Annexures to the Environmental and Social Impact Assessment Report of Reliance Meghnaghat 750 MW Combined Cycle Power Plant

Project Number: 50253-001
October 2017

BAN: Reliance Bangladesh LNG and Power Limited

Prepared by Adroit Environment Consultants Ltd, Bangladesh

Annexure: 1.1

Land Allotment letter by BPDB

RELIANCE

Reliance Power Limited
CIN: L40101MH1995PLC084687

Reliance Centre, Near Prabhat Colony, Off Western Express Highway, Santacruz (East) Mumbai - 400055, India

Tel: +91 22 3303 1000
Fax: +91 22 3303 3662
www.reliancepower.co.in

Ref. No.: RPL/BD/BDT/2017-18/042

24th August, 2017

Delivered by hand/ email

Secretary,

Bangladesh Power Development Board,

WAPDA Building (1st Floor),

Motijheel C/A, Dhaka 1000, Bangladesh

Subject: **Acceptance of Letter of Intent (LOI) dated 26th July, 2017, for development of Gas/ Re-gasified LNG (RLNG) fired Combined Cycle Power Generation Facility of 718 MW (net) Capacity at Meghnaghat, Narayanganj, Bangladesh on Build-Own-Operate (BOO) basis under Private Sector Power Generation Policy of Bangladesh**

References: **1. LOI from BPDB vide Memo no. 27.11.0000.101.14.076.17-2147 dated 26th July, 2017**

2. Letter from Reliance Power with Ref. No. RPL/BD/BDT/2017-18/033 dated 27th July, 2017 in response to the LOI issued by BPDB

3. Letter from Reliance Power with Ref. No. RPL/BD/BDT/2017-18/038 dated 9th August, 2017 requesting for extension in date for issuance of the Proposal Security

4. Memo no. 27.11.0000.101.14.076.17-2375 dated 17th August, 2017

Dear Sir,

1. Further to the aforementioned references, Reliance Power conveys its acceptance of the LOI issued by BPDB vide Memo no. 27.11.0000.101.14.076.17-2147 dated 26th July, 2017 subject to the modifications accepted by BPDB vide Memo no. 27.11.0000.101.14.076.17-2375 dated 17th August, 2017.
2. We also attach herewith the requisite Proposal Security of US$ 7.18 million issued from State Bank of India, Bangladesh.

3. We would like to notify you that we have submitted the initialed copy of the Gas Supply Agreement (GSA) to Titas Gas Transmission & Distribution Company Ltd. (Titas) vide letter Ref. No. RPL/BD/BDT/2017-18/038 dated 10th August, 2017 and requested Titas to share the initialed version with BPDB.
4. We look forward to your continued support for making this Project a grand success.

Thanking you.

Yours sincerely,

For, Reliance Power Limited,

Sameer Kumar Gupta

Senior Vice President and Business Head, Gas Projects

Copy to:

1. **Chairman**, Bangladesh Power Development Board
2. **Chairman**, Petrobangla, Petrocentre, Kawran Bazar, Dhaka
3. **Member,** Company Affairs, Bangladesh Power Development Board
4. **Managing Director,** Power Grid Company of Bangladesh
5. **Managing Director,** Titas Gas Transmission & Distribution Company Ltd.
6. **Managing Director,** Gas Transmission Company Ltd.
7. **Chief Engineer,** Private Generation, Bangladesh Power Development Board
8. **Director,** IPP Cell 1, Bangladesh Power Development Board

WAPDA Building (1st Floor)
Motijheel C/A, Dhaka-1000.

বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড

Bangladesh Power Development Board

Memo No-27.11.0000.101.14.076.17-2375 Date: 17.08.2017

Reliance Power Limited
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Mumbai-400055,India
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www. Reliancepower.co.in

Registered Office: H Block (1st Floor)
Dhirubhai Ambani Knowledge City
Navi Mumbai 400 710

Subject: Acceptance of Letter of Intent dated 26th July, 2017, for development of Gas/Re-gasified LNG (RLNG) fired Combined Cycle Power Generation Facility of 718 MW (net) Capacity at Meghnaghat, Narayanganj, Bangladesh on Build-Own-Operate (BOO) basis under Private Sector Power Generation Policy of Bangladesh.

Ref: (i) Reliance Power Limited, India's Memo No: RPL/BD/BDT/2017-18/038 Dated: 09/08/2017.
(ii) Reliance Power Limited, India's Memo No: RPL/BD/BDT/2017-18/033 Dated: 27/07/2017.
(iii)BPDB LOI's memo no. 27.11.0000.101.14.076.17-2147 Dated: 26-07-2017.

Dear Sir,

Please refer to the above-mentioned subject under references. BPDB has issued LOI, vide memo no. 27.11.0000.101.14.076.17-2147 Dated 26.07.2017. You have given your acceptance of the LOI with a request for some modifications. Regarding your request, BPDB's comments are as follows:

a) Land lease Agreement (LLA) (Clause C4 of the LOI): Due to scarcity of land in Meghnaghat power hub area, BPDB is not in a position to provide additional land for laydown of equipment and other activities during construction phase, as the available land will be used for installation of other power projects.

b) Performance Certificate (Clause C7 of the LOI): You may provide Performance Certificate from GE relating to the Gas Turbines, steam Turbines, and Performance Certificate from EPC contractor for all equipments for the project.

c) Temporary land for transmission Gantry (Clause C 11 of the LOI): The required land for Transmission Gantry will be provided to you on temporary basis with rent. The terms & conditions in relation to it will be finalized later on, which will be separate document apart from LLA.

d) Required Commercial Operations Date (Clause C13 of the LOI): Please follow the LOI.

e) Reference Date for inflation Indexation (Clause C16 of the LOI): The Reference Date may be considered from the date of issuance of LOI as per Project Agreements initialed earlier.

f) Proposal Security (Clause F of the LOI): You may submit Proposal Security within August 24, 2017.

You are therefore requested to take necessary steps for implementation of the Project. BPDB looks forward to working with you to make the Project a great success.

29/8/17

(Md Emrul Hossain)
Secretary (Additional Charge)
Bangladesh Power Development Board
Date: 17.08.2017

Md. Fazlul Hoque
Director
IPP CELL-1, BPDB, Dhaka

Memo No-27.11.0000.101.14. 076.17 – 2375

Copy to:

1. Member, Company Affairs, BPDB, Dhaka.
2. Managing Director, PGCB, IEB Bhaban, Ramna, Dhaka. Fax: 7171833.
3. Chief Engineer, Private Generation/Generation/P&D, BPDB, Dhaka.
4. Controller of Accounts & Finance, BPDB, Dhaka.
5. Director, IPP Cell-1/System planning/Finance/Contract and Consultant Administration, BPDB, Dhaka.
6. C S O to Chairman, BPDB, Dhaka.
7. P S to Secretary, Power Division/Energy Division, Ministry of Power, Energy & Mineral Resources, Bangladesh Secretariat, Dhaka.
8. P S to State Minister, Ministry of Power, Energy & Mineral Resources, Bangladesh Secretariat, Dhaka.

29/08/17

(Pranob Kumar Ghosh)
Assistant Secretary (Dev.)
Central Secretariat, BPDB, Dhaka.

Central Secretariat
Bangladesh Power Development Board
WAPDA Building (1st Floor)
Motijheel C/A, Dhaka-1000.

বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড

Bangladesh Power Development Board

Memo No-27.11.0000.101.14.076.17-2147 Date: 26-07-2017

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Subject: Letter of Intent (LOI) for the development of Gas/Regasified (R-LNG) fired Combined Cycle Power Generation Facility of 718 MW (Net) Capacity at Meghnaghat, Narayangonj, Bangladesh on Build-Own-Operate (BOO) basis under Private Sector Power Generation Policy of Bangladesh.

Ref: 27.00.0000.071.14.051.2017.315 Dated: 14/06/2017.

Dear Sir,

A. REFERENCE

This Letter of Intent, hereinafter referred to as the "LOI" is being issued to the addressee, pursuant to approval received from the Power Division, Ministry of Power, Energy and Mineral Resources (MPEMR), Bangladesh Secretariat, Dhaka vide memo referred above for the development of the project identified below (the "Project") under the special act, 2010 (Revised 2015) for enhancement of power & energy (বিদ্যুৎ ও জ্বালানীর দ্রুত সরবরাহ বৃদ্ধি (বিশেষ বিধান) আইন, ২০১০ (সংশোধিত ২০১৫)) on the terms described in this LOI.

B. AUTHORIZATION

The People's Republic of Bangladesh represented by the Power Division, Ministry of Power, Energy and Mineral Resources, hereinafter referred to as the "GOB" accords its approval on the following Levelized Tariff of Reliance Power Limited, India (the "Sponsor") to design, finance, insure, construct, own, Commission, operate and maintain (the "Project") a 718 MW(Net) (at Reference Site Conditions) Gas/ R-LNG based Combined Cycle Power Generating Facility at Meghnaghat, Narayanganj, hereinafter referred to as the **"Facility"**, as more fully described in the Proposal:

- Levelized Tariff (for R-LNG operation) = US cents 7.3123/kWh (at 84.6% plant factor, 12% discount factor, R-LNG price US dollar 7.2625/mmbtu and exchange rate 1 USD = 80 Taka)

The Facility will have a net electric power generating capacity of 718 MW. Net Dependable Capacity and Net Energy Output from the Facility will be sold under the Power Purchase Agreement, hereinafter referred to as the "PPA". The Company formed by the Sponsor shall be solely responsible for the financing, development and completion of the Project and development of the necessary related facilities in accordance with the requirements contained in the Proposal and the timetable and milestones contained in the Proposal, under the terms & conditions mentioned in this LOI.

C. PROJECT IN BRIEF:

1.	Contracted Capacity	:	718 MW
2.	Shareholding of the Company formed by the Sponsor	:	Reliance Power Limited, India. - 100%
3.	Location of the Project Site	:	Meghnaghat, Narayanganj.

4.	Land of the Project	:	BPDB will provide 35 acres of land available in Meghnaghat, Narayanganj Power Hub area to the Sponsor in "as is" condition. Additional land apart from the BPDB's land shall be arranged by the Sponsor at its own cost and responsibility. The Sponsor shall develop the land at its own cost and responsibility. BPDB shall not incur any liability for delay in developing the land by the Sponsor what so ever the reason.
5.	Fuel Type	:	Re-gasified LNG (from imported LNG) or indigenous Gas to be finalized by the competent authority of GOB
6.	Plant Type	:	Combined Cycle Power Project. (2+2+1 multi shaft configuration)
7.	Status of the Plant Equipment	:	Performance Certificate from Original Equipment Manufacturer (OEM) will be required regarding transportation of Gas Turbines, Steam Turbines, Heat Recovery Steam Generators, Generators, Transformers and all other major equipment from India to Bangladesh.
8.	Project Agreements to be signed for Implementation of the Project	:	Power Purchase Agreement (PPA), Land Lease Agreement (LLA), Implementation Agreement (IA) and Gas Supply Agreement (GSA)
9.	Gas Supply Facility	:	The Sponsor shall ensure necessary gas to its power plant under the GSA to be signed with Petrobangla or its Subsidiary; provided that, due to non-availability of the Facility for non-availability of Fuel, the Sponsor will not be paid any Capacity Payment during such non-availability.
10.	LNG Supply & FSRU Side	:	LNG Supply Agreement (for 500 mmscfd) — To be signed between Petrobangla / its subsidiary & the Sponsor Implementation Agreement (related to FSRU) — To be signed between Energy Division and the Sponsor
11.	Power Evacuation Facility	:	The evacuation voltage will be 400kV. The sponsor shall construct and own 400kV switchyard for evacuation of power with the provision for termination of two double circuit 400kV lines. The Sponsor shall install all equipments and construct Interconnection Line (overhead or underground, as applicable), including bay extension at its own cost and responsibility as per requirement of PGCB. The 400kV switchyard, line breaker, current transformer, potential transformer and associated relays, controls, protection, communication and instrumentation system will be operated and maintained by the Sponsor. The power communication line and the facilities at the remote end (PGCB substation) shall be constructed, owned and operated by PGCB. The Sponsor shall provide communication links to the SCADA control system for the Grid System including adequate Remote Terminal Unit (RTU) points to accommodate PGCB and the National Load Despatch Centre (NLDC) requirements.
12.	Project Effective Date	:	Means the date on which the last of Project Agreements is executed.
13.	Required Commercial Operations Date (RCOD)	:	36 months from the Project Effective Date in Combined Cycle Operation only, provided that, the Commercial Operations Date shall not occur prior to the RCOD.
14.	Contract Period	:	22 years
15.	Financial Closing Date	:	9 (nine) months from the Project Effective Date
16.	Reference Date in relation to the inflation/indexation for invoice payment under PPA	:	Means the Project Effective Date

D. FORMATION OF COMPANY

The Sponsor shall form a "Company" for the purpose of this Project, which will be a special purpose vehicle i.e. a public/private limited company incorporated in the Joint Stock Companies, Bangladesh promoted and sponsored by the Sponsor (in case of Joint Venture Consortium by all the Joint Venture Partners). The Project Agreements shall be executed by that "Company" which will be responsible for design, finance, insure, build, own, operate and maintain etc. of the Project. After the incorporation of the "Company", the rights and obligations of the Sponsor hereunder will be assigned to the "Company".

E. NO LIABILITY FOR REVIEW

No review, examination, evaluation or approval by BPDB of any document, instrument, drawing, specifications or design proposed or delivered by the Sponsor or the Company in connection with the delivering of its Proposal or BPDB's evaluation thereof or the issuance of this LOI shall relieve the Sponsor or the Company from any obligation or liability that it would otherwise have had for its negligence in the preparation of such document, instrument, drawing, specification or design or failure to comply with applicable laws of Bangladesh or to satisfy the Company's obligations under this LOI, the Project Agreements, or the other documents comprising the Security Package (as defined in the IA) with respect thereto, nor shall BPDB be liable to the Sponsor or the Company or any other person by reason of its review, examination, evaluation or approval of any document, instrument, drawing, specification, or design.

F. PROPOSAL AND PROPOSAL SECURITY

The Proposal submitted by the Sponsor will be initially valid for at least 6 (six) months from the date of issuance of this LOI. The Sponsor Shall be required to submit the Bank Guarantee as Proposal Security of the amount of USD 7.18 million only at the rate of USD 10,000.00 per MW for 718 MW along with the acceptance of this LOI. The Proposal Security shall have to be initially valid for at least 6 (six) months from the date of issuance of this LOI.

G. VALIDITY OF THE PROPOSAL AND THE PROPOSAL SECURITY

The validity of the Proposal and Proposal Security shall have to be extended upon request from BPDB for an additional period of three (3) Months or more until such time as the Project Agreements are executed.

H. GOVERNING LAW

This Letter of Intent shall be governed by and construed in accordance with the Laws of Bangladesh.

I. ACCEPTANCE OF LETTER OF INTENT (LOI)

You are requested to communicate your unconditional acceptance (not acknowledgement) of this LOI within 7(seven) days from the issuance of this LOI. If the Sponsor fails to submit the required amount of Proposal Security upon acceptance of LOI, BPDB shall have the right to terminate the LOI.

J. TERMINATION OF LOI

1. The Sponsor will provide its unconditional acceptance of LOI within seven (7) days and the initialed Project Agreements within 30 (thirty) days from the issuance of this LOI.

   If the Sponsor fails to furnish (i) the acceptance of LOI along with Proposal Security and (ii) initialed Project Agreements within stipulated time as mentioned above, BPDB shall reserve the right to terminate this LOI.

2. The Company formed by the Sponsor will sign (i) the Implementation Agreement ("IA") with the GOB, (ii) the Power Purchase Agreement ("PPA") & the Land Lease Agreement ("LLA") with BPDB and (iii) the Gas Supply Agreement ("GSA") with the concerned Gas Supplier (collectively, the "Project Agreements"), failure to which, BPDB shall reserve the right to terminate this LOI by written notification to the Sponsor & forfeit the Proposal Security.

3. The Sponsor shall be required to submit the Bank Guarantee as Proposal Security for the amount of USD 7.18 million (Seven point one eight million) at the rate of USD 10,000.00 per MW for 718 MW upon acceptance of LOI. This Proposal Security shall continue till the Project Effective Date of the Project. If the Company fails to sign the Project Agreements within 7 (seven) Days following the notification of BPDB; BPDB shall have the right to terminate the LOI as well as to forfeit the Proposal Security.

4. The Sponsor will provide the Performance Security Deposit for the amount of USD 25.848 million (Twenty Five point eight four eight million) only at the rate of USD 36,000.00 per MW for 718 MW (Contracted Capacity). Certificate of Incorporation (along with Memorandum and Articles of Association) for newly formed "Company" in Bangladesh no later than two (2) days prior to the date of signing of the Project Agreements, failure to which, BPDB shall reserve the right to terminate this LOI by written notification to the Sponsor as well as to forfeit the Proposal Security

5. The Sponsor shall extend the Proposal validity & the Proposal Security validity at least 7 (seven) days prior to the expiration of the Proposal validity and Proposal Security validity until such time as the project Agreements are executed, failure to which, BPDB shall have the right to forfeit the Proposal Security.

6. Upon termination of LOI, neither the Sponsor nor the Company shall have any claim for compensation or damages against BPDB or any other governmental agency on any grounds whatsoever.

Please note that, if the Company fails to execute the Gas Supply Agreement (GSA) with the concerned Gas Supplier, BPDB shall have no obligation to execute this LOI.

BPDB looks forward to working with you to make the Project a great success.

26/7/17

(Mina Masud Uzzaman)
Secretary
Bangladesh Power Development Board

Md. Fazlul Hoque
Director
IPP Cell-1, BPDB, Dhaka.

Memo No-27.11.0000.101.14.076.17-3327 Date: 26-07-2017

Copy to:

1. Chairman, Petrobangla, Petro Centre, Kawran Bazar, Dhaka.
2. Member, Finance/Company Affairs/Generation/Administration/P&D/Distribution, BPDB, Dhaka.
3. Managing Director, PGCB, IEB Bhaban, Ramna, Dhaka. Fax: 7171833.
4. Managing Director, Titas Gas Transmission & Distribution Company Ltd, Kawran Bazar, Dhaka
5. Managing Director, Gas Transmission Company Ltd (GTCL), Sher-e-Bangla Nagar, Dhaka
6. Chief Engineer, Private Generation/Generation/P&D, BPDB, Dhaka.
7. Controller of Accounts & Finance, BPDB, Dhaka.
8. Director, IPP Cell-1/System planning/Finance/Contract and Consultant Administration, BPDB, Dhaka.
9. C S O to Chairman, BPDB, Dhaka.
10. P S to Secretary, Power Division/Energy Division, Ministry of Power, Energy & Mineral Resources, Bangladesh Secretariat, Dhaka.
11. P S to State Minister, Ministry of Power, Energy & Mineral Resources, Bangladesh Secretariat, Dhaka.

(Pranob Kumar Ghosh)
Assistant Secretary (Dev.)
Central Secretariat, BPDB, Dhaka.

Secretariat
Bangladesh Power Development Board
WAPDA Building (1st Floor)
Motijheel C/A, Dhaka-1000.

বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড

Bangladesh Power Development Board

Memo No. -1482BPDB(Sectt.)/Dev.- 203/2011 Dated: 17-05-2016

Sameer Kumar Gupta
Vice President and Business Head, Gas Projects
Reliance Power Limited
Reliance Centre, 19, Walchand Hirachand Marg,
Ballard Estate, Mumbai, Maharashtra, India 400001 |
Fax: +91 22 3032 7699

Subject: **Request for consent for carrying out the site related studies for the proposed Phase I of 750 MW power plant at Meghnaghat.**

Reference: **Your letter: (i) RPL/BD/BDT/2016-17/001 dated: 06.04.2016**
(ii) RPL/BD/BDT/2016-17/006 dated: 03.05.2016

Dear Sir,

Please refer to the above mentioned subject under reference. In response to your proposal for setting up 750 MW LNG based CCPP at Meghnaghat, Narayanganj, Bangladesh; BPDB has agreed to allow your access in the BPDB's land at Meghnaghat site for conducting the followings:

- Topographic Survey
- Geotechnical Investigations
- Area Drainage Study & Determination of Safe Grade Elevation
- Construction Material Sourcing Study
- Site Specific Seismic Studies
- Construction Material Sourcing Study
- Water related studies
- Environmental studies
- Test piling
- Geotechnical studies

Please note that, BPDB shall have no obligation for conducting above mentioned studies and works.

By order,

17.5.16

(Mazharul Haque)
Secretary (addl. charge)
Bangladesh Power Development Board

Golam Kibria
Director
IPP CELL-1, BPDB, Dhaka.

Memo No. -1482BPDB(Sectt.)/Dev.- 203/2011 Dated: 17-05-2016

Copy for kind information:

1. Member, Company Affairs/Generation, BPDB, Dhaka.
2. Chief Engineer, Private Generation, BPDB, Dhaka.
3. Director, IPP Cell-1, BPDB, Dhaka.
4. Director, State and Transport, BPDB, Dhaka.
5. C.S.O to Chairman, BPDB, Dhaka.
6. PS to Secretary, Power Division, MPEMR, Dhaka.

(Pranob Kumar Ghosh)
Assistant Secretary (Dev.)
Central Secretariat, BPDB, Dhaka

Annexure: 3.1

Environment Conservation Rules

1.0 POLICIES

1.1 Industrial Policy 1991

The Industrial policy of 1991 contains the following clauses in respect of environmental protection

- To conserve ecological balance and prevent pollution during industrialization
- To take effective steps for pollution control and conservation of environment during industrialization.

To ensure embodying of necessary pollution control and preventive measures by industrial investment project endangering environment.

1.2 National Environmental Policy 1992

Bangladesh National Environmental Policy (*GoB, 1992*) was approved in May 1992, and sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. Key elements of the policy are:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment.
- Protection of the country against natural disasters.
- Identification the regulation of all types of activities which pollute and degrade the environment.
- Ensuring sustainable utilization of all natural resources.
- Active association with all environmentally-related international initiatives.

Environmental policy contains the following specific objectives with respect to the industrial sector:

- To adopt corrective measures in phases in industries that causes pollution.
- To conduct Environmental Impact Assessments for all new public & private industries.
- To ban the establishment of any industry that produces goods cause environmental pollution, closure of such existing industries in phases and discouragement of the use of such goods through the development and/or introduction of environmentally sound substitutes.
- To ensure sustainable use of raw materials in the industries to prevent their wastage.

1.3 National Conservation Strategy

National Conservation Strategy *(GoB/IUCN, 1992*) was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle; however the final approval of the document is yet to be made by the cabinet. It underwent a number of modifications over the last five years, and is waiting to be placed before the cabinet finally sometime in late September 1997. For sustainable development in industrial sector, the report offered various recommendations; some of those are as follows:

- Industries based on nonrenewable resources should be made to adopt technology which conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce wastage rate.

- All industries, especially those based on imported raw materials, should be subjected to ESIA and adoption of pollution prevention/control technologies should be enforced.

- No hazardous or toxic materials/wastes should be imported for use as raw material.

- Import of appropriate and environmentally sound technology should be ensured.

- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

1.4 National Environmental Management Action Plan (NEMAP), 1995

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

NEMAP has the broad objectives of:

- Identification of key environmental issues affecting Bangladesh;

- Identification of actions necessary to halt or reduce the rate of environmental degradation;

- Improvement of the natural and built environment;

- Conservation of habitats and biodiversity;

- Promotion of sustainable development;

- Improvement in the quality of life of the people.

One of the key elements of NEMAP is that sectoral environmental concerns are identified. In outline, the environmental issues of the industrial sector include the following:

- Pollution arising from various industrial processes and plants throughout the country causing varying degrees of degradation of the receiving environment (Air, Water, and Land).

- There is a general absence of pollution abatement in terms of waste minimization and treatment.

- Low level of environmental awareness amongst industrialists and entrepreneurs.

- Lack of technology, appropriate to efficient use of resources and waste minimization leading to unnecessary pollution loading in the environment.

- Economic constraints on pollution abatement and waste minimization such as the cost of new technology, the competitiveness of labor, and intensive production methods as compared to more modern methods.

- Concentration of industry and hence pollution in specific areas which exacerbate localized environmental degradation and exceed the carrying capacity of the receiving bodies.

- Unplanned industrial development has resulted in several industries located within or close to residential areas, which adversely affects human health and quality of human environment.

- Establishment of industries at the cost of good agricultural lands and in the residential areas.

- Lack of incentives to industrialists to incorporate emission/discharge treatment plant in their industries.

2.0 NATIONAL LEGISLATION

2.1 Environment Conservation Act 1995 (ECA 1995)

Formal concern at the national level, for the state of environment in Bangladesh can be traced back to at least Independence and passing of the Water Pollution Control Act in 1973. Under this a small unit was established in the Directorate of Public Health Engineering (DPHE) to monitor pollution of ground water and surface water.

In order to expand the scope of environmental management and to strengthen the powers for achieving it, the Government issued the Environmental Pollution Control Ordinance in 1977. The ordinance provided for the establishment of an

Environmental Pollution Control Board, which was charged with formulating policies and proposing measures for their implementation. In 1982, the board was renamed as Department of Environmental Pollution Control (DEPC). Four divisional offices were established in Dhaka, Chittagong, Khulna and Bogra. A special presidential order again renamed the DEPC to the Department of Environment (DOE) and placed under newly formed ministry of Environment and Forest (MoEF) in 1989.

The national environmental legislation known as **Environmental Conservation Act, 1995 (*ECA'95*)** is currently the main legislative document relating to environmental protection in Bangladesh, which repealed the earlier environment pollution control ordinance of 1997 and has been promulgated in 1995. The main objectives of ECA‟95 are:

- Conservation and improvement of environment, and
- Control and mitigation of pollution of environment.

The main strategies of the act can be summarized as:

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

2.2 Environment Conservation Rules, 1997 (Subsequent Amendments in 2002 and 2003)

A set of the relevant rules to implement the ECA‟ 95 has been promulgated (August 1997). The rules mainly consist of:

- The national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;

- Categorization of industries, development projects and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities.

- Procedure for obtaining environmental clearance;

- Requirement for undertaking IEE and ESIA as well as formulating EMP according to categories of industries/development projects/activities;

- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and therefore, they do not require an environmental clearance certificate from the DOE and no environmental study.

Orange: Industries/development projects/activities fall into two categories. Orange “A” is less polluted and Orange “B” is moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities along with their application to DOE for obtaining environmental site clearance and environmental clearance.

Red: Industries/development projects/activities are those which may cause „significant adverse‟ environmental impacts and are therefore required to submit an ESIA report. It should be noted that they might obtain an environmental site clearance on the basis of an IEE report, and subsequently submit an ESIA report for obtaining environmental clearance along with other necessary papers.

Environmental standards in operation in Bangladesh also Promulgated under the Environment Conservation Rules 1997. There are standards prescribed for varying water sources, ambient air, noise, odor, industrial effluent and emission discharges, vehicular emission etc.

The Bangladesh standards intend to impose restrictions on the volume and concentrations of wastewater/solid waste/gaseous emission etc. discharged into the environment. In addition a number of surrogate pollution parameters like Biochemical Oxygen Demand, or Chemical Oxygen Demand; Total Suspended Solids, etc. are specified in terms of concentration and/or total allowable quality discharged in case of waste water/solid waste. Additionally specific parameters depending on the manufacturing process are specified such as phenol, cyanide, copper, zinc, chromium etc. Air emission quality standards refer mostly to concentration of mass emission of various types of particulate, sulfur dioxide, and oxides of nitrogen and in some cases volatile organic compounds and other substances.

The Bangladesh standards in general are less stringent compared to the developed countries. This is in view to promote and encourage industrialization in the country. The Bangladesh standards are not for any specific period of time. There is no provision for partial compliance too.

The ambient standard of water quality, air quality and noise are presented in Table 1 to Table 5 in the following page. Standards refer to discharges to freshwater bodies with values in parentheses referring to direct discharges to agricultural land.

Table 1: Inland Surface Water Quality Standards for Waste from Industrial Units

Parameters	**Unit**	**Inland Surface WaterQuality Standards**
Temperature	Centigrade	40
Biological Oxygen Demand (BOD_5) at 20^0 C	mg/l	50
Chemical Oxygen Demand (COD)	mg/l	200
Dissolve Oxygen (DO)	mg/l	4.5-8
Total Dissolved Solids (TDS)	mg/l	2,100
p		6-9
Suspended Solid (SS)	mg/l	150
Nitrate	mg/l	10.0
Arsenic	mg/l	0.2
Lead	mg/l	0.1
Chloride	mg/l	600
Iron	mg/l	2
Manganese	mg/l	5
Copper	mg/l	0.5
Oil & Grease	mg/l	10

Source: ECR- Schedule 10

Table 2: Standards for Drinking Water

Parameters	**Unit**	**DoE (Bangladesh) Standard for drinking water**
pH		6.5-8.5
Hardness(as $CaCO_3$)	mg/L	200-500
Iron	mg/L	0.3-1.0
Chloride	mg/L	150-600
Arsenic	mg/L	0.05
Residual chlorine	mg/L	0.2
Total Coliform	n/mL	0
Fecal Coliform	n/mL	0
Ammonia	mg/L	0.5
Nitrate	mg/L	10

Parameters	Unit	DoE (Bangladesh) Standard for drinking water
Phosphate	mg/L	6

Source: ECR- Schedule 3

Table 3: Ambient Air Quality Standards

AIR POLLUTANT	STANDARDS	AVERAGE TIME
1	2	3
Carbon Monoxide (CO)	10 mg/m³ (9 ppm) (Ka)	8-hour
	40 mg/m³ (35 ppm) (Ka)	1-hour
Lead (Pb)	0.5 µg/m³	Annual
Oxides of Nitrogen (NO_x)	100 µg/m³ (0.053 ppm)	Annual
Suspended Particulate Matter (SPM)	200 µg/m³	8-hour
PM_{10}	50 µg/m³ (Kha)	Annual
	150 µg/m³ (Ga)	24-hour
$PM_{2.5}$	15 µg/m³	Annual
	65 µg/m³	24-hour
Ozone (O_3)	235 µg/m³ (0.12 ppm) (Gha)	1-hour
	157 µg/m³ (0.08 ppm)	8-hour
Sulfur di Oxide (SO_2)	80 µg/m³ (0.03 ppm)	Annual
	365 µg/m³ (0.14 ppm) (Ka)	24-hour

Source: ECR- Schedule 2 (Amended in 2005)

Abbreviation: ppm: Parts Per Million
Notes:
(Ka) Not to be exceeded more than once per year
(Kha) Annual average value will be less than or equal to 50 microgram/cubic meter
(Ga) Average value of 24 hours will be less or equal to 150 microgram/cubic meter for one day each year.
(Gha) Maximum average value for every one hour each year will be equal or less than 0.12 ppm.

At national level, sensitive areas include national monuments, health resorts, hospitals, archaeological sites and educational establishments.

Table 4: Standards for Gaseous Emission from Industries

Parameters for power plant (<200 MW)	Standard present
Oxides of Nitrogen	40 ppm

Source: ECR- Schedule 11

Table 5: Ambient Noise Standards

Areas	Day Time dBa	Night Time dBa
Silence Zone: Zone A	50	40
Residential Area: Zone B	55	45
Mixed Activity Area: Zone C	60	50
Commercial Area: Zone D	70	60
Industrial Area	75	70

Source: ECR- Schedule 1 (Amendment in 2006)

The second column of limits values refer to day time (06.00 to 21:00) and the third column to night time (21.00 to 06.00). A silence zone is defined as an area within 100m, around hospitals or educational institutions.

2.3 Labor Management Acts

2.3.1 The Factories Act, 1965 and the Factories Rules 1979

This act is generally applicable to any `factory". `Factory" means any premises including the precincts thereof whereon 10 or more workers are working or were working on any day of the preceding twelve months and in any part of which a manufacturing process is being carried on with or without the aid of power, but does not include a mine.

This act defines worker as "a person employed in any manufacturing process or in cleaning any part of the machinery or premises used for a manufacturing process, or in any other kind of work incidental to or connected with, the manufacturing process, but does not include any person solely employed in clerical capacity in any room or place where no manufacturing process is carried on".

Manufacturing process as defined by the act stands for any process for –

A. Making, altering, repairing, ornamenting, painting and washing, finishing, or packing, or otherwise treating any articles or substances with a view to its use, sale, transport, delivery, display or disposal. Or
B. Pumping oil, gas, water, sewerage or other fluids or slurries. Or
C. Generating, transforming or transmitting power or gas. Or
D. Constructing, reconstructing, repairing, refitting, finishing or breaking up of ships or vessels. Or
E. Printing by letter press, lithography, photogravure or other similar work or book-binding which is carried on by way of trade or for purposes for gain or incidental to another business so carried on.

This act prescribes the requirements of safety and health to be maintained, and covers:

a) Maintenance of standards of cleanliness.

b) Adequate lighting, ventilation & temperature.

c) Control of elements hazardous to health like dusts, gases, fumes, etc. associated with particular operations.

d) Requirement of certificate of fitness for young persons from certifying surgeons.

e) Requirement of periodical medical examination for persons engaged in hazardous operations.

f) Requirement for making available adequate first-aid facilities.

g) Requirement of a dispensary manned by a medical practitioner for units employing 500 or more workers.

h) Length of working hours & night work for young persons and women, and prohibition of employment for operating dangerous machines

i) Prohibition of employment of women and children near cotton openers

j) Requirement of precaution against fire and explosions.

k) Requirement of fencing and guarding of machinery, casing of new machinery

l) Requirement for work on or near machinery in motion, striking gear and devices for cutting off power, self-acting machine

m) Requirement for cranes and other lifting machinery, hoist and lift, revolving machinery, pressure plant

n) Requirement of safety measures for buildings.

o) Requirement of precautions against dangerous fumes.

p) Maximum weight to be lifted carried or moved by adult men, women and young persons.

q) Requirement for floors, stairs and means of access; pits, sumps, opening in floors, etc.

r) Requirement for protection of eyes

s) Requirement for explosive or inflammable dust, gas, etc.

t) Reporting of accidents and occupational diseases.

u) Sanitary conveniences- requirement of latrine, urinals, spittoons, drinking water

v) Requirement of canteen, eating place, washing facilities, rest room, child room

w) Requirement for appointment of welfare officer for units employing 500 or more workers.

Responsible authorities-

Department of Inspection for Factories and Establishment under the administrative control of the Ministry of Labor and Manpower is responsible for enforcement of the legislation. It is the responsibility of the employer to provide facilities to employees as asked for by the law and it is the obligation of the workers to abide by the provisions of the Act.

2.3.2 Workmen's compensation Act, 1923, and rules thereunder

This act has been last amended in 1987 and applies to factories, docks, construction work, railways, transport workers, excavation, gas and electricity workers, etc.

It holds liable an employer to pay compensation for death and injury or disablement caused by accident arising out of and in the course of employment. And it considers contraction of occupational diseases peculiar to the nature of the work done as an injury like accident.

The act provides –

- A list of injuries that is considered to result in permanent partial disablement.
- A list of persons considered as workmen.
- A list of occupational diseases, and includes a list of employments for the purpose of such diseases.
- Means of calculating compensation payable for disablement or death.

Responsible authorities-

Department of Inspection for Factories and Establishment is responsible for enforcement of the legislation.

The Chairman of the Labor courts is also the Commissioner of Workers‟ Compensation.

Comment-

The act covers a wide range of workers spells that the employer is not liable for compensation if workers remove or disregard any safety guard or devices provided for securing safety.

2.3.3 Bangladesh Explosive Act, 1884

Power to make rules as to licensing of the manufacture, possession, use, sale, transport and importation of explosives:

Rules under this section may provide for all or any of the following, among other matters, that is to say:-

(a) The authority by which licenses may be granted;

(b) The fees to be charged for licenses, and the other sums (if any) to be paid for expenses by applicants for licenses;
(c) The manner in which applications for licenses must be made, and the matters to be specified in such applications;
(d) The form in which, and the conditions on and subject to which, licenses must be granted;
(e) The period for which licenses are to remain in force; and
(f) The exemption absolutely or subject to conditions of any explosives from the operation of the rules.

Rules made under this section may impose penalties on all persons manufacturing, possessing, using, selling, transporting or importing explosives in breach of the rules, or otherwise contravening the rules:

(a) In the case of a person so manufacturing, using or importing an explosive, an imprisonment for a term which may extend to ten years and shall not be less than two years, and also a fine which may extend to fifty thousand Taka in default of which a further imprisonment for a term which may extend to one year,
(b) In the case of a person so selling or transporting an explosive, an imprisonment for a term which may extend to seven years and shall not be less than one year and also a fine which may extend to thirty thousand Taka in default of which a further imprisonment for a term which may extend to one year,
(c) In the case of a person so possessing an explosive, an imprisonment for a term which may extend to five years and shall not be less than six months, and also a fine which may extend to twenty thousand Taka in default of which a further imprisonment for a term which may extend to six months,

In any other case, an imprisonment for a term which may extend to two years and shall not be less than three months, and also a fine which may extend to ten thousand Taka in default of which a further imprisonment for a term which may extend to three month.

3.0 OTHER LEGISLATIONS

3.1 ENVIRONMENTAL REQUIREMENTS OF THE ASIAN DEVELOPMENT BANK (ADB)

The ADB Safeguard Policy Statement 2009 sets out the requirements for ADB's operations to undertake an environmental assessment for projects funded by the bank. The environmental assessment requirements for projects depend on the significance of impacts on the environment by the project. Each proposed project is scrutinized as to its type; location; the sensitivity, scale, nature, and magnitude of its potential environmental impacts; and availability of cost-effective mitigation measures.

A project is classified as one of the environmental categories (A, B, C, or FI).

Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An ESIA 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 IEE is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

Categorization based on the Most Environmentally Sensitive Component.

Categorization is to be based on the most environmentally sensitive component. This means that if one part of the project is with potential for significant adverse environmental impacts, then project is to be classified as Category A regardless of the potential environmental impact of other aspects of the project. Of course only those aspects of the project with potential for significant adverse environmental impacts need to be assessed in detail. The scoping for the ESIA and the TOR for the ESIA report should focus on the significant environmental issues.

Basic Environmental Assessment Requirements

Category A. ESIA is required to examine the project‟s potential impacts, and to recommend an environmentally sound project by comparing all possible alternatives. Public consultation must be undertaken at least twice during the ESIA process, once during the early stage of the ESIA field studies and after the draft ESIA report has been prepared. The ESIA should recommend mitigation measures for minimizing the adverse impacts and identify environmental monitoring requirements. The mitigation measures and proposed monitoring are to be incorporated into the EMP. An ESIA report must be prepared following the recommended format in Appendix 2. The SESIA shall be circulated to the Board at least 120 days prior the Board consideration. The ESIA and SESIA are to be made available for public (and published it on ADB‟s web-site). The Borrower should translate the SESIA into the local language.

Category B. An IEE is required for Category B projects to determine whether or not significant environmental impacts warranting an ESIA are likely. If an ESIA is not needed, the IEE is regarded as the final environmental assessment report. Public consultation must be undertaken during the IEE process**.** An IEE report is required to follow the recommended format. For Category B projects deemed environmentally sensitive, the SIEE should be submitted to the Board at least 120 days prior to the

Board consideration. In addition to the SIEE, IEE will be made available to Board members upon request. The Bank may make the SIEE available to locally affected groups and NGOs, upon request, through the Board Member of the DMC concerned, or through the Bank‟s Depository Library program, except where confidentiality rules would be violated.

Category C. No ESIA or IEE is required but environmental implications of the project still need to be reviewed and mitigation measures if any should be directly integrated into the project design.

Category FI. Environmental Assessment of the financial intermediation and equity investments is required. A due diligence assessment of the financial intermediary and its environmental management system (EMS) is required, except in the where the subproject involves only small loans with insignificant impacts. In the cases where there will be on lending through credit lines, an environmental assessment and review procedures for subprojects are required. The environmental assessment and review procedures are similar to that for sector loans and the requirements for public involvement, information disclosure, and in some cases, clearances by ADB apply.

A comparison between ADB and DOE requirements are given in the Table below:

Table 6: A comparison between ADB and DOE requirements

ADB		DOE	
Category	Requirements	**Category**	Requirements
Category A	- ESIA to examine potential impacts - Public consultation (atleast twice during ESIA process) - Recommendation of mitigation measures and proposed monitoring in EMP	**Green**	- No Environmental clearance is needed as project is pollution free - No environmental study is required
Category B	- IEE is required to assess possible impact - Public consultation to be incorporated in IEE - IEE report to be written in recommended format	**Orange A**	- General information - Process flow diagram - ETP facilities.
Category C	- No EIA and IEE is required - Environmental implication of the project is required to be reviewed - Mitigation measures (if any) to be incorporated	**Orange B**	- General information - Process flow diagram - ETP facilities.
Category FI	- Environmental Assessment of the financial intermediation and equity investments is	**Red**	- IEE report to be submitted followed by the ESIA report - General information

	required. - A due diligence assessment of the financial intermediary and its environmental management system (EMS) is required.		- Process flow diagram - ETP facilities.

3.2 ENVIRONMENTAL AND SOCIAL GUIDELINES OF THE INTERNATIONAL FINANCE CORPORATIONIFC/WB GROUP

As a member of the World Bank Group, the International Finance Corporation (IFC) has the environmental and social guidelines for projects funded by it following those of the World Bank. The World Bank procedures for EA study cover policies, guidelines and good practices. Such guidelines therefore follow the national best practices in undertaking any development project in Bangladesh. The environment safeguards policies applicable to the proposed project are the following:

• *Environmental Assessment (EA) (OP 4.01/BP/GP 4.01)*: An Environmental Assessment is conducted to ensure that IFC-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. Any IFC-funded project that is likely to have potential adverse environmental risks and impacts in its area of influence requires an EA indicating the potential risks, mitigation measures and environmental management framework or plan.

• *Natural Habitats (OP/BP 4.04)***:** Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and native species. The Natural habitats policy is triggered by any project (including any subproject under a sector investment or financial intermediary loan) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction)or indirectly (through human activities induced by the project). The policy has separate requirements for critical (either legally or proposed to be protected or high ecological value) and non-critical natural habitats. World Bank‟s interpretation of “significant conversion or degradation” is on a case-by-case basis for each project, based on the information obtained through the EA.

• *Forestry (OP/GP 4.36)*: This policy is triggered by forest sector activities and World Bank sponsored other interventions, which have the potential to impact significantly upon forested areas. The World Bank does not finance commercial logging operations but aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty and encourage economic development.

• *Cultural Property (OPN 4.11)*: Physical cultural resources are defined as movable or
immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The Bank seeks to assist countries to manage their physical cultural resources and to avoid or mitigate adverse impact of development projects on these resources. This policy is triggered for any project that requires an EA.

• *Policy on Disclosure of Information, 2002*: There are disclosure requirements at every part of the project preparation and implementation process. Consultation with affected groups and local community should take place during scoping and before Terms of references (ToRs) are prepared; when the draft EA is prepared; and throughout project implementations necessary. The Borrower makes the draft EA and any separate EA report available in country in a local language and at a public place accessible to project-affected groups and local community prior to appraisal. Besides, IFC has set out 8 (eight) performance standards in respect of various parameters pertaining to a proposed project. These eight performance standards of IFC with their corresponding parameters as under:

• Performance Standard 1: Social and Environmental Assessment and Management System
• Performance Standard 2: Labour and Working Conditions
• Performance Standard 3: Pollution Prevention and Abatement
• Performance Standard 4: Community Health, Safety and Security
• Performance Standard 5: Land Acquisition and Involuntary Resettlement
• Performance Standard6: Biodiversity Conservation and Sustainable Natural Resource Management
• Performance Standard 7: Indigenous Peoples
• Performance Standard 8: Cultural Heritage.

Of the above eight performance standards set by IFC, the Performance Standard 1 envisages establishing the importance of: (i) integrated assessment to identify the social and environmental impacts, risks and opportunities; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client‟s management of social and environmental impacts throughout the life of the project. The rest seven of the performance standards, i.e., Performance Standards 2 through 8 seek to ascertain establishing requirements to avoid, reduce, mitigate or compensate the impacts on people and the environment, and to improve conditions where appropriate.

