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ENVIRONMENTAL MONITORING
POST MONSOON SEASON -OCT-DEC 2019

*at*KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

Submitted To:

KOLKATA PORT TRUST
Haldia Dock Complex
Haldia Townahip, Haldia
Distt: PurbaMedinpur (West Bengal)

Prepared by:

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CONTENT

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1. Summary

Kolkata Port Trust, Haldia Dock Complexhasawardedtheprojecttitled"POST PROJECT MONITORING OF DIFFERENT ENVIRONMENTAL PARAMETERS UNDER HALDIA DOCK COMPLEX, HALDIA" to M/s. Eko Pro Engineers Private Limited, Ghaziabad vide work order No. I&CF/IZ&R/T/296/702 dated 10.10.2019.

The main objective of environmental Monitoring is to take the environmental observations, inside and outside the Dock complex.

A comprehensive environmental monitoring program has been planned to monitor data for the Yearly period of **October 2019 – December 2019**. The monitored data of Ambient Air Quality, Fugitive Emission, Ambient Noise Quality, Marine Water Quality, Sediment Quality and green belt study in an around Haldia Dock complex.

In this study, multiple and periodic sampling has been carried out for Ambient air Quality. The frequency of Air monitoring is followed twice a week for a season.

Ambient Noise monitoring is followed once in month i.e. Oct- Dec 2019. The observations of total twelve locations were taken.

Marine Water quality samples for Physico-Chemical Analysis and Biological Analysis are carried out once in season.

Marine Sediment Quality samples for physico-chemical analysis and biological analysisalso being carried out once as the frequency for the same is once in a season.

Green Belt Survey also been conducted in the Dock premises once in season.

Eko Pro Engineers Private Limited mobilized sampling team for conducting the Water, Noise, sediment and Air monitoring in Haldia Dock Complex.

All the work was carried out by team and submitted the samples in lab.

We are very thankful to the official staff of Dock complex to support us and make this successfully happen. A big support of official staff we had at site to get the study and sample collection job done and gave us such type of opportunity.

The results and interpretation of study and monitoring is follows

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(Technical Manager)

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2. Ambient Air Quality

2.1 Selection of Monitoring Station

Ambient Air Quality Monitoring (AAQM) stations were set up at four locations with due consideration of meteorological conditions on synoptic basis, topography of the study area, representatives of regional background air quality for obtaining baseline and consultation with Halia Dock Complex officials. The monitoring locations are given in **Table 2.1**

Table 2.1: Monitoring Station of Ambient Air Quality (AAQ)

S.NO.	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	AAQ-1	Near MBC Jetty	22°01'01.07"N	88°04'06.56"E
2	AAQ-2	Top of Marine House	22°01'32.55"N	88°05'17.88"E
3	AAQ-3	Top of RZ Office	22°01'21.80"N	88°03'43.83"E
4	AAQ-4	Chrinjibpur Office	22°03'08.55"N	88°05'48.64"E

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Figure 2.1 AAQ Location

2.2 Sampling Methodology and Parameter Selection

Ambient air quality monitoring has been carried out twice in each location during the study period (Post Monsoon-October to November). The baseline data of ambient air has been generated for the following parameters as mentioned below.

- SPM
- PM_{10}
- $PM_{2.5}$
- Sulphur-dioxide (SO_2)
- Oxides of Nitrogen (NO_X)
- Carbon monoxide (CO)

It was ensured that the equipment was placed at a height of at least 3 to 4 m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The distance of the sampler from

any air flow obstacle i.e. buildings, walls, was more than two times the height of the obstacle. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results. Monitoring has been carried out as per the latest CPCB and MoEF guidelines and notifications.

2.3 Sampling and Analysis Technique

With a view to collecting the samples, Envirotech Make Calibrated Respirable Dust Samplers (SL No.-2757-DTL-2019 & 2054-DTE-2016) along with Gaseous attachment and Fine Particulate Matter (FPS-Instrument SL No.115-A-2018 & 892-DTL-2019) have been used. The RDS is capable of drawing air at a flow rate of 0.95 to 1.3 m^3/min with very little pressure drop for RDS and FPS is designed to operate at an air flow rate of 1m^3/hr. Filter papers (MGF 2000 and PTFE (46.2 dia)) were used for the collection of particulate matters and heavy metals. SO_2&NOx were collected by drawing air at a flow-rate of 0.5 liters per minute (lpm) through an absorbing solution for the duration of 24 hrs. Ammonia and ozone were collected drawing air flow rate of 1 liter per minute (lpm) for the duration of 1 hour. Sampling and analysis methodology adopted is given in Table 2.2 and National Ambient Air Quality Standards is given in Table 2.3.

Table 2.1: Sampling & Analysis Methodology

Sl. No.	Parameter	Methodology
1	Suspended Particulate Matter (SPM) (µg/m^3)	Respirable Dust Sampler (Gravimetric method)
2	Particulate Matter 10 (PM 10) (µg/m^3)	Respirable Dust Sampler (Gravimetric method)
3	Particulate Matter 2.5 (PM 2.5) (µg/m^3)	APM 550 Fine Particulate Sampler (Gravimetric method)
4	Sulphur Dioxide SO_2 (µg/m^3)	West and Gaeke Method
5	Oxides of Nitrogen (µg/m^3)	IS 5182, Part 6, Jacob &Hochheiser modified
6	Carbon monoxide (mg/m^3)	IS 5182, Part 10, Non-dispersive Infrared Absorption method

2.4 Duration of Sampling

The duration of sampling of fine particulate matter ($PM_{2.5}$), Respirable particulate matter (PM_{10}), SO_2 and NOx was each twenty four hourly continuous sampling per day and CO was sampled for eight hours continuous monitoring. The monitoring was conducted for two days in a week for one month in each quarter. The monitoring parameters and frequency of sampling are describe in tabular below.

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Table- 2.3 Monitored Parameters and Frequency of Sampling

Parameters	Sampling Frequency
Fine Particulate Matter ($PM_{2.5}$)	24 hourly sample twice a week for one months
Respirable Particulate Matter (PM_{10})	24 hourly sample twice a week for one months
Sulphur dioxide (SO_2)	24 hourly sample twice a week for one months
Nitrogen dioxide (NO_2)	24 hourly sample twice a week for one months
Carbon Monoxide (CO)	8 hourly samples twice a week for one months

Table 2.4: National Ambient Air Quality Standards

Pollutant	Concentration in µg/m³ except for CO in mg/m³		
	Time	Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
Sulphur Dioxide (µg/m³)	Annual Avg.* 24 hours**	50 80	20 80
Nitrogen Dioxide (µg/m³)	Annual Avg. 24 hours	40 80	30 80
Carbon monoxide (mg/m³)	8 hours 1 hour	2 4	2 4
PM10 (µg/m³)	Annual Avg. 24 hours	60 100	60 100
PM2.5 (µg/m³)	Annual Avg. 24 hours	40 60	40 60
Ozone O_3 (µg/m³)	8 hourly 1 hourly	100 180	100 180
Lead Pb (µg/m³)	Annual Avg. 24 hours	0.50 1	0.50 1
Ammonia NH_3 (µg/m³)	Annual Avg. 24 hours	100 400	100 400
Arsenic As (µg/m³)	Annual Avg.	06	06
Nickel Ni (ng/m³)	Annual Avg.	20	20
Pyro Benzene (BaP) (ng/m³)	Annual Avg.	1	1

Source: Gazette of India Notification, dated 16th Nov, 2009

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**** Annual Arithmetic Mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals***
***** 24 hourly or 8 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed the limits but not on two consecutive days of monitoring***

2.5 Analytical Result

Table 2.5: Ambient Air Quality-1 (Near MBC Jetty)

S.No.	Parameters	AAQ – 1 Near MBC Jetty							
		1st Round	2nd Round	3rd Round	4th Round	5thRound	6th Round	7th Round	8th Round
		15.11.19	16.11.19	23.11.19	25.11.19	10.12.19	12.12.19	15.12.19	16.12.19
i	PM_{10} (µg/m³)	85.6	82.9	80.9	81.6	84.3	79.8	81.4	82.5
ii	$PM_{2.5}$ (µg/m³)	46.5	48.3	48.6	50.8	49.7	47.9	48.2	49.8
iii	SO_2(µg/m³)	9.25	10.2	10.6	9.56	9.45	9.36	10.4	10.8
iv	NO_2(µg/m³)	23.4	26.2	21.5	19.3	22.3	24.3	25.3	23.9
v	CO(mg/m³	0.65	0.69	0.71	0.69	0.72	0.73	0.71	0.68

Table 2.6: Ambient Air Quality-2 (Top of Marine House)

S.No.	Parameters	AAQ – 2 Top of Marine House							
		1stRound	2nd Round	3rd Round	4th Round	5th Round	6th Round	7thRound	8th Round
		19.11.19	22.11.19	24.11.19	28.11.19	30.11.19	03.12.19	08.12.19	10.12.19
i	PM_{10} (µg/m³)	92.3	94.2	90.4	89.4	88.3	89.5	91.7	89.1
ii	$PM_{2.5}$ (µg/m³)	52.6	51.7	53.8	51.9	50.9	53.2	52.7	51.6
iii	SO_2(µg/m³)	12.2	13.5	13.8	12.6	13.9	12.5	12.8	13.6
iv	NO_2(µg/m³)	30.4	32.6	29.5	28.3	30.4	30.3	32.4	31.6
v	CO(mg/m³	0.86	0.96	0.86	0.86	0.94	0.88	0.87	0.86

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Table 2.7: Ambient Air Quality-3 (Top of RZ Office)

S.No.	Parameters	AAQ – 1 Top of RZ Office							
		1st Round	2nd Round	3rd Round	4th Round	5thRound	6th Round	7th Round	8th Round
		19.11.19	22.11.19	24.11.19	28.11.19	30.11.19	03.12.19	08.12.19	10.12.19
i	PM_{10} (µg/m³)	84.6	85.9	81.7	84.9	89.3	80.7	82.6	84.3
ii	$PM_{2.5}$ (µg/m³)	46.9	49.6	50.3	46.3	45.9	50.1	51.8	52.9
iii	SO_2(µg/m³)	8.36	9.26	8.36	9.12	9.58	10.2	9.36	9.14
iv	NO_2(µg/m³)	18.3	20.3	19.2	19.8	18.4	21.3	20.6	18.6
v	CO(mg/m³	0.56	0.62	0.65	0.62	0.63	0.59	0.58	0.62

Table 2.8: Ambient Air Quality-4 (Chrinjibpur Office)

S.No.	Parameters	AAQ – 4 Chrinjibpur Office							
		1stRound	2nd Round	3rd Round	4th Round	5th Round	6th Round	7thRound	8th Round
		13.11.19	14.11.19	20.11.19	21.11.19	05.12.19	06.12.19	15.12.19	16.12.19
i	PM_{10} (µg/m³)	95.3	91.7	93.7	94.2	90.5	95.1	91.8	93.2
ii	$PM_{2.5}$ (µg/m³)	55.9	52.7	57.3	52.9	54.3	54.9	52.8	55.8
iii	SO_2(µg/m³)	11.5	13.2	12.8	13.6	12.4	13.6	12.8	14.3
iv	NO_2(µg/m³)	32.5	33.6	32.5	31.6	30.4	32.8	31.2	32.4
v	CO(mg/m³	0.95	0.96	0.85	0.94	0.96	0.85	0.93	0.84

