

**ADDENDUM REPORT**

**ENVIRONMENT & SOCIAL IMPACT ASSESSMENT (ESHIA) OF THE PROPOSED  
SIRAJGANJ 225MW COMBINED CYCLE POWER PLANT PROJECT (DUAL FUEL-3<sup>RD</sup>  
UNIT), SAYDABAD, SIRAJGANJ**

## TABLE OF CONTENTS

1.	Introduction	4
2.	Addendum to ESHIA Report	5
2.1.	Addendum to Chapter-2, Policy Legal and Administrative Framework of ESHIA Report	5
2.2.	Addendum to Chapter-3, Project Data Sheet of ESHIA Report	5
2.2.1.	Section 3.6.1 on Water Demand and Source of ESHIA	6
2.2.2.	Section 4.3.7 on Water balance of ESHIA	6
	Addendum to Chapter-6, Description of Baseline Environment, ESHIA Report	8
2.3.		8
2.3.1.	Section 6.6 of Chapter 6 of ESHIA	8
2.3.2.	Section 6.5 on Ambient Air Quality and Noise of ESHIA	8
2.4.	Addendum to Chapter-7, Environmental Impacts, ESHIA Report	11
2.4.1.	Usage of Jetty for transportation of gas turbine components to the Project	11
2.4.2.	Section 7.6.7 on Impact on Socio-Economic Condition of ESHIA	12
2.4.3.	Section 8.4.1 of the ESHIA	13
2.4.4.	Section 9.7.4 on Hazardous Waste Management of ESHIA	14
	Section 7.5.2 on Impact on Socio-Economic Section ESHIA	14
2.4.5.		14
2.5.	Addendum to Chapter-8, Mitigation of Impacts, ESHIA Report	14
2.5.1.	Usage of Jetty for transportation of gas turbine components to the proposed site	14
2.5.2.	Construction of labour accommodation for proposed project	15
2.5.3.	Influx of Migrant Labour	15
2.5.4.	Hazardous Waste Management	15
2.6.	Addendum to Chapter-9, Environmental Management Plan, ESHIA Report	16
2.6.1.	Section 9.10 Emergency Response Plan and Volume III of ESHIA Report	16
2.6.2.	Section 9.12 of the ESHIA report on Organisation Structure	16
2.6.3.	Section 9.7.7 and 10.6 of the ESHIA	17
2.6.4.	Training requirements under Chapter 9 of the ESHIA	18
2.6.5.	Section 9.6.7 on Traffic Management Plan	20
2.6.6.	Section 9.9 on Mitigation Plan of the ESHIA	20
2.7.	Addendum to Chapter-10, Hazard and Risk Assessment, ESHIA Report	24
2.7.1.	Section 10.3.2 on Onsite Hazards of ESHIA	24
2.8.	Addendum to Chapter-11, Environmental Monitoring Plan, ESHIA Report	25
2.9.	Addendum to Chapter-13, Stakeholder Consultation, ESHIA Report	27
2.9.1.	Section 13 on Stakeholder Consultation and Engagement of ESHIA	27
2.9.2.	Section 13.6 on Grievances Management of the ESHIA	27

## LIST OF TABLES

Table 1: Effluent Sources and Quantity in the Proposed Unit – 3 Power Plant	8
Table 2: Training Subjects for Inclusion in Contractors Training Plan (Construction)	18
Table 3: Type of training and training actions (Operation)	19
Table 4: Training Plan	19
Table 5: Mitigation Plan	21
Table 6: pH values of cooling water in which chlorine dosing is best effective	25
Table 7: General Guidelines of Chlorine Dose	25

## LIST OF FIGURES

Figure 1: Revised Water Diagram of NWPGL Unit 3	7
Figure 2: Monitoring locations of noise, soil, fish and effluent	9
Figure 3: NOx Concentration Pattern in the Project AOI	10
Figure 4: Monitoring locations of various environmental aspects	26

## LIST OF ANNEXURES

ANNEX-1: Department of Environment of Approval of ESHIA
ANNEX-2: Applicability of IFC Sustainability Framework 2012
ANNEX-3: Applicability of IFC Equator Principles- III

## 1. Introduction

As a rapidly developing country, Bangladesh aims to achieve the medium income level as a nation by 2021. Currently, it is facing a sharp increase in the demand of power supply. Absence of sustainable power supply would act as a major hindrance in the expected socio-economic development goals. At present, about 60% (including off-grid renewable) population of Bangladesh has access to electricity and per capita electricity generation is only 348 KWh (including captive, FY 2014). The Government has therefore given top priority to the development of power sector and has formulated the Power System Master Plan (PSMP), 2010. To this end, the government has set the goal of providing electricity to all citizens by 2021. The present electricity demand growth is 12% per annum and current installed generation capacity is around 11,532 MW including 5,012 MW from private sector, and 500 MW from imported electricity (as of June, 2015). At present, most of the power plants are natural gas based. Bangladesh Power Development Board (BPDB) has planned to give thrust on combined cycle technology considering the scarce reserve of natural gas of the country.

North West Power Generation Company Limited (NWPGL), an enterprise of the BPDB adopted a plan of developing a Power Generation Hub at Saydabad of Sirajganj, on the right bank of the Jamuna River. Presently, a 225 MW Combined Cycle Power Plant (CCPP), upgraded from 150 MW Peaking Power Plant and later on termed as Unit-1, is being operated there and the construction of another 225 MW CCPP (Unit-2) is underway next to Unit-1. NWPGL now has plans of installing another 225 MW Dual Fuel based (HSD & Gas) CCPP (Unit-3, hereinafter referred to as 'Project') next to Unit-2. For this third unit, a land of 7.09 acre has been allocated in the same premises to the west of the Unit-2 in the Sirajganj complex.

As per the Environmental Conservation Rules, 1997 (amended in 2005) of Bangladesh, the project falls under the 'Red Category' project that requires approval from the Department of Environment (DoE) before starting the construction. The approval process requires carrying out Initial Environmental Examination (IEE) and Environmental Impact Assessment (or Environment & Social Impact Assessment, referred as ESHIA). However, NWPGL has obtained an exemption of carrying out IEE from the DoE with a condition of conducting a comprehensive ESHIA in line with a Terms of References (ToR) approved by the DoE.

The Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources of the Government of Bangladesh and a pioneer scientific organization with vast experience in carrying out ESHIA studies of diversified fuel based power plants in Bangladesh, has been entrusted by NWPGL for carrying out the ESHIA of the third unit of the power plant complex in Sirajganj.

Based on review of the ESHIA, DoE has accorded a letter of Approval of ESHIA on July 16, 2016 which is annexed in Annex 1.

NWPGL is seeking financial assistance from Standard Chartered Bank (hereinafter referred as 'SCB' or 'Bank' or the 'Lenders') wherein, NWPGL is expected to comply with various with International Finance Corporation's (IFCs) Sustainability Framework 2012 (IFC) and its Performance Standards (PS) on Social and Environmental Sustainability and Equator Principle –III, 2013 (reference framework). To meet the requirement of compliance with the reference framework, the ESHIA developed by CEGIS for Unit-3, was reviewed to align with reference framework by lenders, in line of which, the present Addendum Report has been developed. The various sections of this report should be read in conjunction with the ESHIA report dated November 2015.

NWPGL developed Environment and Social Management System dated September 2015, in line with the reference framework (as mentioned above). The present ESHIA updation also captures the elements of ESMS and details deviations (if any).

## **2. Addendum to ESHIA Report**

### **2.1. Addendum to Chapter-2, Policy Legal and Administrative Framework of ESHIA Report**

Due to commitment to lenders, NWPGL shall comply with the reference framework, i.e. IFC Sustainability Framework, 2012 and Equator principles-III. The compliance and applicability of the reference framework is provided below:

Detailed applicability of various regulations i.e. performance standards and equator principles to be implemented for the project are as follows: Out of eight (8) IFC's Performance Standard (PS); PS- 1, 2, 3 and 4 are triggered by the Project while PS- 5 (Land Acquisition and Involuntary Resettlement), PS -6 (Biodiversity and conservation of living natural resources), PS- 7 (Indigenous People) and PS- 8 (Cultural Heritage) are not triggered by the Project. A detail of Performance Standards is given in Annex- 2. PS-6 might be triggered in case of use of Jetty located in Jamuna Eco-park, for construction works, the evaluation of which will be undertaken separately in case the use of Jetty is envisaged by NWPGL.

The Equator Principles Financial Institutions (EPFIs) have adopted the Equator Principles in order to ensure that the Projects finance and advice on are developed in a manner that is socially responsible and reflects sound environmental management practices. If these impacts are unavoidable they should be minimized, mitigated, and/or offset. A detail of Equator Principles is given in Annex 3.

Jamuna Eco Park located at approximately 1km from project site is one of Eco-parks which are established and managed as such the Botanical Gardens in Bangladesh. However, they are not declared under any legal provision. Moreover, the discussed semi-protected Eco-Park in ESHIA report is the planted forest in the land of Jamuna Bridge Authority.

