMILLA, BANGLADESH.					
SUBJECT: GENERAL ASSEMBLY FOR STACK & COLUMN SUPPORT STRUCTURE					
				DRAWN BY: RBP	
				APPROVED BY: LNS	



Annex 10

Proposed TOR for carrying out the Environmental Impact Assessment (ESIA)

1. Project location with latitude and longitude

For location of Project site a comprehensive GPS survey is to be conducted showing the latitude and longitude of at least six points of the project site by which one can easily assess the size, layout of the project site. In this regard, information collected from Google Earth will not consider as enough.

1. Engine emission specification of Power Plant

2. Specification of heavy furnace oil (HFO) as will be used in the project

4. Physical resources (at least geology, topography, seismicity in detail with maps and Photograph

5. Meteorology (at least minimum and maximum temperature of last five years of the project area collected from Bangladesh Meteorological Department including mean temperature map of Bangladesh)

6. Rainfall ((including rainfall data of last five years of the project area collected from Bangladesh Meteorological Department with Bangladesh average rainfall map

7. Humidity (including humidity data of last five years of the project area collected from Bangladesh Meteorological Department)

8. Wind speed and direction of last five years(including wind speed and direction data of last five years of the project area collected from Bangladesh Meteorological Department)

9. Cyclones and alignment of cyclonic event

10. Hydrology (pH, TDS, As, Cl, TSS, DO, BOD, COD, Total coliform and fecal coliform, Fe of surface and ground water)

11. Ambient air quality (twenty four hours hourly data of PM 2.5, PM10, SPM, SOx, NOx, CO at project site)

12. Air dispersion modeling

Air dispersion modeling is to be prepared by using a US EPA approved model preferably AERMOD or ISCST3 model. The modeling is to be prepared for five major pollutants – **NOx, SO2, PM10, PM2.5 and CO**. Deliverables under air dispersion modeling:

- ☐ Modelling results of aforesaid five pollutants
- ☐ Iso pleths for NOx
- ☐ Six wind roses representing six seasons
- ☐ Noise modeling

13. Public consultation

At least three types of focus group discussion. One with male group and another one with female group. And the third one will be large consultation with general people, NGO, political leaders, government officials. **During public consultation leaflet, banner etc. must be used and their photographs must be attached as an evidence of authenticity.**

14. Grievance redress mechanism and risk reduction

15. Faunal Species in the project area

English Name	Scientific Name	Local Name
REPTILES		
AMPHIBIANS		
MAMMALS		
BIRDS		

16. Floral Species in the project area

English Name	Scientific Name	Local Name
HERBS		
TREES		
WOOD TREE		

**Social and Cultural Profile to be inserted in Socio-Economic
Condition under Baseline Description section in EIA**

1. Population and community characteristics(male, female, religion, profession)
2. land acquisition issue
3. Physical and cultural resources(school, college, madrasa, mosque, temple, church, vocational institute)
4. Health and safety
5. Access to education (literacy rate etc, number of student)
6. Access to energy (percentage of electricity facility)
7. Communication facility

Photographs to be used in EIA

1. Photographs of project site
2. Photographs of four adjacent sides from the site
3. Photographs of existing important trees in the project site
4. Photographs of existing animals in the project site
5. Photographs of any endangered species

IPSA is a brief of Initial Socio-economic Impact Assessment of the project area. It has to be included following information:

1. Information on Project site

- a. Name of the mouza, ward no. village, union, upazila/thana and district
- b. Area of the project site¹
- c. Distance from nearby divisional headquarters

2. Demographic Information

- a. Current population in the project area²
- b. Previous population at least of last 10 years
- c. Population breakdown in respect of religion
- d. Number of families/households receiving government relief support as vulnerable group feeding (VGF) or other
- e. Distribution of labor force (service, farming, business)
- f. Farming scenario (independent farmer, lease holder)
- g. Income distribution
- h. Tribal/indigenous composition of the community

