Initial Environmental Examination – Lakdhanavi Bangla Power Limited

Project Number: 42180-013
Annual Report
December 2014

BAN: Second Public-Private Infrastructure Development Facility (PPIDF II)

Prepared by the Infrastructure Development Company Limited (IDCOL) for the People's Republic of Bangladesh and the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 30 June 2015)

Currency unit	–	taka (Tk)
Tk1.00	=	$0.013
$1.00	=	Tk77.775

NOTES

(i) The fiscal year (FY) of the Government of Bangladesh ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2015 ends on June 2015.

(ii) In this report, "$" refers to US dollars.

Second Public-Private Infrastructure Development Facility (RRP BAN 42180)
Loan Number: 3045-BAN

INITIAL ENVIRONMENTAL EXAMINATION

52 MW POWER PLANT AT JANGALIA, COMILLA



Lakdhanavi Bangla Power Limited

June, 2014

Prepared by

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WEIGHTS AND MEASURES

MW	Mega Watt
kV	Kilo Volt
kW	Kilo Watt
A	Ampere
Hz	Hertz
rm	Running meter
rft	Running feet
ppm	Parts per million
K	Kelvin
C	Celsius

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ABBREVIATIONS

ADB	Asian Development Bank
BCAS	Bangladesh Centre for Advanced Studies
AQMP	Air Quality Management Project of Word Bank
BEZ	Bio-ecological zones
BGDCL	Bakhrabad Gas Distribution Company Limited
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
CCC	Comilla City Corporation
COD	Chemical Oxygen Demand
DOE	Department of Environment
DSC	Design and Supervision Consultant
EA	Executing Agency
ECR	Environment Conservation Rules
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
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	Hectare
IA	Implementing Agency
IDCOL	Infrastructure Development Company Limited
IEE	Initial Environmental Examination
IPSA	Initial Poverty and Social Impact Assessment
KII	Key Informant Interview
LBPL	Lakdhanavi Bangla Power Limited
LLA	Land Lease Agreement
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
PPA	Power Purchase Agreement
PPM	Parts Per Million
PRIME	Plume Rise Model Enhancement
LBPL	Regent Energy and power Limited
SO_2	Sulfur di Oxide
SPM	Suspended Particulate Matters
SPS	Safeguards Policy Statement
TDS	Total Dissolved Solid
TSS	Total Suspended Solid
US EPA	United States Environmental Protection Agency

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 based technology with capacity of about 52 MW. The project site is located at Ward no. 22 of Comilla City Corporation under Jangalia Mouza[1]. For financial assistance, LBPL has approached to a number of financial institutions including Infrastructure Development Company Limited (IDCOL), Bangladesh. Considering the importance of the Project to meet the national power demand, IDCOL Board has approved a term loan facility of USD 15 million in favour of the Project. IDCOL plans to source the required financing from the fund allocated as ordinary capital resources (OCR) for large infrastructure projects under Public-Private Infrastructure Development Facility (PPIDF) of Asian Development Bank (ADB).

According to the Environment Conservation Rules, 1997 of Bangladesh Government, industrial projects have been categorized into four classes—Green, Orange A, Orange B and Red. Considering the magnitude of environmental impacts, power plant projects have been classified as Red Category projects. So, LBPL project has fallen into the Red Category according to ECR 1997. According to the ADB guidelines, small power plant projects like the 52 MW project of LBPL is likely to be fallen into Category B, as the environmental impacts of these type of projects are mostly project site specific[2]. In addition, the environmental and social safeguards framework (ESSF) of IDCOL has categorised the Project as Moderate Risk Project.

As a part of environmental compliance, there is a requirement for preparation of an Initial Environmental Examination (IEE) report. In this regard, LBPL has appointed Bangladesh Centre for Advanced Studies (BCAS) to prepare this IEE report following the guidelines of Department of Environment (DOE), Government of Bangladesh (GOB) and Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS, 2009).

Initially, LBPL has thought for a number of alternative sites. But finally they have selected the site locating just beside the existing sub-station of Power Grid Company of Bangladesh (PGCB) due to the close proximity to the sub-station, good accessibility, favourable baseline environmental and social conditions etc. The site at Jangalia has been finalised.

The ambient condition of project site has been found suitable for a power plant project. The ambient noise level ranges 30 to 85 dBA at various times of day and night. The temporal higher noise level comes from the heavy vehicles as the project site is in a close proximity to Dhaka-Chittagong National Highway and Comilla-Laksham Road. The topography of the project site has been found as mostly flat. The result of Topographic Survey shows that there is no significant difference in contour. But LBPL will require about 1.5-2 meters of land filling to adjust the height of the project site with adjacent roads and railway lines and above all the issue of annual flood. In construction phase, dust comes from construction activities

[1] **Mouza** is a type of administrative district, corresponding to a specific land area within which there may be one or more settlements.

[2]Based on the information as has been found in www.adb.org/documents/guidelines/environmental_assessment/environmental_categorization.pdf

including traffic movement, which is to be mitigated through regular sprinkling and covering of construction materials and above all enforcing relevant standards. Solid, kitchen and sanitation wastes are to be mitigated through application of 3R principles (as is possible), ensuring disposal of waste to dustbin and landfill (as is designated by local authority) and ensuring application of proper sanitation facility. Noise is a common issue in most of the construction activities, which can be mitigated by application of sound mitigation device and shifting of construction time, such as accomplishment of major noise generating activities from 10. a.m. to 3.00 p.m. Although there are no significant trees, herbs or shrubs in the project site, there will be some impacts on localised flora and fauna, which can be mitigated by application of proper design and above all adopting compensation measures including re-planting/re-introduce them. The scale of visual impacts can be mitigated by adopting fencing all around the project site and accomplishing the construction activities as early as possible. In consideration of nature of construction activities, it can be said that there is limited scope of surface and ground water contamination as no hazardous materials will be used. As mitigation application of mud-tank to manage construction wash water seem to be effective. Accident is general concern for any construction activities, which is to be addressed with ensuring due awareness and providing required Personnel Protective equipment (PPE) to the workers. Key environmental impacts during construction and operation phase are provided in following table:

Table: Summary of environmental impacts during construction and operation phases

Subject area	Potential impacts during Construction	Potential impacts during Operation
Air quality	▪ Dust from construction activities ▪ Traffic related air quality impacts	▪ Impacts of emission from stacks on ambient air quality ▪ Traffic related air quality impacts
Aquatic environment	▪ Control and management of site drainage ▪ Waste water discharge ▪ Sewage disposal and foul drainage	▪ Thermal water discharge ▪ Water requirement for power plant operation ▪ Discharge of process and wastewater ▪ Operation of on-site drainage system ▪ Discharge of storm water, sewage and drainage
Noise and vibration	▪ Noise from construction activities	▪ Noise from power plant operation on surrounding landuse
Flora and fauna	▪ Loss of habitat or species due to land intake. ▪ Disturbance or damage to adjacent habitat of species	▪ Disturbance or damage to adjacent habitat
Land use, landscape and visual issues	▪ Land use on site and surrounding area ▪ Effects of construction activities on landscape character ▪ Visual impact on construction activities	▪ Land use on site and surrounding area. ▪ Effects of operational activities on landscape character

Subject area	Potential impacts during Construction	Potential impacts during Operation
		Visual impact on construction activities
Soil, geology and hydrogeology	▪ Effects on soils and geological features. ▪ Ground contamination ▪ Effect on groundwater	▪ Effects on soils and geological features ▪ Ground contamination ▪ Effect on groundwater
Natural disaster	▪ Seismic risk, flood risk	▪ Seismic risk, flood risk
Solid and hazardous waste management	▪ Contamination of soils and water ▪ Hazards to workers health ▪ Accident risks	▪ Contamination of soils and water ▪ Hazards to workers health ▪ Accident risks
Occupational health and safety	▪ Accidents and injury ▪ Effects on health of workforce ▪ Safety at work	▪ Accidents and injury ▪ Effects on health of workforce. ▪ Safety at work

It is said that the plant has dual fuel options-i.e. heavy fuel oil (HFO) and natural gas. While operating with HFO, SOx emission could be a concern. In this regard, an air dispersion modelling was done by using US EPA approved ISC3P Model. The model results show that the concentration level will be within the Ambient Air Quality Standard of the Department of Environment (DOE), as the presence of Sulphur is only 3.5% of the total weight of mass (Source: Bangladesh Petroleum Corporation). In case of using natural gas, NO_X emission could be an issue in case of incomplete combustion. In the Project, electricity will be produced by using lean burn mixture of air and oil in the cylinder *i.e.* more air will be present in the cylinder than required for complete combustion. Thermal discharge has a potentiality to adversely affect local biodiversity. In the Project, the amount of boiler blow-down is 250 litres/day, which will be cooled down into two stages. Initially the blow-down water is cooled down up to 60^0C at blow-down tank by mixing with cooling water (approximately 900 litres). Then the mixture is drained to the boiler-washing water tank. Here, the mixed blow-down water is stored for about 4 days for natural cooling until it reaches the ambient temperature. So, the Project will not be a concern in regard of thermal discharge. Although the noise modelling result depicts a pleasant scenario about noise impact, LBPL has to ensure application of silencer, rock-wool and styrofoam for better compliance. The loss of flora and fauna and visual impacts can be mitigated by adopting satisfactory landscaping and architectural design. Ground water may be affected due to requirement of cooling water. As the estimated daily water requirement is only 20 m^3/day, there will be limited impact to local ground water availability. By ensuring proper management of spent/burned lube oil and addressing the spillage by the DOE designated vendor, surface water contamination can be prevented. According to the Seismic Zoning, Comilla has fallen into Zone-2, requiring adapting adequate measures to address the earthquake. In addition, annual flood is a

common phenomenon at Comilla. So, while planning, design and construction, LBPL has to consider the issue with due importance. Improper attention may result in sever occupational health hazard during operation phase. So, LBPL has to adopt detail Environmental and Health Safety (EHS) guidelines/manual to address the occupational health safety during construction and operation phases in a comprehensive manner. In addition, there will be a detail Disaster Management Plan with focus on fire and earthquake.

The project site comprises about 3.0 acres of land, which has been leased from Bangladesh Power Development Board (BPDB). As BPDB has reserved the land for establishing power plant, they did not allow any cultivation or developing any squatter in the project site. So, there is no issue of resettlement. 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 Comilla City Corporation (CCC). So, it can be said that LBPL Project has no potentiality to adversely affect the rights of indigenous community. Moreover, it can facilitate them in search of an improved quality of life by providing additional 52 MW electricity to national grid.

As a part of the IEE, public consultation was accomplished. 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.

LBPL is considering the environmental and social compliance issues with due importance. For addressing the potential environmental and social adverse 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.

Chapter-1

INTROUCTION

1.1 BACKGROUND OF THE PROJECT

Bangladesh has made remarkable growth in electricity generation over the last five years. The generation capacity has increased around 6658MW in 2012[3] to 10,000 MW in 2014[4]. To meet the increasing demand of industrial and commercial sectors and to enlighting about 50% deprived household, there is requirement of more power generation.

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 of 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 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 a tender for independent power producer (IPP) arrangement in 2010 for selecting sponsor to implement a 50 ±10% MW dual fuel fired power project on build own and operate (BOO) basis at Jangalia, within the jurisdiction of 22 no. Ward of Comilla City Corporation (CCC), Bangladesh.

Through a competitive selection process, Lakdhanavi Bangla Power Limited (LBPL) was selected and accordingly a Letter of Intent (LOI) was issued to them on 29 November 2010 to establish this plant. According to the arrangement, 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 leased out an area of about 3.0 acres of land at Jangalia Mouza, under the jurisdiction of Comilla City Corporation through lease arrangement. 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. In northern side of the project site there are residential area, Sub- station of Power Grid Company of Bangladesh (PGCB) in the southern side, residential area in the western side, and on the eastern side there are office of the Power Development Board (PDB). The

[3] Electricity Scenario in Bangladesh, Unnayan Onneshan, 2011

[4] www.bpdb.gov.bd

PPA and Land Lease Agreements (LLA) for the proposed plant has signed on 30 October, 2013.

1.2 EXTEND OF THE STUDY

Environment Conservation Rules (ECR, 1997) of Bangladesh and Safeguards Policy Statement (SPS), 2009 of ADB require that the environmental 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.

1.3 SCOPE OF THE STUDY

The specific objectives of the IEE study are as follows:

- conduct preliminary examination of the environmental consequences of the Project;
- describe the existing environmental and social condition of the proposed Project site;
- collect detail information about technology, equipment and machinery;
- assess the potential environmental impacts of the proposed power plant;
- develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities, and cost estimates to address adverse environmental impacts; and

  carry out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design.

1.4 STUDY METHODOLOGY

It is already mentioned that the IEE has been prepared according to the guidelines of ECR, 1997 and Environmental Assessment Guidelines 2003 and SPS, 2009 of ADB.

Field visits were undertaken to assess the baseline physical, biological and social environments. An area within 1.0 km radius around the proposed power plant has been defined as the study area for collection of baseline data. The data collected from secondary sources including the field study, Internet, Forest Atlas of Bangladesh, Statistical Handbook for Bangladesh, District Maps, National Atlas were also consulted as secondary source.

The methodology for conducting the IEE was fully participatory ensuring participation to the relevant stakeholders. The IEE study used all the information generated through field visit, consultations with the stakeholders and output of primary and secondary sources.

1.5 LIMITATION OF THE IEE STUDY

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, it has been tried to cover all important environmental, social and occupational health safety impacts and formulate pragmatic recommendations for mitigating any adverse impacts.

1.6 THE IEE TEAM

LBPL has appointed Bangladesh Centre for Advanced Studies (BCAS) to prepare the required IEE report. From BCAS, Dr. Moinul Islam Sharif has served as Team Leader and IEE Expert in this Project. Dr. M. Eusuf has conducted the required air dispersion modeling. The other members of the team were Mr. Osman Gani Shawkat (Sociologist), Mr. Shaker Ali (Noise Modeling Expert) and Ms. Ismot Ara (GIS and Mapping Expert). They were supported by Mr. Moniruzzaman and Mr. Z.H.khan.

1.7 ACKNOWLEDGEMENT

In preparing the IEE, various stakeholders were consulted including relevant government agencies, Comilla City Corporation, NGOs, Financial Institution, 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 (BGDCL), Fire Service and Civil Defense Department, and Bangladesh Agricultural Development Corporation etc. The IEE team is grateful to these stakeholders for their contribution.

Chapter-2

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 NATIONAL ENERGY POLICY

The first National Energy Policy (NEP) of Bangladesh was formulated in 1996 by the Ministry of Power, Energy and Mineral resources to ensure proper exploration, production, distribution and rational use of energy resources to meet the growing energy demands of different zones, consuming sectors and consumers groups on a sustainable basis.[1] With rapid change of global as well as domestic situation, the policy was updated in 2004. The updated policy included additional objectives namely to ensure environmentally sound sustainable energy development programmes causing minimum damage to environment, to encourage public and private sector participation in the development and management of energy sector and to bring the entire country under electrification by the year 2020. The major objectives of the revised National Energy Policy (NEP) are outlined as follows.

- To provide energy for sustainable economic growth so that the economic development activities of different sectors are not constrained due to shortage of energy.
- To ensure optimum development of all the indigenous energy sources.
- To meet the energy needs of different zones of the country and socioeconomic groups.
- To ensure sustainable operation of the energy utilities
- To ensure rational use of total energy sources.
- To ensure environmentally sound sustainable energy development programmes, with due importance to renewable energy, causing minimum damage to environment.
- To encourage public and private sector participation in the development and management of the energy sector.
- To integrate energy with rural development to boost rural economy.
- To bring entire country under electrification by the year 2020.
- To ensure reliable supply of energy to the people at reasonable and affordable price.
- To develop a regional energy market for rational exchange of commercial energy to ensure energy security.

2.2 PRIVATE SECTOR POWER GENERATION POLICY OF BANGLADESH

In 1996 the government of Bangladesh has adopted the private sector power generation policy. The policy has detailed the modality for implementation of private power projects, tariff for bulk purchase of power at busbar, fiscal incentives, other facilities and incentives for foreign investors and so on. The policy has been revised in 2004.

2.3 NATIONAL ENVIRONMENTAL POLICY, REGULATIONS AND GUIDELINES IN RELEVANT TO ENVIRONMENTAL IMPACT ASSESSMENT

GoB has approved the **National Environmental Policy**, in 1992. The Policy has set 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. In 1995, GOB has adopted the **National Environment Management Action Plan** (NEMAP). The NEMAP is a wide-ranging and multifaceted 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 set out of the framework within which the recommendations of the National Conservation Strategy are to be implemented. According to the NEMAP, **The Environment Conservation Act, 1995** was approved. 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 to declare Ecologically Critical Areas and to obtain Environmental Clearance Certificate.