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2.6 Interpretation

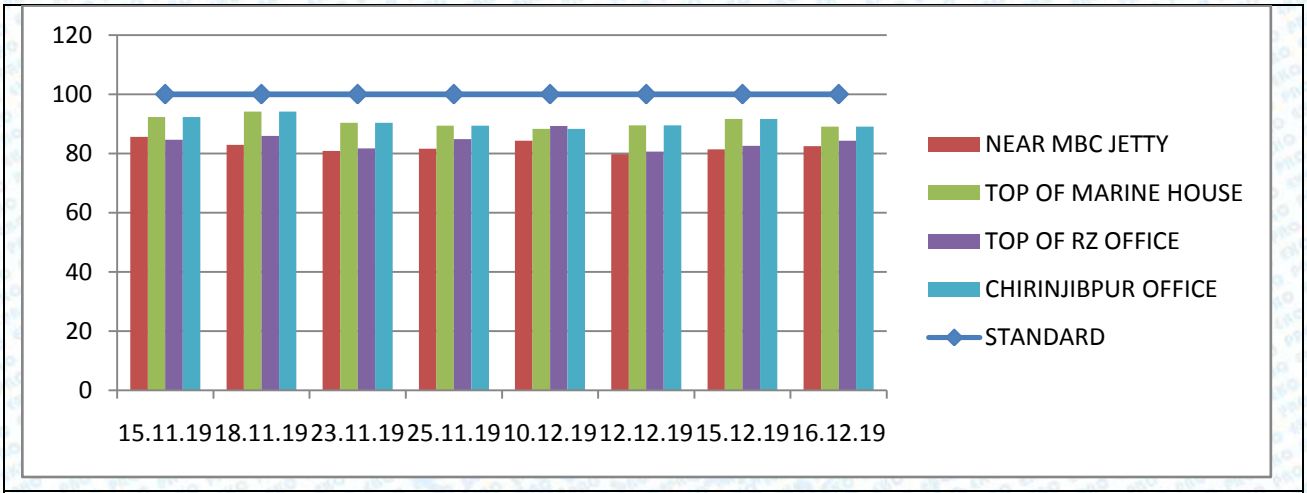

Figure 2.2: PM_{10}

The PM_{10} concentration varies between 79.8 µg/$m^3$to 95.3 µg/m^3during the study period (in post monsoon season October to December 2019). The results were compared with the National Ambient Air Quality Standards 2009. The values were found within the permissible limit. The various sources of air pollution are observed in the study area i.e. industrial, traffic, urban and rural activities.

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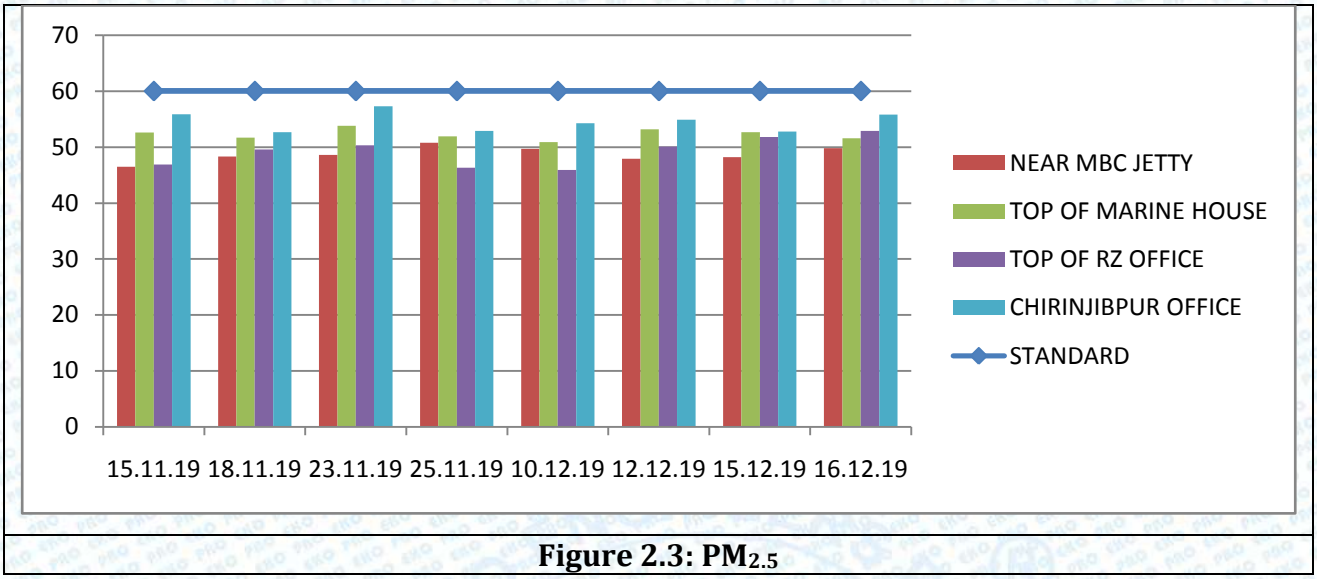

Figure 2.3: $PM_{2.5}$

The $PM_{2.5}$ concentration varies between45.9 µg/m^{3}to 57.3 µg/m^{3}in post monsoon season (October to December 2019). However, the levels for $PM_{2.5}$were found to be below the National Ambient Air Quality Standards (< 60µg/m^3) of NAAQS: 2012.Populations subjected to long-term exposure to particulate matter has a significantly higher cardiovascular incident and mortality rate. Short-term acute exposures subtly increase the rate of cardiovascular events within days of a pollution spike.

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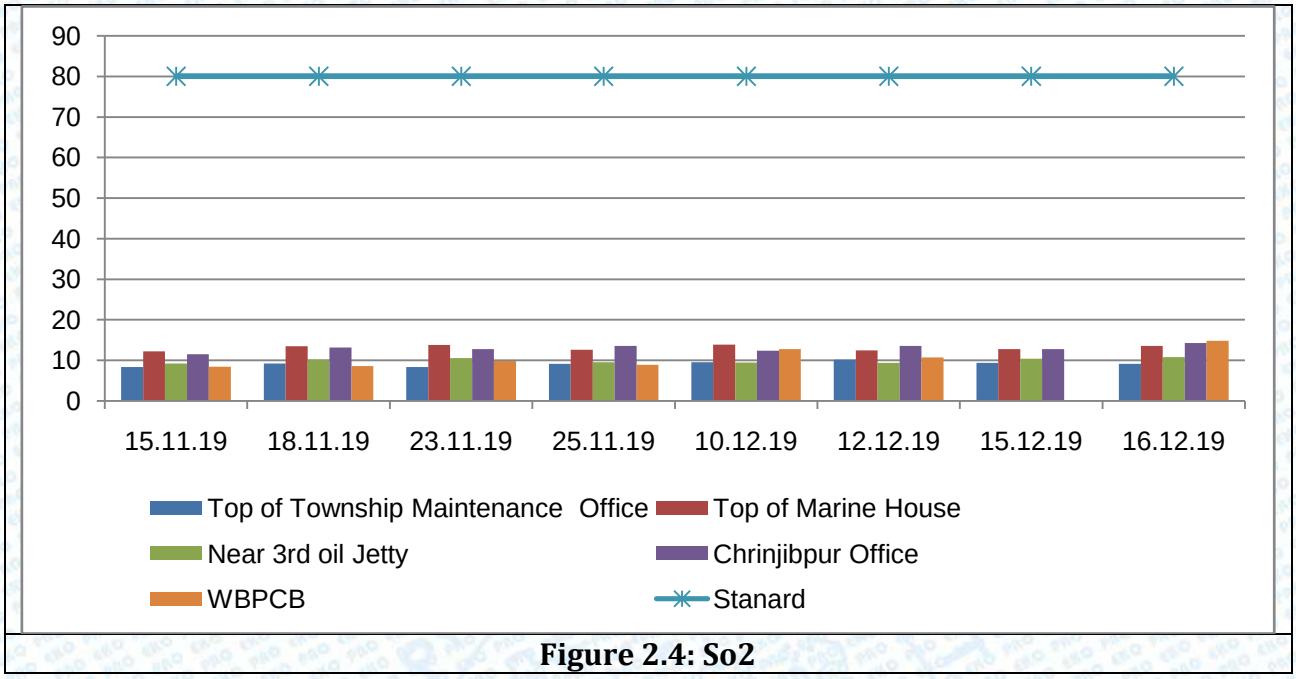

Figure 2.4: So2

The SO_2 concentration varies between 8.36 µg/m³to 14.3 µg/m³during the study period (October to December 2019), which is far below that national ambient air quality standard (< 80µg/M3) of NAAQS: 2012.The source of SO_2 in the study area is mainly from burning fuels containing sulfur. Other anthropogenic sources are emissions from domestic burning and vehicles Exposure to sulfur dioxide in the ambient air has been associated with reduced lung function, increased incidence of respiratory symptoms and diseases, irritation of the eyes, nose, and throat.

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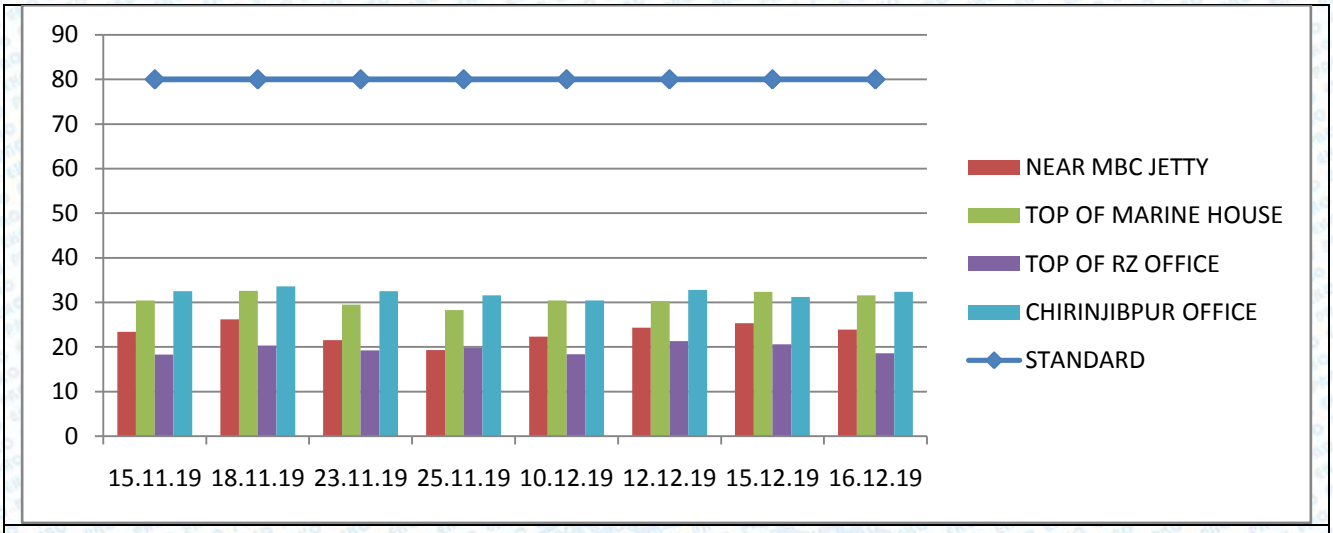

Figure 2.5: NO_{X2}

The NO_2 concentration varies between 18.3 µg/m³to 32.8 µg/m³ in post monsoon season. The values of Nitrogen dioxide were found well below the NAAQ standard. The primary sources of NO_2 are motor vehicles, electric utilities, and other industrial and residential sourcesthat burn fuels. NO_2 is one of the main ingredients involved in the formation of ground level zone, which can trigger serious respiratory problems.