3. Existing condition of the Project

Current use of the project site (farming, small business, encroached/slums or vacant)

i. If existing use is farming

1. Mention what crops are cultivated in the site
2. How many people are involved with farming?
3. How people have been permitted to farming in the project site?
4. What will they do, if they have to leave the land for project purpose
5. Mention the name of farmers and their contact details

ii. If existing project site is used for small business

1. Mention type of small business
2. How many people are involved with small business
3. How people have been permitted to start business in the Project site (lease/force)
4. What will they do, if they have to leave the business from the Project site
5. b. Does the project site require general land filling? if required

iii. Depth of the land filling

- i. Arrangement of land filling (type of filling materials, source of filling materials, compliance of Water Body Act 2000 etc. as applicable)
- ii. Does the site require filling pond, ditch, beel, khal etc.? if required
- iii. Depth of land filling
- iv. Arrangement of land filling
- v. What are the existing tangible assets in the site?
- vi. What are the existing non-tangible assets in the site?
- vii. Project site means the specific piece of land where the project will be developed
- viii. Project area means the surrounding area of the project site

4. Accessibility to medical facility

- a. Number and qualification of available doctors in the project area
- b. Arrangement of general health care facility-hospital, clinic or none
- c. Arrangement of maternal health care facility-hospital, clinic or traditional midwifery

5. Access to education

- a. Name and number of primary schools in the project area
- b. Name and number of secondary school in the project area

6. Cultural heritage

- a. Name of the historic place
- b. Name of the famous persons
- c. Name of the famous place in the project area
- d. Name of the famous mosque, temple, pagoda etc.
- e. Name of the famous waterbody
- f. Name of the famous forest
- g. Name of nearest ecologically critical area

7. Maps and photographs

- a. CS, RS or SA map of the site as is available indicating the project site
- b. Photographs of the site taken from the east, west, north and south boundary position of the site
- c. Photographs of access road of the site
- d. If the Project site is near a water body, at least two photographs showing the relative position between the water body and project site

GENERIC OUTLINE OF AN ENVIRONMENTAL IMPACT ASSESSMENT REPORT

A typical EIA report contains the following major elements. The substantive aspects of this outline will guide the preparation of environmental impact assessment reports, although not necessarily in the order shown.

A. Executive Summary

This section describes concisely the critical facts, significant findings, and recommended actions.

B. Policy, Legal, and Administrative Framework

This section discusses the national, local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party.

C. Description of the Project

This section describes the proposed project; its major components; and its geographic, ecological, brief social, and temporal context, including any associated facility required by and for the project. It normally includes drawings and maps showing the project's layout and components, the project site, and the project's area of influence.

D. Description of the Environment (Baseline Data)

This section describes relevant physical, biological, and socioeconomic conditions within the study area. It also looks at current and proposed development activities within the project's area of influence, including those not directly connected to the project. It indicates the accuracy, reliability, and sources of the data.

E. Anticipated Environmental Impacts and Mitigation Measures

This section predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic (including occupational health and safety, community health and safety, vulnerable groups and gender issues, and impacts on livelihoods through environmental media and physical cultural resources in the project's area of influence, in quantitative terms to the extent possible; identifies mitigation measures and any residual negative impacts that cannot be mitigated; explores opportunities for enhancement; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions and specifies topics that do not require further attention; and examines global, transboundary, and cumulative impacts as appropriate.

F. Analysis of Alternatives

This section examines alternatives to the proposed project site, technology, design, and operation including the no project alternative-in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under

local conditions; and their institutional, training, and monitoring requirements. It also states the basis for selecting the particular project design proposed and, justifies recommended emission levels and approaches to pollution prevention and abatement.

G. Information Disclosure, Consultation, and Participation

This section:

- i. describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders;
- ii. summarizes comments and concerns received from affected people and other stakeholders and how these comments have been addressed in project design and mitigation measures, with special attention paid to the needs and concerns of vulnerable groups, including women, the poor, and Indigenous Peoples; and iii. describes the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for carrying out consultation with affected people and facilitating their participation during project implementation.