In absence of a clear definition of protected area, it is a general conviction that protected areas are designated and established in accordance with a formal legal system. There are 16 protected areas in Bangladesh declared under the provisions of the Bangladesh Wildlife (Preservation) Order, 1973. These are eight National Parks (IUCN category V), namely, Bhawal, Modhupur, Lawachara, Himchari, Nijhum Dweep, Kaptai, Ramsagar and Medha Kachsapia; seven wildlife sanctuaries (IUCN category IV), namely, Rema-Kalenga, Chunati, Pablakhali, Char Kukri Mukri and Sundarban East, Sundarban West and Sundarbans South; and only one game reserve 5 (IUCN category VI), known as Teknaf Game Reserve. The Eco Park is not in the list of protected areas those are conserved and managed under the Bangladesh Wildlife (Preservation), Order, 1973. However, activities those are not allowed for the national park may be applicable for the Eco Park. The activities are as follows:

- Hunting, killing or capturing any wild animal in a national park and within the radius of one mile outside its boundary;
- Firing any gun or doing any other act which may disturb any wild animal or doing any act which may interfere with the breeding places of any wild animal;
- Feeling, tapping, burning or in any way damaging or destroying taking collecting or removing any plant or tree the reform;
- Clearing or breaking up any land for cultivation, mining or for any other purpose; and
- Polluting water flowing in and through the national park: Provided that the Government may, for scientific purposes or for betterment of the national park or for aesthetic enjoyment of scenery or for any other exceptional reasons, relax all or any of the prohibitions specified above.

Additionally, in case NWPGL will use the jetty located in the Jamuna Eco-park, Bangbandhu Bridge Authority (BBA) for transportation of heavy equipments, permissions will be sought from the BBA.

### **2.2. Addendum to Chapter-3, Project Data Sheet of ESHIA Report**

### 2.2.1. Section 3.6.1 on Water Demand and Source of ESHIA

Section 3.6.1 on Water Demand and Source to be referred in conjunction to this section.

#### *Water requirement during construction phase*

Following activities have been identified where it is thought the majority of water utilization is envisaged during construction phase of the project. However, currently there is very limited information on the proportion of construction site water used for different activities and processes.

Key water using processes on construction sites are considered to be:

- Site cabins and temporary accommodation;
- General site activities including tool washing;
- Wet trades, such as brickwork, screening, concreting and plastering;
- Groundwork's, including piling, grouting and drilling;
- Dust suppression, including road and wheel washing;
- Hydro-demolition;
- Cleaning of tools and plant equipment, lorry washing; and
- Commissioning and testing of building plant and services

Quantification of water required during construction phase will be assessed by the EPC Contractor when it will be onboard. The contractor will maintain records of daily water requirements during construction phase of the project.

### 2.2.2. Section 4.3.7 on Water balance of ESHIA

Section 4.3.7 on Water balance; to be referred in conjunction to this section.

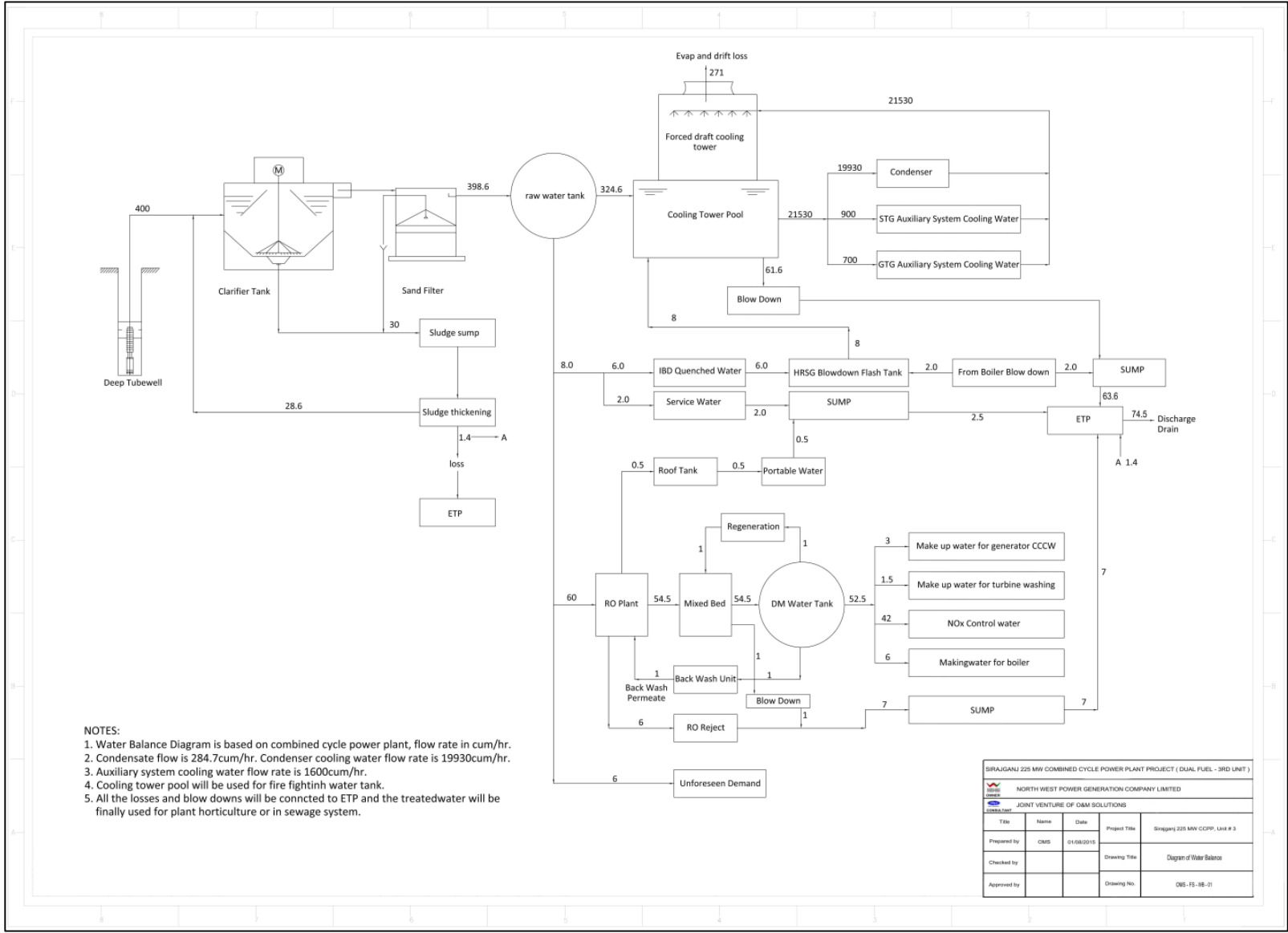
#### *Revision of Water Balance Diagram*

The Demineralized Water treatment plant as shown in figure 4-2 of ESHIA report has been replaced with provision of Reverse Osmosis (RO) Plant. The revised water diagram has been presented below.

One block water requirement will be 50 cubic meter per hours. This will meet by RO plant consists of two trains, each of 50% capacity for the demand of one block. During natural gas firing one stream meets the requirement, whenever liquid fuel firing happens both blocks will be operating to meet the additional De NO<sub>x</sub> water injection requirement. During cleaning of the membranes, only one train shall be in operation (it will be planned only when plant is operating on gas fuel). Any shortfalls in water shall be taken from the permeate storage tank.

The RO plant will be sized to meet the requirements of the demineralization plant. Initial cleaning of the dealkalized raw water is provided by filtration through pre-filters before supplying it to the reverse osmosis membrane by means of a feed pump.

Both trains are equipped with all necessary dosing and storage systems for chemicals, and membrane-cleaning equipment is provided for use by both. One permeate storage tank is provided for a 24 hour supply of one blocks.



NOTES:  
 1. Water Balance Diagram is based on combined cycle power plant, flow rate in cum/hr.  
 2. Condensate flow is 284.7cum/hr. Condenser cooling water flow rate is 19930cum/hr.  
 3. Auxiliary system cooling water flow rate is 1600cum/hr.  
 4. Cooling tower pool will be used for fire fighting water tank.  
 5. All the losses and blow downs will be connected to ETP and the treated water will be finally used for plant horticulture or in sewage system.

SIRAJGANJ 225 MW COMBINED CYCLE POWER PLANT PROJECT ( DUAL FUEL - 3RD UNIT )				
NORTH WEST POWER GENERATION COMPANY LIMITED				
JOINT VENTURE OF OAM SOLUTIONS				
Title	Name	Date	Project Title	Sirajganj 225 MW CCPP- Unit # 3
Prepared by	CMS	01/08/2015	Drawing Title	Diagram of Water Balance
Checked by			Drawing No.	CMS-FS-18-01
Approved by				

Figure 1: Revised Water Diagram of NWPGL Unit 3

Computation of percentage loss has been undertaken based on experience of CEGIS, ESHIA consultant for the proposed project.

Blow down from cooling tower of 61.6 Kl is channelized to a sump as shown in figure above. Subsequently, the sump is connected to CEPT proposed for the project.