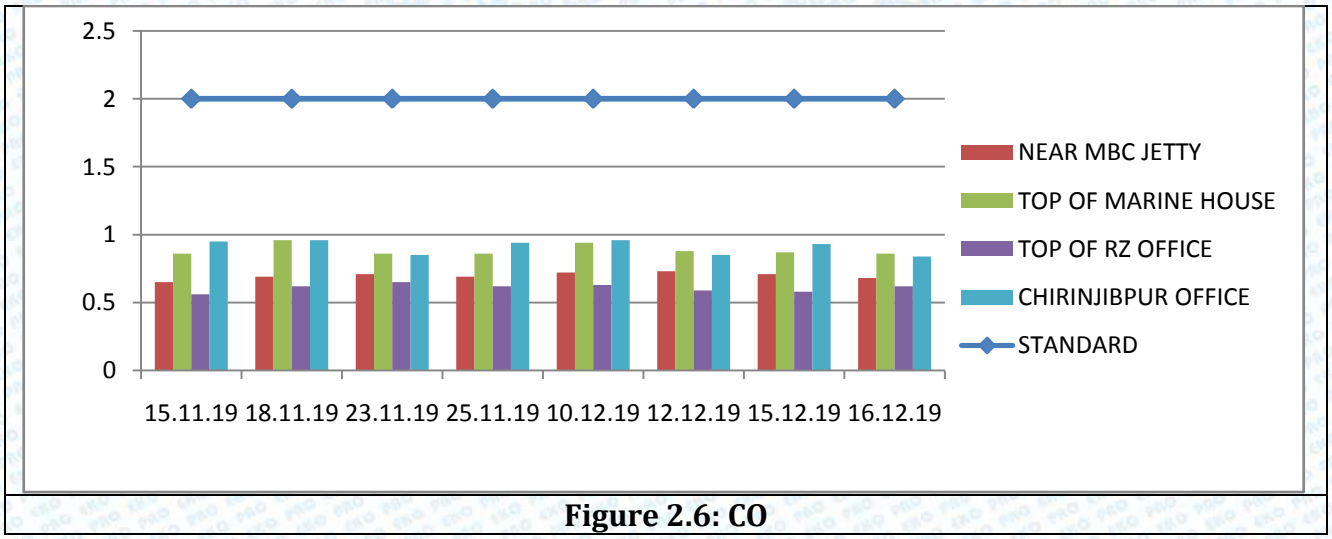

Figure 2.6: CO

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The CO concentration varies between 0.56 µg/m^{3}to 0.96 µg/m^3 in post monsoon season. The values of CO were found well below the NAAQ standard.

2.7 Air Quality Monitoring Site Photograph

AAQ1: Near MBC Jetty

AAQ2: Top of Marine House

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AAQ3: Top of RZ Office (Township)	AAQ4: Chrinjibpur Office

3. Ambient Noise Quality

3.1 Selection of Monitoring Station

Ambient Noise Quality Monitoring stations were set up at twelve locations for the period of October to December 2019. The monitoring station were setup by filed visit, identify the source noise, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 3.1**

Table 3.1: Monitoring Station of Ambient Noise Quality

S.NO	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	NQ-1	Chrinjibpur OB Gate	22°03'08.89"N	88°05'47.98"E
2	NQ-2	GC Berth Main Gate	22°02'45.86"N	88°05'12.08"E
3	NQ-3	Jawahar Tower Main Gate	22°01'05.98"N	88°04'02.71"E
4	NQ-4	MBC Jetty / Floating Jetty	22°01'11.83"N	88°04'34.53"E
5	NQ-5	CJB Gate	22°03'01.71"N	88°05'53.14"E
6	NQ-6	Lock Gate	22°01'29.11"N	88°05'06.40"E
7	NQ-7	Marine House	22°01'31.80"N	88°05'17.26"E
8	NQ-8	Master Control	22°02'02.16"N	88°05'25.13"E
9	NQ-9	Port Hospital (Township)	22°01'25.96"N	88°03'44.03"E
10	NQ-10	Cluster 4/61 (Township)	22°01'06.30"N	88°03'38.53"E
11	NQ-11	DAV School (Township)	22°01'25.33"N	88°03'34.30"E
12	NQ-12	Gate No.4 (Township)	22°01'35.06"N	88°03'54.55"E

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Figure 3.1 Ambient Noise Quality Location

3.2 Sampling Methodology and Parameter Selection

Noise monitoring has been carried out with using sound level meter ((HTC SL 1352) at monthly basis, in post monsoon season. (October - December, 2019). Noise level monitoring was carried out for 24 hours. Noise levels measured over a given period of time of interval, enable to describe scenario of noise using statistical techniques.

a) Leq (d)

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b) Leq(n)
c) L10
d) L50
e) L90
f) Lmax
g) Lmin
h) Ldn
i)

- Lday: Average noise levels between 6.00 hrs to 22.00hrs
- Lnight: Average noise levels between 22.00 hrs to 6.00hrs.

3.3. Sampling Techniques with Standards

The HTC make sound level meter was used to record the sound data and the model number of used device is SL 1352 i.e. designed on the basis of "Type 2" professional requirements. The instrument has a frequency weighting of "A" type and allows the user to select Slow or Fast mode of measurement. A built-in Data Logger can record all the important Sound Level parameters in Non-Volatile Flash memory for 24 hours making detailed field data collection very simple. Each record contains the observation of each second, with the detailed data, L_{EQ}, L_{MIN} and L_{MAX} and many others calculations also can be drawn. Sound Pressure Level and Sound Exposure Level (SEL) observed during the recording interval. A built-in Real Time Clock maintains a Date and Time stamp in the recorded data.

Noise survey is conducted in areas where noise exposure is likely to be maximum. Noise level refers to the level of sound. A noise survey involves measuring noise level at selected locations throughout an entire plant or sections to identify noisy areas. This is usually done with a sound level meter (SLM). A reasonably accurate sketch showing the locations of workers and noisy machines is drawn. Noise level measurements are taken at a suitable number of locations around the area. National Ambient Noise Quality Standards as per CPCB is given in Table 3.2 to compression with the observed results.

Table 3-2: Ambient Noise Quality Standards as per CPCB

Type of Area	Limits in dB(A) Leq*	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

*-dB (A) Leq denotes the time weighted average of the level sound in decibels on scale A which is relatable to human hearing
Source: Pollution Control Acts, Rule and Notifications issued there under, by Pollution Control Law Series: PCLS/02/2006(Fifth Edition) of Central Pollution Control Board, January 2006, pp 926. Day and Night time shall mean from 6:00 a.m. to 10:00 p.m. and 10:00 p.m. to 6:00 a.m. respectively.

3.4 Analytical Result

Table 3.3: Location wise Noise Quality Results

SN	Parameters	NQ-1 Chrinjibpur OB Gate	NQ-2 GC Berth Main Gate	NQ-3 Jawahar Tower Main Gate	NQ-4 MBC Jetty / Floating Jetty	NQ-5 CJB Gate	NQ-6 Lock Gate	NQ-7 Marine House	NQ-8 Master Control	NQ-9 Port Hospital Township	NQ-10 Cluster 4/61 (Township)	NQ-11 DAV School (Township)	NQ-12 Gate no.4 (Township)
1	Leq (d)	66.3	74.9	67.2	74.3	73.5	62.8	64.3	65.8	64.9	65.8	64.7	66.8
2	Leq(n)	49.5	53.8	48.3	55.3	52.3	50.2	48.3	49.8	48.6	47.3	48.3	49.2
3	L10	65.3	73.1	66.3	73.1	72.4	61.4	62.9	64.3	63.2	64.8	63.9	65.1
4	L50	59.3	64.2	58.3	66.8	63.2	57.9	58.3	58.4	57.3	57.9	58.3	59.8
5	L90	51.6	54.9	50.4	56.9	52.9	52.3	50.1	51.8	49.8	49.7	50.4	51.3
6	Lmax	78.3	81.3	85.4	85.3	80.2	75.3	74.3	76.5	77.4	76.5	78.3	78.9
7	Lmin	40.3	45.2	41.6	43.5	43.1	42.3	40.6	39.8	41.2	38.6	39.5	41.7
8	Ldn	57.9	64.4	57.8	65.3	62.9	56.5	56.3	57.8	56.8	56.6	56.5	**58.0**

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3.5 Interpretation

In the study area, noise source was observed only by vehicular movement & construction activities. High wind velocity in the river front area is another major source for high sound level in the study area. Noise levels were observed below the CPCB standards for Ambient Noise Quality in day time &night time.