H. Grievance Redress Mechanism

This section describes the grievance redress framework (both informal and formal channels), setting out the time frame and mechanisms for resolving complaints about environmental performance.

Annex 11

Minutes of the Stakeholders Consultation Meeting On 52.2 MW Proposed Power Plant project at Jangalia, Comilla

A Stakeholders consultation meeting was held in the City Club of Jangalia, Comilla Sadar South, Comilla on 24th November 2013 from 10 am to 2.0 pm. The meeting was presided over by the Ward Counselor of 22 no. Ward, Comilla City Corporation and keynote Speech presented by Dr. Moinul Islam Sharif, Project Director of this project and the meeting was conducted by Mr. Osman Goni Shawkat, SRO, BCAS. There participated different categories of people from Farmers level, Businessman, Service holders, NGO representative, Public leaders, government officials around the project site and discussed about the impacts from different angle ie. Water related impacts, Air related impacts and the Sound which will directly affect the nearest settlement. The list of participant of the meeting is included in the end of the report.

The discussing issues are as follows:

1. Mr. Abdul Malek, Ward Commissioner, 22no. Ward of Comilla city corporation, Comilla Sadar South raise the following issues:
 - a. Water:

The power plant will uptake a lot of water from the ground level and will discharge after using. We are concern about the pollution of water and the hot water which will release in the outside and we also concern that we have no sewerage line to flow the water, therefore our agriculture and the surroundings fisheries will be affected. As per example we see the impact of nearest Export Processing Zone (EPZ).
 - b. Sound:

As you told that the plant will run by the Heavy Furnace Oil, we know the oil based plant creates high sound. Our settlement is nearly closed to the proposed plant site. If the sound become high than the children, student and old people will be affected therefore our question is –what measure will be taken by the project sponsor to check the pollution .
 - c. Air:

We don't have knowledge on air pollution what type of air pollution will be generated. If it polluted the surrounding environment than what type of measures the project sponsor will take.

Response from the consultant end by Dr. MI Sharif, project director, BCAS

Project sponsor engaged us as a consultant to address the impact of the project site due to 52.2MW power plant installation and operation. We already study the baseline situation of this area especially the Air, Sound, Water condition and exchange the opinion with the local people for their perception. We developed a model to predict the impact of the air and sound. According to this we found that such kind of small project will not affect the nearest settlement

and also for better environment we suggested to minimize the sound and air pollution through high technology usages and fencing boundary by thickness wall and tree plantation.

2. Mr. Saiful Amin, Land owner and the social worker of Jangalia Ward, Comilla City Corporation
 - a. We are living very closed to the proposed project site, Deputy Commissioner have acquired 4.0 acre of land from us and we have some land adjacent to the project boundary, by this project we will be the most affected people and our child and student and the old age people will be severe affected by this. As you told that this plant will operate by the HFO and I know that the diesel based plant generate high volume of sound. If sound cross the limit and affect us than what measures will be taken by the project sponsor.
 - b. We suggest revising the plan and changing the plant site from Jangalia to Lalmi Hill area. The area is 4-5 Km away from here and the area is not so population densely.

Response from the consultant end by Dr. MI Sharif, project director, BCAS

As I described in earlier that the sound will not affect the nearest household which we shows by model.

To revise the plan for relocating the plant site from here, I will convey the message to the project sponsor and to government through my report.

3. Mr. Mafijul Islam
 - a. Water pollution is the main problem and it will decrease our fisheries resources. Do you have any plan to purify the water than release to the outside of the plant? In addition to, here is no sewerage line for discharging the waste water, in this stage what type of measures you are going to adopt
 - b. Sound pollution will be the major concern to us, by this impact- our student, children and our natural life will be hampered, what measures you will be taken?

Response from the consultant end by Dr. MI Sharif, project director, BCAS

Drainage system will be developed for water discharge but I can tell you that a little quantity of water will be used for operating the equipments and the discharge water will be treated by using ETP in the project site than will release. We suggested keeping monitoring cell for monitoring the waste water in every 3 month later and sending the report to DOE. GOB. Dr. Shariff appreciated the participants that this type of consultation meeting will help me to understand the opinion and present situation of the locality.