The Environment Conservation Rules (ECR), 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. These Rules provide the national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust; and requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities. According to the guidelines of ECR, 1997 the EIA Guidelines for Industry has been prepared in 1997.The EIA Guidelines is a handbook for procedures for preparing the EIAs and for reviewing them for the benefit of the development partners, IEE/EIA Consultant, reviewers, and academicians. While preparing these guidelines, the present environmental status as well as the need for rapid economic development of Bangladesh has been kept in view. These considerations have essentially resulted in simpler procedures to be followed for preparing the EIAs and their review.

In addition of aforesaid laws, polices and acts, Bangladesh has promulgated a number of policies, acts and rules, which are required to improve the environmental condition. Some of these are mentioned as follows:

- Environment Court Act, 2000 and subsequent amendments in 2002
- The National Water Policy, 1999
- The Brick Burning (Control) Amendment Act, 1992 and 2001
- The Ground Water Management Ordinance 1985
- The Forest Act, 1927 and subsequent amendments in 1982 and 1989
- National Biodiversity Strategy and Action Plan (2004)

Bangladesh has also ratified/accessed, accepted or adapted a number of international conventions, protocols and treaties, some of them are mentioned as follows:

- International Plant Protection Convention (Rome, 1951)
- International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954) (as amended on 11 April 1962 and 21 October 1969)
- Kyoto Protocol to the United Nations Framework Convention on Climate Change.

2.4 ENVIRONMENTAL CLEARANCE

DOE, the technical arm of the Ministry of Environment and Forests (MOEF) is the regulatory body and the enforcement agency of all environmental related activities in Bangladesh. Like all other projects, this Project also needs to meet the requirement of the DOE. Being categorised as Red, the Project requires a detail environmental impact assessment to be awarded environmental clearance. The various steps as are to be followed for obtaining Environmental Clearance Certificate (ECC) from DOE are outlined in **Figure 2.1.**

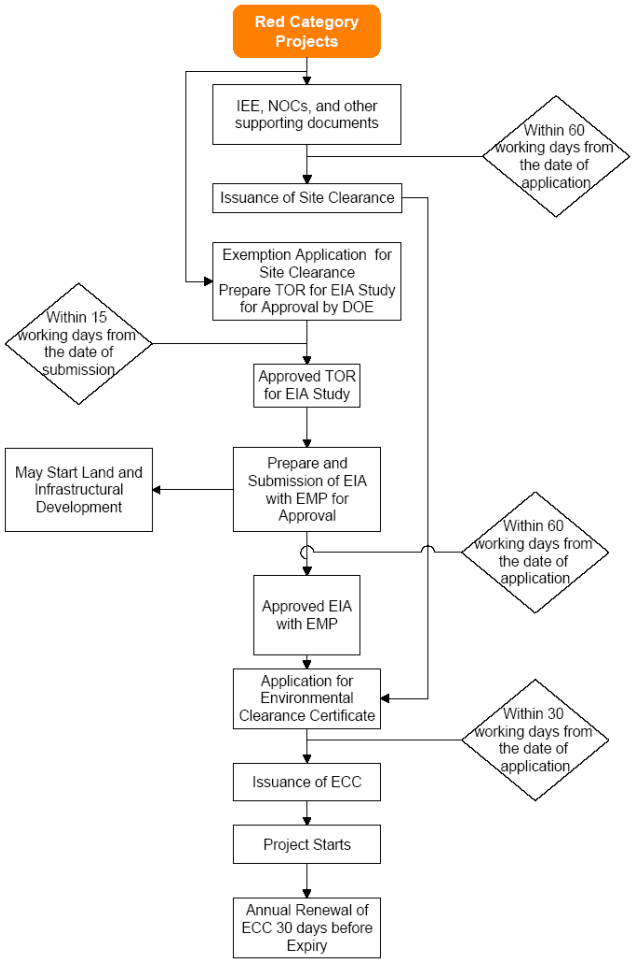

Figure 2.1: Steps followed for environmental clearance of Red category project

2.5 POLICY AND GUIDELINES OF ASIAN DEVELOPMENT BANK

Aaccording to ADB SPS, 2009 and Operational Manual F1/BP (2013), ADB will carry out project screening and categorization at the earliest stage of project preparation, when sufficient information is available for this purpose. Screening and categorization is undertaken to:

- reflect the significance of potential impacts or risks that a project might present;
- identify the level of assessment and institutional resources required for the safeguard measures;
- determine disclosure requirements.

The process of determining a project's environment category is to prepare a Rapid Environmental Assessment (REA). REA requires the completion of the environmental categorization form prior to the project initiation. REA uses sector-specific screening checklist, taking into account the type, size, and location of the proposed project; sensitivity and vulnerability of environmental resources in project area; and the potential for the project to cause significant adverse environmental impacts. A project is classified as one of the four environmental categories (A, B, C, or FI) based on the most environmentally sensitive component. Categories are as follows:

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. For a Category A project, 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 (FI).

ADB has adopted public Communication Policy in 2005. Thereafter it has been revised in 2011. The fundamental features of this Policy are:

Proactive disclosure ADB shall proactively share its knowledge and information about its work, as well as its opinions, with stakeholders and the public.

Presumption in favor of disclosure The policy is based on a presumption in favor of disclosure.

Right to access and impart information and ideas ADB recognizes the right of people to seek, receive, and impart information and ideas about ADB-assisted activities.

Country ownership ADB recognizes the importance of country ownership of the activities it supports in its DMCs.

Limited exceptions Full disclosure is not always possible. For example, ADB needs to explore ideas, share information, hold frank discussions internally and with its members, and consider the special requirements of its non-sovereign operations.

Right to appeal The policy recognizes the right of those requesting information to a two stage appeals process when they believe that ADB has denied their request in violation of its policy.

Relation to other policies The policy establishes the disclosure requirements for documents that ADB produces or requires to be produced.

In accordance with the requirements under the Safeguard Policy Statement, ADB shall post on its website the following documents submitted by the borrower and/or client:

- a draft environmental impact assessment (EIA) report for an environment category A project, at least 120 days before Board consideration;
- a draft environmental assessment and review framework, where applicable, before appraisal;
- the final EIA or initial environmental examination (IEE), upon receipt by ADB;
- a new or updated EIA or IEE, and a corrective action plan, if any, prepared during project implementation, upon receipt by ADB; and
- the environmental monitoring reports, upon receipt by ADB.

2.6 ENVIRONMENTAL AND SOCIAL SAFEGUARDS FRAMEWORK OF IDCOL

IDCOL has adopted an Environmental and Social Safeguards Framework[5] (ESSF) in 2011, which is to be complied with all projects to be funded by the Public-Private infrastructure Development Facility of ADB. In the ESSF, it is mentioned that "Since IDCOL is an FI, ADB requirements for Category FI shall be applicable for development of the ESSF and ADB's environmental assessment process shall be applicable to each sub-project for project processing under the ESSF".

According to the environmental categorization of ESSF, the Project has been categorised as Moderate Risk Project requiring significant compliance safeguards. For a Moderate Risk Project, there is requirement of conducting detail environmental impact assessment and submitting the environmental clearance certificate to IDCOL as is to be issued by the DOE before loan disbursement. But in regard of Social categorization, the Project has been categorised as Low Risk Project both for Indigenous People (IP) and Involuntary Resettlement (IR) perspectives. So, there is no requirement of adopting indigenous peoples development framework (IPDF), indigenous peoples development plan (IPDP), resettlement framework (RF) and resettlement plan (RP).

[5] http://www.idcol.org/Download/ESSF_Final.pdf

Chapter-3

DESCRIPTION OF THE PROJECT

3.1 TYPE AND CATEGORY OF THE PROJECT

The project is a dual fuel based power following the technology of reciprocating engine. According to the guideline of SPS, 2009 and Environmental Assessment Guidelines 2003 of ADB, the Project falls under category B, which requires IEE study. According to the ECR, 1997 of the DOE and ESSF of IDCOL the Project has been categorized as Red and Moderate Risk respectively.

3.2 PROJECT SITE

3.2.1 Location and area of Project site

It is said that the project site is located at 22 no. Ward of Comilla City Corporation (CCC) with the geographical location 91° 25′ 73″ E longitude and 23° 25′ 27″ N latitude . Locally the project area is known as Jangalia. The site is adjacent to the sub-station of PGCB. It is about 3 km away from the CCC. The site is approximately 145 km from Chittagong city and approximately 105 km from capital Dhaka. The area of project site is 3 acres. The required natural gas and Furnace Oil will be served by Bakhgrabad gas field and Bangladesh Petroleum Corporation (BPC) respectively. The gas field is about 20 km away from the site. Railway line, 100 m wide pacca road, commercial establishment and some settlements are on the eastern side of the site, whereas sub-station of PGCB is on the southern side. Agricultural land, wetland and some settlements have been observed both in both northern and western sides.

Figure 3.1: Location of the project site in respect of Bangladesh

Figure 3.2: Location of the project site in respect of Comilla Sadar Upazila

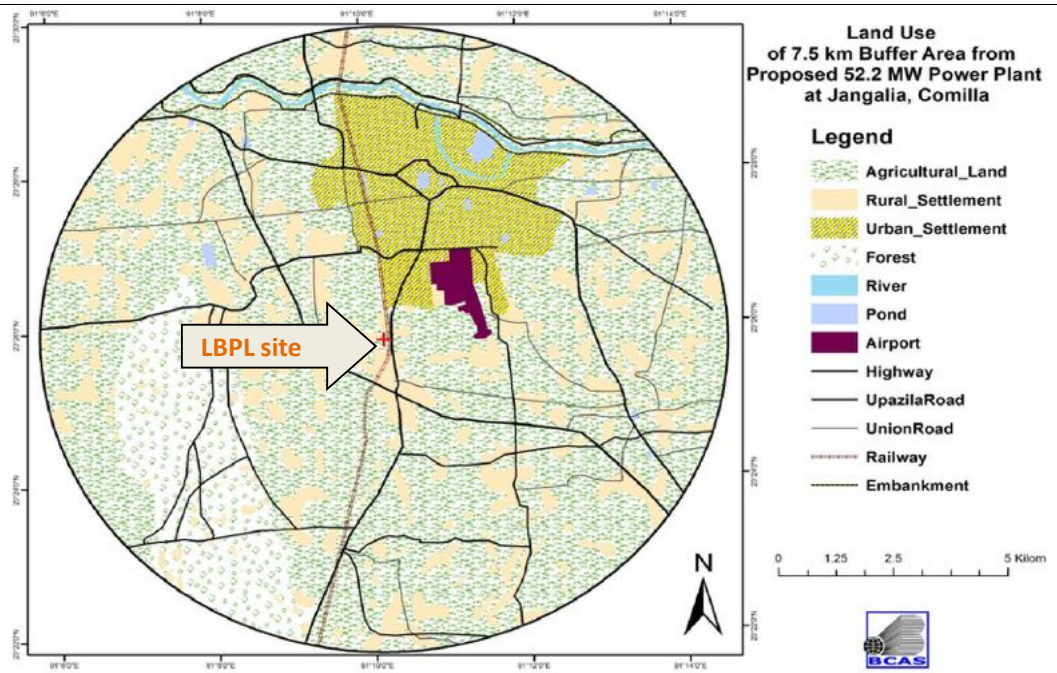

Figure 3.3: Current landuse pattern of the project area

3.2.2 Land use pattern

The land use pattern within 5 kilometers of the project area is shown in Figure 3.3. Based on this Figure, it can be said that agriculture is the most dominating land use pattern. Thereafter, comes forest and rural settlement, urban settlement and forest as well. According to the Photograph 3.1 agriculture is the dominating landuse around the project site. But Project site has been remained mostly as vacant with limited grazing activities.

Photograph 3.1: An schematic view of the Project site (not as per scale)

3.2.3 Accessibility to the site

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–Laksham Road.

Photograph 3.2 : Dhaka Chittagong Highway (left) and an approach road to sub-station (mid and

Photograph 3.3: An approach road to sub-station connecting site with Comilla-Laksham Road

Photograph 3.4: Mainamati Station is just beside the project side

Photograph 3.5: Location of the project site in relation to the railway line

3. 3 BRIEF DESCRIPTION OF PROJECT

3.3.1 Technology and major electro-mechanical components of the Project

The proposed dual fuel power plant has the option to use either HFO or natural gas. The Project comprises six (6) numbers of Wartsila made 20V32 GD engines, each coupled with ABB made AMG 1210M (or equivalent) of 11.155 MVA(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 11 kV Bus and is fed to a 70 MVA 132/11 kV generator step up transformer. 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.

The proposed capacity of the plant is 52 MW. 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. Radiator cooling system will be installed and therefore there will be no need to extract cooling water from surface water. The stack height has been determined as 42 meter through US EPA approved ISC3P Model. The detailed technical specifications of the machinery and equipment, and some major features are depicted in the following Table 3.1 and 3.2 respectively.

Table 3.1: List of machineries with country of origin and model

Component	Manufacturer/ Country	Model / type
Reciprocating Engine	WARTSILA / FINLAND	W20V32GD
Control system	WARTSILA / FINLAND	WOIS
Main Step-up Transformer	4 JSHP / INDIA (or Equivalent)	Oil Immersed ONAF
Station Transformer	LTL / Sri Lanka	Oil Immersed ONAN
HV Switchgear	ABB / India (or Equivalent)	Outdoor
Medium Voltage Switchgear	ABB / Czech republic (or Equivalent)	Uni Gear ZS1
Low Voltage Switchgear	KIK8 / Sri Lanka (or Equivalent)	Indoor
Rectifiers	Reputed supplier from China / India	Indoor
Battery system	Reputed supplier from China/India	Lead acid
Power Cables	Reputed supplier from Srilanka/China	XLPE/PVC insulated
Air compressors	Dalgakiran/Turkey (for equivalent)	Reciprocating & Screw Type
Fuel Treatment Plant	Westphalia/Germany (or Equivalent)	Centrifugal Separators
EOT Cranes	DEMAG/Germany (or equivalent)	Centrifugal Separators
Aux & Ex gas Boiler	Aalborg/Finland	Overhead Crane(Electric)

Table 3.2: Technical specification of some major parameters

Parameter	Technical specification
Stack Height	42 meter
Effective Stack Height	30 meter
Design Stack diameter	1.1m each
Exit gas velocity	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
Fuel consumption per unit power production	8850.58 BTU/KWH
Mass of pollutant emission per unit power production	47.37 g/KWH
Mass of pollutant emission per unit time g/sec	NOx: 260grams/second, SOx 401.92 grams/second and, CO: 18.40 grams/second
Capacity of ventilation fan	222 m^3/s (air)
Height of air exhaust	13 m
Fuel storage Tank	There will be two HFO storage tanks with capacity of 25000 m^3 each. In addition, there will be one HFO buffer tank and HFO day tank with capacity of 55 and 100 m^3 respectively.
Fuel Treatment Plant	Fuel treatment system consists of 2 centrifuge type separators with capacity 15,400 Litres/hour each designed for treatment of HFO with maximum density 1010 kg/m3 (at 15°C) and Heavier solids content than oil up to max. 4%.

3.3.2 Transmission and interconnection

The generated electricity of the Project will be transmitted through the nearby PGCB sub-station requiring about 50 meters long interconnection line. 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.

3.3.3 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 project site by tanker. The specification of the HFO as has been provided by the BPC is mentioned in the following Table 3.3.

Table 3.3: Specification of HFO

Tests	Method	Limit
Density a 15^{0}C, kg/L	ASTM D 1298	0.925
Flash point PM (cc), ^{0}C	ASTM D 93	Min. 66
Sediment, % mass	ASTM D 473	Max. 0.25
Water Content, % vol	ASTM D 95	Max. 0.5
Kinematic viscosity at 50^{0}C, cSt	ASTM D 445	Min. 45 and Max. 180
Pour point, ^{0}C	ASTM D 97	Max. 33
Sulphur Content, % mass	ASTM D 1552	Max. 3.5
Carbon Residue (Conradson), % mass	ASTM D 189	Max. 10
Calorific value, Gross, BTU/lb	ASTM D 240	Max. 18424

The natural gas supply system of Bakhrabad would be used for the supply of natural gas to the proposed LBPL plant. In this regard LBPL has signed a Gas Supply Agreement with Bakhrabad Gas Fields Company Limited (BGFCL). In this regard, a pipeline with length of 0.5 kilometers has to be laid from flunk line along the Comilla-Laksham Road. One of the BGFCL enlisted contractors of Bakhrabad will implement the pipeline installation assignment.

While using the natural gas in power plant, there is necessity of conditioning. 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

3.3.4 Water Requirement

Maximum amount of water requirement is estimated to be around **20m^3/day** including both process and service water requirement. The main process water requirement is for makeup of steam generation system and consumption is estimated to be around **7.5 m^3/day**. The remaining amount is for human usage, washing, cleaning, plantation and emergency usage. For required water supply, LBPL will install deep tubewell at project site. The cooling water system of the project is of basic radiator type design with closed cooling water circuit. 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.

3.3.5 Civil Construction

Some major civil components in relevant to the Project are discussed in brief in the following sections.

