Bharat Heavy Electricals Limited

Monthly Monitoring Report - 2

(May, 2018)

Environmental Compliance Monitoring During Construction Period of 2x660 MW Maitree Super Thermal Power Project Rampal, Bagerhat

Submitted in June, 2018

CEGIS

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CEGIS greatly acknowledges the extensive support of Mr. Surojit Mandal, General and Construction Manager, BHEL (Power Sector – Eastern Region: Maitree 2x660 MW STPP) to entrust CEGIS as an independent agency for monthly environmental compliance monitoring. CEGIS is thankful to Mr. Sartaj Husain, Dy. Engineer, BHEL, (BIFPCL 2 x 660 MW MSTPP) for his cooperative and collaborative insistence for accelerating this Project. Additionally, CEGIS is also grateful to Mr. Ratnadeep Kumar, Asst. Engineer (Safety), BHEL (BIFPCL 2x660 MW MSTPP) for mobilizing the field activities.

Abbreviation and Acronyms

BHEL	Bharat Heavy Electricals Limited
BIFPCL	Bangladesh-India Friendship Power Company Limited
BOD	Biochemical Oxygen Demand
BPDB	Bangladesh Power Development Board
CEGIS	Center for Environmental and Geographic Information Services
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DoE	Department of Environment
EC	Electric Conductivity
EIA	Environmental Impact Assessment
EHS	Environmental Health Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
HSE	Health Safety and Environment
MW	Mega Watt
NO_x	Oxides of Nitrogen
NTPC	National Thermal Power Corporation
PM	Particulate Matter
PP	Power Plant
PPE	Personal Protective Equipment
SO_2	Sulfur Dioxide
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solid
ToR	Terms of Reference
USEPA	United States Environmental Protection Agency

Glossary

Term	Definition
Compliance	When construction activities are being conducted in accordance with the Environmental Requirements of the Project.
Environmental Requirements	Environmental Specifications set out in the Environmental Management Plan (EMP) and relevant Environmental Protection Plan (EPP). Conditions included in the Environmental Assessment Approval for the Project
Non-conformance	A construction activity conducted in a manner that deviates from a best management practice, compliance with which is required in the EPP for that construction activity.
Non-compliance	A construction activity conducted in a manner that deviates from a legal condition under a permit, an enactment, or a regulation, compliance with which is required in the EPP for that construction activity.
Reportable Environmental Incident	An incident of non-conformance or non-compliance which has caused or has the potential for causing an impact on the quality of air, land or water, wildlife, aquatic species, species at risk or heritage resources, and is reportable under a permit, an enactment, or a regulation.

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Chapter 1 : Introduction

1.1 Background

The Maitree Super Thermal Power Plant is a joint venture Project of Bangladesh Power Development Board (BPDB), and National Thermal Power Corporation (NTPC) Ltd., India and is run by Bangladesh-India Friendship Power Company Pvt. Ltd. (BIFPCL). Bharat Heavy Electricals Limited (BHEL) has been awarded the contract of all Engineering, Procurement and Construction works of the Power Plant within the specified schedule. BHEL has already initiated the construction works. In order to fulfil the environmental due diligence, BHEL has decided to engage third party for monthly monitoring of the environmental compliance within the Project area as per the requirement of Department of Environment (DoE) EIA approval Condition No-44 which is : "*Environmental Monitoring Reports according to specific format specified in the EIA Report shall be made available simultaneously to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters on a monthly basis during the construction period of the Project."* In this regard, monitoring of environmental parameters as well as the status of Environmental Health and Safety (EHS) should be conducted in accordance with the EMP as stated in EIA Study Report.

Accordingly, CEGIS has been appointed by BHEL for conducting the monthly monitoring of the environmental compliance of BIFPCL Project. This monitoring activities need to be continued for the entire construction period and the reports need to be submitted to DoE. According to the contract CEGIS has already conducted monthly monitoring activities during April, 2018 and submitted the 1st monitoring Report to BHEL for their consideration. As a continuous process CEGIS conducted the 2nd monthly monitoring activities during May, 2018 and this 2nd monitoring Report has been prepared for submission to BHEL for their consideration. The aforementioned format of the report specified in the EIA study along with the monitoring results has been appended in the ***Annex-I***.

1.2 Brief of the Project

The construction of BIFPCL 2x660 MW Maitree STPP has been progressing well as the project is now in the infrastructure development stage. The Project area includes 905 acres of land (Block-A) which is just beside the BPDB Project area (Block-B). The MSTPP Project area is connected with a 6 km length two lane access road from the Khulna-Mongla Highway to the MSTPP area. Expansion works are going on to convert this access road into a six lane road. A number of construction companies are now working at the BIFPCL Project site to complete the civil works within the stipulated time schedule. The Project activities conducted at various stages, include:

- Extension work for increasing the width of the access road within the Project area;
- Passage of road for traffic movement for construction purposes;
- Construction of road and drains in the Plant area.
- Pile driving, base and sub-base construction activities;
- Land filling and construction works in the Jetty area:
- Labour shed construction;
- Service works;
- Power supply from the national grid and also from generator at working site;
- Concrete batching Plant and concrete pouring operations.

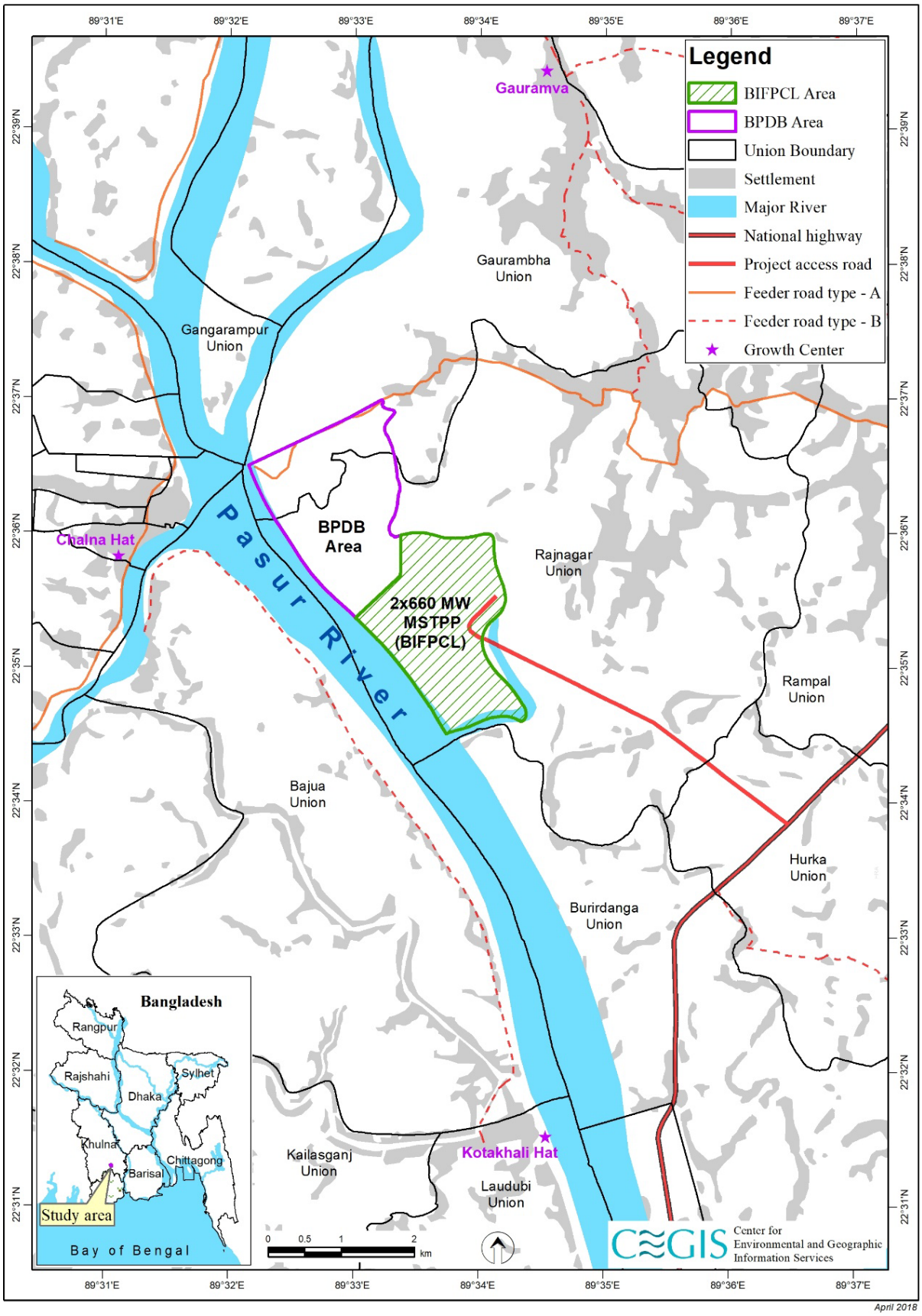
- Development of various infrastructure works like store, material shed, office complex, residential complex etc.