To keep the sound in ambient level we already developed a model and found that the sound limit will not cross the project boundary, we have recommended taking necessary action to keep the sound within the DoE standard during operation period

4. Mr. Abdul Kader Bulu, Candidate for the Ward Counselor, Jangalia

This is a semi urban area, every day by day the amount of people increases and settled here. In future this area will be completely a town. I am very much concern about the sound pollution. Sound mitigation should be taken

Response from the consultant end by Dr. MI Sharif, project director, BCAS

We will consider the sound pollution and will recommend the mitigation system so that sound may not affect the nearest settlement.

5. Mr. Rezaul Karim, a house owner adjacent to the plant side
I am living very near to the project site. All kinds of pollution will affect me directly. Power crisis is acute in the country and such kind of power plant installation is good news but simultaneously government has to think about the surrounding environment and interest of the citizen. If hamper our health by this plant, we will go to the procession to quit this from here. We suggest installing this plant in Lalmai Hill area where settlement will not be hindering position
6. Mr. Nesar Alam, neighbor

Raised same type of quarries and expect to use the natural gas driven machineries so that sound pollution will not be the causes.
7. Mr. Mahbubur Rahman, Ward Counselor, 21 no. Ward, Comilla City Corporation, Sadar South

Electricity is a burning question now a days, we appreciate the government to establish this plant here but expect that the project sponsor should consider the people health and environment. Project sponsor should use sound free modern technology.
8. Mr. Kabir, Public leader and candidate of 21no. Ward, Comilla City Corporation, Sadar South

I would like to draw the attention of concern ministry, GOB to consider the villagers opinion and the interest through you (consultant). I am afraid the hot water and waste water will decrease our fisheries resources, please adopt a good system to make the water chemical free. Sound free equipment should have to install. We have a good number of unemployment youth. We hope the project sponsor will engage our villagers according to their skill. We expect our local contractor will do all types of work, supplying concrete, cement, brick, manpower, sand and soil to fill the low land.

Response from the consultant end by Dr. MI Sharif, project director, BCAS

This is a good suggestion and good comments; I will convey the message to the concern ministry, GOB and the project sponsor through my report. Project sponsor will consider all types of recommendations which come from the villagers end. The system is- we will send the report to the client and client will deliver the report to ADB and IDCOL who will be the funding agencies. ADB will keep the report in the internet for public disclosure and there you can share your opinion. ADB will take it into consideration. This will happen 2/3 month later from now.

Finally the meeting was concluded by the thanks of the chair.

The participant list is below:

List of Consultation Meeting on

Proposed 52.2 MW Power Plant at Jangalia, Comilla, Bangladesh

Venue: City Club, Jangalia Bus Stand, Comilla Sadar South, Comilla

Date: 24th November 2013, Organized by: Bangladesh Centre for Advanced Studies (BCAS)

Sl. No.	Name	Age and Sex	Occupation	Contact No	Signature
1	Mr. Shamim	25 , Male	Agriculture	01911305860	
2	Mr. Al Amin Hasan	30, Male	„	01711444411	
3	Mr. Jahangir Alam	35, Male	„	01834801842	
4	Mr. Shah Poran	36, Male	Business	01960969280	
5	Mr. Robin	41, Male	Business	01916116828	
6	Mr. Abdul Mannan	36, Male	Business	01711146699	
7	Me. Ziaur Rahman	43, Male	Business	01681599214	
8	Mr. Mehedi Hasan	42, Male	Business	01960990105	
9	Mr. Md. Jakariya	45, Male	Business	01981121807	
10	Mr. Mehedi Hasan	33, Male	Business	01760691834	
11	Mr. Abul Bashar	55, Male	Business	01717960856	
12	Mr. Mahabubur Rahman	44. Male	Business	01711337645	
13	Mr. Md. Forhad	27, Male	Business	01710803820	
14	Mr. Md. Osman Goni	42, Male	Service	01713248374	
15	Mr. Md. Sohel	41, Male	„	01713248359	
16	Ms. Rahima Begum	27, Female	House Wife	x	
17	Ms. Hosn Ara	22, Female	„	x	
18	Mr. Abdul Karim	33, Male	...	x	
19	Ms. Nurjahan Begum	33, Female	House Wife	x	
20	Ms. Shafia Begum	32, Female	„	x	