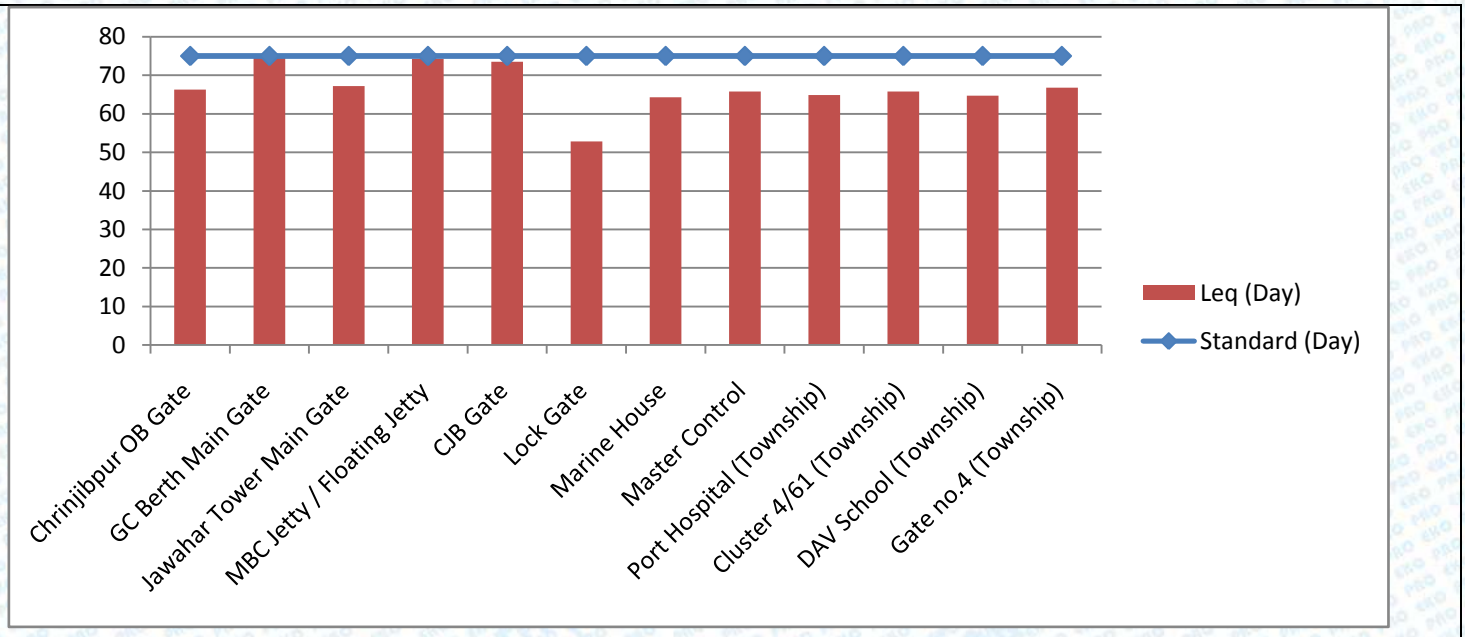

Fig:5 Noise Quality in Day Time

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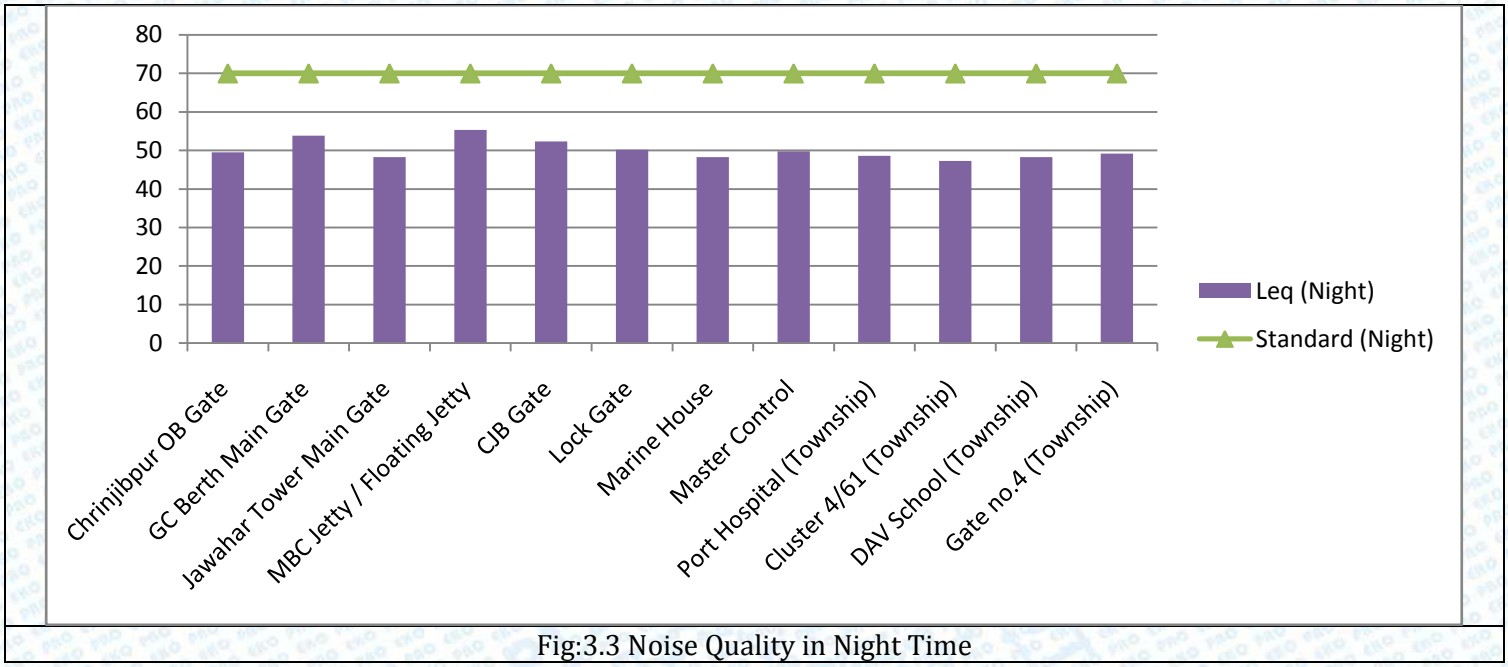

Fig:3.3 Noise Quality in Night Time

3.6 Noise Quality Monitoring Site Photograph

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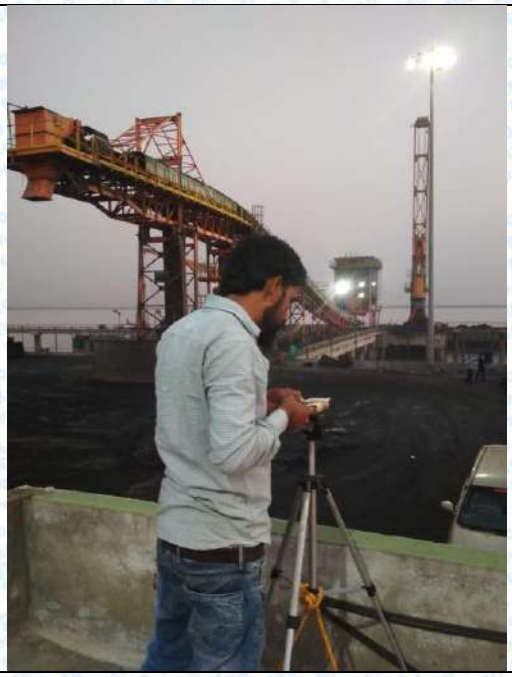
N1: ChrinjibPur Main Gate	N2: GC Berth Main Gate Noise
	
N3: Jawahar Tower	N4: MBC Jetty
	
N5: CJB gate	N6: Lock Gate

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N7: Marine House

N8: Master Control

N9: Port Hospital (Township)

N10: Gate No. 4 (Township)

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N11: DAV Schol (Township)	N12: Cluster 4 Quarter No 61

4. Water Quality

4.1 Selection of Monitoring Station

Water Quality Monitoring stations were set up at four locations. The monitoring stations were setup by filed visit, sensitive location of the site and official discussion with the Halia Dock Complex officials. The monitoring locations are given in **Table 4.1**

Table 4.1: Monitoring Station of Water Quality

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S.No	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	WQ-1	Near 1st Oil Jetty	22°01'55.32"N	88°06'03.16"E
2	WQ-2	Near 2nd Oil Jetty	22°01'43.42"N	88°05'50.88"E
3	WQ-3	Near 3rd Oil Jetty	22°01'02.13"N	88°04'32.26"E
4	WQ-4	Near Lock Gate	22°01'19.59"N	88°05'11.12"E

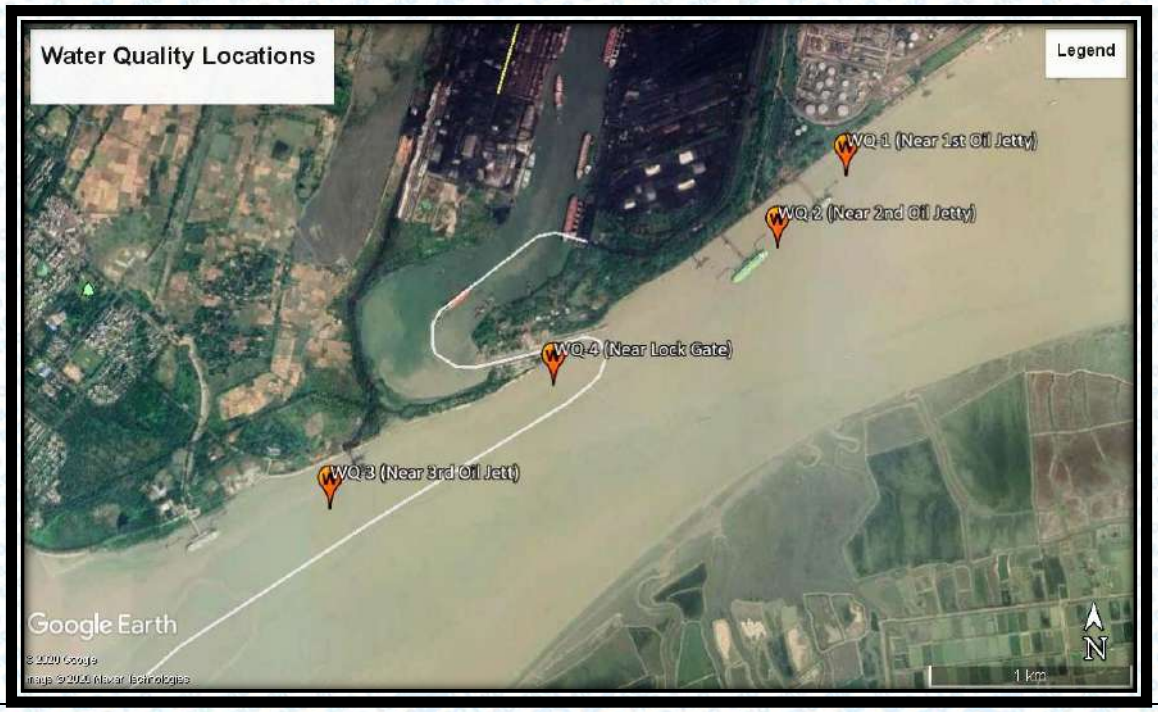

Figure 4.1 Water Quality Location

4.2 Sampling Methodology and Parameter Selection

The parameter selections for the marine sediment quality are described below.

A. Physio-Chemical Parameters

- Colour
- Turbidity
- pH
- Electrical Conductivity (EC)

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- Total Dissolve Solids (TDS)
- Total Suspended Solid (TSS)
- Floating matters
- Oil & Grease
- Petroleum Hydrocarbons
- Salinity
- Alkalinity as $CaCO_3$
- Total Hardness as $CaCO_3$
- Calcium as Ca
- Magnesium as Mg
- Sodium as Na
- Potassium as K
- Chloride as Cl
- Sulphate as SO_4
- Nitrate as NO_3
- Flouride as F
- Phenolic compound as C_6H_5OH
- Cyanide
- Aluminium
- Arsenic
- Cadmium
- Chromium as Cr^{+6}
- Iron
- Copper
- Lead
- Manganese
- Mercury
- Zinc
- Dissolve Oxygen
- BOD, 27°C 3 days
- COD
- Total coliforms

B. Biological Parameters

- Phytoplankton

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- Zooplankton
- Shell Fishes
- Fin Fishes
- Chlorophyll Content
- Gross Primary Productivity
- Net Primary Productivity
- Community Respiration

Marine water samples shall be collected at the rate of 2 samples per location (one sample at surface i.e. 0.3 meter depth and another sample form bottom (6 meter to 16 meter depth). Sampling for Marine water quality shall be conducted inside the protected water i.e., within break waters. The analysis of marine water for physico-chemical parameters as per the procedures specified in Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. Samples for physico-chemical analysis were collected in polyethylene and glass bottle and preserved as per standard procedure. Samples collected for metal content were acidified with 1ml HNO_3. Samples for bacteriological analysis were collected in sterilized bottles. The details sample collection procedures are described in below.