*Breakup of water used in irrigation, flushing and final discharge in drain of the discharged 11.9 kl water*

The quantity of treated waste water has been revised to 74.5 m<sup>3</sup>/hr. The quantity of water required for irrigation, flushing etc. would not be same every day. Therefore, a generalized use has been provided.

**Table 1: Effluent Sources and Quantity in the Proposed Unit – 3 Power Plant**

SI no	Sources	Quantity (m <sup>3</sup> /hr)	Discharge Pathway
1	Water Pre-treatment Plant: Clarifier Tank, Sand Filter and Sludge thickening Plant	1.40	Waste Water Sump > CETP > Discharge Channel > River
2	Cooling Tower blow Down and HRSG Blow Down	61.60	
3	Water Demineralization Plant Blow Down	6.00	
4	Other sources	5.5	
	<b>Total</b>	<b>74.5</b>	

Source: CEGIS

### 2.3. Addendum to Chapter-6, Description of Baseline Environment, ESHIA Report

#### 2.3.1. Section 6.6 of Chapter 6 of ESHIA

In conjunction to Section 6.6 of Chapter 6, SDCPL (2015) and EAL 2014 reports on Water Availability Study as provided in Annex 4, shall be referred.

#### 2.3.2. Section 6.5 on Ambient Air Quality and Noise of ESHIA

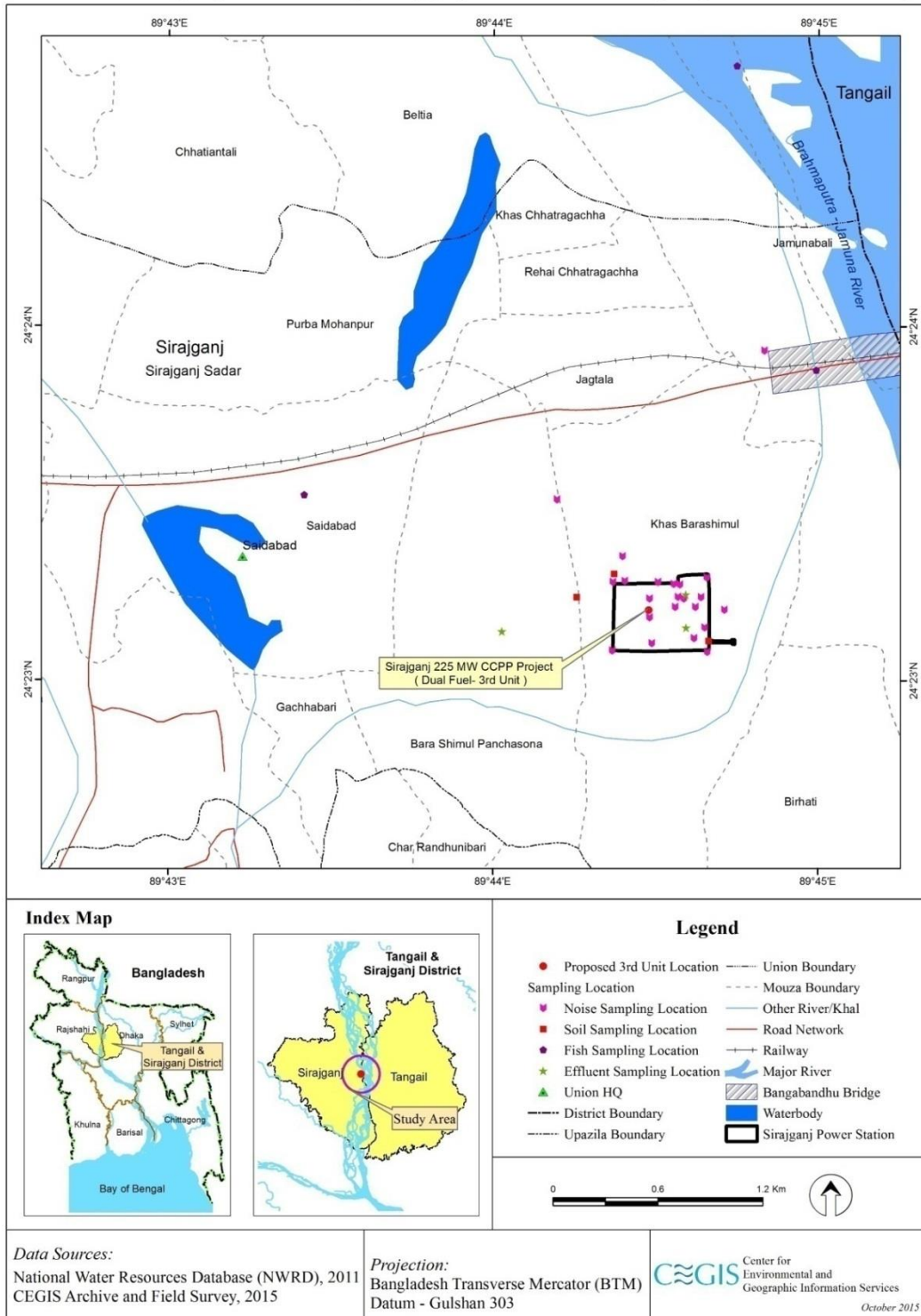
Section 6.5 on Ambient Air Quality and Noise; to be referred in conjunction to this section

*Rationale for identifying the locations of air sampling:*

According to the wind rose diagram (**Figure 6-9**) as provisioned in ESHIA report, the wind directed from south to north during monsoon period (sampling time) and as well as throughout the year. Therefore, one sample (Barashimul Village) was selected considering the incoming direction of pollution free wind and next two sampling locations (Rehabilitation Village and Eco-Park) were selected considering the path of air which is susceptible to carry the pollution load. In selecting these three locations, the sensitivity of people being affected and ecological sensitivity were also considered as they are the nearest communities from the power plant.



**Combined Sampling Location Map: Sirajganj 225 MW CCPP Project ( Dual Fuel- 3rd Unit )**



**Figure 2: Monitoring locations of noise, soil, fish and effluent**

*Rationale for 8hr sampling in 3locations and 24 hr sampling inside the plant*

Considering the worst case scenario (as pollution load is highest during day time) air sampling has been conducted for 8hrs at three (3) locations. To capture the variation of the plant load leading to emission, similar kind of sampling has been conducted for 24 hrs inside the Plant.

### Air monitoring frequency and monitoring period

As per the Terms of Reference issued by DoE and considering the narrow study period, the air sampling was conducted only once. Moreover, the study period was the monsoon having fresher air and SPM, PM<sub>10</sub>, and PM<sub>2.5</sub> were suppressed due to continual rainfall.

### Details on NO<sub>x</sub> monitoring

The air quality was monitored at four locations (Map 6-18) in and around the Project site considering the air directions and sensitive receptors. Only annual standard for NO<sub>x</sub> is considered according to GoB guideline. For this reason, measured 8 hour and 24 hour NO<sub>x</sub> data was converted using conventional formula and compared with annual standard. The 24-hourly average NO<sub>x</sub> concentration was recorded in the range of 4.2 – 20.9 µg/m<sup>3</sup>. The 98th percentile was recorded in the range of 12.5 – 20.7 µg/m<sup>3</sup>. Average concentrations of NO<sub>x</sub> at all the monitoring locations were reported in the range of 7.8 – 15.6 µg/m<sup>3</sup>. The annual Bangladesh standard for NO<sub>x</sub> is 100 µg/m<sup>3</sup> and present 24 hourly average concentrations at all the locations are well below these values.

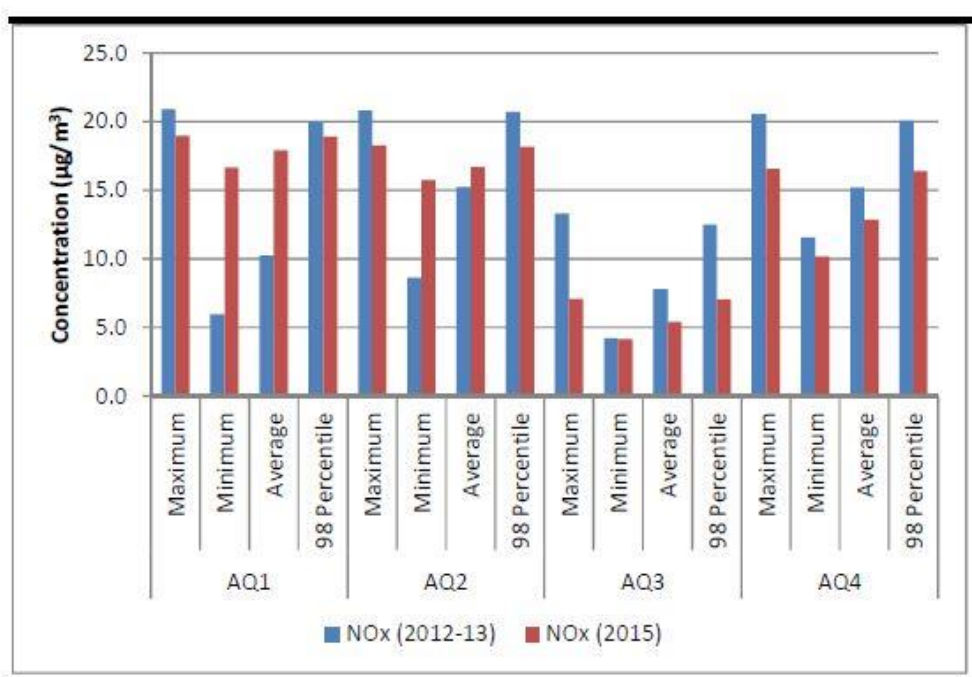


Figure 3: NO<sub>x</sub> Concentration Pattern in the Project AOI

### Reason for noise exceedance during plant operation

All the noise monitoring results are provided in L<sub>eq</sub>. As they are workplaces, it is expected that the noise level would exceed in these places (according to IFC guideline, L<sub>Amax</sub>, Fast for heavy industry can be as high as 110 dBA and L<sub>Aeq</sub> 8h can be 85 dBA). In some locations, the noise level during night increases from the level found during day. It was probably due to high sound of some insects like cricket and others. In addition to this, heavy traffic movement during night time on the national highway affects the sound level. Moreover, following the suggested mitigative measures and ECP-11 (Appendix-8) in page # would reduce the level of noise in many of the nearby places and also inside the office rooms.