Site Preparation

Site preparation comprises land filling of 1.5-2.0 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.

Piling

The proposed power plant is to be founded on piles. The piles could be bored, augured or driven and the type will depend upon the geotechnical condition. 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.

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.

Drainage

It is recommended that the storm water and sewage system should be separated 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 compliant with the required statutory limits and standards of Bangladesh.

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. It is recommend 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.

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.

CHAPTER-4

ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

4.1 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.

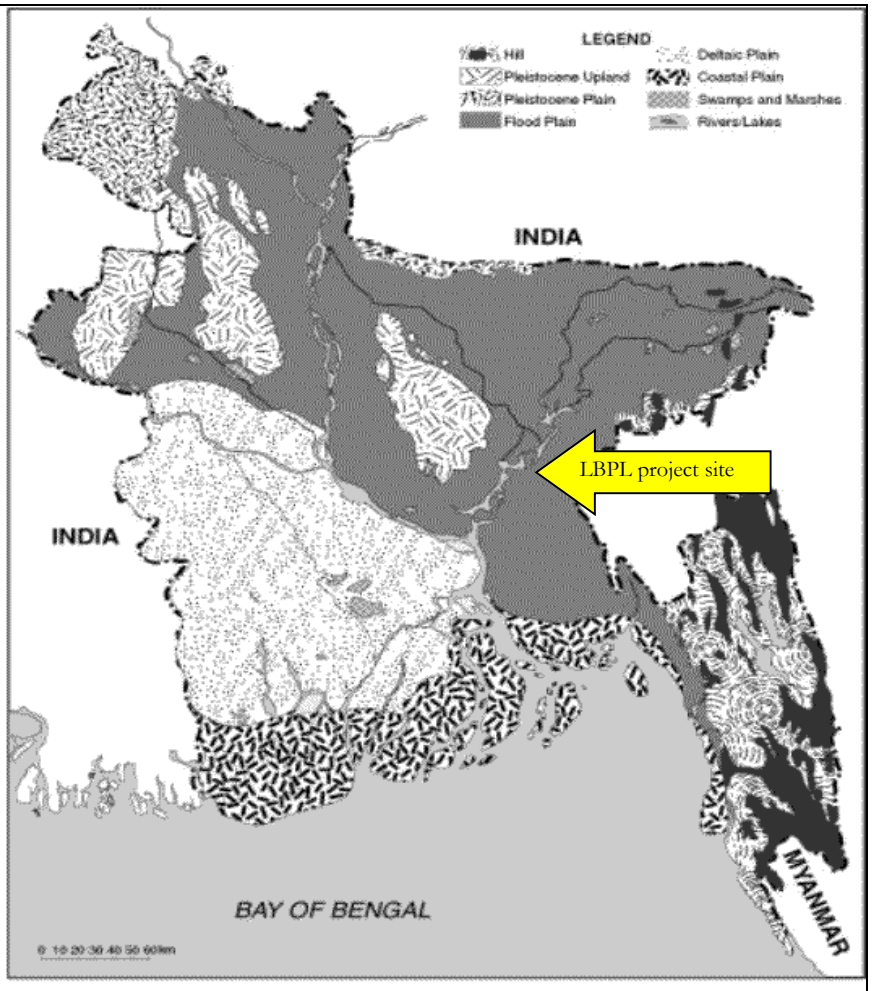

Figure 4.1: Physiographical Map of Bangladesh

Based on the aforesaid classification, the topography of Comilla has been fallen into the Northern and Eastern Piedmont Plains Tract under the Pleistocene Terrace. It can also be categorised as part of 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. The soil structure is assumed to have satisfactory load bearing capacity as is suitable for a power plant project. In addition, the stability of topographic pattern has made the site a better choice for complex type of construction having significant vibration and momentum.

4.2 METEOROLOGY

Temperature, precipitation, humidity and wind speed are the basic element of meteorological condition. For recording the data of these elements Bangladesh Meteorological Department has set-up meteorological stations in different districts of the country. In case of Comilla, the Meteorological Station (MS) of Chandpur is considered as reference. The data of temperature, precipitation, humidity and wind speed as recorded in MS of Chandpur over the year 2008-12 are presented as follows with their implication to the Project.

4.2.1 Temperature

By analyzing the data of temperature in the year of 2008-12, it has been 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 7A (a) of Annex 7. The maximum temperature was observed in April for three consecutive years (2009-2011). But in 2012, an unusual scenario was observed as maximum temperature was recorded in September. On the other hand the minimum temperature was observed usually in December to January with the range of variation about 4.5°C.

The power generation process has significant relationship with ambient air temperature. Due to the increase of temperature, the mass flow rate of air decreases. It results in less power output from steam turbines. Above all, it results in less efficiency and less production.[6] As there is significant difference between minimum and maximum temperature at Comilla, it is expected that LBPL will adopt required technical measures by considering the variation of temperature.

4.2.2 Precipitation

According to the Table 7A (b) of Annex 7, the highest (753 mm) rainfall was observed in July, 2008. But in general January, there was no rainfall except in 2009 (23 mm). The significant amount of rainfall has been observed with the period of June-August. In November 2008, there was about 111mm rainfall, which is quite unusual in respect of the general rainfall pattern of the project area. The significant issue in respect of rainfall pattern is the decline trend. The quantity rainfall started to decline significantly from 2011.

There is no significant relationship between short period precipitation and power generation. But precipitation for a long period may result in water logging and even flood within the power plant area, which may adversely affect the power generation. From the trend of scale and intensity of precipitation at Comilla, it can be said that the annual precipitation will not appear as a concern if there is well designed storm water management process.

[6] International Journal of Engineering Science and Technology, August 2012

4.2.3 Relative Humidity

The average annual humidity of Comilla District is about 70%. Based on the data of Table 7A(C) of Annex 7 , the lowest monthly mean humidity was recorded in March, 2010 (about 53%) and the highest humidity was recorded in July, 2008 (about 84%). By analysing the data, it can be concluded that the humidity scenario is almost stable in the Project area with a moderate trend to increase.

Measuring humidity is vital in operating power plant. For instance, accurately monitoring the humidity of inlet air is essential for good turbine control. The turbine performs better when the air is cooler, because the density of the air increases as the temperature of air decreases. With a greater mass of air flowing through the turbine, the result is increased power generation. However, just a 1^0C increase in temperature can result in 0.5% electricity loss. On the other hand, inlet air that is too cold or humid must be avoided as it may lead to water condensation or even icing, which significantly reduces the performance of turbine blades. As the mean humidity of Comilla ranges about 55-80%, LBPL is expected to consider this issue in their technical specifications.

4.2.4 Wind Speed and Direction

Monthly prevailing wind speed and direction of Comilla for the period of 2008-12 are presented in Table 7A (d) of Annex 7. 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. Minimum wind speed was observed in October in three consecutive years (2010-2012).

Effects of wind on power system include effects on the losses in power generation, transmission and distribution, negative effects on fuel uasage and emissions. The impacts of wind power depend on the penetration level of wind including its speed and direction, in the system as well as the size and inherent flexibility o the plant.[7] So, it can be said that higher speed of ambient wind, the higher the scope of dispersion of emission (SOx, NOX, and so on) and the lower the efficiency. In the following four figures 4.2-4.5, direction of wind movement has been presented in a graphical manner, which is known as 'Wind Rose'.

[7] The Effect of a Large Scale Wind Power on Thermal System Operation, Hannel Holttinen, 2003

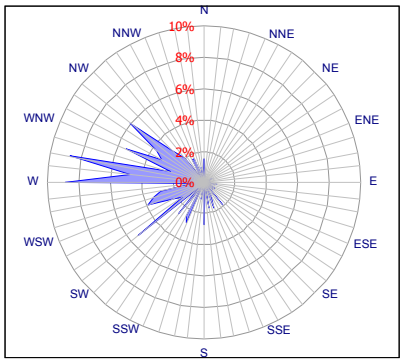

Figure 4.2: Wind rose diagram for the month of January-March 2012

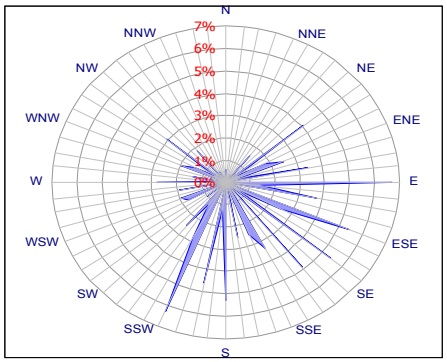

Figure 4.3: Wind rose diagram for the month of April-June 2012

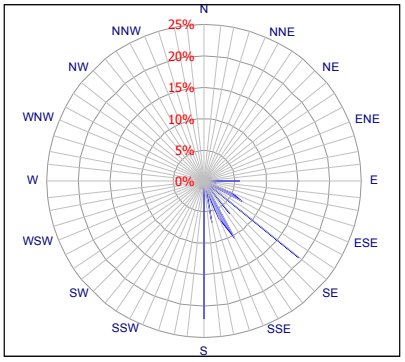

Figure 4.4: Wind rose diagram for the month of July-September 2012

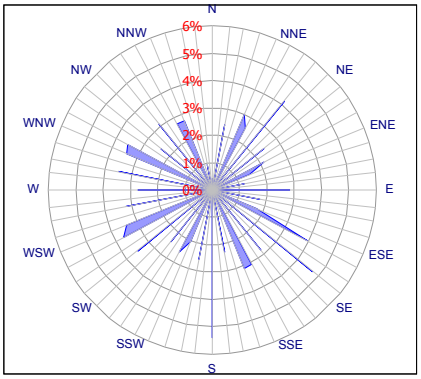

Figure 4.5: Wind rose diagram for the month of October-December 2012

The basis of these four wind roses is the average direction of wind movement in 2012. In January-March, wind blew mostly from the West and North-West direction. In April-June, the dominating wind direction were East and South, South-West. But in July, its direction were East and the South; and in October, wind blew practically from all directions. In January-March, the main concentration of wind flow is towards agricultural land and forest areas. In April-June, the direction of wind is towards agricultural land, rural settlement. In July-September wind speed was significantly low and its direction was to agricultural land. But in October –December wind flowed almost in all direction with relatively higher speed. So, in conclusion, it can be said that the speed and direction of ambient wind has limited scope to disperse of air pollutants to the main developed areas of Comilla City Corporation.

4.3 AMBIENT AIR QUALITY

The landuse pattern of the Project area can be categorized as Mixed Type according to the landuse categorization of ECR, 1997. To assess the ambient air quality, the samples of ambient air quality were collected weekly for the period from 3 October to 3 November 2013. The samples were collected from five locations. In the following Table 4.1, the average of value of major six parameters of air quality are mentioned with other relevant information.

Table 4.1: Ambient air quality at project site

Location of monitoring point near project boundary	Ambient Air Pollutants Concentration in µg/m^2					
	SPM	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**CO**
South side *91°10'13.09"E, 23°25'45.35"N*	85.28	55.06	39.41	1.79	31.34	15.0
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
West side *91°10'9.51"E , 23°25'55.15"N*	145.82	66.23	35.50	1.92	18.90	32.0
North side *91°10'19.47"E, 23°25'48.64"N*	114.87	63.48	41.35	1.49	9.03	37.0
East side *91°10'10.47"E , 23°25'43.32"N*	80.44	43.69	38.50	2.39	31.36	20.4
DOE Standard	500	150	65 (24 hr)	120	100	210
IFC air quality standard (Annual)		75		200	125	
Method of Analysis	**Gravimetric**	**Gravimetric**	**Gravimetric**	**West-Geake**	**Jacob & Hochheiser**	**CO Meter Indicator tube**

4.4 AMBIENT NOISE QUALITY

The Project site is found to have ambient noise level with a range of 30-80 dBA at different time of the day. There was 24 hours noise monitoring at 4 locations in the project site at four sides, which has been provided as Annex 8. Based on the monitoring result, the highest noise level at western, northern, southern and eastern corner of the project are 80, 85, 78 and 72 dBA respectively, whereas the lowest noise level of the four corners are 35, 42, 40 and 45 dBA respectively. Although there is no significant source of noise in the project area, the horn of various heavy vehicles moving in Dhaka-Chittagong Highway and Comilla-Laksham Road appear as the source of high noise level.

4.5 SEISMICITY

Bangladesh has been classified into three seismic zones as is shown in Figure 4.6, where Zone-I has the most severe and Zone-III has the least impact. The project area falls in Zone-II, which means that there is considerable risk of earthquake and associated hazard.

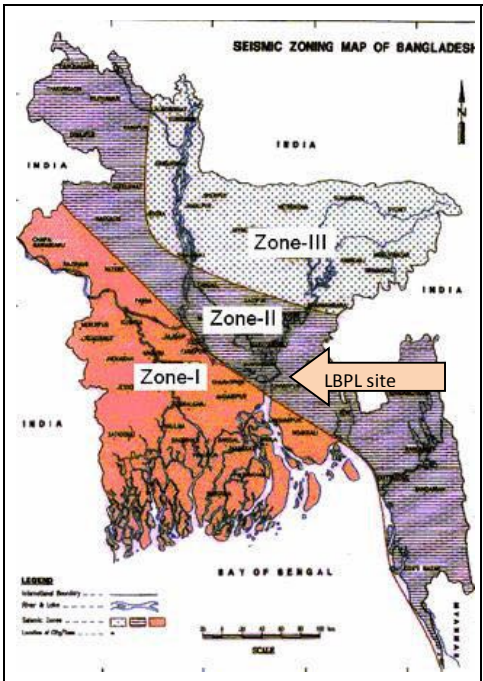

Figure 4.6: Seismic zoning in Bangladesh

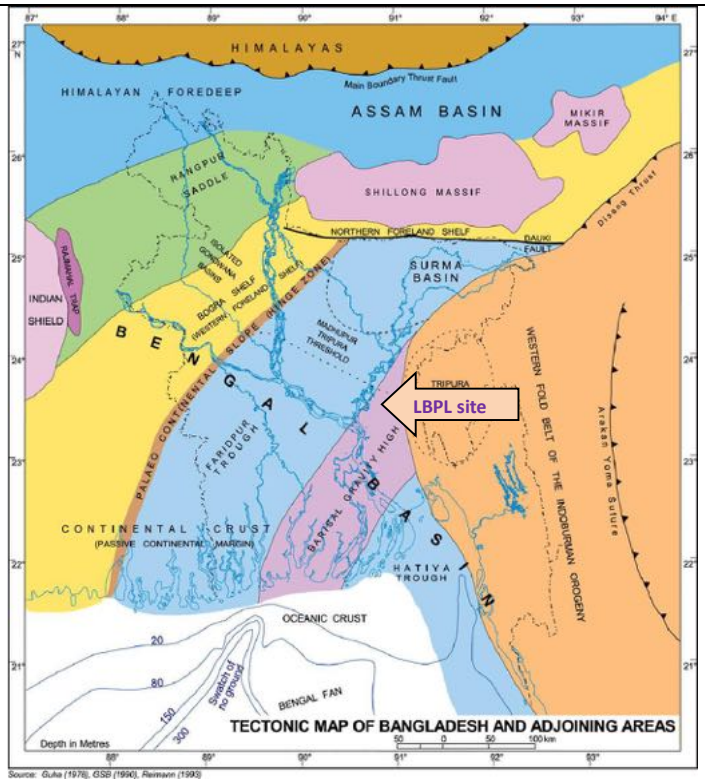

Figure 4.7: Location of LBPL site in respect of Tectonic Map of Bangladesh and adjoining areas[8]

[8] Source: Geological Survey of Bangladesh

4.6 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

Surface water samples were obtained from a canal adjacent to the site on 15 October 2013. The test result of this sample is presented in the following Table 4.2.

Table 4.2: Surface water quality at project area

Parameter	Water collected from a nearby canal (mg/l)	DOE standard (mg/l)
pH at 24.5℃	7.8	6.0 - 9.0
TDS	170.0	2100
Suspended Solid	67.0	150
DO	6.4	4.5 – 8.0
BOD at 20℃	2.0	50
Arsenic	< 0.01	0.05
COD	8.0	200
Manganese	< 0.05	5
Phosphate	0.52	-
Phosphorus	0.55	1
Conductivity	160	-

Source: Enviro Consultants Limited (ECL) Lab

Ground Water

To determine quality of ground water, water sample was collected on 15 October 2013 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 4.3.

Table 4.3: Ground water quality at project area

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

Source: ECL Lab

4.7 FLORA AND FAUNA

Some aquatic and terrestrial flora and fauna as have been found during a reconnaissance survey on 28 October 2013 at project area, are mentioned in the following Table 4.4.