Table 7: WHO Ambient Air Quality Guidelines

	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM_{10}	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 8: Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

Table 9: Emission Guidelines for Combustion Turbines (in mg/Nm^3)

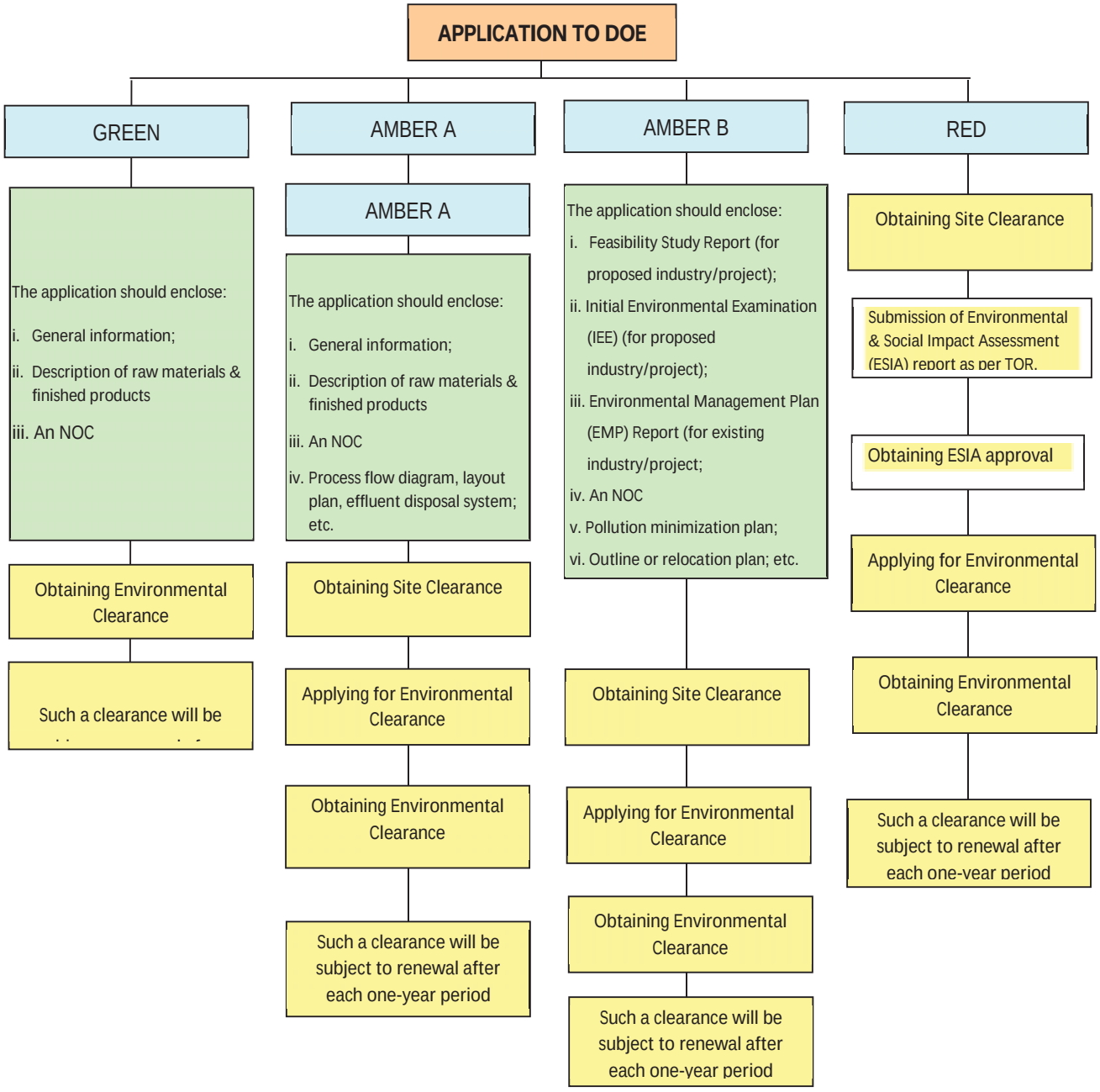
Combustion Technology / Fuel	Particulate Matter (PM)		Sulfur Dioxide (SO_2)		Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
Combustion Turbine			NDA/DA		NDA/DA	
Natural Gas (all turbine types of Unit > 50MWth)	N/A	N/A	N/A	N/A	51 (25 ppm)	15%
Fuels other than Natural Gas (Unit > > 50MWth)	50	30	Use of 1% or less S fuel	Use of 0.5% or less S fuel	152 (74 ppm)[a]	15%

4.0 ENVIRONMENTAL CLEARANCE

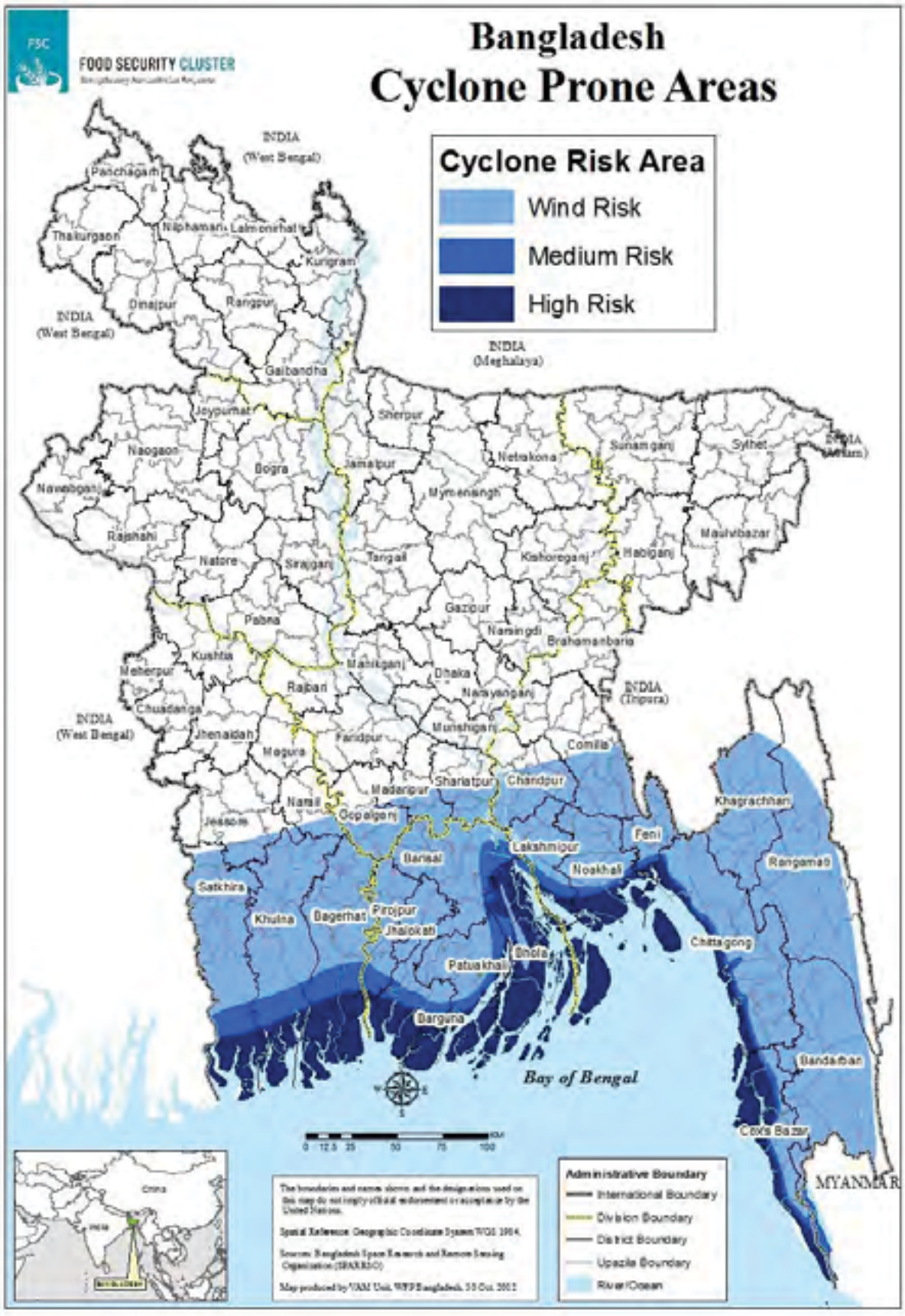
Formal ESIA guidelines in Bangladesh are set out in “Rules and Regulations under the 1995 Environmental Protection Acts” as published in the official Gazette on August 27,

1997. Any proponent planning an industrial project is currently required under Paragraph 12 of the Environmental Protection Acts, 1995 to obtain “environmental clearance letter:” from the Department of Environment.

The first to obtain environmental clearance is for the project proponent to complete & submit an application form which may be obtained from the appropriate DoE regional offices as per the category. The application is accompanied by other supporting documents (i.e. project profile, lay-out plan, NOC from local authority, Govt fees etc.) reviewed by the divisional and district offices of DOE who has the authority to request supporting documents as applicable. The divisional office has the power to take decision on Green and Amber-A & B category projects and the Red category projects are forwarded to head office for approval. The proposed projects receive an environmental site clearance at the beginning and the environmental clearance subject to the implementation of the project activities and all mitigation measures suggested in the IEE report or in the application. In case of Red category, the client needs to submit an IEE report for site clearance and ESIA to obtain ESIA approval and environmental clearance.


APPLICATION TO DOE
GREEN
AMBER A
AMBER B
RED
The application should enclose:
i. General information;
ii. Description of raw materials & finished products
iii. An NOC
Obtaining Environmental Clearance
Such a clearance will be
AMBER A
The application should enclose:
i. General information;
ii. Description of raw materials & finished products
iii. An NOC
iv. Process flow diagram, layout plan, effluent disposal system; etc.
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period
The application should enclose:
i. Feasibility Study Report (for proposed industry/project);
ii. Initial Environmental Examination (IEE) (for proposed industry/project);
iii. Environmental Management Plan (EMP) Report (for existing industry/project;
iv. An NOC
v. Pollution minimization plan;
vi. Outline or relocation plan; etc.
Obtaining Site Clearance
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period
Obtaining Site Clearance
Submission of Environmental & Social Impact Assessment (ESIA) report as per TOR.
Obtaining ESIA approval
Applying for Environmental Clearance
Obtaining Environmental Clearance
Such a clearance will be subject to renewal after each one-year period

Annexure: 3.2
Cyclone Prone Area Map


FSC
FOOD SECURITY CLUSTER
Bangladesh
Cyclone Prone Areas
Cyclone Risk Area
Wind Risk
Medium Risk
High Risk
INDIA
(West Bengal)
INDIA
(Meghalaya)
INDIA
(Tripura)
INDIA
(Assam)
MYANMAR
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Sherpur
Naogaon
Bogra
Jamalpur
Netrakona
Sunamganj
Sylhet
Nawabganj
Mymensingh
Rajshahi
Maulvibazar
Natore
Sirajganj
Tangail
Kishoreganj
Habiganj
Gazipur
Pabna
Narsingdi
Brahmanbaria
Kushtia
Manikganj
Meherpur
Dhaka
Rajbari
Narayanganj
Chuadanga
Munshiganj
Jhenaidah
Faridpur
Comilla
Magura
Shariatpur
Chandpur
Madaripur
Khagrachhari
Narail
Gopalganj
Jessore
Feni
Lakshmipur
Barisal
Rangamati
Noakhali
Satkhira
Khulna
Bagerhat
Pirojpur
Jhalokati
Chittagong
Bhola
Patuakhali
Barguna
Bandarban
Bay of Bengal
Cox's Bazar
Administrative Boundary
International Boundary
Division Boundary
District Boundary
Upazila Boundary
River/Ocean

Annexure: 4.1
Ambient Air Quality

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Monguler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')
SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')
SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')
SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')
SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')
SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 4th September, 2016 to 7th September, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
01	4-5/09/16	SL1	21	41	87	6	7	128
	4-5/09/16	SL2	19.9	27.8	37.0	5.4	6.2	137
	5-6/09/16	SL3	13.4	29.3	41.7	4.3	5.8	132
	5-6/09/16	SL4	7.8	18.8	31.8	3.6	5.1	131
	6-7/09/16	SL5	13.8	16.0	23.8	3.7	6.7	148
	6-7/09/16	SL6	8.9	17.0	25.6	2.1	3.7	143
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Note: This monitoring report was usually accomplished by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) an Fine Particulate Sampler (Model-Envirotech India APM-55

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

2/11/16
Nigar Sultana
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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 7th September, 2016 to 19th September, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
02	7-8/09/16	SL1	10.8	22.5	35.6	4.6	5.5	135
	7-8/09/16	SL2	17.7	33.0	36.3	4.3	4.2	134
	17-18/09/16	SL3	10.6	16.2	23.1	2.0	3.1	139
	17-18/09/16	SL4	12.5	58.4	76.5	4.8	5.0	147
	18-19/09/16	SL5	10.3	14.5	23.9	2.1	3.4	130
	18-19/09/16	SL6	13.4	20.2	31.2	3.3	3.9	120
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Note: This monitoring report was usually accomplished by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 19th September, 2016 to 22nd September, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
02	19-20/09/16	SL1	12.1	33.8	52.7	4.8	6.5	112
	19-20/09/16	SL2	18.5	41.9	62.7	4.8	5.1	129
	20-21/09/16	SL3	21.4	70.1	123.3	7.2	9.0	185
	20-21/09/16	SL4	11.8	38.1	48.6	5.5	6.6	149
	21-22/09/16	SL5	11.6	18.3	28.7	4.2	4.7	156
	21-22/09/16	SL6	10.3	33.8	44.7	2.7	3.2	127
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Note: This monitoring report was usually accomplished by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

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AECL LABORATORY ANALYSIS REPORT
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Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 23rd September, 2016 to 26th September, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
03	23-24/09/16	SL1	5.5	21.7	32.6	4.7	5.3	123
	23-24/09/16	SL2	6.4	15.7	24.4	2.6	3.4	164
	24-25/09/16	SL3	5.1	18.3	52.0	4.6	6.0	139
	24-25/09/16	SL4	10.4	18.5	25.9	3.3	4.3	181
	25-26/09/16	SL5	7.7	16.0	21.0	3.0	3.7	175
	25-26/09/16	SL6	8.7	16.8	25.4	3.4	4.6	184
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
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AECL LABORATORY ANALYSIS REPORT
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Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1 -** Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

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SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 26th September, 2016 to 29th September, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
03	26-27/09/16	SL1	10.1	29.5	42.3	4.1	6.1	101
	26-27/09/16	SL2	16.7	35.9	47.8	4.6	5.7	147
	27-28/09/16	SL3	12.8	27.4	43.2	4.2	5.4	136
	27-28/09/16	SL4	10.8	37.8	59.6	5.2	6.3	161
	28-29/09/16	SL5	14.7	28.6	43.3	4.5	5.1	141
	28-29/09/16	SL6	17.4	31.8	45.8	3.8	3.8	117
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
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Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 29th September, 2016 to 2nd October, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
04	29-30/09/16	SL1	15.8	33.5	58.9	4.8	5.5	112
	29-30/09/16	SL2	13.2	41.7	65.9	3.7	5.5	129
	30/9/16-1/10/16	SL3	19.1	31.4	63.2	4.2	5.4	158
	30/9/16-1/10/16	SL4	11.2	33.5	48.2	5.3	6.1	151
	1-2/10/16	SL5	22.1	48.6	74.2	4.1	6.3	162
	1-2/10/16	SL6	15.3	24.1	49.9	3.8	4.2	122
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
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Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1 -** Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Bolddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 2nd October, 2016 to 5th October, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
04	2-3/10/16	SL1	13.9	31.7	54.8	4.8	5.9	124
	2-3/10/16	SL2	22.3	39.8	66.7	5.2	8.6	177
	3-4/10/16	SL3	11.7	24.8	40.4	4.5	4.1	129
	3-4/10/16	SL4	12.5	33.9	51.7	4.4	5.7	130
	4-5/10/16	SL5	17.9	25.5	46.2	3.9	5.2	145
	4-5/10/16	SL6	10.7	19.7	38.4	3.2	4.1	115
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
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5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

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Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 5th October, 2016 to 8th October, 2016.

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
05	5-6/10/16	SL1	13.4	22.8	48.6	4.2	5.6	121
	5-6/10/16	SL2	11.4	28.6	43.1	4.9	6.3	155
	6-7/10/16	SL3	19.7	37.5	57.7	5.7	6.4	189
	6-7/10/16	SL4	16.9	31.1	50.7	4.5	5.6	164
	7-8/10/16	SL5	12.7	24.7	38.9	4.1	4.6	132
	7-8/10/16	SL6	23.3	34.5	64.6	4.3	4.4	129
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

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Total Solution of Complete Environmental Management Solutions

~~AECL LABORATORY ANALYSIS REPORT~~

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 8th October, 2016 to 11th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
05	8-9/10/16	SL1	12.4	28.7	41.9	4.4	4.6	154
	8-9/10/16	SL2	11.2	23.8	42.5	4.4	5.1	132
	9-10/10/16	SL3	16.9	28.1	49.8	4.6	4.6	127
	9-10/10/16	SL4	9.5	18.4	32.1	3.4	4.1	122
	10-11/10/16	SL5	10.9	22.5	43.7	4.8	5.2	158
	10-11/10/16	SL6	16.1	24.5	46.8	3.9	5.7	137
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1 -** Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team)

Sampling date : 11th October, 2016 to 14th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
06	11-12/10/16	SL1	27.5	36.1	69.2	4.8	6.6	110
	11-12/10/16	SL2	17.4	34.2	51.2	3.4	4.3	135
	12-13/10/16	SL3	22.9	37.1	63.4	4.5	5.5	125
	12-13/10/16	SL4	11.7	25.6	69.3	4.1	4.3	146
	13-14/10/16	SL5	9.3	21.6	39.8	4.8	4.5	137
	13-14/10/16	SL6	16.4	24.7	44.8	4.2	4.8	144
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 14th October, 2016 to 17th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
06	14-15/10/16	SL1	14.8	27.1	46.9	4.2	5.2	115
	14-15/10/16	SL2	12.8	33.3	48.7	4.3	4.7	127
	15-16/10/16	SL3	9.6	17.8	33.5	3.9	5.1	131
	15-16/10/16	SL4	25.4	45.8	88.9	6.6	7.2	194
	16-17/10/16	SL5	8.7	16.8	32.5	3.3	3.8	111
	16-17/10/16	SL6	11.2	18.9	45.2	4.5	4.8	125
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1 -** Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 35' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 17th October, 2016 to 20th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
07	17-18/10/16	SL1	10.7	24.7	36.9	3.5	5.4	122
	17-18/10/16	SL2	17.5	28.4	49.9	4.1	5.4	144
	18-19/10/16	SL3	13.9	31.5	54.7	5.1	6.8	149
	18-19/10/16	SL4	19.8	31.2	55.7	4.9	4.5	131
	19-20/10/2016	SL5	11.2	22.1	40.5	4.0	5.6	137
	19-20/10/2016	SL6	12.4	32.9	54.1	4.1	4.4	120
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 20th October, 2016 to 23rd October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
07	20-21/10/16	SL1	15.8	50.6	87.9	7.9	9.7	134
	20-21/10/16	SL2	26.9	57.9	91.2	10.6	11.2	169
	21-22/10/16	SL3	22.4	57.4	85.1	6.0	7.9	163
	21-22/10/16	SL4	27.9	64.0	92.7	8.5	8.9	154
	22-23/10/2016	SL5	21.3	49.4	85.1	9.0	10.5	196
	22-23/10/2016	SL6	22.3	62.9	94.1	11.4	12.4	187
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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Description of sample : Ambient air quality analysis report at different location.

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 24th October, 2016 to 27th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
08	24-25/10/16	SL1	27.9	74.3	91.2	8.5	9.3	172
	24-25/10/16	SL2	31.2	87.9	104.7	9.1	9.5	152
	25-26/10/16	SL3	29.1	72.6	152.0	12.3	13.3	201
	25-26/10/16	SL4	33.5	82.1	188.8	10.1	12.2	223
	26-27/10/2016	SL5	22.9	51.4	111.6	5.2	8.9	197
	26-27/10/2016	SL6	12.7	41.8	101.4	9.0	9.8	134
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
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SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 27th October, 2016 to 30th October, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
08	27-28/10/16	SL1	33.5	102.0	171.1	6.2	8.0	179
	27-28/10/16	SL2	34.9	100.1	173.2	12.2	13.7	209
	28-29/10/16	SL3	30.3	78.5	119.7	10.0	11.2	189
	28-29/10/16	SL4	10.8	41.7	51.9	7.9	8.2	102
	29-30/10/2016	SL5	23.6	57.1	92.4	6.8	7.4	125
	29-30/10/2016	SL6	19.3	52.7	83.4	7.2	7.4	147
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

19.12.16
Nigar Sultana
Sr. Chemist

19.12.16
Syed Hosnee Jahab
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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : SL1 - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 31st October, 2016 to 3rd November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
09	31/10/16-01/11/16	SL1	38.9	101.9	119.6	13.1	15.7	167
	31/10/16-01/11/16	SL2	33.2	105.3	245.4	9.4	12.6	221
	01-02/11/16	SL3	24.2	94.5	238.4	9.2	11.7	161
	01-02/11/16	SL4	22.3	92.5	226	8.6	11.9	185
	02-03/11/2016	SL5	29.8	61.3	118.4	7.1	8.9	202
	02-03/11/2016	SL6	12.3	52.6	104.8	7.2	9.4	197
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

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5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO)*

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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 579

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : SL1 - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team)

Sampling date : 3rd November, 2016 to 6th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
09	03-04/11/16	SL1	14.2	43.8	90.7	5.9	8.9	106
	03-04/11/16	SL2	12.4	42.9	120.8	6.7	8.0	161
	04-05/11/2016	SL3	25.7	94.0	158.2	8.6	10.3	188
	04-05/11/2016	SL4	39.04	104.6	196.9	9.5	11.8	203
	05-06/11/16	SL5	29.06	73.8	99.7	4.1	6.5	141
	05-06/11/16	SL6	35.7	88.2	129.0	5.2	8.3	170
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 7th November, 2016 to 10th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air ($\mu g/m^3$)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
10	07-08/11/2016	SL1	29.8	117	133.7	1.8	3.1	153
	07-08/11/2016	SL2	32.3	122.9	157.5	5.8	7.3	162
	08-09/11/16	SL3	39.7	139.0	184.1	9.0	9.9	151
	08-09/11/16	SL4	35.3	112.4	179.9	7.8	8.1	147
	09-10/11/16	SL5	67.9	126	147.0	3.9	4.8	151
	09-10/11/16	SL6	75.3	140	178.5	5.8	2.8	4.2
	Units		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
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8.12.16
Nigar Sultana
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AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 10th November, 2016 to 13th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
10	10-11/11/2016	SL1	41.0	133.0	201.6	6.3	7.4	169
	10-11/11/2016	SL2	29.2	119.1	127	8.58	9.29	159
	11-12/11/16	SL3	32.3	114	189	7.2	11.7	169
	11-12/11/16	SL4	45.6	146.8	193.7	7.8	8.2	185
	12-13/11/16	SL5	33.5	119	151.5	3.6	5.5	177
	12-13/11/16	SL6	34.5	83.2	129.4	5.8	6.4	141
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
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19.12.16
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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: : N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 14th November, 2016 to 17th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
11	14-15/11/16	SL1	26.4	101	137.0	5.1	6.0	193
	14-15/11/16	SL2	40.1	106.7	137.0	6.5	9.6	184
	15-16/11/16	SL3	45.1	85.8	157.2	5.0	6.3	179
	15-16/11/16	SL4	42.6	119.2	189.7	6.2	7.8	181
	16-17/11/2016	SL5	54.1	147	199.7	3.7	6.7	125
	16-17/11/2016	SL6	45.6	93.2	153.7	3.9	5.8	150
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
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AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

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SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 17th November, 2016 to 20th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
11	17-18/11/16	SL1	27.9	106	150.9	3.7	3.6	133
	17-18/11/16	SL2	30.1	115.9	198.7	5.2	7.1	176
	18-19/11/2016	SL3	33.7	95.7	164.9	6.0	7.4	197
	18-19/11/2016	SL4	28.4	124.7	185.1	6.6	7.4	188
	19-20/11/2016	SL5	54.1	147	199.7	3.7	6.7	174
	19-20/11/2016	SL6	35.5	110	146.2	3.2	5.1	169
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
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Sultana 13.12.16
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AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : Ambient air quality analysis report at the proposed project of Reliance Bangladesh LNG & Power Ltd 750 MW CCPP

Sample Location : Meghnaghat, Sonargaon, Narayanganj.

Description of sample : Ambient air quality analysis report at different location.

Sample Location Name : **SL1** - Pachani, Mongoler Gao, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 36' 29.81'' & E- 90° 34' 35.21'')

SL2 - Mogra para, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 38' 6.66'' & E- 90° 35' 18.01'')

SL3 – Boiddar Bazar, Sonargaon, Narayanganj (GPS Coordinate: N- 23° 39' 0.17'' & E- 90° 37' 28.23'')

SL4 – Jamaldi, Hosendi,Gojaria, Munshiganj (GPS Coordinate: N- 23° 35' 44.03'' & E- 90° 36' 54.72'')

SL5 - Gowal Gao, Gozaria, Munshigonj (GPS Coordinate: N- 23° 35' 22.07'' & E- 90° 34' 39.52'')

SL6 - Vati Bolaki, Hossendi, Gozaria, Munshigonj (GPS Coordinate: N- 23° 34' 21.64'' & E-90°35' 22.22'')

Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 21st November, 2016 to 24th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
12	21-22/11/2016	SL1	43.4	121	156.9	4.3	5.8	179
	21-22/11/2016	SL2	36.7	115.9	174.3	5.8	6.1	165
	22-23/11/2016	SL3	40.4	102.5	148.1	3.2	4.3	159
	22-23/11/2016	SL4	38.9	98.7	149.1	8.7	9.6	184
	23-24/11/2016	SL5	90.2	197	259.3	4.4	7.4	135
	23-24/11/2016	SL6	57.2	205	319.5	9.0	11.2	209
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. Respirable Dust Sampler (Model-Envirotech India APM-460BL) and
2. Fine Particulate Sampler (Model-Envirotech India APM-550)

1. *Fine Particulate Matter ($PM_{2.5}$).*
2. *Respirable Dust Content (PM10).*
3. *Suspended Particulate Matter (SPM).*
4. *Oxides of Nitrogen (NO_x).*
5. *Sulphur Di-Oxide (SO_2).*
6. *Carbone Mono-Oxide (CO).*

19.12.16
Nigar Sultana
Sr. Chemist

19.12.16
Syed Hosnee Jahab
Sr. Environmental Engineer(Lab)

for
Md. Zahedur Rahman
Chief Operating Officer.

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Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team)

Sampling date : 25th November, 2016 to 28th November, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
12	25-26/11/2016	SL1	46.1	148	210.6	4.1	6.2	177
	25-26/11/2016	SL2	39.8	98.2	154.1	6.2	6.3	114
	26-27/11/2016	SL3	41.7	105.5	158.7	3.6	4.1	145
	26-27/11/2016	SL4	49.8	129.7	195.1	4.1	7.9	155
	27-28/11/2016	SL5	66.2	85.7	168.1	5.0	6.9	127
	27-28/11/2016	SL6	48.9	124.4	249.1	7.5	8.9	199
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF – Not found

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Sample collector : Adroit Environment Consultants Ltd. (Monitoring Team).

Sampling date : 30th November, 2016 to 3rd December, 2016

Description of analysis:

Week	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
13	30/11/16-01/12/16	SL1	42.6	132	198.4	4.9	5.8	175
	30/11/16-01/12/16	SL2	41.2	106.9	184.2	5.8	6.5	126
	01-02/12/16	SL3	49.6	118.7	142.6	7.8	8.1	149
	01-02/12/16	SL4	31.7	119.4	175.8	4.8	5.4	151
	02-03/12/2016	SL5	58.4	125.8	169.3	5.4	5.6	159
	02-03/12/2016	SL6	51.7	155.4	203.2	7.1	8.2	206
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
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Annexure: 4.2

Ecology Flora

AQUATIC ECOLOGY STUDY FOR THE PROPOSED RELIANCE MEGHNAGHAT 750 MW LNG-BASED COMBINED CYCLE POWER PLANT PROJECT AT MEGHNAGHAT, NARAYANGANJ, BANGLADESH

[BASELINE SURVEY FOR DATA GENERATION ON ECOLOGY IN AND AROUND THE PROPOSED PROJECT AREA AT MEGHNAGHAT, SONARGAON, NARAYANGANJ]

PART-I: THE FLORA

Submitted by

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Professor
Department of Botany
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INTRODUCTION

Sustainable power supply is a major prerequisite for the socio-economic development of a nation. Bangladesh is a dense populated country in the world and at present about 53% of the total population of Bangladesh has access to electricity. In our country per capita electricity generation is only 272 KWh but reliable and quality supply of power is still a faraway. In this situation, to achieve the Millennium Development Goal (MDG) the country need to generate more power. Honorable Prime Minister Sheikh Hasina has reiterated her determination to reach electricity to every household of the country by 2021 calling upon the people to maintain austerity in using power and gas at their houses and workplaces to achieve the goal. The prime ministers said the electricity and gas are country's national resources which accelerate the country's economic activities. "So we will have to protect this valuable resources," she said, also urging all to maintain austerity in use of water. She said her government has been implementing a masterplan to generate 24,000 MW electricity by 2021; 40,000 MW by 2030 and 60,000 MW by 2041 under a long term plan.

Reliance Power has received in-principle approval from the Bangladesh government for the first phase of a 3,000 megawatt gas-based power plant, paving the way for the largest Foreign Direct Investment in the neighboring country. The project is part of a memorandum of understanding signed between Reliance Power and the BPDB. The MoU spoke of developing in phases a 3,000MW LNG-based combined cycle power project in Bangladesh at an estimated investment of about $3 billion (Nikkei Asian Review, 5 May 2016).

A combined cycle power plant is highly efficient as it uses both gas and steam turbines to produce electricity. The gas turbine produces electricity using natural gas, while the steam one generates additional power with the waste heat from the gas turbine.

A baseline ecological survey was conducted in and around the proposed Reliance Meghnaghat 750 MW CCPP area during December 2016. The specific objective of the baseline ecological survey was to collect existing floras of both aquatic and terrestrial ecosystems as well as to identify the plant species under threatened categories (i.e., Critically Endangered, Endangered and Vulnerable) as per Red Data Book.

Flora relates to all aquatic and terrestrial based plants. Plants are vital for ecosystem function and are used as resources for human food, shelter, clothing and other products. Developments often have the potential to impact flora. These potential impacts may be felt at several different levels including individuals, communities, populations, species, ecosystems or habitats.

Potential impacts to flora could include a reduction in diversity, change in species composition, and the destruction of individuals, species or communities or, changes to species population distributions or health. This section identifies the potential impacts to flora that may occur as a result of the Project.

Bangladesh Govt. always give emphasize to control human impact and interaction with the environment in order to preserve natural resources. It is a process that industries, companies, and individuals undertake to regulate and protect the health of the natural world. Thus in view of the above point a floral study was carried out at the proposed LNG based power plant site of Meghna river bank.

Description of the studied area:

The first phase, a 750 MW power plant, will be set up on 35 Acres of land at Meghnaghat (Sonargaon, Narayanganj district), around 40 km south east (GPS coordinate 23º36′25.56″N, 90º35′32.16″) of Dhaka, along with the FSRU (floating storage and re-gasification unit) terminal at Maheshkhali Island in Cox's Bazar district of Bangladesh. The water requirement will be 1076 m^3/hr and quantity of discharged water will be about 206 m^3/hr. Both procurement source and discharge site will be the Meghna river.

Methodology

The present baseline ecological survey was conducted during December 2016. The basic methodological approaches which were followed for the present baseline work are-

- Field survey,
- Site selection for sampling,
- Plant samples collection,
- Identification of plant samples,
- Data analysis and interpretation.

Field survey

A comprehensive field survey was conducted almost throughout the designated sites of the proposed power plant areas at Reliance Meghnaghat 750 MW CCPP area during December 2016.

Site selection for sampling

All types of ecological habitats like aquatic/wetland, cultivated land, fallow land, homestead area, road side, forest area and salt/shrimp culture area etc. of the designated sites/locations within 2 km radius of the project area were selected for sampling of both qualitative and quantitative data collection.

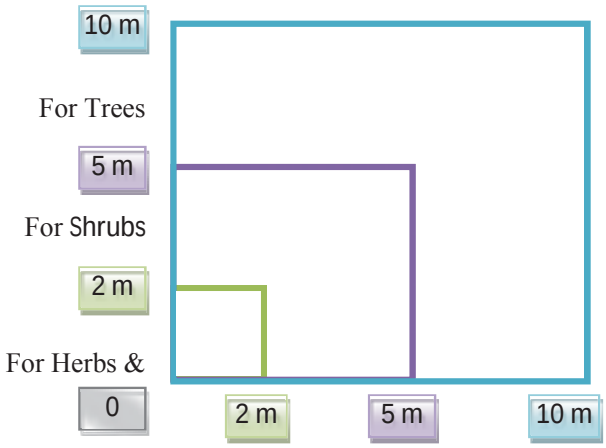


Figure 1. Quadrat size applied for quantitative analysis of different categories of plants.

Plant samples collection

Plant samples of different species, observed in the visited sites were collected following standard quadrat method (Braun-Blanquet, 1932; Raunkiaer, 1934). The quadrat size- 2m×2m for herbs and grasses, 5m×5m for shrubs and 10m×10m for trees were standardized on the basis of species-area-curve method (Cain, 1938).

Identification of plant samples

All the collected plant specimens found in the selected sites of Proposed Power Plant area was identified by taxonomic expertise and through cross-checking with herbarium specimens preserved at BNH/JUH and also matching the taxonomic description, keys or the photographs/illustrations in the relevant literatures, especially the recent Floras and Manuals of Hooker, 1872-1897; Prain, 1903; Khan, 1972-1987; Khan amd Halim, 1987; Siddiqui, 2007a, b; Ahmed, 2008a,b, c, d; 2009a,b etc.

In each selected sites/location, ten quadrats were randomly applied in diversified habitats. Collected plant samples were processing and preparation of herbarium sheets following standard herbarium techniques (Jain and Rao, 1977).

Data analysis and interpretation

Abundance and Frequency of the recorded species was determined by using formulae described as Shukla and Chandal (1993), and Verma and Agarwal (1986).

Abundance: No. of individuals per quadrat of occurrence.

$$A = \frac{\text{Total no. of individuals of a species in all the quadrats}}{\text{Total no. of quadrats in which the species occurred}}$$

Frequency: This is described as the % of quadrats occupied by a given species.

$$F\,(\%) = \frac{\text{Total no. of quadrats in which the species occurred}}{\text{Total no. of quadrats studied}} \times 100$$

According to the values of abundance as well as frequency, the recorded plant species were recognized and categorized as their existing status following DAFOR scale (described as Shukla and Chandal, 1993; and Kent and Coker, 1992).

The categorization of threatened plant species in this project has followed the IUCN Red List categories, where the species are classified in nine groups based on the criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation. Each of these groups has been defined according to the followings:

1. **Extinct** (EX): No individuals remaining.
2. **Extinct in the Wild** (EW): Known only to survive in captivity, or as a naturalized population outside its historic range.
3. **Critically Endangered** (CR): Extremely high risk of extinction in the wild.
4. **Endangered** (EN): Very high risk of extinction in the wild.
5. **Vulnerable** (VU): High risk of extinction in the wild.
6. **Near Threatened** (NT): Likely to become endangered in the near future.

7. **Least Concern** (LC): Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
8. **Data Deficient** (DD): Not enough data to make an assessment of its risk of extinction.
9. **Not Evaluated** (NE): Has not yet been evaluated against the criteria.

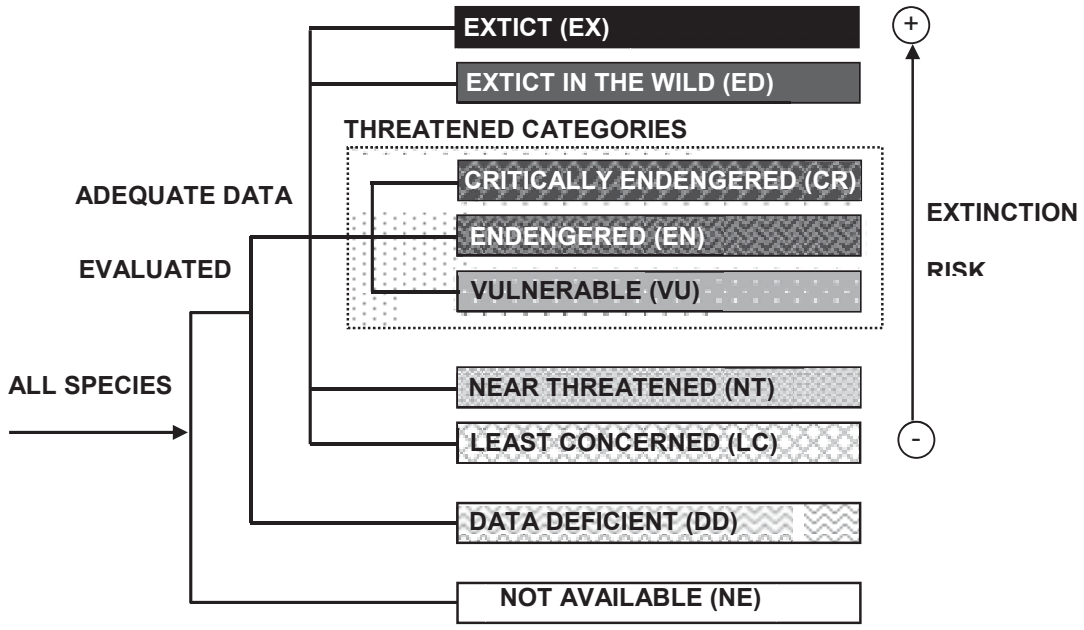


Figure 2. Correlation of IUCN Red List categories based on the extent of extinction risk.

Observations

A total of 192 vascular plant species belonging to 161genera under 78 families have been recorded from the proposed LNG-based power plant area (Table 1 and Figure 3) where the maximum 153 (80%) plant species belonged to the dicotyledonous group, followed by 32 (17%) and 7 (3%) plant species belonged to the monocotyledonous and pteridophytes (ferns) groups, respectively (Figure 4).

Among the habit categories, the highest number of species 105 (54.69%) were herbs, followed by 42 (21.88%), 16 (8.33%) and 15 (7.81%) species were trees, shrubs and climbers, respectively whereas the lowest number of plant species 11 (5.73%) were recorded as creeper (Figure 5).

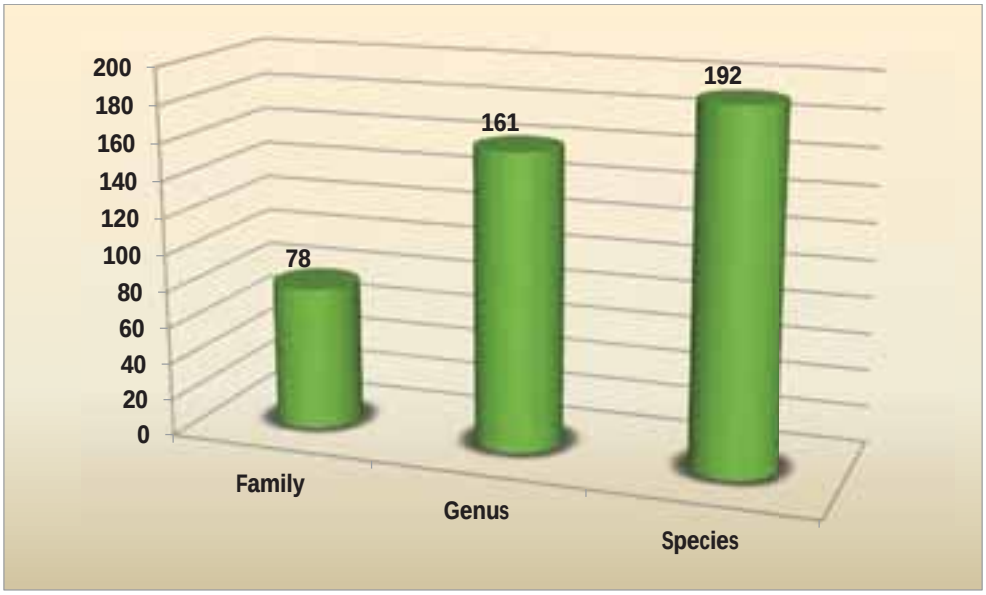


Figure 3. Species composition of the in the proposed LNG-based power plant area area.

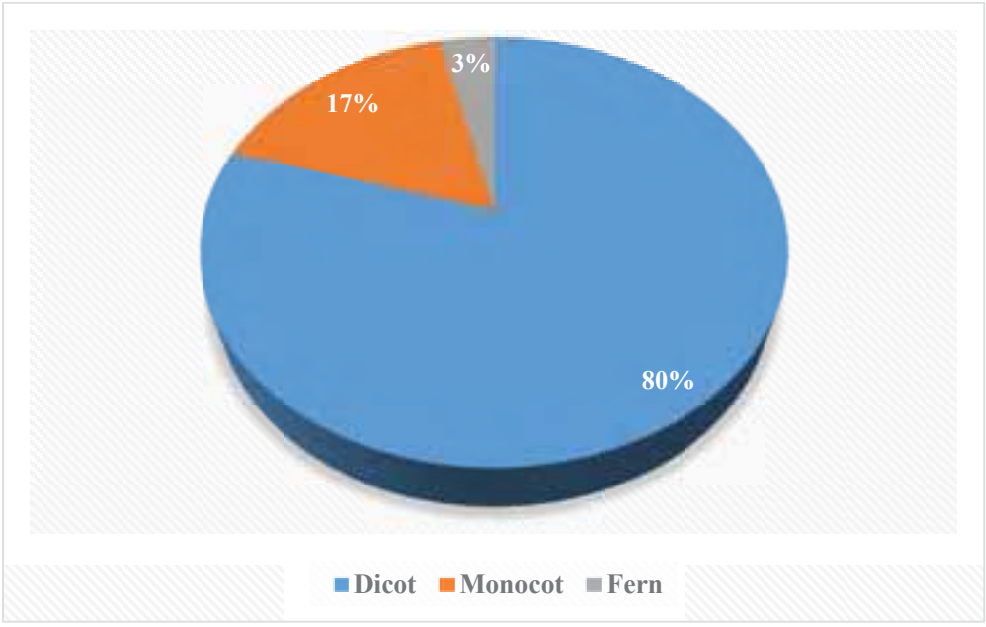


Figure 4. Cotyledonary status of the recorded plant species in the proposed LNG-based power plant area area.

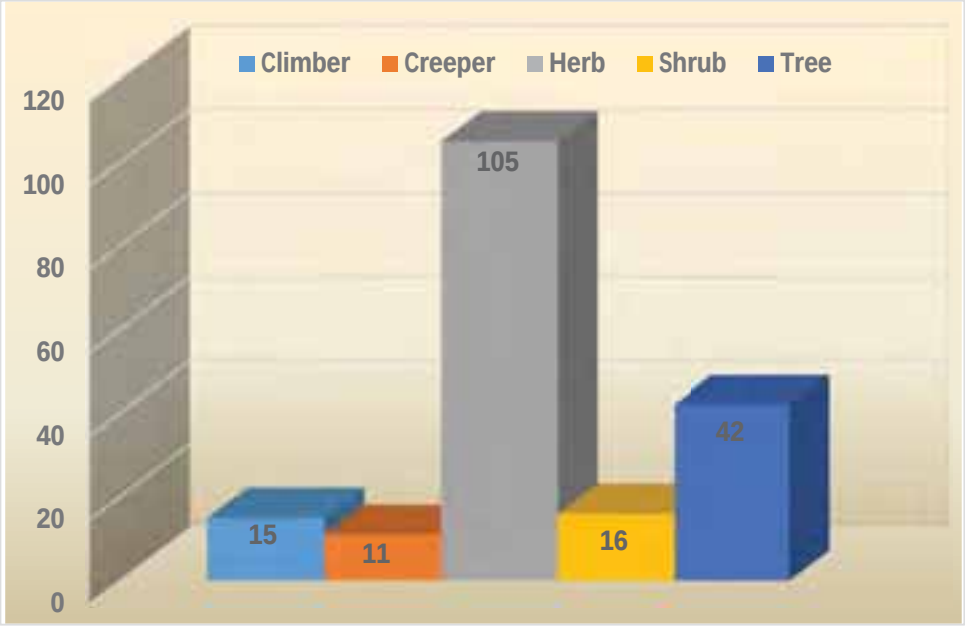


Figure 5. Habit categories of the recorded plant species of the present LNG-based power power plant sites.

From the present study, out of 192 recoeded plant species, terrestrial habitats represent 153 (79.69%) species whereas the aquatic /or wetland habitats harbored 39 (20.31%) species in the present power plant project sites (Figure 6).

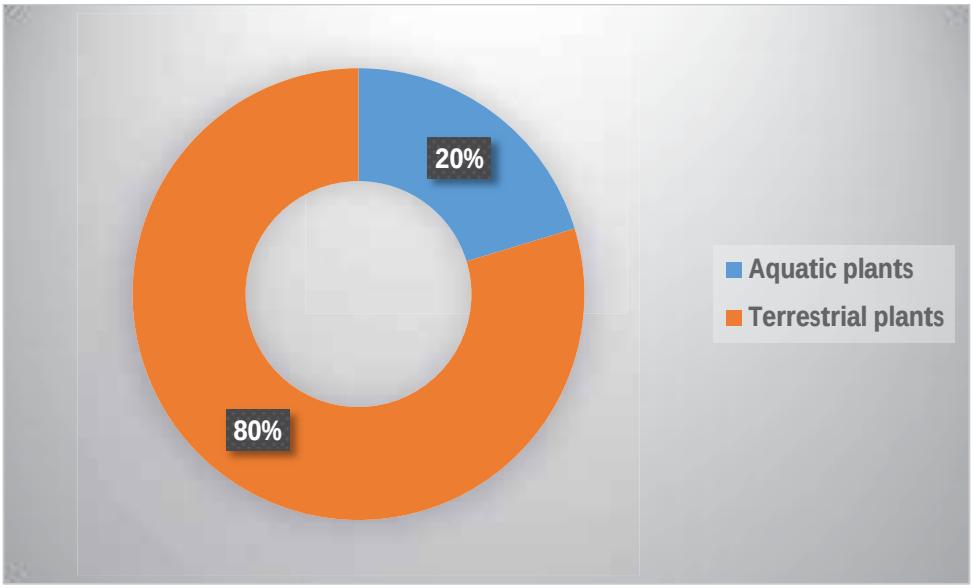


Figure 6. Habitat categories of the recorded plant species of the present power plant sites.