### Population dependency on fishing for livelihood

Information sourced from ESHIA studies undertaken for Unit IV presents the following on the livelihood of fishermen in Sirajganj Sadar area:

- Fishing is reported to be practiced in Sirajganj Sadar is at a very small scale and involves only 1590 fishing households in Sirajganj Sadar Upazilla;
- Though the Saidabad and Punorbason Colony do not have any fishermen household, a few fishermen households may be present in other villages in periphery zone.
- It was reported that fishing is prohibited under the bridge considering security reasons and adjoining channel that connects to the Jamuna River;
- It was also informed that the fishing grounds in the other bank (east side –opposite of Project site) of the river are more productive, hence fishermen access them more often;
- The fish population in Jamuna River in Saidabad Union territory is sufficient to provide livelihood to local fishermen families;
- The fishing activities in the village are restricted to approx. 3 months in a year, around monsoon;

It was also reported that as per information provided in ESHIA studies for Unit-IV that local fishermen representatives were of the opinion that the use of the Jetty by the project should be undertaken during the pre-monsoons and outside of the spawning period of the important species.

#### *Phytoplankton and Zooplankton status of the River*

Information sourced from ESHIA studies undertaken for proposed Unit-IV presents that the phytoplankton collected from four ( 4) duplicate samples of Jamuna River include different species of Diatoms (5 species), cyanobacteria (3 species), green algae (8 species) and protozoa (1 species). The zooplankton enumerated from the 4 duplicate samples include different species of rotifers (4 species), crustaceans (2 species), Copepods (2 species) and ostacods and cladoceras with single species. None of the species observed are of conservational significance.

#### *Details pertaining to calculations of GHG emissions, carbon intensity, emission factors used along with calculated CO<sub>2</sub> equivalents*

The calculation of GHG was conducted according to 2006 IPCC Guidelines for National Greenhouse Gas Inventories, which is also mentioned in the notes of Table 7-21 inside the report.

## **2.4. Addendum to Chapter-7, Environmental Impacts, ESHIA Report**

### **2.4.1. Usage of Jetty for transportation of gas turbine components to the Project**

Usage of temporary jetty in Jamuna Eco Park is envisaged for transportation of heavy equipments such as gas turbine, transformer etc. for proposed Unit-III. Site management has informed that the temporary jetty will be constructed by using layers of sand and sand bags and these will be arranged so as to provide compaction and strength to temporary jetty.

Dredging activities may be required to carry out near the temporary jetty envisaged to be constructed in order to provide sufficient draft for the incoming barges carrying heavy lifts. Reportedly, magnitude of dredging will depend on the bathymetry of the channel connecting with the main river and the water level at the time of heavy lifts transportation in Jamuna River.

Information sourced from Environment and Social Impact Assessment (ESHIA) studies carried out proposed Unit-IV in Sirajganj Complex in year of 2015 details that dredging on Jamuna River is being carried out by the Bangladesh Water Development Board (BWDB) in order to remove silt from the main channel as well as for river bank erosion control. Considering the on-going dredging activities near to the temporary jetty location as well as construction of closures in the upstream of the temporary jetty, the impact magnitude of limited dredging during the transportation of heavy lifts was considered as not significant.

As per the baseline data generated for ESHIA studies of proposed Unit-IV, Twenty (20) species of fish were reported by primary survey and secondary information from the Jamuna River and none of the species listed are protected by law (national laws of Bangladesh). The South Asian Dolphins (*Platanista gangetica* -IUCN EN) were studied in Jamuna River at the rate of 0.13 sightings per kilometer and 1.5 sightings per hour, based on a study conducted in year of 1995-1996. Fishermen confirmed their presence in the Jamuna River all through the year during the site survey conducted for proposed Unit-IV.

The area identified for temporary jetty was already being used in the past by NWPGL for unloading and transportation of heavy lifts during the commissioning of Sirajganj 1 (225 MW) power plant, located with the same complex and there is an existing road of BBA, which connects this jetty location to the national highway.

## Impacts

### *Spillage due to transportation of heavy equipments in Jamuna River*

Transportation will be undertaken with the help of barges/trawlers. There is a likelihood of leakage of fuels and other contaminants from barges to Jamuna River. Impact on aquatic flora and fauna is predicted as moderate from spillage from transportation vessels (any leakage of oil and ballast water) since the spillage may affect their habitat and egg laying sites.

### *Impact on Dolphin*

The Jamuna is the roaming way for the Ganges River Dolphin i.e. South Asian River Dolphin (*Platistina gangeticus*) which is endangered in IUCN global status. They use the main channel of the river for their migration particularly during monsoon season. However taking into consideration the sensitivity of the receptors, i.e. South Asian River Dolphin (*Platistina gangeticus*) IUCN 2015.2 EN, the impact significance was assessed to be moderate.

#### 2.4.2. Section 7.6.7 on Impact on Socio-Economic Condition of ESHIA

Section 7.6.7 on Impact on Socio-Economic Condition; to be referred in conjunction to this section

### *Construction of labour accommodation for proposed project*

As the 1st unit is in its operational phase, there can be only a few day-laborers. Rest is employees of NWPGL. It is presumed that construction work of unit 2 will be finished or near to finish by the time construction work of unit 3 starts. Similarly, unit 2 will also have only a few numbers of day laborers, rest will be employees of NWPGL.

NWPGL will arrange the accommodation for some of its employees inside the project site while the rest will stay in the nearby locality.

Approximately 150 to 200 laborers and technicians will be engaged in different activities during the entire construction phase of Unit-III by the EPC contractor. Based on the phase of construction, this quantity may increase from 200-600 for a short period of time. Out of which around 50-60% of laborers is expected to be hired and engaged on day basis from the local community surrounding the project site. This would alleviate the problems related to accommodation and other social amenities including sanitation. Accommodation of the remaining laborers and technicians will be arranged in the labor camp established on the leased land of Bangladesh Bridge Authority (BBA).

The labour influx will be for short term and they would return back to their home provinces at the end of construction period. There is a likelihood of overlapping in the construction schedule of Unit-II and Unit-III within the power generation complex and this will lead to unavailability of land within the

complex for construction workers camp. Therefore, the labour camp will be located outside the power generation complex. The area identified for the construction workers camp is located between the main highway and Punorbason village fence line. Available land area for this purpose is about 8.37 acres.

As per the data provided in ESHIA studies undertaken for Unit-IV, it is provided that no activity is permitted on top of this corridor on land portion towards the national highway which has a ~6 m wide right of way for the Main Gas Pipeline of PGCL. Furthermore, the embankment of the road also need to be avoided and hence only the area between the slope of embankment and the fence line of Punorbason village has been considered suitable for the construction camp, due to its proximity to the project site as well as availability of land from BBA.

#### 2.4.3. Section 8.4.1 of the ESHIA

Section 8.4.1 of the ESHIA report shall be read in conjunction with the details provided in this section.