Table 4.4: Available flora and fauna at project area

Habitat	Flora		Fauna	
	Local Name	**Scientific Name**	**Local Name**	**Scientific Name**
Aquatic	Helencha	*Enhydro fluctu ans*	Kolabang	*Rana tigrina*
	Kalmi	*Ipomoea aquatica*	Guishap	*Varanus bengalensis*
	Dhol Kalmi	*Ipomaoa fistulosa*	Matia sap	*Enhydris enhydris*
	Kochuripana	*Eichorina crassipes*	Pancowri	*Phalacrocorax carto*
	Shapla	*Nymphaea nouchali*	Kanibok	*Ardeola grayii*
Terrestrial	Durba gash	*Cynodon dactylon*	Toad	*Bufo melanostictus*
	Telakachu	*Coccinea cordifolia*	bull frog	*Rang tigrina*
	Babla	*Acacia nilotica*	Water snake	*Enhydris enhydris*
	Akanda	*Calotropis procera*	Dora sap	*Xenochrophis piscator*
	Nishinda	*Vitex negundo*	Darajgap	*Ptyas mucosus*
	Akashmoni	*Acacia moniliformis*	Red-vented bulbul	*Pycnonotus jacosus*
	Mahogony	*Suritenia mahogany*	House crew	*Corvus splendens*
	Shishu	*Dalbergia sissoo*	House sparrow	*Passer domestica*

Photograph 4.1: Water Hyacinth and Palm trees near the proposed project site


Photograph 4.2: Terrestrial flora (tree) close to the project site


Photograph 4.3: Terrestrial flora (herb) close to the project site

Photograph 4.4: Terrestrial fauna close to the project site


Photograph 4.5: Ducks and poultry are rearing in the household

4.8 SOCIO-ECONOMIC CONDITION

According to the Census of 2011 of Bangladesh Bureau of Statistics (BBS), the major occupation in Comilla District is Agriculture (43.28%). Then come Commerce (11.6%) and Service (10.78%). In case of Transport, Agricultural laborer and Wage laborer the percentage of involvement are 3.36%, 15.89%, and 2.46% respectively. The contribution of Construction and others are 1.03% and 11.6% respectively.

Table 4.5: The availability of various socio-economic facilities at Comilla City Corporation

Feature	Component	Number/amount of availability
General information	Area	5 3.04 Square K.M.
	Ward	27
	Population	5 00,000
Water supply	Overhead Tank	06
	Capacity (litre)	54 00000
	Deep Tube well	23
	Pipe Line	146 K.M
	House Connection	5015
	Street Hydrant	300
	Pump Station/ house	23
	Arsenic Status	Within acceptable limit
Public Health	Public Toilet	16
	Sanitary Latrine	23,802
	Dustbin	155
	Sanitary Land field	01
	Hospital	02
	Clinic (TB)	01
	Maternity Clinic	02
	Private Clinic	59
	Diabetic Hospital	01
Education	Public University	01
	Private University	01
	Govt College	04
	Private College	12
	Cadet College	01

Feature	Component	Number/amount of availability
	Public Medical College	01
	Private Medical College	02
	Art College	01
	Law College	02
	Homoeopathic Medical College	01
	Public Polytechnic Institute	01
	Private Polytechnic Institute	03
	Madrasha	37
	Teachers Training College	02
	Govt High School	03
Market	Market	08
	Shopping Complex	05
Street lighting	Electricity Line	132.35 K.M.
	Light Post	4,661
	Tube Light Point	1,060
	Energy Savings Light Point	3,601
	Meter/ Switch Point	22 Nos
Recreation	Park	01
	Zoo	01
	Cinema Hall	04
	Stadium	01
	Auditorium	01
	Gymnasium	02

Source: Comilla City Corporation

4.9 COMPLIANCE WITH STRUCTURAL PLAN

CCC has adopted a Structural Plan. According to this Plan, the project area has fallen into Future Urban Area which includes industrial zone, educational zone, waste water treatment zone and so on. The site of proposed power plant has fallen between the waste water treatment plant and industrial zone.

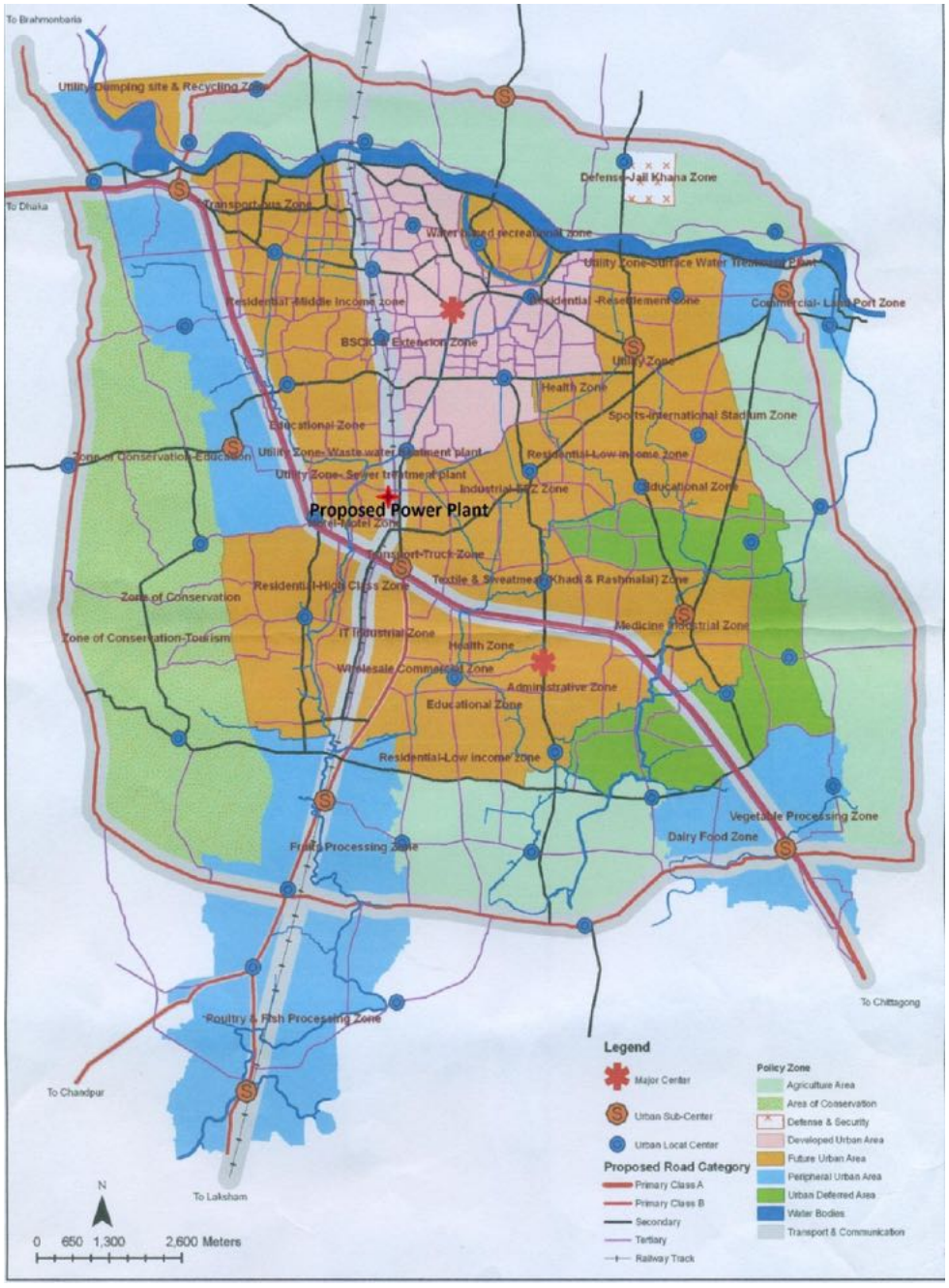

Figure 4.8: Location of proposed power plant in the Structure Plan

So, it can be said that the proposed project is consistent with the Structure Plan of CCC.

4.10 VULNERABILITY TO CLIMATE CHANGE AND NATURAL CALAMITY

Climate Change

Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming". In general, the major impacts of climate changes are:

- Sea Level rise
- Intrusion of salinity in ground water
- Changing rain and snow patterns
- Droughts
- Higher Temperature and more heat waves
- Stronger storms
- Warmer oceans

Consequence of Climate Change Impact on the Project

In the following sections, the various consequences of climate change impact in relevant to the Project are discussed:

Sea level rise and intrusion of salinity: It is assumed that due to the impact of climate change sea level will rise significantly resulting intrusion of salinity, which means the level of water of the Bay of Bengal will rise. But due to geographical position of Comilla City Corporation, the project is in an advantageous position (Figure 4.9). However, it is vulnerable to normal flood but there is insignificant risk in relevant to flash flood and river bank erosion. To address the flood, LBPL is expected to consider the flood data of Comilla district and adjacent areas for last 50 years. In addition, the issue of salinity intrusion in groundwater has not yet taken any concern raising situation in Comilla (Figure 4.12).

Increase of cyclone: As a consequence of climate change, there is possibility of increasing intensity and scale of cyclone. In case of cyclonic impact, it has fallen under the category of low risk area (Figure 4.10). However, for better safety LBPL is expected to consider the cyclone data of Comilla district and adjacent areas for last 50 years

Drought: In terms of drought, no significant concern is assumed for the Project. Because it requires only $7m^3$ of water per day. So, depletion of water table seems not to be an alarming issue for the sustainability of the Project.

Based on the aforesaid discussion, it can be said that the adverse impact of climate change and general trend of natural calamity will not adversely affect the Project.

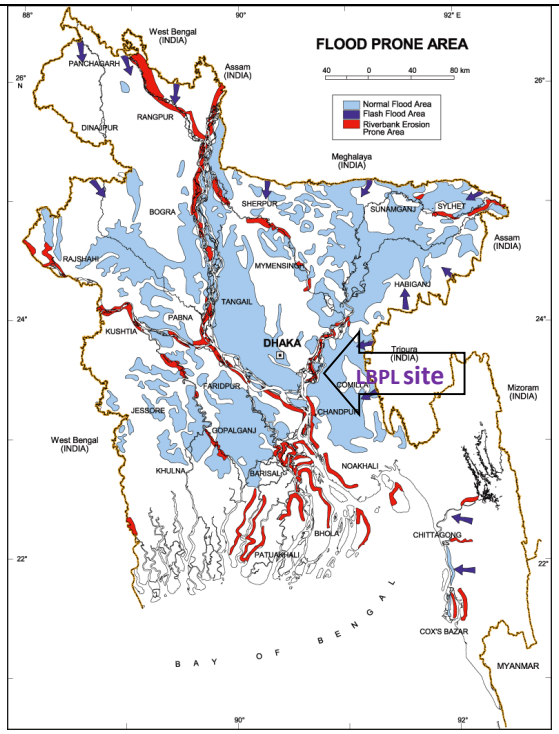

Figure 4.9: Flood prone area in Bangladesh

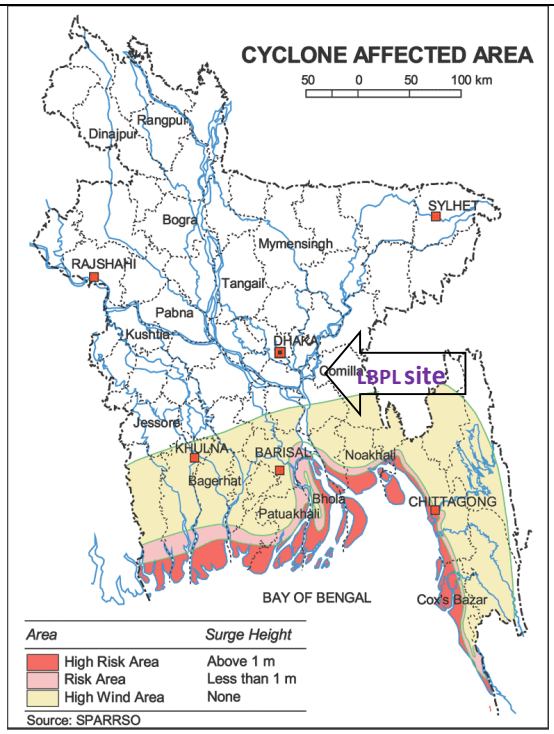

Figure 4.10: Cyclone affected area in Bangladesh

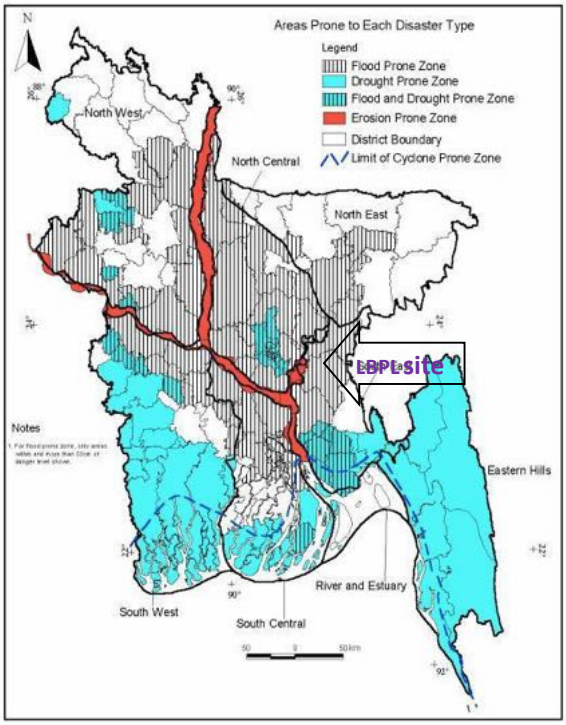

Figure 4.11: Drought prone area in Bangladesh

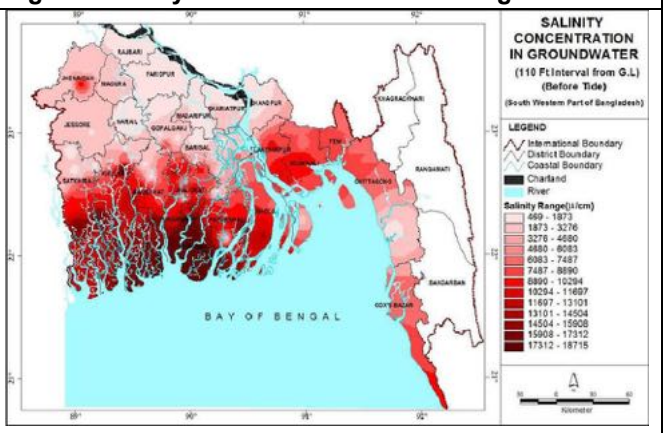

Figure 4.12: Salinity intrusion in groundwater

Chapter-5

ANTCIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 ASSESSMENT OF ENVIRONMENTAL IMPACTS

A Rapid Environmental Assessment (REA) Checklist for power plant as has been found in the Environmental Assessment Guidelines 2003 was used to screen the potential environmental impacts (Annex-1).

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, social and occupational health safety impacts during pre-operation phase

A. ENVIRONMENTAL IMPACTS DURING PRE-OPERATION

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

Impact on Topography

During pre-operation phase, 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 moderate loss of biodiversity because of filling, which can be compensated by adopting various restoration initiatives including tree plantation and so on.

Impact on Air quality

During pre-operation, the important sources of dust emissions of the power plant 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. 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, SOx generated from the diesel fueled construction equipments will marginally affect local air quality at the site which will be transitory in nature.

As mitigation measure, LBPL has to made sure the application of construction equipment with sound condition, as will reduce the duration of construction period as well as the emission of SOx will be less. In addressing dust emission, the guidelines as have been provided in Table 5.1 can be taken into consideration.

Table 5.1: Guidance on applying water at construction site to reduce dust

Stage	Guidance on the application of water
Site preparation	Water may be applied prior to the earthmoving activities to increase the moisture content of the soils thereby increasing their stability and reducing dust emission.
Storage piles	For some materials, hard crusts can be built-up on storage piles by application of water.
Material handling and transfer systems	Materials to be transported may be mixed with water prior to loading and/or the entire surface area of materials may be watered after loading.
Road surfaces	Water spraying may be applied to all unpaved roads used for vehicular traffic at least once per every two hours of active operation

Impact on Noise Levels

High to medium level of noise shall be generated during pre-operation phase. 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. Figure 5.1 presents some typical noise levels as are usually found in construction site.

According to The Noise Pollution (Control) Rules, 2006, the noise limit at various zones are mentioned in Table 5.2.

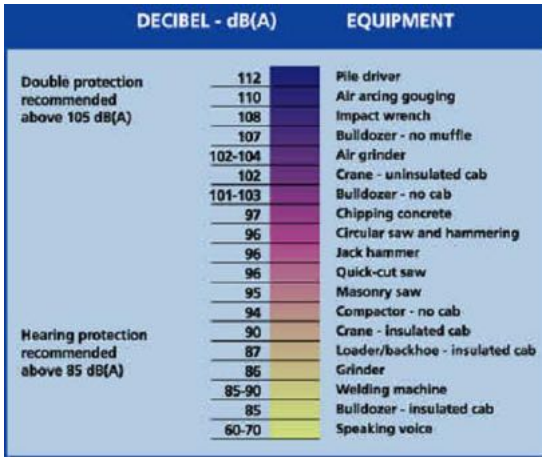

Figure 5.1: Some typical noise levels found on construction site

Table 5.2: Noise Limit at various zones

Zone	Noise limit in dBA	
	Day time	Night time
Silent zone	50	40
Residential zone	55	45
Mixed zone	60	50
Commercial zone	70	60
Industrial zone	75	70

Based on the trend of landuse pattern, the project area may be categorized as Mixed Zone. In case of Mixed Zone, the allowable noise limit is 60 dBA at day and 50 dBA at night respectively.