Table 1. Comprehensive checklist of the identified plant recorded from the selected sites of the proposed power plant project area at Meghnaghat, Bangladesh during December 2016.

A. Aquatic/wetland flora					
Sl.no.	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
1.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Baghjama	Herb	Dicot
2.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Henchi	Creeper	Dicot
3.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	Jalkachu	Herb	Monocot
4.	*Azolla pinnata*	Azollaceae	Azola	Herb	Fern
5.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Hijal	Tree	Dicot
6.	*Colocasia esculenta* (L.) Schott	Araceae	Kachu	Herb	Mocot
7.	*Crateva magna* (Lour.) DC.	Capparaceae	Borun	Tree	Dicot
8.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Gangkochu	Herb	Monocot
9.	*Cyperus rotundus* L.	Cyperaceae	Muthaghas	Herb	Monocot
10.	*Cyperus* sp	Cyperaceae	Bhadighas	Herb	Monocot
11.	*Eichhornia crassipes* (Mart.) Solms	Pontedariaceae	Kachuripana	Herb	Mocot
12.	*Enhydra fluctuans* Lour.	Asteraceae	Helencha	Creeper	Dicot
13.	*Ficus heterophylla* L. f.	Moraceae	Latadumur	Climber	Dicot
14.	*Floscopia* sp.	Commelinaceae	Kanshira	Herb	Monocot
15.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Makhna	Herb	Dicot
16.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Jalghas	Creeper	Monocot
17.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kolmi shak	Creeper	Dicot
18.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Dholkalmi	Herb	Dicot
19.	*Leersia hexandra* Sw.	Poaceae	Aralighas	Herb	Mocot
20.	*Lemna perpusilla* Torrey	Lemnaceae	Khudipana	Herb	Mocot
21.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Limnophila	Herb	Dicot
22.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Keshordom	Creeper	Dicot
23.	*Ludwigia hyssopifolia* (G. Don) Exell apud A. & R. Fernandas	Onagraceae	Bonmorich	Herb	Dicot
24.	*Marsilea minuta* L.	Masileaceae	Susni sak	Creeper	Fern
25.	*Najas minor* L.	Najadaceae	Najas	Herb	Dicot
26.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Chandmala	Herb	Dicot
27.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Bishkathali	Herb	Dicot
28.	*Persicaria barbata* (L.) Hara	Polygonaceae	Bishkathali	Herb	Dicot
29.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
30.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
31.	*Pistia stratiotes* L.	Araceae	Topapana	Herb	Mocot
32.	*Polygonum plebeium* R. Br.	Polygonaceae	Bishkathali	Herb	Dicot
33.	*Rotala indica* (Willd.) Koehne	Lythraceae	Deshi ghurni	Herb	Dicot
34.	*Salvinia cucullata*	Salviniaceae	Indurkanipana	Herb	Fern
35.	*Salvinia molesta*	Salviniaceae	Boropatapana	Herb	Fern
36.	*Salvinia natans*	Salviniaceae	Basanpatapana	Herb	Fern
37.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Chechri	Herb	Mocot
38.	*Trewia nudiflora* L.	Euphorbiaceae	Petali	Tree	Dicot
39.	*Vallisneria spiralis* L.	Hydrocharitaceae	Patajahangi	Herb	Mocot

Table continued….

B. Terrestrial flora					
Sl no	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
40.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Akashmoni	Tree	Dicot
41.	*Aegle marmelos* (L.) Corr.	Rutaceae	Bel	Tree	Dicot
42.	*Ageratum conyzoides* L.	Asteraceae	Phulkuri	Herb	Dicot
43.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Kkoroi	Tree	Dicot
44.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Kalokoroi	Tree	Dicot
45.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Silkoroi	Tree	Dicot
46.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Chhoto chanchi	Creeper	Dicot
47.	*Amaranthus gangeticus* L.	Amaranthaceae	Notey shak	Herb	Dicot
48.	*Amaranthus spinosus* L.	Amarantaceae	Katanotey	Tree	Dicot
49.	*Amaranthus tricolor* L.	Amaranthaceae	Lalshak	Herb	Dicot
50.	*Amaranthus viridis* L.	Amaranthaceae	Notey	Herb	Dicot
51.	*Ammannia baccifera* L.	Lythraceae	Acidpata	Herb	Dicot
52.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Dekia	Herb	Fern
53.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Bontulshi	Herb	Dicot
54.	*Annona reticulate* L.	Annonaceae	Ata, Nona Ata	Tree	Dicot
55.	*Annona squamosa* L.	Annonaceae	Shorifa	Shrub	Dicot
56.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Pitraj	Tree	Dicot
57.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Chapalish	Tree	Dicot
58.	*Artocarpus heterophyllus* Lamk.	Moraceae	Kathal	Tree	Dicot
59.	*Arundo donax* L.	Poaceae	Gangabena	Tree	Mocot
60.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Kukshim	Climber	Dicot
61.	*Averrhoa carambola* L.	Oxalidaceae	Kamranga	Tree	Dicot
62.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Chapraghas	Herb	Mocot
63.	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Tree	Dicot
64.	*Brassica nigra* (L.) Koch	Brassicaceae	Shorisha	Herb	Dicot
65.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Arhor	Shrub	Dicot
66.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Akond	Shrub	Dicot
67.	*Cardiospermum halicacabum* L.	Sapindaceae	Phutkilata	Climber	Dicot
68.	*Carica papaya* L.	Caricaceae	Papaya	Herb	Dicot
69.	*Centella asiatica* (L.) Urban	Apiaceae	Thankuni	Creeper	Dicot
70.	*Chenopodium album* L.	Chenopodiaceae	Botua shak	Herb	Dicot
71.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	German lata	Herb	Dicot
72.	*Chloris barbata* Sw.	Poaceae	Ghash	Herb	Monocot
73.	*Christella dentate*	Thelypteridaceae	Dekia	Herb	Fern
74.	*Cissampelos pareira* L. var. hirsuta (Buch.-Ham. *ex* DC.) Forman	Menispermaceae	Lotagach	Climber	Dicot
75.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Jambura	Tree	Dicot
76.	*Cleome rutidosperma* DC.	Capparaceae	Hurhurey	Herb	Dicot
77.	*Cleome viscosa* L.	Capparaceae	Holudhurhurey	Herb	Dicot
78.	*Clerodendrum viscosum* Vent.	Verbenaceae	Vat	Shrub	Dicot
79.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Telakucha	Herb	Dicot
80.	*Cocos nucifera* L.	Arecaceae	Narical	Tree	Mocot
81.	*Commelina benghalensis* L.	Commelinaceae	Kanchira	Herb	Mocot
82.	*Commelina longifolia* Lamk.	Commelinaceae	Kanai, Kanchira	Herb	Mocot
83.	*Corchorus olitorius* L.	Tiliaceae	Bonpat/Titpat	Herb	Dicot
84.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Babuni	Herb	Dicot
85.	*Crotalaria pallida* Ait.	Fabaceae	Jhonjhoni	Herb	Dicot
86.	*Croton bonplandianus* Baill.	Euphorbiaceae	Banmarich	Herb	Dicot
87.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Mistikumra	Climber	Dicot
88.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	Chhoto Apang	Herb	Dicot
89.	*Cynodon dactylon* (L.) Pers.	Poaceae	Durba	Herb	Mocot
90.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Sharnalata	Climber	Dicot

Table continued….

91.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	unknown	Herb	Dicot
92.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Ghash	Herb	Monocot
93.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Sharpil bhuipata	Herb	Dicot
94.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Bonmotosuti	Herb	Dicot
95.	*Desmodium triflorum* (L.) DC.	Fabaceae	Tripatri shak	Herb	Dicot
96.	*Dillenia indica* L.	Dilleniaceae	Chalta	Tree	Dicot
97.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Chuprialu	Climber	Monocot
98.	*Diospyros peregrina* Guerke	Ebenaceae	Deshigab	Tree	Dicot
99.	*Eclipta alba* (L.) Hassk.	Asteraceae	Kalokeshi	Shrub	Dicot
100.	*Eleusine indica* (L.) Gaertn.	Poaceae	Kechla	Herb	Mocot
101.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Unknown	Herb	Mocot
102.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Mulakoni	Herb	Mocot
103.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	Eucalyptus	Tree	Dicot
104.	*Euphorbia hirta* L.	Euphorbiaceae	Dudhia	Herb	Dicot
105.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Khetpapra	Creeper	Dicot
106.	*Ficus benghalensis* L.	Moraceae	Bat	Tree	Dicot
107.	*Ficus hispida* L. f.	Moraceae	Kagdumur	Tree	Dicot
108.	*Ficus religiosa* L.	Moraceae	Ashwath	Tree	Dicot
109.	*Fimbristylis acuminata* Vahl	Cyperaceae	Acumifimbry	Herb	Mocot
110.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Gimashak	Herb	Dicot
111.	*Gmelina arborea* Roxb.	Verbenaceae	Gamar	Tree	Dicot
112.	*Gnaphalium luteo-album* L.	Asteraceae	Sadalomi	Herb	Dicot
113.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Nemuti	Herb	Dicot
114.	*Heliotropium indicum* L.	Asteraceae	Hatisur	Herb	Dicot
115.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Khetpapra	Herb	Dicot
116.	*Hibiscus rosa-sinensis* L.	Malvaceae	Jaba	Shrub	Dicot
117.	*Hibiscus sabdariffa* L.	Malvaceae	Stholpadda	Shrub	Dicot
118.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Misti alu	Creeper	Dicot
119.	*Jasminum sambac* (L.) Ait.	Oleaceae	Jui	Shrub	Dicot
120.	*Kyllinga microcephala* Steud.	Cyperaceae	Muthaghas	Herb	Monocot
121.	*Lablab purpureus* (L.) Sweet	Fabaceae	Shim	Climber	Dicot
122.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lau	Climber	Dicot
123.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Jiga	Tree	Dicot
124.	*Launaea aspleniifolia* DC.	Asteraceae	Lonia	Herb	Dicot
125.	*Lawsonia inermis* L.	Lythraceae	Mehedi	Tree	Dicot
126.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Ipil-Ipil	Tree	Dicot
127.	*Leucas aspera* (Willd.) Link	Lamiaceae	Swetdrawn	Herb	Dicot
128.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Chotohelencha	Herb	Dicot
129.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lipia	Herb	Dicot
130.	*Litchi chinensis* Sonn.	Sapindaceae	Litchu	Tree	Dicot
131.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Jhinga	Climber	Dicot
132.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Mohua	Tree	Dicot
133.	*Mangifera indica* L.	Anacardiaceae	Am	Tree	Dicot
134.	*Melia azedarach* L.	Meliaceae	Gora Neem	Tree	Dicot
135.	*Melochia corchorifolia* L.	Sterculiaceae	Unknown	Shrub	Dicot
136.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Unknown	Climber	Dicot
137.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Assam lata	Climber	Dicot
138.	*Mimosa pudica* L.	Mimosaceae	Lazzabati	Herb	Dicot
139.	*Mirabilis jalapa* L.	Nyctaginaceae	Shayndhamaloti	Herb	Dicot
140.	*Moringa oleifera* Lamk.	Moringaceae	Shojna	Tree	Dicot
141.	*Momordica charantia* L.	Cucurbitaceae	Korolla	Climber	Dicot
142.	*Musa paradisiaca* L.	Mussaceae	Kathalikola	Herb	Mocot
143.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Kadom	Tree	Dicot
144.	*Ocimum sanctum* L.	Lamiaceae	Babuitulshi	Herb	Dicot
145.	*Oldenlandia corymbosa* L.	Rubiaceae	Khetpapra	Herb	Dicot
146.	*Oxalis corniculata* L.	Oxalidaceae	Amrul	Herb	Dicot
147.	*Panicum* sp.	Poaceae	Bashpatighas	Herb	Mocot

Table continued….

148.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Moissaghas	Herb	Mocot
149.	*Passiflora foetida* L.	Passifloraceae	Jhumkalata	Climber	Dicot
150.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Bera Chita	Herb	Dicot
151.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Bakan	Herb	Dicot
152.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Arboroi	Tree	Dicot
153.	*Phyllanthus niruri* L.	Euphorbiaceae	Bhuiamla	Herb	Dicot
154.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Sitka	Shrub	Dicot
155.	*Phyllanthus urinaria* L.	Euphorbiaceae	Sitka	Shrub	Dicot
156.	*Physalis minima* L.	Solanaceae	Phutka	Herb	Dicot
157.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Aripachuli	Herb	Dicot
158.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Bilati luchipata	Herb	Dicot
159.	*Psidium guajava* L.	Myrtaceae	Peyara	Tree	Dicot
160.	*Punica granatum* L.	Punicaceae	Dalim	Shrub	Dicot
161.	*Richardia scabra* L.	Rubiaceae	Khetpapra	Herb	Dicot
162.	*Ricinus communis* L.	Euphorbiaceae	Rerhi/Vrenda	Shrub	Dicot
163.	*Rorippa indica* (L.) Hiern	Brassicaceae	Bonshorisha	Herb	Dicot
164.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Ghash	Herb	Monocot
165.	*Saccharum spontaneum* L.	Poaceae	Kash	Herb	Mocot
166.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Raintree	Tree	Dicot
167.	*Scoparia dulcis* L.	Scrophulariaceae	Bandhoney	Herb	Dicot
168.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Datmardan	Shrub	Dicot
169.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Kolkashunda	Shrub	Dicot
170.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Kolkashunda	Herb	Dicot
171.	*Sida acuta* Burm. f.	Malvaceae	Berela	Herb	Dicot
172.	*Sida rhombifolia* L.	Malvaceae	Pitberela	Herb	Dicot
173.	*Solanum lycopersicum* Dunal	Solanaceae	Tomato	Herb	Dicot
174.	*Solanum melongena* L.	Solanaceae	Begun	Herb	Dicot
175.	*Solanum nigrum* L.	Solanaceae	Kakmachi	Herb	Dicot
176.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Kataegun	Herb	Dicot
177.	*Sphaeranthus indicus* L.	Asteraceae	Mundi	Herb	Dicot
178.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Amra	Tree	Dicot
179.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Ghaupata	Climber	Dicot
180.	*Swietenia mahagoni* Jacq.	Meliaceae	Mehagoni	Tree	Dicot
181.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Nakphul	Herb	Dicot
182.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jam	Tree	Dicot
183.	*Tamarindus indica* L.	Caesalpiniaceae	Tetul	Tree	Dicot
184.	*Terminalia catappa* L.	Combretaceae	Kathbadam	Tree	Dicot
185.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Holud korobi	Tree	Dicot
186.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Gulancha	Climber	Dicot
187.	*Trema orientalis* (L.) Blume	Ulmaceae	Jibon	Tree	Dicot
188.	*Tridax procumbens* L.	Asteraceae	Tridhara	Herb	Dicot
189.	*Urena lobata* L.	Malvaceae	Banokra	Shrub	Dicot
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Kukurshunga	Herb	Dicot
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Ghagra	Herb	Dicot
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Kul, Boroi	Tree	Dicot

According the DAFOR status, the existing flora of the visited site represents 17, 39, 74, 50 and 12 species as rare, occasional, frequent, abundant and dominant respectively (Figure 7). Plant species belonging to Azollaceae, Ebenaceae, Euphorbiaceae, Lamiaceae, Lecythidaceae, Lythraceae, Malvaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Oleaceae, Passifloraceae, Poaceae, Sapotaceae, Scrophulariaceae, Thelypteridaceae families were found to be rare according to DAFOR categories (Table 2).

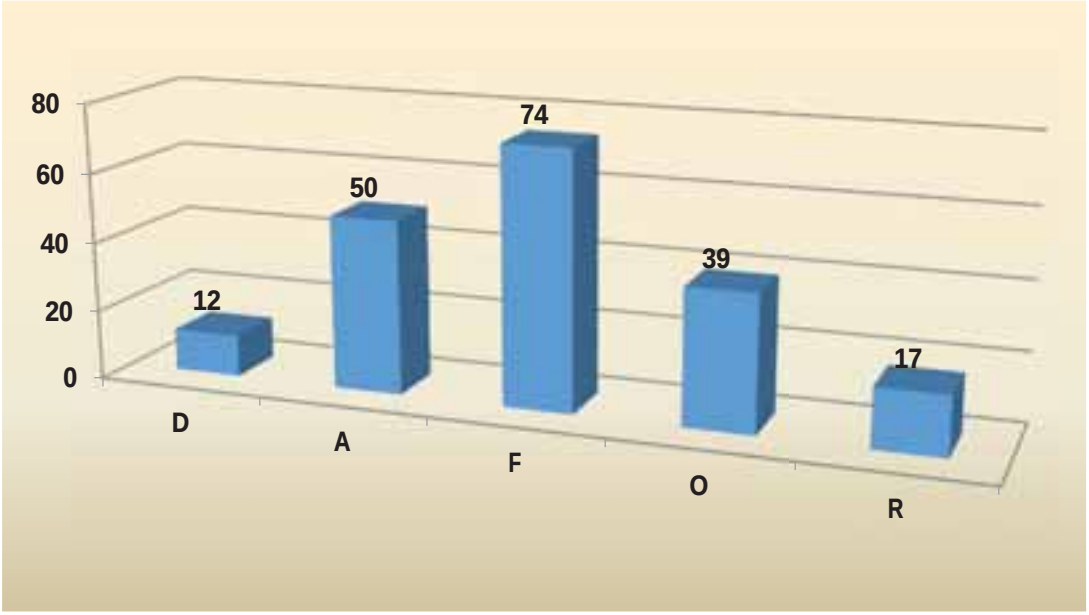
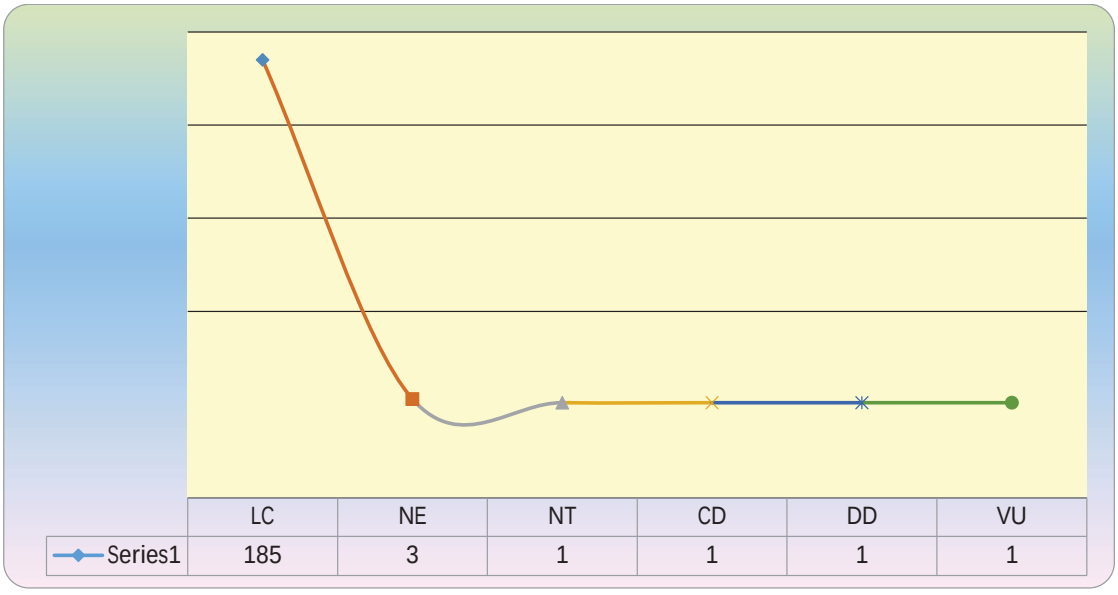


Figure 7. Existing DAFOR status of recorded plants from the present project area.

According to the Red List categories, out of 192 recorded plants, 185 species were included in Least Concern (Lc) category, 3 species were recognized as Not Evaluated (NE), 1 species were Near Threatened (NT), 1 species were Coservation Dependent (CD), 1 species was recognized for each the Data Dificit (DD) and 1 species was recognized as Vulnerable (VU) categories (Table 2, Figure 8).



	LC	NE	NT	CD	DD	VU
Series1	185	3	1	1	1	1

Figure 8. Red list categories of the flora recorded from the present power plant project area.

Table 2. Redlist categories and existing DAFOR status of the recorded vegetation in the proposed LNG-based power plant area area.

Sl.no.	Scientific name	Family name	Red list status	DAFOR status
1.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Lc	O
2.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Lc	R
3.	*Aegle marmelos* (L.) Corr.	Rutaceae	Lc	O
4.	*Ageratum conyzoides* L.	Asteraceae	Lc	F
5.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Lc	O
6.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Lc	F
7.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Lc	A
8.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Lc	A
9.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Lc	D
10.	*Amaranthus gangeticus* L.	Amaranthaceae	Lc	F
11.	*Amaranthus spinosus* L.	Amarantaceae	Lc	A
12.	*Amaranthus tricolor* L.	Amaranthaceae	Lc	F
13.	*Amaranthus viridis* L.	Amaranthaceae	Lc	F
14.	*Ammannia baccifera* L.	Lythraceae	Lc	O
15.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Lc	F
16.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Lc	R
17.	*Annona reticulate* L.	Annonaceae	Lc	O
18.	*Annona squamosa* L.	Annonaceae	Lc	O
19.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Lc	R
20.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	CD	F
21.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Lc	O
22.	*Artocarpus heterophyllus* Lamk.	Moraceae	Lc	O
23.	*Arundo donax* L.	Poaceae	Lc	F
24.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Lc	O
25.	*Averrhoa carambola* L.	Oxalidaceae	Lc	O
26.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Lc	A
27.	*Azadirachta indica* A. Juss.	Meliaceae	Lc	F
28.	*Azolla pinnata*	Azollaceae	Lc	R
29.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Lc	R
30.	*Brassica nigra* (L.) Koch	Brassicaceae	Lc	A
31.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Lc	F
32.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Lc	F
33.	*Cardiospermum halicacabum* L.	Sapindaceae	Lc	O
34.	*Carica papaya* L.	Caricaceae	Lc	F
35.	*Centella asiatica* (L.) Urban	Apiaceae	Lc	A
36.	*Chenopodium album* L.	Chenopodiaceae	Lc	A
37.	*Chloris barbata* Sw.	Poaceae	NE	R
38.	*Christella dentata*	Thelypteridaceae	NT	R
39.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	VU	A
40.	*Cissampelos pareira* L. var. hirsuta	Menispermaceae	Lc	R
41.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Lc	F
42.	*Cleome rutidosperma* DC.	Capparaceae	Lc	A
43.	*Cleome viscosa* L.	Capparaceae	Lc	F
44.	*Clerodendrum viscosum* Vent.	Verbenaceae	Lc	F
45.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Lc	A
46.	*Cocos nucifera* L.	Arecaceae	Lc	F
47.	*Colocasia esculenta* (L.) Schott	Araceae	Lc	D
48.	*Commelina benghalensis* L.	Commelinaceae	Lc	A
49.	*Commelina longifolia* Lamk.	Commelinaceae	Lc	F
50.	*Corchorus olitorius* L.	Tiliaceae	Lc	O
51.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Lc	F
52.	*Crateva magna* (Lour.) DC.	Capparaceae	Lc	A

Table continued…

53.	*Crotalaria pallida* Ait.	Fabaceae	Lc	F
54.	*Croton bonplandianus* Baill.	Euphorbiaceae	Lc	D
55.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Lc	F
56.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Lc	F
57.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Lc	A
58.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	Lc	F
59.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	NE	F
60.	*Cynodon dactylon* (L.) Pers.	Poaceae	Lc	A
61.	*Cyperus rotundus* L.	Cyperaceae	Lc	F
62.	*Cyperus* sp	Cyperaceae	Lc	O
63.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Lc	F
64.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Lc	F
65.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Lc	O
66.	*Desmodium triflorum* (L.) DC.	Fabaceae	Lc	A
67.	*Dillenia indica* L.	Dilleniaceae	Lc	O
68.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Lc	O
69.	*Diospyros peregrina* Guerke	Ebenaceae	Lc	R
70.	*Eclipta alba* (L.) Hassk.	Asteraceae	Lc	A
71.	*Eichhornia crassipes* (Mart.) Solms	Pontedariaceae	Lc	D
72.	*Eleusine indica* (L.) Gaertn.	Poaceae	Lc	A
73.	*Enhydra fluctuans* Lour.	Asteraceae	Lc	A
74.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Lc	A
75.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Lc	F
76.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	NE	F
77.	*Euphorbia hirta* L.	Euphorbiaceae	Lc	F
78.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Lc	F
79.	*Ficus benghalensis* L.	Moraceae	Lc	O
80.	*Ficus heterophylla* L. f.	Moraceae	Lc	F
81.	*Ficus hispida* L. f.	Moraceae	Lc	O
82.	*Ficus religiosa* L.	Moraceae	Lc	O
83.	*Fimbristylis acuminata* Vahl	Cyperaceae	Lc	F
84.	*Floscopia* sp.	Commelinaceae	Lc	A
85.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Lc	F
86.	*Gmelina arborea* Roxb.	Verbenaceae	Lc	O
87.	*Gnaphalium luteo-album* L.	Asteraceae	Lc	A
88.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Lc	A
89.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Lc	F
90.	*Heliotropium indicum* L.	Asteraceae	Lc	D
91.	*Hibiscus rosa-sinensis* L.	Malvaceae	Lc	O
92.	*Hibiscus sabdariffa* L.	Malvaceae	Lc	R
93.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Lc	O
94.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Lc	A
95.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Lc	D
96.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Lc	F
97.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Lc	A
98.	*Jasminum sambac* (L.) Ait.	Oleaceae	Lc	R
99.	*Kyllinga microcephala* Steud.	Cyperaceae	Lc	D
100.	*Lablab purpureus* (L.) Sweet	Fabaceae	Lc	F
101.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lc	F
102.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Lc	F
103.	*Launaea aspleniifolia* DC.	Asteraceae	Lc	A
104.	*Lawsonia inermis* L.	Lythraceae	Lc	O
105.	*Leersia hexandra* Sw.	Poaceae	Lc	A
106.	*Lemna perpusilla* Torrey	Lemnaceae	Lc	A
107.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Lc	F
108.	*Leucas aspera* (Willd.) Link	Lamiaceae	Lc	A
109.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Lc	A
110.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Lc	A

Table continued…

111.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lc	F
112.	*Litchi chinensis* Sonn.	Sapindaceae	Lc	O
113.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Lc	A
114.	*Ludwigia hyssopifolia*	Onagraceae	Lc	D
115.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Lc	F
116.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Lc	R
117.	*Mangifera indica* L.	Anacardiaceae	Lc	F
118.	*Marsilea minuta* L.	Masileaceae	Lc	A
119.	*Melia azedarach* L.	Meliaceae	Lc	F
120.	*Melochia corchorifolia* L.	Sterculiaceae	Lc	O
121.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Lc	F
122.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Lc	F
123.	*Mimosa pudica* L.	Mimosaceae	Lc	F
124.	*Mirabilis jalapa* L.	Nyctaginaceae	Lc	R
125.	*Momordica charantia* L.	Cucurbitaceae	Lc	A
126.	*Moringa oleifera* Lamk.	Moringaceae	Lc	O
127.	*Musa paradisiaca* L.	Mussaceae	Lc	F
128.	*Najas minor* L.	Najadaceae	Lc	F
129.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Lc	O
130.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Lc	F
131.	*Ocimum sanctum* L.	Lamiaceae	Lc	F
132.	*Oldenlandia diffusa* (Willd.) Roxb.	Rubiaceae	DD	F
133.	*Oxalis corniculata* L.	Oxalidaceae	Lc	A
134.	*Panicum* sp.	Poaceae	Lc	F
135.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Lc	F
136.	*Passiflora foetida* L.	Passifloraceae	Lc	R
137.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Lc	O
138.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Lc	F
139.	*Persicaria barbata* (L.) Hara	Polygonaceae	Lc	F
140.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Lc	A
141.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Lc	D
142.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Lc	F
143.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Lc	R
144.	*Phyllanthus niruri* L.	Euphorbiaceae	Lc	A
145.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Lc	D
146.	*Phyllanthus urinaria* L.	Euphorbiaceae	Lc	F
147.	*Physalis minima* L.	Solanaceae	Lc	F
148.	*Pistia stratiotes* L.	Araceae	Lc	A
149.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Lc	A
150.	*Polygonum plebeium* R. Br.	Polygonaceae	Lc	F
151.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Lc	F
152.	*Psidium guajava* L.	Myrtaceae	Lc	F
153.	*Punica granatum* L.	Punicaceae	Lc	O
154.	*Richardia scabra* L.	Rubiaceae	Lc	A
155.	*Ricinus communis* L.	Euphorbiaceae	Lc	O
156.	*Rorippa indica* (L.) Hiern	Brassicaceae	Lc	A
157.	*Rotala indica* (Willd.) Koehne	Lythraceae	Lc	R
158.	*Saccharum spontaneum* L.	Poaceae	Lc	A
159.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Lc	F
160.	*Salvinia cucullata*	Salviniaceae	Lc	A
161.	*Salvinia molesta*	Salviniaceae	Lc	F
162.	*Salvinia natans*	Salviniaceae	Lc	D
163.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Lc	A
164.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Lc	A
165.	*Scoparia dulcis* L.	Scrophulariaceae	Lc	F
166.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Lc	A
167.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Lc	F

168.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Lc	F

Table continued…

169.	*Sida acuta* Burm. f.	Malvaceae	Lc	F
170.	*Sida rhombifolia* L.	Malvaceae	Lc	O
171.	*Solanum lycopersicum* Dunal	Solanaceae	Lc	A
172.	*Solanum melongena* L.	Solanaceae	Lc	A
173.	*Solanum nigrum* L.	Solanaceae	Lc	F
174.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Lc	D
175.	*Sphaeranthus indicus* L.	Asteraceae	Lc	F
176.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Lc	O
177.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Lc	O
178.	*Swietenia mahagoni* Jacq.	Meliaceae	Lc	F
179.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Lc	F
180.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Lc	O
181.	*Tamarindus indica* L.	Caesalpiniaceae	Lc	F
182.	*Terminalia catappa* L.	Combretaceae	Lc	O
183.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Lc	O
184.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Lc	R
185.	*Trema orientalis* (L.) Blume	Ulmaceae	Lc	O
186.	*Trewia nudiflora* L.	Euphorbiaceae	Lc	A
187.	*Tridax procumbens* L.	Asteraceae	Lc	F
188.	*Urena lobata* L.	Malvaceae	Lc	O
189.	*Vallisneria spiralis* L.	Hydrocharitaceae	Lc	A
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Lc	O
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Lc	A
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Lc	F

Note: LC= Least Concern, NE= Not Evaluated, NT= Near Threatened, CD= Coservation Dependent, DD= Data Deficient, VU= Vulnerable. D= Dominant, A= Abundant, F= Frequent, O= Occasional, R= Rare.

Oldenlandia diffusa of the family Rubiaceae was found data deficit, *Aponogeton appendiculatus* of the family Aponogetonaceae was found conservation dependent, *Christella dentate* of the family Thelypteridaceae was found near threatened and *Chromolaena odorata* of the family Asteraceae was found vulnerable categories. Besides, *Cyathula prostrata* of the family Amaranthaceae, *Eucalyptus camaldulensis* of the family Myrtaceae, *Chloris barbata* of the family Poaceae were found in not evaluated category.

Threats to the Project Sites and Biodiversity

The major threats to habitats of the project area as well as on the biodiversity which were recognized from the present baseline survey as well as from consult with the local people are-

- Dusting and generation of waste during the course of construction work,
- Water pollution as a result of possible leakage of fuels and lubricants and chemical substances in the course of the construction work,
- Aquatic freshwater plant species may become affected due to increase of water temperature,

- Regular natural calamities

The overall floristic composition and their existing status of the present project sites is quite good facing under different threats due to multifarious anthropogenic activities as well as the natural calamities.

Suggestions

Suggestions should be implemented for proper management and conservation of the poject area:

- Further disturbance to the natural habitats and its diversity should be stoped,
- Regular monitoring of ecosystem health by specialists,
- Proper management plan should be implemented to maintain ecological integrity,

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List of some important photographs taken from the Proposed Power Plant Area.

	
Acacia auriculiformis	*Adenosma indianum*
	
Achyranthus aspera	*Acmella culva*
	
Ageratum conyzoides	*Albizia procera*

	
Amaranthus blitum	*Amaranthus spinosus*
	
Alternanthera sessilis	*Ammannia baccifera*
	
Ampelopteris prolifera	*Anisomeles indica*

	
Aponogeton appendiculatus	*Atylosia scarabaeoides*
	
Azadirachta indica	*Azolla pinnata*
	
Centella asiatica	*Barringtonia acutangula*

	
Colocasia esculenta	*Colocasia esculenta*
	
Calotropis procera	*Calotropis gigantia*
	
Cardiospermum helicacabum	*Cardiospermum helicacabum* (Fruit)

	
Carica papaya	*Christella dentata*
	
Clerodendrum viscosum	*Cocos nucifera*
	
Cissampelos pareira L. var. hirsuta	*Coccinia cordifolia*

	
Cotula hemispherica	*Crotalaria pallida*
	
Commelina longifolia	*Commelina benghalensis*
	
Crateva magna	*Croton banplandianum*

Cryptocoryne spiralis

Cuscuta reflexa

Desmodium triflorum

Dioscoria alata

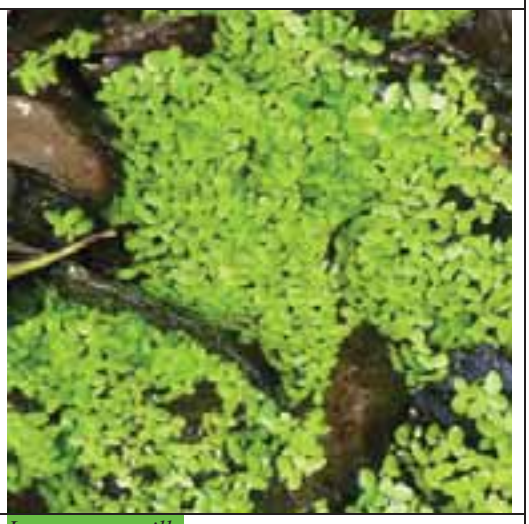
Eleusine indica

Enhydra fluctuans

	
Eclipta prostrata	*Eichhornia crassipes*
	
Eucalyptus camaldulensis	*Ficus heterophylla*
	
Evolvulus nummularius	*Fimbristylis acuminata*

	
Fimbristylis squarrosa	*Glinus oppositifolius*
	
Gmelina arborea	*Grangea maderaspatana*
	
Heliotropium indicum	*Floscopia*

	
Gnaphalium luteo-album	*Hygroryza aristata*
	
Ipomoea aquatica	*Ipomoea fistulosa*
	
Ipomoea batatas	*Kyllinga microcephala*

	
Kyllinga brevifolia	*Lagenaria siceraria*
	
Lablab purpureus	*Launaea aspleniifolia*
	
Leucas aspera	*Lemna perpusilla*

	
Leucaena leucocephala	*Lindernia rotundifolia*
	
Limnophila sessiliflora	*Ludwigia adscendens*
	
Lippia alba	*Ludwigia hyssopifolia*

	
Luffa cylindrica	*Merremia hederacea*
	
Marsilea minuta	*Mikania cordata*
	
Mimosa pudica	*Mirabilis jalapa*

	
Momordica charantia	*Musa paradisiaca*
	
Najas minor	*Oldenlandia corymbosa*
	
Oryza sativa	*Oxalis corniculata*

	
Passiflora foetida	*Persicaria assamica*
	
Persicaria hydropiper	*Persicaria orientalis*
	
Phyla nodiflora	*Phyllanthus reticulatus*

	
Pistia stratiotes	*Pogostemon crassicaulis*
	
Richardia scabra	*Rorippa indica*
	
Saccharum spontaneum	*Ricinus communis*

Rotala rotundifolia

Salvinia cucullata

Salvinia molesta

Salvinia natans

Samanea saman

Schoenoplectus articulatus

Senna alata

Senna alata (Fruit)

Senna occidentalis

Senna tora

Sida acuta

Solanum nigrum

Solanum sisymbrifolium

Solanum sisymbrifolium (Fruit)

Sphaeranthus indicus

Stephania japonica

Thevetia peruviana

Tinospora cordifolia

	
Trewia nudiflora	*Vallisneria spiralis*
	
Tridax procumbens	*Xanthium indicum*

Annexure: 4.3

Ecology Fauna

AN ECOLOGICAL SURVEY OF THE FAUNA AND FLORA OF PROPOSED SITE FOR RELIANCE MEGHNAGHAT 750 MW COMBINED CYCLE POWER PLANT AT MEGHNAGHAT, NARAYANGANJ, BANGLADESH

[BASELINE SURVEY FOR DATA GENERATION ON ECOLOGY IN AND AROUND THE PROPOSED PROJECT AREA AT MEGHNAGHAT, SONARGAON, NARAYANGANJ]

PART-II: THE FAUNA

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An Ecological Survey of the Fauna of Proposed Site for Reliance Meghnaghat 750 MW Combined Cycle Power Plant

The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants and animals, the enormous diversity of genes in these species, the different ecosystems on the planet is all part of a biologically diverse Earth. It represents the wealth of biological resources available to us. Humans cannot breathe unless both flora and fauna survive and thrive on the earth. Fauna is a significant part of the ecosystem. All the animals are connected in one way or another, mainly through food chains. As the usage of the land is getting more and more intensive throughout the country, there is a threat for natural habitat to vanish, also many populations of different species has declined. Some of the animal populations that have been abundant earlier now are vanishing or are almost disappeared. For the reasons, conservation of global biodiversity has become the issue of prime importance in recent decades (Turner *et al*., 1990; Ehrlich and Wilson, 1991). Conservationists around the globe are battling with conservation challenges under the ever accelerating threats of anthropogenic disturbances to biodiversity. Bangladesh has realm number of biological diversity for its geographical location and favorable climatic condition for life. Biodiversity is facing unprecedented levels of threat due to unwise industrialization. For the reasons, It has become imperative to assay diversity prior to any big set up.

Understanding biological diversity in terms of the processes by which ecosystems and their components function, be it at community, species, population or genetic levels, is critical to informing its sustainable use and safeguarding it for the benefit of future generations. Sustainable ecosystem and sustainable development is intensely interrelated (Fig. 1).

Identifying and monitoring biological diversity is a huge and potentially infinite task given its variability in time and space and its spectrum of levels. Biodiversity estimation applying short span studies are becoming ever popular and in this regard preparation of checklists of birds on a wider scale has been given much importance (Roy *et al*., 2011). The reliance Group of Bangladesh is planning to construct a 750 MW Conbined Cycle Powe Plant. at Meghnaghat, Sonargaon, Narayangonj. The GPS position of the site is $23^0$36’25.56’N, $90^0$35’32.16”E. A rapid faunal diversity assessment was carried out at different locations of the proposed site to get idea about the biodiversity of the area. Though the present short study

does not reflect complete biodiversity of that area. Detail investigation is necessary to have a complete list.

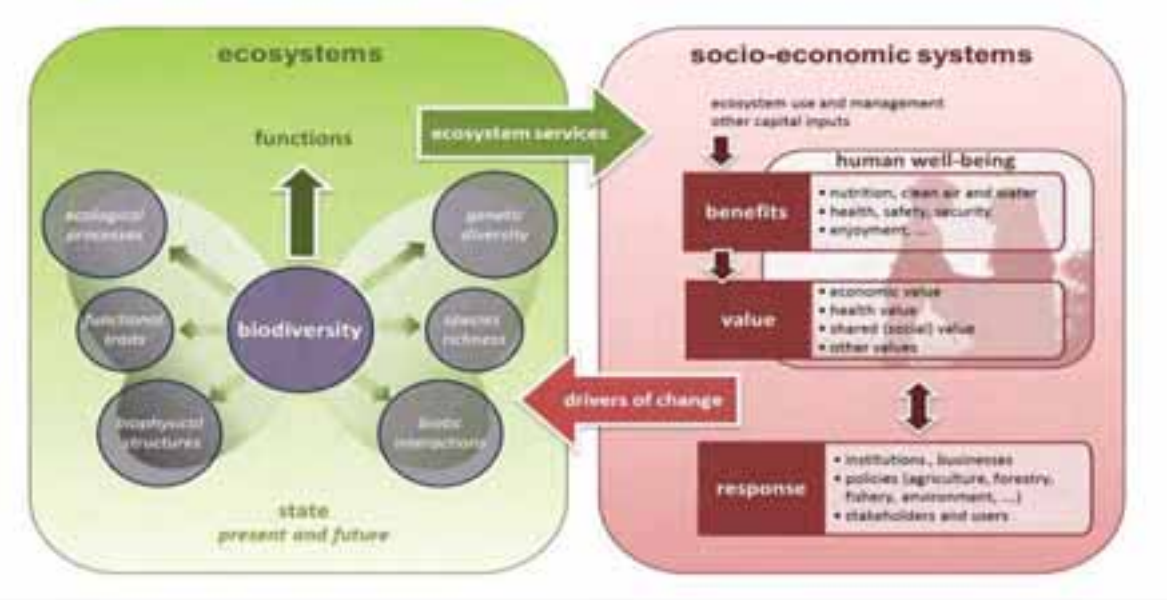


Fig. 1: Conceptual framework for ecosystem assessment

Indicator species assessment of different biotypes and habitats has been used as tools to assess the biological health of habitats. They are also considered model organisms to assess the effects of global climate change. We made a quick survey on some bio indicator species viz, Odonate, Butterfly, Mollusc, Plankton, Fish and Avifauna. Diversity of these indicator species will give an idea about the health of that specific area.

INDUSTRIALIZATION IN THE STUDY AREA

We cannot avoid demand of industrialization for the better development of the country. But careful decision should be taken prior to any new set up. If any such set up create threat to the biodiversity, country development would not be sustainable. Fisherman of the river near study area informed that they hardly can catch any fish from the river nowadays. There are some industries already existed near the study are. Such industries should be very careful for their effluent and byproduct.

Plate 1: Industry near study area

Plate 2: Industry near study area

Plate 3: Dust coming out from an industry made shade over the industry building, may also be harmful for all biodiversity

Plate 4: Making carrier ship near the bank of river

Plate 5: Water coming out from an industry

Plate 6: Carrier vessel in the river

Plate 7: Carrier vessel in the river

Methods of sample collection

A comprehensive survey was conducted at the vicinity of proposed Reliance Meghnaghat 750 MW CCPP on December 2, 2016 to get an idea about the status of the diversity of animals in that area. Water samples of the river were collected from different locations around the proposed power plant. Different physical parameters of the water samples were checked and recorded. Phytoplankton and Zooplankton nets were used to collect different types of planktons available in each type of water sample. Different types of fishes, macro and micro-invertebrates were collected from each of the location. Several types of fishing nets were utilized for this purpose. To get an idea about the biodiversity of each location, water samples were collected around 40 meter radius of each sampling location. The collected specimens were identified instantly or brought to the laboratory for further confirmation. Proper keys, Journals, books and encyclopedia were consulted for identification of the collected specimens. Fishermen were interviewed to get an idea about the present status and past records of the availability and abundance of fish population of the river. Fish sellers of the local fish market were also interviewed to collect their opinion about the present and past status of the abundance of fishes in the area.

For phytoplankton and Zooplankton survey 10 lit of water (two liters each time) was collected from each sampling location and was sieved by plankton net. 45 ml of sieved water was collected in a 50 ml Falcon tube. Then 5 ml of alcohol was added in each Falcon tube as preservative so that the microorganisms are not damaged before identification, In this way 5 samples were collected from each sampling location 1 ml of water from each 50 ml sample was studied in a “rafter cell counter” under microscope.