##### *Influx of Migrant Labours*

Due to the non-availability of land within the complex, the labour camp for the Sirajganj 2's construction phase (approx. 25-30 months) will be located outside the power generation complex. Since the end of construction phase of Unit-II, is likely to be around the same time of commencement of construction phase of Unit-III, a total of 150-200 migrant workers may be present in the area. This is likely to result in an increase in the interaction of the local community with migrant workers, with an increased risk of sexually transmitted and communicable diseases, conflict and social unrest. Also, due to the presence of a large workforce, there may be a strain on local resources and infrastructure, especially water, medical facilities, electricity, food and provisions in the local markets. This may also result in an increase in the overall price of essential commodities in the area,

The project plans to maximize local involvement in the employment during the construction phase, however migrant labours will also be recruited; the severity of the impacts identified in expected to be moderate. The anticipated impacts are:

- Community Infrastructure: Influx of migrant workers may strain existing infrastructure of local community. Drinking water arrangement for labour camps will be met through prevailing ground water in the area which is also a potential water sources for local community. Workers can also utilize local transport for commutation to nearby areas thereby increasing risks such as road accidents, and other detrimental consequences of increased traffic generated by the project (dust, noise, and pollution).
- Community Services and facilities: Strain on local resources and infrastructure, especially water, medical facilities, electricity, food and provisions in the local markets. This may also result in an increase in the overall price of essential commodities in the area.
- Community Health and Safety: The construction of the labour camp will require the diversion of the small tracks used by the community for reaching the highway and other villages as well as the drainage of the waste water from the village into the block identified, to avoid health risks from accumulated water to community and workers.
- Local Business: Local businesses such as shops are likely to benefit from their proximity to labour camps that will be provided to accommodate migrant workers. However there can be negative issues due to different lifestyles or cultural backgrounds of migrant workers.
- High interaction with the local community, with a potential of certain risks associated with increase in conflict and social unrest, health related issues including risk of sexually transmitted and communicable diseases.
- Also, due to the presence of pipelines in the area identified, precautions will have to be taken to mitigate the risks of fire and explosions and the workers will have to be aware of the same.

#### 2.4.4. Section 9.7.4 on Hazardous Waste Management of ESHIA

Section 9.7.4 on Hazardous Waste Management and ECP-1 & ECP-2 (Appendix-8) to be referred in conjunction to this section.

The other identified hazardous waste envisaged to be generated during operation phase:

- Chemical waste;
- Chemical Cleaning waste from the CT compressor;
- Waste/used oil from the power house and workshop;
- Oil/dust contaminated cloths and rags from the lube oil system and spill kit waste

These hazardous wastes, if haphazardly stored can cause spillage or leachate generation, which in turn can contaminate the land and ground water. Hence it is recommended that the hazardous wastes generated from the proposed Project will be collected and stored in designated roofed-areas and/or barrels with concrete flooring and secondary containment and disposed of/ sold through contractors or treated prior to discharge.

#### 2.4.5. Section 7.5.2 on Impact on Socio-Economic Section ESHIA

Section 7.5.2 on Impact on Socio-Economic Section of ESHIA to be referred in conjunction to this section

Bangladesh Power Development Board (BPDB) has acquired a land of about 53 acres at Sayedabad, Sirajganj district for establishment of Sirajganj Generation Hub. 10 acres of land was leased to NWPGL to establish Sirajganj 150MW Peaking Power Plant. Subsequently, NWPGL has applied for getting the land of 17.5 acres (10 acres for Sirajganj 225MW 2nd Unit and 7.5 acres for Sirajganj 225MW 3rd unit) leased from BPDB as per decision of GOB to establish the said power plants in the Sirajganj Generation Hub. On this basis, BPDB has decided to lease land of 17.5 acres in Sirajganj Generation Hub to NWPGL. Now, Land Lease Agreement (LLA) between BPDB and NWPGL is under process. Hence, no land acquisition for the proposed power plant will be required.

### 2.5. Addendum to Chapter-8, Mitigation of Impacts, ESHIA Report

#### 2.5.1. Usage of Jetty for transportation of gas turbine components to the proposed site

##### Mitigation Measures

- The following prevention and mitigation measures will be proposed in the Specification Manual for EPC Contractors:
  - The Contractor will prepare unloading and loading protocols for the temporary jetty and train staff to prevent spills and leaks;
  - Loaders will be checked for lubricant leaks prior to their usage;
  - The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oils, fuels or chemicals;
- Any leakage of fuels and other contaminants from barges to Jamuna River to be avoided through proper maintenance;
- During transportation of equipment's the vessel speed should be regulated and observer for the Dolphin movement should be appointed to guide the vessel to the temporary jetty area. Ballast discharge to be regulated near the area of influence;
- Barges with valid requisite licenses and emergency handling capacity or tie-ups shall only be engaged for transportation of heavy equipments through Jamuna River;

- Vessel patrols and deck monitoring during movement of vessels in Jamuna River should organize or enforced/ supervised by the site security for detecting movement of South Asian River Dolphin. If such movement is observed, the vessel should be stopped until the species moves out of the path of the vessel.

#### **2.5.2. Construction of labour accommodation for proposed project**

The following points shall be implemented before construction of labour camp:

- It is to ensure that land lease agreement has been executed between NWPGL and BBA for construction of labour camp for Unit-III;
- EPC contractor is required to submit a detailed labour camp plan with provision of all the facilities;
- In addition to detailed labour camp plan, EPC is required to submit ESMP covering labour camp requirements in line with the Environment & Social Management System of NWPGL and requirements detailed under IFC- EBRD requirements for Labour Camp Management.

#### **2.5.3. Influx of Migrant Labour**

The following mitigation measures will be implemented to avoid impact due to influx of migrant workers:

- It should be ensured that the labour camp constructed should have basic amenities such as electricity, drinking water, health & sanitation facility, kitchen and rest room in accordance with local regulations as well as IFC handbook for labour accommodation;
- All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated and all the migrant workers will be instructed accordingly;
- It should ensure that accommodation which is provided is not overcrowded and does not pose a risk to the health and safety of workers;
- The labour camp will be equipped with septic tanks and soak pits and avoid presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes;
- Security staff have a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers and community members;
- NWPGL should ensure that workers and members of the surrounding communities have specific means to raise concerns about security arrangement and staff;
- Where possible, an adequate transport system to surrounding communities will be provided. It is good practice to provide workers with free transportation to and from local communities.

#### **2.5.4. Hazardous Waste Management**

The mitigation measures to be implemented for hazardous waste generation during operation phase are:

- Provision of secondary containment systems with materials appropriate for the wastes being contained and adequate to prevent loss to the environment;
- The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater);
- Provide adequate ventilation where volatile wastes are stored;

- Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents;
- Limiting access to hazardous waste storage areas to employees who have received proper training;
- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan; and
- Conducting periodic inspections of waste storage areas and documenting the findings.

## **2.6. Addendum to Chapter-9, Environmental Management Plan, ESHIA Report**

### **2.6.1. Section 9.10 Emergency Response Plan and Volume III of ESHIA Report**

Emergency Response Plan (ERP) have been developed as part of ESHIA addendum as Vol- II.

The ERP of the ESHIA comprises following positions like (i) Emergency Response Group Leader, (ii) Operations & Technical Coordinator, (iii) Logistics and procurement Coordinator (iv) Health, Safety and Environment (HSE) Coordinator, (v) Human Resources & Travel Services (HR) Coordinator, (vi) Public Affairs (PA) Coordinator, and (vii) Reception.

The ERP of ESMS comprises positions like (i) Emergency Manager (Team Leader), (ii) Fire Officer, (iii) Safety Officer, (iv) Chief Security Officer, (v) Chief Medical Officer, (vi) Rescue Officer, and (vii) Public Relations Officer.

The functions of Emergency Response Group Leader dealt in ERP-ESHIA are equivalent to the functions of Emergency Manager (Team Leader) dealt in ERP-ESMS. ERP-ESHIA has considered the position Logistics and procurement Coordinator, for urgent supply of logistics during the emergency and procurement of logistics as required for coping up the urgency. The positions of Fire officer, Safety officer, and Chief Medical officer are mentioned separately in the ERP-ESMS, whereas the roles and responsibilities of these three positions were considered in the ERP-ESHIA under the position of Health, Safety and Environment (HSE) Coordinator. Similarly, the roles and responsibilities of the positions of Chief Security Officer and Rescue Officer are separately considered in the ERP-ESMS, whereas the similar roles and responsibilities were considered under the position of Human Resources & Travel Services (HR) Coordinator in the ERP-ESHIA. The function of Public Affairs (PA) Coordinator mentioned in ERP-ESMS is equivalent to the function of the Public Relations Officer mentioned in ERP-ESHIA. The roles and responsibilities of the position 'Reception' is to record or register the name of the people enter into and exit from the premise. This position has been considered in the ERP-ESHIA but not in the ERP-ESMS. These positions can be considered synonymous and should be ensured by NWPGL for implementation of ERP. Based on the ERP in ESHIA and that detailed in ESMS, NWPGL Corporate EHS Manager shall develop a site specific ERP. The site specific ERP shall have elements both from ESHIA and ESMS and in cases of overlap or contradiction, the ERP of ESHIA will prevail. In cases ERP of ESHIA is silent; requirements of ESMS will be taken into consideration.

### **2.6.2. Section 9.12 of the ESHIA report on Organisation Structure**

Section 9.12 of the ESHIA report shall be read in conjunction with the details provided in this section.

In Project Implementation Unit (PIU) proposed for 3rd Unit, there were no personnel for looking after the environment, health & safety issue. Reasonably, the ESHIA study proposed two positions in the organization structure for the project; one for environment and other for health and safety as Assistant Manager (AM). The study also proposed external monitoring by EPC (Engineering, Procurement and Construction) itself, CSC (Construction Supervision Consultant) and Independent Monitoring Agency.