1.3 Selection of Sample collection site and discussion with the Proponent

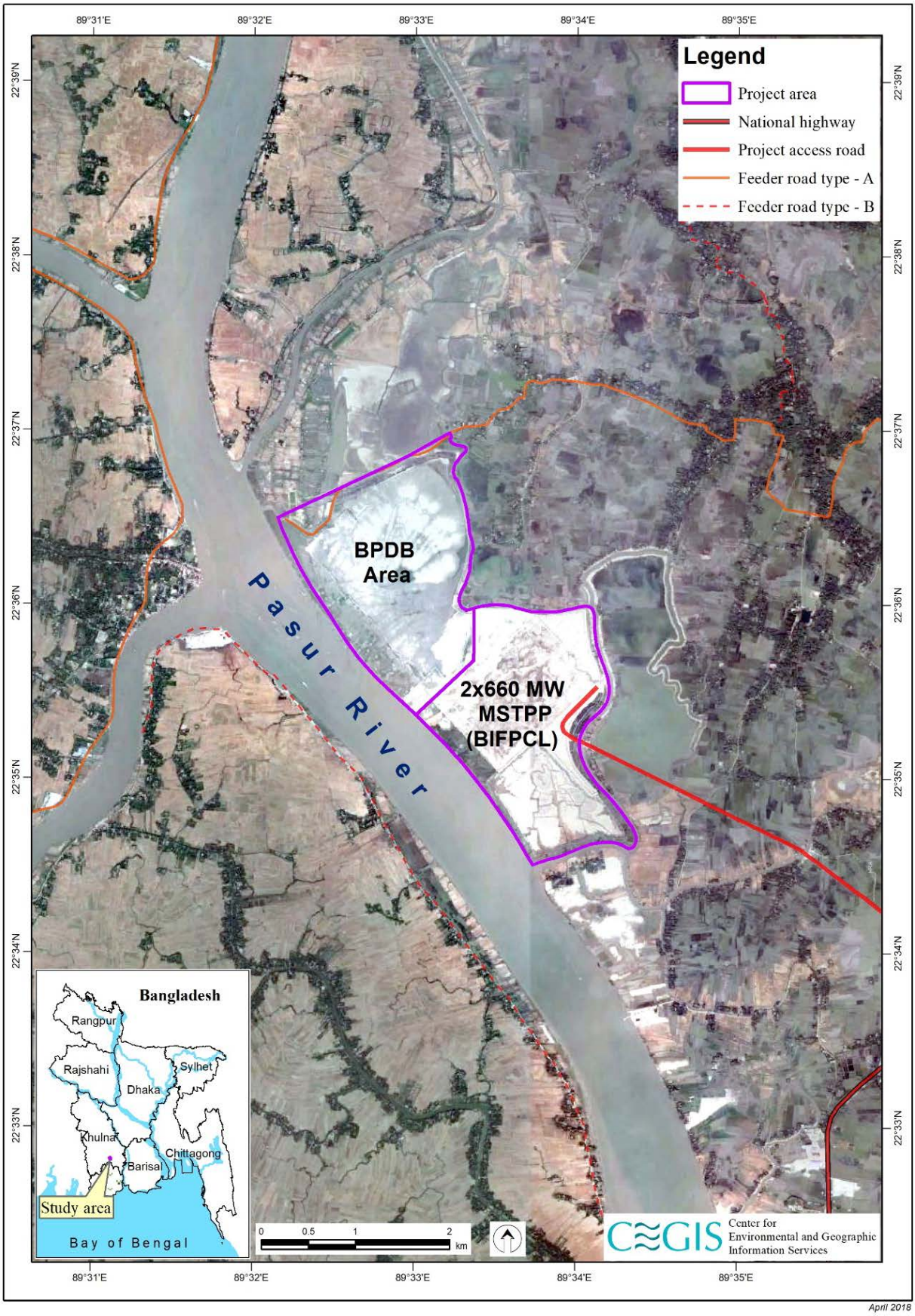
During the 2nd monthly monitoring, on 7th May, 2018 morning the Executive Director , CEGIS along with the Team members met with Mr. Surojit Mandal, General Manager and Construction Manager, BHEL and Mr. Nabendu Lodh, Dy. General Manger, BIFPCL and discussed with them regarding the related activities for conduction of the Monthly Environmental Compliance Monitoring at 2X660MW MSTP Project during 1st visit in April and the 2nd visit in May, 2018. The Proponent gave necessary guidance and appointed one professionals to accompany with the CEGIS monitoring Team for facilitating the field monitoring activities during the 2nd monitoring. It was observed that the location of sampling point has been selected in such a way that it reflects the worst case of ambient air quality, water quality and noise level status in and around the Project area. During this 2nd field trip the monitoring Team has successfully conducted the field activities which was observed by ED, CEGIS and DGM. BIFPCL. The monitoring results generated after lab analysis has been presented in this second monthly monitoring Report.

1.4 Location of the Project

The MST Power Plant is located in between latitude 22^0 37' 0''N to $22^0$34'30''N and longitude $89^0$32'0''E to $89^0$34'5''E and at about 23 km south of the Khulna City and 14 km north-westward from the Sundarbans. Location of the MSTP Project area is presented in **Map1.1a and 1.1b**



Map 1.1a: Locaiton of 2x660 MW Maitree Super Thermal Power Plant



Map 1.1b: Location of 2x660 MW Maitree Super Thermal Power Plant

1.5 Study Objectives

The overall objective of this study is to monitor the environmental compliance of certain parameters during the construction phase of this Power Plant Project.

- Monitoring of the certain environmental parameters of air quality, water quality and noise level at the sensitive receptor (point) in the Project site;
- Comparing the monitoring results with national (ECR, 1997) and international standard (IFC, 2007) and;
- Identifying the causes behind non-compliance and suggesting mitigation measures accordingly.

1.6 Scope of the Services

The scope of the study are as follows which are specified in **Table 1.1**

- Conducting monthly air quality monitoring continuously (24 hrs.) at the sensitive receptors within the project boundary. Air quality monitoring stations are to be set at least one in every location near the labour shed, one in major construction works area, and one at the Jetty area. Air quality monitoring parameters to be monitored include SO_2, NOx, CO, $PM_{2.5}$, PM_{10}, SPM and O_3.
- Conducting monthly water quality monitoring in the project area, especially at the discharge points. At least three samples are to be collected from the Project area which include discharge outlet point and drinking water, etc. The monitoring parameters are pH, DO, Temperature, BOD_5, COD, Hardness, Electric Conductivity (EC), TDS, NO_3, PO_4, SO_4, Cl^- after grab sampling.
- Conducting monthly monitoring of noise level as Leq (dBA) values both for day and night time. Noise level will be monitored at ten locations through USEPA approved standard procedure. Monitoring locations will be determined on the basis of site specific work and location sensitivity.