Observations

Huge number of floating water hyacinth was trapped by the local people. They use bamboo poles for trapping. They use this place to attract different kinds of fishes as shelter place. Fishermen encircle this area after every 15-20 days with nets and capture fish. During

interview with the local people, they informed that during each fishing huge quantity of different kinds of fishes are captured. Water quality includes various physical and biological parameters which has direct influence on the aquatic organisms and vegetations. Abundance of fishes and their growth are dependent on the quality of water and availability of food. Few physical parameters of water samples of each sampling location examined and presented in Table 1:

Plate:8

Plate:9

Plate:10

Plate:11

Plate:12

Plate:13

Plate: Showing different sampling locations and collection of samples

CHAPTER – I

INSECT FAUNA

Insects are one of the most important groups in the natural world. Approximately 80% of animal species on earth are insects. They affect the life and welfare of humans in many different ways. **Insects play** crucial **roles** in **ecosystem** functioning. As pollinators, they contribute to the reproduction of most flowering plants. About 80% of the flowering plants on Earth are pollinated by insects. According to some estimates, over ⅓ of the human diet can be traced directly or indirectly to bee pollination. **Insects** are often the first decomposers of dead plants and animals, and introduce microorganisms that continue this process and release nutrients for new plant growth. Nevertheless they are extremely important as essential components of both natural and modified ecosystems. In this survey we targeted few bio-indicator species.

ODONATA FAUNA

Odonata is an order of carnivorous insects, encompassing the dragonflies (Anisoptera) and the damselflies (Zygoptera). Odonates are aquatic or semi-aquatic as juveniles. Thus, adults are most often seen near bodies of water and are frequently described as aquatic insects. However, many species range far from water. Adult Odonates are terrestrial and are found near water, whereas the immature stages are aquatic and inhabit all typesof freshwater habitats ranging from permanent running waters and lakes to small temporary rain pools (Silsby 2001, Harp 1996, Corbet 1999). Many species are limited to some particular habitats, both during larval and adult life

stages especially the stenotopic species. However, their specificity to aquatic habitats makes them an ideal model for monitoring the health of freshwater ecosystems (Subramanian 2009, Orr 2003, Watanabe et al., 2004).The adults are harmless and their beautiful colorpattern raised strong aesthetic sense to human being. People in some countries also take the adult dragonflies as a minor food item (Chowdhury, 1989; Chovanec 1994; Legner 1995; Clarke 1996; Nikula *et al*., 2007).

They are carnivorous throughout their life, mostly feeding on smaller insects.Dragonflies and damselflies play key roles in both terrestrial and aquatic habitats. They are predators as both

nymphs and adults, feeding on a variety of prey including nuisance species such as mosquitoes and biting flies. Nymphs can be top predators in fishless wetlands and help structure the wetland community. Dragonfly and damselfly nymphs in turn are an essential food resource for fish and amphibians, and adults are eaten by upland predators such as birds, bats, lizards, and spiders.

Odonates can act as **bioindicators** of water quality in rivers because they rely on high quality water for proper development in early life. Odonate nymphs are important components ofmost fresh water habitats, intermediate links in aquatic food webs, functioning as both prey andpredators. Nymphs are food for birds, fish, bugs. Since their diet consists entirely of insects, odonate density is directly proportional to the population of prey, and their abundance indicates the abundance of prey in the examined ecosystem (Golfieri *et al*., 2016). Species richness of vascular plants has also been positively correlated with the species richness of dragonflies in a given habitat. This means that in a location such as a lake, if one finds a wide variety of odonates, then a similarly wide variety of plants should also be present. This correlation is not common to all bioindicators, as some may act as indicators for a different environmental factor, such as the pool frog acting as a bioindicator of water quality due to its high quantity of time spent in and around water (Sahlén *et al.* 2000).

They can be indicators of different biotypes and habitats, and have been used as tools to assess the biological health of aquatic habitats and to detect levels of heavy metals such as mercury. They are also considered model organisms to assess the effects of global climate change. For the reasons, a survey of this group was prime important.

Survey and identification

Adult Odonates were observed were recorded and some were collected by using standard hand nets and anesthetized in the field. Back in the laboratory they were identification with thehelp of taxonomic key provided by Fraser (1933, 1934, 1936, Lahiri (1987), Mitra (1983),Srivastava and Sinha (1993), Needham and Westfall (1954), Walker and Corbet (1975),Westfall (1996) and available photographs. As the survey time was only one day, it was not possible to survey all species. We also consulted previous information to enlist the survey species.

FINDINGS

Odonates found during the survey are recorded in the following tables:

Table: List of dragonfly species recorded from the study area

Family: Libellulidae

Sl. No.	**Common Name**	**Scientific name**
1.	Coral Tailed Cloud Wing	*Tholymis tillarga*
2.	Skimmer	*Rhodothemis rufa*
3.	Wandering Glider	*Pantala flavescens*
4.	Green Marsh Hawk	*Orthetrum sabina*
5.	Fulvous Forest Skimmer	*Neurothemis fulvia*
6.	Ruddy Marsh Skimmer	*Crocothemis servilia*
7.	Ditch Jewel	*Brachythemis contaminata*

Family: Gomphidae

Sl. No.	**Common Name**	**Scientific name**
8.	Common Clubtail	*Ictinogomphus rapax*

Table: Damselfly species recorded from the study area

Family: Coenagrionidae

Sl. No.	**Common Name**	**Scientific name**
1.	Saffron-faced Blue Dart	*Pseudagrion rubriceps*
2.	Coromandel Marsh Dart	*Ceriagrion coromandelianum*
3.	Pigmy Darlet	*Agriocnemis pygmaea*
4.	Orange-tailed Marsh Dart	*Ceriagrion cerinorubellum*
5.	Narrow-winged damselfly	*Agriocnemis femina*
6.	Little Blue	*Enallagma parvam*

Family: Platycnemididae

Sl. No.	**Common Name**	**Scientific name**
7.	Common Bush Dart	*Copera ciliata*

Plate 1: Dominant Anisopteran Odonate of the survey area: Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male)

Plate 2: Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male): Dorsal view

Plate 3: Resting of Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male): Lateral view

Plate 4: Coromandel Marsh Dart *Ceriagrion coromandelianum*

Plate 5: Zygopteran Odonate Little Blue (*Enallagma parvam*) (Male) feeding

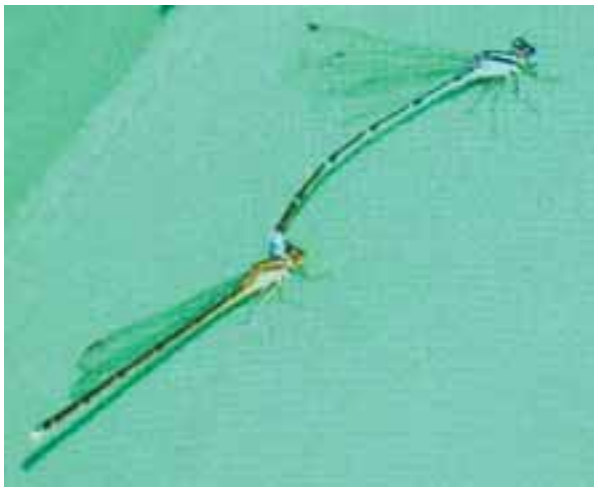


Plate 6: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-i

Plate 7: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-ii

Plate 8: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-iii

Plate 9: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-iv

In our study, out of 15 species recorded, 8 species weredragonflies belonging to two families: Libellulidae, and Gomphidae; 7 species were damselflies under two families:

Coenagrionidae, and Platycnemididae.

Collection of data for phylogenetic analysis:

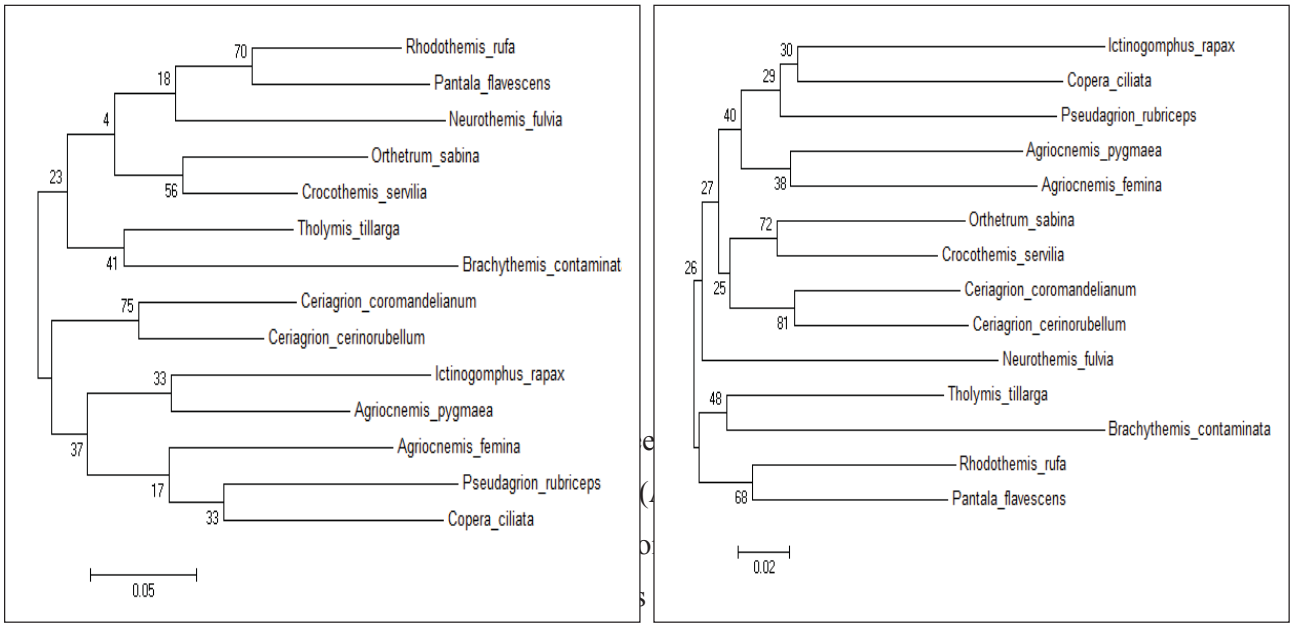
COI gene sequence of fourteen (14) Odonata species was collected from National Center for Biotechnology Information (NCBI) (http://ncbi.nlm.nih.gov) for their molecular and phylogenetic analysis.

Name of species	**GenBank Accession Number (COI gene)**
Tholymis tillarga	AB709198.1
Rhodothemis rufa	KX281843.1
Pantala flavescens	KR080133.1
Orthetrum sabina	KU496904.1
Neurothemis fulvia	JN817427.1
Crocothemis servilia	KR149807.1

Brachythemis contaminata	KC287157.1
Ictinogomphus rapax	KX891024.1
Pseudagrion rubriceps	KX263704.1
Ceriagrion coromandelianum	KU220871.1
Agriocnemis pygmaea	KU871002.1
Ceriagrion cerinorubellum	KU220868.1
Agriocnemis femina	KF369283.1
Copera ciliata	KF369527.1

Phylogenetic analysis:

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885; Tamura et al., 1985).In both phylogenetic trees (Maximum Likelihood and Neighbour-joining), grouped Fourteen (14) Odonata species into two clusters. In maximum likelihood tree, *Rhodothemis rufa, Pantala flavescens, Neurothemis fulvia, Orthetrum sabina, Crocothemis servilia, Tholymis tillarga, Brachythemis contaminata* gropued within same clusters. *Ictinogomphus rapax, Pseudagrion rubriceps, Ceriagrion coromandelianum, Agriocnemis pygmaea, Ceriagrion cerinorubellum, Agriocnemis femina* and *Copera ciliate* clustered into another group. All species are closely related and highest bootstrap value (75) was shown in the sub cluster of *Ceriagrion coromandelianum* and *Ceriagrion cerinorubellum.* Same results were observed in neighbor joining tree construction. In context of branch length, *Brachythemis contaminate* was genetically most distance from the common ancestors in both trees (Fig. 2).



evolutionaryhistory was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 0.57177990 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches. The bar at the bottom is a scale for genetic change.

Genetic Distance:

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6(Tamura et al., 2013). Interspecific genetic divergence range of Odonata species was 0.13-0.32.*Ictinogomphusrapax* showed highest (0.32) pairwise distance than rest. *Ceriagrion cerinorubellum* showed lowest (0.13) pairwise distance among studied Odonates.

Table: Interspecific K2P sequence divergence at the COI barcode region among the Odonates

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.*Tholymistillarga*														
2. *Rhodothemisrufa*	0.20													
3. *Pantalaflavescens*	0.21	0.16												
4.*Orthetrumsabina*	0.21	0.20	0.17											
5. *Neurothemisfulvia*	0.21	0.22	0.22	0.23										
6. *Crocothemisservilia*	0.17	0.21	0.19	0.14	0.21									
7.*Brachythemisconta minata*	0.23	0.25	0.24	0.27	0.26	0.28								
8.*Ictinogomphus rapax*	0.25	0.27	0.26	0.26	0.26	0.25	0.32							
9.*Pseudagrion rubriceps*	0.24	0.23	0.23	0.22	0.24	0.22	0.30	0.24						
10.*Ceriagrion coromandelianum*	0.21	0.21	0.21	0.19	0.20	0.16	0.27	0.25	0.23					
11.*Agriocnemis pygmaea*	0.22	0.26	0.21	0.21	0.23	0.21	0.28	0.21	0.29	0.21				
12.*Ceriagrion cerinorubellum*	0.20	0.18	0.21	0.19	0.24	0.17	0.27	0.28	0.23	0.13	0.18			
13.*Agriocnemis femina*	0.25	0.21	0.27	0.23	0.25	0.24	0.31	0.24	0.22	0.21	0.19	0.20		

14.*Copera ciliate*	0.23	0.26	0.25	0.22	0.26	0.20	0.32	0.22	0.21	0.22	0.23	0.26	0.22	

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LEPIDOPTERA (BUTTERFLY) FAUNA

Lepidoptera (butterfly) is widely accepted as a good indicator of ecosystem health. Butterfly is a primarily day-flying insect belonging to order Lepidoptera. Several characters of the butterflies like their wide distribution, species diversity, specific to vegetation type, rapid response to perturbation, taxonomic tractability, statistically significant abundance and ease of sampling made them successful and useful organism to check changes in environmental parameters. Butterflies are diverse animals and sensitive to changes in microclimate and habitat (Bobo *et al.* 2006, Akite 2008 and Bonebrake *et al.* 2009) which influences their distribution and abundance. Butterflies have been found to be a specific useful indicator group in grasslands and in other open habitats . They also react to pressures such as climate change (Corezzola, 2011). For the reasons mentioned above and well visibility, butterfly fauna was studied in the 2 km radius of the spot area.

Butterfly collection and identification (Methodology):

Field survey and butterflies collections were carried using line transect method described by (Kunte, 1997). All transects were walked between 9.30 am and 4.30 pm, which was a peak time for butterfly activities under sunny weather condition. The study area was covered with cultivated land, wetland and homestead vegetation include trees, herbs, shrubs, grasses and climbers which support butterflies species for their larval food, nectar feeding and resting.

Butterfly species were primarily identified directly in the field or, in difficult cases, following capture using a sweep net and that were immobilized and brought back in the laboratory. Specimens were identified using taxonomic key mentioned in the reference. Previous works of the area was also consulted to prepare the list.

Table: List of butterflies of the survey area

Family: Danaidae

1.	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)
2.	Common Crow	*Euploea core* (Cramer, 1780)
3.	Striped Tiger	*Danaus genutia* (Cramer 1779)

Family: Papilionidae

4.	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)

5.	Lime Butterfly	*Papilio demoleus* (Linné, 1758)
6.	Common Mormon	*Papilio polytes* (Cramer, 1775)

Family: Pieridae

7.	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)
8.	Common Grass Yellow	*Eurema hecabe* (Linné, 1758)
9.	Common Jezebel	*Delias eucharis* (Drury, 1773)
10.	Mottled Emigrant	*Catopsilia pyranthe* (Linné, 1758)

Family: Nymphalidae

11.	Grey Pansy	*Junonia atlites* (Linné, 1763)
12.	Lemon Pansy	*Junonia lemonias* (Linné, 1758)
13.	Chocolate Pansy	*Junonia iphita* (Cramer, 1779)
14.	Peacock Pansy	*Junonia almana* (Linnaeus, 1758)
15.	Common Duffer	*Discophora sondaica* (Stichel, 1902)

Family: Lycaenidae

16.	Striped Pierrot	*Tarucus nara* (Kollar, 1848)
17.	Pale Grass Blue	*Pseudozizeeria maha* (Kollar, 1848)
18.	Slate Flash	*Rapala manea* (Moore, 1879)
19.	Common Lineblue	*Prosotas nora* (Moore, 1875)
20.	Common Ciliate Blue	*Anthene emolus* (Godart, 1823)

Family: Hesperidae

21.	Straight Swift	*Parnara guttatus* (Moore, 1865)
22.	Conjoined Swift	*Pelopidas conjuncta* (Herrich-Schäffer, 1869)
23.	Brown Awl	Badamia exclamationis (Fabricius, 1775)

Family: Satyridae

24.	Common Evening Brown	*Melanitis leda* (Linné, 1758)

A total of 24 species of butterflies were recorded during the survey. The existing checklist of butterfly is not complete so further studies are needed to update the checklist. This inventory work will be helpful for decision makers to implant any industry keeping the diversity intact.

Collection of data for phylogenetic analysis

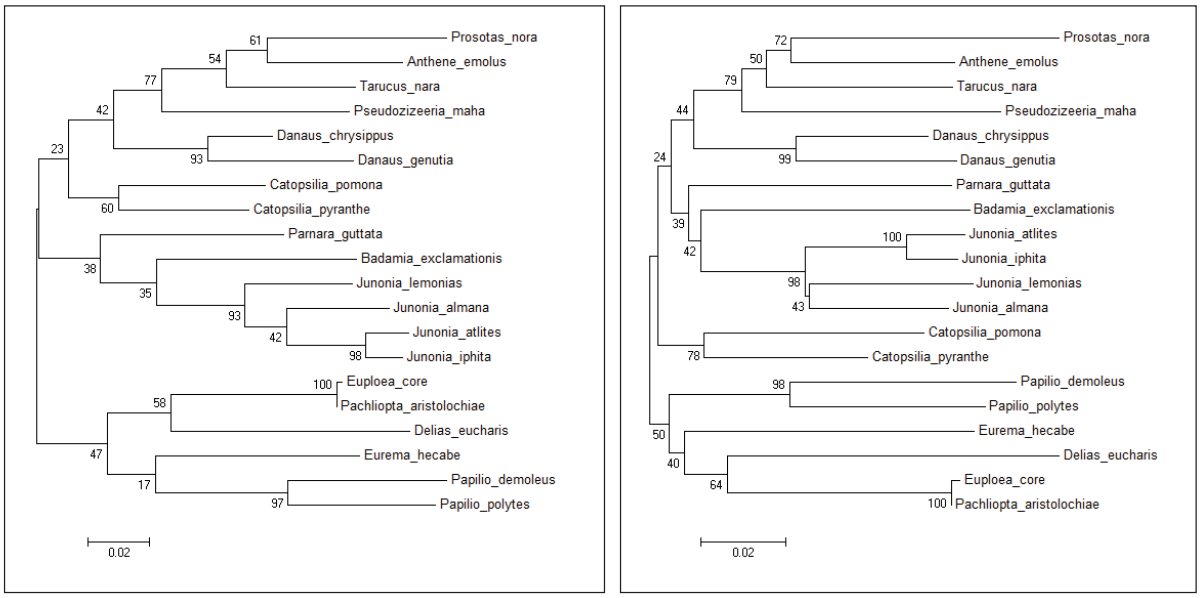
COI gene sequence of Twenty (20) butterfly species was collected from National Center for Biotechnology Information (NCBI) for their molecular and phylogenetic analysis.

Name of Species	GenBank Accession Number
Danaus chrysippus	HQ990426.1
Euploea core	JX261942.1
Danaus genutia	KC755857.1
Pachliopta aristolochiae	AB851904.1
Papilio demoleus	KP759524.1
Papilio polytes	HQ962338.1
Catopsilia pomona	HQ962273.1
Eurema hecabe	KC755861.1
Delias eucharis	KX008047.1
Catopsilia pyranthe	KC755841.1
Junonia atlites	HQ962256.1
Junonia lemonias	HQ962241.1
Junonia iphita	HQ962225.1
Junonia almana	KC755867.1
Tarucus nara	KJ402193.1
Pseudozizeeriamaha	KF492057.1
Prosotas nora	HQ962284.1
Anthene emolus	KJ508004.1
Parnara guttatus	HQ990729.1
Badamia exclamationis	KF391242.1

Phylogenetic analysis

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885; Tamura *et al*., 1985). All twenty species of butterfly were grouped into two clusters in both

maximum-likelihood and Neighbour-joining tree construction. In maximum-likelihood tree, *Euploea core* and *Pachliopta aristolochiae* showed highest bootstrap value (100). Sub cluster *Euploea core* and *Pachliopta aristolochiae, Junonia atlites and Junonia almana* showed highest bootstrap value 100 in neighbor Joining tree. In both phylogenetic analyses, all species showed very close relationship.



A. Maximum-likelihood tree **B. Neighbor-Joining Tree**

Fig 3. Evolutionary relationships among twenty butterfly species were constructed using MEGA 6 software. In maximum likelihood tree (A), the evolutionary history was inferred by using the Maximum Likelihood method based on the Kimura 2-parameter model. The tree with the highest log likelihood (-3863.6675) is shown. In neighbor- joining tree (B), the evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 1.05302345 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches. The bar (0.02) at the bottom is a scale for genetic change.

Genetic Distance:

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6 (Tamura *et al*., 2013).Interspecific genetic divergence range of butterfly species was 0.00-0.20. *Prosotas nora* showed highest (0.20) pairwise distance than rest. *Pachliopta aristolochiae* showed lowest (0.00) pairwise distance among studied butterflies.

Table : Interspecific K2P sequence divergence at the COI barcode region among butterflies

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Danaus chrysippus																				
Euploea core	0.15																			
Danaus genutia	0.07	0.14																		
Pachliopta aristolochiae	0.14	0.00	0.14																	
Papilio demoleus	0.17	0.12	0.17	0.13																
Papilio polytes	0.16	0.14	0.16	0.13	0.10															
Catopsilia pomona	0.12	0.13	0.14	0.13	0.13	0.15														
Eurema hecabe	0.14	0.13	0.14	0.13	0.15	0.14	0.14													
Delias eucharis	0.14	0.13	0.15	0.13	0.19	0.18	0.17	0.15												
Catopsilia pyranthe	0.10	0.12	0.12	0.12	0.13	0.13	0.09	0.13	0.15											
Junonia atlites	0.13	0.15	0.11	0.14	0.15	0.15	0.13	0.15	0.16	0.11										
Junonia lemonias	0.14	0.15	0.14	0.15	0.17	0.15	0.14	0.16	0.18	0.14	0.08									
Junonia iphita	0.13	0.14	0.11	0.14	0.15	0.14	0.13	0.15	0.16	0.12	0.03	0.07								
Junonia almana	0.13	0.14	0.14	0.13	0.14	0.13	0.14	0.13	0.17	0.13	0.07	0.07	0.07							
Tarucus nara	0.12	0.15	0.14	0.15	0.18	0.16	0.14	0.16	0.17	0.12	0.13	0.10	0.13	0.11						
Pseudozizeeria maha	0.12	0.17	0.13	0.17	0.17	0.15	0.14	0.16	0.17	0.12	0.16	0.15	0.16	0.17	0.10					

Prosotas nora	0.12	0.19	0.14	0.18	0.18	0.19	0.16	0.16	0.20	0.15	0.16	0.17	0.16	0.16	0.11	0.13				
Anthene emolus	0.12	0.16	0.13	0.15	0.15	0.14	0.13	0.15	0.17	0.11	0.13	0.12	0.12	0.13	0.0	0.13	0.10			
Parnara guttatus	0.13	0.14	0.13	0.14	0.15	0.14	0.13	0.16	0.17	0.13	0.13	0.13	0.13	0.12	0.12	0.15	0.15	0.13		
Badamia exclamationis	0.13	0.15	0.14	0.15	0.17	0.16	0.13	0.15	0.17	0.12	0.13	0.11	0.13	0.12	0.13	0.15	0.17	0.14	0.13	

Plate 10: Two dominant butter fly species of study area Grey pansy(left) and Common Duffer (right)

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OTHER COMMON INSECT FAUNA OBSERVED IN THE STUDY AREA

Plate 10: Oleander aphids(Aphis nerii) and ant association on a Akond (*Calotropis*) tree growing in study area. Aphids sucking latex.

Plate 11: Green spotted beetle

Plate 12: Huge number of Ground Beetle was observed in the bank of river near study area

Plate 13: Considerable number of Cattle poisoning sawfly was observed near cattle grazing in the study area

Plate 14: Flies on Akond leaf

Plate 15: Green Bottle Fly – *Lucilia sp.*

CHAPTER - II

MOLLUSCA FAUNA

Numerous molluscs live in freshwater and terrestrial habitats, both lotic (flowing water) such as rivers, streams, canals, springs, and underground cave streams (stygobite species) and lentic (still water) such as lakes, ponds. The two major classes of molluscs have representatives in freshwater: the gastropods (snails) and the bivalves (freshwater mussels and clams).Freshwater mollusca populations have been declining for decades and are among the most seriously impacted aquatic animal's worldwide (Bogan 1993, Williams *et al*.1993). However, in 2004 the IUCN Red List of Threatened Species included nearly 2,000 endangered non marine molluscs.

Human interaction: For millennia, molluscs have been a source of food for humans, as well as important luxury goods, notably pearls, mother of pearl, Tyrian purple dye, sea silk, and chemical compounds. Their shells have also been used as a form of currency in some preindustrial societies. Snails and slugs can also be serious agricultural pests.

Bioindicators: Most freshwater mollusca prefer well oxygenated water and a constant flow of shallow water (COSWIC 2003, Strayer2004). Biological monitoring of rivers using benthic macro invertebrates is accepted as a useful tool for the assessment of water quality (Hellawell 1986, Rosenberg and Resh 1993).Bivalve molluscs are used as bioindicators to monitor the health of aquatic environments in both fresh water and the marine environments. Their population status or structure, physiology, behavior or the level of contamination with elements or compounds can indicate the state of contamination status of the ecosystem.

Collection and Identification

Specimens were collected by hand picking from the dry areas of river bank and from fisherman. Species were identified based upon morphological characteristics of the shell, photographs and other taxonomic keys. The shell characters such as shape, spire length and shape, mouth opening, opercular shape, umbilicus shape and size, color and ornamentation of the shell are used mainly for the identification apart from the internal characters of which the important one is radula.

FINDINGS

Molluscs found during the survey are as follows:

Table: List of Molluscs found in survey areas

i. Class: Gastropoda

Sl No.	Family	Common name	Scientific name
1.	Pilidae	Common Apple snail	*Pila globosa*
2.	Pilidae	Apple-snail	*Pila virens*
3.	Viviparidae	River Snail	*Bellamya begalensis*
4.	Thiaridae	Screw Snail	*Melanoides tuberculata*
5.	Thiaridae	Brotia Snail	*Brotia costula*
6.	Lymnaeidae	Lymneid Snail	*Lymnaea luteola*

ii. Class: Bivalvia

Sl No.	Family	Common name	Scientific name
1.	Unionidae	Fresh water Mussel	*Lamellidens corrianus*
2.	Unionidae	Fresh water Mussel	*Lamellidens marginalis*
3.	Unionidae	Fresh water Mussel	*Lamellidens jenkinsianus*
4.	Unionidae	Fresh water Mussel	*Parreysia corrugata*
5.	Sphaeriidae	Striated Fingernail	*Sphaerium striatinum*

Six Gastropod species and 5 Bivalves were found during survey. Ofcourse, this area contains more mollusc fauna that could not found during this short time survey. Future research needs to continue to make a complete list and look at the habitatlocations of the different species of freshwater mollusca of this area.

Plate 16: Dead Mollusc shells in the survey area

Plate 17: River snail (*Bellamya begalensis*)

Plate 18: Apple snail (*Pila globusa*)

Plate 19: Screw Snail (*Melanoides* sp)

Plate 20: Fresh water Mussel: *Parreysia corrugata* (External view of shell)

Plate 21: Fresh water Mussel: *Parreysia corrugata* (Internal view of shell)

Plate 22: Fresh water Mussel (*Lamellidens jenkinsianus*)

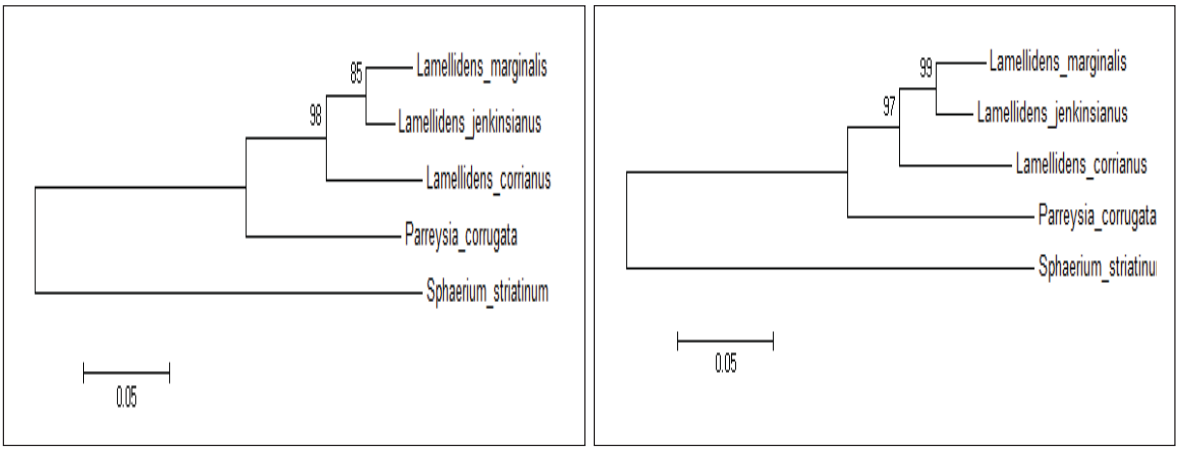
Collection of data for phylogenetic analysis

COI gene sequence of five (5) mollusk species was collected from National Center for Biotechnology Information (NCBI) (http://ncbi.nlm.nih.gov) for their molecular and phylogenetic analysis.

Name of species	GenBank Accession number (COI gene)
Lamellidens corrianus	JQ861225.1
Lamellidens marginalis	KP268834.1
Lamellidens jenkinsianus	KP268836.1
Parreysia corrugate	KJ872816.1
Sphaerium striatinum	AF120667.1

Phylogenetic analysis of Mollusca

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885;Tamura et al., 1985). In both phylogenetic trees (Maximum Likelihood and Neighbour-joining), grouped Five (5) mollusc species into two clusters. In maximum likelihood tree, *Lamellidens corrianus, Lamellidens marginalis, Lamellidens jenkinsianus, Parreysia corrugate* were grouped within same cluster. Same results were shown in neighboou-joining tree analysis. In maximum likelihood trees, highest bootstrap value (98) were observed in *Lamellidens corrianus ,Lamellidens marginalis, Lamellidens jenkinsianus*sub clusters. In neighbor-joining tree, highest bootstrap value (99) was observed in *Lamellidens marginalis* and *Lamellidens jenkinsianus*sub cluster. The bar at the bottom 0.05 is a scale for the genetic change (Fig 1).



A. Maximum likelihood tree **B. Neighbour Joining tree**

Fig 4. Evolutionary relationships among five mollusc species were constructed using MEGA 6 software. In maximum likelihood tree (A), the evolutionary history was inferred by using the Maximum Likelihood method based on the Kimura 2-parameter model. The tree with the highest log likelihood (-2220.1663) is shown. In neighbor- joining tree (B), the evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 1.42922426 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches.

Genetic Distance

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6(Tamura et al., 2013). Interspecific genetic divergence range of mollusc species was 0.04-0.48.*Sphaeriumstriatinum* showed highest (0.41) pairwise distance than rest. *Lamellidens jenkinsianus* showed lowest (0.04) pairwise distance among studied Mollusc.

Table : Interspecific K2P sequence divergence at the COI barcode region among molluscs

	1	2	3	4	5
1.*Lamellidens corrianus*					
2.*Lamellidens marginalis*	0.10				
3.*Lamellidens jenkinsianus*	0.10	0.04			
4.*Parreysia corrugate*	0.18	0.17	0.16		
5.*Sphaerium striatinum*	0.41	0.40	0.39	0.42	

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CHAPTER - III

FISH FAUNA

Meghna river estuary is the largest estuarine ecosystem of Bangladesh and support diverse fisheries communities compared to others. Present study was carried out to assess the fish diversity status with relation to major hydrological parameters in both spatio-temporal scales. Fish samples were collected together with water quality parameters from different sampling stations of the Meghna river estuary.

Several types of small fishes were captured and have been presented in Table 1. We were not able to capture any single big fish. Names of fishes available at other seasons of the year are presented in Table 2. According to fisherman, the rivers becomes devoid of fishes in the dry season. However, in the rainy season, few types of fishes become available. It was learnt from interviews with the fisherman and fish sellers that in the recent past the river had abundant fishes. Several types of big fishes like Rui, Catla, Ayre, Mrigel, Boal along with different types of small fishes were very common. But at present number of all types of fishes has declined greatly. The physical parameters are shown in table 3.

Table 1. List of small fishes captured during survey period by using different types of fishing nets from the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Local Name	Scientific Name	Sampling Locations			
		Location 1	Location 2	Location 3	Location 4
Golsha	*Mystus cavasius*	-	-	-	+
Bele	*Glossogobius giuris*	-	-	-	-
Tengra	*Mystus vittatus*	+	-	-	
Puti	*Puntius conchonius*	+	+	+	+
Fali	*Notopterus notopterus*	-	+	-	-
Kachki	*Coricasu borna*	++	++	++	++
Mola	*Amblypharyngodon mola*	+	-	-	+
Kakila	*Xenentodon cancila*	-	-	-	-
Chapila	*Gudusia chapra*	-	+	-	+
Kholisha	*Colisha fasciatus*	-	-	-	+

Chingri	*Macrobrachium eqidense*	-	+	-	+
Shol	*Channa striatas*	-	-	-	-
Taki	*Channa punctatus*	-	-	-	-
Shing	*Heteropneustes fossilis*	-	-	-	-
Koi	*Anabas testudineus*	-	-	-	-
Pabda	*Ompok pabda*	-	-	-	+

Status: ++Common, +Few, - Absent

Table 2. List of fish fauna recorded during the survey as mentioned by the local people and fishermen

Common English name	Local Name	Scientific Name	Abundance
Rohu	Rui	*Labeo rohita*	+
Catla	Katla	*Catla catla*	+
Black Rohu	Kalibaush	*Labeo calbasu*	+
Freshwater Shark	Boal	*Wallago attu*	+
Long-whiskered Catfish	Ayre	*Sperata aor*	+
Tire-track Spiny Eel	Bain	*Mastacembelus armatus*	+
Humped Featherback	Chital	*Chitala chitala*	+
Dwarf Chamelonfish	Meni	*Badis badis*	+
Dwarf Catfish	Batashi	*Batasio tengana*	+
Pama Croaker	Poa	*Otolithoides pama*	+
River Shad	Ilish	*Tenulosa ilisha*	+
Gangetic Hairfin	Fasha	*Setipinna phasa*	+
Silondia Vacha	Shilong	*Silonia silondia*	+
Batchwa Vacha	Bacha	*Eutropiichthys Vacha*	+
Gangetic Lotia	Kala Bata	*Crossocheilus latius*	+
Ghora-chela	Ghora Chela	*Securicula gora*	+
Giant Snakehead	Gagarr	*Channa marulius*	+
Walking Catfish	Magur	*Clarius batrachus*	+
Spotted Snakehead	Taki	*Channa punctatus*	+

Spotted Snakehead	Shol	*Channa punctatus*	+
Walking Snakehead	Ranga Cheng	*Channa orientalis*	+
Victory Loach	Dari	*Scistura scaturigina*	+
Choukkani	Kanpona	*Aplocheilus panchanx*)	+
Stinging Catfish	Shing	*Heterpeneustes fossilis*	+

Status: +Few

Phylogenetic analysis:

The evolutionary history was depicted using MEGA 6 (Tamura *et al*., 1985) based on maximum likelihood tree method.

The Maximum Likelihood method grouped 13 fish species into two clusters. One cluster includes *Labeo rohita, Labeo bata, Labeo gonius, Punctius ticto, Channa striata, Channa marulius, Mystus vitatus, Mystus cavasius and Ambyypharyngodon mola* while other cluster includes *Punctius sarana, Labeo calbasu, Channa punctatus and Mystus tengra*. All species are closely related and highest bootstrap value (82) was shown in the sub cluster of *Channa striata* and *Channa marulius.*

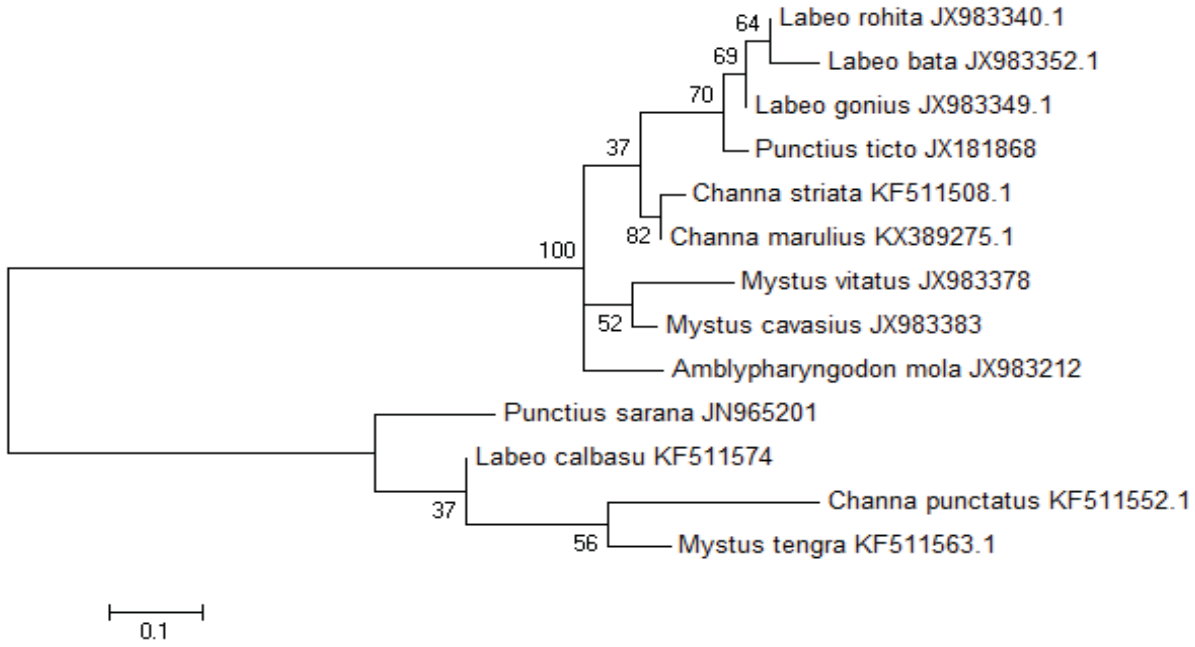

Fig. Evolutionary relationship among 13 fish species were constructed using MEGA-6 software based on Kimura 2- best fitted model.

Table 3. Water quality parameters of the river Meghna near Reliance Meghnaghat 750 MW CCPP

Parameters	Location 1	Location 2	Location 3	Location 4
Temperature (^{0}C ±SE)	22.6 ± 1.2	22.4 ± 1.01	21.6 ± 1.05	22.8 ± 1.02
Secchi depth (Cm±SE)	114 ± 10.2	88.6 ± 9.1	79 ± 14.1	105 ± 15.01

Macrobrachium rosenbergii

Macrobrachium ohione

Glossogobius giuris

Metapenaeus joyneri and *Acetes japonicas*

Giant fresh water prawn, Acetes japonicas and *Anguilla bengalensis*

Parambassis ranga

Fig. Some representative of the freshwater fishes collected from different locations of the River Meghna.

Chitala chitala and Labeo bata

Amblypharyngodon mola

Ambassis nalua

Notopterus notopterus, labeo bata and *puntius sarana*

Ailia coila

Apocryptes bato

CHAPTER - IV

Plankton diversity

Phytoplanktons are the producer of the river ecosystem and thus their status are of prime importance. List of Phytoplanktons and Zooplankton found in the water samples of different sampling locations are presented respectively in Table 1 and 2.

Table 1.List of zooplanktons recorded from the water samples of the different sampling locations of the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Name of the species	Number of the species at different sampling locations			
	Location 1	Location 2	Location 3	Location 4
Escarpia	9	5	11	8
Keratella	2	1	5	8
Brachiomus	4	8	9	13
Lepadella	-	5	9	-
Cyclops	6	9	12	9
Diatomus	7	5	4	13
Bosmina	5	9	3	8
Daphnia	7	3	8	7
Euglena sp	3	9	4	4
Phacus	2	5	2	8
Trichocera	-	1	1	-
Monostyta	1	1	3	1
Nebalia	5	2	8	11
Hexarthra	-	5	11	12
Heterocypris	2	8	12	14

Data from each sampling locations represents total of 5 samples, 1 ml each time

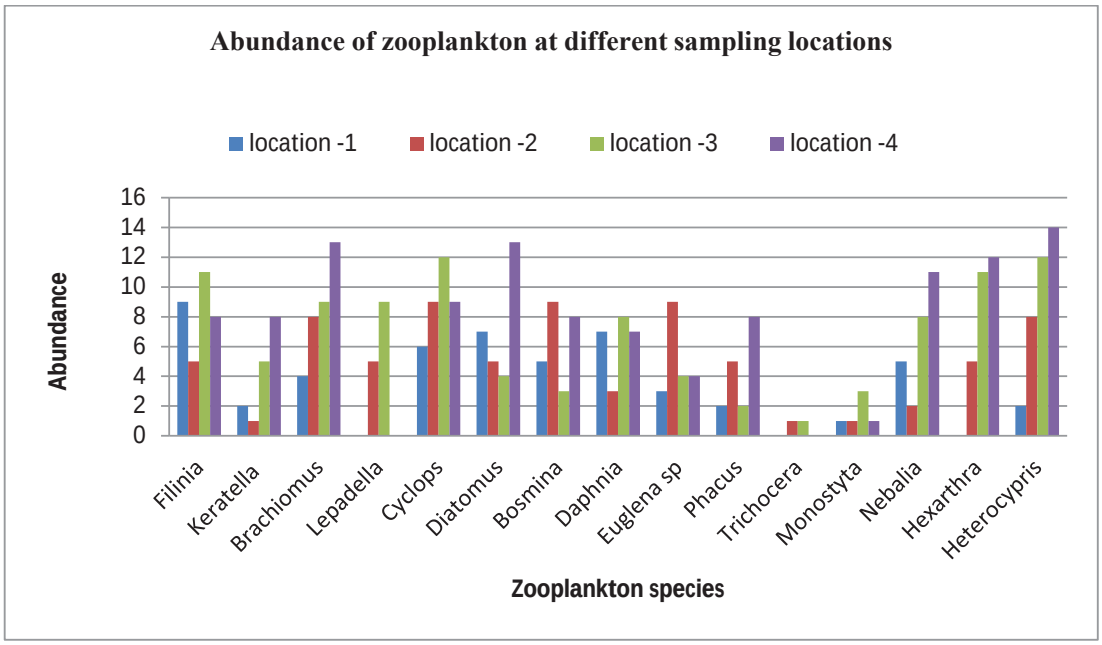

Table 2. List of phytoplanktons recorded from the water samples of the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Name of the species	Number of the species at different sampling locations			
	Location 1	Location 2	Location 3	Location 4
Chlorella	8	3	6	11
Nostoc sp.	3	5	4	8
Chlamydomonas	8	11	-	9
Oedogonium sp.	8	4	7	2
Cosmarium	5	9	11	9
Pithophora sp.	2	11	10	1
Pinnularia	1	3	-	2
Volvox sp.	1	11	2	11
Oscillatoria sp.	4	-	2	-
Chlamydomonas sp.	-	3	2	2
Nitzschia	2	11	2	3

Synedra	3	7	8	1
Navicula sp.	8	-	1	2
Melosira,	2	5	1	-
Cymbella	1	3	2	1
Anabaena	3	2	3	7
Nitzschia sp.	-	1	2	3
Microcystis,	-	2	1	10
Euglena	4	11	8	9

Data from each sampling locations represents total of 5 samples, 1 ml each time

CHAPTER - IV

WILDLIVE FAUNA (AVI FAUNA)

WILDLIFE DIVERSITY

Biodiversity boosts ecosystem productivity where each **species**, no matter how small, all have an **important** role to play. Greater **species diversity** ensures natural sustainability for all life forms. Besides basic survival and global health, wildlife plays an important role in other facets of life like economics and recreation. One of the most important of wild lives are birds. Birds are among the best monitors of environmental changes. Changes in their population, behavior patterns, and reproductive ability have most often been used to examine the long-term effects of habitat fragmentation (Harisha and Hosetti, 2009). Ecologically, birds are of tremendous importance because of their key roles as pollinators and agents of seed dispersal (Bibi and Ali, 2013). Therefore, understanding the diversity and structure of bird communities is essential to delineate the importance of regional or local landscapes for avian conservation (Kattan and Franco, 2004). The preservation of global species diversity has emerged as one of the most important issues today (Hu *et al*., 2011). Birds are very sensitive to environmental changes and are used as a "**bioindicator**."