The ESMS (Environmental and Social Management System) also identifies requirement of developing an EHS and Social Cell at the project level which comprises of Deputy Manager or Assistant Manager EHSS, which shall be hired exclusively for the project who will work in coordination with EHSS Cell at the corporate level.

The Organogram for the proposed SPS (Sirajganj Power Station) 3rd unit has five (5) circles which are Operation, Mechanical, Electrical, I&C and Chemical. ESMS has provisioned a dedicated Environment, Health, and Safety (EHS) Circle to address environmental management and occupational health and safety issues at project level. ESMS details requirement of EHSS cell under the XEN Operation mentioning DM/AM (EHSS), JAM (EHSS) and MLSS and does not detail numbers of personnel to the existing organogram. There is also provision of Medical Officer and Medical Assistant who will be managed by Admin Manager at project level.

In view to provide more detailed organogram in line with ESMS and considering requirement of senior management at the site, the ESHIA study proposed an EHS Circle headed by a Manager, a Deputy Managers supporting the manger and two assistant managers; one for environment and another one for health and safety along with one MLSS (Ref. Page # 249 of ESHIA Report).

A separate medical unit is also proposed, which will be headed by a manager, a Medical Officer and a Medical Assistant. The medical officer and medical assistant will be deputed from Admin circle. Along with this, two nurses, two ward boys and one MLSS are also proposed under the ESHIA study. The organogram revised under the ESHIA study is shown in Figure 9-5 (Ref. Page 249 of ESHIA).

The Manager (EHS) and Manager (Medical Unit) will report to Corporate Manager EHSS.

The contractor will also have an EHS and social organization for ensuring implementation of various requirements as identified in the ESHIA and ESMS developed for the company.

### 2.6.3. Section 9.7.7 and 10.6 of the ESHIA

Section 9.7.7 and 10.6 of the ESHIA report shall be read in conjunction with the details provided in this section.

For taking care the health and safety issue of the personnel involved in the project activities and surrounding community as well, a complete and separate Occupational Health Safety and Environment Plan (OHSEP) has been prepared under the ESHIA study and submitted as Volume No. II. The implications of OHSEP is more or less similar to the implications of Occupational and Community Health and Safety Management (OCHSM) Procedure prepared under ESMS. The organization of a typical occupational health and safety plan should include the following positions:

1. Project Director (Chief Engineer)
2. Superintending Engineer
3. Executive Engineer
4. EHS Manager
5. Sub-Divisional Engineer
6. Deputy Manager (EHS)
7. Assistant Engineer
8. Assistant Manager- Environment

Out of aforementioned eight (8) positions, first three positions are generally involved in decision support system in chronological manner. Later five positions (4-8) are involved in operational activities of the OHSEP-ESHIA.

The position of Environmental Health and Safety (EHS) Manager in OHSEP-ESHIA is equivalent to the EHSS Manager in OCHSM-ESMS. Both the health and safety plans have considered Deputy Manager, and/or Assistant Manager for Environmental Health Safety and Social. For the smooth functioning of the plan and its proper service to the project personnel and community two additional positions were considered in the OHSEP-ESHIA than that of OCHSM-ESMS. Hence, organization structure detailed in the ESHIA will be applied for Unit-3. Additionally, the procedures detailed in ESMS shall be implemented by NWPGL for managing occupational and community health and safety related risks and impacts. Procedures number 6.5 of the ESMS covers aspects pertaining to Permit to Work System, work at height, PPE, accident/incident investigation, medical first aid, maintenance safety, electrical safety, confined space entry, general work environment and OHS trainings, etc.

#### 2.6.4. Training requirements under Chapter 9 of the ESHIA

This section compliments various training requirements under Chapter 9 of the ESHIA. The ESHIA report deals with the required trainings. However, there are specific sections where all the required trainings are listed down (i.e. Table 9-8, Table 10-11). Section 10.8.3 specifically mentions the requirements related to fire safety training. Moreover, in the Section 6 of Table 1-1 of Volume II (Occupational Health, Safety, and Environmental Plan) briefly describes the proposed NWPGL OSHE Management System's Key Responsibilities regarding Awareness, Training and Competency. Section 5-2 of Volume II clearly describes the procedure and required frequency of OSHE training which is further depicted in Table 5-1. In addition, Section 1.13 and Section 1.39 of Volume III (Emergency Response Plan) describes the required training modules for ERP.

**Table 2: Training Subjects for Inclusion in Contractors Training Plan (Construction)**

Training Subject	Target Group
Handling, use & disposal of hazardous material	Construction workers with authorized access to hazardous material storage areas and required to use hazardous material during their works
Waste Management	All staff (construction and camp staff)
Efficient & safe driving practices, including road & vehicle restrictions	Drivers & mobile plant operators
Actions to be taken in the event of major or minor pollution event on land	All construction staff
Use of flexible booms and surface skimmers in event of pollution event in water	All construction staff working on the jetty renovation (if required)
Pollution prevention: Best practice	All staff
Refuelling of water borne plant – pollution prevention	Operators of water borne plant & vehicles
Health & Safety: Safe way to work & hazard awareness	All construction staff
Health & Safety: Safe use of plant & equipment	Operators of plant & equipment
Health & Safety: Working at height	Turbine hall, HRSG and cooling tower refurbishment construction staff
Health & Safety: Working near/on water	All staff working on jetty strengthening and unloading heavy equipment from ship
Health & Safety: Use of PPE	All construction staff
Emergency procedures and evacuation	All staff
Fire fighting	All staff
Site inductions, including requirements under the Environmental Management Plan & details of environmentally sensitive areas of the site	All staff
Awareness raising on risks, prevention and available treatment of vector-borne diseases	All staff
Cultural sensitivities of the local population	On induction of all non-local staff

**Table 3: Type of training and training actions (Operation)**

SI	Type of Training	Training Actions
1	Actions to be taken in the event of a fire	Use fire exit and educating workers and staffs of the nearest emergency evacuation zone. Proper evacuation procedure in the event of a fire. Training on locating emergency equipments and use of portable fire extinguishers to extinguish fires. Training on whom to contact in case of an emergency.
2	Handling of flammable liquids	Training on the safe handling and storage of volatile/flammable chemicals/oils. Training on waste classification system and use of various colour-coded bins for various waste disposals. Training on the use of PPEs.
3	Emergency Drills	Regular monthly training on mock fire drills. Regular monthly workshop on emergency response and preparedness plan.
4	First-aid and medical assistance	Training on first-aid treatment for broken bones/fractures, burns, cuts/wounds, unconsciousness, breathlessness.

**Table 4: Training Plan**

Training Subject	Target Personnel
Leadership and project management training	NWPGCL senior management (Dhaka and site based staff)
OHSE Management System awareness-Detailed	NWPGCL senior management (Dhaka and site based staff)
OHSE Management System awareness-basic	All staffs
Emergency response and management	IRT, ERG and IMT team
Handling, use & disposal of hazardous material	Construction workers with authorized access to hazardous material storage areas and required to use hazardous material during their works
Waste Management	All staffs (construction and camp staff)
Defensive and Evasive training- Efficient & safe driving practices, including road & vehicle Restrictions	Drivers & mobile plant operators
Actions to be taken in the event of major or minor pollution event on land	All construction staff
Use of flexible booms and surface skimmers in event of pollution event in water	All construction staff working on the jetty renovation (if required)
Pollution prevention: Best practice	All staffs
Refuelling of water borne plant – pollution Prevention	Operators of water borne plant & vehicles
Health & Safety: Safe way to work & hazard Awareness	All construction staff
Health & Safety: Safe use of plant & equipment	Operators of plant & equipment
Front line leadership and project management Training	Senior management of NWPGCL (both Dhaka and field personnel)
Health & Safety: Working at height	Turbine hall, HRSG and cooling tower construction staff

Training Subject	Target Personnel
Health & Safety: Working near/on water	All staffs working on jetty strengthening and unloading heavy equipment from ship
Health & Safety: Use of PPE	All construction staffs
Emergency procedures and evacuation	All staffs
Fire fighting	All staffs
Health & Safety: Confined space entry	Designated workers
Health & Safety: Lifting and rigging	Crane operator and all riggers
Culturally sensitive awareness rising on HIV/AIDS and the spread of sexually Transmitted diseases. Awareness raising on risks, prevention and available treatment of vector-borne diseases	All staffs
Cultural sensitivities of the local population	On induction of all non-local staff

Based on the above identified training requirements, the Human Resources Manager in close coordination with Manager EHS at the plant level and Manager EHS at the corporate level to develop the half yearly training matrix and yearly training need assessment for the project.

#### 2.6.5. Section 9.6.7 on Traffic Management Plan

Section 9.6.7 on Traffic Management Plan and ECP-15 (Appendix-15) to be referred in conjunction to this section. During the operation phase of the Project, the regular traffic and transportation will be limited to the movement of plant personnel and contracted workers during their working shifts. As the total manpower will be limited to 70 who will work in shifts, their transportation will not lead to any impact on road safety of the nearby communities using the access road. Key raw material for power generation (natural gas/ HSD) will be transported by pipeline. Considering these facts, impact due to traffic movement during operation phase will be negligible.