Table 1.1: Environmental parameters measurement during monthly monitoring visit

Parameters		Number of Location	Frequency of Sampling	Quantity of Samples	Guidance and Acceptance of the tests.
Air Quality	SO_x, NO_x, SPM, PM_{10} and $PM_{2.5}$,CO,O_3	• North west corner of the Power Plant./ Jetty Location • Labor Shed area. • Major Construction area	1	3	As per the guidelines provided in approved EIA reports for 2X660 MW, Coal based Thermal Power Construction. Project at Rampal Upazila, under Bagerhat district of Bangladesh. And in line with the relevant
Water Quality	BOD_5	• Outlet point-1 • Outlet point-2 • Outlet point-3	1	3	
	COD		1	3	
	Total Hardness		1	3	
	Chlorine		1	3	
	pH		1	3	
	DO		1	3	
	Temperature		1	3	

Parameters		Number of Location	Frequency of Sampling	Quantity of Samples	Guidance and Acceptance of the tests.
	EC		1	3	Environmental Acts and Rules of Govt. of Bangladesh.
	Nitrate		1	3	
	Sulphate		1	3	
	Phosphate		1	3	
	TDS		1	3	
Noise Level	Noise level	10 sites (considering the major sensitive area/construction activities)	1	10	

1.7 Purpose of the study

Environmental Compliance Monitoring is immensely necessary for a Project to assess the environmental status, non-compliance and non-conformance issues as per national environmental standards and good international practices. Additionally, with the aim of complying the EIA approval condition (Condition no.: 44) of Department of Environment, Bharat Heavy Electricals Limited (BHEL) has engaged Center for Environmental and Geographic Information Services (CEGIS) for carrying out the Monthly Environmental Compliance Monitoring study of the Maitree Super Thermal Power Plant. The Environmental Monitoring report will present the results of physical environment, particularly ambient air quality, ambient noise level and water quality, during the construction phase of the proposed Power Project. This monitoring activities will be conducted monthly, which has already started from the month of April, 2018 and continued during this second month i.e.,in May, 2018. Moreover, quarterly monitoring of environmental parameters is already being conducted by BIFPCL since February, 2014. The results of the monitoring will be presented monthly to BHEL reflecting the compliance status of the environmental parameters along with the follow-up action.

Chapter 2 : Approach and Methodology

2.1 Overall Approach

Study approach is prepared based on the scope of services. According to the ToR, this monitoring report is being prepared for the month of May, 2018. The environmental parameters for air quality, water quality and noise level have been selected based on the monitoring framework of the EIA study of 2x660 MW Coal based Thermal Power Plant Project at Rampal, Bagerhat which is also recommended in the scope of the services.

The location of air, water and noise monitoring sites (stations) are selected depending on the recommendation of the EIA study, location sensitivity and impact potentiality of that particular area in a specific time period. The **Figure 2.1** below provides an understanding of the different activity which has been carried out during the monitoring of Environmental Compliance of Maitree Super Thermal Power Plant.

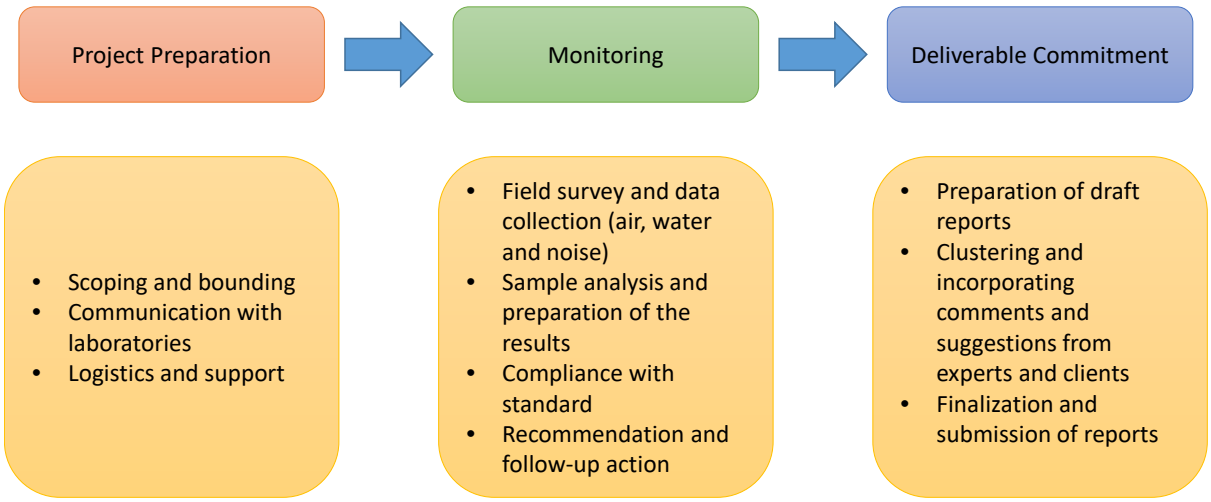


Figure 2.1: Monitoring Framework

Monitoring of environmental parameters like air quality, water quality and noise level are investigated though different monitoring equipment and tools. For air quality monitoring *volumetric sampler* has been used, water quality parameters has been tested *in-situ in the field and grab sample* has been collected for laboratory analysis and finally the *sound pressure level meter* has been used to estimate the present noise level equivalent in the surrounding areas. However, the monitoring activities have been conducted continuously at specified locations with skilled technicians and professionals.

2.2 Team Mobilization

An Environmental Compliance monitoring Team consisting of one Environmental Expert, one Junior Environmental Engineer and two technicians have conducted the monitoring study in the field (**Table 2.1**). The monitoring Team has worked at the BIFPCL 2x660 MW MSTPP site for 4 days i.e., from 6th to 9th May, 2018. The monitoring activities have been performed independently as per standard practices.

Table 2.1: Composition of Environmental Compliance Monitoring Team

Position Assigned	Number	Responsibilities
Environmental Expert	1	Preparation of the Monitoring Plan, maintaining effective communication with BHEL and preparation of the Report.
Junior Environmental Engineer	1	Implementation of the compliance monitoring and preparation of the Report
Technician	2	Operation of the machineries and equipment, sampling etc.,

Samples collected from the field have been submitted to laboratory for analysis and testing. The results were checked precisely. The root cause has been assessed after analysis of the results and field observation. Additionally, a compliance monitoring Report for the month of May, 2018 has been prepared, which is reviewed by the internal and external experts. A number of internal professional manpower inputs have been used within the Consultant's Team for the efficient functioning and completion of the services.

2.3 Methodology of Environmental Compliance Monitoring

The monitoring activities have been performed through a methodological frame work. QA/QC procedure have been maintained during the field investigation and sampling of all the environmental parameters. The locations of air quality, water quality and noise level monitoring are shown in **Map 2.1a and 2.1b**. The locations are subjected to change in future depending on the potentiality of the impacts and its magnitude, sensitivity of the receptors and capturing the worst case scenarios. The procedure associated with the monitoring of each of the environmental parameters are described in the following sub-articles.

2.3.1 *Ambient Air Quality*

The ambient air quality has been monitored in three locations as specified in **Map 2.1a and 2.1b**. Air quality monitoring is performed at locations adjacent to the labor shed, jetty areas and construction site where the ambient air quality might be affected by construction and installation works as well as transportation of materials for working. The air samples were collected at the construction areas to test the environmental parameters to ensure that BHEL complies with the terms of environmental protection.