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Table 4.2: Sample Collection Procedure

S.No	Parameter	Sample collection	Sample Size	Storage/ Preservation
1	pH, EC, TDS	Grab sampling Plastic container	50 ml	On site analysis
2	Other Physico-Chemical Parametrs	Grab sampling Plastic glass container	2000 ml	As per SOP
3	Oil & Grease	Wide mouth glass container	500 ml	Add HCl to pH>2, refrigeration, 28 days
5	Cyanide	Grab sampling glass container	500 ml	As per SOP
6	BOD	Grab sampling glass container	1000 ml	Cooling between 2 to 5 degree
7	COD	Grab sampling plastic container	100 ml	Add HNO3 to pH <2
8	Heavy Metals	Glass rinsed with 1+1 HNO_3	500 ml	HNO_3 to pH>2; Grab sample; 6 months
9	Biological Sample	Sterilized plastic container	500 ml	As per SOP

.

Plankton

Plankton samples were collected from the surface waters of the study areas by towing a plankton net (mouth diameter 0.35 m) made of bolting silk (No.25 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope

4.3 Analysis Technique

The analysis techniques were followed by Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. After the analysis the results were compared as per the SW Class IV (CPCB). The instrument used for the above mention parameters are given below.

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Table 4.3: Instrument Used

S. No.	Parameters	Instrument Used
1	pH	pH meter
2	Turbidity	Nephelo Meter
3	Conductivity (at 25^0C)	Conductivity meter
4	Total Dissolve Solids	Gravimetric
5	Alkalinity as $CaCO_3$	Titrimetric Method
6	Total Hardness as $CaCO_3$	TitrimetricMethod
7	Calcium as Ca	Titrimetric Method
8	Magnesium as Mg	Calculation
9	Sodium	Flame Photometric
10	Potassium	Flame Photometric
11	Chloride as Cl	Argentometric
12	Sulphate as SO_4	Turbidimetric
13	Nitrate as NO_3	Spectro photometric
14	Phosphate	Spectrophotometric
15	Fluoride as F	Spectrophotometric
16	Phenolic compound as C_6H_5OH	Spectrophotometric
17	Cyanide	Spectrophotometric/Spot test
18	Dissolve Oxygen	Winkler Method
19	Oil & Grease	Gravimetric
20	Heavy Metal	Induced Couple Plasma- Mass Spectro Meter (ICP-MS)
21	Total Coliform	MPN Method
22	Plankton Study	Microscope

Onsite Parameter Analyses

pH, temperature and conductivity were analyzed at the time of sample collection. For dissolved oxygen, samples were collected in standard BOD bottle and fixed the oxygen by manganese oxide and alkaline iodide immediately after collection of the sample.

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4.4Analytical Result and Interpretation

A. Physio-Chemical Parameters

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINE (CLASS SW-IV)
			19.12.19	19.12.19	19.12.19	19.12.19	
(0.3 Meter Depth)							
1	Colour	Haze n	50	60	60	70	No visible colour
2	Turbidity	NTU	460	476	420	430	–
3	pH	–	7.87	7.91	7.98	7.99	6.5-9.0
4	Conductivity	µs/cm	4914	5180	7133	5157	–
5	Total Dissolved Soild	mg/l	3452	3620	4636	3760	–
6	Total Suspended Soilds	mg/l	574	718	615	229	–
7	Floating Matters	mg/l	0.2	0.25	0.2	0.2	10.0
8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	–
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	–
10	Salinity	mg/l	4760	4962	6920	5018	–
11	Alkalinity as CaCO3	mg/l	148	149	140	144	–
12	Total Hardness as CaCO3	mg/l	750	800	956	850	–

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13	Calcium as Ca	mg/l	90.1	70.1	80.5	70.2	–
14	Magnesium as Mg	mg/l	127.6	97.4	182.3	164	–
15	Sodium as Na	mg/l	889	894	1169	872	–
16	Potassium as K	mg/l	40	39.5	51.1	37.8	–
17	Chloride as Cl	mg/l	1759.5	1669.5	2299.3	1639.5	–
18	Sulphate as SO4	mg/l	278.1	273.3	423.9	279.6	–
19	Nitrate as NO3	mg/l	6.18	7.20	7.68	7.13	–
20	Flouride as F	mg/l	1.25	1.28	1.41	1.36	–
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	–
22	Cyanide	mg/l	Absent	Absent	Absent	Absent	–
23	Aluminium	mg/l	26.35	34.6	47.18	32.47	–
24	Arsenic	mg/l	0.016	0.011	0.034	0.096	–
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	–
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	–
27	Iron	mg/l	26.35	31.15	35.86	17.26	–
28	Copper	mg/l	0.21	0.22	0.31	0.23	–
29	Lead	mg/l	0.165	0.175	0.41	0.239	–
30	Mangnese	mg/l	1.36	1.2	1.62	1.069	–
31	Mercury	mg/l	<0.005	<0.005	<0.005	<0.005	–

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32	Zinc	mg/l	2.14	0.94	2.97	2.51	–
33	Dissolve Oxygen	mg/l	4.8	4.5	5.1	5.0	3.0
34	BOD, 27°C 3 Days	mg/l	6.0	8.0	4.0	3.0	5.0
35	COD	mg/l	33.6	37.8	25.2	21.7	–
36	Total Coliforms	MPN/100ml	1400	1300	1100	1400	–

In the physico –chemical analysis of the marine water quality from 0.3 meter depth, the pH variation was found from 7.87 to 7.99 , Conductivity is found from 4914 µs/cm to 7133 µs/cm, Magnesium is found from 97.4. mg\l to 182.3 mg\l and Calcium is found from 72.1 mg\l to 90.1 mg\l.

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINES (CLASS IV)
			19.12.19	19.12.19	19.12.19	19.12.19	
(7 Meter Depth)							
1	Colour	Haze n	60	80	70	80	No visible colour
2	Turbidity	NTU	470	520	510	490	–
3	pH	–	7.89	7.82	7.96	7.98	6.5-9.0
4	Conductivity	µs/cm	5163	5298	7536	5429	–
5	Total Dissolved Soild	mg/l	3690	3790	4830	3970	–
6	Total Suspended Soilds	mg/l	610	750	680	240	–

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7	Floating Matters	mg/l	0.3	0.4	0.4	0.45	10.0
8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	–
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	–
10	Salinity	mg/l	4930	5190	7340	5018	–
11	Alkalinity as CaCO3	mg/l	160	152	144	150	–
12	Total Hardness as CaCO3	mg/l	780	820	980	890	–
13	Calcium as Ca	mg/l	95.8	74.1	95.8	75.8	–
14	Magnesium as Mg	mg/l	131.5	154.3	180.1	170.3	–
15	Sodium as Na	mg/l	895	904	1120	893	–
16	Potassium as K	mg/l	42	35.9	56.9	40.1	–
17	Chloride as Cl	mg/l	1850.5	1760.3	2360.9	1740.5	–
18	Sulphate as SO4	mg/l	285.6	290.5	460.8	299.5	–
19	Nitrate as NO3	mg/l	7.23	8.25	8.69	9.14	–
20	Flouride as F	mg/l	1.65	1.98	1.45	1.98	–
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	–
22	Cyanide	mg/l	Absent	Absent	Absent	Absent	–
23	Aluminium	mg/l	29.58	36.9	49.5	36.7	–

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24	Arsenic	mg/l	0.019	0.015	0.042	0.098	–
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	–
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	–
27	Iron	mg/l	28.69	35.24	38.69	19.58	–
28	Copper	mg/l	0.25	0.29	0.36	0.29	–
29	Lead	mg/l	0.198	0.189	0.425	0.369	–
30	Manganese	mg/l	1.45	1.36	2.45	1.39	–
31	Mercury	mg/l	<0.005	<0.005	<0.005	<0.005	–
32	Zinc	mg/l	3.24	0.98	3.24	2.39	–
33	Dissolve Oxygen	mg/l	4.5	4.2	5.0	4.9	3.0
34	BOD, 27°C 3 Days	mg/l	6.3	9.0	5.0	4.5	5.0
35	COD	mg/l	35.9	40.9	28.9	25.7	–
36	Total Coliforms	MPN/100ml	1600	1400	1200	1600	–

In the physico –chemical analysis of the marine water quality from 7 meter depth, the pH variation was found from 7.89 to 7.98, Conductivity is found from 5163 µs/cm to 7536 µs/cm, Magnesium is found from 131.5 mg\l to180.1mg\l and Calcium is found from 74.1 mg\l to 95.8 mg\l.

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5. Marine Biological Parameters

S.NO.	PARAMETERS		UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate
				19.12.19	19.12.19	19.12.19	19.12.19
1	**Phytoplankton**						
	1	Coscinodiscuscentralis	Cells/l	1076	1275	1293	2618
	2	Dinophysiscaudata	Cells/l	1064	1084	880	-
	3	Odontellaaurita	Cells/l	310	708	454	880
	4	Triceratiumbroeckii	Cells/l	740	1100	-	620
	5	Cerataulinapelagica	Cells/l	920	460	520	198
	6	Hemiaulussinensis	Cells/l	182	-	150	281
	7	Ceratiumsp	Cells/l	1100	910	1048	880
	8	Guinardiastriata	Cells/l	1237	840	950	460
	9	Coscinodiscuswailesii	Cells/l	-	750	880	776
	10	Lauderiaannulata	Cells/l	1100	589	-	-
	11	Achnanthessp	Cells/l	916	480	660	550
	12	Striatellaunipunctata	Cells/l	740	660	520	420
	13	Rhizosoleniasp	Cells/l	225	182	199	320

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2	**Zooplankton**						
	1	Parvocalanussp	Org./m³	160	150	114	182
	2	Centropagesorsini	Org./m³	180	140	159	206
	3	Oithona nana	Org./m³	210	40	88	114
	4	Oithonasp	Org./m³	115	118	216	-
	5	Mysis larvae	Org./m³	40	-	22	15
	6	Oikopleura larvae	Org./m³	120	100	90	101
	7	Oithonaplumifera	Org./m³	150	117	95	80
	8	Centropagessp	Org./m³	170	153	119	110
	9	Copepod nauplii	Org./m³	-	152	180	150
	10	Calanopiaeliptica	Org./m³	136	150	95	100
	11	Temora sp.	Org./m³	144	186	119	132
	12	Tintinnopsissp	Org./m³	65	89	-	75
	13	Calanopiasp	Org./m³	115	-	98	76
	14	Temoraturbinata	Org./m³	122	167	154	-
	15	Pseudodiaptomussp	Org./m³	-	78	87	93
3	**Shell Fishes (No Shrimps and Crabs were found)**						
4	**Fin Fishes**		-	Not found	Not found	Not found	Not found
5	**Chlorophyll Content**		-	Not found	Not found	Not found	Not found
6	**Light Penetration**		-	Not found	Not found	Not found	Not found

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7	**Gross Primary Productivity**	-	Not found	Not found	Not found	Not found
8	**Net Primary Productivity**	-	Not found	Not found	Not found	Not found
9	**Community Repiration**	-	Not found	Not found	Not found	Not found

4.5 Interpretation

A total number of 13 Phytoplankton species were found, out of which the higher number of Phytoplankton is Coscinodiscus centrails and the lowest number of Phytoplankton is Hemiaulus sinensis.