Birds occupy almost all habitat types and diversity of birds often serves as a good indication of overall diversity of a given area (Furness and Greenwood, 1993). Birds are also known to be responsive to any kind of changes to their ambient conditions hence can be used as bioindicator (Padoa–Schioppa *et al*., 2006).

Study of avifaunal diversity is an essential ecological tool which acts as an important indicator to evaluate different habitats both qualitatively and quantitatively (Bilgrami, 1995). Unfortunately global diversity of birds is decreasing incessantly primarily due to anthropogenic disturbances (Rapoport, 1993) and climate change (Chen *et al*., 2011; Sekercioglu *et al*., 2012). No surprise that IUCN Red List of endangered birds has already recognized 1226 bird species as threatened globally (Bird Life International 2010).

We noted **common bird species** that we observed during our one day survey. Certainly this is not a complete list of avifaunal diversity. To make a complete list more intensive and season wise study is necessary.

COMMON BIRDS OBSERVED DURING THE STUDY

Plate 23: Jungle Myna searching for food in a field

Common name: Jungle Myna
Scientific name: *Acridotheres fuscus*
Family: Sturnidae

Behavior

This bird is a common resident breeder in tropical southern Asia including Bangladesh. This common passerine is typically found in forest and cultivation. The jungle myna builds a nest in hole. During the study this species was abundantly observed near cattle grazing field.

The jungle myna is fairly omnivorous, eating fruit, grain and insects. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites.

Plate 24: Pied Myna searching for food in a field(left), a yet to be adult resting (right)

Common name **:** Pied Myna or Asian Pied Starling
Scientific Name **:** *Gracupica contra*
Family **:** Sturnidae

Behavior

This myna is strikingly marked in black and white and has a yellowish bill with a reddish bill base. They are found mainly in areas with access to open water.

Its habitat is lowland open areas with scattered trees near water, often near human habitation. This species is often seen at sewage farms and refuse tips. During the study this species was abundantly observed near cattle grazing field.

These starlings are usual found in small groups, foraging mainly on the ground but perching on trees and buildings. Their diet mostly consists of insects, worms, spiders, etc. and various fruits.

Plate 25: Brahminy kite flying and searching for food over the river

Common Name: Brahminy kite
Scientific Name: *Haliastur indus*
Family: Acciptridae

Behavior

The **brahminy kite** (*Haliastur indus*), is a medium-sized bird of prey in the family Accipitridae. They are found mainly on the coast and in inland wetlands where they feed on dead fish and other prey. Adults have a reddish-brown plumage and a contrasting white head and breast which makes them easy to distinguish from other birds of prey.

During the study few such birds were found flying and searching for food and perching.

It is primarily a scavenger, feeding mainly on dead fish and crabs, especially in wetlands and marshland but occasionally hunts live prey such as hares and bats.

Plate 26: Pariah kite flying and searching for food (left) and preying (right)

Common Name **:** Pariah kite
Scientific Name **:** *Milvusmigrans*
Family **:**Acciptridae

Behavior

The **black kite** (*Milvus migrans*) is a medium-sized bird of prey in the family Accipitridae. Unlike others of the group, black kites are opportunistic hunters and are more likely to scavenge. They spend a lot of time soaring and gliding in thermals in search of food. Their angled wing and distinctive forked tail make them easy to identify.

Black kites are most often seen gliding and soaring on thermals as they search for food.

During the study a good number of such birds were observed flying and preying.

Plate 27: Black headed sea gull (First winter plumage)

Common Name	**:** Black headed sea gull
Scientific Name	**:** Chroicocephalus *ridibundus*
Family	**:** Laridae

Behavior

Like most gulls, it is highly gregarious in winter, both when feeding or in evening roosts. During the study, a considerable such birds were found swimming and searching their food on the river. The black-headed gull is Omnivorous in nature and opportunistic feeder. It eats insects, fish, seeds, worms, some seeds and berries, scraps, and carrion in towns, or invertebrates in ploughed fields with equal relish. It is a noisy species, especially in colonies.

Plate 28: Fork tailed drongo/Black drongo (*Dicrurus adsimilis*)

Common Name **:** Fork tailed drongo

Scientific Name **:** *Dicrurus adsimilis*

Family **:**Dicuridae

Behavior

The **fork-tailed drongo**, also called the **common drongo**, black droongo (*Dicrurus adsimilis*), is a species of drongo in the family Dicruridae, which are medium-sized passerine birds .

The fork-tailed drongo is a common and widespread resident breeder. They also utilize disturbance caused by animals, and may perch on their backs. At times they catch ectoparasites on mammals, plunge-dive to catch fish, or kleptoparasitise mammals or birds. During our study we observed a considerable such birds in resting, perching and preying condition.

These insect-eating birds are usually found in open forests or bush, and are tolerant of arid climates. They are almost exclusively carnivorous, but may take nectar when available. They flycatch or take prey from the ground, and are attracted to bush fires.

Plate 29: Little cormorant resting (up) and searching food (down) in the study area of river Meghna

Common Name	**:** Little cormorant
Scientific Name	**:** *Microcarbo niger*
Family	**:** Phalacrocoracidae

Behavior

The **little cormorant** (*Microcarbo niger*) is a member of the cormorant family. It forages singly or sometimes in loose groups in lowland freshwater bodies, including small ponds, large lakes, streams and sometimes coastal estuaries. These birds are seen in both inland and coastal water bodies. They are found in village ponds, estuaries, lagoons, creeks, tidal flats, marshes, swamps, fish ponds, lakes and streams. Little cormorants tend to forage mainly in small loose groups and are often seen foraging alone.

The little cormorant mostly feed on fish and sometimes also crustaceans and amphibians. They drive to catch they prey and surface to swallow it.

Plate 30: Cattle egret searching for its food.

Common Name **:**Cattle egret
Scientific Name **:***Bubulcus ibis*
Family **:** Ardeidae

Behavior

It is a white bird adorned with buff plumes in the breeding season. It nests in colonies, usually near bodies of water and often with other wading birds.

Their feeding habitats include seasonally inundated grasslands, pastures, farmlands, wetlands and rice paddies. They often accompany cattle or other large mammals, catching insect and small vertebrate prey disturbed by these animals.

The cattle egret feeds on a wide range of prey, particularly insects, especially grasshoppers, crickets, flies(adults and maggot, and moths, as well as spiders, frogs, and earthworms.

Plate 30: Common tern flying

Common Name **:** Common Tern

Scientific Name **:** *Sterna hirundo*

Family **:** Sternidae

Feeding behavior:

The common tern feeds by plunge-diving for fish, from a height of 1–6 m (3.3–19.7 ft), either in the sea or in freshwater lakes and large rivers. The bird may submerge for a second or so, but to no more than 50 cm (20 in) below the surface. When seeking fish, this tern flies head-down and with its bill held vertically. Few tern was observed during the study time

GARDEN LIZARD

The oriental garden lizard, eastern garden lizard or changeable lizard (*Calotes versicolor*) is an agamid lizard found widely distributed in Asia. Garden lizard was observed during the survey period.

Changeable Lizards eat mainly insects and small vertebrates, including rodents and other lizards. Although they have teeth, these are designed for gripping prey and not tearing it up. So prey is swallowed whole, after it is stunned by shaking it about. Sometimes, young inexperienced Changeable Lizards may choke on prey which are too large. Occasionally changeable lizards also consume vegetable matter. During the breeding season, the male's head and shoulders turns bright orange to crimson and his throat black. Males also turn red-headed after a successful battle with rivals. Both males and females have a crest from the head to nearly the tail, hence their other common name "Crested Tree Lizard".

Plate 32: Oriental Garden Lizard *Calotes versicolor*

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Annexure: 4.4

I-BAT Findings

I-BAT FINDINGS OF PROJECT AREA

Table 1. Comprehensive checklist of the identified plant recorded from the selected sites of the proposed power plant project area at Meghnaghat, Bangladesh during December 2016.

A. Aquatic/wetland flora					
Sl.no.	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
1.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Baghjama	Herb	Dicot
2.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Henchi	Creeper	Dicot
3.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	Jalkachu	Herb	Monocot
4.	*Azolla pinnata*	Azollaceae	Azola	Herb	Fern
5.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Hijal	Tree	Dicot
6.	*Colocasia esculenta* (L.) Schott	Araceae	Kachu	Herb	Mocot
7.	*Crateva magna* (Lour.) DC.	Capparaceae	Borun	Tree	Dicot
8.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Gangkochu	Herb	Monocot
9.	*Cyperus rotundus* L.	Cyperaceae	Muthaghas	Herb	Monocot
10.	*Cyperus* sp	Cyperaceae	Bhadighas	Herb	Monocot
11.	*Eichhornia crassipes* (Mart.) Solms	Pontedariaceae	Kachuripana	Herb	Mocot
12.	*Enhydra fluctuans* Lour.	Asteraceae	Helencha	Creeper	Dicot
13.	*Ficus heterophylla* L. f.	Moraceae	Latadumur	Climber	Dicot
14.	*Floscopia* sp.	Commelinaceae	Kanshira	Herb	Monocot
15.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Makhna	Herb	Dicot
16.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Jalghas	Creeper	Monocot
17.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kolmi shak	Creeper	Dicot
18.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Dholkalmi	Herb	Dicot
19.	*Leersia hexandra* Sw.	Poaceae	Aralighas	Herb	Mocot
20.	*Lemna perpusilla* Torrey	Lemnaceae	Khudipana	Herb	Mocot
21.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Limnophila	Herb	Dicot
22.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Keshordom	Creeper	Dicot
23.	*Ludwigia hyssopifolia* (G. Don) Exell apud A. & R. Fernandas	Onagraceae	Bonmorich	Herb	Dicot
24.	*Marsilea minuta* L.	Masileaceae	Susni sak	Creeper	Fern
25.	*Najas minor* L.	Najadaceae	Najas	Herb	Dicot
26.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Chandmala	Herb	Dicot
27.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Bishkathali	Herb	Dicot
28.	*Persicaria barbata* (L.) Hara	Polygonaceae	Bishkathali	Herb	Dicot
29.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
30.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
31.	*Pistia stratiotes* L.	Araceae	Topapana	Herb	Mocot
32.	*Polygonum plebeium* R. Br.	Polygonaceae	Bishkathali	Herb	Dicot
33.	*Rotala indica* (Willd.) Koehne	Lythraceae	Deshi ghurni	Herb	Dicot
34.	*Salvinia cucullata*	Salviniaceae	Indurkanipana	Herb	Fern
35.	*Salvinia molesta*	Salviniaceae	Boropatapana	Herb	Fern
36.	*Salvinia natans*	Salviniaceae	Basanpatapana	Herb	Fern
37.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Chechri	Herb	Mocot
38.	*Trewia nudiflora* L.	Euphorbiaceae	Petali	Tree	Dicot
39.	*Vallisneria spiralis* L.	Hydrocharitaceae	Patajahangi	Herb	Mocot

Table continued….

B. Terrestrial flora					
Sl no	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
40.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Akashmoni	Tree	Dicot
41.	*Aegle marmelos* (L.) Corr.	Rutaceae	Bel	Tree	Dicot
42.	*Ageratum conyzoides* L.	Asteraceae	Phulkuri	Herb	Dicot
43.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Kkoroi	Tree	Dicot
44.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Kalokoroi	Tree	Dicot
45.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Silkoroi	Tree	Dicot
46.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Chhoto chanchi	Creeper	Dicot
47.	*Amaranthus gangeticus* L.	Amaranthaceae	Notey shak	Herb	Dicot
48.	*Amaranthus spinosus* L.	Amarantaceae	Katanotey	Tree	Dicot
49.	*Amaranthus tricolor* L.	Amaranthaceae	Lalshak	Herb	Dicot
50.	*Amaranthus viridis* L.	Amaranthaceae	Notey	Herb	Dicot
51.	*Ammannia baccifera* L.	Lythraceae	Acidpata	Herb	Dicot
52.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Dekia	Herb	Fern
53.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Bontulshi	Herb	Dicot
54.	*Annona reticulate* L.	Annonaceae	Ata, Nona Ata	Tree	Dicot
55.	*Annona squamosa* L.	Annonaceae	Shorifa	Shrub	Dicot
56.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Pitraj	Tree	Dicot
57.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Chapalish	Tree	Dicot
58.	*Artocarpus heterophyllus* Lamk.	Moraceae	Kathal	Tree	Dicot
59.	*Arundo donax* L.	Poaceae	Gangabena	Tree	Mocot
60.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Kukshim	Climber	Dicot
61.	*Averrhoa carambola* L.	Oxalidaceae	Kamranga	Tree	Dicot
62.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Chapraghas	Herb	Mocot
63.	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Tree	Dicot
64.	*Brassica nigra* (L.) Koch	Brassicaceae	Shorisha	Herb	Dicot
65.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Arhor	Shrub	Dicot
66.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Akond	Shrub	Dicot
67.	*Cardiospermum halicacabum* L.	Sapindaceae	Phutkilata	Climber	Dicot
68.	*Carica papaya* L.	Caricaceae	Papaya	Herb	Dicot
69.	*Centella asiatica* (L.) Urban	Apiaceae	Thankuni	Creeper	Dicot
70.	*Chenopodium album* L.	Chenopodiaceae	Botua shak	Herb	Dicot
71.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	German lata	Herb	Dicot
72.	*Chloris barbata* Sw.	Poaceae	Ghash	Herb	Monocot
73.	*Christella dentate*	Thelypteridaceae	Dekia	Herb	Fern
74.	*Cissampelos pareira* L. var. hirsuta (Buch.-Ham. *ex* DC.) Forman	Menispermaceae	Lotagach	Climber	Dicot
75.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Jambura	Tree	Dicot
76.	*Cleome rutidosperma* DC.	Capparaceae	Hurhurey	Herb	Dicot
77.	*Cleome viscosa* L.	Capparaceae	Holudhurhurey	Herb	Dicot
78.	*Clerodendrum viscosum* Vent.	Verbenaceae	Vat	Shrub	Dicot
79.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Telakucha	Herb	Dicot
80.	*Cocos nucifera* L.	Arecaceae	Narical	Tree	Mocot
81.	*Commelina benghalensis* L.	Commelinaceae	Kanchira	Herb	Mocot
82.	*Commelina longifolia* Lamk.	Commelinaceae	Kanai, Kanchira	Herb	Mocot
83.	*Corchorus olitorius* L.	Tiliaceae	Bonpat/Titpat	Herb	Dicot
84.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Babuni	Herb	Dicot
85.	*Crotalaria pallida* Ait.	Fabaceae	Jhonjhoni	Herb	Dicot
86.	*Croton bonplandianus* Baill.	Euphorbiaceae	Banmarich	Herb	Dicot
87.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Mistikumra	Climber	Dicot
88.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	Chhoto Apang	Herb	Dicot
89.	*Cynodon dactylon* (L.) Pers.	Poaceae	Durba	Herb	Mocot
90.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Sharnalata	Climber	Dicot

Table continued….

91.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	unknown	Herb	Dicot
92.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Ghash	Herb	Monocot
93.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Sharpil bhuipata	Herb	Dicot
94.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Bonmotosuti	Herb	Dicot
95.	*Desmodium triflorum* (L.) DC.	Fabaceae	Tripatri shak	Herb	Dicot
96.	*Dillenia indica* L.	Dilleniaceae	Chalta	Tree	Dicot
97.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Chuprialu	Climber	Monocot
98.	*Diospyros peregrina* Guerke	Ebenaceae	Deshigab	Tree	Dicot
99.	*Eclipta alba* (L.) Hassk.	Asteraceae	Kalokeshi	Shrub	Dicot
100.	*Eleusine indica* (L.) Gaertn.	Poaceae	Kechla	Herb	Mocot
101.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Unknown	Herb	Mocot
102.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Mulakoni	Herb	Mocot
103.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	Eucalyptus	Tree	Dicot
104.	*Euphorbia hirta* L.	Euphorbiaceae	Dudhia	Herb	Dicot
105.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Khetpapra	Creeper	Dicot
106.	*Ficus benghalensis* L.	Moraceae	Bat	Tree	Dicot
107.	*Ficus hispida* L. f.	Moraceae	Kagdumur	Tree	Dicot
108.	*Ficus religiosa* L.	Moraceae	Ashwath	Tree	Dicot
109.	*Fimbristylis acuminata* Vahl	Cyperaceae	Acumifimbry	Herb	Mocot
110.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Gimashak	Herb	Dicot
111.	*Gmelina arborea* Roxb.	Verbenaceae	Gamar	Tree	Dicot
112.	*Gnaphalium luteo-album* L.	Asteraceae	Sadalomi	Herb	Dicot
113.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Nemuti	Herb	Dicot
114.	*Heliotropium indicum* L.	Asteraceae	Hatisur	Herb	Dicot
115.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Khetpapra	Herb	Dicot
116.	*Hibiscus rosa-sinensis* L.	Malvaceae	Jaba	Shrub	Dicot
117.	*Hibiscus sabdariffa* L.	Malvaceae	Stholpadda	Shrub	Dicot
118.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Misti alu	Creeper	Dicot
119.	*Jasminum sambac* (L.) Ait.	Oleaceae	Jui	Shrub	Dicot
120.	*Kyllinga microcephala* Steud.	Cyperaceae	Muthaghas	Herb	Monocot
121.	*Lablab purpureus* (L.) Sweet	Fabaceae	Shim	Climber	Dicot
122.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lau	Climber	Dicot
123.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Jiga	Tree	Dicot
124.	*Launaea aspleniifolia* DC.	Asteraceae	Lonia	Herb	Dicot
125.	*Lawsonia inermis* L.	Lythraceae	Mehedi	Tree	Dicot
126.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Ipil-Ipil	Tree	Dicot
127.	*Leucas aspera* (Willd.) Link	Lamiaceae	Swetdrawn	Herb	Dicot
128.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Chotohelencha	Herb	Dicot
129.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lipia	Herb	Dicot
130.	*Litchi chinensis* Sonn.	Sapindaceae	Litchu	Tree	Dicot
131.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Jhinga	Climber	Dicot
132.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Mohua	Tree	Dicot
133.	*Mangifera indica* L.	Anacardiaceae	Am	Tree	Dicot
134.	*Melia azedarach* L.	Meliaceae	Gora Neem	Tree	Dicot
135.	*Melochia corchorifolia* L.	Sterculiaceae	Unknown	Shrub	Dicot
136.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Unknown	Climber	Dicot
137.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Assam lata	Climber	Dicot
138.	*Mimosa pudica* L.	Mimosaceae	Lazzabati	Herb	Dicot
139.	*Mirabilis jalapa* L.	Nyctaginaceae	Shayndhamaloti	Herb	Dicot
140.	*Moringa oleifera* Lamk.	Moringaceae	Shojna	Tree	Dicot
141.	*Momordica charantia* L.	Cucurbitaceae	Korolla	Climber	Dicot
142.	*Musa paradisiaca* L.	Mussaceae	Kathalikola	Herb	Mocot
143.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Kadom	Tree	Dicot
144.	*Ocimum sanctum* L.	Lamiaceae	Babuitulshi	Herb	Dicot
145.	*Oldenlandia corymbosa* L.	Rubiaceae	Khetpapra	Herb	Dicot

146.	*Oxalis corniculata* L.	Oxalidaceae	Amrul	Herb	Dicot
147.	*Panicum* sp.	Poaceae	Bashpatighas	Herb	Mocot

Table continued….

148.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Moissaghas	Herb	Mocot
149.	*Passiflora foetida* L.	Passifloraceae	Jhumkalata	Climber	Dicot
150.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Bera Chita	Herb	Dicot
151.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Bakan	Herb	Dicot
152.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Arboroi	Tree	Dicot
153.	*Phyllanthus niruri* L.	Euphorbiaceae	Bhuiamla	Herb	Dicot
154.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Sitka	Shrub	Dicot
155.	*Phyllanthus urinaria* L.	Euphorbiaceae	Sitka	Shrub	Dicot
156.	*Physalis minima* L.	Solanaceae	Phutka	Herb	Dicot
157.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Aripachuli	Herb	Dicot
158.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Bilati luchipata	Herb	Dicot
159.	*Psidium guajava* L.	Myrtaceae	Peyara	Tree	Dicot
160.	*Punica granatum* L.	Punicaceae	Dalim	Shrub	Dicot
161.	*Richardia scabra* L.	Rubiaceae	Khetpapra	Herb	Dicot
162.	*Ricinus communis* L.	Euphorbiaceae	Rerhi/Vrenda	Shrub	Dicot
163.	*Rorippa indica* (L.) Hiern	Brassicaceae	Bonshorisha	Herb	Dicot
164.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Ghash	Herb	Monocot
165.	*Saccharum spontaneum* L.	Poaceae	Kash	Herb	Mocot
166.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Raintree	Tree	Dicot
167.	*Scoparia dulcis* L.	Scrophulariaceae	Bandhoney	Herb	Dicot
168.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Datmardan	Shrub	Dicot
169.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Kolkashunda	Shrub	Dicot
170.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Kolkashunda	Herb	Dicot
171.	*Sida acuta* Burm. f.	Malvaceae	Berela	Herb	Dicot
172.	*Sida rhombifolia* L.	Malvaceae	Pitberela	Herb	Dicot
173.	*Solanum lycopersicum* Dunal	Solanaceae	Tomato	Herb	Dicot
174.	*Solanum melongena* L.	Solanaceae	Begun	Herb	Dicot
175.	*Solanum nigrum* L.	Solanaceae	Kakmachi	Herb	Dicot
176.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Kataegun	Herb	Dicot
177.	*Sphaeranthus indicus* L.	Asteraceae	Mundi	Herb	Dicot
178.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Amra	Tree	Dicot
179.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Ghaupata	Climber	Dicot
180.	*Swietenia mahagoni* Jacq.	Meliaceae	Mehagoni	Tree	Dicot
181.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Nakphul	Herb	Dicot
182.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jam	Tree	Dicot
183.	*Tamarindus indica* L.	Caesalpiniaceae	Tetul	Tree	Dicot
184.	*Terminalia catappa* L.	Combretaceae	Kathbadam	Tree	Dicot
185.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Holud korobi	Tree	Dicot
186.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Gulancha	Climber	Dicot
187.	*Trema orientalis* (L.) Blume	Ulmaceae	Jibon	Tree	Dicot
188.	*Tridax procumbens* L.	Asteraceae	Tridhara	Herb	Dicot
189.	*Urena lobata* L.	Malvaceae	Banokra	Shrub	Dicot
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Kukurshunga	Herb	Dicot
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Ghagra	Herb	Dicot
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Kul, Boroi	Tree	Dicot

According the DAFOR status, the existing flora of the visited site represents 17, 39, 74, 50 and 12 species as rare, occasional, frequent, abundant and dominant respectively (Figure 1). Plant species belonging to Azollaceae, Ebenaceae, Euphorbiaceae, Lamiaceae,

Lecythidaceae, Lythraceae, Malvaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Oleaceae, Passifloraceae, Poaceae, Sapotaceae, Scrophulariaceae, Thelypteridaceae families were found to be rare according to DAFOR categories (Table 2).

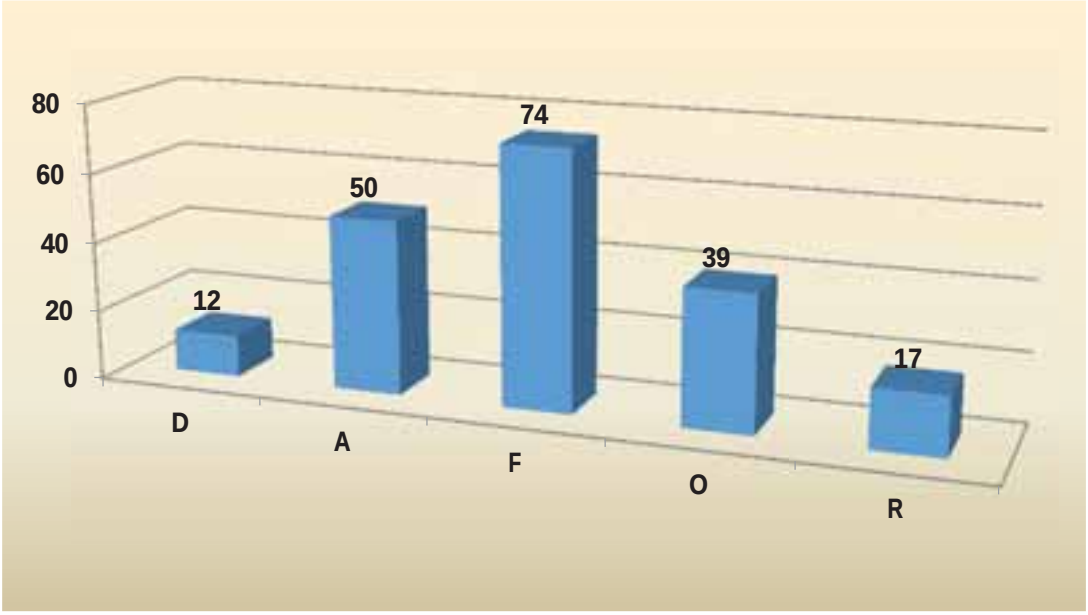

Figure-1: Existing DAFOR status of recorded plants from the present project area.

According to the Red List categories, out of 192 recorded plants, 185 species were included in Least Concern (Lc) category, 3 species were recognized as Not Evaluated (NE), 1 species were Near Threatened (NT), 1 species were Coservation Dependent (CD), 1 species was recognized for each the Data Dificit (DD) and 1 species was recognized as Vulnerable (VU) categories (Table 2, Figure 2).

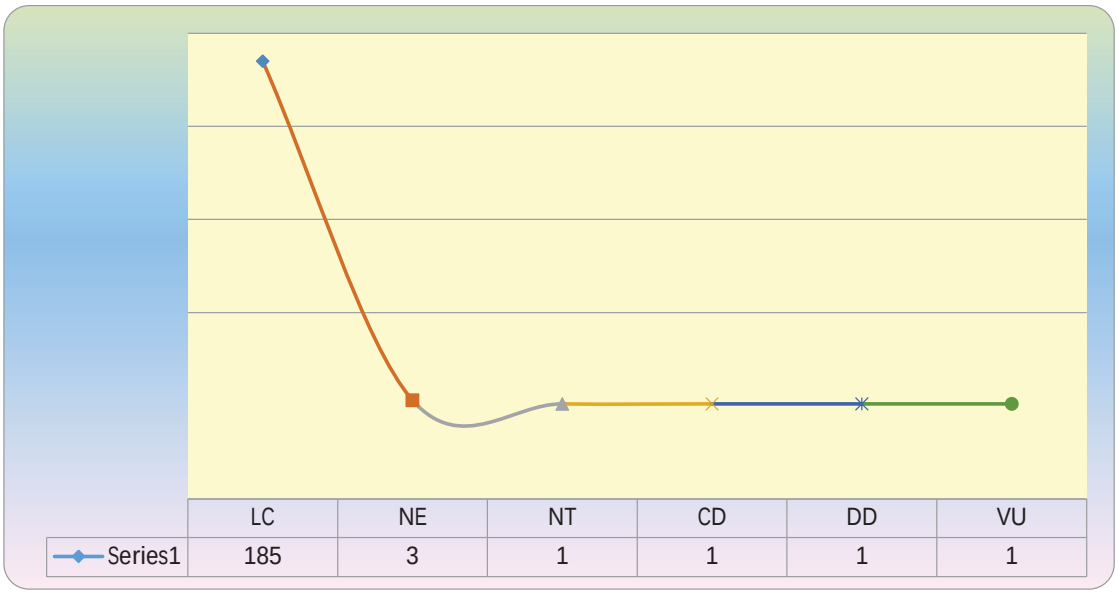

Figure 2. Red list categories of the flora recorded from the present power plant project area.

Table 2. Redlist categories and existing DAFOR status of the recorded vegetation in the proposed LNG-based power plant area area.

Sl.no.	Scientific name	Family name	Red list status	DAFOR status
1.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Lc	O
2.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Lc	R
3.	*Aegle marmelos* (L.) Corr.	Rutaceae	Lc	O
4.	*Ageratum conyzoides* L.	Asteraceae	Lc	F
5.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Lc	O
6.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Lc	F
7.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Lc	A
8.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Lc	A
9.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Lc	D
10.	*Amaranthus gangeticus* L.	Amaranthaceae	Lc	F
11.	*Amaranthus spinosus* L.	Amarantaceae	Lc	A
12.	*Amaranthus tricolor* L.	Amaranthaceae	Lc	F
13.	*Amaranthus viridis* L.	Amaranthaceae	Lc	F
14.	*Ammannia baccifera* L.	Lythraceae	Lc	O
15.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Lc	F
16.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Lc	R
17.	*Annona reticulate* L.	Annonaceae	Lc	O
18.	*Annona squamosa* L.	Annonaceae	Lc	O
19.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Lc	R
20.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	CD	F
21.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Lc	O
22.	*Artocarpus heterophyllus* Lamk.	Moraceae	Lc	O
23.	*Arundo donax* L.	Poaceae	Lc	F
24.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Lc	O
25.	*Averrhoa carambola* L.	Oxalidaceae	Lc	O
26.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Lc	A
27.	*Azadirachta indica* A. Juss.	Meliaceae	Lc	F
28.	*Azolla pinnata*	Azollaceae	Lc	R
29.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Lc	R
30.	*Brassica nigra* (L.) Koch	Brassicaceae	Lc	A
31.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Lc	F
32.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Lc	F
33.	*Cardiospermum halicacabum* L.	Sapindaceae	Lc	O
34.	*Carica papaya* L.	Caricaceae	Lc	F
35.	*Centella asiatica* (L.) Urban	Apiaceae	Lc	A
36.	*Chenopodium album* L.	Chenopodiaceae	Lc	A
37.	*Chloris barbata* Sw.	Poaceae	NE	R
38.	*Christella dentata*	Thelypteridaceae	NT	R
39.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	VU	A
40.	*Cissampelos pareira* L. var. hirsuta	Menispermaceae	Lc	R
41.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Lc	F
42.	*Cleome rutidosperma* DC.	Capparaceae	Lc	A
43.	*Cleome viscosa* L.	Capparaceae	Lc	F
44.	*Clerodendrum viscosum* Vent.	Verbenaceae	Lc	F
45.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Lc	A
46.	*Cocos nucifera* L.	Arecaceae	Lc	F
47.	*Colocasia esculenta* (L.) Schott	Araceae	Lc	D
48.	*Commelina benghalensis* L.	Commelinaceae	Lc	A
49.	*Commelina longifolia* Lamk.	Commelinaceae	Lc	F
50.	*Corchorus olitorius* L.	Tiliaceae	Lc	O
51.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Lc	F
52.	*Crateva magna* (Lour.) DC.	Capparaceae	Lc	A

Table continued…

53.	*Crotalaria pallida* Ait.	Fabaceae	Lc	F
54.	*Croton bonplandianus* Baill.	Euphorbiaceae	Lc	D
55.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Lc	F
56.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Lc	F
57.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Lc	A
58.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	Lc	F
59.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	NE	F
60.	*Cynodon dactylon* (L.) Pers.	Poaceae	Lc	A
61.	*Cyperus rotundus* L.	Cyperaceae	Lc	F
62.	*Cyperus* sp	Cyperaceae	Lc	O
63.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Lc	F
64.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Lc	F
65.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Lc	O
66.	*Desmodium triflorum* (L.) DC.	Fabaceae	Lc	A
67.	*Dillenia indica* L.	Dilleniaceae	Lc	O
68.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Lc	O
69.	*Diospyros peregrina* Guerke	Ebenaceae	Lc	R
70.	*Eclipta alba* (L.) Hassk.	Asteraceae	Lc	A
71.	*Eichhornia crassipes* (Mart.) Solms	Pontedariaceae	Lc	D
72.	*Eleusine indica* (L.) Gaertn.	Poaceae	Lc	A
73.	*Enhydra fluctuans* Lour.	Asteraceae	Lc	A
74.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Lc	A
75.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Lc	F
76.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	NE	F
77.	*Euphorbia hirta* L.	Euphorbiaceae	Lc	F
78.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Lc	F
79.	*Ficus benghalensis* L.	Moraceae	Lc	O
80.	*Ficus heterophylla* L. f.	Moraceae	Lc	F
81.	*Ficus hispida* L. f.	Moraceae	Lc	O
82.	*Ficus religiosa* L.	Moraceae	Lc	O
83.	*Fimbristylis acuminata* Vahl	Cyperaceae	Lc	F
84.	*Floscopia* sp.	Commelinaceae	Lc	A
85.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Lc	F
86.	*Gmelina arborea* Roxb.	Verbenaceae	Lc	O
87.	*Gnaphalium luteo-album* L.	Asteraceae	Lc	A
88.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Lc	A
89.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Lc	F
90.	*Heliotropium indicum* L.	Asteraceae	Lc	D
91.	*Hibiscus rosa-sinensis* L.	Malvaceae	Lc	O
92.	*Hibiscus sabdariffa* L.	Malvaceae	Lc	R
93.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Lc	O
94.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Lc	A
95.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Lc	D
96.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Lc	F
97.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Lc	A
98.	*Jasminum sambac* (L.) Ait.	Oleaceae	Lc	R
99.	*Kyllinga microcephala* Steud.	Cyperaceae	Lc	D
100.	*Lablab purpureus* (L.) Sweet	Fabaceae	Lc	F
101.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lc	F
102.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Lc	F
103.	*Launaea aspleniifolia* DC.	Asteraceae	Lc	A
104.	*Lawsonia inermis* L.	Lythraceae	Lc	O
105.	*Leersia hexandra* Sw.	Poaceae	Lc	A
106.	*Lemna perpusilla* Torrey	Lemnaceae	Lc	A
107.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Lc	F
108.	*Leucas aspera* (Willd.) Link	Lamiaceae	Lc	A
109.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Lc	A
110.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Lc	A

Table continued…

111.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lc	F
112.	*Litchi chinensis* Sonn.	Sapindaceae	Lc	O
113.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Lc	A
114.	*Ludwigia hyssopifolia*	Onagraceae	Lc	D
115.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Lc	F
116.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Lc	R
117.	*Mangifera indica* L.	Anacardiaceae	Lc	F
118.	*Marsilea minuta* L.	Masileaceae	Lc	A
119.	*Melia azedarach* L.	Meliaceae	Lc	F
120.	*Melochia corchorifolia* L.	Sterculiaceae	Lc	O
121.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Lc	F
122.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Lc	F
123.	*Mimosa pudica* L.	Mimosaceae	Lc	F
124.	*Mirabilis jalapa* L.	Nyctaginaceae	Lc	R
125.	*Momordica charantia* L.	Cucurbitaceae	Lc	A
126.	*Moringa oleifera* Lamk.	Moringaceae	Lc	O
127.	*Musa paradisiaca* L.	Mussaceae	Lc	F
128.	*Najas minor* L.	Najadaceae	Lc	F
129.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Lc	O
130.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Lc	F
131.	*Ocimum sanctum* L.	Lamiaceae	Lc	F
132.	*Oldenlandia diffusa* (Willd.) Roxb.	Rubiaceae	DD	F
133.	*Oxalis corniculata* L.	Oxalidaceae	Lc	A
134.	*Panicum* sp.	Poaceae	Lc	F
135.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Lc	F
136.	*Passiflora foetida* L.	Passifloraceae	Lc	R
137.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Lc	O
138.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Lc	F
139.	*Persicaria barbata* (L.) Hara	Polygonaceae	Lc	F
140.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Lc	A
141.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Lc	D
142.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Lc	F
143.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Lc	R
144.	*Phyllanthus niruri* L.	Euphorbiaceae	Lc	A
145.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Lc	D
146.	*Phyllanthus urinaria* L.	Euphorbiaceae	Lc	F
147.	*Physalis minima* L.	Solanaceae	Lc	F
148.	*Pistia stratiotes* L.	Araceae	Lc	A
149.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Lc	A
150.	*Polygonum plebeium* R. Br.	Polygonaceae	Lc	F
151.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Lc	F
152.	*Psidium guajava* L.	Myrtaceae	Lc	F
153.	*Punica granatum* L.	Punicaceae	Lc	O
154.	*Richardia scabra* L.	Rubiaceae	Lc	A
155.	*Ricinus communis* L.	Euphorbiaceae	Lc	O
156.	*Rorippa indica* (L.) Hiern	Brassicaceae	Lc	A
157.	*Rotala indica* (Willd.) Koehne	Lythraceae	Lc	R
158.	*Saccharum spontaneum* L.	Poaceae	Lc	A
159.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Lc	F
160.	*Salvinia cucullata*	Salviniaceae	Lc	A
161.	*Salvinia molesta*	Salviniaceae	Lc	F
162.	*Salvinia natans*	Salviniaceae	Lc	D
163.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Lc	A
164.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Lc	A
165.	*Scoparia dulcis* L.	Scrophulariaceae	Lc	F
166.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Lc	A

167.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Lc	F
168.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Lc	F

Table continued…

169.	*Sida acuta* Burm. f.	Malvaceae	Lc	F
170.	*Sida rhombifolia* L.	Malvaceae	Lc	O
171.	*Solanum lycopersicum* Dunal	Solanaceae	Lc	A
172.	*Solanum melongena* L.	Solanaceae	Lc	A
173.	*Solanum nigrum* L.	Solanaceae	Lc	F
174.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Lc	D
175.	*Sphaeranthus indicus* L.	Asteraceae	Lc	F
176.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Lc	O
177.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Lc	O
178.	*Swietenia mahagoni* Jacq.	Meliaceae	Lc	F
179.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Lc	F
180.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Lc	O
181.	*Tamarindus indica* L.	Caesalpiniaceae	Lc	F
182.	*Terminalia catappa* L.	Combretaceae	Lc	O
183.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Lc	O
184.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Lc	R
185.	*Trema orientalis* (L.) Blume	Ulmaceae	Lc	O
186.	*Trewia nudiflora* L.	Euphorbiaceae	Lc	A
187.	*Tridax procumbens* L.	Asteraceae	Lc	F
188.	*Urena lobata* L.	Malvaceae	Lc	O
189.	*Vallisneria spiralis* L.	Hydrocharitaceae	Lc	A
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Lc	O
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Lc	A
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Lc	F

Note: LC= Least Concern, NE= Not Evaluated, NT= Near Threatened, CD= Coservation Dependent, DD= Data Deficient, VU= Vulnerable. D= Dominant, A= Abundant, F= Frequent, O= Occasional, R= Rare.

Oldenlandia diffusa of the family Rubiaceae was found data deficit, *Aponogeton appendiculatus* of the family Aponogetonaceae was found conservation dependent, *Christella dentate* of the family Thelypteridaceae was found near threatened and *Chromolaena odorata* of the family Asteraceae was found vulnerable categories. Besides, *Cyathula prostrata* of the family Amaranthaceae, *Eucalyptus camaldulensis* of the family Myrtaceae, *Chloris barbata* of the family Poaceae were found in not evaluated category.

Annexure: 6.1

EHS Norms

FRAME WORK FOR DEVELOPING ESMS –

A PART OF CONTRACTUAL AGREEMENT & OBLIGATION

Reliance Bangladesh LNG Terminal & Power Limited being funded by Asian Development Bank for the project development to establish a 750 MW GCPP and 4MTPA LNG Terminal, thus subscribes to the Asian Development Bank's Safeguard Policy Statement, 2009 as guideline for developing, adopting the practices pertaining to Environment, Health, Safety and Social during execution of the project work to comply with the requirements. Hence, the contractors are required to follow the same as per following guideline based on which Contractors are obliged to submit their Environmental & Social Management Plan / System **(ESMP/ ESMS)** before 30 days of starting their respective works.

The Guiding Principle:

Asian Development Bank's Safeguard Policy Statement, 2009 and ESMP/ESIA Report of the Project developed by the Owner in 2017.

The Owner's Responsibility:

Reliance Bangladesh LNG Terminal & Power Limited shall [either itself or through external monitoring agency] review; approve the ESMP as submitted by the contractor, in concurrence with ADB.

The review frequency:

a. Within 05-07 days of receiving of the ESMS document
b. Review of ESMS of each contractor on each quarter for its adequacy
c. EHS&S Compliance status review on monthly basis

The contractor's Responsibility:

The contractor shall have the responsibility of

1. Devising ESMS Manual
2. Putting an EHS& Organnization in place
3. Implementing the EHS & S requirements as defined in ESIA of the project and as applicable to its work

4. Extend all co-operation to project owner group in all inspections / audit.

The Practictioner:

All the Contractors associated with supply, logistics and construction works are obliged to submit their Environmental & Social Management Plan/System **(ESMP/ ESMS)** before 30 days of starting their respective works. The respective manual shall include the following in to it

1. Introduction to the Organization with Contact details of the head of the organization at site and corporate.
2. The Organization structure at site including EHS&S Team and their contact details (Due care should be taken to make The Head at site as person responsible for execution and adherence to EHS & Implementation.)
3. Policies
    a. EHS
    b. Social
    c. Equal Opportunity Employment
    d. Human Rights
    e. Human Resources
    f. Redressal of Sexual Harassment in Work Place
    g. Child Labour
    h. E-Waste / Hazardous Waste / Battery Management
4. Codes / Practices / Guidelines followed to develop the manual for practice (LNG / Power)
5. Working Philosophy
6. Identification of Hazard(HAZID is carried out by PMC and Contractors both) / Environmental Impact(Part of EIA study-by owner) / Social Impact taking clues from ESIA and practices at other sites (Part of EIA study-by owner)
7. Standard Operating Procedures to mitigate and minimize the EHS & Social Impact in the vicinity

a. OHS Manual
b. Environmental Manual
c. Social Engagement Plan

8. Training Need and Schedule
9. Health Care Facility at site
10. Emergency Response Plan with Emergency Organization and Contacts
11. Documents Control procedure (DCI is prepared by each Contractor duly approved by Project Owner or through its PMC)
12. Disaster Management Plan, coordinated with the National Disaster Management Plan

Framework for developing ESMS

The contractor is to follow the following frame work for developing ESMS by considering the outcome of the ESIA of the project and regulatory requirements pertaining to EHS and Social issues of their respective works.

Following are the abstract guidelines for developing the ESMS document.

ENVIRONMENT

The owner company has obtained / in the process of obtaining the site clearance certificate from DOE of Bangladesh. To carry out the activities at site various contractors have been awarded the specified jobs as mentioned in their contract order. In order to respectfully complete the job the Contractors are abide with the conditions of the consent as laid down by the statutory bodies and Lenders requirement.

1. All the contractors as their contractual obligation shall nominate / designate a qualified person to be the Environment & Safety Officer / Engineer along with adequate number of Stewards / Chemists / Social Officer / Support Staff to coordinate between the concerned contractual worker and Owner Group responsible officer to implement the required EHS & Social norms and guidelines for their respective contractual work.

2. The contractor shall ensure the deployment of adequate numbers of EHS representative as defined in to organization chart of their manual and approved by RBLTPL in its working sites, failing which his work shall may be suspended by Project Owner till satisfactory arrangements are made by the contractors.
3. The Contractor shall install equipments such as Low Noise and Low emission DG sets with emission less than 50mg/Nm3 and noise level less than 75 dB at a distance of _____ mts. Such DG sets shall not interfere in any manner in the day to day activity of the local people in the vicinity.
4. The Contractor shall be responsible to provide water tankers / water spray system at their respective work places at their own cost to minimize / eliminate fugitive dust which may be arising out of the construction activities.
5. The Contractor shall restrict the disposal of the construction material (fresh/waste) in its isolated work place only, which can be taken out by the contractor once their job is completed to the designated place / authorized vendor for scarp (if, any available at Bangladesh) at main land. In case of non compliance, the same shall be got done at the risk & cost of the contractor.
6. The Contractor shall be liable for maintenance of his construction machineries at site in such a manner that it does not pollute air, water, soil and noise of the area.
7. The Contractors shall ensure that their workforce do not involve in any cutting of trees in the nearby area, defacing and tampering any installation.
8.

HAZARDOUS MATERIAL/WASTE MANAGEMENT

9. Storage and handling of any hazardous material such as petrol/diesel/lube oil/grease etc shall be handled on a PCC platform duly covered at top and drain lined with glazed tiles

followed by a RCC tank. This is to comply with the HWM rules and acts of the host country. The replaced /waste oil & grease from automobiles, machineries and DG sets are required to be collected in a container and disposed to the authorized vendors. The copies of chalans of such disposal are required to be submitted to project owner on demand.

10. In no case the effluent will be allowed to be discharged to nearby fields/drains.
11. The Contractor's workforce will not litter the near by agricultural fields by any means.
12. The Contractor will provide an effective garbage management system.
13. In case of labour settlement is required to be established, then that should follow SPS / IFC Guideline. The labour establishment shall practice and adhere to the ADB's SPS / IFC Guideline to avoid and minimize the municipal waste management, water supply and treatment of effluent, fuel supply, hygiene, avoidance and reduced impact practices on local population – it's cultural & aesthetical aspects, religious ethics & sentiments, Political & Social aspects, and dependency on local natural resources (like Fuel wood, Fuel Oil, Potable water etc.) of the local villagers / population. A separate labor establishment SOP shall be provide by the contractors before site mobilization and to be approved by project owner in concurrence of ADB.
14. After completion of the work the Contractor will clear the construction site after depositing back the waste material in to the waste bins at the designated places on every day basis. The non-metallic waste is to be disposed of at the frequency arranged with authorities in main land.