Emission of particulate matters and gaseous pollutants from construction site are monitored for 24 hours continuously. All of the criteria pollutants (SPM, CO, O_3, $PM_{2.5}$, PM_{10}, SO_x, and NO_x) have been monitored at specified places. *Respirable Dust Sampler* (Model-Envirotech India APM-460BL) and *Fine Particulate Sampler* (Model-Envirotech India APM-550) have been used to collect the air samples. The $PM_{2.5}$, PM_{10}, and SPM have been tested by *gravimetric method*. The SO_2 has been absorbed in a specified chemicals and tested by *West-Gaeke method*. The NO_2 has also been absorbed in a specified chemicals and tested by *Jacob and Hochheiser method*. Finally CO and O_3 has been measured using a Metravi *CO-10 meter and Tongdy O_3 monitor respectively.*

2.3.2 *Water Quality*

At present there is only one active water discharge point at the Project site. So, surface water quality monitoring includes the sample of the discharge water from the site and drinking water used by the labours and BIFPCL and BHELofficials. The location of water quality monitoring have been shown in **Map 2.1a and 2.1b**. Samples of water discharge from the Project site to Passur River has been collected to determine the current status of discharge water quality.

Water quality field investigation has been conducted during first half of May, 2018 which is marked as pre-monsoon dry season. Therefore, no outlet discharge has been observed and recorded from the project boundary except one from Reverse Osmosis Plant rejected water outlet. BHEL use to reserve the storm water inside the project boundary and use this water for dust suppression and curing by spraying. Considering the present scenario, checking the quality of drinking water used by the labors as well as by the Project officials has become very much important. Therefore, during the 2nd monthly monitoring, two samples have been collected from the aforementioned locations to monitor the drinking water quality of the project area. Standard practices have been followed for monitoring water quality. In-situ testing have been done at field and collected samples were brought and submitted to the laboratory for various analyses. The parameters that are being analyzed include pH, DO, Temperature, BOD_5, COD, EC, TDS, NO_3, PO_4, SO_4, and Chloride as recommended in the EIA study done for this Project. Detail methodology for testing the water quality parameters are shown in **Table 2.2**.

Table 2.2: Methods followed in analyzing water samples

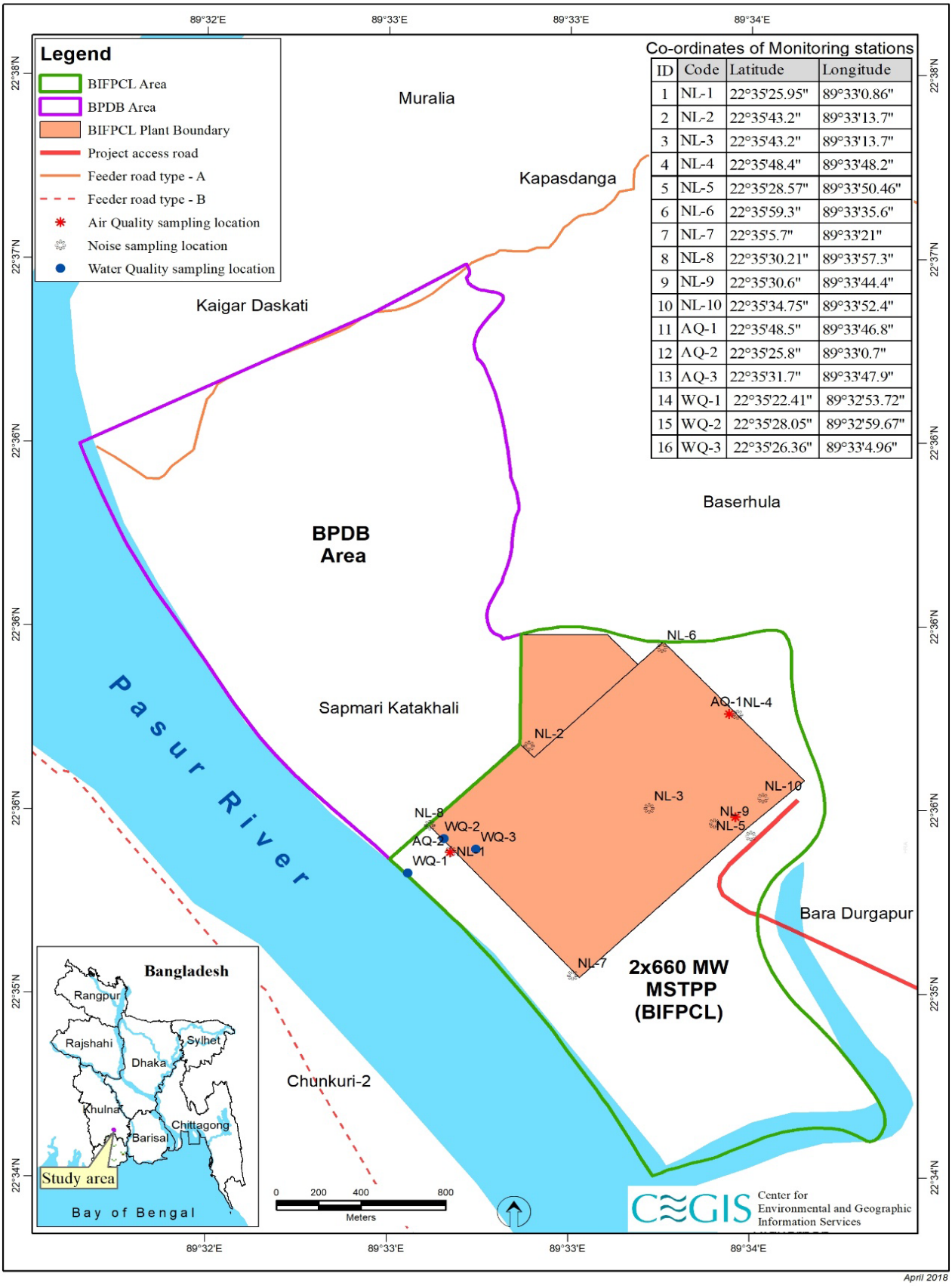
Sl. No	Parameters	Methods	Reference
01	Temp	Electrode	HORIBA, U-50 Multi-parameter Water Quality Meter
02	pH	Electrode	HORIBA, U-50 Multi-parameter Water Quality Meter
03	EC	Electrode	Multi-parameter meter (Instrument Catalog)
04	TDS	Electrode	Multi-parameter meter (Instrument Catalog)
05	Dissolved Oxygen (DO)	DO Meter	Lutron DO 5519 (Instrument Catalog)
06	Biological Oxygen Demand (BOD_5)	DO Meter	Lutron DO 5519 (Instrument Catalog)
07	Chemical Oxygen Demand (COD)	Colorimetric Method (COD Reactor: Et 125 SC and Spectrophotometer: UNICO 4802)	APHA, (1992)
08	Total Hardness (TH)	Titrimetric Method	APHA, (1992)
09	Chloride (Cl^-)	Moh's Titration	APHA, (1992)
10	Sulfate (SO_4^{2-})	Turbiditymetric Method	APHA, (1992)
11	Phosphate (PO_4^{3-})	Ascorbic Acid Method	APHA, (1992)
12	Nitrate (NO_3^-)	Ultraviolet Spectrophotometric Screening Method	APHA, (1992)
13	Salinity	Electrode	HORIBA, U-50 Multi-parameter Water Quality Meter
14	Turbidity	Electrode	HORIBA, U-50 Multi-parameter Water Quality Meter