On the other hand, total 15 species were found of Zooplankton, out of which the higher number of Zooplankton is Oithona sp and the lowest number of Zooplankton is Mysis larvae.

No shellfishes and fin fishes were recorded during the marine biological survey carried out in the study area.

In addition, along with the above, some parameters also were not found i.e. shown in table.

6.Marine Sediment Quality

6.1 Selection of Monitoring Station

Sediment Quality Monitoring stations were set up at four locations. The monitoring stations were setup by filed visit, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 3.1**

Water Quality Location				
1	S 1	Near 1st Oil Jetty	22° 1'55.63"N	88° 5'58.27"E
2	S 2	Near 2nd Oil Jetty	22° 1'46.05"N	88° 5'43.49"E
3	S 3	Near 3rd Oil Jetty	22° 1'03.26"N	88° 4'25.38"E
4	S 4	Near Lock Gate	22° 1'20.72"N	88° 5'06.04"E

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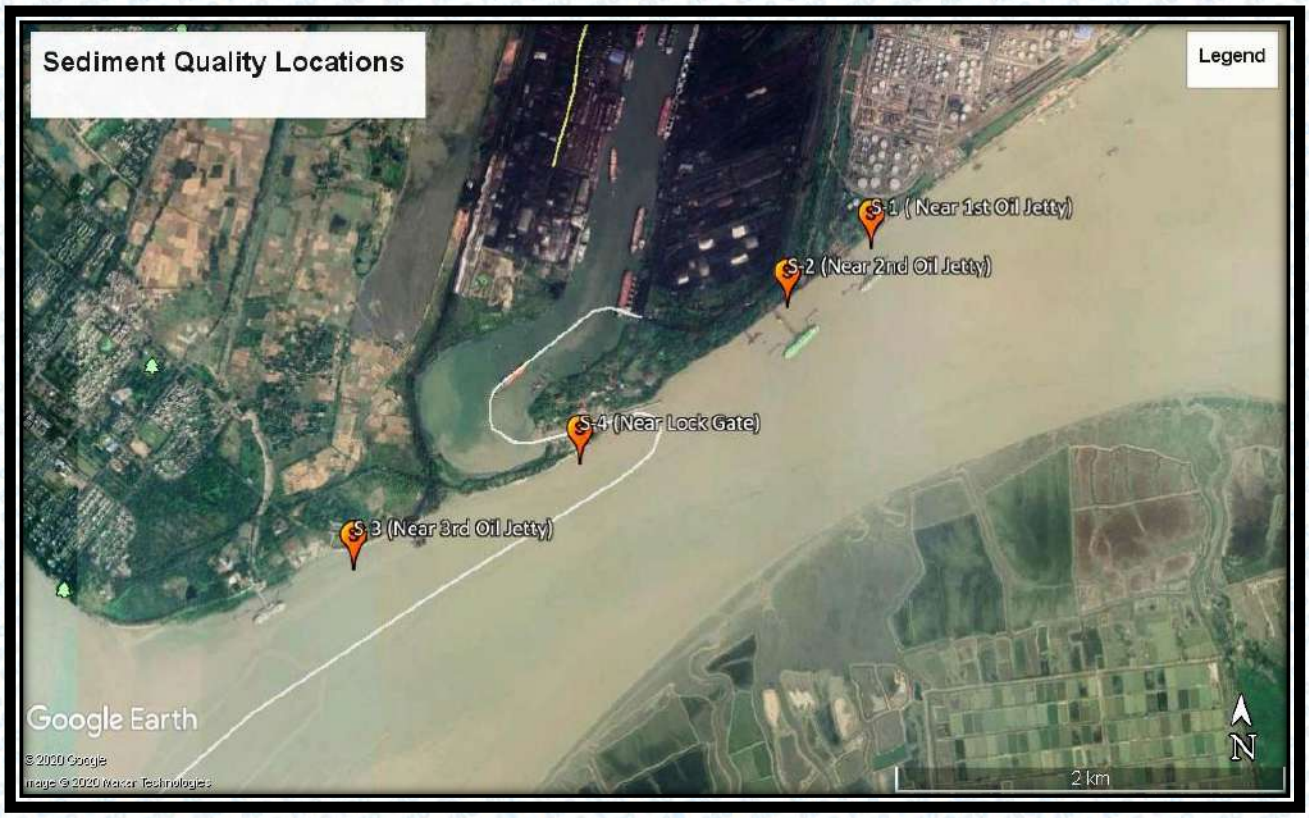

Figure 5.1 Sediment Quality Location

6.2 Sampling Methodology and Parameter Selection

The samples were collected and analyzed as per the procedures specified in Standard existing procedure. Sediment samples are collected as grab sampling procedure. The samples were collected using a Petersen grab sampler from bottom of the river. The collected samples were taken by a fresh plastic container and marked the lab code for physico-chemical analysis. The samples were taken into the laboratory and dry in normal temperature. .

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The biological analysis for microbenthic, meiobenthic and macrobenthic community structure, samples were also collected using a Petersen grab sampler and collected sample were taken in the sterilized plastic container.

The parameter selections for the marine sediment quality are described below.

C. Physio-Chemical Parameters

- Texture
- pH
- Sodium as Na
- Potassium as K
- Cadmium as Cd
- Copper as Cu
- Lead as Pb
- Zinc as Zn
- Magnesium as Mg
- Arsenic as As
- Phosphate as PO4
- Chloride as Cl
- Sulphate as SO4

D. Biological Parameters

- Meiobenthos
- Microbenthos
- Macrobenthos

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6.3 Analysis Technique

The samples were analyses in laboratory with the procedures of APHA 22nd Edition and SOP (Standard Operating Procedure) of the Laboratory. For the biological analysis the collected wet sediment samples are sieved with varying mesh sizes for segregating the organisms. Macrobenthos are organisms which are retained in the sieve having mesh size between 0.5 and 1 mm. The term meiofauna loosely defines a group of organisms by their size, larger than microfauna but smaller than macrofauna, rather than a taxonomic grouping. In practice, that is organisms that can pass through a 1 mm mesh but will be retained by a 45 µm mesh. Organisms below size of 45 µm are regarded as microbenthos. The sieved organisms are then stained with Rose Bengal and sorted into different groups. The number of organisms in each grab sample is expressed in number per meter square.

6.4 Analytical Result

A. Physico-chemical Parameter

S.NO.	PARAMETERS	UOM	S-1 Near Ist Oil Jetty	S-2 Near 2nd Oil Jetty	S-3 Near 3rd Oil Jetty	S-4 Near Lock Gate
			19.12.19	19.12.19	19.12.19	19.12.19
1	Texture	–	Silty Clay	Silty Clay	Silty Clay	Silty Clay
2	pH	–	7.12	7.62	7.57	7.88
3	Sodium as Na	mg/kg	982.0	1192.0	1210.0	1179.3
4	Potassium as K	mg/kg	516.0	818.0	820.0	791.4
5	Cadmium as Cd	mg/kg	<1.0	<1.0	<1.0	<1.0
6	Copper as Cu	mg/kg	<1.0	<1.0	<1.0	<1.0
7	Lead as Pb	mg/kg	<1.0	<1.0	<1.0	<1.0

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8	Zinc as Zn	Mg/kg	2.86	2.70	2.90	2.13
9	Magnesium as Mg	Mg/kg	926.8	966.0	945.0	907.4
10	Arsenic as As	Mg/kg	<1.0	<1.0	<1.0	<1.0
11	Phosphate as PO4	Mg/kg	210.0	213.0	220.0	208.3
12	Chloride as Cl	Mg/kg	640.0	702.0	680.0	675.3
13	Sulphate as SO4	Mg/kg	320.4	348.8	332.7	307.7

7.0 Marine Sediment Quality- Biological Parameters

S.NO.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate
			19.12.19	19.12.19	19.12.19	19.12.19
1	Meiobenthos	Org./10 m^2	NIL	NIL	NIL	NIL
2	Microbenthos	Org./10 m^2	NIL	NIL	NIL	NIL
3	Macrobethos					
3.1	Capitellacapitata	Org./10 m^2	148	44	15	16
3.2	Neantheschingrighattensis	Org./10 m^2	36	45	15	30
3.3	Ceratonereis sp.	Org./10 m^2	110	-	120	130

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3.4	Nepthyspolybranchia	**Org./10 m²**	132	45	46	149
3.5	Perinereis sp.	**Org./10 m²**	46	32	28	40
3.6	Notocirrusaustralis	**Org./10 m²**	-	164	56	-
3.7	Nereiscapensis	**Org./10 m²**	99	15	66	151

6.5 Interpretation

As per the analysis of Biological parameters of Sediment quality, Meiobenthos and Microbenthos, both were found nil and Marcobenthos found with its 7 species i.e reported above in table

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Sediment Quality Monitoring Site Photograph

S 1: Near 1st Oil Jetty

S 3: Near 3rd Oil Jetty

S 2: Near 2nd Oil Jetty

S 4: Near Lock Gate

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8.0 Green Belt Survey

8.1 Selection of monitoring station

In the whole proposed project area, stratified random samples were taken to study intensively various ecological parameters so as to understand the ecological structure and functions of the study area. The project area is triangular one. It has been started from Haldia Port office to bank of Ganga River (Fig.- 4 & 5). There are few offices, degraded area, waste land, paddy field and a small village within the study area. Most of the area is blank. But there are thick vegetation near to the river and floating jetty. Four (4) study sites have been randomly selected throughout the proposed area (Table-1). Brief description of study sites are as follows.

Site – 1 - This site is on the bank of Ganga River and near to floating jetty. The bank road is planted by Arica palm. There is open land in parallel to the river. This area is covered by scrubby plants, one or two tress are seen here and there.

Site –II - This site is located beside Haldia Bhawan. A green patch is partly surrounded by a concrete wall. A small pond is within this area. Large tree like *Eucalyptus sp. Bauhinia sp, Lagerostroemia sp.* Etc. are available here. This area is dense and with shrubby plant like *Eupatorium odoratum* species.

Site –III - This site is located behind central garage. A small waste area is seen behind this garage. This area is water lagged. The dominant species of this area is *Typha angustifolia*. Beside this a mangrove fern like *Acrostichium aurious* is also seen. Another species such as *Tamarix troupi, Callistemon sp. Casuarina equsetifolia, Delonix regia, Ficus glomerata* etc. are also seen.

Site –IV - This is a road from township gate to floating jetty. Roadside plantation was both side of the road. One side by *Swetenia macrophyla* and other side is *Delonix regia*. GBH of *Swetenia macrophyla* are varies from 39 cm to 126cm and heights are 4 to 6 m. whereas GBH of *Delonix regia* varies from 36to116cm and heights are 4 to 7m.