As mitigation measure the major construction work 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 localities as they are not situated in very 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 5.3. Moreover, a rotational work plan is advised for the workers and operators of these equipments.

Table 5.3: 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 during Installation of Gas Transmission Line

It is said that the required natural gas of the project will be supplied by BGTDCL requiring about 100m long pipeline. The pipeline would be laid through the side of Comilla-Laksham Road under the jurisdiction of Roads and Highway Department (RHD). The pipeline would be approximately 1.5m deep from the surface with an approximate width of 18″-24″. Although the traffic movement of the Comilla-Laksham Road is not very high, 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. As the pipeline will follow the right of way of RHD owned road and the pipeline installation work will be accomplished by the professionals, it is expected that there will be no significant environmental impact except some temporal inconvenience to the movement of local people and vehicles. But the nature of inconvenience is general, so no significant mitigation measures is not suggested in this regard other than the due care to health and safety of the adjacent neighborhood.

Gas distribution systems may generate gas leaks as a result of normal operations, equipment venting for maintenance and aging. Gas leakage, principally consisting of methane (CH4), a greenhouse gas, may result from corrosion and degradation of pipelines and related components over time and from fugitive emissions from pipelines and regulating stations.

Recommended measures to prevent and control air emissions due to leaks include:

- Gas pipelines and pipeline components in addition to general installation and pipe joining techniques such as welding should meet international standards for structural integrity and operational performance ;
- Corrosion prevention of buried ferrous metal pipelines should be undertaken using coating or cathodic protection techniques;
- For underground applications, the use of polyethylene pipe, which is not subject to corrosion, should be considered as an alternative to ferrous metal pipeline materials;
- Testing of pipelines and pipeline components for pressure specifications and presence of leaks should be undertaken prior to commissioning. The system should be gas tight;
- Leak and corrosion detection programs should be undertaken, including use of appropriate leak detection assessment techniques and equipment;

Impact on Surface Water Quality

It is assumed that there will be no significant adverse impact on the surface water quality in the Project area. Contamination to water bodies may result due to oil spillage during construction activities and/or surface runoff from the construction site to the nearby water body. But as the construction wash-water will be managed by mud-tank, the wash-water will not appear as a concern. In addition, due to using construction devices with satisfactory condition, the scope of diesel and lube oil spillage seems to be low. Provision for adequate washing and toilet facilities with septic tanks and appropriate refuse collection and disposal system should be made obligatory to reduce the surface water pollution.

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 spillage at the construction site will minimize the chances of leaching chemicals to the ground water.

Traffic, Transport and Road Safety

As the project site has good accessibility in regard of close proximity to national highway (Dhaka-Chittagong National Highway) and regional thoroughfare (Comilla-Laksam Road), it is assumed that there will be no significant adverse impact in regard to traffic movement during construction phase. However, LBPL has to ensure the basic health safety compliance in regard to traffic movement. In this regard, it is suggested that the construction materials are to be transported at night because at night the private modal split declines significantly resulting the reduction of risk of adverse health impact.

Impact on Ecological Resources

There is no designated protected areas, 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. The faunal species in the study area is mainly of those associated with manmade habitat. No wildlife adverse occurrence is expected around the proposed Project area. There may be possibility of bird hits to the conductors, which should be avoided by installing the deflectors. 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.

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 Environmental Management Plan (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 contractors. 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 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.[9]

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

[9] http://large.stanford.edu/courses/2010/ph240/cook2/

(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.

B. SOCIAL IMPACTS DURING PRE-OPERATION

Resettlement and Rehabilitation

It is already said that LBPL has taken the land from BPDB through lease arrangement by following all relevant rules and regulations of GoB. Initially, after having possession, BPDB has reserved the land to use for power generation activities. So, they did not allow to develop any settlement, industrial or commercial activities in the project site. During visit, the site has been found almost vacant. So, there is no issue of resettlement or rehabilitation.

Indigenous People and Cultural Sites

According to CCC, there is no recorded habitat of indigenous people at Jangalia Mouza. In addition, there is no ecologically critical area and physical cultural resources in close proximity to the site.

C. OCCUPATIONAL AND HEALTH SAFETY IMAPCTS DURING PRE-OPERATION

Occupational Safety

During construction works, there is possibility of different health hazards, injury and accident. Some of the relevant occupations and their corresponding health hazards are given in Table 5.4. It is expected that LBPL will adopt required mitigation measures to reduce the risk of these occupational health hazards.

Table 5.4: List of occupation and corresponding health hazards in relevant to construction work

Occupations	Hazards
Brick masons	Cement dermatitis, awkward postures, heavy loads
Hard tile setters	Vapor from bonding agents, dermatitis, awkward postures
Carpenters	Wood dust, heavy loads, repetitive motion
Electricians	Heavy metals in solder fumes, awkward posture, heavy loads
Painters	Solvent vapors, toxic metals in pigments, paint additives
Plasterers	Dermatitis, awkward postures
Plumbers	Lead fumes and particles, welding fumes
Pipefitters	Lead fumes and particles, welding fumes, asbestos dust
Concrete finishers	Awkward postures
Insulation workers	Asbestos, synthetic fibers, awkward postures
Welders	Welding emissions

To ensure the compliance of occupational health safety in a satisfactory manner, LBPL has to adopt a detail EHS guideline as will clearly deal with all relevant aspects in a detailed manner, as are required for construction phase and operation phase.

Accommodation and Other Relevant Aspects

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's 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 temporary accommodation facilities 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.

5.1.2 Environmental, social and occupational health safety impacts during operation phase

A. ENVIRONMENTAL IMPACTS DURING OPERATION PHASE

Impact on Air quality

To assess the emission concentration of SO_2 and NOx during operation phase, a detail air dispersion modeling was conducted by USEPA certified Industrial Source Complex (ISC3P) Model. The individual engine stack data was used as point source of NO_2 and SO_2 emission. The parameters and corresponding values are summarized in the Table 5.5.

Table 5.5: 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*** ***Other 4 Engines with no Exhaust Gas Boilers***	 27 m/s 32 m/s
Exhaust temperature ***2 Engines with Exhaust Gas Boilers***	240 +(-) 15 °C335+(-) 15 °C
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 one engine releasing gaseous emission as point source with simple terrain. The model assumes the stack tip downwash with receptors on flat terrain and no flagpole receptor heights.

Table 5.6: National ambient air quality standards 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)

Air dispersion modeling was completed to predict ground level concentrations (GLCs) of pollutants, including NO_X, CO, PM_{10}, 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 based on the background values of the project area between March and October 2011.

Box 5.1: Set-up for ISC3P

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.

Based on the result of air dispersion modelling, the concentration of SOx and NOx at various distance in respect of assumed mid points of the Project is mentioned in Table 5.7

Table 5.7: Concentration of SOx and NOx at various distance from the project site

Direction	Parameters (μg/m^3)	Concentration in respect to distance from mid of project site (in m)			
		500	**1000**	**1500**	**2000**
North	SO_2	16.0	42.5	55.0	61.4
	NOx	21.0	53.3	68.4	76.2
South	SO_2	1.8	7.5	8.1	9.0
	NOx	3.7	10.7	11.4	12.4
West	SO_2	0.1	0.7	0.9	1.1
	NOx	1.7	2.4	2.6	2.9
East	SO_2	0.9	4.0	4.0	4.1
	NOx	2.6	6.4	6.3	6.5

The concentration value of SO_2 and NOx is within the annual limit of NAAQS, Bangladesh. So, it can be said that the Project will not aggravates the ambient air quality of the project area to a significant extent. The main reason of limiting the NOx emission is in the Project electricity will be produced using lean burn mixture of air and oil in the cylinder i.e. more air will be present in the cylinder than required for complete combustion.

The stack height as per design of 42 meters is adequate as per the modeling which indicates that the stack height of 42 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 should be installed for emission monitoring on each stack.

Noise

Based on the secondary source, it is assumed that the possible level of noise at the plant location is 85 dBA. According to the categorization of project are (based on landuse pattern), the Project area of LBPL seems to be mixed type due to the trend of commercial activities and rural nature of adjacent neighborhood

Table 5.8: Standards of noise level at different zones

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	Residential area	50	40
	Mixed area	60	50
	Commercial	70	60
	Industrial	75	70

To assess the impact of noise, a noise modeling was conducted based on the method of International Energy Agency. This model 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 in Box 5.2.

Box 5.2: Formula for calculating noise level

L_A, = $10\log_{10}$ ($^{10LA/10}$) dBA

Where: LA = Sound source 1 (i.e. LBPL power plant)

For better compliance the 'worst-case scenario' situation has been considered, which means that while calculating noise impact, no noise attenuation has been considered due to

- 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:

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

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

Where: r = the distance from source to receiver;
a = 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
Lp =the output sound power level of the turbine at different radius away from the source

Graphic User Interface (GUI) was built based upon the model developed in MATLAB programming language, for enhancement in calculation and analysis. The screenshot including the MATLAB code is given in Figure 5.1.

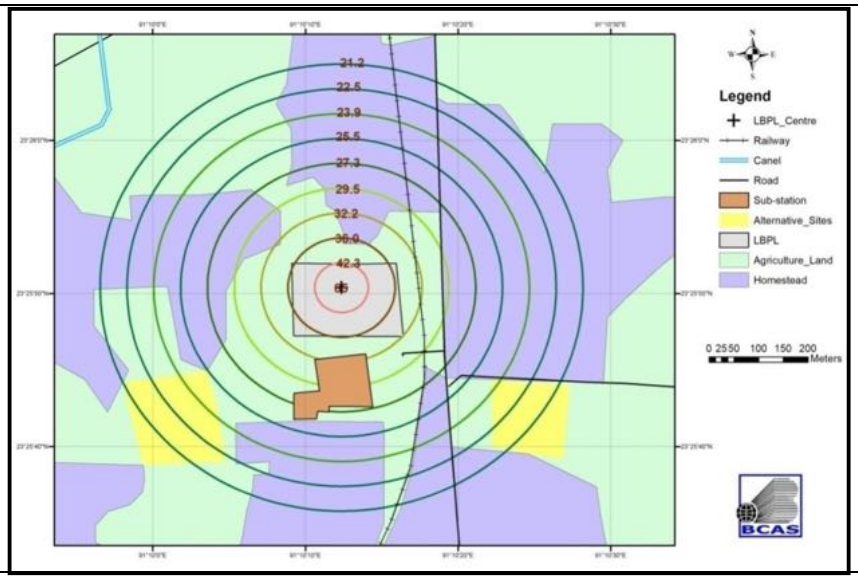

Figure 5.1: noise concentration around 500m of the plant site

Table 5.9: The predicted noise output at different points at 85 dB noise input

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

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 combined noise levels at locations in the vicinity of the Site based on modeling at various distances from the plant location are given in Table 5.10.

Table 5.10: The combined noise levels at various distances from the plant (based on modeling)

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
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 5.10 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 of Table 5.10, it may be concluded that the proposed power plant will exhibit less impact on the ambient noise level as it is expected to comply with the noise limit standards of Bangladesh and IFC EHS guidelines (based on the result of model). However, for better compliance, to reduce the effect of noise LBPL has to use 100mm thick rock wool (density 100 kg/m3) walls as are capable to absorb significant level of noise. In addition, to address the vibration issue, application of vibration pads at the bed of all power generation units is to be ensured.

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. There should be four types waste bins to collect four types of waste. Among these four types of bin Green colored bin will be used for collecting paper/cardboard types of waste, whereas Blue, Brown and Black colored bins will be used to manage plastics, food waste and general types of wastes[10]. All plastic and paper materials would sale to DOE enlisted secondary users for recycling. Biodegradable could be distributed to the farmers for compost and later on use as fertilizer.

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.

[10]Source: www.preventandsave.ie/.../**Waste**%20Management%20for%20Offices.pdf

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 50 persons.

Thermal Discharge

Plant Main Cooling Water (MCW) System is of radiator type closed cooling water circuit, which has no thermal discharge issue. The only possible mode of thermal discharge is through boiler blow-down water. But, even this carries no any heat to the environment since the blow-down system is designed to cool down the discharged water up to ambient temperature.

The amount of boiler blow-down is around 250litres/day. The blow-down water is cooled down mainly in two stages until it reaches the ambient temperature before it is discharged. Initially the blow-down water is cooled down up to 60^0C at blow-down tank by mixing with cooling water (approximately 900Litres). Then this mixture is drained to the boiler washing water tank, which is having a capacity of 5000 litres. Here, the mixed blow-down water is stored for about 4 days for natural cooling until it reaches ambient temperature and then only it is pumped out, where it is again mixed with Reverse Osmosis (RO) unit reject water as an additional measure of cooling, before it is discharged to the environment.

B. SOCIAL IMPACTS DURING OPERATION

Involuntary Resettlement

During operation phase there is no issue of land acquisition, resulting no issue of resettlement either in the form of voluntary or involuntary.

Indigenous People

LBPL is committed to provide equal opportunities and facilities for all workers and officials. In this regard, there is no scope of discrimination in the excuse of difference of sex, age, religion or even ethnic identities. In the same way, it will to pay the committed salary to all workers and officials. There is no scope of any discrimination. So, it is assumed that the indigenous community has no opportunity to feel undermine in regard of service or manner of LBPL.

C. OCCUPATIONAL HEALTH AND SAFETY IMPACTS DURING OPERATION

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 given in Table 5.11.

Table 5.11: Health safety impact and proposed mitigation measures

Issue	Health safety Impact	Mitigation measure
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.	▪ Earthing network around the generator room ▪ Mesh system is expected to be used as safety measure.
Heat	Occupational exposure to heat occurs during operation and maintenance of combustion units, pipes and related hot equipment.	▪ Regular inspection and maintenance of pressure vessels and piping; ▪ Provide adequate ventilation in work areas to reduce heat and humidity
Noise	Gas generators and auxiliaries, gas engines, fans and duct work; compressors etc. Can generate significant noise.	▪ Provision of sound-insulated control room with noise level ass is permitted in ECR, 1997; ▪ Design of generators to meet applicable noise levels.
Fire and Explosion Hazards	The daily activities of power plant include store, transfer and use large quantities of fuels resulting the risk of fire hazard.	▪ 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.
General Safety	General health hazard	▪ Provide personal protective equipments like safety gloves, helmet, mufflers etc. during construction period and during the maintenance work while the plant is in operation. ▪ Ensure first aid box for the workers.

5.1.3 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 50skilled 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 de-commissioning 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.

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 has 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 sub-station. 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 at the power plant. Therefore the power plant will be run on using HFO until gas is available.

6.1.2 Analysis of site alternatives

In regard of site alternatives, LBPL initially considered a number of sites. But when PGCB agreed to lease the land just beside their existing sub-station, there was no necessity to think for any other option because:

Cost saving: The land price within CCC is increasing rapidly. The average land price in any underdeveloped area is not less than 5,00,000/decimal. So, LBPL would require significant amount of money to purchase land. But due to the land lease agreement with PGCB, a significant amount of capital cost has been saved.

Distribution issue: For distribution of power, there is usually requirement of high tension line and other accessories and devices. But due to the close proximity of PGCB sub-station, LBPL will be in an advantageous position in this regard.

Productivity: While distribution, there is an issue of system loss due to stepping up and stepping down of voltage. So, if the distribution line is short, the system loss will be less resulting higher productivity. The selected site has this basic advantage in this regard.

Accessibility: A power plant project generally requires a site with good accessibility because there is issue of distribution of fuel and accessories. As the selected site is just beside Mainamati Rail Station and Dhaka-Chittagong Highway, the distribution of HFO will not appear as a concern.

Chapter-7

INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 STAKEHOLDER CONSULTATION

Stakeholder consultation forms an important part of the IEE study. The main objective of the consultation process 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:

- disseminate information about the Project to the stakeholders;
- have a better understanding of existing environmental conditions;
- aware stakeholders to contribute meaningfully to in different phases of project;

7.2 DESCRIPTION OF THE STAKEHOLDER CONSULTATION PROCESS

In conducting the IEE, a number of stakeholders consultation were conducted. In the following sections theses consultations are discussed with outcome.

7.2.1 Focus group discussion with affected communities

As a part of focus group discussion with affected communities, there were consultations with male and female group as live in adjacent to the project site. During this consultation, it has been tried to ensure the presence of all classes of people including businessman, general people, housewife, service holders and so on. These have been documented in the following sections:

Outcome:

The major findings of large public consultation are:

- local people are aware about the proposed power plant project;
- people do not have clear idea about when the project will commission and when they will get electricity;
- they are expecting employment during the construction and operation phases of the project;
- people may be temporarily disturbed by noise and dust emitted by vehicles during the construction period.