2.3.3 *Ambient Noise Level*

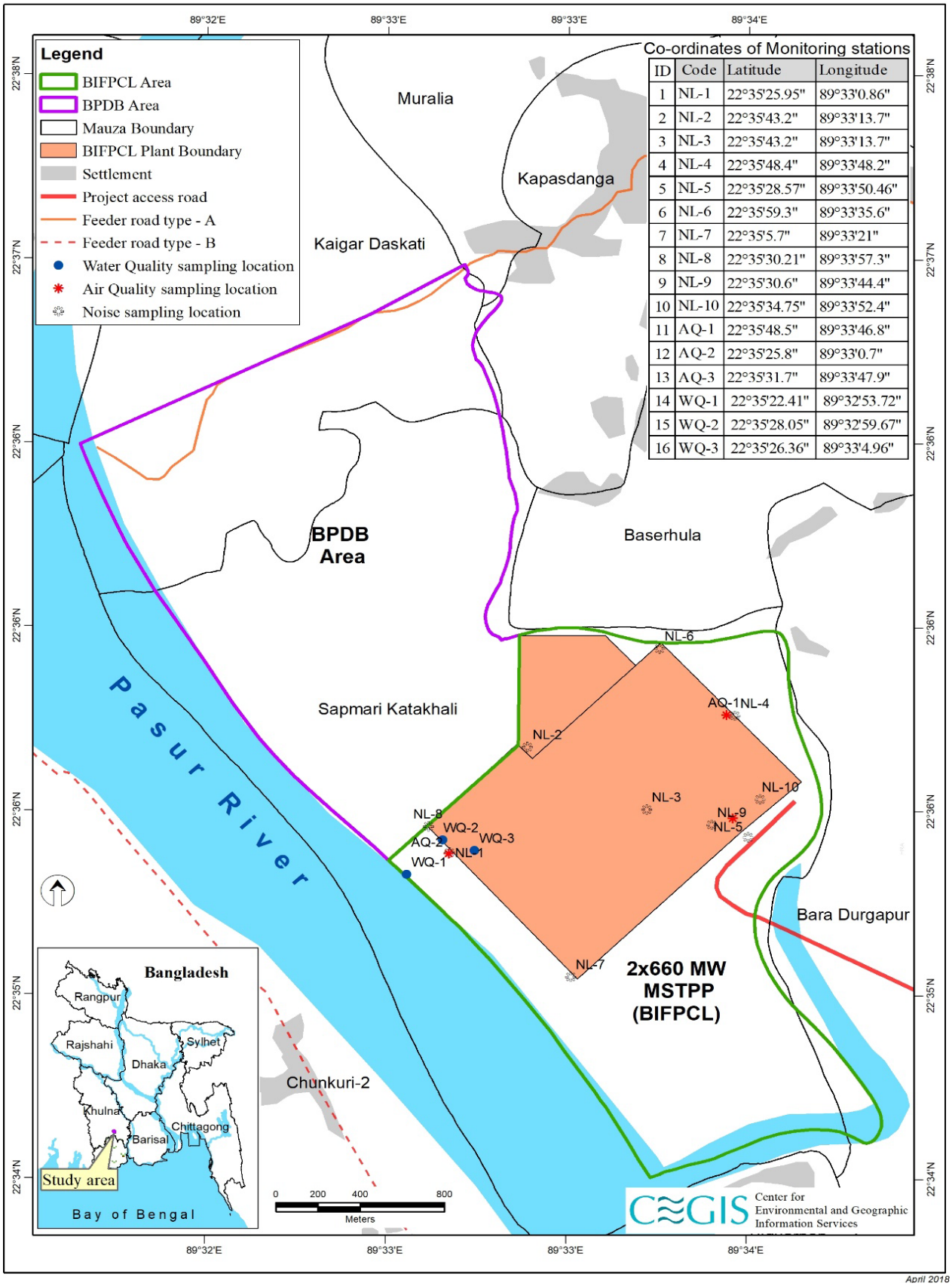
During construction stage major source of noise is expected to stem from construction site, movement of vehicles, electricity producing generator etc. Ambient noise levels have been monitored at ten locations. Noise levels have been measured during day and night time at each

of the 10 locations based on the location sensitivity, importance and impact potentiality. Each time noise level was recorded for fifteen minutes continually by using portable noise level meter. The sites are subject to change in future monitoring schedule based on the changing of working areas, types of work and importance of the location.

Noise is described by a weighted sound intensity (or level) and is measured in units called decibels (dBA). However, in this circumstance the noise level has been measured in terms of A-weighted equivalent continuous sound pressure level (Leq) and recorded by *Sound Level (Sound Pressure Level) Meter (kanomax-4431)*. Depending on the site condition and acoustic environment, the noise meter was set up and calibrated each time following the manufacturer's instruction manual.



Map 2.1a:Sampling locations



Map 2.1b:Sampling locations

Chapter 3 : Monitoring Results and Discussion

Environmental compliance monitoring is being implemented by an independent organization, CEGIS under a contract signed between BHEL and CEGIS. In line with the directives of the ToR of the contract the environmental compliance monitoring is being performed. This Monthly Environmental Monitoring results have been generated through in-situ testing and lab analysis. This report also compares data collected with targets, checked with the standard limits and provides commentary environmental issues during the month of May, 2018. This Report also incorporated results of the previous investigations so as to compare the overall trend of the concerned environmental compliances .

3.1 Ambient Air Quality Monitoring Results and Discussion

Air quality has been sampled through volumetric sampling procedure. Sample has been collected for 24 Hours continually at three places especially at the site of labour shed, Jetty area and major construction areas. All of the criteria pollutants have been checked randomly in the Project site in order to assess the baseline situation as well as for the compliance standard. **Table 3.1** shows the monitoring results of the criteria pollutants.

Table 3.1: Ambient air quality monitoring results

Criteria Pollutants ($\mu g/m^3$)	Monitoring Locations						Standard Limit	
	Labour Shed AQ-1 (24hr)		Jetty Location AQ-2 (24hr)		Major Construction Area AQ-3 (24hr)			
	1st MM (April 2018)	2nd MM (May 2018)	1st MM (April 2018)	2nd MM (May 2018)	1st MM (April 2018)	2nd MM (May 2018)	ECR, 2005	IFC, 2007
SO_2	13.3	11.5	15.3	11.2	10.7	8.9	365 (24hr)	125 (IT-1), 20 (24hr)
NO_x	15.4	15.1	16.7	13.6	12.9	10.2	100 (Annual)	200 (1-Hr)
SPM	174.1	148.9	187.1	112.3	164.6	108.7	200 (8hr)	-
PM_{10}	149.1	115.1	134.3	103.4	91.9	69.2	150 (24hr)	150 (IT-1), 50 (24hr)
$PM_{2.5}$	32.2	24.6	35.7	25.2	23.0	15.0	65 (24hr)	75 (IT-1), 25 (24hr)
CO	35	25	41	32	29	21	10000 (8hr)	-
O_3	4	6	2	10	6	11	157 (8hr)	160 (IT-1), 100 (8-hr)

Source: CEGIS, 2018

Note:MM: Monthly Monitoring; AQ : Air Quality;

Ambient air quality for the pollutant gases has been recorded to be well below the standard limit during this month. In fact, all values recorded were lower than the the previous month. Frequent use of water sprinkler and increasing the grass land in project site is responsible for lowering the concentration of particulate matter in the air. Bassically, SPM and PM_{10} are relatively higher as the project area and adjacent areas are the key sources of pollutatnt at the three locations; however, the values recorded have been lower than the previous month. The potential sources of air pollutants at the time of sampling for 24 hrs is presented below.