HEALTH:

1. The contractor shall be responsible for constructing his labour establishment as per the approved drawings and practices conforming to the local labour laws.
2. The Contractor shall be responsible for providing the labour establishments constructed in the allocated area in a manner such that it shall accommodate people to live in hygienic condition.
3. Providing safe drinking water and chlorine tablets to the workers are required to be adhered to strictly.
4. The Contractor to provide emergency / common medical facilities to its workforce, and 24 hours first aid facilities.
5. The Contractors are required to provide and maintain first aid box, Trauma Blanket and Eye wash facility at their respective working site / office as well as at the labour establishments.
6. The Contractor will provide the working site(s) and labour establishment with proper sanitation facilities like toilets/ bathrooms / drinking water and crèche etc.
7. Contractor shall make arrangements for ambulance services and for the treatment of industrial injuries. Names of those shall be providing these services shall be furnished to Project Owner prior to start of construction, and their telephone numbers shall be prominently displayed in Contractor's field office / labour establishments.

Social

1. The contractor shall give priority in maximizing the deployment of local population (both men and women) for its work based on the requirement and meeting minimum criteria of the work. However,

a short on job training for skill development can also be envisaged to engage the local population during construction activity. All such records shall be furnished to project owner on monthly basis.

2. The contractor shall make provision to address the grievances for it's employees where as the grievances of workers / community shall to be resolved under the banner of Grievances Redressal Cell of Project Owner.

GENERAL

1. The contractor shall be liable for obtaining the required permissions and clearances from appropriate government regulatory authorities for extraction / transportation of building construction materials.
2. The contractor shall issue I-cards to all of his employees and workers and shall also ensure that those are displayed as their persons during working at the site. All work men are required to be verified by local police so that their origin can be traced back in case of need.
3. The contractor shall not engage any child labour (less than 18 years) in any of the construction sites.
4. The contractors' labors must not resort to drinking and indulgence with local people.

   The contractor will notify the owner if any precious/ semi precious materials or any object of heritage importance is found during the course of excavation without tampering the same

SAFETY

1. Before commencing of contract work, all the workers/supervisors and employees of all contractors are required to go for Safety awareness programme to be organized by the EHS Personnel of the Contractor and will be witnessed by EHS Personnel of the project owner. Every day there will be a Tool Box Talk in the site by the

contractor. All workers and supervisors of the contractors are required to attend the same. Attendance shall be marked for all these activities and failure to attend these programmes shall attract the attention of Project Owner to report such an activity to the Head of Site and Head Office leading to stop their payment.

2. All new inductees of the contractor are also required to follow the stipulations mentioned in Sr. No.1
3. The contractor's Safety personnel in consultation with project owner shall deliver the following responsibilities;
    a. The scheduling of man power arrival at site to start the job required to be furnished with project owner.
    b. The safety supervisor shall find, procure and maintain inventory of a minimum quantity of various safety gears / PPE requirement and fire extinguishers required for the allotted job and submit regular monthly report to project owner.
    c. The contractor shall be allowed to start their work at site only after proper verification of adequacy of safety gears/PPE and fire fighting equipment required for the specific job at site by the Safety personnel of project owner. The list of some standard safety gears and PPE are as follows:
        i. Safety Shoes – With Steel toes (CE approved / IS)
        ii. Dust Mask: DGMS or equivalent regulators approved
        iii. Vapour Mask (EN 149 / IS 9473 - CE approved) – As per the requirement
        iv. Ear Muffs: Ability to reduce sound level till 24dB.
        v. Ear plugs: Ability to reduce sound level till 29dB.
        vi. Full Body Harness: IS 3521
        vii. Safety Helmets: IS 2925
        viii. Wielding shield / Apron
        ix. Goggles

x. Hand Gloves
xi. Safety Nets
xii. Breathing Apparatus
xiii. Diving Apparatus
xiv. Fluorescent vest

All the above PPE should meet either host country quality standard & requirement or international standards are to be used.

d. The inventory list of the available safety gears and its place is required to be furnished on monthly basis to the project owner.
e. In case of any lapse of the adherence to practice of the safety to same project owner shall have right to stop their work at site.
f. The contractor's EHS officer shall execute / practice the muck drill as per Emergency preparedness / response plan to the site specific job allocation and the same shall be submitted to Project Owner.
g. In case of any eventuality the contractor's safety officer shall inform the site engineer and EHS In-charge of Project Owner as a matter of first information.
h. The event is required to be recorded in the accident reporting format.
i. Such reporting shall be investigated jointly with Project Owner authorized personnel/committee. The inability to adhere to any safety requirement shall be recommended to the authority for appropriate action and cancellation of work.
j. Various offense in violation of safety requirement are categorized below with penal clauses and fine,

Sr. No.	Type of Offense	Category	Penal Clause	Remarks
1	Not Wearing Helmets/Safety shoes/ Wielding goggles / Shield / Apron / Safety Goggles / Hand Gloves	**A**	First Offence - Warning Note Second Offence - Warning Note and a Fine of BD TK.500/- Third Offence - Warning Note and a fine of BD TK 1000/- Fourth Offense - Note of recommendation of the concerned workmen /supervisors for termination of his job.	Authority to execute: Recommendation of Safety In Charge and the concerned site engineer of Project Owner. Approving authority: Construction Manager
2	Non Use of A. Full body Harness/ Safety Belts / Any Other life saving safety gear	**B**	First Offence - Warning Note & Fine of BD TK 1000/- Second Offence - Warning Note for dismissal and a Fine of BD TK 2000/- Third Offense - Action for the concerned workman/ supervisor for termination of his job and a fine of BD TK 3000/-	Authority to execute: Recommendation of Safety In Charge and the concerned site engineer of Project Owner. Approving authority: Construction Manager
	B. Electrical Gloves / Electrical Safety Shoes		First Offence - Warning Note & Fine of BD TK.500/- Second Offence - Warning Note for dismissal and a Fine of BD TK 1000/- Third Offence - Warning Note for dismissal and a fine of BD TK.2000/- Fourth Offence - Action for the concerned workman/ supervisor for termination of his job and a fine of BD TK.3000/-.	
3	Non Use of Safety Net / Unsafe working which may tend to fatal events	**C**	First Offence - Warning Note & Fine of BD TK.3000/- Second Offence - Action for the concerned workmen/ supervisors for termination of his job and fine of BD TK.5000/-	Authority to execute: Recommendation of Safety In Charge and the concerned site engineer of Project Owner. Approving authority: Construction Manager

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SAFETY DURING WELDING, CUTTING AND STONE BREAKING

1. Those engaged in welding and cutting works shall be provided with protective face and eye shields, and gloves, etc.
2. The Contractors / vendors engaged for the construction / erection /commissioning purpose are permitted to use Industrial LPG cylinders for cutting purpose.

SAFETY DURING PAINTING/ PIPE COATING WORKS

In no case the contractor shall not employ workers below the age of 18 years and in particular no women should be deployed in to the work of painting or products containing lead in any form. Wherever there is painting work the following precautions should be taken.

1. No paint containing lead product in powder form except in the form of paste or readymade paint to be used.
2. Suitable face masks shall be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.
3. Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable the working painters to wash during and on cessation of work.

USE OF HOISTING EQUIPMENTS

1. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
    a. These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect

and shall be kept in good condition and in good working order.

b. Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength and free from patent defects.
c. Every crane driver or hoisting appliance operator shall be properly qualified and adequately experienced. No inexperienced person should be in charge of any hoisting machine including any scaffolding winch or giving signals to the operator.
d. In case of hoisting machine and of chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load and the conditions under which it is applicable. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
e. In case of departmental machine, the safe working load shall be notified by the Construction Manager / his authorized representative. As regards Contractors machines, the Contractor shall notify the safe working load of the machine to the Construction Manager, where ever he brings any machinery to site of work and get it verified by the Safety I/C concerned.
f. The tools, tackles, lifting and hoist to be used by the contractors are required to be tested for its suitability and certified by a third party competent safety personnel as per factories Acts / Rules etc.. All such copies are required to be

submitted to Construction Manager of Project Owner for further verification and record.

SAFETY DURING ELECTRICAL WORKS

1. The electrical safety is the most vulnerable because of its typicality, required to be attended with specific safety gears like; safety shoes with out steel toes tested for 11/33 kv, Hand gloves tested for 11/33kv (IS 4770).
2. If any equipment, machinery or materials to be used or supplied or methods or processes to be practiced or employed in the performance of this Contract is/are covered by a patent under which Contractor is not licensed. Contractor shall before supplying or using the equipment, machinery, materials, methods or process as the case may be, obtain such license (s) and pay such royalty (ies) and license fee (s) as may be necessary in connection with the performance of this Contract. In the event that the Contractor fails to pay such royalty or obtain such license, the Contractor will defend at his own expense any suit for infringement of patent which is brought against the Contractor or the Owner as a result of the failure, and shall pay any damages and costs awarded in such suit and will keep Owner indemnified from and against all other consequences thereof.
3. A PTW (including confined space, isolation) system should be in place for working in any live installation and other places as applicable. Such records are required to be maintained and produced as and when required by the project owner.

SAFETY DURING WORKING AT HEIGHT

1. Provide adequate area lighting at appropriate height.
2. The ladders / monkey ladders are to be as per IS: 3696(Part 2) or equivalent Bangladesh Standard for a safe working.

3. Safe means of access shall be provided to all working platforms and other working place. Every ladder shall be securely fixed. No portable single ladder shall be over 30 feet in length while the width between the side rails in rung ladder shall in no case be less than 11feet 5 inches for ladder up to and including 10feet in length for longer ladders this with would be increased at least ¼" for each additional foot of length. Un-inform step spacing shall not exceed 12". Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site of work shall be so stacked or placed as to cause danger or inconvenience t any person or public. The Contractor shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings, as law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay damages and costs which may be awarded in ay such suit or action or proceedings to any such person, or which may with the consent of the Contractor be paid to compromise any claim by any such person.
4. The contractors those who will be working at height shall have to arrange for Fall Arrestor (CE Approved) and fix it at definite height in consultation with Safety personnel of Project Owner.
5. The contractor at his own cost shall be responsible for putting safety protection barriers, warning signals and posting the safety flag man at desired locations.
6. Contractor shall erect and maintain barricades required in connection with his operation to guard or protect:-
    (i) Excavation
    (ii) Hoisting areas
    (iii) Areas adjudged hazardous by Contractor's or Project

Owner's Safety I/c, including storage of hazardous material

(iv) Project Owner's existing property liable to damage by contractor's operations, in the opinion of Construction Manager / Site Engineer / Safety In Charge.

(v) Material Unloading spots.

7. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 3'. This will also be marked with "Danger" sign boards.
8. Contractor's employees and those of its sub-contractors shall become acquainted with barricading practice and shall respect the provisions thereof to ensure safe work practices.
9. Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights.

SAFETY DURING WORKING WITH SCAFFOLDING:

1. Suitable scaffolding shall be provided for all works that cannot safely be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra person shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 in 4 (1horizontal 4 vertical).
2. Scaffolding or staging more than 12 numbers above the ground or floor, swing or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bottled, braced and otherwise rewarded at least 3' high above the

floor or platform of scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

3. Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform or the gangway or the stairway is more than 12', above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened.
4. Prior to start of work the contractors shall submit method statements for approval of PMC/Safety personnel. Contractor to commence works only after receipt of approved method statements.
5. The contractor shall provide camera to its EHS personnel, so that any unsafe acts are captured in photos and analyzed on review.

SAFETY DURING EXCAVATION AND TRENCHING

1. All trenches 4feet or more in depth, shall at all times be supplied with at least one ladder for each 10 feet length or fraction thereof.
2. Vertical cutting of soil shall be avoided, instead slopes, as approved by PMC shall be done.
3. Ladder shall be extended from bottom of the trench to at least 3'3'' above the surface of the ground. The site of the trenches which is 5' or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated material shall not be placed within 5' of the edge of the trench or half of trench depth whichever is more.

Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting to be done.

4. Cross-over bridges/planks should be provided for movement of personnel. Under no circumstances jumping across the trenches should be permitted.

SAFETY AND INFORMATION SIGNS

#

1. The Contractor shall provide a full set of safety and information signs at temporary facilities which will have:
   - Identify escape routes from buildings
   - Give directions to different camp facilities
   - Identify buildings
   - Give hazard, fire, prohibitive and advisory warnings
   - Identify Company offices
   - Identify Contractors offices
   - Identifies the camp, the Company, the Contractor and other agreed parties, from the roadside
   - Identifies emergency response assembly areas, emergency and medical instructions and contacts.
   - All information and warning signs shall be in English, local languages.
   - Emergency Contact No.'s, Fire, Security, Medical
   - Ambulance Points & Emergency vehicle rendezvous points
   - Public address system usage

COMMUNICATIONS

- The Contractor shall provide all temporary communication services and facilities to its Project working site
- Mobile, intrinsically safe radios, antenna mast and all supporting software and hardware

- Mobile telephone system including any local transmitter/receiver antenna

LIFTING AND TRANSPORTATION IN MARINE WORK

- Company anticipates that the majority of Contractor project materials will be delivered by sea freight to Chittagong Port; delivery from Chittagong Port to the WORK Site will be by sea transport. Contractor shall be required to make a RORO jetty close to the Site to offload the consignments and bring those at site.

- Contractor will note that there will not be a marine jetty available at the WORK Site for the receipt of materials delivered by sea freight.

- The contractor will deploy adequate number of barges/pantoons with adequate capacity for safe working of personnel and movement of T&Ps.

- Major equipment and prefabricated items greater than 40 tonnes in weight or out of gauge size (4m x 4m cross section) will require detailed lifting and/or transport studies to be carried out by Contractor; Company will review these studies.

- Civil and other works will be carried out or utilities diverted by Contractor, if required, to facilitate its transportation requirements.

- Transport route survey should be conducted by the Contractor before bid submission to determine maximum allowable weight and size.

- Contractor will develop lifting strategies and plans to maximize schedule opportunities without compromising the project HSE and quality requirements; these strategies and plans will be submitted to Company for review.

- All heavy lift cranage will only be used in configurations recommended by the crane manufacturers. All crane capacities are to be within the published equipment chart capacities for the crane in the configuration being used for the lift and in compliance to applicable codes and industry practices.

- Full certification for all cranes, rigging tackle, etc will be required for inspection prior to use at the WORK Site.

- Rigging studies will be carried out for all key items of equipment and be subject to approval by experienced and qualified lifting engineers.

INSULATION OF EQUIPMENT AND PIPING

- Company preference for the manufacture of bulk insulation material is that it be carried out off-site and that Contractor maximises the insulation and pre-dressing of equipment and piping off-site such that in-situ insulation is minimised.

- This Plan will reduce the full extent of scaffold requirement, Subcontractor interface, reduce safety risk and maintain a high level of quality control.

- Any pre-dressed pipe-work will have to be lifted using lifting frames designed for such usage; Company will review the design of all such lifting frames.

- Contractor cold pre-insulation fabrication shop will be air-conditioned to ensure polyurethane foam spraying quality.

Contractor should display adequate numbers of safety posters and banners in the work site.

SAFETY DURING DEMOLITION OF CONSTRCUTION ARRANGEMNETS

1. Before any demolition work is commenced and also during the process of the work all roads and open area adjacent to the work site shall either be closed or suitably protected with proper warning signs.
2. No electric cable or apparatus which is liable to be a source of danger over a cable or as apparatus used by the operator shall remain electrically charged in such areas.

   All practical steps shall be taken to prevent danger to persons employed, from risk of fire or explosion or flooding. No floor or other part of the building shall be so overloaded with debris or material as to render it unsafe.
3. When the work is done near any place where there is a risk of drowning, all necessary safety equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work. One person must be kept to keep watch on safety of personnel working.

GENERAL

1. All vehicles plying for construction purpose will observe restricted speed of 15kms/h.
2. Wearing of the safety helmets shall follow the color coding as per the table in Sr.No.16.
3. Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Owner's safety rules set forth herein and as brought out from time to time.
4. To ensure effective enforcement of the rules and regulation relating to safety arrangements made by the Contractor shall be open to inspection by the Construction Manager / his representative at any working hours.

5. The works throughout including any temporary works shall be carried on in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpaths, at the site or in the vicinity there to or any existing works whether the property of project owner or of a third party.
6. In addition to the above, the Contractor shall abide by the HSE codes/ provision as per Factories / Environmental Protection Acts / Rules/ Regulations/ Stipulations/ Guidelines / Notifications of Bangladesh / State and Safe working code framed from time to time.
7. The Contractor shall also arrange to obtain valid gate passes for his men and equipment from the concerned authorities of Project Proponent.
8. No man/material/equipment not covered by valid passes shall be permitted within the Project area and no material/equipment shall be permitted to be taken out of the Project area, unless authorized by the concerned authorities of the Project.
9. The Contractor shall be held fully responsible for any or all delays/losses/damages that may result consequent on any lapses that may occur on the part of his-sub-contractors/employees in this regard.
10. A weekly EHS coordination meeting will be conducted at site by Safety Personnel of Owner group with different contractors along with concerned HODs as per schedule to be circulated by EHS Personnel of Owner.
11. There will be a EHS coordination meeting at site every fortnight of each month constituting all the contractors in charges, their authorized representatives, representatives of Project Owner, which will be chaired by the Construction Manager.
12. The entire MOM in this regard shall be issued to the contractors for execution after approving the same from Construction Manager.
13. Any problem related to the implementation of EHS norms can be discussed with Project Owner site management responsible for EHS activity at given point of time.
14. The Contractor shall submit a monthly compliance report of the above mentioned clauses to Project authority, failing which Contractor will be responsible for the disciplinary action to be initiated against him.
15. Notwithstanding the above Clauses, there is nothing in these to exempt the Contractor from the operations of any other Act or

rules in force in the Republic of Bangaldesh towards satisfactory implementation of EHS norms.

16. Color coding for wearing the safety helmets at Site

Sr. No.	Colour of Helmets	Who will wear	Remark
1.	**YELLOW**	Labourers / Workers	LOGO / NAME OF THE COMPANY / CONTRACTOR AT THE BACK SIDE OF THE HELMET
2.	**RED**	Security / Contractors / Employees Of Contractor	LOGO / NAME OF THE COMPANY / CONTRACTOR AT THE BACK SIDE OF THE HELMET
3.	**GREEN**	EHS In Charge / Safety In Charge & Safety Staff/	LOGO OF REL/RTPP AT THE BACK SIDE OF THE HELMET
4.	**SKY BLUE**	All Executives / Supervisors of REL	LOGO OF REL/RTPP AT THE BACK AND NAME AT THE FRONT SIDE OF THE HELMET
5.	**WHITE**	VISITORS	LOGO OF REL/RTPP AT THE BACK AND *"VISITORS"* AT THE FRONT SIDE OF THE HELMET

List of Applicable Acts, Rules & Regulations and Guidelines for the project

Acts, Rules& Regulations

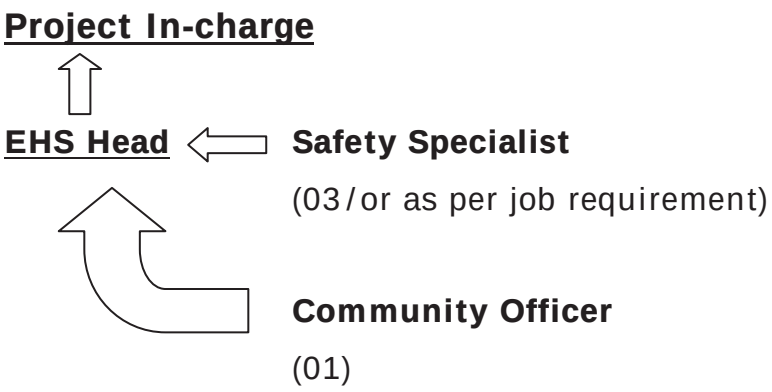
1. Bangladesh Building Construction Act, 1952
2. Bangladesh Dangerous Cargoes Act, 1953 (Act No. V of 1953)
3. Bangladesh Dangerous Cargoes Act, 1953
4. Bangladesh Environment Court Act, 2010
5. Bangladesh Environmental Conservation Act, 1995
6. Bangladesh Environmental Conservation Rules, 1997
7. Bangladesh Explosive Substances Act, 1908
8. Bangladesh Explosives Act, 1884
9. Bangladesh Fatal Accidents Act 1855
10. Bangladesh Fire Prevention and Protection Act, 2003
11. Bangladesh Forests Act, 1927
12. Bangladesh Labour Act, 2006
13. Bangladesh Mining Settlements Act, 1912
14. Bangladesh Smoke Nuisances Act, 1905
15. Bangladesh Standards

Guidelines

16. Notes on Compensation for Workplace deaths and injuries for Bangladesh
17. Asian Development Bank's Safeguard Statement Policy, 2009
18. Environmental & Social Impact Assessment for LNG Terminal at Kutabdia Island, September 2009, Bangladesh

Where in the contractor can access all the documents from Sr. 1 till Sr. No. 17 through internet, the document in Serial No. 18 will be available for reference in Project Owner's Office at construction site (Kutabdia / Narayanganj) or in it's Head office at Dhaka.

Suggested EHS Organogramme for Contractors



Annexure: 7.1

SOP of Hazardous Waste Management Plan

SOP - Hazardous Waste Management Plan

Overview

This Standard Operating Procedure (SOP) outlines the procedures workers are responsible for following to ensure consistency with the Reliance Bangladesh LNG & Power Limited's Environmental Management System (EMS). Specifically, this SOP outlines the requirements for handling and disposal of hazardous wastes. All employees and contractors must fully understand and adhere to this SOP. Any alterations to this SOP or related problems arising during work must be brought to the attention of the supervisor.

Requirements for hazardous waste handling are specified by the Hazardous Waste Regulation, Environmental Management Act. Special wastes are environmentally hazardous and must be separated from other waste materials and appropriately handled, stored and disposed of.

Special wastes include:

1. Used/Waste oil
2. Contaminated fuel
3. Explosives
4. Battery Waste
5. E Waste
6. Lubricating Oil
7. Solvents and solvent containers
8. Hydraulic oil

Procedures: Special wastes shall be stored in areas designated by the job site supervisor and will be stored in an environmentally safe manner (clearly marked containers, covered areas, secondary containment, etc.). The final disposal of hazardous wastes will be determined by the Environmental Manager and will be undertaken by qualified waste disposal contractors. Frequency of delivery shall be based on an effective and efficient schedule. Stored quantities are not to exceed the

limits specified by the Hazardous Waste Regulation (refer to the Spill Reporting SOP for details).

Special waste shipping is to be done only by personnel assigned this responsibility and who are certified vendors. Waste disposal manifests are to be obtained from disposal contractors at the time of shipping and forwarded to the RBLPL authority for filing. A Hazardous Waste Disposal Record Form is to be completed and submitted to the personnel in charge of Hazardous waste management.

Each job site supervisor will prepare a Hazardous Waste Management and Disposal Plan describing the management and procedures for hazardous waste handling, storage and disposal at the job site.

Annexure: 10.1

Format of FGD and Evidence of Participation

A Report on "Focused Group Discussion" for Reliance Meghnaghat 750 MW Combined Cycle Power Plant

Prepared By: Adroit Environment Consultants Ltd.

5/17/2017

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1.0 Introduction

A few focus group discussions (FGD) were conducted to gather together people from similar backgrounds or experiences to discuss the setting up of Reliance Meghnaghat 750 MW Combined Cycle Power Plant with the participation of different major stakeholder along with the consultants and the proponents. There were five FGDs for the following project in total: three of them were for fishermen who are identified as some of the stakeholders of that project area and two were for the cow owners whose cows were seen to be grazing in the project site.

2.0 Fishermen FGD

The village, Char Balaki, has roughly 200 families living there nearly for many years. Most of the households depend on the fishing for their livelihood. On the aspect of livelihood currently their greatest needs are:

1) Lack of safe landing station for travellers, commodities and goods.

2) No proper communication means to reach from mainland to the char.

3) Lack of variety of fish nets.

4) Seasonal variation of number of fishes found.

Nearly 70% people in the village are poor, 20% are low middle class and 20% middle class who earn nearly BDT 5000.00-10000.00 and 10000- 20000 per month respectively as reported by the participants. They identified the major reasons of poverty is due to:

1) Lack of education,

2) Lack of capital,

3) And their involvement with fishing occupation as their forefather did it.

To reduce the poverty and to address their current problem participants suggested to

1) Provide them opportunity for safe fishing with the intervention from District and Local Administration,

2) Construct a permanent landing station in both side of the river,

3) Take protective measures to safe fishing,

4) Establish primary schools.

5) Provide them capital with easy and low interest rate,

6) Establish one cyclone shelter that can be used as primary schools during normal time,

7) Arrange income generation activities for women along with training.

8) Provide employment opportunity for the poor both men and women,

9) Provide electricity for the betterment of the people from all age

The participants including men and women were noticed from the local people about installation of Reliance Meghnaghat 750 MW CCPP and they do not find any negative impact on their livelihood/fishing. Instead they welcome the power generation activities for the betterment of the country but they regret being deprived of electricity till days. In the past, they didn't find the activities of the power plants detrimental to the fishing activity. They seek help from the "Reliance" to provide employment to skilled and unskilled workers. They also hope that Reliance will contribute to the betterment of the locality by providing hospitals, training centres and roads for gentrification of the community.

2.1 Inventory of Fishing Activity of the Surrounding Area

Fishermen in the village do fishing within 5-6 kilo meters around the char including 40-50 meters from the outfall. Some fishermen do fishing in other areas sometimes. Each fishermen consisting of two members can catch 5-10 kg fish per day in rainy season and 1.5 - 2 kg per day in winter season. Per kg of fish is sold ranging from BDT 500.00 to 700.00 tk.

The fishermen generally catch small fish like prawn and catalee. They also catch Aiyeer, Ruhi, Ishish, Boyal, Kachki, Chapila, Cheowa etc. abundantly from this area. Some fishermen make their living entirely on catching prawns of different size. The whole surrounding area near the project site and Char Balaki is enriched with various fishes.

Types of Fishes Caught in the Area

In the entire island of Char Balaki, there are more than 100 fishermen families whose incomes are primarily dependent on fishing activity. According to the fishermen, they make somewhere between 10,000 to 20,000 tk per month depending on the season and availability of fish.

The main concern of the fishermen is that after the heavy industrialization of the area (especially chemical factories and ship breaking yards), the amount of fishes that

can be caught daily has lowered than it used to be 10-15 years ago. But they stated that the power plant projects have not affected their fishing activities because the existing power plants have imposed strict regulations in terms of the discharge. The people fishing around the power plant discharge points are mainly intermittent or recreational fishermen and they have not complained about the river water near the existing power plants.

The seasonal availability of fishes is shown in Figure 1 & 2 (according to fishermen).

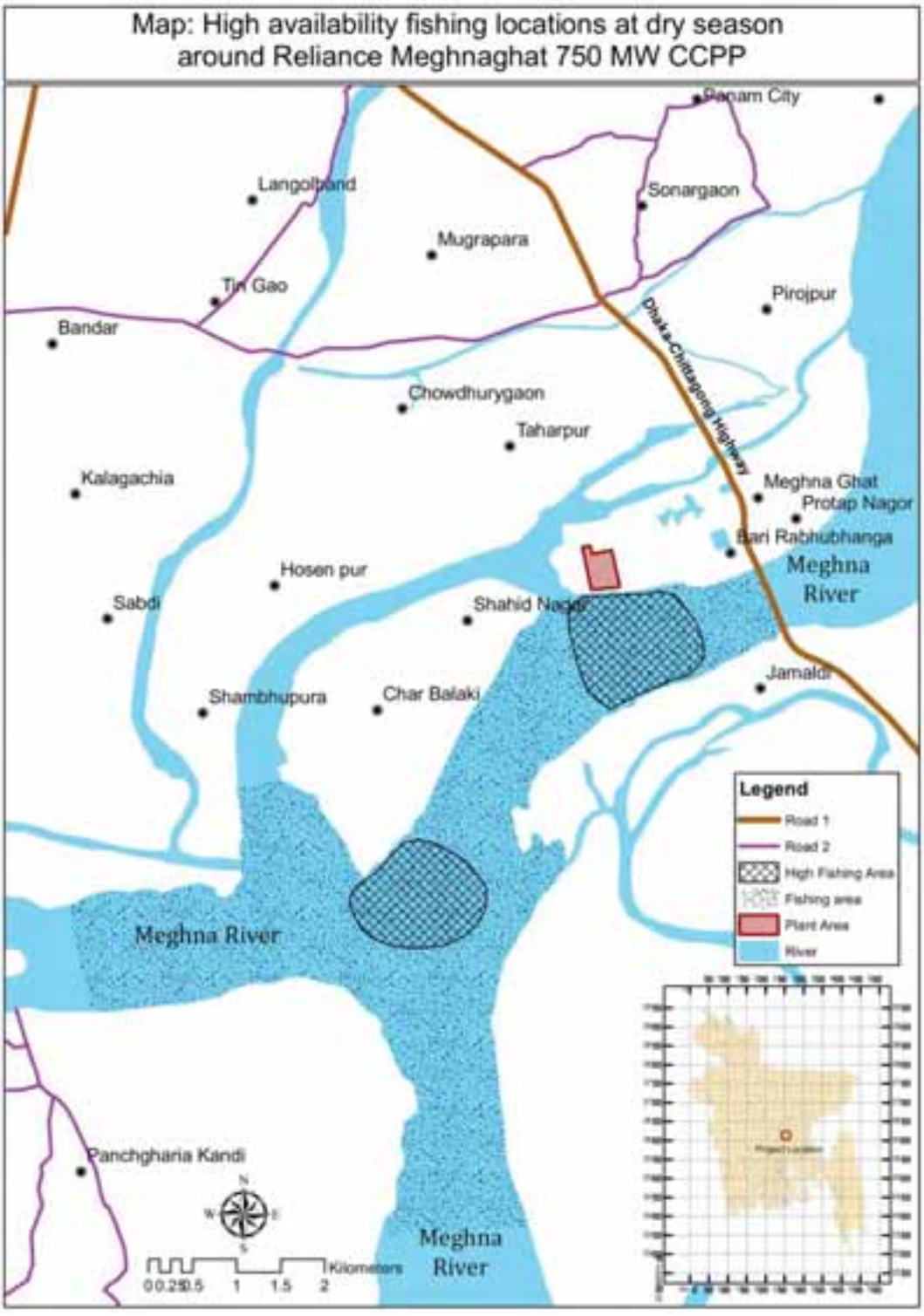

Figure 1: Areas of Fish availability in the Dry Season (according to the Local Fishermen)

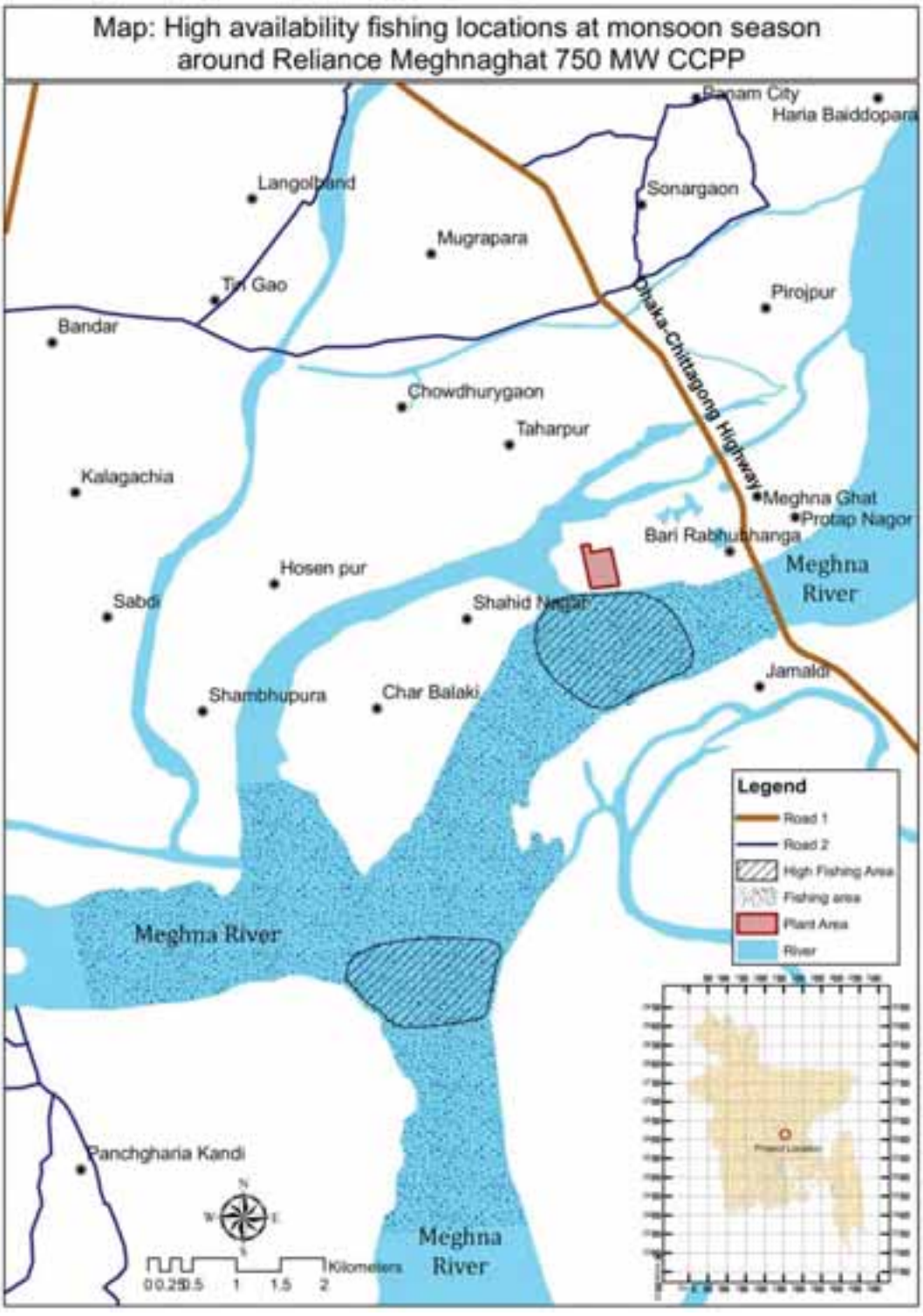

Figure 2: Areas of Fish availability in the Monsoon (according to the Local Fishermen)

Figure 3: Fisherman FGD (Day 1 & 2)

Figure 4: Fisherman FGD (Day 3)

Figure 5: The FGD Gathering

3.0 FGD of Cow Owners

As the project site is empty at present and without any fencing, people living around the area as a cattle grazing ground. There are 25 to 30 cows that graze in the existing project site everyday. People living in the area named Mongoler Gaon are the ones who own most of these cows. It is their secondary source of income and many of them are workers of existing power plants. They have been consulted about the future of their now used grazing ground. They have been informed about how much place will be occupied by the proposed project.

After consultation they have stated a few demands:

- As the cows are their second source of income, the project authority must consider them while recruiting for the construction and operation phase.
- The road across Mongoler Gaon is in terrible shape and they what the authority to help them fix their road.

3.1 Alternate Grazing Ground

According to the cow owners, the Project site is not the only place they use for grazing their cows. They graze their cows wherever they can manage an empty piece of land covered with grass. The project will not occupy the entire land; therefore the remaining land can be used as a grazing ground. As per their indication, the future grazing ground has been shown in **Figure 6.**

Figure 6: Alternative Grazing Ground after the Completion of the Project

Figure 7: Consultation with Local Cow Owners (Day 1; Location: Mongoler Gaon)

Figure 8: Consultation with Local Cow Owners (Day 2; Location: Mongoler Gaon)

4.0 Participants of Stakeholder Consultations

Table 1: Participants of FGDs

SL	Name	Address	Age	Sex	Profession	Mobile No
Fishermen FGD						
01.	Nurul Haque	Bolakir Char	60	M	Fisherman	01858740836
02.	Saleh Ahmod	Bolakir Char	62	M	Business	01725886995
03.	Firoz Mia	Bolakir Char	67	M	Fisherman	
04.	Mohammd Ali	Bolakir Char	45	M	Fisherman	
05.	Delowar Hosen	Bolakir Char	52	M	Business	01987048074
06.	Nazmul Alom	Bolakir Char	42	M	Business	01821498332
07.	Monowara	Bolakir Char	60	F	Housewife	01862754207
08.	Sirajul Islam	Mugrapara	36	M	Fisherman / Worker	01849285305
09.	Md. Saidul Islam	Mugrapara	30	M	Fisherman / Business	01747690287
10.	Md. Abdul Kader	Mugrapara	30	M	Fisherman / Worker	01881554365
11.	Saroti	Chandpur	46	M	Fisherman	01860482196
12.	Tapos	Chandpur	25	M	Fisherman	
13.	Sumon	Chandpur	25	M	Fisherman	
14.	Esob Bapari	Bolakir Char	52	M	Fisherman/ Business	01852101652
15.	Rubel Rana	Bolakir Char	19	M	Student	
16.	Mohammod Rasel	Bolakir Char	20	M	Student	
17.	Jakir	Bolakir Char	17	M	Fisherman	01820894170
18.	Md. Falanur	Bolakir Char	21	M	Fisherman	01834156499
19.	Ruma	Bolakir Char	30	F	Housewife	
20.	Eiasmin	Bolakir Char	26	F	Housewife	
21.	Hazi Mahafuj Member	Bolakir Char	75	M	Retired	
22.	Ebrahim	Bolakir Char	60	M	Fisherman	
23.	Md. Akter Hosen Khan	VatiBolaki	51	M	Retired	01734240464
24.	Hannan	Char Bolaki	50	M	Fisherman	01851491846
25.	Azgor Ali	Sonarganj	61	M	Business	01986750512
26.	Munir Hosen	Char Bolaki	50	M	Retired	
27.	Israfil	Balakir Char	38	M	Fishermen	01824900450
28.	Md. Zakir	Balakir Char	42	M	Fishermen	
29.	Mokter Hosen	Shahid Nagar, Char Balaki	50	M	Fisherman	01932533351
30.	Hazrot Ali	Shahid Nagar, Char Balaki	50	M	Fisherman	
31.	Mitu	Shahid Nagar, Char Balaki	30	F	Housewife	01834460424

32.	Mamun	Shahid Nagar, Char Balaki	10	M	Student	
33.	Rashed Rasel	Shahid Nagar, Char Balaki	10	M	Student	
34.	Zulhas	Shahid Nagar, Char Balaki	50	M	Fisherman	
35.	Faisal	Shahid Nagar, Char Balaki	9	M	Student	
36.	Sumona	Shahid Nagar, Char Balaki	8	F	Student	
37.	Farjana	Shahid Nagar, Char Balaki	7	F	Student	
38.	Akas	Shahid Nagar, Char Balaki	15	M	Fisherman	
39.	Tar Hosen	Shahid Nagar, Char Balaki	7	M	Fisherman	
40.	Moinul	Shahid Nagar, Char Balaki	10	M	Fisherman	
41.	Akter Hosen	Charbalaki	36	M	Fisherman	01837385812
42.	Mokter Hosen	Dudhghata	34	M	Fisherman	01830952907
43.	Ahammod Ali	Dudhghata	32	M	Fisherman	01816788635
Cow Owners						
1.	Akter Hossen	Gonga Nagar	60	M	Cow Farmer	
2.	Tamu Mia	Gonga Nagar	70	M	Cow farmer	01862706916
3.	Wazuddin	Ganga Nagar	90	M	Cow Farmer	
4.	Md. Rasel	Gonga Nagor	27	M	Service/Cow farmer	01676799311
5.	Ali Ahmed	Gonga Nagor	42	M	Business	01814389367
6.	Sonia	Gonga Nagor	22	F	Housewife	01814973631
7.	Nurul	Gonga Nagor	40	M	Farmer	01992701571
8.	Shahinur	Gonga Nagor	35	F	Housewife	
9.	Shila	Gonga Nagor	30	F	Housewife	
10.	Rakib	Gonga Nagor	16	M	Student	01726324502
11.	Zorina	Gonga Nagor	45	F	Housewife	

5.0 Concerns and Recommendation

5.1 Concerns from FGD

Project Approval

The FGDs demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities is evident. The proponent recognizes that benefits from the project should be distributed judiciously and equitably especially among primary stakeholders in the project area, and will continue to ensure that this

principle is followed in its projects and community development program. The consultation process should include the local people with different life styles.

Local Employment

Communities in the project area emphasized that local people should be given priority when employing people for various project-related works and activities according to their skills.

Impact on Environment & Livelihood

The FGDs included the impact on people of their living environment and livelihood. In the public consultation meetings, people should be asked regarding this issue.

Impact on Fishing

Since the proposed project would have close circuit cooling and no thermal discharge, the temperature rise in the Meghna River not be an issue for such project; therefore, the project will not hamper aquatic life.

Impact on Grazing

The project site is currently empty, unprotected and not fenced. Currently scattered cow owners use this land to graze their cows taking the advantage of unprotected nature. After consulting the cow owners, it appeared that they are concerned about their activities and they are motivated themselves to find alternative space for the cow grazing near the river bank once the project will be implemented. They still appreciated this endeavor which will lead to the development of the surrounding area and create employment opportunities.

5.2 Recommendations from FGD

1. They local communities recommend and demands development of infrastructures surrounding the project area to provide better communication.
2. They demand employment of the local young manpower during construction and operation phase.
3. They want to be provided with technical and vocational training centers to help them build up their skills.
4. They want training centers for the local women so that they can join the workforce as well.
5. There is no hospital nearby the project site. A medical facility will be a great facility for the community.
6. Primary and high schools need to be built up to ensure educational facility for the local children so that they can propel towards a better future.

6.0 Future Engagement Plan with the Communities

For the betterment of the community, the Reliance Bangladesh LNG & Power Limited authority is advised to hold future consultation events with the fishermen and cow owners during construction and operation phase in order to make sure that the dwellers are not being harmed by any means.

The consultation process has been planned to be carried out at regular interval with people near and around the project site. It can be carried out half yearly or annually and in those meetings, the Reliance authority must listen to their voices and try to solve their problems if any that will be caused for the project.