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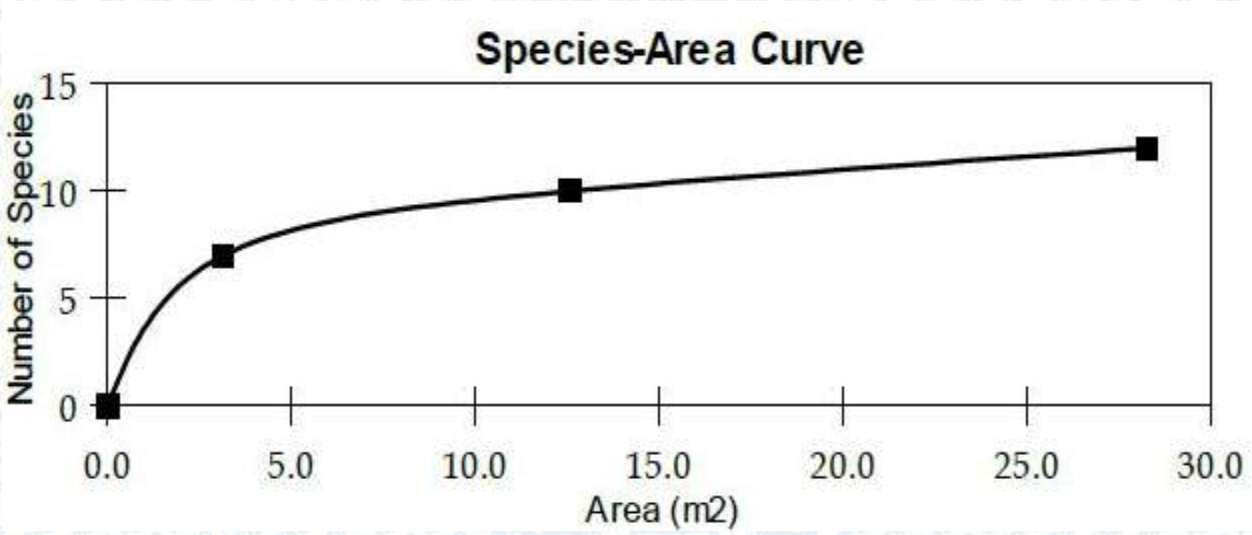
8.2 Sampling Methodology

The study of biodiversity in the study area includes the study of flora and qualitative and /or quantitative enumeration and their socio-ecological framework, but also the study of ecosystems and habitat characteristics, of which they are part. The scope of the study covers all these factors along with impact identification and or prediction and conservation measures.

8.3 Analysis Technique

1. **Quantitative enumeration:** The terrain of the proposed study site is flat so quadrate method is adopted for ecological study. The size of quadrate is determined by species-area curve as stated below.



In this case size of tree quadrate is determined 10m x 10m, for shrubs 5m x 5m and for herbs is 1m x 1m.

2. **Ecosystem diversity:** diversity of different habitats (Terrestrial, Aquatic and Ecotone zone) within this ecosystem and their habit characterization is done. Besides species listing other studies like phyto-sociology of plants in different habitats of the study area is done with the following tools. Habitats are treated separately while making such calculations).

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Importance Value Index (IVI = Relative Density + Relative Dominance + Relative Frequency

Relative Frequency (R F) = Frequency of a species x 100/ Total Frequency of all species

Relative Dominance (R Dom) = Dominance of a species x 100/ Total dominance of all Species

Relative Density (R Den) = Density of a species x 100/ Total Density of all species

Species Richness - Species richness is a measure of the number of species found in a sample. Since the larger the sample, the more species we would expect to find, the number of species is divided by the square root of the number of individuals in the sample. This particular measure of species richness is known as D, the Menhinick's index. $D = s \sqrt{N}$

where s equals the number of different species represented in your sample, and N equals the total number of individual organisms in your sample.

Diversity Index - As a measure of species diversity, we will calculate the Shannon Wiener Diversity Index. It turns out that the mathematical relationships hold true whether one is dealing with molecules in solution or species in an ecological community.

$H = \sum (pl) |\ln pl|$

Where (pl) is the proportion of the total number of individuals in the population that are in species "l".

3. Identification and preservation of specimen - An intensive literature survey has been carried out for assemblage of existing information on various uses of the coastal plain and sand dune species at different parts of the coast of Midnapore. Each of the plant material has been assigned a field note books and documented as to Binomials with family, local name, part used and therapeutic uses, plant parts that were identified as useful in ethno-botany were collected, compressed, the voucher specimens have been collected and identified by referring to standard flora (Prain,1903).

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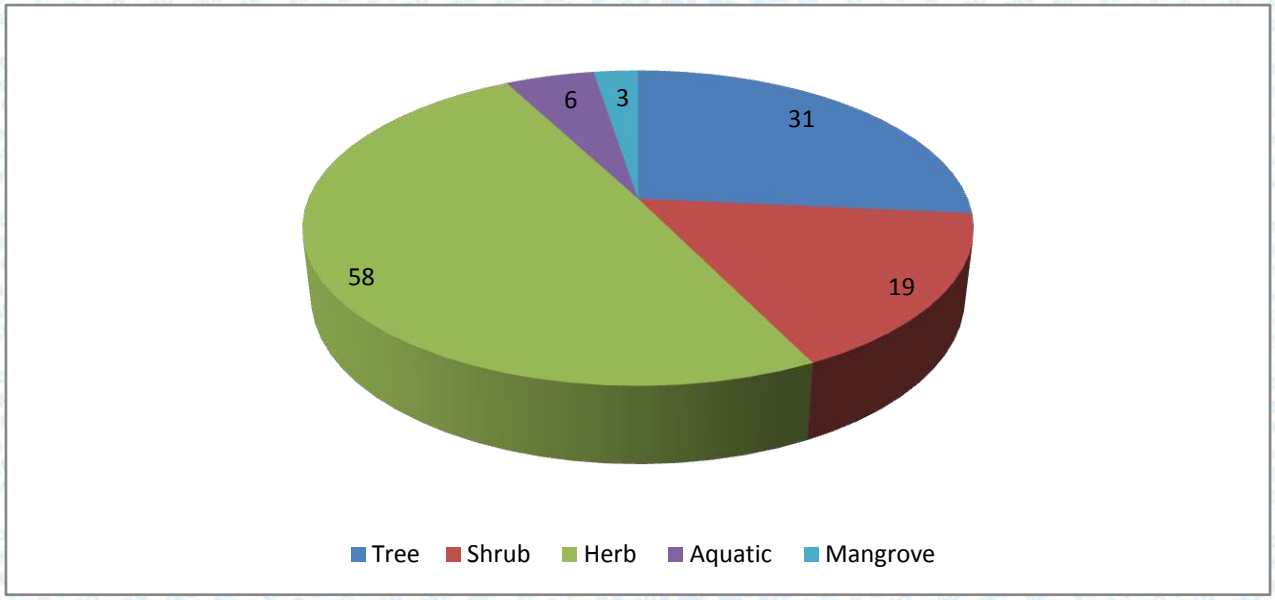
8.4 Analytical results and interpretation

Biodiversity Resources

Floral Diversity

The study area has 31species of trees, 19 species of shrubs and 58 species of herbs (Table-3). There are also 6 aquatic and 3 mangrove species (Table-3D & 3E). Presence of 117 number of plant species (Fig.-1) within only a small part of Haldia Port area is highly diverse in its vegetation composition.

Fig.-1: Vegetation composition of study area



Presence of species like *Enhydra fluctuans (Hincha),Marselia quadrifolia* (Susni), *Ipomoea carnea* and *Commelina benghalnensis* (Kansira**)** etc shows that the ecotone zone in between the water body and the road is rich in diversity. The above-mentioned species are medicinally important and the first two species like *E. fluctuans* and *M. quadrifolia* are commercially important as these are considered as very precious herbs in Bengali kitchens. Species like *Eupatorium odoratum* is considered to be deadly invasive

and therefore needs to be controlled in general and not particularly for this project. The only way to manage these species is increasing the frequency of indigenous species.

Heliotropium indicum

In the tree level species like *Albezia lebbek (Siris), Samania saman (Khiris)*, *Borassus flabellifer (Tal), Cocos nucifera (narkel), Azadirachta indica (Neem), Mangifera indica* (Mango)etc. are commercially very important species. Species like *Ficus beghalensis,* and *Ficus religiosa* are considered to be "key stone" species as it provides shelter to many animal as well as plant species. During plantation and rehabilitation work emphasis will be given on plantation of these species so as to compensate the loss to the ecosystem. Presence of a large number of *Roystonea regia* (Plam) is a very interesting aspect of the ecological setting of the study area. It is said that the plantation of this monocot tree species is works as soil binder in bank area. The ecological set up seems to be suitable for such plantation. Therefore, it is necessary to replicate this habitat at least with its structural components.

Importance Value Index (IVI) of trees

The IVI results show that within 17 species there are 6 (six) species having importance value more than 15. *Lagerostroemia perviflora* has the highest IVI (Table-4) followed by *Sweitenia macrophylla*. *Bauhinia purpuria* has the lowest IVI followed by *Delonix regia, Zizyphus jujube, Albizea procera.* Importance Value Index is a measure of how dominant a species is in the study area. Here Relative frequency, Relative density and Relative Abundance of the highest IVI value is the dominant species. A graphical presentation is followed of comparative importance values in given in Fig.-2.

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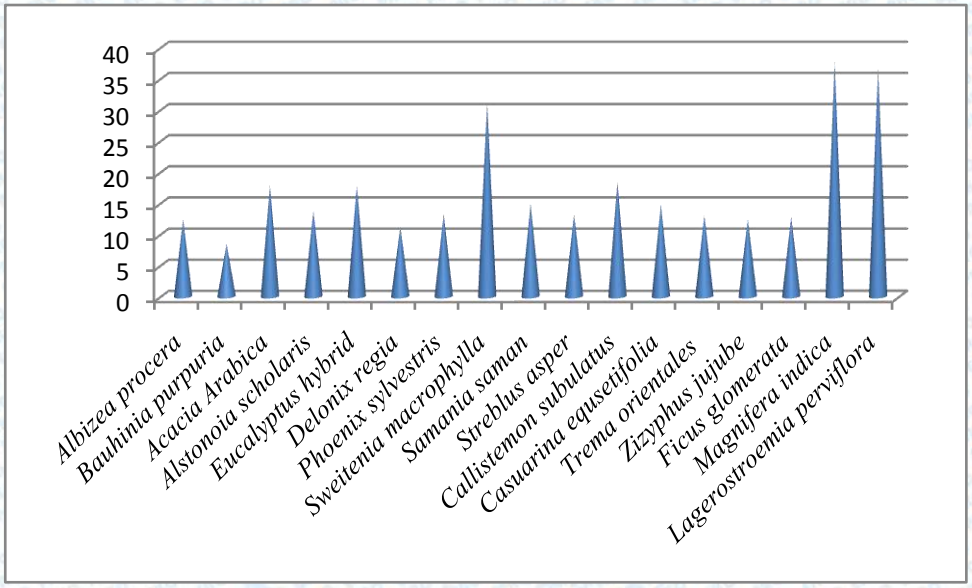
Fig.-2: IVI of tree species in the study area



Canopy cover – a 10m /2m rectangle is used for canopy percentage calculations. It has been found that canopy cover is varies from 5% to 30% throughout the study area.