Photograph 7.1 and 7.2: Male and female FGDs

7.2.2 Consultation with Government Officials

As part of consultation with government officials, there were consultations with Mr. Rafikul Islam, Executive Engineer and Mr. Sheikh Md. Nurulla, Executive Engineer of CCC. Thereafter, the IEE Team has consulted with Mr. Jashim Uddin, GM, Planning of BGDCL. In addition, Mr. Mrinal Kanti Sen, Executive Engineer, BPDB and Mr. Rezaul Karim, Station Officer, Fire Service and Civil Defense Department were also consulted.

Outcome:

The major findings of consultation with government officials are:

- According to the Structural Plan of CCC, the project site has fallen in mixed (commercial and residential) zone. So, it is in compliant with the Structural Plan;
- Power plant is required for the growth of the national economy;
- Due to Comilla EPZ and some industrial developments, there is significant power shortage in CCC;
- A considerable number of people will get direct and indirect employment opportunities
- Due to use of HFO, there could be an issue of air pollution;
- Civil Defense Department will provide the required fire fighting training to the LBPL staff;

Photographs 7.3 and 7.4: Consultation with government officials

7.2.3 Consultation with Non Governmental Organizations

There are several non-government organizations (NGOs) working in the project area. 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.

Photograph 7.5: Consultation with ASA

Outcome:

The major findings of consultation with NGOs are-

- The power plant is expected to improve the power availability scenario of the country;
- If possible, there should be priority about supply the power in CCC area.

7.2.4 Large public Consultation

On 24 November 2013, a large public consultation was arranged at City Club located at Jangalia Bus Stand, Comilla. There were 64 participants in this consultation. The detail list of participant is provided in Annex 12.

Outcome:

The major findings of large public consultation are:

- There should be detail assessment of environmental impact of the power plant with emphasis on noise and air pollution;
- LBPL should contribute in development of local schools, library and so on;
- While erecting gas pipeline, adequate safety measures need to be adopted;
- While deploying workers and staff, priority should be given to local candidates;

Photographs 7.6 and 7.7: Large public consultation

Table 7.1: Summary of findings of consultation and response of LBPL

Main theme	Suggestions/findings of consultation	Response of LBPL
Employment	To engage local people during construction and operation phases on priority basis	LBPL will try to engage local people on priority basis.
Environmental impact	Air pollution and noise impacts need to be properly mitigated	Based on the result of air dispersion modeling and noise modeling, required mitigation measures will be adopted.
Social support	Financial support in local schools, library, etc.	LBPL considers social support issue as a part of corporate social responsibility
Safety in gas pipe line erection	Due safety measures need to be adopted during gas pipeline erection.	LBPL will engage BGDCL nominated contractor for erecting gas pipeline
Distribution priority	The generated power of the power plant should be distributed to CCC on priority basis.	The full responsibility of power distribution is BPDB. So, LBPL cannot give any commitment in this regard.

7.3 DISCLOSURE PLAN

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

LBPL has adopted an open policy. *It has requested local people if they have any observation, objection or suggestion for any phase-construction and operation, they are welcome to submit their views in writing in the Project office located at the Project site.*

LBPL has informed that the summary of the findings of the study will be published on the LBPL website and to the local newspaper to disclose project related information to the wider communities.

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, phone/mobile call, email or facsimile using the contact information.

All comments and complaints will be responded to either verbally or in writing, in accordance with preferred and popular 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 Manger, 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

8.3.2 Corporate level resource and responsibilities

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 from plant level. After reviewing the plant level findings/observations on grievances, he will adopt required measures to immediately resolve the grievances. Actually corporate level of grievance redress mechanism will deal with the serious issues requiring strategic decision of top management of LBPL.

Table 8.2: Contact detail of respective official of LBPL

Level	Designated official	Phone	Cell phone	e-mail
Plant level	Mr. N. Sivakumar, Stakeholder's Liaison Officer	8802-8410330	-	nskumar@lakdhanavi.net
Corporate level	Mr. A.B Siddique, Communication Manager	8802-8418513	+88-01711825517	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 also manage the external reporting requirement.

Chapter-9

ENVIRONMENTAL MANAGEMENT PLAN

9.1 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

9.1.1 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 10.1 summarizes the potentially significant environmental impacts associated with the pre-operation phase, mitigation measures and institutional responsibility.

Table 9.1: Potential impacts and mitigation measures at pre-operation phase

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	▪ Spraying of water in 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 night time disruption	EPC Contractors' responsibility with LBPL oversight
Dust and exhaust gases from construction machinery and vehicles	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 by purchasing ready-mix construction mixture (sand, cement and gravel) ▪ 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.	EPC Contractors' responsibility with LBPL

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
		▪ Regular inspection of lines for faults prone to accidents. ▪ Provision of fire protection equipments. ▪ Provision of lightening arrestors	oversight

9.1.2 Operation phase

LBPL is 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 9.2 summarizes the potentially significant environmental impacts during operation phase, the measures needed to eliminate or offset adverse impacts and institutional responsibility.

Table 9.2: 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	▪ 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; ▪ Implement 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;	LBPL especially ESMU
Air emission, noise generation	Emission from the power plant	▪ Install stack emission monitoring equipment for major pollutants; ▪ Plant 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

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
	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
	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 and 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 bin 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
	Labour conditions	▪ Bangladesh has ratified key International Labour Organisation (ILO) conventions, to ensure the	ESMU

Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility
		work conditions are reasonable and safe, and employees are free from any form of discrimination.	
Disaster Management, Fires, explosion and other accidents	Emergency Response (i.e. Fire, Earthquake, Flood etc.)	▪ Develop an Emergency Response Plan (ERP),to cover all foreseeable emergencies, for approval by LBPL	ESMU
	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 Lightening arrestors	ESMU
Domestic wastewater, sewage and sanitary waste	BOD, fecal coliform contamination in groundwater and surface water	▪ Need to provide septic tank with soak pit for treatment of sewage. ▪ Provision of an appropriate number of toilets and hand-washing points. ▪ Provision of on-site treatment of sanitary wastes. ▪ Training on hygiene and sanitation practices.	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	Emergence of grievance	▪ 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.	ESMU

9.1.3 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 9.3 summarizes the potentially significant environmental impacts during decommissioning phase, the measures needed to eliminate or offset adverse impacts and institutional responsibility.

Table 9.3: 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	Regular spraying of water 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

9.2 INSTITUTIONAL ARRANGEMENT

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.

9.2.1 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 .

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.

Figure 9.1: Proposed organogram of ESMU

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;
- Submit EHS Implementation Report to relevant stakeholder.

9.2.3 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 and safety management;
- Training on environmental safeguards and compliance;
- Staff training on environmental monitoring and reporting;
- Training on occuptional health and safety measure.

9.3 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 pre-operation phase, the EPC 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. But during operation phase, the Compliance Manager and Compliance Officers of ESMU of the power plant will look after the

required environmental and health safety compliances. 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.

9.3.1 Environmental monitoring plan

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 9.4.

Table 9.4: Environmental monitoring plan

Phase	Env. parameter	Sampling	Test for	Frequency
Trial Run	Ambient Air Quality	Sampling of air quality collected from 2 stations of project site	SOx, NOx and CO	Once during trial run
	Noise	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	Once during trial run
Operation Phase	Ambient Air Quality	At Project site, residential /institutional /commercial areas within 500m outside from plant boundary	SPM, SOx, NOx and CO	Quarterly (routine) analysis
	Surface water	Project site at Jangalia, Comilla	pH, Temperature, DO, BOD, COD, TDS,TSS, Oil and grease	Bi-annual basis in each year (pre-monsoon and post-monsoon)
	Surface water	Project site at Jangalia,	pH, Temperature, DO, BOD, COD,	Bi-annual basis in each year (pre-

		Comilla	TDS,TSS, Oil and grease	monsoon and post-monsoon)
	Noise	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	Quarterly (routine) analysis

9.3.2 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 responsible for monitoring as well as implementation of EMP. 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 9.5. Laboratory analysis fees considered as per monitoring fees format of DOE/private laboratories.

Table 9.5: An annual tentative budget for environmental monitoring (Operation Phase)

Activity	Unit/position	Total Cost (Tk.)
Fire fighting and suppression equipments, training and annual fire safety drill	1 unit	150,000
Cost of occupational health and safety equipment	1 unit	125,000
Quarterly test of ambient air quality (SPM, SOx, NOx, CO)	2 positions	75,000
Half yearly test of surface water (pH, Temperature, DO, BOD, COD, TDS, Oil and grease) quality	1 position	75,000
Half yearly test of ground water (pH, Temperature, DO, BOD, COD, TDS, Oil and grease) quality	1 position	75,000
Quarterly noise monitoring	2 positions	25,000
Training on environmental safeguards and compliance measures	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**

In case of quarterly ambient air quality monitoring, there will be monitoring at two positions (one position is within the Project site and the other position is about 500 m away from the project site) . But in case of noise monitoring, there will be one monitoring point within the project site and the another will be at project boundary.

9.3.3 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 9.6.

Table 9.6: Reporting schedule

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

Chapter-10

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 be 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 equipments;
- preventive maintenance;
- aware the workers about electric shock and other hazards;
- electro-magnetic wave or electrical interference;
- declaring the factory a “no smoking zone”
- mock drills by the fire fighting cells/coups;
- 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, emergency, 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 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 (DMP), which will cover all relevant aspects with focus on fire, earthquake and cyclone. This DMP is to be made available and practiced from the construction phase of the project. Thereafter, it has to be followed in operation phases as well, in a due satisfactory manner with regular report to relevant stakeholders (as are required).

Chapter-11

CONCLUSION

The environmental impacts of the proposed 52 MW dual fuel based power plant at Jangalia, Comilla has been assessed 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. While impact assessment, 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 MW power plant seems to be acceptable for the proposed Project.

The findings of this IEE suggests that the Project involves some environmental impacts (localized in nature) 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 project is environmentally in an advantageous condition 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 will follow all sorts of required environmental compliances 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, particularly that of air emission 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.

So, issuance of environmental clearance in favor of LBPL 52 MW dual fuel based power plant project may be considered.

Annex 1: Rapid Environmental Assessment Checklist

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 proposed Project site is located at Jangalia, under the jurisdiction of 22 no. Ward of Comilla City Corporation. In Jangalia, there is no significant cultural heritage site according to local respondents.
▪ **Protected area**		√	In Jangalia of Comilla, no protected area (environmental point of view) has been reported.
▪ **Wetland**	√		The Project site is located about 5 (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. As Comilla is far away from the bay of Bengal, no mangrove forest has been found in the adjacent river of Comilla.
▪ **Estuarine**		√	
▪ **Buffer zone of protected area**		√	
▪ **Special area for protecting biodiversity**		√	In April 1999, the Department of Environment (DOE) 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. 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?		√	Comilla is rich in cultural heritage. But based on the findings of site visit and secondary source, it may be said that there is no important cultural heritage within the radious of 5 km air shed.
▪ encroachment into precious ecosystem (e.g. sensitive habitats like protected forest areas or terrestrial wildlife habitats)?		√	There is no precious ecosystem in Comilla City Corporation (based on the secondary source).
▪ 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 significant scope of 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. In case of salary and other facilities, LBPL will adopt a uniform equal policy irrespective of

			difference in gender, religions and so on.
▪ 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 relevance 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. In addition, there is scope of significant noise as is to be reduced by adopting required reduction measures.
▪ 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 its proposed two fuels are natural gas and 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 regions as the requirement of water is only 25 m^3/day
▪ pollution of water bodies and aquatic ecosystem from wastewater treatment plant for boiler feed, bleed-off from cooling towers, boiler blow-down 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 the atmosphere?	√		There is risk air pollution due to SOx and NOx emission as HFO facilitates SOx emission and Natural gas facilitates emission of NOx. Based on the result of air dispersion modeling, it is assumed that the proposed type HFO will not raise concern in regard of SOx . On the other hand, NOx emission could be reduced by introducing low-NOx burner, which has now become a common technology.
▪ 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 small, there is no need to hire workers from other regions for the project.
▪ 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 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 and HFO based power plant having no relevance with coal, so, there is no issue of 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 trend of 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 IEE 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)?		√	Based on the scale of the technology and complexity of the project, it may be concluded that the Project will not increase the climate and disaster vulnerability of the surrounding areas.

Annex 2: Site Clearance

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
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তারিখ: ০৪/ ৭৯/১৪২০ বঙ্গাব্দ
১৮/১২/২০১৩ খ্রিস্টাব্দ

পরিবেশ সংরক্ষণ বিধিমালা-১৯৯৭ এর ৮ নং ধারা অনুযায়ী

বিষয়: Lakdhanavi Power Limited (পূর্ববর্তী নাম-ম্যাক্স লংকা পাওয়ার লিঃ) নামক (৫০ মেগাওঃ) বিদ্যুৎ উৎপাদন কেন্দ্রের অনুকূলে অবস্থানগত ছাড়পত্র নবায়ন।

আপনার ২৪/১১/২০১৩ তারিখে কুমিল্লা জেলা কার্যালয়ে পরিবেশগত ছাড়পত্র নবায়নের আবেদন এবং কুমিল্লা জেলা কার্যালয়ের গত ২৫/১১/২০১৩ তারিখে প্রেরিত প্রতিবেদনের প্রেক্ষিতে এ দপ্তরের গত ২১/১২/২০১৩ তারিখের পূর্বিবেশ/চবি/ছাড়পত্র-১৭৭৭৩/২০১২/ ১৬২০ সংখ্যক স্মারকে পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ অনুযায়ী "লাল" শ্রেণীভুক্ত বিবেচনায় সাং-দৈয়ারা, ডাক: আহম্মদ নগর, ক্রমালিয়া,থানা:-সদর দক্ষিণ,জেলা-কুমিল্লা নামক বিদ্যুৎ উৎপাদন কেন্দ্রের অনুকূলে জারীকৃত অবস্থানগত ছাড়পত্রের সকল শর্তাবলী অপরিবর্তিত রেখে নাম পরিবর্তনসহ নিম্নবর্ণিত শর্ত যুক্তক্রমে আগামী ২০/০৩/২০১৪ তারিখ পর্যন্ত মেয়াদের জন্য নবায়ন করা হলো। উল্লেখ্য যে, আরোপিত যে কোন শর্ত ভঙ্গের কারণে জারীকৃত ছাড়পত্র বাতিল বলে গণ্য হবে

শর্তাবলী :

১. প্রতিষ্ঠানের কার্যক্রম ও প্রক্রিয়া দ্বারা কোনভাবে পরিবেশ (মাটি, পানি, বায়ু ও শব্দ) দূষণ করা যাবে না।
২. অবস্থানানুমোদনপত্র ইস্যুনের অতিরিক্ত অন্যান্য বিষয়ের মধ্যে আইইই প্রতিবেদনে বর্ণিত সকল মিটিগেশন মেজার্স যথাযথভাবে বাস্তবায়ন করতে হবে।
৩. শিল্প ইমারত দ্বারা সাইটের সর্বাধিক ৬৬% স্থান আচ্ছাদিত করা যাবে এবং উহার পশ্চাতে এ দুই পার্শ্বে ন্যূনতম ২.৫০ মিটার ছুস উন্মুক্ত রাখতে হবে।
৪. আইইই প্রতিবেদনে বর্ণিত কার্যপরিধির ভিত্তিতে ইআইএ প্রতিবেদন প্রণয়ন করতে হবে এবং উক্ত ইআইএ প্রতিবেদন পরিবেশ অধিদপ্তরে অনুমোদনের নিমিত্তে পেশ করতে হবে।
৫. ইআইএ প্রতিবেদনে এ আওতাধীন সৃষ্ট গ্যাসীয় পদার্থের নিঃসরণ(SOx, NOx, CO ইত্যাদি) এবং ক্ষুদ্র কণার(particulate Matters) নির্গমন পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭-এ উল্লিখিত মানমাত্রার মধ্যে রাখা, কুলিং ওয়াটার পুনঃব্যবহারের ব্যবস্থা এবং তরল বর্জ্য পরিশোধনের ডিটেইল পরিকল্পনা অন্তর্ভুক্ত করতে হবে। প্রতিবেদনে অন্যান্যের মধ্যে Spent lubricating oil, oil Filter এবং Sludge ব্যবস্থাপনার বিবরণী ও ফ্লেবেক্স প্লান অর্ন্তভুক্ত থাকতে হবে।
৬. ইআইএ প্রতিবেদনে নিরুপ স্লোকবল ও ইন্সট্রুইপমেন্ট এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম গড়ে তোলার বিষয়ে প্রয়োজনীয় কারিগরী ও অর্থিক প্রস্তাবনা অন্তর্ভূক্ত করতে হবে।
৭. ইআইএ অনুমোদিত না হলে আমদানীতব্য যন্ত্রপাতির অনুকূলে L/C খোলা যাবে না।
৮. সংশ্লিষ্ট বিষয়ে অভিজ্ঞ মাল্টিডিসিপ্লিনারী টীমের মাধ্যমে ইআইএ প্রণয়ন করতে হবে।
৯. পরিবেশগত ছাড়পত্র ব্যতিরেকে গ্যাস সংযোগ গ্রহণ ও বিদ্যুৎ উৎপাদনে যেতে পারবে না।
১০. ছাড়পত্র ইস্যুর তারিখ হতে ১(এক) বছরের জন্য বহাল থাকবে এবং মেয়াদ শেষ হওয়ার অন্ততঃ ৩০(ত্রিশ) দিন পূর্বে উহা নবায়নের জন্য আবেদন করতে হবে।