Annexure

Attendance Sheets of Social Studies

NGO

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date:
Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
1	Md: Ahsan Habib	Sonargaon Uddan ganj	30	meal	Service	01711-032807	[signature]
2.	MD. Akifur Rahman	Sonargaon UDDIPAN	29	Male	Brench Accaunt	01837775196	[signature]
3.	Jhuna Paul	Sonargaon Deba	29	Female	Branch Accountant	01733219966	[signature]
4.	[illegible]	Sonargaon Branch	49	male	B.com -	01713-710228	[signature]

Cow owners

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	Md. Akter Hasan	Gronga Nagar	60	male	Cow farmer	0	
	[illegible]	[illegible]	70	male	Cow farmer.	01862706916	

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	48	Male	Fisherman	01824900450	[illegible]
	[illegible]	[illegible]	42	"	"		[illegible]
	[illegible]	[illegible]	70	"	Owns a store	01829012664	[illegible]
	[illegible]	[illegible]	80	Female	Housewife		[illegible]
	[illegible]	[illegible]	60	Female	Housewife		BEAUTY ISLAM
	[illegible]	[illegible]	48	Male	Business	01882512105	
	[illegible]	[illegible]	50	"	Cowfarmer		
	[illegible]	[illegible]	48	"	Business	01714619426	Ansel
*	[illegible]	[illegible]	40	"	Meghnaghat Workers (Turbine Setting/ Maintainance)	01828655780	

Govt. Representative

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
1.	Mafizar Rahman	Secretary, Projects Up.	35 yr.	Male	Gov. Service	01933302040	
	Masudur Rahman Masum	Meghnaghat	39	Male	Chairman, Projects Up.	01836412121	

General

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	27	M	Service/Cultivation	01C7C799311	[illegible]
	Md. Ali Ahmed	"	42	M	Business	01814389367	[illegible]
	[illegible]	"	22	F	House wife	01814973631	[illegible]
	[illegible]	"	40	M	Farmer	01992701571	[illegible]
	[illegible]	"		F	House wife		
	[illegible]	"	30	F	House wife		[illegible]
	[illegible]	"	16	M	Student	01726324502	[illegible]
	[illegible]	"	45	F	House wife		[illegible]

Fishermen

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	60	M	Fishermen	01858940836	[illegible]
	[illegible]	[illegible]	42	M	Business	01725886995	SalehAhmed
	[illegible]	"	49	M	Fishermen		
	[illegible]	"	38	M	Fishermen		[illegible]
	[illegible]	"	62	M	Business	01987048074	[illegible]
	[illegible]	"	42	M	Business	01821498332	[illegible]
	[illegible]	"	60	M	Housewife	01862754207	[illegible]
	Arun Prasad R	Dhaka	31	M	Service	+917303409259	[illegible]
	RITUPARN SINGH	Dhaka	27	M	Service	+91 8587092131	[illegible]
	Mohamad Sibbir Ahamed	Dhaka	41	M	Service	01730447076	[illegible]

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD:

Venue:

Date: 25-01-17

Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
১।	[illegible]	[illegible]	৫০	M	Fishermen	01932533351	[illegible]
2	[illegible]	"	৫0	M	Fishermen		[illegible]
3	[illegible]	"	৬0	F	Housewife	01839460429	[illegible]
	[illegible]	"	২০	M	Student		[illegible]
	[illegible]	"	১0	M	"		[illegible]
	[illegible]	"	৫0	M	Fisherman		
	[illegible]	"	৯	M	Student		[illegible]
	[illegible]	"	৮	F	Student		[illegible]
	[illegible]	"	৭	F	Student		[illegible]
	[illegible]	"	১৫	M	Fishermen		[illegible]
	[illegible]	"	৭	M	"		
	[illegible]	"	১0	M	"		

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD:

Venue:

Date:

Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	২৬	F	Housewife		[illegible]
	[illegible]	"	৭৮	M	Retired		[illegible]
	[illegible]	"	৬০	M	Fishermen		[illegible]
	[illegible]	[illegible]	৫১	M	Retired	01734240464	[illegible]
	[illegible]	[illegible]	৫০	M	Fishermen	01851491846	[illegible]
	[illegible]	[illegible]	৬৩	M	Business	01986750512	[illegible]
	[illegible]	[illegible]	৫০	M	Retired		

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	[illegible]	M	Worker/Fisherman	01849285305	[illegible]
	[illegible]	[illegible]	60	M	Business/Fisherman	01847690289	
	[illegible]	[illegible]	[illegible]	M	Worker/Fisherman	01881554365	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fisherman	01860482196	[illegible]
	[illegible]	[illegible]	[illegible]	M	"		[illegible]
	[illegible]	[illegible]	[illegible]	M	"		✓
	[illegible]	[illegible]	[illegible]	M	Fisherman/Business	01852101652	
	[illegible]	[illegible]	[illegible]	M	Student	"	[illegible]
	[illegible]	[illegible]	[illegible]	M	Student	"	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fishermen	01820894190	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fishermen	01834156499	[illegible]
	[illegible]	[illegible]	[illegible]	F	Housewife		[illegible]

Annexure: 10.2

Public Consultation Process

Reliance Meghnaghat 750 MW Combined Cycle Power Plant

Meeting Minutes of Public Consultation

8/28/2017

Proponent: Reliance Bangladesh LNG & Power Limited

Prepared By: Adroit Environment Consultants Limited

Adroit Environment Consultants Limited

2/12, Block B, Humayun Road, Mohammadpur, Dhaka-1207, Bangladesh
Cell: +880 1711-565728, +880 1733376609-10, Tel: +88029116712, +88029116713,
Fax: +88029116714, E-Mail: aecldhaka@gmail.com, eia.aecl@gmail.com,
Web: www.aecl-bd.org

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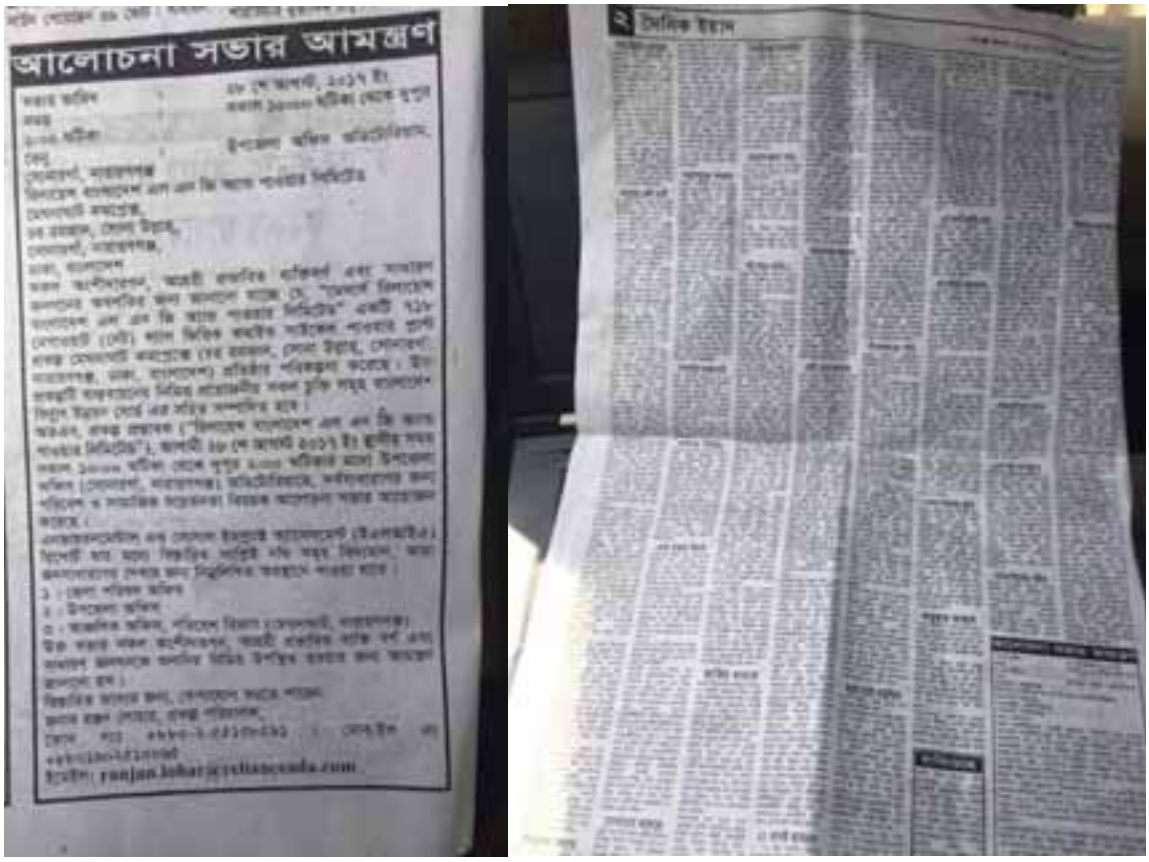
List of Annexures

1. Sample Feedback Questionnaire for Public Consultation in Bangla
2. Executive Summary of the ESIA Report on Reliance Meghnaghat 750 MW CCPP in Bangla and in English
3. A Presentation on the Specifications of Reliance Meghnaghat 750 MW CCPP
4. Attendance Sheet of the Audience Present in the Public Consultation
5. News Coverage on the Public Consultation

1. Public Notice

An advertisement was published on 21st August, 2017 in Daily Iyad (দৈনিক ইয়াদ), a local newspaper of Narayanganj, to send the announcement to the general dwellers of Sonargaon.



2. Invitation Letter to the Honorable Guests

An invitation letter was issued and then was sent to the honorable guests who were expected to be present in the Public Consultation meeting. Among the guests, there were the local Member of the Parliament, Representatives of the Local Chairman as he wasn't available at the time for public consultation, UNO of Sonargaon Upazilla, representatives of Local NGOs, Headmasters of local schools, local religious leader etc. The list of the special guests is given below:

1. Hon'ble MP of Narayanganj, Mr. Liakat Hossain (Khoka)
2. Hon'ble UNO, Mr. Shahenur Islam
3. Project Director, Meghnaghat (BPDB), Mr. Sontosh Kumar Sadhukhan
4. Project Director (Reliance Power), Mr. Ranjan Lohar
5. Senior Vice President, Environment (Reliance Power), Dr. Bijan Mishra
6. Senior Safeguards Specialist, Asian Development Bank, Mr. Anik Ajmera
7. Nari Maitree, Mr. Quamrul Islam
8. Assistant Director of Aparajeyo, Mr. Mustafa
9. Representative from Aparajeyo, Mr. Shah Alam

Sample of Invitation Letter to Honorable Guests is given below:

PUBLIC CONSULTATION INVITATION

21st August 2017

Dear Sir,

We take this opportunity to notify that M/s. Reliance Bangladesh LNG & Power Limited shall be setting up a 718 MW (net) gas based combined cycle power project at Meghnaghat Complex, Char Ramzan Sonaullah, Sonargaon, Narayanganj, Dhaka division, Bangladesh under agreements to be signed with authorities under the Ministry of Power, Energy and Mineral Resources.

The project proponent is organizing a public consultation process for environmental & social concerns on **28th August, 2017 between 10:00 AM to 2:00 PM local time** at the office of the Upazilla Nirbahi Officer (UNO), Sonargaon, Narayanganj, Dhaka, Bangladesh.

The Environmental and Social Impact Assessment (EIA) report, containing the detailed concerned documents is available at following locations:

A. In the Office of Zilla Parishad Office,
B. In the Office of Upazilla Parishad Office,
C. In the Regional Officer, DoE at Meghnaghat

We take this opportunity to invite you and the esteemed officials from your organization to attend the proceedings.

For further Information, please contact:

Mr. Ranjan Lohar, Project Director
Phone: +880-2-55138591 Cell:+880-1902510065
e-mail: ranjan.lohar@relianceada.com

3. Summary of the Audiences Present at the Public Consultation

People from all walks of life were present at the public consultation meeting. They listened to what the proponents had to say about the project. They also gave their valuable opinions and stated their concerns. A brief summary of the people present at the public consultation meeting is given below:

Male = 66	Politician = 02	Engineer =04
Female=19	Driver = 01	Service= 08
Student = 07	Journalist = 06	UNO = 01
Housewife =10	Contractor = 01	Agriculture=02
Businessman = 10	UP Member= 12	ADB =01
Teacher = 09	NGO= 03	

A sample attendance sheet has been given in the Table that follows:

Reliance Meghnaghat 750 MW CCPP

Participant List for Public Consultation

Date: 28/08/17

Venue: UNO Office Auditorium, Sonargaon, Narayanganj. Time: 10 AM

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign

4. Summary of the Q&A Session

Questions Asked by the Audience Members

SL No.	Name of the Questioner	Occupation	Question asked	Key Words of Issues Raised
1	Md. Kabir Hossain	UP Member	• Electricity is essential for the country but the thermal discharge is bad for the river and the ecosystem. What has this project done to diminish this problem? • Natural gas is no longer abundant in this country. How will the project avoid being the part of the problem? • Has the authority considered building an alternate and ecofriendly power plant? • Can the authority think of an alternative site as there are already too many in this area?	Scarcity of Natural Gas, Environmental Damage, Thermal Discharge, Alternate Methods of Power Generation, Alternate Land
2	Minara Aktar	School Teacher	The ancestral lands of the local people were acquired by GOB and that left people unemployed as a result. Has the proponents devised any plan to create employment opportunities for local people?	Employment Opportunity, Training Programs
3	Md. Jahangir Alam	UP Member	The local people are ready to offer any help that is needed. But has the proponent made sure to mitigate the possible adverse effects of the project?	Environmental Damage
4	Md. Alamgir Kabir	Acting Chairman	Will the proponents put maximum effort to employ local labors and experts?	Employment opportunity
5	Md. Morshed	UP Member	Will the proponents make sure to alleviate the unemployment problem that local youths have at present?	Employment opportunity
6	Robiul Hossain	Journalist	• Has the proponent conducted environmental assessment to evaluate the suitability of the area to build a power plant? • What measures will be taken to mitigate the adverse effect of the emission and thermal discharge?	Environmental Assessment, Emission, Thermal Discharge

*UP= Union Parishad

*GOB= Government of Bangladesh

As Answered by Mr. Ranjan Lohar

Scarcity of Natural Gas:

Reliance Bangladesh LNG & Power Limited (RPLBL) is aware of the recent scarcity of natural gas in Bangladesh. Taking that concern into consideration, RPLBL has decided to operate the project on RLNG which will be imported, re-gasified and then added to the grid. The added amount will be far more than what is needed for the project. Therefore, the project will not contribute to the existing problem.

Environmental Damage:

RPLBL will use the latest and advanced technology as the power plant turbines, stacks, cooling system etc. to mitigate the environmental adverse effect as much as possible.

Thermal Discharge:

The plant will have "Closed Circuit Cooling" system which will result in minimal discharge; 206 m^3/hr to be precise. The discharged water will be cooled down as well as treated in ETP before returning back to the river.

Emission:

NOx, CO and hot air are the main emitted gases from power plant stacks. RBLPL has used latest technology in engines and filters to ensure maximum efficiency as well as very little emission in the environment. Even after the project goes enters operation phase, the emission gases will be well below the IFC/WB, ADB and GOB standards.

Alternate Methods of Power Generation:

Bangladesh has acute scarcity of land in recent years. The alternate methods of power generation such as solar power, wind power etc. will require much larger land area and will still not be as efficient. In this scenario, gas based power plant is the best bet.

Alternate Land:

Bangladesh Power Development Board (BPDB) has declared the area of project site a power hub. Anywhere else will require more land acquisition and eventually will involve resettlement and rehabilitation of people which is not required in case of this project. So, the project site is the best piece of land for this purpose.

Employment Opportunity:

RBLPL authority has noted the concerns regarding the unemployment problem of the local dwellers and would create appropriate plan to efficiently utilize available skills in the local areas. Furthermore, the project will create various means for income generation; not only locally but

also across the nation. Therefore, the project will contribute towards uplifting the economy of the country.

Training Programs:

RBLPL plans to organize various training programs for capacity building through skillset development before engaging the local people for working in similar industries. International safety measures will be in place to ensure the guidelines of OHSA so as to minimize accidents as well as to guarantee safety at workplace.

Environmental Assessment:

RBLPL has hired Adroit Environment Consultants Ltd., a leading expert on environmental consultation, to run an assessment of the environmental condition of the area. The environmental condition was found to be quite satisfactory for a power plant project. Also, the aforementioned environmental experts have suggested mitigation measures for every possible adverse effect that may result from the project and they will be followed accordingly. There will be stringent monitoring programs once the project goes into operation to ensure that the emission gases are within limit.

5. Concerns

After taking everything into consideration, there was no major concern that aroused during the public consultation. The cooperation from the participants was worthy of praise and the entire meeting can be considered as worthwhile.

6. Photographs from the Public consultation








Annexures

Sample Feedback Questionnaire for Public Consultation in Bangla and in English

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট বিদ্যুৎকেন্দ্রের জন্য সামাজিক ও পরিবেশ সম্পর্কিত বিস্তারিত মতামত

সামাজিক সম্পৃক্তি

১) সাধারন তথ্যাবলিঃ

গ্রামের নামঃ	ইউনিয়নঃ	জেলাঃ	বিভাগঃ

২) বাসিন্দার বিবরণীঃ

উত্তরদাতার নামঃ			পারিবারিক প্রধানের নামঃ	
উত্তরদাতার সাথে প্রধানের সম্পর্কঃ			ধর্মঃ	জাতিগত গোষ্ঠী:
পরিবারের ধরনঃ (√/x)	একক পরিবারঃ	যৌথ পরিবারঃ	বর্ধিত পরিবারঃ	
পরিবারের সদস্য সংখ্যাঃ				
প্রাপ্তবয়স্ক পুরুষঃ	প্রাপ্তবয়স্ক নারীঃ	ছেলে শিশুঃ	মেয়ে শিশুঃ	
নারী পারিবারিক প্রধান (যদি প্রযোজ্য হয়):	নামঃ		বয়সঃ	

৩) পরিবারের বিবরণীঃ

নং	পারিবারিক সদসস্যের নাম	লিঙ্গ (পু/ম)	উত্তরদাতার সাথে সম্পর্ক[১]	বয়স	বৈবাহিক অবস্থা[২]	শিক্ষাগত যোগ্যতা[৩]	সাধারন কর্মকাণ্ড[৪]

নং	পারিবারিক সদস্যের নাম	লিঙ্গ (পু/ম)	উত্তরদাতার সাথে সম্পর্ক[১]	বয়স	বৈবাহিক অবস্থা[২]	শিক্ষাগত যোগ্যতা[৩]	সাধারন কর্মকাণ্ড[৪]

[১) ক)বাড়ীর প্রধান, খ)স্ত্রী, গ)স্বামী, ঘ)পুত্র, ঙ)কন্যা, চ)জামাতা, ছ)পুত্রবধূ, জ)ভাই, ঝ)বোন, ঞ)বাবা, ট)মা, ঠ)নাতি, ড)নাতনি, ঢ)দাদা/নানা, ণ)দাদি/নানি, ত)খালা/ফুফু/চাচি/মামি, থ)চাচা/মামা/খালু/ফুপা, দ)ভাগিনা/ভাতিজা, ধ)ভাগিনি/ভাতিজি, ন)অন্যান্য

২) ক)বিবাহিত, খ)অবিবাহিত, গ)তালাকপ্রাপ্ত, ঘ)বিচ্ছিন্ন, ঙ)বিপত্নিক/বিধবা

৩) ক)অশিক্ষিত, খ)সশিক্ষিত, গ)প্রাইমারি পাশ (১ম-৫ম শ্রেণী), ঘ)নিম্ন মাধ্যমিক পাশ (৬ঠ-৮ম শ্রেনী), ঙ) মাধ্যমিক (৯ম-১০ম শ্রেণী), চ)উচ্চ মাধ্যমিক (১১ম-১২ম শ্রেণী), ছ)স্নাতক, জ)স্নাতকোত্তর, ঝ)কারিগরি, ঞ)অন্যান্য

৪) ক)চাকরিজীবী, খ)শ্রমিক, গ)জেলে, ঘ)ব্যবসা, ঙ)সাংসারিক কাজ, চ)ছাত্র, ছ)বৃদ্ধ/অবসরপ্রাপ্ত, জ)স্কুলগামী বয়সের কমবয়সী, ঝ)প্রতিবন্ধী, ঞ)অন্যান্য]

৪) স্থাপনার বিবরণীঃ

১)স্থাপনার ধরনঃ[১]	২)কক্ষের সংখ্যাঃ	৩)ছাদের ধরনঃ[২]
৪)দেয়ালের ধরনঃ[৩]	৫)মেঝের ধরনঃ[৪]	৬)গোয়াল ঘরঃ

[১)ক)পাকা, খ)আধাপাকা, গ)কাচা, ঘ)টিন;

২)ক)দালান, খ)টিন, গ)কাঠ ও পাথর, ঘ)ইটের ঘর, ঙ)কাঠ, চ)অন্যান্য;

৩)ক)পাথর, খ)টিন, গ)কাদামাটি, ঘ)ইট, ঙ)কাঠ, চ)অন্যান্য;

৪)ক)সিমেন্ট, খ)কাদামাটি, গ)পাথর, ঘ)অন্যান্য]

৫) সম্পদের বিবরণীঃ

গবাদি পশু (সংখ্যা) –	গরু:	ষাঁড়:	মহিষ:	ছাগল:	ভেড়াঃ	হাস/মুরগিঃ	উল্লেখ্য অন্যান্যঃ
স্যানিটেশন সুবিধাঃ (হ্যাঁ/না)	বিদ্যুৎ সুবিধাঃ (হ্যাঁ/না)		খাবার পানির উৎসঃ (হ্যাঁ/না)		পানির মানঃ		
টেলিভিশনঃ (হ্যাঁ/না)	মোবাইলঃ (হ্যাঁ/না)		কেরোসিন চুলাঃ (হ্যাঁ/না)	গ্যাসের চুলাঃ (হ্যাঁ/না)	ফ্যানঃ (হ্যাঁ/না)		
ট্রাক্টরঃ (হ্যাঁ/না)	গাড়িঃ (হ্যাঁ/না)		মোটরসাইকেলঃ (হ্যাঁ/না)	বাইসাইকেলঃ (হ্যাঁ/না)	রেফ্রিজারেটরঃ (হ্যাঁ/না)		
উল্লেখযোগ্য অন্যান্যঃ							

৬) পেশা এবং আয়ের বিবরণীঃ

পেশার শ্রেণী:	কৃষিকাজ	পশুপালন	ব্যাবসা	জেলে	চাকরি (সরকারি/বেসরকারি)	গৃহস্থালির কাজ	আত্ম নির্ভরশীল	পণ্য উৎপাদন	অন্যান্য
পেশার ধরনঃ	কৃষি শ্রমিক			স্বনির্ভর খামারি		স্বনির্ভর কিন্তু খামারি নয়		বেতনপ্রাপ্ত	

মাসিক আয় (টাকা)	৫০০০/- এর নিচে	৫০০০-১০০০০/-	১০,০০০-২০,০০০/-	২০,০০০/- এর উপর

পরিবেশের সম্পৃক্তি

৭) প্রকল্প সম্পর্কে ধারণাঃ

প্রকল্প সম্পর্কে ধারনা?	
কোন ঐতিহাসিক স্থাপনা আশেপাশে আছে কি?	
মাছ ধরার ক্ষেত্রে কি ধরনের সমস্যা হতে পারে?	
পরিবেশগত কি ধরনের সমস্যা হতে পারে?	
গো-চারণের কোন অসুবিধা হবে কিনা?	
প্রকল্প থেকে কি আশা করা যায়?	

৮) চিহ্নিতকরণ (১ থেকে ৫ এর মধ্যে)

অত্যন্ত গুরুত্তপুরন-৫, বেশ গুরুত্বপূর্ণ-৪, নিরপেক্ষ-৩, খুব গুরুত্বপূর্ণ নয়-২, একদমই গুরুত্বপূর্ণ নয়-১

শিক্ষা প্রতিষ্ঠান			স্বাস্থ্যকেন্দ্র	
গুরুত্বপূর্ণ স্থাপনা (রাস্তা, বিদ্যুৎ ইত্যাদি)			কাজে নিয়োগ	
পানি সরবরাহ			পরিবহন ব্যবস্থা	
দক্ষতার উন্নয়ন			নারীর ক্ষমতায়ন (প্রশিক্ষণ, চাকরি, স্বাস্থ্য সুবিধা, শিক্ষা ইত্যাদি)	
কৃষির উন্নয়ন			বিনোদন সুবিধা	
অন্যান্য (উল্লেখ করুন):		মন্তব্যঃ		

Date:

A. GENERAL INFORMATION

1. Name of the Village:	2. Name of the Union:	3. District:	4. Division:
5. Serial Number in acquired plot list:	6. Dag No.:	7. Area of Land Sold:	8. Respondent Detail*:

*(A: Landowner; B: Tenant; C: Relative; D: Share Cropper; E: Others – specify)

B. RESPONDENT DETAILS

1. Name of the Respondent:			2. Name of Head of Household (HoH):	
3. Relationship with HOH:			4. Religion:	5. Ethnic Group:
6. Household Type (Y/N)	Joint Family:	Nuclear Family:	Extended Family:	
7. No. of Family Members:				
Adult Males:	Adult Females:	Males (Child):	Females (Child):	
8. Female Head, if any:	Name:		Age of Head:	

C. FAMILY DETAILS

S. No.	Name of Family Members	Gender (M/F)	Relationship with Respondent[1]	Age	Marital Status[2]	Literacy Level[3]	Usual Activity[4]
1.							
2.							
3.							
4.							

Date:

S. No.	Name of Family Members	Gender (M/F)	Relationship with Respondent[1]	Age	Marital Status[2]	Literacy Level[3]	Usual Activity[4]
5.							
6.							
7.							
8.							
9.							
10.							

[[1]: (a) Head of Household (b) Wife (c) Husband (d) Son (e) Daughter5 (f) Son in law(g) Daughter in law (h) Brother (i) Sister (j) Father (k) Mother(l) Grandson(m) Grand Daughter (n) Grandfather (o) Grandmother (p) Aunt (q) Uncle(r) Nephew (s) Niece (t) others

[2]: (a) Married (b) Unmarried (c) Divorced (d) Separated (e) Widow

[3] (a) Illiterate (b) Literate but no formal education (c) Primary (Class 1-5)(d) Middle (Class 6-8) (e) High School (Class 9-10) (f) Senior Secondary(g) Graduate (h) Post Graduate (i) Technical (j) Others (specify)

[4]: (a) Worker (b) Non Worker (c) Household Work(d)Student(e) Old/Retired(f) Non school going age (g) Handicapped (h) others]

D. LAND DETAIL (in hectares/acres)

1. Total Land Area Owned:		2. Total Land Acquired for the Project:
3. Type of Land[1]:	4. Usage of Land[2]:	5. Name of Owner/Occupant:
6. Name of Father/Husband/Guardian:	8.Ownership Status[3]:	9. Place of Residence:

[[1]: (a) Irrigated (b) Unirrigated;

[2]: (a) Agriculture, (b) residential, (c) agriculture and residential, (d) commercial, (e) residential and commercial, (f) barren, (g) others, please specify

[3]: (a) Owned, (b) Lease holder, (c) squatter, (d) encroacher, (e) share cropper, (f) other, please specify]

E. CROP PARTICULARS

1. Do you grow any crops in the land proposed to be acquired or acquired? Yes/No.
2. Please provide the following details of crops cultivated on land parcels owned, (in hectares/acres)

Date:

1. Crop(s) Name:	2. Area Cultivated:	3. Yield and Rate:

3. Any agricultural labourer who is working for you and dependent upon the land proposed for acquisition? Yes/No
4. If yes, provide the following details,

1. Name:	2. Place of Residence:

F. STRUCTURE PARTICULARS

1. Any structure is getting affected due to the proposed land acquisition? Yes/No
2. Provide details of dwelling structure

1. Type of Structure[1]:	2. No. of Rooms:	3. Roof Type[2]:
4. Wall Type[3]:	5. Floor Type[4]:	6. Cattle Shed:

[[1]: (a) Pucca (b) Semi Pucca (c) Kutcha
[2]: (a) RCC, (b) Slate stones with wood, (c) Thatched, (d) Tin (e) Others, please specify
[3]: (a) Stone Masonry, (b) Mud, (c) Brick Masonry, (d) Wood, (e) other, please specify
[4]: (a) Plane cement concrete, (b) Mud, (c) Stone, (d) Others, please specify]

G. BASIC ASSETS AND AMENITIES (answer yes/no)

Livestock Ownership (mention total number)	Cows:	Bullock:	Buffaloes:	Goat:	Sheep:	Poultry (Hens/Ducks):	Others(pls. specify):
Sanitation Facility (Y/N):	Electricity Connection (Y/N):		Drinking Water Source:		Quality of Water:		
Television (Y/N):	Mobile (Y/N):		Kerosene Stove (Y/N):	LPG Stove (Y/N):		Electric Fan (Y/N):	
Tractor (Y/N):	Car (Y/N):		Scooter/Bike (Y/N):	Bicycle (Y/N):		Refrigerator (Y/N):	
Others (specify):							

Date:

H. OCCUPATION AND INCOME LEVEL

1. Employment Sector:	Agriculture	Animal Husbandry	Trade & Business	Manufacturing	Service (govt./private)	Household Activities	Professional	Self-employed	Others (pls. specify)
2. Occupation Type:	Agricultural Labours		Self employed in Farm		Self employed in non farm		Salaried		
3. Income Level (monthly):	Below 5000 BDT		5000-10000 BDT		10000-20000 BDT		20000 BDT & above		
4. Bank Account (Govt. / Pvt.):									

I. PERCEPTION ABOUT THE PROJECT

1. Awareness about the project?	
2. Status of the land prior to the purchase/ procurement?	
3. What would you do once you receive the payment for selling your land?	
4. Any cultural heritage/ archaeological site near the project area?	
5. Overall has land prices increased with the coming of the project in the area?	
6. Concerns about the project	
7. Expectations from the project	

J. NEED ASSESSMENT (very important -5; somewhat important- 4; neutral- 3; not very important- 2; not at all important -1)

Educational Institutions			Health Centres	
Infrastructure (roads, electricity etc.)			Employment	
Water Supply			Transport Facilities	
			Women Empowerment (vocational centres, jobs, healthcare, education	

Date:

Skill Development			etc.)	
Agricultural Improvement			Recreational/Community Hall etc.	
Others (specify) :		Remarks:		

Executive Summary of the ESIA Report on Reliance Meghnaghat 750 MW CCPP in Bangla and in English

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট

প্রস্তাবকঃ রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড

প্রতিবেদন প্রস্তুতকারীঃ এড্রয়েট এনভাইরনমেন্ট কন্সাল্টেন্টস লিমিটেড

নির্বাহী কার্যসংক্ষেপ

১। ভূমিকাঃ

রিলায়েন্স বাংলাদেশ এলএনজি ও পাওয়ার লিমিটেড (পরবর্তীতে 'আরবিএলপিএল,' বা 'প্রস্তাবক' হিসাবে উল্লিখিত) ৭৫০ মেগাওয়াট গ্যাস ভিত্তিক যৌথ চক্র বিদ্যুৎ কেন্দ্র (কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট- সি.সি.পি.পি.) প্রকল্পের উন্নয়নের প্রস্তাব করা হয়েছে। প্রকল্পটির ঠিকানাঃ উপজেলাঃ সোনারগাঁও, গ্রামঃ মেঘনাঘাট, জেলাঃ নারায়ণগঞ্জ। বাংলাদেশ দক্ষিণ এশিয়ায় দ্রুততম ক্রমবর্ধমান অর্থনীতির একটি। বাংলাদেশের মোট জনসংখ্যার প্রায় ৭২% বিদ্যুৎ ব্যবহারের সুযোগ রয়েছে। কিন্তু এখনও এদেশে বিদ্যুতের নির্ভরযোগ্য ও গুণগত সরবরাহের ঘাটতি রয়েছে। বিদ্যুৎ ও খনিজ সম্পদ মন্ত্রণালয়ের মতে বাংলাদেশে বিদ্যুতের চাহিদা ক্রমাগত বৃদ্ধি পাচ্ছে।

বর্তমান বিদ্যুৎ সংকট এবং ভবিষ্যতের চাহিদা পূরণের লক্ষ্যে বাংলাদেশ সরকার ২০৩০ সালের মধ্যে ৩৯ হাজার মেগাওয়াট বিদ্যুৎ উৎপাদনের পরিকল্পনা গ্রহন করেছে। বাংলাদেশ সরকার বিদ্যুৎকেন্দ্র বৃদ্ধির উদ্যোগ নিতে বিভিন্ন পদক্ষেপ নিয়েছে এবং পাওয়ার সেক্টর মাস্টার প্ল্যান (পিএসএমপি) ২০১০ অনুমদিত হয়েছে। এই লক্ষ্যে বাংলাদেশ সরকার (জিওবি) পাবলিক প্রাইভেট পার্টনারশিপের মাধ্যমে বিদ্যুৎ খাতের উন্নয়নে পরিকল্পনা করে। অতএব, মেঘনাঘাটের প্রস্তাবিত ৭৫০ মেগাওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্রজেক্টের নির্মাণ বাংলাদেশের বর্তমান বিদ্যুৎ চাহিদার পাশাপাশি বিদ্যুৎ চাহিদা নিশ্চিত করার জন্য সহায়তা করবে। বর্তমান প্রকল্প বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়ের সাথে সঙ্গতিপূর্ণ হয় এবং এই প্রকল্পকে নীতিগত অনুমোদন দেওয়া হয়। প্রস্তাবিত প্রকল্পটি ১৫/০১/২০১৭ তারিখে চিঠি মেমো নং ২২.০৭.৬৭৭০০.১৪০.৭২.১৬৪.১৬-১৮ এর মাধ্যমে সাইট অনুমোদন প্রাপ্ত হয়েছে।

প্রাকৃতিক গ্যাস বাংলাদেশের সবচেয়ে গুরুত্বপূর্ণ খনিজ সম্পদ যা ৭৩% বাণিজ্যিক কার্যক্রমের সহায়ক। ২০২১ সালের মধ্যে সকলকে সাশ্রয়ী ও নির্ভরযোগ্য বিদ্যুৎ ব্যবহারের সুযোগ প্রদান এবং বাংলাদেশ সরকারের নীতিমালা মেনে চলার লক্ষ্যে আরপিএলবিএল সরকারের বরাদ্দক্রীত জমিতে একটি নতুন ৭৫০ মেগাওয়াট সি.সি.পি.পি নির্মাণ করা হবে। প্ল্যান্টের প্রস্তাবিত এলাকা মেঘনাঘাটে পিডিবির বরাদ্দকৃত ৩৫ একরের সরকারি জমির মধ্যে অবস্থিত।

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট সিসিপিপি প্রকল্পটি আরবিএলপিএল, এশিয়ান ডেভেলপমেন্ট ব্যাংক (এডিবি) এবং অন্যান্য ঋণদাতাদের অর্থায়নে বাস্তবায়ন করা হবে। এই প্রতিবেদনের উদ্দেশ্য হচ্ছে নির্মাণ এবং চলাকালীন সময় প্রস্তাবিত প্রকল্পের কার্যকলাপের ফলে সৃষ্ট পরিবেশগত ও সামাজিক প্রভাবগুলির মূল্যায়ন করা। কোন প্রতিকূল প্রভাবের ক্ষেত্রে সম্ভাব্য ক্ষয়ক্ষতির ব্যবস্থা কি হতে পারে, তার একটি প্রস্তাবনাও এখানে উপস্থাপন করা হয়েছে। প্রশমন ব্যবস্থা এবং তার কার্যকারিতা নির্ণয় করার জন্য একটি ব্যবস্থাপনা এবং পর্যবেক্ষণ পরিকল্পনা "ইএসআইএ" এর অংশ হিসাবে সুপারিশ করা হবে।

এই প্রকল্পের ইএসআইএ প্রতিবেদনটি এডিবি'র সুরক্ষা নীতি বিবৃতি (সেইফগার্ড পলিসি স্টেইটমেন্ট- এসপিএস) ২০০৯ এবং আইএফসি কর্মক্ষমতা মানদণ্ডের পাশাপাশি বাংলাদেশে ইআইএ নির্দেশিকা অনুসারে প্রণয়ন করা হয়েছে যা "পরিবেশ সংরক্ষণ আইন ১৯৯৫" কে মেনে চলে।

২। প্রকল্পের বিবরণীঃ

আরবিএলপিএল নারায়নগঞ্জের সোনারগাঁ উপজেলার মেঘনাঘাটে একটি ৭৫০ মেগাওয়াট গ্যাস ভিত্তিক যৌথ চক্র বিদ্যুৎ কেন্দ্র (কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট- সি.সি.পি.পি.) নির্মাণের জন্য পরিকল্পনা প্রণয়ন করেছে। প্রকল্পের জন্য তরল প্রাকৃতিক গ্যাস (এলএনজি) এর প্রয়োজনীয় স্বালানী কুটুমপুর থেকে মেঘনাঘাট পর্যন্ত প্রস্তাবিত ২৪ ইঞ্চি গ্যাস পাইপলাইনের মাধ্যমে জিটিসিএল (গ্যাস ট্রান্সপোর্টেশন কোম্পানি লিমিটেড) সরবরাহ করা হবে। বিদ্যুৎ কেন্দ্র থেকে উৎপাদিত বিদ্যুৎ মেঘনাঘাটে পাওয়ার গ্রিড কোম্পানির (পিজিসিবি) নির্মিত ৪০০ কেভি ট্রান্সমিশন নেটওয়ার্কের মাধ্যমে সারাদেশে বন্টন করা হবে। প্রকল্পের মৌলিক তথ্য নিচে দেয়া হল:

প্রকল্পের নাম	রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট
প্রকল্পের ঠিকানা	মেঘনাঘাট, সোনারগাঁ, নারায়ণগঞ্জ, বাংলাদেশ
প্রধান পৃষ্ঠপোষক	রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড
উৎপাদিত পণ্য	বিদ্যুৎ
বিদ্যুৎকেন্দ্রের ক্ষমতা	৭৫০ মেগাওয়াট
মোট ভূমির পরিমান	৩৫ একর
স্বালানির চাহিদা	আরএলএনজি/প্রাকৃতিক গ্যাস: ১৩০ mmscfd @১০০% লোড
পানির চাহিদা ও উৎস	১০৭৬ ঘনমিটার/ ঘন্টা
বর্জ্য পানির পরিমান	২০৬ ঘনমিটার/ ঘন্টা
শীতলীকরণ ব্যাবস্থা	বন্ধ চক্র শীতলীকরণ (ক্লোজড লুপ কুলিং)

৩। আইন এবং নীতিমালাঃ

বাংলাদেশে পরিবেশগত শ্রেণীবিভাগের "অন্তর্ভুক্তি তালিকার" উপর ভিত্তি করে ইসিআর ৯৭-এ প্রদত্ত হয় যার মধ্যে "রেড ক্যাটাগরি" সর্বোচ্চ বিভাগ। বিদ্যুৎ প্ল্যান্টটি ইসিআর ৯৭ অনুসারে "রেড ক্যাটাগরির" অন্তর্ভুক্ত।

এডিবির শ্রেণীবিভাগ অনুযায়ী, প্রকল্পটি পরিবেশগত দিক থেকে " ক্যাটাগরি এ", সামাজিক দিক থেকে "ক্যাটাগরি সি" এর অন্তর্গত।

৪। বিকল্প পন্থার বিশ্লেষণঃ

বাংলাদেশের সম্পদ সীমাবদ্ধতা বোঝার পর, এটি স্পষ্ট যে বিদ্যুৎ উৎপাদনের জন্য সর্বোত্তম প্রযুক্তি যৌথ চক্র (কম্বাইন্ড সাইকেল) প্রযুক্তি। সুতরাং, অন্য কোন বিদ্যুৎ উৎপাদনের প্রযুক্তি এই অবস্থায় অনুপযোগী।

৫। প্রাথমিক পরিবেশগত সমীক্ষার বিবরনঃ

বাতাসের গুনগতমানঃ

পরিবেশ অধিদপ্তরের ক্যামস (CAMS) ডাটা উক্ত এলাকার জন্য পাওয়া সম্ভব হয়নি বিধায় একটি বাস্তবসম্মত বায়ুর গুণমান নির্ণয় করতে, AECL প্রতিটি অবস্থানে ১২ সপ্তাহে ২ বার করে ২৪ ঘন্টা বায়ু স্যাম্পলিং পরিচালনা করেছে। প্রকল্পের আশেপাশের এলাকার বায়ুর প্রতিটি স্থিতিপরিমাপক নির্দিষ্ট পরিসীমার মধ্যে পাওয়া গেছে।

শব্দঃ

প্রকল্পের নিকটবর্তী এলাকার শব্দের মাত্রা ৪৮.১ থেকে ৭১.২ ডেসিবলের মধ্যে আছে যা বাংলাদেশের পরিবেশ আইন এবং IFC/ওয়ার্ল্ড ব্যাংকের নির্ধারিত পরিসীমার মধ্যে আছে।

পানিঃ

মেঘনা নদীটি মূল ভূখণ্ডের প্রধান অংশ। নদীভাণ্ডারের গুণমানটি প্রকল্পের প্রায় তিনটি স্থানে সংগৃহীত এবং বিশ্লেষণ করা হয়েছিল এবং মানচিত্রের সাথে তুলনা করলে প্রকল্প এলাকার কাছে মেঘনা নদীর বিদ্যমান পানির গুণমান পাওয়া যায়। গ্রাউন্ড ওয়াটার এই এলাকায় গৃহস্থালির পানির উৎস। প্রকল্পের আশেপাশের তিনটি স্থান থেকে ভূগর্ভস্থ জল সংগৃহীত এবং বিশ্লেষণ করে সাইটটির চারপাশে বাফার জোন গঠন করা হয়েছে। উল্লেখ্য পানির নমুনাগুলোর মধ্যে জাতীয় এবং আন্তর্জাতিক নিরাপদ সীমার উপরে কোন প্যারামিটার খুঁজে পাওয়া যায় নি।

জীববৈচিত্র্যঃ

প্রকল্পের আশেপাশে কোন বন্যপ্রাণী, প্রাকৃতিক বন এবং উদ্ভিদ বা প্রাণীর বিপন্ন প্রজাতি নেই।

৬। প্রকল্পের প্রভাব সনাক্তকরনঃ

প্রাক-নির্মাণ পর্যায়ঃ

বিদ্যুৎ প্রকল্পটির অবস্থানের কারণে ক্ষুদ্র প্রভাব ফেলতে পারে যেমন জমির ক্ষতি, ঐতিহাসিক ও নান্দনিক স্থাপনার ক্ষতি, পবিত্র স্থানের ক্ষতি, প্রাকৃতিক ভূচিত্র পরিবর্তন, ভূপৃষ্ঠের ভাঙ্গন ইত্যাদি কারণে জমি ব্যবহারের প্যাটার্নের উপর প্রভাব। ইএসআইএআই রিপোর্টে সকল প্রভাব নিয়ে আলোচনা করা হয়েছে এবং প্রশমন ব্যবস্থার সুপারিশ করা হয়েছে।

নির্মাণ পর্যায়ঃ

নির্মাণের সময় বিদ্যুৎ প্রকল্পটির উল্লেখযোগ্য পরিবেশগত প্রভাব থাকবে। সম্ভাব্য প্রভাবসমূহকে দুটি অংশে বিভক্ত করা যায়ঃ- ১) নির্মাণ সংশ্লিষ্ট সুবিধার কারণে প্রভাব এবং ২) প্রকল্প নির্মাণের সময় প্রভাব।

১) সংযুক্ত সুবিধার নির্মাণের প্রভাবঃ- এতে নিম্নলিখিত বিষয়গুলি অন্তর্ভুক্ত রয়েছেঃ

- অস্থায়ী জেটি নির্মাণ
- লেবার শেড ও সাইট অফিস নির্মাণ
- সংযোগ প্রদানকারী রাস্তা নির্মাণ
- ট্রান্সমিশন লাইন নির্মাণ

২) প্রকল্প নির্মাণের সময় প্রভাবঃ- এতে নিম্নলিখিত বিষয়গুলি অন্তর্ভুক্ত রয়েছেঃ

- বায়ুমণ্ডলের উপর প্রভাব
- ভূপৃষ্ঠ এবং ভূগর্ভস্থ পানির উপর প্রভাব
- শব্দের প্রভাব
- কঠিন বর্জ্য ব্যবস্থাপনার প্রভাব
- স্যানিটেশন এবং পানীয় জলের বিপত্তির প্রভাব
- অভিবাসী এবং বিদেশী কর্মীদের সামাজিক গ্রহণযোগ্যতা
- কর্মীদের দুর্ঘটনা এবং পেশাগত নিরাপত্তা
- যানজট
- সাইটে বিপদজনক বর্জ্য ব্যবস্থাপনা

যেহেতু প্রকল্পটি বিদ্যুতের জন্য বিপিডিবির বরাদ্দকৃত ও উন্নয়নকৃত জমিতে বাস্তবায়িত হবে এবং তা বিপিডিবির নির্ধারিত পাওয়ার ভিলেজে অবস্থিত, এই ক্ষেত্রে পুনর্বাসনের কোন সমস্যা হবে না। বিশদ পরিবেশগত প্রভাব এবং তার সঠিক বাস্তবায়ন "ব্যবস্থাপনা ও নিরীক্ষণ পরিকল্পনা" বা ইএমপিতে আলোচনা করা হয়েছে এবং উপরের প্রভাবগুলি নিয়ন্ত্রণ করার পরামর্শ দেওয়া হয়েছে। ইএমপি মোতাবেক ইপিসি ঠিকাদার এবং প্রকল্পের দায়িত্বপ্রাপ্ত কোম্পানিকে নির্মানের সময় জাতীয় এবং এডিবি এসপিএস,আইএফসি এবং ডব্লুবিআই নির্দেশিকা মেনে চলতে হবে- আরবিএলপিএল তা নিশ্চিত করবে।

সক্রিয় পর্যায়ঃ

বায়ুমণ্ডলীও নির্গমন এবং বায়ুর গুনমানঃ

প্রস্তাবিত বিদ্যুৎ প্ল্যান্টটি প্রাকৃতিক গ্যাসকে জ্বালানি হিসাবে ব্যবহার করবে; তাই প্রকল্পটির সক্রিয় পর্যায়ে সম্ভাব্য দূষণকারী হবে শুধুমাত্র নাইট্রোজেনের অক্সাইড (NO_x)। গ্যাস টার্বাইন থেকে অতিরিক্ত তাপ ব্যবহার করে হিট রিকভারি স্টিম জেনারেটর (এইচআরএসজি) সিস্টেম বাষ্প উৎপাদন করবে এবং এতে নিষ্কাশন তাপমাত্রা ৩৬৫° তে নেমে আসবে। নির্গমনস্থল হতে NO_x এর নির্গমন ঘনত্ব ডিস্পারশন মডেলিং দ্বারা নির্ধারিত হয়েছে (USEPA অনুমোদিত AERMOD ৯.২.০ মডেল) যা ইএসআইএ রিপোর্টে উল্লেখ করা হয়েছে।

শব্দঃ

গ্যাস টারবাইন এবং বাষ্প টারবাইনের আভ্যন্তরীণ শব্দ মাত্রা প্রায় ৮৫ ডিবিএ হবে যা সর্বাধুনিক শব্দ নিয়ন্ত্রণকারী বিল্ডিং নকশার দ্বারা কমিয়ে আনা হবে। তাপ পুনরুদ্ধারের বাষ্প জেনারেটর স্ট্যাকের সাইলেন্সার শব্দের মাত্রাকে ৮৫ ডিবিএ তে কমিয়ে আনতে সক্ষম হবে। শব্দের প্রভাব কমাতে, স্ট্যাকের মধ্যে সবচেয়ে কার্যকর এবং টেকনোলজিক্যালি উন্নত ক্রিটিকাল টাইপ সাইলেন্সার ব্যবহার করা হবে।