IEE Final for 52.2 MW Power Plant at Jangalia, Comilla, Bangladesh
January 2014, Prepared by: BCAS

Sl. No.	Name	Age and Sex	Occupation	Contact No	Signature
21	Ms. Hoshne Ara	20, Female	„	x	
22	Ms. Rajia Khatun	22, Female	„	x	
23	Ms. Moni Begum	25, Female	Service	x	
24	Ms. Nasima Begum	35, Female	House Wife	x	
25	Ms. Shahin Sultana	36, Female	House Wife	01720454358	
26	Mr. Iftekhar Ahmed	38, Male	Agriculture	x	
27	Mr. Tanjir	27, Male	Service	x	
28	Mr. Shihab	25, Male	Business	x	
29	Mr. Mojibul Haque	25, Male	„	x	
30	Mr. Shohidul Islam	30, Male	„	01923701290	
31	Mr. Mofijul Islam	35, Male	Agriculture	01829049535	
32	Ms. Shelina	35, Female	Agriculture	x	
33	Ms. Ayesha	40, Female	„	x	
34	Ms. Tania	25, Female	Service	x	
35	Ms. Jui	26, Female	„	x	
36	Mr. Robin Uddin	22, Male	„	x	
37	Mr. Munna	35, Male	„	x	
38	Mr. Johor Ali	35, Male	Agriculture	01835302757	
39	Mr. Delowar Hossain	36, Male	„	01811662023	
40	Mr. Momtaz Uddin	39, Male	„	01715906016	
41	Mr. Sarafot Ali	35, Male	„	x	
42	Mr. Shirajul Islam	41, Male	„	01845957121	
43	Mr. Tofazzal	45, Male	„	x	

IEE Final for 52.2 MW Power Plant at Jangalia, Comilla, Bangladesh
January 2014, Prepared by: BCAS

Sl. No.	Name	Age and Sex	Occupation	Contact No	Signature
44	Mr. Ruhul Amin	45,Male	„	01712202615	
45	Mr. Foyej Ahmed	46,Male	Service	01715217387	
46	Mr. Mofijul Islam	32,Male	Business	01966481648	
47	Mr. Saiful Islam	36,Male	„	01711300139	
48	Mr. Shah Alam	35,Male	„	01711143298	
49	Mr. Johirul Islam	39,Male	Unemployed	01711383784	
50	Mr. Nirmol Gosh	40,Male	„	01711948091	
51	Mr. Wahab Ali	42,Male	„	x	
52	Mr. Raju	27,Male	Business	01837367211	
53	Abdul Malek Ansary	52, Male	Ward Counselor	01711322669	
54	Mr. Saiful Amin	42, Male	Social worker	x	
55	Mr. Mafijul Islam	35, Male	Political leader	x	
56	Mr. Abdul Kader Bulu	55, Male	Business	x	
57	Mr. Rezaul Karim	52, Male	Business	x	
58	Mr. Nesar Alam	37,Male	Business	x	
59	Mr. Mahbubur Rahman	41, Male	Business	x	
60	Mr. Kabir Hossain	45, Male	Business	x	
61	Mr. Sha Alam	34,Male	Business	01711143298	
62	Mr. Zahirul Islam	55, Male	Business	01711383784	
63	Mr. Nurul Islam	42, Male	Journalist	01713248301	
64	Mr. Md. Abul Hossain	42, Male	NGO representative	01812053427	

Photos of consultation meeting



1. Stakeholder's Meeting with women vulnerable group

A stakeholder's meeting with the vulnerable female group of the project area was held on 15th October 2013 at 11.30 am. The meeting was organized by Bangladesh Centre for Advanced Studies (BCAS) and conducted by Mr. Osman Goni Shawkat and Mr. MZH Khan, BCAS. The list of the participants is given below:

1. Moshammad Lalmoti Bibi
2. Moshammad Sundari Bibi
3. Moshammad Sufia Begum
4. Moshammad Faijunnesa
5. Moshammad Fatima Begum
6. Mosammad Khosi Bibi
7. Mosammad Shamima
8. Moshammad Mina Begum
9. Moshammad Surma Begum
10. Moshammad Mojlis Bibi
11. Moshammad Monowara Begum
12. Mrs. Begum Bibi

The meeting discussed the following issues:

1. Mrs. Khushi Begum pointed out that we have no financial capability to do any business or create a firm or culturing the domestic animal. We are seeking some fund so that we can earn money with this and look after our family
2. We are physically sick and seeking treatment but we have no capability to go to Dr. Chambers. We need a hospital to primary health care and treatment to the pregnant women and old aged people
3. We have adult son, they are totally unemployment and therefore we are seeking work in the power plant site. Our people don't get chance to do the work in the plant side, people from far area are working here by cheap rate. It is administered by some local elite and take additional fund.
4. We are seeking food for work and old age incentives from the government
5. Surma Bibi said she has no capacity to build a house. She is living in the road side and has no capacity to build the house by tin or brick therefore she went to the loan payer. She is seeking some fund to build the house
6. Khushi Bibi carried when she briefed her life that she is passing so miserable life that she has no any way to stand the house. She is lying in another relative house. She is seeking some fund to construct the house.
7. Begum Bibi said she is working in a relative house and lying in the khas land. After a quarrel she went away from here and living in the roadside in a thatched house which is about to sink in the by the rain water during rainy season. At the time of the study she heard that we came here and she rushed to us and briefed her story. Now she is expecting a shelter and some food for living. She briefed that she has three daughters at the age of marry and still she is widow.
8. Some of them are seeking sanitary latrines
9. Finally the focused group discussion meeting was closed by the thanks of the participant and admiring to solve the problem as soon as possible.

2. Stakeholder's Meeting with Project Affected Persons (PAPs) group

A stakeholder's meeting with the Project Affected Person whose are directly and indirectly affected by the lost of land (although they received all the compensation of land) was held on 18th October 2013 at 11.30 am in the Jangalia village at the house premises of Mr. Jahirul Mia. The meeting was organized by Bangladesh Centre for Advanced Studies (BCAS) and conducted by Mr. Osman Goni Shawkat and assisted by Mr. Moniruzzaman, SRO,

The list of the participants is given below:

1. Mr. Jahir Mia informed the meeting about 98% people already received the compensation from the LAO office and the remaining 2% in land dispute and litigation problem of the Power plant. The remaining are rushing to the court to show the documents and some people have no any documents in favour of their land.
2. Mr. Jahir Mia also said that DC has acquired the land and noticed to whom has legal deed, on the contrary, the men whose are cultivating the DC Khas land from last 20-30 years they did not got any notice and compensation.
3. Mr. Anhar Mia pointed some issues that some people were depended on it. They cultivating the land through share cropping over the year, at present they are workless and don't get any suitable job which helps them to maintain their family. We are seeking compensation and working facilities of them in the

S.N.	Name	Age	Sex	Occupation	Contact No.
1	Mrs. Nilufa Begum	36	Female	Business	01677801787
2	Mrs. Firoza Begum	65	Female	Housewife	01921087477
3	Mr. Jahir Mia	36	Male	Business	01739242334
4	Mrs. Jahanara	70	Male	Job	01736673303
5	Abdul Matin	67	Female	Housewife	01726619815
6	Mr. Suman	60	Male	Business	01727019225
7	Mrs. Jahanara	39	Female	Housewife	01921087841
8	Mrs. Mamataz	23	Female	Job	01558680452
9	Mrs. Lili Begum	20	Female	Housewife	01917285232
10	Mrs. Amina Begum	26	Female	Housewife	01819591391
11	Mr. Nizam Mia	45	Male	Business	01676120012
12	Mr. Amir Hossain	38	Male	Business	01716484017
13	Mrs. Salma Begum	39	Female	Housewife	01732648011
14	Mr. Niranjana Devnath	60	Male	Business	01837660013
15	Mr. Belal Hossain	35	Male	Driver {CNG}	01911722344

power plant.