- Exposed/uncovered soil of the project site.
- Land development sites of BPDB.
- Construction works like piling, testing, building construction and other civil works etc.
- Vehicular movement over the paved and unpaved roads inside the project area.
- Operation of generators and different types of machineries.
- Stockpile of sand, stone, debris etc.
- Dredged spoil dumping and excavation works.

Since maximum project works are limited to day time, the pollutants increases during day time and reduces during night. Therefore, the collective pollution concentration for each of the criteria pollutants represent the average values for 24 hrs. Moreover, frequent rainfall is also responsible for washout of air pollutants of the Project air shed. However, the ambient air pollutants were found within the standard limit as set by the DoE. The Project authority should take further necessary action to reduce the PM_{10} and SPM especially at labour shed and Jetty construction areas.

Photo 3.1: Setting up air quality monitoring station inside the MSTPP

3.2 Water Quality Monitoring Results and Discussion

AS per EMP and EIA approval condition, the Project Authority will not use ground water during construction as well as operation purposes of the Power Plant. Therefore, BHEL has planned to use desalinised Passur river water during construction as well as operation stages. Accordingly, a large scale desalinization Plant based on Reverse Osmosis (RO) technology has been established in the Project area and is underoperation for supplying the construction water at site. This desalinization RO Plant is also used for supplying drinking water for the labours as well as officials working at site. Therefore, a small quantity of rejected water from RO desalinization Plant, which is highly concentrated brine, has been disposed off to the Passur River. At present, discharge from the worker's shed are being dried up before discharging it into the adjacent river. Moreover, storm water are kept into the temporary trench for re-using the same water for sprinkling or curing purpose. During this 2nd monitoring program three samples were collected, one from RO discharge outlet and two from drinking water outlets for analysis. The analysis results has been presented in **Table 3.2**, **Table 3.3** and **Table 3.4**.

Table 3.2: Discharge water quality monitoring result (Discharge Point)

Parameters	1st MM Result (April 2018)	2nd MM Result (May 2018)	ECR , 1997 for Inland SW	IFC 2007, Effluent Guidelines	Remarks
Temp (^{0}C)	30.8	32.1	40 (Summer)	3 at the age of the mixing zone	
pH	7.7	7.9	6-9	6-9	
EC (µS/cm)	28,000.00	48,800.00	1200	-	EC value of intake water from Passur river, is already higher than Standard value especially the summer period
TDS (mg/L)	14,000.00	24,600.00	2100	-	TDS value of intake water from Passur, a highly tidal influenced river, is already higher than Standard value
DO(mg/L)	4.50	4.90	4.8-8	-	
BOD_5 (mg/L)	2.30	2.41	50	30*	
COD (mg/L)	417.25	520.00	200	125*	
TH (mg/L)	4,900.00	5,220.00	-	-	
Cl^- (mg/L)	514.00	14,500.00	600	-	
SO_4^{2-} (mg/L)	1209.00	1520.00	-	-	
PO_4^{3-} (mg/L)	0.299	0.450	-	2*	
NO_3^- (mg/L)	5.07	5.40	10	10*	
Salinity (ppt)	15.80	25.80	-	-	
Turbidity (NTU)	13.00	10.60	-	-	

Source: CEGIS 2018

Note: WQ – Water Quality; SW – Surface Water; MM: Monthly monitoring

*Sanitary Sewage Discharges of IFC, 2007

- It is observed that discharge from RO Plant contains high percentage of TDS and EC which is much higher than the previous month. RO plant has been running for purification of Passur river water. Experience from other studies, it has been observed that the salinity or TDS or EC level of Passur river water reaches to the peak during dry days of May. Intake of tide water by the RO Plant intake pipe would definitely increase the TDS, EC or Salinity level of RO discharge water after purifying the river water. Moreover, COD value 520 mg/L of the brine was observed to be higher than the national standard and was also higher than the previous month (417.25 mg/L) as the inorganic ions increase in the discharge water. It is reported that the quantity of discharge from RO Plant is very much insignificant with respect to the flow quantity of Passur, which is a tidal river. It is expected that this insignificant discharged water will have little effect on the existing quality of Passur flow. It is suggested that the proponent

should ensure management and reuse of the RO rejected water i.e. brine water after necessary treatment.

Table 3.3: Drinking water quality monitoring result (Near Jetty area)

Parameters	1st MM Result (April 2018)	2nd MM Result (May 2018)	ECR , 1997 standard for Drinking Water
Temp (^{0}C)	31.8	31.70	20-30
pH	8.7	8.97	6.5-8.5
EC (µS/cm)	70.50	176.00	-
TDS (mg.L-1)	34.80	87.00	1000
DO (ml.L^{-1})	4.10	5.14	6
BOD_5 (ml.L^{-l})	2.10	2.08	2.0
COD (ml.L^{-1})	bdl	4.00	4
TH (mg.L^{-1})	bdl	105.00	4
Cl^- (mg.L^{-1})	102.80	36.00	150-600
SO_4^{2-} (mg.L^{-1})	11.65	4.00	400
PO_4^{3-} (mg.L^{-1})	0.0795	0.18	6
NO_3^- (mg.L^{-1})	1.83	0.10	10
Salinity (ppt.)	1	0.20	-
Turbidity (NTU)	5.08	8.81	10

Source: CEGIS, 2018

bdl- beyond detectable limit; ppt: parts per thousand; MM: Monthly monitoring

Table 3.4: Drinking water quality monitoring result (Near BHEL Office)

Parameters	1st MM Result (April 2018)	2nd MM Result (May 2018)	ECR , 1997 for Drinking Water
Temp (^{0}C)	32	31.96	20-30
pH	8.3	9.11	6.5-8.5
EC (µS/cm)	47.40	122.00	-
TDS (mg.L-1)	23.8	60.00	1000
DO (ml.L^{-1})	4.00	5.08	6
BOD_5 (ml.L^{-l})	2.20	2.31	2.0
COD (ml.L^{-1})	bdl	4.00	4
TH (mg.L^{-1})	bdl	110.00	4
Cl^- (mg.L^{-1})	70.90	15.00	150-600

Parameters	1st MM Result (April 2018)	2nd MM Result (May 2018)	ECR , 1997 for Drinking Water
SO_4^{2-} (mg.L^{-1})	8.34	7.00	400
PO_4^{3-} (mg.L^{-1})	0.0476	0.27	6
NO_3^- (mg.L^{-1})	2.99	3.00	10
Salinity (ppt)	0	0.10	-
Turbidity (NTU)	6.18	5.97	10

Source: CEGIS, 2018

bdl- beyond detectable limit; MM: Monthly monitoring

The drinking water quality is good as the parameters results are well within the standard limit except temperature, pH and BOD_5 value as like as in the previous months. It is suggested that the proponent should construct a shed over the drinking water storage tank in order to reduce the water temperature. They should also take necessary steps to reduce the pH and BOD_5 level during water treatment at the RO Plant.

3.3 Ambient Noise Level Monitoring Results and Discussion

Ambient noise level has been monitored at 10 locations around the Project area which is shown in **Map 2.1a and 2.1b**. The locations were selected based on the sensitivity of the areas and potentiality of the impact magnitude. Noise level monitoring results of the ambient noise levels are shown in **Table 3.5**. Results were recorded from 10 locations during both the day and night time as the equivalent noise level (Leq) in dBA scale.