তরল নির্গমনঃ

প্রস্তাবিত প্রকল্পের দৈনিক ব্যবহৃত পানির পরিমান ১০৭৬ ঘনমিটার/ঘন্টা এবং পানি নিঃসরণের পরিমান ২০৬ ঘনমিটার/ঘন্টা। পানি নিঃসরণ এত কম হওয়ার কারন হচ্ছে "ক্লোজড সার্কিট কুলিং" প্রযুক্তির ব্যবহার। উক্ত প্রযুক্তির কারনে কম পরিমাণে বর্জ্য তৈরি হবে এবং নদী তাপমাত্রা নগণ্য পরিমানে বৃদ্ধি পাবে। এ কারনে নদীর কাছাকাছি অন্যান্য বিদ্যুৎকেন্দ্র থেকে বর্জ্যের পরিমাণের তুলনায় নদীর তাপমাত্রার উপর এই প্রকল্পের প্রভাব অত্যন্ত কম অথবা নেই বললেই চলে। গৃহস্থালির তরল বর্জ্য একটি সেপটিক ট্যাংক সিস্টেমের মাধ্যমে নিঃসরিত হবে।

৭। পরিবেশগত ব্যবস্থাপনা পরিকল্পনা (ইএমপি)-

নির্মাণ পর্যায়ের ব্যবস্থাপনাঃ

নির্মাণ কাজ চলাকালীন সময়ে প্রযুক্তিগত প্রক্রিয়া পরিচালনার দায়িত্ব সাধারণ নির্মাণ ব্যবস্থাপনা ও নিয়ন্ত্রণ ঠিকাদার এবং আরবিএলপিএলপিএলের উপর অর্পিত হবে।

সক্রিয় পর্যায়ের ব্যবস্থাপনাঃ

অপারেশন ফেজের সময় অপারেশন ও রক্ষণাবেক্ষণ (মেইনটেইনান্স) ইউনিট (ওএন্ডএম) এর অধীনে বিদ্যুৎ প্রকল্প পরিচালনার দায়িত্ব আরবিএলএলএল ব্যবস্থাপনা পর্ষদের উপর বর্তাবে এবং প্রকল্পের জন্য পরিবেশগত ও সামাজিক মান বজায় রাখার দায়িত্বও থাকবে।

প্রশমন বর্ধন ব্যবস্থাঃ

একটি প্রকল্প কার্যকর এবং পরিবেশ বান্ধব ক্রিয়াকলাপের জন্য, নির্দেশিকা সরঞ্জাম এবং পরামর্শের জন্য একটি সেট প্রয়োজনীয় যা প্ল্যান্ট নির্মাণ, অপারেশন এবং রক্ষণাবেক্ষণের বিভিন্ন পর্যায়ে অনুসরণ করা আবশ্যক। প্রকল্প বা প্ল্যান্টের কার্যকলাপ, বিভিন্ন ধরনের বর্জ্য এবং তাদের দূষণ সম্ভাব্য ধরনের উপর নির্ভর করে এই ব্যবস্থাপনা পরিকল্পনার বিভিন্ন বিভাগ আছে।এই পরিবেশগত এবং সামাজিক ব্যবস্থাপনা পরিকল্পনা বা ইএসএমপি পরবর্তীতে সক্রিয় পর্যায়ের ক্রিয়াকলাপের উপর ভিত্তি করে পরিবর্তনযোগ্য।

নিরীক্ষণ পরিকল্পনাঃ

পরিবেশগত নিরীক্ষণের জন্য একটি ব্যবস্থাপনা প্রতিষ্ঠা করা হবে যা জাতীয় পরিবেশগত মানদণ্ডের সাথে সম্মত হবে। একটি কমিটি তৈরি করা হবে যাতে প্রধান হিসাবে প্লান্ট ম্যানেজার এবং অন্য ২-৪ জন সদস্য উপস্থিত থাকবেন। কমিটি কমপক্ষে ত্রৈমাসিকভাবে একত্রিত হবে এবং প্ল্যান্টের পরিবেশগত অবস্থা সম্পর্কে আলোচনা করবে। মনিটরিং প্ল্যান অনুযায়ী প্ল্যান্টের প্রধান নির্গমন প্যারামিটারসমূহ বিশ্লেষণ করা হবে। ত্রৈমাসিক এবং বাৎসরিক পরিবেশগত নিরীক্ষা প্রতিবেদন পরিবেশ অধিদপ্তর এবং এডিবির কাছে দাখিল করা হবে এবং প্রাতিষ্ঠানিক ওয়েবসাইটে উল্লেখ করা হবে।

৮। স্টেকহোল্ডারদের সাথে মতবিনিময়ঃ

প্রকল্প নির্মাণের নিমিত্তে অনানুষ্ঠানিক মতবিনিময়কালে বিভিন্নধরনের স্টেকহোল্ডারের সাথে মতবিনিময় করা হয়েছে যাদের মধ্যে স্থানীয় পুরুষ ও মহিলা, জেলে, গরু খামারি, স্থানীয় সরকারের নির্বাচিত প্রতিনিধি, এনজিও ইত্যাদি শ্রেণীর মানুষ উপস্থিত ছিলেন। এদের মধ্যে সবচেয়ে গুরুত্বপূর্ণ স্টেকহোল্ডার মতবিনিময় হয় গরু খামারি এবং জেলেদের সাথে।

স্থানীয় স্টেকহোল্ডারগন উক্ত প্রকল্প নির্মাণের উদ্যোগকে স্বাগত জানিয়েছেন এবং এই প্রকল্প ভবিষ্যতে পার্শ্ববর্তী এলাকার উন্নয়ন করবে বলে আশা ব্যক্ত করেছেন।

৯। উপসংহার এবং সুপারিশঃ

আলোচ্য ইএসআইএআই প্রতিবেদনটি এটাই ব্যক্ত করে যে, যদিও বিদ্যুৎ প্রকল্পটির কিছু পরিবেশগত প্রভাব রয়েছে, তবুও তা নিয়ন্ত্রনসাধ্য।

বাংলাদেশের বর্তমান বিদ্যুৎ সংকটের পরিপ্রেক্ষিতে প্রকল্পটি অপরিহার্য। প্রকল্পের থেকে সৃষ্ট স্থানীয় বাসিন্দাদের জন্য তৈরি কর্মসংস্থান এবং ব্যবসায়িক সুযোগ সামাজিকভাবে ইতিবাচক প্রভাব ফেলবে। প্রকল্পটি শিল্পায়ন, আর্থ-সামাজিক উন্নয়নের ত্বরান্বিতকরন হবে এবং জীবনের মান উন্নত করতে সহায়তা করবে। প্রকল্পের জন্য সবচেয়ে গুরুত্বপূর্ণ বিষয়গুলির মধ্যে একটি হল নিরাপত্তা। ভূমিকম্প ও ঘূর্ণিঝড়ের মত প্রাকৃতিক দুর্যোগের সময় নিরাপত্তা নিশ্চিত করার লক্ষ্যে নির্মাণে জাতীয় বিল্ডিং কোড (BNBC) যেন মেনে চলা হয় তা নিশ্চিত করা হয়েছে।

পরিবেশের উপর প্রতিকূল প্রভাব ছাড়া কোন উন্নয়নই সম্ভব নয়। দেশ ও জাতির জন্য উন্নয়ন তখনই ফলপ্রসূ হবে যখন এইসব প্রতিকূল প্রভাব কঠোর ব্যবস্থাপনা এবং নিয়ন্ত্রণ ব্যবস্থার মাধ্যমে প্রশমিত হবে। এসব পদক্ষেপ বাস্তবায়ন করতে দরকার হবে সতর্ক দৃষ্টি এবং আর্থিক সংগতি।

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট সিসিপিপি প্রকল্পটি জাতীয়ভাবে গুরুত্বপূর্ণ এবং পরিবেশগতভাবে টেকসই শিল্প উদ্যোগ হতে যাচ্ছে। পরিবেশ এবং জনসাধারণের সুবিধার্থে, আরবিএলসিএল কর্তৃপক্ষ ভবিষ্যতে যেকোনো উদ্যোগ নিতে প্রস্তুত থাকবে।

Reliance Meghnaghat 750 MW Combined Cycle Power Plant

Proponent: Reliance Bangladesh LNG & Power Limited

Report Prepared By: Adroit Environment Consultants Limited

Executive Summery

1. Introduction

Reliance Bangladesh LNG and Power Limited (herein after referred as „RBLPL," or „proponent") proposes for development of a 750 Megawatt (MW) gas based combined cycle power plant (CCPP) project at Village Meghnaghat, sub-district Sonargaon, District Narayanganj, Bangladesh. Bangladesh is a one of the fastest growing economy in south Asia. As per the estimates only around 72% of the total population of Bangladesh had access to electricity but reliable and quality supply of power is still a faraway. The demand for electricity is steadily increasing in Bangladesh as per Ministry of Power and Mineral Resources.

To meet the existing power shortage and the demand-growth in future years the Government of Bangladesh (GoB) is planning for power generation target of 39,000 MW by 2030. The Bangladesh government has taken several steps to initiate the augmentation of electricity gap by placing Power Sector Master Plan (PSMP) 2010. In order to achieve the said target, the Government of Bangladesh (GoB) planning to develop power sector projects through public private partnership. Therefore, the development of the proposed 750 MW Combined Cycle Power Project at Meghnaghat will aid in securing both current as well as future electricity demand of Bangladesh. The present project is in line with Ministry of Power, Energy and Mineral Resources provided an in-principle approval to the project. The proposed project also has obtained the site clearance vide letter Memo No. 22.07.67700.140.72.064. 16-18 dated 15. 01. 2017.

In Bangladesh, natural gas is the most important indigenous source of energy that accounts for 73% of the commercial energy of the country. To provide access to affordable and reliable electricity to all by 2021 as well as to comply with the policy of Government of Bangladesh (GoB) RBLPL intends to construct a new 750 MW CCPP in the Government allotted land. The proposed area of the plant is located at Meghnaghat inside the vicinity of BPDB's allocated 35 acres government land.

The Reliance Meghnaghat 750 MW CCPP project will be implemented by RBLPL and financed by Asian Development Bank (ADB) and other lenders. The objective of this study is to provide an examination and assessment of the major environmental and social impacts arising due to the proposed project activity during its construction and operation phase. The study will also focus on suggesting the possible mitigation measures for any adverse impacts. A management and monitoring plan to evaluate the effectiveness of the mitigation measures will be suggest as a part of Environment Management Plan.

This Environment and Social Impact Assessment (ESIA) report is prepared in accordance with the ADB"s safeguard policy statement SPS 2009 and IFC Performance Standards as well as EIA guideline in Bangladesh which are set out in “Rules and Regulations under the 1995 Environmental Protection Acts”.

2. The Project

RBLPL, proposes for development of a 750 Megawatt (MW) gas based combined cycle power plant (CCPP) project at Village Meghnaghat, sub district Sonargaon, District Narayanganj, Bangladesh. Fuel requirement of Liquefied Natural Gas (LNG) for the project shall be supplied through a proposed 24 inches Gas Pipeline from Kutumbpur to Meghnaghat being set up by GTCL (Gas Transportation Company Limited). Electricity generated from the power plant will be evacuated at Power Grid Company of Bangladesh (PGCB) 400 kV transmission network available at Meghnaghat. The salient feature of the project is highlighted below:

Name of the Project	Reliance Meghnaghat 750 MW Combined Cycle Power Plant
Location of the Project	
Village	Meghnaghat
Sub district	Sonargaon
District	Narayanganj
Latitude and Longitude	23° 36‟29” N & 90° 35‟ 39” E
Project Proponent	Reliance Bangladesh LNG & Power Ltd.
Type of Project	Combined Cycle power plant
Total Area of Land	35 acres
Fuel Requirement	RLNG/Natural Gas: 130mmscfd @ 100% load
Water Requirement & Source of Water	1076 m^3/h; Source: Meghna River
Quantity of Discharge Water	206 m^3/hr

3. Policy and Legal Considerations

This ESIA report has been prepared following the methodology prescribed in the EIA guidelines for industries of DOE, ECA95 and ECR97 that are the main legislative documents relating to environment protection in Bangladesh.

The environmental classifications for industrial projects in Bangladesh are based on "inclusion lists" given in the ECR97 with "RED" being the highest category. Power Plant is listed in the "Red Category" in ECR97 (i.e., serial no.6 in the ECR97 Red list in Schedule-1.).

According to the ADB's classification, the project is a "Category A" in environmental aspect, "Category C" in the social aspect.

4. Analysis of Alternatives

After understanding the resource limitation of Bangladesh, it is evident that the best possible technology for power generation is combined cycle technology. So, no other power generation technology is recommended.

5. Baseline Environment

Ambient Air Quality

The data from the DOE CAMS (continuous air quality monitoring stations) is not available near the project area. So, to establish a realistic baseline air quality, AECL has conducted 24 hours air sampling at 6 locations twice a week at each location12 weeks. The baseline levels for criteria pollutants i.e., $PM_{2.5}$, PM_{10}, CO, NO_2 and SO_2 are compliant with DoE and Asian Development bank/IFC standard. Gaseous pollutants were within the national and international limits whereas particulate matter though observed to be complying with ECR, 2005 but it crosses the limits with respect to WHO IT-1. The pollutant levels (24 hourly averages) at these sampling stations reflect that the regional background, i.e. PM10 is 72.8- 125 µg/m3 and $PM_{2.5}$ ranged between 33.3 and 47.5 µg/m3. The concentrations of SO2 are in the range of 7.1-8.8 µg/m3 and NO_x is in the range of 6.8- 9.4 µg/m3 respectively during the study period.

Noise

The noise levels during daytime were found in the range of 48.1 to 71.2 dB(A) and during night time Leq value was between 50.4 and 68.1 dB(A). In general noise level was found within the prescribed standards in absence of any major noise source. Since there is no homestead within the 2 km radius of the proposed project, so, the noise emission from the project or anywhere nearby would not create any harm to the neighboring community.

Water Environment

River Meghna which is adjacent to the site is the main surface water body. The quality of the river water was collected and analyzed at three locations around the project and the existing water quality of the Meghna River near the project area found to comply when compared with the standards. According to Bangladesh Water Development Board, the ground water level of Sonargaon Upazila is about 7.0 m. Ground water is the source of water for domestic use in this area. Water from underground source is assumed to be available as most of the period of the year the area remains under water. The ground water from the three locations was collected and analyzed form the buffer zone around the site. No parameter was found to be above the national and international safe limit.

Ecology & Biodiversity

Ecological survey at the study area recorded 192 floral species of which one vulnerable and one is in near threatened category.

6. Prediction and Evaluation of Impacts

Preconstruction Stage

The power project would have minor impacts due to the location of the project such as Impact on land use pattern in terms of Loss of Homestead land, historical and Aesthetic Loss, Loss of sensible places, change in landscape, disruption of earth surface, etc. All the impacts have been discussed and mitigation measures have been recommended in the ESIA report.

Construction Stage

The power project would have significant environmental impacts during the construction period. The potential impact would be divided into two parts as 1) Impact due to construction associated facilities and 2) Impact during project construction.

1. Impact due to construction of associated facilities: These include the following:

- Construction of Jetty
- Construction of Labor Shed and Site Office
- Construction of Access Road
- Construction of Transmission Line

2. Impact during project construction: These include the following:

- Impact on air quality
- Impact on surface and ground water quality
- Impact on noise quality
- Impact on solid waste management
- Impact due to sanitation and drinking water hazard
- Social acceptability of migratory and foreign workers at site
- Workers accident and Occupational safety
- Traffic congestion
- Hazardous waste management at site

Since the project would be implemented on the preoccupied and developed land of BPDB for the power project and situated at the designated power village of BPDB, resettlement will not be an issue in this case. Detailed environmental impacts and its mitigation measured have been discussed in the ESIA report and proper management & monitoring plan have been suggested to control the above impacts. The EPC contractor and the project company – RBLPL will ensure the necessary implementation and monitoring of EMP to comply the national and ADB SPS /IFC/ WB guideline during the construction period.

Operation Stage

Atmospheric Emission and Air Quality

As the proposed power plant will utilize Natural gas as fuel, the pollutants of potential concern will only be the Oxides of Nitrogen (NOx) during the operation period of the project. The Heat Recovery Steam Generation (HRSG) system which produces steam by using the waste heat from the Gas turbine will reduce the exhaust heat temperature to 3650C. The ground concentration of NOx emission has been determined by emission dispersion modeling (USEPA approved AERMOD 9.2.0 model). The air quality modeling has been done for individual emission from this particular power project as well as the cumulative emission from the all power projects in the area.

Noise

The gas turbine and the steam turbine will have internal noise level of around 85dBA which will be minimized by sophisticated acoustic power house building design so as to minimize the noise up to standard. The heat recovery steam generator stack will emit a noise level of 85dBA after providing the silencer. To reduce the effect, the most effective and technologically advanced Critical Type Silencer will be used in the stack.

Liquid Discharge

The estimated water consumption is 1098 m^3/hr and discharge will be 206 m^3/hr in the proposed Reliance Meghnaghat 750 MW CCPP project. The low amount of water discharge is due to the use of "Closed Circuit Cooling System". Owing to the low amount of discharge and use of closed circuit cooling, rise in river temperature will have minimal or no impact on river water temperature considering the amount of discharge from the other power plants near the project premise and the adhering the discharge standard of temperature of +/- 5oC than the ambient water temperature in any season.

7. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Management in Construction Stage

General construction management and control over conducting technological process during construction works will be assigned to the contractor and RBLPL project management. The contractor, in turn, concludes contracts with subcontract organizations performing works at the construction site. The RBLPL authority bears responsibility under Project Implementation unit (PMU) for selection and assessment of subcontract organizations. Control functions over contract organizations activity in the field of labor safety, industrial safety and preservation of the environment are also assigned to the Consortium.

Management in Operation Phase

RBLPL Management will be responsible to operate the power project under Operation & Maintenance unit (O&M) during the operation phase and will be responsible to maintain the environmental and social standards for the project.

Mitigation Enhancement Measures

For effective and environment friendly operation of a project, a set for guiding tools and suggestions are necessary which need to be followed at various stages of plant installation, operation and maintenance. This plan generally has various components of management depending on the type of project or plant activity and types of discharge and their pollution potential. This Environmental and Social Management Plan (ESMP) once prepared forms the basis of environmental management actions from the part of the project authority may need modification or up-gradation because of changes in the plant operation or accurate pollution load/environmental problems detected afterwards.

8. Stakeholder Consultation and Disclosure

Stakeholder consultations are very important and sensitive issues for setting up a new industry in any area of Bangladesh. The process was initiated with an open objective to ensure people‟s participation right from the planning stage of the project. Furthermore, this was aimed at improving the study taking into account opinions from the people of the impacted area. Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women.

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and „local knowledge‟ can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation.

9. CONCLUSION AND RECOMMENDATIONS

The present ESIA report finds that though there are certain environmental impacts associated with the industrial unit under consideration, these are manageable.

The project is indispensable in view of the current energy shortage scenario in Bangladesh. The impact on the social environment is positive given the employment and business opportunities created for local residents from the project. The project will help in the industrialization, accelerating socioeconomic growth, and improving quality of life. One of the most critical issues for the project is safety. This has been adequately addressed through compliance with national building code (BNBC) in the construction to ensure safety during natural disasters like earthquake and cyclone.

The project has been designed to comply with the country‟s environmental laws and regulations, especially on air emissions, ambient air quality, waste water effluent, and noise. The project management has taken steps to ensure that the plant meets the DOE/World Bank/ADB‟s environmental standards.

A Presentation on the Specifications of Reliance Meghnaghat 750 MW CCPP

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট

অবস্থানঃ মেঘনাঘাট, সোনারগাঁও, নারায়ণগঞ্জ, বাংলাদেশ

প্রস্তাবকঃ রিলায়েন্স বাংলাদেশ এলএলজি এন্ড পাওয়ার লিমিটেড

প্রতিবেদকঃ এক্সয়েট এনভাইরনমেন্ট কন্সালটেন্টস লিমিটেড

ভূমিকা

- রিলায়েন্স বাংলাদেশ এলএনজি ও পাওয়ার লিমিটেড ৭৫০ মেগাওয়াট গ্যাস ভিত্তিক যৌথ চক্র বিদ্যুৎ কেন্দ্র (কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট- সি.সি.পি.পি.) প্রকল্পের নির্মাণ প্রস্তাবিত হয়েছে।

- প্রকল্পটি রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড, এশিয়ান ডেভেলপমেন্ট ব্যাংক (এডিবি) এবং অন্যান্য ঋণদাতাদের অর্থায়নে বাস্তবায়ন করা হবে।

পটভূমি

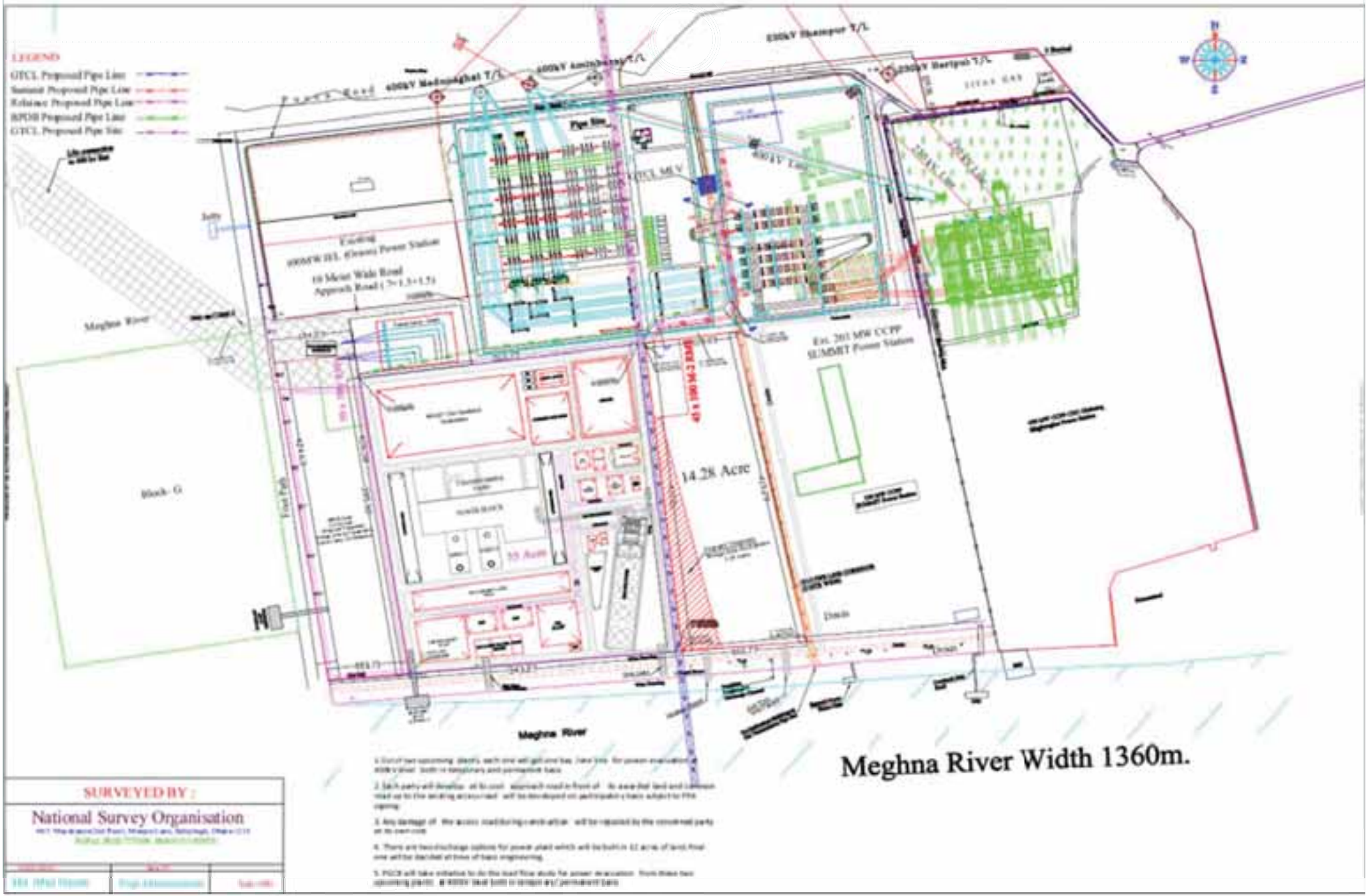
- বাংলাদেশ দক্ষিণ এশিয়ার দ্রুততম ক্রমবর্ধমান অর্থনীতির একটি। বাংলাদেশের মোট জনসংখ্যার প্রায় ৭২% বিদ্যুৎ ব্যবহারের সুযোগ রয়েছে।
- বর্তমান বিদ্যুৎ সংকট এবং ভবিষ্যতের চাহিদা পূরণের লক্ষ্যে বাংলাদেশ সরকার ২০৩০ সালের মধ্যে ৩৯ হাজার মেগাওয়াট বিদ্যুৎ উৎপাদনের পরিকল্পনা গ্রহন করেছে।
- এই লক্ষ্যে বাংলাদেশ সরকার আইপিপির এবং পিপিপির মাধ্যমে বিদ্যুৎ খাতের উন্নয়নের পরিকল্পনা গ্রহন করেছে যার ধারাবাহিকতায় উক্ত প্রকল্প, যা একটি আইপিপি, অনুমোদন পেয়েছে।

প্রকল্পের বিবরণ

প্রকল্পের নাম	**রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট কম্বাইন্ড সাইকেল পাওয়ার প্ল্যান্ট**
প্রকল্পের ঠিকানা	মেঘনাঘাট, সোনারগাঁ, নারায়ণগঞ্জ, বাংলাদেশ
প্রধান পৃষ্ঠপোষক	রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড
উৎপাদিত পণ্য	বিদ্যুৎ
প্রকল্পের মোট খরচ	৫,২০০ কোটি টাকা
বিদ্যুৎকেন্দ্রের ক্ষমতা	৭৫০ মেগাওয়াট
মোট ভূমির পরিমান	৩৫ একর
জ্বালানির চাহিদা	আরএলএনজি/প্রাকৃতিক গ্যাস: ১৩০ mmscfd @১০০% লোড
পানির চাহিদা ও উৎস	১০৭৬ ঘনমিটার/ ঘন্টা
বর্জ্য পানির পরিমান	২০৬ ঘনমিটার/ ঘন্টা
শীতলীকরণ ব্যাবস্থা	বন্ধ চক্র শীতলীকরণ (ক্লোজড লুপ কুলিং)

প্রকল্পের অবস্থান

প্রকল্পের নকশা


LEGEND
Meghna River
Block- G
14.28 Acre
Meghna River
Meghna River Width 1360m.
SURVEYED BY :
National Survey Organisation

প্রাথমিক পরিবেশগত সমীক্ষা

- বাতাসের গুনগতমানঃ প্রকল্পেটির জন্য AECL প্রকল্পের আশেপাশের ৬টি অবস্থানে ১২ সপ্তাহব্যাপী, সপ্তাহে ২ বার করে, ২৪ ঘন্টা বায়ু স্যাম্পলিং পরিচালনা করেছে। প্রকল্পের আশেপাশের এলাকার বায়ুর প্রতিটি প্যারামিটার নির্দিষ্ট পরিসীমার মধ্যে পাওয়া গেছে।
- শব্দঃ প্রকল্পের নিকটবর্তী এলাকার শব্দের মাত্রা ৪৮.১ থেকে ৭১.২ ডেসিবলের মধ্যে আছে যা বাংলাদেশের পরিবেশ আইন এবং IFC/ওয়ার্ল্ড ব্যাংকের নির্ধারিত পরিসীমা অতিক্রম করেনি।
- পরিবেশ ও জীব বৈচিত্র্যঃ প্রকল্পের আশেপাশে কোন বন্যপ্রাণী, প্রাকৃতিক বন এবং উদ্ভিদ বা প্রাণীর বিপন্ন প্রজাতি নেই।

প্রকল্পের আশেপাশে প্রাপ্ত উদ্ভিদ ও প্রাণী





প্রাথমিক পরিবেশগত সমীক্ষা

পানিঃ

- মেঘনা নদীটি মূল ভূখণ্ডের প্রধান অংশ। নদীর পানির গুণগতমান নিরীক্ষা করতে প্রকল্পের প্রায় তিনটি স্থানে নমুনা সংগৃহীত এবং বিশ্লেষণ করা হয়েছিল।
- ভূগর্ভস্থ পানি এই এলাকার গৃহস্থালির পানির উৎস। প্রকল্পের আশেপাশের তিনটি স্থান থেকে ভূগর্ভস্থ পানি সংগৃহীত এবং বিশ্লেষণ করে সাইটটির চারপাশে বাফার জোন গঠন করা হয়েছে।
- উল্লেখ্য পানির নমুনাগুলোর মধ্যে জাতীয় এবং আন্তর্জাতিক নিরাপদ সীমার উপরে কোন প্যারামিটার খুঁজে পাওয়া যায় নি।

প্রকল্পের প্রভাব

<u>জমির ব্যবহারঃ</u>

প্রস্তাবিত প্রকল্পটি বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ডের (বিপিডিবি) বরাদ্দকৃত জমিতে নির্মিত হবে। তাই কোন প্রকার পুনর্বাসনের প্রয়োজন হবে না।

চিত্রঃ প্রকল্পের নির্মাণস্থল

প্রকল্পের প্রভাব

<u>বায়ুমণ্ডলীয় নির্গমন এবং বায়ুর গুনগতমানঃ</u>

- প্রস্তাবিত বিদ্যুৎ প্ল্যান্টটি প্রাকৃতিক গ্যাসকে জ্বালানি হিসাবে ব্যবহার করবে, তাই সম্ভাব্য দূষণকারী শুধুমাত্র নাইট্রোজেনের অক্সাইড (NO_x) হবে।
- গ্যাস টার্বাইন থেকে অতিরিক্ত তাপ ব্যবহার করে হিট রিকভারি স্টিম জেনারেটর (এইচআরএসজি) সিস্টেম বাষ্প উৎপাদন করবে এবং এতে নিষ্কাশন তাপমাত্রা ৩৬৫° তে নেমে আসবে।

প্রকল্পের প্রভাব

<u>শব্দঃ</u>

- গ্যাস টারবাইন এবং বাষ্প টারবাইনের আভ্যন্তরীণ শব্দ মাত্রা প্রায় ৮৫ ডিবিএ হবে যা সর্বাধুনিক শব্দ নিয়ন্ত্রণকারী বিল্ডিং নকশার দ্বারা কমিয়ে আনা হবে।
- তাপ পুনরুদ্ধারের বাষ্প জেনারেটর স্ট্যাকের সাইলেন্সার শব্দের মাত্রাকে ৮৫ ডিবিএ তে কমিয়ে আনতে সক্ষম হবে। শব্দের প্রভাব কমাতে, স্ট্যাকের মধ্যে সবচেয়ে কার্যকর এবং টেকনোলজিক্যালি উন্নত **<u>ক্রিটিকাল টাইপ সাইলেন্সার</u>** ব্যবহৃত হবে।

প্রকল্পের প্রভাব

তরল নির্গমনঃ

- প্রস্তাবিত প্রকল্পে ১০৭৬ ঘনমিটার/ঘন্টা পানি ব্যবহৃত হবে এবং পানি নিঃসরণের পরিমান ২০৬ ঘনমিটার/ঘন্টা। পানি নিঃসরণ এত কম হওয়ার কারন হচ্ছে “বদ্ধ চক্র শীতলীকরণ” (ক্লোজড সার্কিট কুলিং) প্রযুক্তির ব্যবহার। উক্ত প্রযুক্তির কারনে কম পরিমাণ বর্জ্য তৈরি হবে এবং নদী তাপমাত্রা নগণ্য পরিমানে বৃদ্ধি পাবে।
- এ কারনে নদীর কাছাকাছি অন্যান্য বিদ্যুৎকেন্দ্র থেকে বর্জ্যের পরিমাণের তুলনায় নদীর তাপমাত্রার উপর এই প্রকল্পের প্রভাব অত্যন্ত কম অথবা নেই বললেই চলে। গৃহস্থালির তরল বর্জ্য একটি সেপটিক ট্যাংক সিস্টেমের মাধ্যমে নিঃসরিত হবে।

উপসংহার

- বাংলাদেশের বর্তমান বিদ্যুৎ সংকটের পরিপ্রেক্ষিতে প্রকল্পটি অপরিহার্য। প্রকল্পের থেকে সৃষ্ট স্থানীয় বাসিন্দাদের জন্য তৈরি কর্মসংস্থান এবং ব্যবসায়িক সুযোগ সামাজিকভাবে ইতিবাচক প্রভাব ফেলবে।

- প্রকল্পটি শিল্পায়ন, আর্থ-সামাজিক উন্নয়ন ত্বরান্বিত করবে এবং জীবনের মান উন্নয়ন করতে সহায়তা করবে।

Attendance Sheet of the Audience Present in the Public Consultation

Annexure

Attendance Sheets of Social Studies

NGO

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
1	Md: Ahsan Habib	Sonargaon Uddan [illegible]	30	meal	Service	01711-032807	Habib
2.	MD. Akifur Rahman	Sonargaon UDDIPAN	29	Male	Branch Account	01837775196	[signature]
3.	Jhuma Paul	Sonargaon Deba	29	Female	Branch Accountant	01733219966	[signature]
4.	Md. [illegible]	Sonargaon Branch	49	male	B.com -	01713-710228	[signature]

Cow owners

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	Md. Akter Hasan	Gronga Nagar	60	male	Cow farmer	0	
	[illegible]	[illegible]	70	male	Cow farmer.	01862706916	

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	48	Male	Fisherman	01824900450	[illegible]
	[illegible]	[illegible]	42	"	"		[illegible]
	[illegible]	[illegible]	70	"	Owns a store	01829012664	[illegible]
	[illegible]	[illegible]	80	Female	Housewife		[illegible]
	[illegible]	[illegible]	60	Female	Housewife		BEAUTY ISLAM
	[illegible]	[illegible]	48	Male	Business	01882512105	
	[illegible]	[illegible]	50	"	Cowfarmer		
	[illegible]	[illegible]	48	"	Business	01714619426	Ansel
*	[illegible]	[illegible]	40	"	Meghnaghat Workers (Turbine Setting/ Maintainance)	01828655780	

Govt. Representative

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
1.	Mafizar Rahman	Secretary, Projects Up.	35 yr.	Male	Gov. Service	01933302040	
	Masudur Rahman Masum	Meghnaghat	39	Male	Chairman, Projects Up.	01836412121	

General

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	27	M	Service/Cultivation	01C7C799311	[illegible]
	Md. Ali Ahmed	"	42	M	Business	01814389367	[illegible]
	[illegible]	"	22	F	House wife	01814973631	[illegible]
	[illegible]	"	40	M	Farmer	01992701571	[illegible]
	[illegible]	"		F	House wife		
	[illegible]	"	30	F	House wife		[illegible]
	[illegible]	"	16	M	Student	01726324502	[illegible]
	[illegible]	"	45	F	House wife		[illegible]

Fishermen

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	60	M	Fishermen	01858940836	[illegible]
	[illegible]	[illegible]	42	M	Business	01725886995	SalehAhmed
	[illegible]	"	49	M	Fishermen		
	[illegible]	"	38	M	Fishermen		[illegible]
	[illegible]	"	62	M	Business	01987048074	[illegible]
	[illegible]	"	42	M	Business	01821498332	[illegible]
	[illegible]	"	60	M	Housewife	01862754207	[illegible]
	Arun Prasad R	Dhaka	31	M	Service	+917303409259	[illegible]
	RITUPARN SINGH	Dhaka	27	M	Service	+91 8587092131	[illegible]
	Mohamad Sibbir Ahamed	Dhaka	41	M	Service	01730447076	[illegible]

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD:

Venue:

Date: 25-01-17

Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
১।	[illegible]	[illegible]	৫০	M	Fishermen	01932533351	[illegible]
2	[illegible]	"	৫০	M	Fishermen		[illegible]
3	[illegible]	"	৬০	F	Housewife	01839460429	[illegible]
	[illegible]	"	১০	M	Student		[illegible]
	[illegible]	"	১০	M	"		[illegible]
	[illegible]	"	৫০	M	Fisherman		
	[illegible]	"	৯	M	Student		[illegible]
	[illegible]	"	৮	F	Student		[illegible]
	[illegible]	"	৭	F	Student		[illegible]
	[illegible]	"	১৫	M	Fishermen		[illegible]
	[illegible]	"	৭	M	"		
	[illegible]	"	১০	M	"		

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date:
Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	২৬	F	Housewife		[illegible]
	[illegible]	"	৭৮	M	Retired		[illegible]
	[illegible]	"	৬০	M	Fishermen		[illegible]
	[illegible]	[illegible]	৫৫	M	Retired	01734240464	[illegible]
	[illegible]	[illegible]	৫০	M	Fishermen	01851491846	[illegible]
	[illegible]	[illegible]	৬৫	M	Business	01986750512	[illegible]
	[illegible]	[illegible]	৫০	M	Retired		

Reliance Meghnaghat 750 MW CCPP

Participant List for FGD (Focus Group Discussion)

FGD: Venue: Date: Time:

SL	Name	Address	Age	Sex	Profession	Mobile No	Sign
	[illegible]	[illegible]	[illegible]	M	Worker/Fisherman	01849285305	[illegible]
	[illegible]	[illegible]	60	M	Business/Fisherman	01847690289	
	[illegible]	[illegible]	[illegible]	M	Worker/Fisherman	01881554365	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fisherman	01860482196	[illegible]
	[illegible]	[illegible]	[illegible]	M	"		[illegible]
	[illegible]	[illegible]	[illegible]	M	"		✓
	[illegible]	[illegible]	[illegible]	M	Fisherman/Business	01852101652	
	[illegible]	[illegible]	[illegible]	M	Student	"	[illegible]
	[illegible]	[illegible]	[illegible]	M	Student	"	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fishermen	01820894190	[illegible]
	[illegible]	[illegible]	[illegible]	M	Fishermen	01834156499	[illegible]
	[illegible]	[illegible]	[illegible]	F	Housewife		[illegible]

News Coverage on the Public Consultation

সোনারগাঁওয়ে পরিবেশ ও সামাজিক সচেতনতা বিষয়ক আলোচনা

সোনারগাঁও করেসপনডেন্ট || নিউজ নারায়ণগঞ্জ

প্রকাশিত : ০৫:৫০ পিএম, ২৮ আগস্ট ২০১৭ সোমবার

সোনারগাঁওয়ে পরিবেশ ও সামাজিক সচেতনতা বিষয়ক আলোচনা সভা অনুষ্ঠিত হয়েছে। রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড এর উদ্যোগে ২৮ আগস্ট সোমবার দুপুরে সোনারগাঁও উপজেলা অডিটোরিয়ামে এ সভা অনুষ্ঠিত হয়।

সভায় প্রধান অতিথি হিসেবে উপস্থিত ছিলেন নারায়ণগঞ্জ-৩ আসনের সাংসদ লিয়াকত হোসেন খোকা।বিশেষ অতিথি ছিলেন সোনারগাঁও উপজেলা নির্বাহী কর্মকর্তা মো. শাহিনুর ইসলাম, অন্যান্যদের মধ্যে উপস্থিত ছিলেন রিলায়েন্স এলএনজি এন্ড পাওয়ার লিমিটেড এর সিনিয়র ভাইস প্রেসিডেন্ট ড.বিজেন মিশ্রা, সিনিয়র ব্যবস্থাপক স্মিতেশ বৈদিয়া, রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড এর প্রজেক্ট ডিরেক্টর রঞ্জন লোহার,সহকারী ব্যবস্থাপক আব্দুল্লাহ বিন হোসেন, সিনিয়র এক্সিকিউটিভ মো. সিয়াম সাফিউর রহমান, এডিবি'র প্রতিনিধি মি.অনিক আজমিরা, এনজিও প্রতিনিধি মোস্তফা রহমান ও কামরুল ইসলাম প্রমুখ।

সভায় রিলায়েন্স বাংলাদেশ এলএনজি এন্ড পাওয়ার লিমিটেড এর প্রতিনিধিরা স্থানীয়দের সাথে পাওয়ার প্লান্ট স্থাপনে পরিবেশ ও সামাজিক সচেতনতা বিষয়ে আলোচনা করেন। সোনারগাঁওয়ের মেঘনা ঘাটে ৭৫০ মেগাওয়াট ক্ষমতা সম্পন্ন এ পাওয়ার প্লান্ট স্থাপনে মোট ব্যয় ধরা হয়েছে ৫হাজার ২শত কোটি টাকা।

Annexure - 11

শেখ হাসিনার বাংলাদেশ
পরিচ্ছন্ন পরিবেশ ।

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.6700.140.72.064.16. 497 Date: 11 /10/2017

Subject: **Approval of Environmental Impact Assessment (EIA) Report for 750 MW LNG Based Combined Cycle Power Plant (CCPP) of Reliance Bangladesh LNG & Power Limited at Meghnaghat, Sonargaon, Narayanganj.**

Ref: Your Application dated 17.09.2017 & 05.10.2017.

With reference to the above, the Department of Environment (DOE) is pleased to approve Environmental Impact Assessment (EIA) Report for 750 MW LNG Based Combined Cycle Power Plant (CCPP) of Reliance Bangladesh LNG & Power Limited at Meghnaghat, Sonargaon, Narayanganj subject to fulfilling the following terms and conditions.

1. This Environmental Impact Assessment (EIA) repot is approved only for 750 MW LNG Based Combined Cycle Power Plant (CCPP) of Reliance Bangladesh LNG & Power Limited at Meghnaghat, Sonargaon, Narayanganj Project. Any expansion or extension of this power plant will be required further/fresh EIA study for the Environmental clearance from the Department of Environment (DOE).
2. Project Proponent may undertake activities for land development and infrastructural development of the project.
3. Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to waste treatment plant and other pollution control devices.
4. The activity under the Power Plant Construction Project shall not result in the loss of containment of any materials that would affect health or will have damaging impact on the environment or natural resources.
5. Proper and adequate mitigation measures shall be ensured throughout preparation, construction and operation period of the proposed Power Plant Construction Project activities.
6. Any heritage sight, ecological critical area, and other environmentally and/or religious sensitive places shall be avoided during project construction phase.
7. Proper construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.
8. Construction works shall be restricted to day time hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.

9. Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.
10. In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.
11. No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during the whole period of the project in the field.
12. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.
13. All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative/functioning on a continuous basis.
14. To reduce dust, spraying of water over the earthen materials should be carried out from time to time.
15. Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.
16. Adequate considerations should be given to facilitate drainage system for runoff water from rain.
17. Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies.
18. Construction material should be properly disposed off after the construction work is over.
19. The project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work commences in the field to the Narayanganj District Office, Narayanganj and Headquarters of the Department of Environment, Dhaka simultaneously.
20. Environmental Monitoring Reports shall be made available simultaneously to DOE Narayanganj District Office, Narayanganj and Headquarters of DOE at Dhaka on a monthly basis during the construction period of the project.
21. The following records must be kept in respect of any samples required to be collected for the purposes of environmental monitoring activities :
    (a) the date(s) on which the sample was taken;
    (b) the time(s) at which the sample was collected;
    (c) the point at which the sample was taken; and
    (d) the name of the person who collected the sample.
22. The results of any monitoring required to be conducted under this EIA report must be recorded.
23. In case of any emergency, the following information shall immediately be reported to Narayanganj District Office, Narayanganj and Headquarters of DOE at Dhaka simultaneously;
    a) Nature of incident (land slides, fire, accident, collision, etc.)

b) Personnel affected (injured, missing, fatalities, etc.)
c) Emergency support available and its location (standby transport, medical facilities, etc.)
d) Weather conditions
e) Current operations (abandoning the site, fire fighting, etc.)

24. Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling of any plant/tree/sapling forested by any individual or government before doing such type of activity.

25. The project authority shall extend active cooperation to DOE officials to facilitate their visit to the site as and when necessary.

26. Violation of any of the above conditions shall render this approval void.

27. The project authority shall, after land development, infrastructural development and installation of the plant, apply for Environmental Clearance Certificate at Narayanganj District Office, Narayanganj with a copy to Headquarters of DOE at Dhaka. Without which proponent shall not start operation of the project.

28. This EIA Approval has been issued with the approval of the appropriate authority.

11.10.2017

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 02-8181673

Deputy General Manager
Reliance Bangladesh LNG & Power Limited
Unique Heights (Level 8-Q)
117 Kazi Nazrul Islam Avenue, Eskaton, Dhaka-1217.

Copy Forwarded to :

1) PS to the Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka Regional Office, Dhaka.
3) Deputy Director/ Officer-In-Charge, Department of Environment, Narayanganj District Office, Narayanganj.
4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.