4. There were some day labourer whose led their life by labour on this land, at present they are totally unemployed and didn't get chance in the plant.
5. We already lost our grazing field where the four villagers cattle to Graz.

Finally the meeting ended with the thanks of the facilitators.

3. Stakeholder's Consultation Meeting with Local Elite Group

A stakeholder's discussion meeting with the local elite whose are directly and indirectly affected by the project was held on 17 October 2013 at 11.30 am in Ramnagar village at the house premises of Mr. Shah Alam. The meeting was organized by Bangladesh Centre for Advanced Studies (BCAS), presided over by Mr. Saiful Amin and conducted by Mr. Osman Goni Shawkat and assisted by Mr. Moniruzzaman, BCAS. The participant list of the meeting is given at the end of this report. The

S.N.	Name	Age	Sex	Occupation	Contact No.
1	Mr. Faruk Mia	27	Male	Carpenter	01731189201
2	Mr. Kuddus	30	Male	Job	01815546819
3	Mr. Khurseed Alam	60	Male	Business	01835024987
4	Abdul Kader	35	Male	Job	01967378410
5	Mr. Tofazzal Hossain	25	Male	Job	01919574592
6	Mr. Shahjahan	38	Male	Business	01849146118
7	Mr. Monir Mia	32	Male	Business	01558680452
8	Mr. Serajul Islam	24	Male	Job	01840021963
9	Mr. Abu Taher Mia	40	Male	Business	01836300324
10	Mr. Idris Mia	39	Male	Job	01824260824
11	Mr. Shohel Mia	29	Male	Job	01557030482
12	Mr. Babu Mia	45	Male	Job	01716478011
13	Mr. Abdul Kashem	41	Male	Business	01781245306
14	Mr. Shamim Mia	38	Male	Business	01727019225
15	Mr. Zaman Mia	27	Male	Job	01736673303
16	Mr. Hanif Mia	40	Male	Driver {CNG}	01731184905
17	Mr. Nausher Ali	24	Male	Rickshaw Puller	01836003231

meeting discussed the following issues:

Advantages:

1. The value of the land is increasing in every day by day. Once we could not imagine that the price of land would be in this position now it is about five lac taka/decimal
2. The unemployment youth will get the job opportunity in the project site

3. Local Road will made by concrete by the project sponsor as we expect
4. In future, this area will be a urban area and according to other project , the project sponsore will establish a college, a hospital, a high school and construct the road, if they follow this word than this area will turn into a urban area
5. In the light of project facilities, our children will get higher education and society will be developed by the project facility

Disadvantages: Firstly we have lost our fathers' land where we cultivated the land from time immemorial

1. We got a good amount of cash as land compensation but we are afraid it will be exhausted once
2. Sound pollution by the industrial setup will be high which will be the causes to our daily life
3. During Filling the heavy hammer will cause the crack of our house floor
4. Decrease the natural fish, in future pollution will be severe as we realize
5. We afraid to sound and air pollution in future as we are living in the project site(500m away)

Demand:

1. Technical Training for capacity building the general people who lost their land
2. Working facilities in the plant site as per qualification and stillness
3. We hope the project sponsored will establish a college, a hospital, a high school
4. We demand uninterrupted electricity, gas line in our residence, sanitation facility etc
5. We highly demanded to keep the surrounding environment pollution free and the agricultural land chemical free.
6. As we hard that this plant will uptake a huge amount of water from ground and hot water will release into the land. Our expectation is the hot water should release into the land after make it cool because, a large community is dependent on the fisheries of the wet land.

Finally this meeting was concluded by the thanks of the president

The participant list with occupation and contact number is given below:



Annex 12