১১. অবস্থানগত ছাড়পত্রের মূলকপি প্রতিষ্ঠানে সংরক্ষণ করতে হবে। পরিবেশ অধিদপ্তরের এনফোর্সমেন্ট টীম, পরিদর্শক ও পারদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ প্রকল্প পরিদর্শনকালে ছাড়পত্র/নবায়নপত্র প্রদর্শন এবং প্লান্টের কার্যক্রম পরিদর্শনে সহযোগিতা প্রদান করতে হবে।
১২. উপর্যুক্ত ১-১১ অনুচ্ছেদে বর্ণিত যে কোন শর্ত ভংগ করলে এ ছাড়পত্র বাতিল বলে গণ্য হবে এবং আপনার/আপনার প্রতিষ্ঠানের বিরুদ্ধে বাংলাদেশ পরিবেশ সংরক্ষণ আইন, ১৯৯৫ পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ এবং শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা, ২০০৬ অনুসারে আইনগত ব্যবস্থা গ্রহণ করা হবে।

(মোঃ জাফর আলম)
পরিচালক
ফোনঃ ৬৫৯৩৭৯

ব্যবস্থাপনা পরিচালক
Lakdhanavi Power Limited (পূর্ববর্তী নাম-ম্যাক্স লংকা পাওয়ার লিঃ)
২৭, দিলকুশা বা/এ, ঢাকা-১০০০।

Annex 3: EIA Approval

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

নম্বর ০৯ ৫৫

পরিবেশ অধিদপ্তর, চট্টগ্রাম বিভাগ

পরিবেশ ভবন

জাকির হোসেন রোড, ফয়'স লেক, খুলশী, চট্টগ্রাম
ফোন : ৬৫৯৩৭৯, www.doe-bd.org

স্মারক নম্বরঃ পঅ/চবি/ছাড়পত্র-১৭৭৭৩/২০১৩/ ১৫৫

তারিখঃ ২৪ /০১/১৪২১ বঙ্গাব্দ
০৭ /০৫/২০১৪ খ্রিস্টাব্দ।

পরিবেশ সংরক্ষণ আইন, ১৯৯৫ এর ১২ ধারা এবং পরিবেশ সংরক্ষণ বিধিমালা, ১৯৯৭ এর ৭ ধারা অনুযায়ী

বিষয়ঃ Lakdhanavi Bangla Power Limited নামক ৫২.২ মেঃওঃ বিদ্যুৎ উৎপাদন কেন্দ্রের ইআইএ অনুমোদন।

পরিবেশ অধিদপ্তর, সদর দপ্তরের পরিবেশগত ছাড়পত্র বিষয়ক কমিটির ৩৭৫ তম সভার কার্যবিবরণীর গ অনুচ্ছেদের ১ নম্বর ক্রমিকে বর্ণিত সিদ্ধান্ত মোতাবেক সাং-দৈয়ারা, ডাকঃ আহম্মদ নগর, জাঙ্গালিয়া,থানাঃ-সদর দক্ষিণ,জেলা-কুমিল্লা ঠিকানায় নির্মাণাধীন Lakdhanavi Bangla Power Limited নামক ৫২.২ মেঃওঃ বিদ্যুৎ উৎপাদন কেন্দ্রের অনুকূলে নিম্নবর্ণিত শর্তে ইআইএ অনুমোদন প্রদান করা হল।

১. ইআইএ অনুমোদনের প্রেক্ষিতে আমদানীতব্য যন্ত্রপাতির জন্য এল/সি খুলতে পারবে, যাতে দূষন নিয়ন্ত্রণ সংক্রান্ত যন্ত্রপাতি অন্তর্ভূক্ত থাকবে।
২. ইআইএ প্রতিবেদনে দাখিলকৃত সকল মিটিগেশন মেজারস বাস্তবায়ন সম্পন্ন করে পরিবেশগত ছাড়পত্রের জন্য আবেদন করতে হবে।
৩. নিজস্ব লোকবল ও ইকুইপমেন্ট এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম গড়ে তোলার বিষয়ে প্রয়োজনীয় ব্যবস্থাপনা গড়ে তুলতে হবে।
৪. প্রকল্পের পরিবেশগত ব্যবস্থাপনার জন্য পরিবেশ বিষয়ে ডিগ্রীধারী প্রশিক্ষিত জনবল নিয়োগ করতে হবে।
৫. প্রকল্প চত্বরের সীমানাসহ ন্যূনতম ৩৩% জায়গার অধিক পরিবেশ উপযুক্ত প্রজাতির ফলজ ও বনজ গাছ লাগিয়ে সবুজায়ন করতে হবে।
৬. প্রকল্পটিতে যন্ত্রপাতি স্থাপনের লক্ষ্যে বিদ্যুৎ সংযোগ গ্রহণ করা যাবে।
৭. তরল বর্জ্য রিসাইক্লিং ও জিরো ডিসচার্জ পরিকল্পনা দাখিল করতে হবে।
৮. সরকার অনুমোদিত 3R(Reduce, Reuse & Recycle) নীতি ও সকল প্রকার Resource Conservation Plan বাস্তবায়ন করতে হবে।
৯. পরিবেশগত ছাড়পত্র গ্রহণ ব্যাতরেকে বিদ্যুৎ উৎপাদন করা যাবে না।
১০. উপর্যুক্ত ১-৯ অনুচ্ছেদে বর্ণিত যে কোন শর্ত ভংগ করলে এ অনুমোদন বাতিল বলে গণ্য হবে এবং আপনার/ আপনার বিদ্যুৎ উৎপাদন কেন্দ্রের বিরুদ্ধে বাংলাদেশে প্রচলিত পরিবেশ সংরক্ষণ আইন ও বিধিমালা এবং সংশিষ্ট অন্যান্য আইন ও বিধিমালা অনুসারে আইনানুগ ব্যবস্থা গ্রহণ করা হবে।

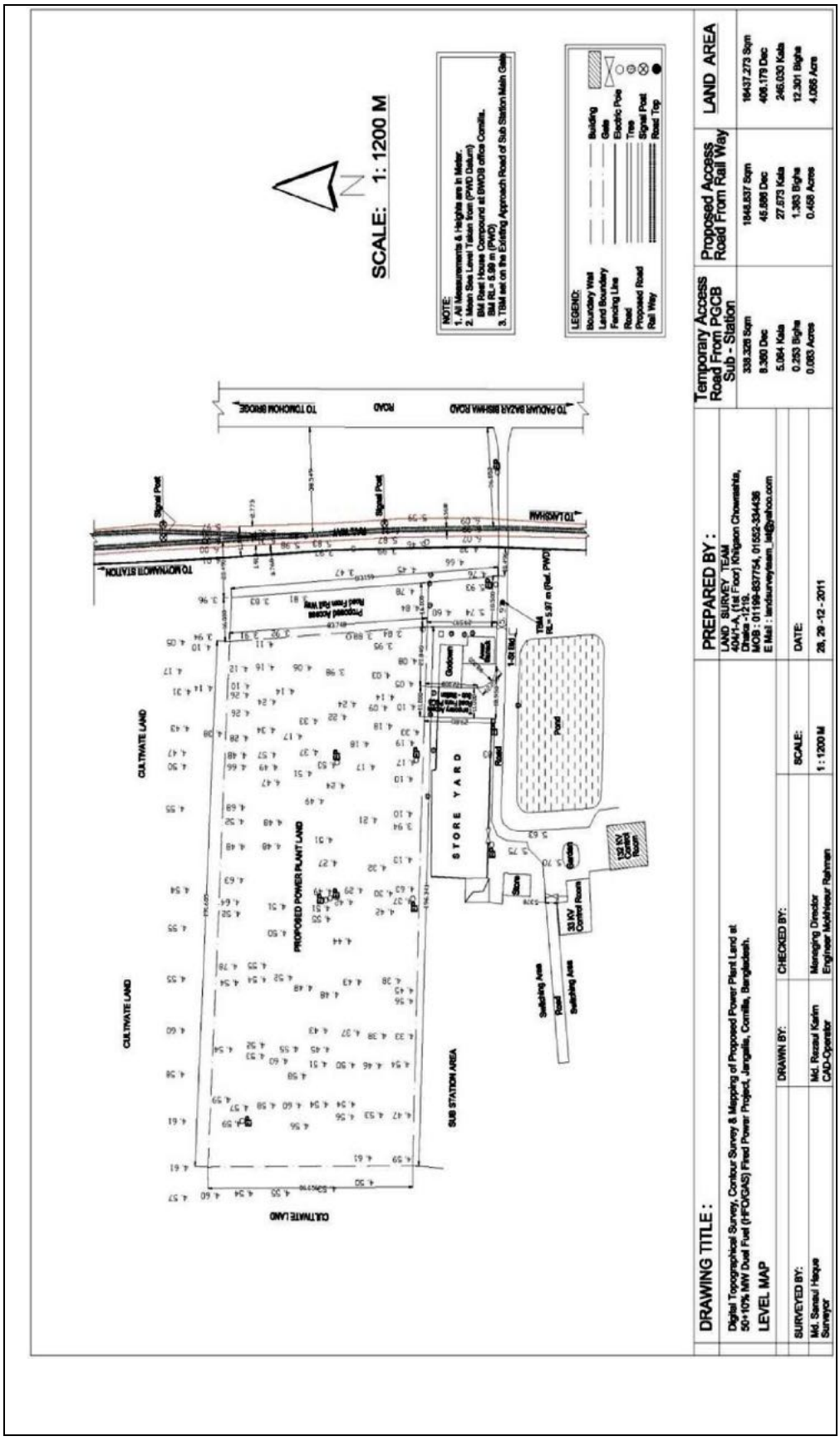
৭/৫/২০১৪

(মোঃ জাফর আলম)
পরিচালক
ফোন-৬৫৯৩৭৯

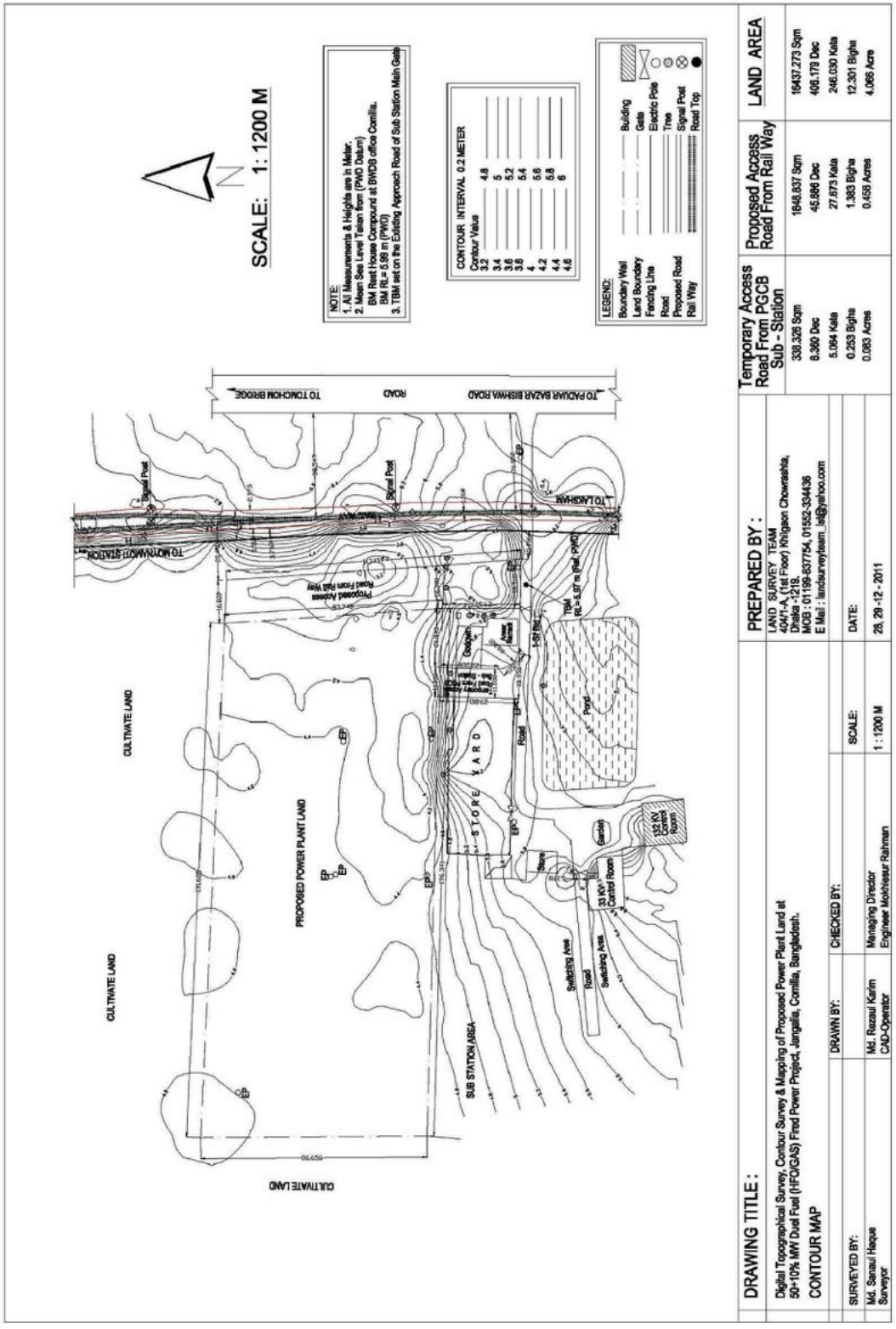
ব্যবস্থাপনা পরিচালক
Lakdhanavi Bangla Power Limited
২৭, দিলকুশা বা/এ, ঢাকা-১০০০।

Annex 4: Satellite image of the project area (general image)

Annex 5: Level map of the project site



Annex 6: Contour map of the project site



Annex 7: Temperature, rainfall, humidity and wind speed in the project area

Table 7a: 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	Dec	10.7
2010	April	39.8	Jan	11.9
2011	April	38.0	Dec	9.7
2012	Sep	36.2	Jan	7.3

Source: BMD

Table 7b: 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

Table 7c: 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

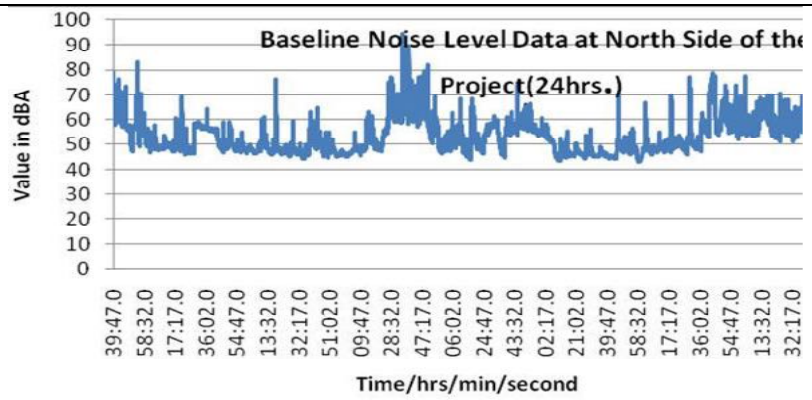
Source: BMD

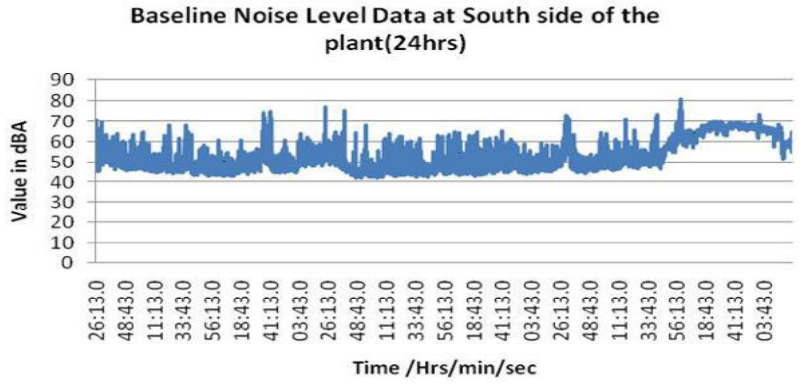
Table 7d: Average monthly wind speed and direction in the project area