#### 2.6.6. Section 9.9 on Mitigation Plan of the ESHIA

Section 9.9 on Mitigation Plan of the ESHIA to be referred in conjunction to this section.

**Table 5: Mitigation Plan**

Risks/Impacts Elements	Environment Impacts	Mitigation Measures	Implementation	Supervision
Temporary Jetty	<p>Spillage due to transportation of heavy equipments in Jamuna River</p> <p>Impact on Dolphin movement</p>	<ul style="list-style-type: none"> <li>• The Contractor will prepare unloading and loading protocols for the temporary jetty and train staff to prevent spills and leaks;</li> <li>• Loaders will be checked for lubricant leaks prior to their usage;</li> <li>• Preparation of guidelines and procedures for immediate clean-up actions following any spillages of oils, fuels or chemicals;</li> <li>• Any leakage of fuels and other contaminants from barges to Jamuna River to be avoided through proper maintenance;</li> <li>• During transportation of equipment's the vessel speed should be regulated and observer for the Dolphin movement should be appointed to guide the vessel to the temporary jetty area;</li> <li>• Barges with valid requisite licenses and emergency handling capacity or tie-ups shall only be engaged for transportation of heavy equipments through Jamuna River;</li> <li>• Vessel patrols and deck monitoring during movement of vessels in Jamuna River should organize or enforced/ supervised by the site security for detecting movement of South Asian River Dolphin.</li> <li>• If such movement is observed, the vessel should be stopped until the species moves out of the path of the vessel.</li> </ul>	EPC	NWPGL
Construction of labour accommodation	Availability of space for labour camp construction	<ul style="list-style-type: none"> <li>• It is to ensure that land lease agreement has been executed between NWPGL and BBA for construction of labour camp for Unit-III;</li> <li>• EPC contractor is required to submit a detailed labour camp plan with provision of all the facilities;</li> </ul>	EPC	NWPGL
Influx of migrant labours	<p>strain on local resources and infrastructure</p> <p>Community health and safety</p>	<ul style="list-style-type: none"> <li>• Labour camp to be constructed should have basic amenities such as electricity, drinking water, health &amp; sanitation facility, kitchen and rest room in accordance with local regulations as well as IFC handbook for labour accommodation;</li> </ul>	EPC	NWPGL

Risks/Impacts Elements	Environment Impacts	Mitigation Measures	Implementation	Supervision
		<ul style="list-style-type: none"> <li>• All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated and all the migrant workers will be instructed accordingly;</li> <li>• It should ensure that accommodation which is provided is not overcrowded and does not pose a risk to the health and safety of workers;</li> <li>• The labour camp will be equipped with septic tanks and soak pits and avoid presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes;</li> <li>• Security staff have a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers;</li> <li>• NWPGL should ensure that workers and members of the surrounding communities have specific means to raise concerns about security arrangement and staff;</li> <li>• Where possible, an adequate transport system to surrounding communities will be provided. It is good practice to provide workers with free transportation to and from local communities.</li> </ul>		
Hazardous Waste Management	spillage or leachate generation	<ul style="list-style-type: none"> <li>• Provision of secondary containment systems with materials appropriate for the wastes being contained and adequate to prevent loss to the environment;</li> <li>• The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater);</li> <li>• Provide adequate ventilation where volatile wastes are stored;</li> <li>• Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents;</li> <li>• Limiting access to hazardous waste storage areas to employees who have received proper training;</li> <li>• Clearly identifying (label) and demarcating the area, including</li> </ul>	EPC	NWPGL

Risks/Impacts Elements	Environment Impacts	Mitigation Measures	Implementation	Supervision
		<p>documentation of its location on a facility map or site plan; and</p> <ul style="list-style-type: none"> <li>• Conducting periodic inspections of waste storage areas and documenting the findings.</li> </ul>		

## 2.7. Addendum to Chapter-10, Hazard and Risk Assessment, ESHIA Report

### 2.7.1. Section 10.3.2 on Onsite Hazards of ESHIA

Section 10.3.2 on Onsite Hazards; to be referred in conjunction to this section. EPC contractor will provide the quantity of chemical and the number of its storage installations. Recommended safe handling requirement of hazardous and nonhazardous chemicals will be practiced onsite:

A storage facility with sufficient capacity to store spare parts, consumables like lube oil, boiler and water treatment chemicals, electrical and electronic items for the power plant. Sufficient capacity need to be arranged for the storage of GT air filters which takes large spaces. Special facility is required to be built for lube oil and chemical storage with secondary containment. For electronic items air conditioned facilities need to be developed. Due to space constraint in the power plant it is recommended to make common storage facilities for Sirajganj 225MW CCPP (2nd & 3rd Unit).

Chemical feed room and chemical storage room will provide ventilation systems with natural air intake and mechanical exhaust air with axial flow fan in wall. The fan will be antiseptic. The laboratory installations and equipment shall be installed for routine control of:

- Service water;
- Water-steam-condensate water; and
- Waste water and to be installed in a combined cycle power plant.

#### *Quantity and dosing requirement of chlorine and ERP of chlorine storage*

Chlorination is done for controlling microbiological fouling; filtration is done for prevention of fouling of heat transfer surface and sulfuric acid treatment is done for regulation of pH.

Reasons of fouling: Silt introduced by the makeup water and dirt from air. Reaction of residues from chemical treatment and microbiological debris. Products produced by corrosion such as hydroxides and insoluble salts. If fouling is not controlled, it will result in heavy deposits inside cooling water tubes, resulting in reduced tube diameter. Fouling is controlled by side stream pressure filter/ Chlorination/ chemical dosing.

Biocides: Bacteria, algae & fungi present in cooling water circuit decreases the efficiency of heat transfer in cooling tower and condensers. Chlorine is the most widely used chemical in industry as oxidizing agent for destruction and dissolution of micro-organisms. In cooling tower system, these foulants are more notorious, as temperature and pH of cooling water with warm sunlight and Oxygen and Organic and inorganic salts present as nutrients create very much favourable environment for growth and cultivation of biomass.

Chlorine is the most familiar and effective industrial biocide in the form of Hypochlorous acid. This diffuses easily through the cell walls of micro-organism reaching the cytoplasm to produce a chemically stable nitrogen-chlorine bond with the cell proteins. Chlorine also oxidizes the active sites on certain co-enzyme sulfhydryl groups that are intermediate steps in the production of Adenosine triphosphate (ATP) which is essential to microbial respiration. Algae are generally easier to kill than killing bacteria. The dosing of chlorine is done in an intermittent manner so as to maintain 0.2 to 0.5 ppm of residual chlorine in the cooling water after one hour of chlorination. In certain cases, low dose continuous chlorination or exomotive chlorination is also practiced.

The optimum pH values of cooling water in which chlorine dosing is best effective, is 6.0 to 7.0 (Table below). While using chlorine, the chlorine demand has to be met. The presence of reducing agents and nitrogenous matter including ammonia, demands for stronger doses of chlorine. Certain micro-



organisms sometime become immune to the regular dose of chlorine (Table below describes the general guidelines of chlorine dose). Hence, under such circumstances „Stock Chlorination“ employing heavy doses of chlorine for few hours are undertaken to kill the micro-organisms.

**Table 6: pH values of cooling water in which chlorine dosing is best effective**

Cooling Water pH	% of HOCl for effective oxidation	Recommended Dose
6	97	Free residual chlorine of minimum 0.5 ppm is recommended after meeting chlorine demand in C.W. sample analysis.
7	76	
8	24	
9	3	
At pH 7 in C.W. System every 1 ppm Cl <sub>2</sub> dosed only 0.76 ppm is used as oxidizing agent for control of microorganism.		

**Table 7: General Guidelines of Chlorine Dose**

Component	Dosing Requirement
CW system	Estimated Chlorine dosage - ppm
Once thro' inland Lake / River Water / Sea water	Continuous dosing 1 to 2 ppm + shock dosing 3-5 ppm for 15 min. for every 8 hr. Cycle.
Recirculation CW system (inland / Sea water)	Continuous 1-2 ppm Shock 3 to 5 ppm
Make up water for CW circulation water	Continuous 1-2 ppm

Source: [http://www.iecfabchem.com/cooling\\_water\\_treatment.htm](http://www.iecfabchem.com/cooling_water_treatment.htm)

<https://law.resource.org/pub/in/bis/S02/is.8188.1999.html>

## 2.8. Addendum to Chapter-11, Environmental Monitoring Plan, ESHIA Report

Chapter 11 of the ESHIA report shall be referred in conjunction with this section. The environmental compliance monitoring plan has been prepared for pre-construction, construction and operation phases and given in Chapter 11. The monitoring locations have been selected based on the sensitive receptors (Eco-Park, Rehabilitation Village, River, Villages around the Power Plant, etc.) and based on the predominant wind direction. The locations of the monitoring of different environmental and social parameters are shown in the following Map 11-1 (Ref. Page 291 of ESHIA). The monitoring matrix is given in Table 11-1 (Ref. Page 295) for pre-construction and construction phases and Table 11-2 (Ref. Page 297) for operation phase has considered components of EHS monitoring, monitoring indicators, locations, frequency, type/duration of sampling and finally implemented by the Client. NWPGL will also implement monitoring and reporting plan as indicated in the ESMS.