Table 3.5: Ambient noise level from in and around the Project site

Location Name	Types of Area	Time	Noise Level dB(A) Leq (1st MM)	Noise Level dB(A) Leq (2nd MM)	ECR 2006 dB(A) Leq	IFC 2007 dB(A) Leq	Remark
Jetty Site NL-1	Industrial	D	59.3	59.0	75	70	Movement of Vehicles, Engine running, Construction works Noise from water treatment Plant etc.,
		N	55.0	66.9	70	70	Noise from water treatment Plant, . Generators running etc.
Township Construction Area NL -2	Industrial	D	59.5	55.5	75	70	Pump Station running, Vehicle movement, Hammering on piles, Generator running etc.
		N	55.3	63.3	70	70	Vehicle movement, Construction works, Excavator working etc.
Construction Area NL-3	Industrial	D	58.7	68.8	75	70	Vehicle movement, Construction work
		N	63.2	70.3	70	70	Crane working. Generator running
Labor Shed (Area) NL-4	Residential	D	58.2	65.6	55	55	Vehicle movement, Construction works of labor shed, Batching works,

Location Name	Types of Area	Time	Noise Level dB(A) Leq (1st MM)	Noise Level dB(A) Leq (2nd MM)	ECR 2006 dB(A) Leq	IFC 2007 dB(A) Leq	Remark
							Pile driving etc.
		N	44.4	59.9	45	45	Generator noise, Wind blowing, Construction noise etc.
Near Entrance Gate in front of Health Care Center NL-5	Commercial Area	D	59.6	60.6	70	70	Batching plant , Vehicle movement, Wind blowing , Running of construction machine.
		N	49.2	52.8	60	70	Vehicle movement, Wind blowing, Running of construction machine
North-East corner of the PB NL-6	Industrial	D	53.8	51.6	75	70	Construction works noise, Natural sound in corporation, Machinery noise from batching plant etc.
		N	45.9	49.7	70	70	Construction works noise, Natural sound in corporation, Machinery noise from batching plant etc,
South – West Corner NL-7	Industrial	D	60.6	55.8	75	70	Dredging Machine operation noise, Excavator's noise Wind blowing etc.
		N	53.5	52.4	70	70	Wind blowing, Noise of the vessel movement, Generator noise
North west corner of the Project boundary NL-8	Industrial	D	49.8	54.4	75	70	Wind Blowing
		N	63.4	50.5	70	70	Generator Machineries Vehicular movement
Major construction Area NL-9	Industrial	D	58.5	71.1	75	70	Machine running, Construction works, Plie driving etc.
		N	55.1	73.3	70	70	Construction works, Generator, Vehicular movement Plie driving
Near BIFPCL Area NL-10	Commercial	D	62.8	62.8	70	70	Vehicular movement Nearby construction works, Wind blowing etc.

Location Name	Types of Area	Time	Noise Level dB(A) Leq (1st MM)	Noise Level dB(A) Leq (2nd MM)	ECR 2006 dB(A) Leq	IFC 2007 dB(A) Leq	Remark
		N	49.4	51.1	60	70	Vehicular movement Nearby construction works, Generator noise etc.

Source: CEGIS, 2018

Massive civil construction activities are being carried out by BHEL as per design and stipulated time schedule. The sources of noise has been identified and presented in **Table 3.5**. The construction activities, vehicular movement, running of generator and wind blowing are major sources of noise generation. As seen from the above Table that the overall noise level during the construction period (both day and night time) was higher than the previous month as the construction works are increasing day by day. However, the monitored noise level are still within ECR, 2006 and IFC, 2007 standards. The only exception was in labor shed areas, which was still higher (in both day and night time) due to the ongoing construction work of laborshed. Additionally, absence of boundary wall and gate were also causing the elevated noise level. However, it can be assumed that the noise level will be lowered/subsided when construction works around the labor camp is completed fully. In the meantime, suggestions were given to implement the use of ear-muffs by the labourers during constrution activities.

Photo 3.3: Ambient noise level monitoring during day time

Photo 3.4: Ambient noise level monitoring during night

Chapter 4 : Follow-up Action Required

The monitoring activities have been performed independently in order to capture the worst case scenarios of the vital environmental parameters. The result of the environmental parameters shows that although the overall values have increased, they are still within the compliance standard limit as per ECR 2006 and IFC 2007. In order to reduce the pollution level in the coming months BHEL should adopt following measures immediately.

- Continue water spraying at roads and exposed soil especially the dry days of upcoming monsoon;
- Ensuring the use of dust mask by the labours during work;
- Ensuring the use ear plugs/ ear muffs by the labours for long time exposure at the construction sites;
- Ensuring the management and reuse of the RO rejected water e.g. brine water after necessary treatment; and
- Ensuring the continuation of the best working and safety practises at construction sites.

Annex - I

Compliance monitoring Form for 2x660 MW MSTPP, Rampal, Bagerhat

BIFPCL

Book No. _____ **Monitoring Report No.**_____

Date: _____ **Time:** _____

Location Id/GPS point: _____

Weather Condition: _____

Name of the Investigator: _____ **Signature:** _____

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation ($\mu g/m^{3)}$	Deviation / Change (± %)	Performance/ Comments	Remarks
Checking of the Equipment							
1	Air quality measuring instrument	**I.** Respirable Dust Sampler (Model-Envirotech India APM-460 BL) **II.** Fine Particulate Sampler (Model-Envirotech India APM-550) **III.** Metravi CO-10 meter and	1. CO (8hrs)-(10000µg/m^3-ECR)) **2.** Oxides of Nitrogen (NOx)- 100 µg/m^3 (Annual)- ECR; [200 (1-Hr)- IFC] **3.** Ozone (O_3)- 157 µg/m^3 (8 Hrs)-ECR; 160-(IT-1), 100- (8-hr)-IFC	**AQ-1 (Labor Shed):** a. SO_2 = 11.5 b. NO_x = 15.1 c. SPM= 148.9 d. PM_{10} = 115.1 e. $PM_{2.5}$ = 24.6 f. CO = 25.0 g. O_3 = 6.0	**N/A**	**AQ 1-** Within the standard limit **AQ 2-** Within the standard limit	

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation ($\mu g/m^3$)	Deviation / Change (± %)	Performance/ Comments	Remarks
		Tongdy O_3 Monitor	**4.** $PM_{2.5}$-65 $\mu g/m^3$-ECR; 75 (IT-1) , 25 (24 hr)-IFC **5.** PM_{10}-150 $\mu g/m^3$-ECR; 150 (IT-1), 50 (24 hr)-IFC **6.** SPM- 200 $\mu g/m^3$ (8 Hrs)-ECR; Oxides of Sulfur (SOx)-365 $\mu g/m^3$	**AQ-2 (Jetty area):** a. SO_2 =11.2 b. NO_x = 13.6 c. SPM= 112.3 d. PM_{10} = 103.4 e. $PM_{2.5}$ = 25.2 f. CO = 32.0 g. O_3 = 10.0 **AQ-3 (Major Construction area):** a. SO_2 = 8.9 b. NO_x = 10.2 c. SPM= 108.7 d. PM_{10} = 69.2 e. $PM_{2.5}$ = 15.0 f. CO = 21.0 g. O_3 = 11.0		**AQ 3-** Within the standard limit	
2	Water quality measuring instrument	**HORIBA U-50 Multi-metre and Lab Analysis**	**Standard (Effluent Guidelines)** a. Temperature.=3^{0}C at the age of the mixing zone, IFC2007; 40^{0}C (ECR, 1997) b. pH=6-9 (ECR **,** 1997;IFC,2007) c. EC=1200 (µS/cm) (ECR , 1997) d. TDS=2100 mg/L(ECR,1997)	**WQ-1 : Discharge Water** a. Temp = 32.1 (^{0}C), b. pH = 7.9 c. EC = 48800 (µS/cm) d. TDS = 24600 (mg/L) e. DO = 4.90 (mg/L) f. BOD_5 = 2.41 (mg/L) g. COD = 520 (mg/L) (std. 125, IFC-2007) h. TH = 5220 (mg/L) i. Cl^- = 14500 (mg/L) j. SO_4^{2-} = 1520 (mg/L)	N/A	**WQ -1** All of the parameter within the standard limit except EC, COD, Cl^- and TDS	Intake water EC (Electric Conductivity), TDS (Total Dissolve Solid), Cl^- and COD (Chemical Oxygen Demand value is already higher