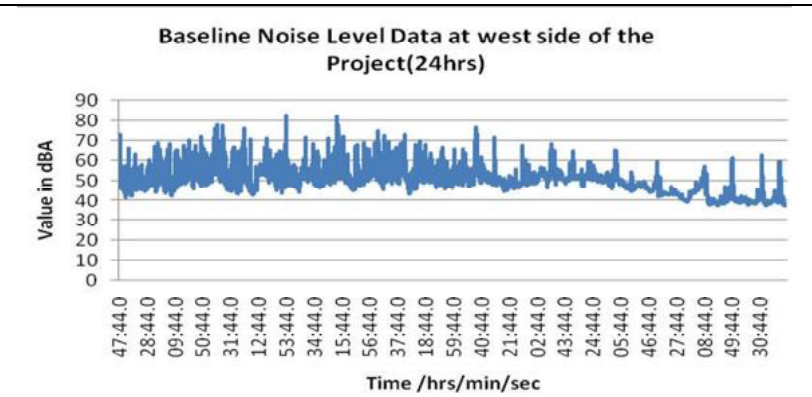
Year	Maximum wind speed (knot/hour)			Minimum wind speed (knot/hour)		
	Month	Wind speed	Direction	Month	Wind speed	Direction
2008	Nov	5.5	N-E	Jan	2.9	N-W
2009	Oct	5.6	N-E	August	2.8	N-E
2010	July	4.3	S-E	Oct	2.3	E
2011	April	4.1	S	Oct	2.1	N-E
2012	March	3.8	S	Oct	2.0	N-W

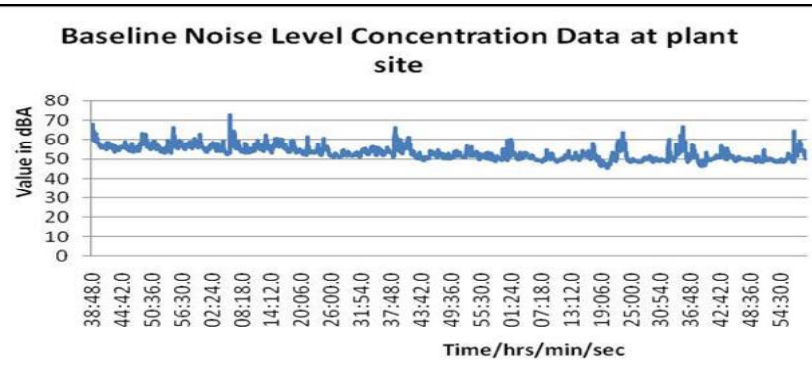
Source: BMD

Annex 8: Ambient noise level at some locations close to project site

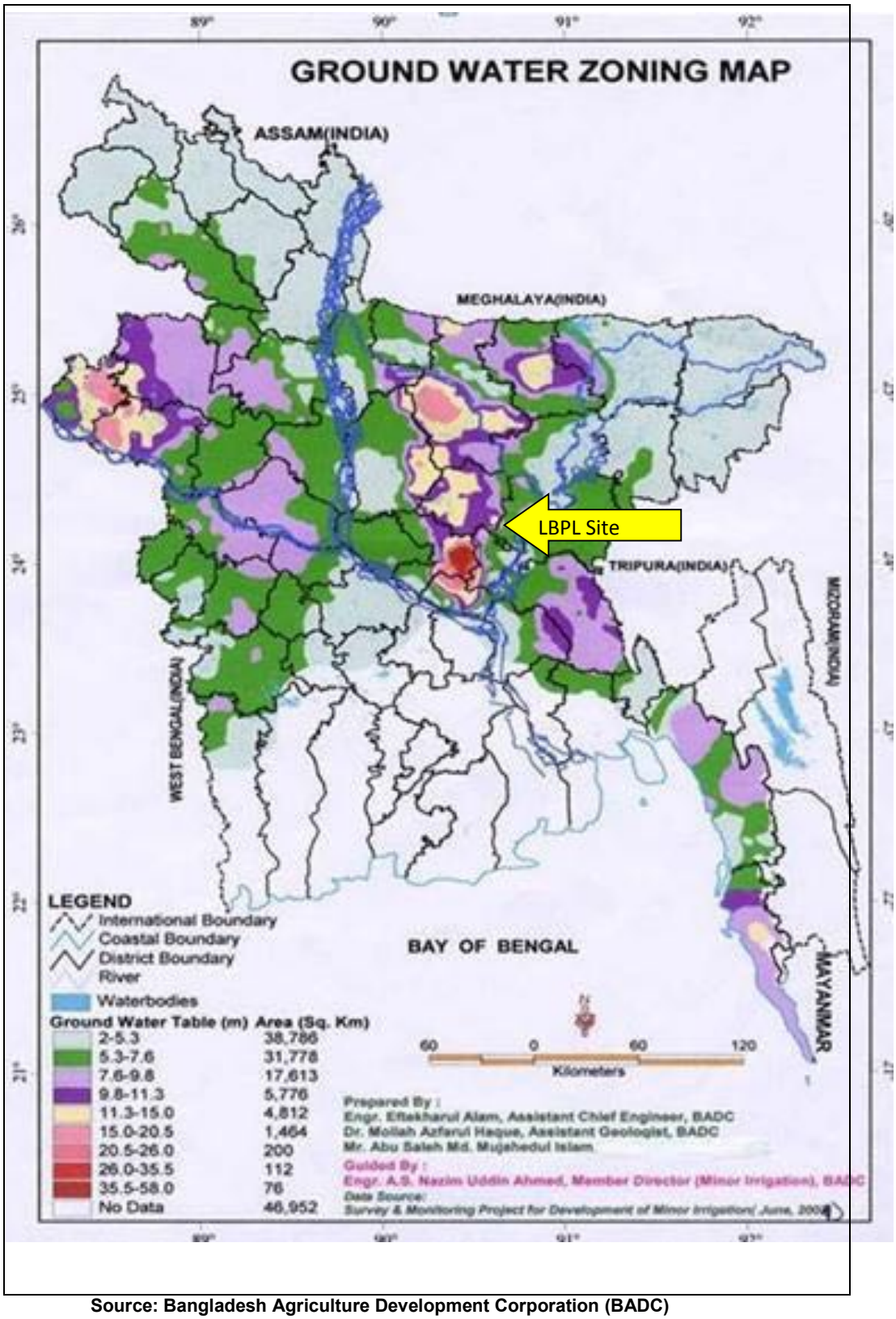






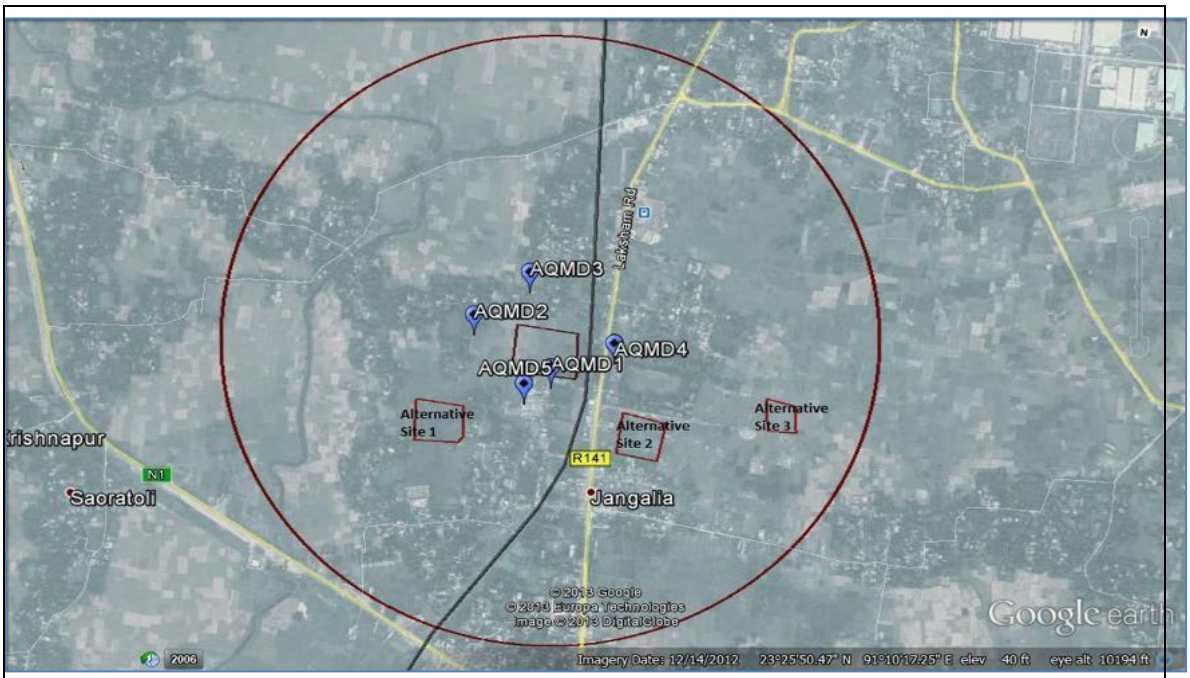


Annex 9: Ground Water Zoning Map of Bangladesh



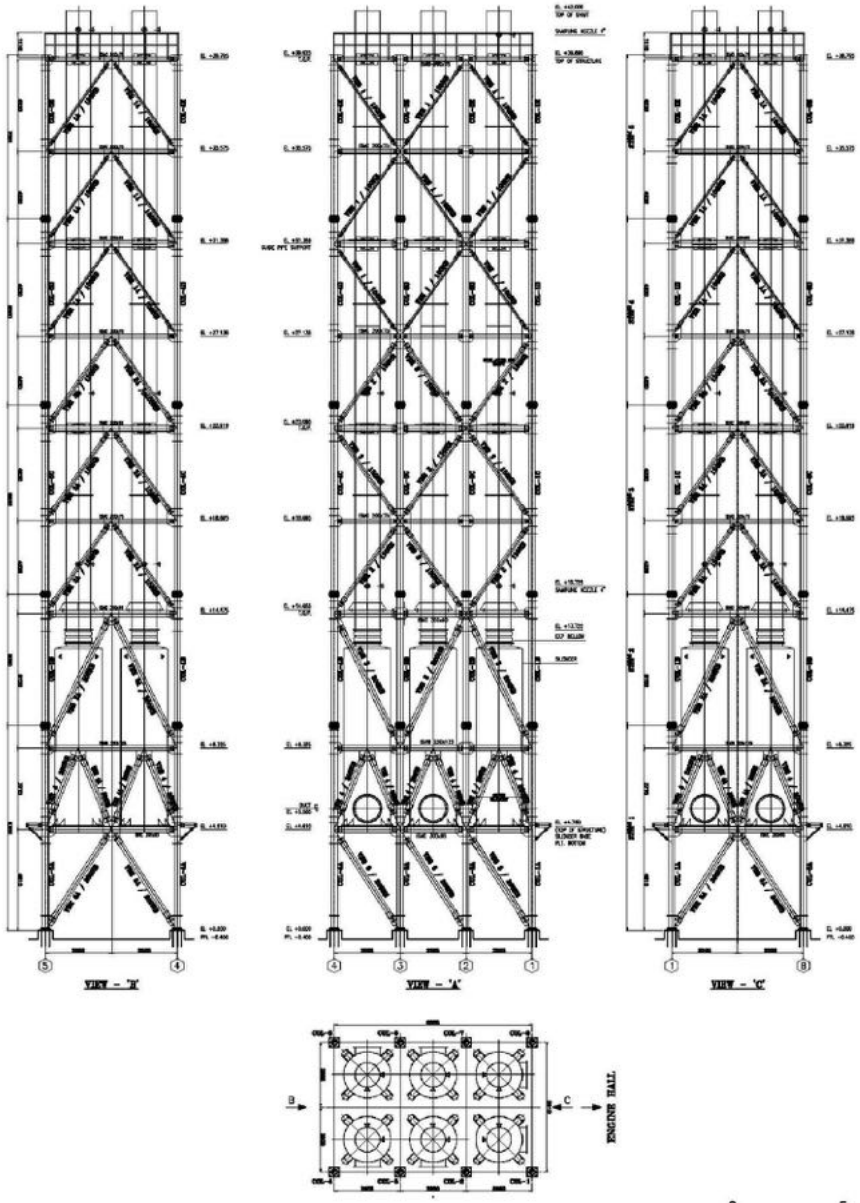
Source: Bangladesh Agriculture Development Corporation (BADC)

Annex 10: Air quality monitoring stations with 5 km radious airshed



Source: BCAS (overlay on Google base map)

Annex 11: Assembly of stack and column support structure



Annex 12: Female participants in FGD

Sl.No.	Name	Age	Sex	Occupation	Cell phone 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	Mrs. Jahanara	39	Female	Housewife	01921087841
6	Mrs. Mamataz	23	Female	Job	01558680452
7	Mrs. Lili Begum	20	Female	Housewife	01917285232
8	Mrs. Amina Begum	26	Female	Housewife	01819591391
9	Mrs. Salma Begum	39	Female	Housewife	01732648011

Annex 13: Male participants in FGD

Sl.No.	Name	Age	Sex	Occupation	Cell phone 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

Annex 14: Participants in large consultation

Sl. No.	Name	Age	Occupation	Cell phone no.
1	Mr. Shamim	25	Agriculture	01911305860
2	Mr. Al Amin Hasan	30	,,	01711444411
3	Mr. Jahangir Alam	35	,,	01834801842
4	Mr. Shah Poran	36	Business	01960969280
5	Mr. Robin	41	Business	01916116828
6	Mr. Abdul Mannan	36	Business	01711146699
7	Me. Ziaur Rahman	43	Business	01681599214
8	Mr. Mehedi Hasan	42	Business	01960990105
9	Mr. Md. Jakariya	45	Business	01981121807
10	Mr. Mehedi Hasan	33	Business	01760691834
11	Mr. Abul Bashar	55	Business	01717960856
12	Mr. Mahabubur Rahman	44	Business	01711337645
13	Mr. Md. Forhad	27	Business	01710803820
14	Mr. Md. Osman Goni	42	Service	01713248374
15	Mr. Md. Sohel	41	,,	01713248359
16	Ms. Rahima Begum	27	House Wife	x
17	Ms. Hosn Ara	22	,,	x
18	Mr. Abdul Karim	33	…	x
19	Ms. Nurjahan Begum	33	House Wife	x
20	Ms. Shafia Begum	32	,,	x
21	Ms. Hoshne Ara	20	,,	x
22	Ms. Rajia Khatun	22	,,	x
23	Ms. Moni Begum	25	Service	x
24	Ms. Nasima Begum	35	House Wife	x
25	Ms. Shahin Sultana	36	House Wife	01720454358
26	Mr. Iftekhar Ahmed	38	Agriculture	x
27	Mr. Tanjir	27	Service	x
28	Mr. Shihab	25	Business	x
29	Mr. Mojibul Haque	25	,,	x

Sl. No.	Name	Age	Occupation	Cell phone no.
30	Mr. Shohidul Islam	30	,,	01923701290
31	Mr. Mofijul Islam	35	Agriculture	01829049535
32	Ms. Shelina	35	Agriculture	x
33	Ms. Ayesha	40	,,	x
34	Ms. Tania	25	Service	x
35	Ms. Jui	26	,,	x
36	Mr. Robin Uddin	22	,,	x
37	Mr. Munna	35	,,	x
38	Mr. Johor Ali	35	Agriculture	01835302757
39	Mr. Delowar Hossain	36	,,	01811662023
40	Mr. Momtaz Uddin	39	,,	01715906016
41	Mr. Sarafot Ali	35	,,	x
42	Mr. Shirajul Islam	41	,,	01845957121
43	Mr. Tofazzal	45	,,	x
44	Mr. Ruhul Amin	45	,,	01712202615
45	Mr. Foyej Ahmed	46	Service	01715217387
46	Mr. Mofijul Islam	32	Business	01966481648
47	Mr. Saiful Islam	36	,,	01711300139
48	Mr. Shah Alam	35	,,	01711143298
49	Mr. Johirul Islam	39	Unemployed	01711383784
50	Mr. Nirmol Gosh	40	,,	01711948091
51	Mr. Wahab Ali	42	,,	x
52	Mr. Raju	27	Business	01837367211
53	Abdul Malek Ansary	52	Ward Counselor	01711322669
54	Mr. Saiful Amin	42	Social worker	x
55	Mr. Mafijul Islam	35	Political leader	x
56	Mr. Abdul Kader Bulu	55	Business	x
57	Mr. Rezaul Karim	52	Business	x
58	Mr. Nesar Alam	37	Business	x
59	Mr. Mahbubur Rahman	41	Business	x
60	Mr. Kabir Hossain	45	Business	x

Sl. No.	Name	Age	Occupation	Cell phone no.
61	Mr. Shah Alam	34	Business	01711143298
62	Mr. Zahirul Islam	55	Business	01711383784
63	Mr. Nurul Islam	42	Journalist	01713248301
64	Mr. Md. Abul Hossain	42	NGO representative	01812053427