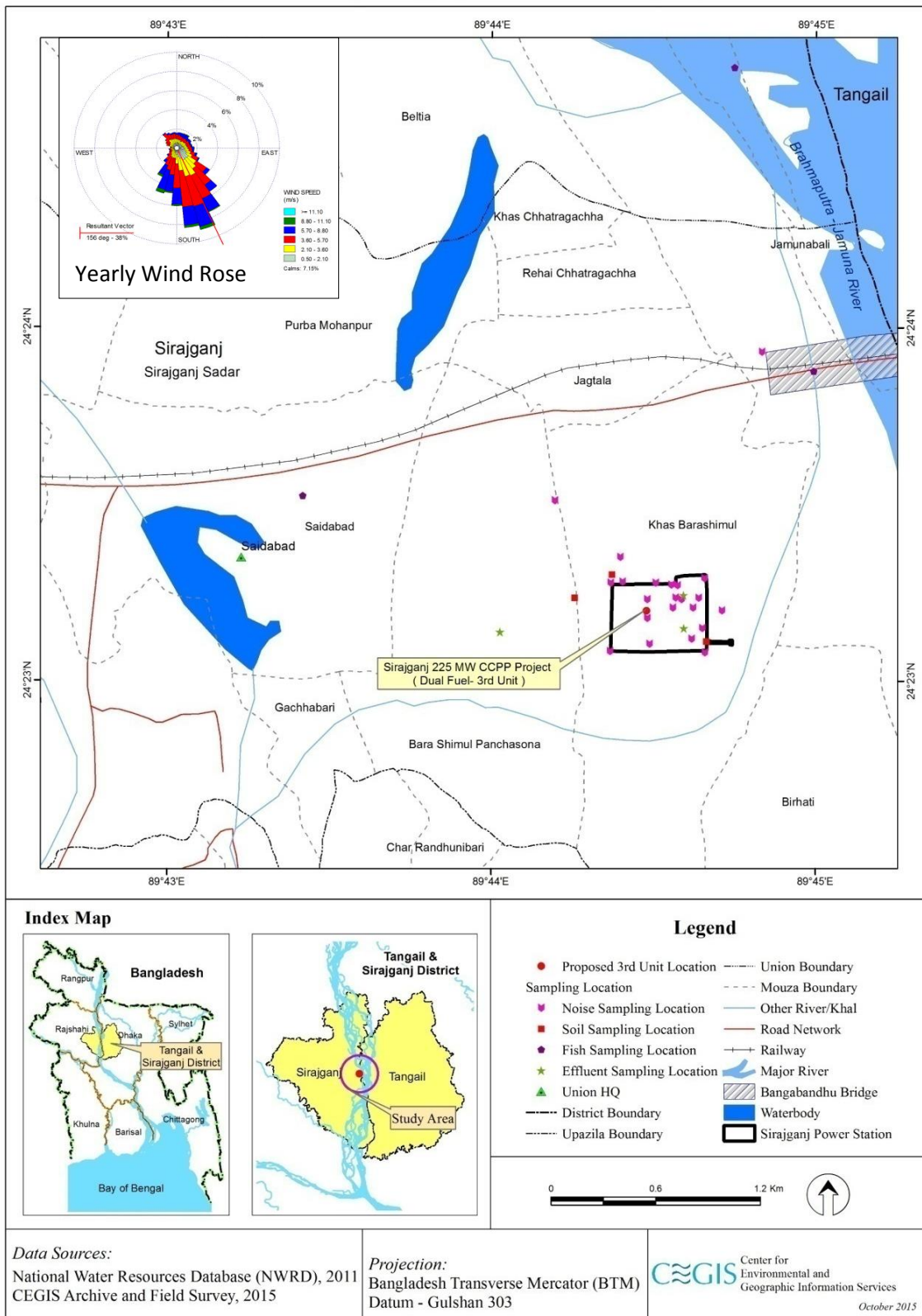


Figure 4: Monitoring locations of various environmental aspects

## **2.9. Addendum to Chapter-13, Stakeholder Consultation, ESHIA Report**

### **2.9.1. Section 13 on Stakeholder Consultation and Engagement of ESHIA**

Section 13 on Stakeholder Consultation and Engagement; to be referred in conjunction to this section. The stakeholder consultations have been carried out using multiple tools and techniques where applicable including Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), Focus Group Discussion (FGD), Key Informant's Interview (KII), Public Consultation Meeting (PCM) mentioned in the Chapter 13: Stakeholder Consultation.

The stakeholder engagement in realizing the public consultations has been done in different means like selection of venue, contacting the Project Implementation Unit (PIU), Local Government Institutes (LGIs), distribution of letters containing the invitation to the PCM at the selected venue, flier describing the project description and possible impacts and mitigation measures, etc. A set questionnaire is prepared for the participants for getting their feedback regarding the construction of the Sirajganj 3rd unit power plant. In addition to these, open discussion was held where all participants had equal access to raise their voices. The Manager EHS at the corporate level will develop a formal Stakeholder Engagement Plan in line with ESMS and observations made in ESHIA before contractor mobilization.

Plan to be developed should comprise the following components:

- Categorization of key stakeholders as per their interest and influence;
- Summary of Proposed plan of activities;
- Methods for Information disclosure;
- Minutes of Meetings held;
- Monthly reporting template

### **2.9.2. Section 13.6 on Grievances Management of the ESHIA**

Section 13.6 on Grievances Management to be referred in conjunction to this section. The ESHIA study suggested Project Implementation Unit (PIU) who will work proactively towards redressal of grievances through implementation of impact mitigation and community liaison activities that anticipate and address potential issues before they become grievances. Minor issues will be solved by the contractor in consultation with the Owners Engineer. A two-tier Grievance Redressal Committee (GRM) is suggested to form, e.g., (i) local grievance redress committee (LGRC); and (ii) project grievance redress committee (PGRC). Detail of GRM is given in Section 13.6: Grievance Redress Mechanism in Page # 326 of ESHIA study.

The proposed composition of LGRC is as follows:

- Deputy Manager/Executive Engineer (Environment)
- Ward Member: Member Secretary
- Environmental Specialist, Owners Engineer: Member
- Community Representatives: Members
- Representative of Women Affected Persons (APs): Member
- Contractors Representative: Member

The proposed composition of the PGRC is as follows:

- Project Director: Chair Person
- Member Secretary (Environmental Specialist of Owners Engineer will assist the Member Secretary in grievance redress mechanism)

- Representative of Civil Society: Member (nominated by Project Director with the help of Owners Engineer)

The GRM-ESMS has also considered a two-tier approach for the redressal of grievances. The compositions of those tiers as follows:

**Level-I (Corporate Level):**

- Managing Director
- Manager (EHSS)
- HR Manager
- DM/AM (HSS) & DM/AM (Environment)

**Level-II (Site Level):**

- Chief Engineer (operation)
- DM/AM (EHSS)
- JAM (EHSS)

The functions of PGRC of GRM-ESHIA are to take care the grievances of the project related personnel whereas Level-I (Corporate Level) in ESMS is considered for similar nature of functions. The position of Project Director in PGRC-ESHIA is equivalent to the position of Managing Director in Level-I in ESMS. The Member Secretary of PGRC is responsible for taking care of grievances redressal in connection with the environmental health and safety issues with the assistance of the Environmental Specialist of Owners Engineer. On the contrary, for taking care of the grievances redressal for the mentioned issues, the ESMS proposed a position of Manager (EHSS) in Level-I. The GRM-ESHIA has considered the position of Representative of Civil Society: Member (nominated by Project Director with the help of Owners Engineer) for handling the grievance redressal issues those cannot be resolved by the LGRC for the local community. In Level-I-ESMS, the Human Resources (HR) Manager is considered for managing the personnel involved in the GRM and DM/AM for health safety and security and the same position for environment is considered for handling the grievance issues regarding environment health and safety in the corporate level.

The position of the Deputy Manager/Executive Engineer (Environment) in the LGRC-ESHIA is equivalent to the position of the Chief Engineer (operation), both of which are responsible for making prompt decision for resolving the grievance issues.

In Level-I-ESMS, the DM/AM and JAM for health safety and security and the same position for environment is considered for taking care the grievance issues regarding environment health and safety in the site level.

In LGRC-ESHIA, Ward Member: Member Secretary, Environmental Specialist, Owners Engineer: Member, Community Representatives: Members, Representative of Women Affected Persons (APs): Member, Contractors Representative: Member, these all positions were considered from locally available human resources for taking care the local grievance issues for both men and women so as to make the grievance redress committee more transparent, available and manageable by the stakeholders group. The steps for obtaining and managing the grievances as detailed in the ESMS shall be used by the project.

The same grievance mechanism should be extended to the contractors as well to register and document complaints received from workers onsite. The grievance mechanism will be formalized and community will be informed about it through community meetings and consultation process.