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation (µg/m$^{3)}$	Deviation / Change (± %)	Performance/ Comments	Remarks
			e. DO=4.8-8 (mg/L) (ECR,1997) f. BOD_5=50 (mg/L) (ECR,1997)/30 (mg/L) (IFC, 2007) g. COD=200 mg/L (ECR, 1997)/125 (mg/L) (IFC, 2007). h. TH=N/A Cl^- =600 mg/L (ECR, 1997) i. SO_4^{2-} =N/A j. PO_4^{3-} = 2 mg/L(IFC, 2007) k. NO_3^- =10 mg/L (ECR, 1997) l. Salinity= N/A m. Turbidity=N/A **Drinking water standard** a. Temp =20-30 (^{0}C) b. pH=6.5-8.5 c. EC=N/A d. TDS =1000 (mg/L) e. DO=6.00 (mg/L) f. BOD_5 =0.20 (mg/L) g. COD =4 (mg/L) h. TH=4 (mg/L) i. Cl^- =150-600 (mg/L) j. SO_4^{2-} =400 (mg/L)	k. PO_4^{3-} = 0.450 (mg/L) l. NO_3^- `= 5.40 (mg/L) m. Salinity = 25.8 (ppt) n. Turbidity = 10.6 (NTU) **WQ-2: Drinking Water** a. Temp = 31.70 (^{0}C) b. pH = 8.97 c. EC = 176 (µS/cm) d. TDS = 87 (mg/L) e. DO = 5.14 (mg/L) f. BOD5 = 2.08 (mg/L) g. COD) = 4.00 (mg/L) h. TH = 105 (mg/L) i. Cl^- = 36 (mg/L) j. $SO4^{2-}$ = 4 (mg/L) k. $PO4^{3-}$= 0.18 (mg/L) l. NO^{3-} = 0.10 (mg/L) m. Salinity = 0.20 (ppt) n. Turbidity = 8.81 (NTU) **WQ-3: Drinking Water** a. Temp = 31.96 (^{0}C) b. pH = 9.11 c. EC = 122 (µS/cm)		**WQ-2** All the analyzed results of the parameter were found within the standard limit Temp. pH and BOD_5. **WQ-3** All the analyzed results of the parameter were found	than the standard limit Necessary action should be taken for reducing the Temp, pH and BOD_5

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation (µg/m$^{3)}$	Deviation / Change (± %)	Performance/ Comments	Remarks
			k. PO_4^{3-} =6 (mg/L) l. NO_3^- =10 (mg/L) m. Salinity =0 (ppt) n. Turbidity=10 (NTU)	d. TDS = 60 (mg/L) e. DO = 5.08 (mg/L) f. BOD_5 = 2.31(mg/L) g. COD = 4 (mg/L) h. TH= 110 (mg/L) i. Cl^- = 15 (mg/L) j. SO_4^{2-} = 7 (mg/L) k. PO_4^{3-} = 0.27 (mg/L) l. NO_3^- = 3 (mg/L) m. Salinity = 0.10 (ppt) n. Turbidity= 5.97 (NTU)		within the standard limit except the values Temp. and BOD_5.	Necessary action should be taken for reducing the Temp and BOD_5
3	Noise quality measuring instrument	Kanomax Sound level meter-MODEL 4431	1. std. ECR 2006, day= 75dB(A),Night=70 dB(A) IFC2007, day=70 dB(A), night=70 dB(A) 2. std. ECR 2006, day= 75 dB(A),Night=70 dB(A) IFC2007, day=70 dB(A), night=70 dB(A) 3. std. ECR 2006, day= 75 dB(A),Night=70 dB(A); IFC2007, day=70 dB(A), night=70 dB(A) 4. std. ECR 2006, day= 55 dB(A),Night=45 dB(A);IFC2007, day=55 dB(A), night=45 dB(A) 5. std. ECR 2006, day= 70 dB(A),Night=60	1. Jetty Site NL-1, Day = 59.0 dB(A), Night = 66.9 dB(A) 2. Township Construction Area NL -2, Day = 55.5 dB(A), Night = 63.3 dB(A) 3. Construction Area NL-3, Day = 68.8 dB(A), Night = 70.3 dB(A) 4. Labor Shed (Area) NL-4, , Day = 65.6 dB(A), Night = 59.9 dB(A) 5. Near Entrance Gate in front of Health Care Center-NL-5, Day = 60.6 dB(A),	**N/A**	All values were within standard limit except in the labour shed area, where it exceeded the standard limit (for both day and night time)	1. Industrial 2. Industrial 3. Industrial 4. Residential 5. Commercial 6. Industrial 7. Industrial 8. Industrial 9. Industrial 10.Commercial

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation (µg/m$^{3)}$	Deviation / Change (± %)	Performance/ Comments	Remarks
			dB(A);IFC2007, day=70 dB(A), night=70 dB(A) 6. std. ECR 2006, day= 75 dB(A),Night=70 dB(A);IFC2007, day=70 dB(A), night=70 dB(A) 7. std. ECR 2006, day= 75 dB(A),Night=70 dB(A); IFC2007, day=70 dB(A), night=70 dB(A) 8.. std. ECR 2006, day= 75 dB(A),Night=70 dB(A); IFC2007, day=70 dB(A), night=70 dB(A) 9. std. ECR 2006, day= 75 dB(A),Night=70 dB(A); IFC2007, day=70 dB(A), night=70 dB(A) 10. std. ECR 2006, day= 70 dB(A),Night=60 dB(A); IFC2007, day=70 dB(A), night=70 dB(A)	Night = 52.8 dB(A) 6. North-East corner of the PB NL-6, Day = 51.6 dB(A), Night = 49.7 dB(A) 7. South –West Corner NL-7, Day = 55.8 dB(A), Night = 52.4 dB(A) 8. North west corner of the Project boundary NL-8, Day = 54.4 dB(A), Night = 50.5.4 dB(A) 9. Major construction Area NL-9, Day = 71.1 dB(A), Night = 73.3 dB(A) 10. Near BIFPCL Area NL-10, Day = 62.8 dB(A), Night = 51.1 dB(A)			
Activities of monitoring							

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation (µg/m$^{3)}$	Deviation / Change (± %)	Performance/ Comments	Remarks
4	Digital process and online system						
5	Documentation/ archiving the monitoring data						
6	Number of accidental events						
7	Sampling of biota to the susceptible zone						
8	LCA of bio indicators						
9	Toxicity magnitude						
10	Behavioral/ attitude in all changes of fauna						
11	Performance of the Ecosystem management plan						
Interrogating to the investigator							
12	Regularity and authenticity check						
13	Continuation of training and capacity building and awareness, motivational						

A	Monitoring	Description of equipment/ Indicators	Standard/ Situation	Observed Situation (µg/m$^{3)}$	Deviation / Change (± %)	Performan ce/ Comments	Remarks
	program						
14	Ensure PEPs, ISO standards and ILL during operation of the projects						
15	Ensure the social development program and CSR during the operation of the project						
Interviews of the stakeholders							
16	Socio-economic progress investigation						
17	Assessing environmental pollution related problems						
18	Assess the changes of bio-diversity and ecosystem fragility						
19	Achievement of the social development program						
20	Checking of the proper implementation of the EMP						

B. EVALUATION (of any of above points)

C. STEPS To Be TAKEN:

Non Compliance	Action	Tine Frame
1. Minor:		
2. Moderate:		
3. Major:		
4. Critical:		