Diversity Index

The Diversity Index (H') of tree species is 1.23. Shrub and herb diversity index are 1.47 and 1.51 respectively. Though there is dense vegetation near and within the township area but less vegetation is outside the township.

Some Important Ecological notes

Coastal morphology shows the natural structure which protects the coastal environment by absorbing energy from wind, tide and wave action. These species are playing a crucial role in protecting the coast from erosion and flooding (Desai, 2000). There are *Ficus benghalnensis* and *Ficus religiosa*. These are keystone species and, therefore support a lot of faunal species. Ecotone zone of the water body supports

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like *Cassia tora* which in turn is a host plant for butterflies of different species. Swampy marshland behind the Central garage is an ideal habitat for birds, small mammals and reptiles like land monitors, otters etc.

ANNEXURES

TABLE-1: DETAILS OF DIFFERENT STUDY SITES FOR THE ASSESSMENT OF BIODIVERSITY AND ECOLOGICAL STUDY WITHIN HALDIA DOCK AREA.

Sl. No	Site No	Site details	GPS bearing
1	Site – I	The bank of Ganga River and near to floating jetty	22^0 1/ 1// N / 88^0 4/ 17// E
2	Site – II	Beside Haldia Bhawan	22^0 1/ 33// N / 88^0 4/ 52// E
3	Site – III	Behind central garage	22^0 1/ 22// N / 88^0 4/ 14// E
4	Site – IV	Road from township gate to floating jetty	22^0 1/ 29// N / 88^0 4/ 17// E

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TABLE-2: DETAILS OF DIFFERENT STUDY SITES FOR THE ASSESSMENT OF BIODIVERSITY AND ECOLOGICAL STUDY WITHIN PROPOSED AREA.

Site – 1

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Acacia arabica*	28	5
2.	*Samania saman*	35	5

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	15
2	*Adhatoda vesica*	6
3	*Solanum xanthocarpon*	2
4	*Ipomoea batatas*	6
5	*Cassia alata*	1
6	*Datura stramonium*	3

Herb

Sl. No.	Name of species	No.
1	*Blumea lacera*	13
2	*Hemigraphis hirta*	36
3	*Cyanodon dactylon*	96

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Site –II

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Bauhinia purpuria*	34	5
2	*Lagerostroemia perviflora*	68	7
3	*Eucalyptus hybrid*	76	12
4	*Eucalyptus hybrid*	110	14
5	*Callistemon subulatus*	40	5
6	*Casuarina equsetifolia*	45	8

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	1
2	*Ventilago denticulate*	1
3	*Zizyphus oenopliea*	1
4	*Eupatorium odoratum*	67

Herb

Sl. No.	Name of species	No.
1	*Rungia pectinata*	14
2	*Hemigraphis hirta*	18
3	*Cyanodon dactylon*	24
4	*Vernonia ceneria*	1

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Site –III

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Delonix regia*	136	8
2	*Delonix regia*	96	9
3	*Eucalyptus hybrid*	70	9
4	*Eucalyptus hybrid*	110	14
5	*Phoenix sylvestris*	55	4

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	15
2	*Flacourtia indica*	1

Herb

Sl. No.	Name of species	No.
1	*Rungia pectinata*	9
2	*Blumea lacera*	2
3	*Desmodium triflorum*	15
4	*Cyperus rotundus*	6
5	*Cyanodon dactylon*	5
6	*Evolvulus alsenoides*	13
7	*Evolvulus numularius*	4

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Site –IV

This is a road from township gate to floating jetty. Roadside plantation was both side of the road. One side by *Swetenia macrophyla* and other side is *Delonix regia*. GBH of *Swetenia macrophyla* are varies from 39 cm to 126cm and heights are 4 to 6 m. whereas GBH of *Delonix regia* varies from 36to116cm and heights are 4 to 7m.

TABLE-3: PLANT SPECIES DIVERSITY IN THE STUDY AREA

Table-3A: Tree species

Sl. No.	Scientific name of Plants	Family
1	*Acacia Arabica*	fabaceae
2	*Acacia auriculiformis*	Fabaceae
3	*Albizea procera*	Fabaceae
4	*Alstonia scholaris*	Apocynaceae
5	*Araucaria heterophylla*	Araucariaceae
6	*Azadirachta indica*	Meliaceae
7	*Bauhinia purpuria*	Fabaceae
8	*Borassus fabilifer*	Arecaceae
9	*Callistemon subulatus*	Myrtaceae
10	*Casuarina equsetifolia*	Casuarinaceae
11	*Cocos nucifera*	Arecaceae
12	*Dalbergia sissoo*	Fabaceae

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13	*Delonix regia*	Fabaceae
14	*Eucalyptus hybrid*	Myrtaceae
15	*Eujenia jambolana*	Myrtaceae
16	*Ficus benghalensis*	Moraceae
17	*Ficus infectoria*	Moraceae
18	*Ficus religiosa*	Moraceae
19	*Lagerstromia perviflora*	Lythraceae
20	*Mangifera indica*	Anacardiaceae
21	*Mymusops elangi*	Sapotaceae
22	*Phoenix sylvestris*	Arecaceae
23	*Roystonea regia*	Arecaceae
24	*Samania saman*	Fabaceae
25	*Saraca asoca*	Fabaceae
26	*Streblus asper*	Moraceae
27	*Swietenia macrophylla*	Meliaceae
28	*Tabernaemonta divaricata*	Apocynaceae
29	*Techtona grandis*	Lamiaceae
30	*Trema orientales*	Urticaceae
31	*Zizyphus jujube*	Rhamnaceae

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Table-3B: Shrub species

Sl. No.	Scientific name of Plants	Family
1	*Adhatoda vesica*	Acanthaceae
2	*Calotropis procera*	Apocynaceae
3	*Cassia alata*	Fabaceae
4	*Clerodendron infortunatum*	Verbenaceae
5	*Datura metal*	Solanaceae
6	*Eupatorium odoratum*	Asteraceae
7	*Euphorbia nerrifolia*	Euphorbiaceae
8	*Ficus hispida*	Moraceae
9	*Flacourtia indica*	Flacourtiaceae
10	*Ipomoea batatas*	Convolvulaceae
11	*Pedilanthus sp.*	Euphorbiaceae
12	*Polyalthia cerasoides*	Fabaceae
13	*Polygonum barbatum*	Polygonaceae
14	*Ricinus communis*	Euphorbiaceae
15	*Solanum xanthocarpon*	Solanaceae
16	*Typha angustifolia*	Typhaceae
17	*Ventilago denticulate*	Rhamnaceae

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18	*Vitex negundo*	Verbenaceae
19	*Zizyphus oenopliea*	Rhamnaceae

Table-3C: Herb species

Sl. No.	Scientific name of Plants	Family
1	*Aerva aspera*	Amaranthaceae
2	*Ageratum conyzoides*	Asteraceae
3	*Alocasia esculanta*	Liliaceae
4	*Alternanathera philoxeroides*	Amaranthaceae
5	*Alternanathera sessiles*	Amaranthaceae
6	*Amaranthus viridis*	Amaranthaceae
7	*Andropogon aciculatus*	Poaceae
8	*Blumea lacera*	Asteraceae
9	*Boerhavia repens*	Nyctaginaceae
10	*Brachiaria reptans*	Poaceae
11	*Cassia tora*	Malvaceae
12	*Centella asiatica*	Apiaceae
13	*Chenopodium album*	Chenopodiaceae
14	*Chrysopogon aciculatus*	Poaceae

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15	*Coccinia grandiflora*	Cucurbitaceae
16	*Commelina benghalensis*	Commelinaceae
17	*Commelina diffusa*	Commelinaceae
18	*Croton bonplandianum*	Euphorbiaceae
19	*Crozophora sp.*	Euphorbiaceae
20	*Cuscuta reflexa*	Cucutaceae
21	*Cyanodin dactylon*	Poaceae
22	*Cyperus articulantus*	Cyperaceae
23	*Cyperus corymbosus*	Cyperaceae
24	*Cyperus difformis*	Cyperaceae
25	*Cyperus distans*	Cyperaceae
26	*Cyperus iria*	Cyperaceae
27	*Cyperus kyllinga*	Cyperaceae
28	*Cyperus rotundus*	Cyperaceae
26	*Dactyloctenium egypticum*	Poaceae
30	*Dentella repens*	Rubiaceae
31	*Desmodium triflorum*	Fabaceae
32	*Digitaria sanguinales*	Poaceae
33	*Eclipta alba*	Asteraceae

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34	*Eclipta protrata*	Asteraceae
35	*Eleusine indica*	Poaceae
36	*Evolvulus alsenoides*	Convolvulaceae
37	*Evolvulus numularius*	Convolvulaceae
38	*Fimbristylis japonicum*	Cyperaceae
39	*Grangea madaraspatana*	Asteraceae
40	*Heliotropium indicum*	Boraginaceae
41	*Hemigraphis hirta*	Acanthaceae
42	*Hygrophila difformis*	Acanthaceae
43	*Ipomoea aquatic*	Convolvulaceae
44	*Mukia scabroides*	Cucurbitaceae
45	*Murdania vaginata*	Commelinaceae
46	*Oldenlandia corymbosa*	Rubiaceae
47	*Oxalis corniculata*	Oxalidaceae
48	*Panicum paludosum*	Poaceae
49	*Paspalidium punctatum*	Poaceae
50	*Perotis indica*	Poaceae
51	*Phyla nodiflora*	Verbenaceae
52	*Polygonum barbetum*	Polygonaceae

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53	*Ruellia tuberose*	Acanthaceae
54	*Rungia pectinata*	Asteraceae
55	*Solanum nigram*	Solanaceae
56	*Spilanthus acmella*	Asteraceae
57	*Vernonia cineria*	Asteraceae
58	*Wedelia chinensis*	Asteraceae

Table-3D: Aquatic species

Sl. No.	Scientific name of Plants	Family
1	*Colocasia esculentans*	Araceae
2	*Eichorrnia crassipes*	Pontederiaceae
3	*Enhydra fluctuans*	Ateraceae
4	*Lemna perpusilla*	Araceae
5	*Marsilea minuta*	Marsileaceae
6	*Pistia stratiotes*	Araceae

Table-3E: Mangrove species

Sl. No.	Scientific name of Plants	Family
1	*Acanthus volubilis*	Acanthaceae

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2	*Acrostichium aureum*	Pteridaceae
3	*Tamarix troupii*	Tamaricaceae

TABLE – 4: IVI OF TREE SPECIES IN THE STUDY AREA

Sl. No.	Species	R Den	RF	R Dom.	IVI
1	*Albizea procera*	4.17	5.41	2.84	12.42
2	*Bauhinia purpuria*	2.78	5.41	0.28	8.47
3	*Acacia Arabica*	4.17	5.41	8.24	17.82
4	*Alstonoia scholaris*	4.17	5.41	4.19	13.77
5	*Eucalyptus hybrid*	4.17	5.41	8.24	17.82
6	*Delonix regia*	5.56	5.41	0.2	11.17
7	*Phoenix sylvestris*	4.17	5.41	3.65	13.23
8	*Sweitenia macrophylla*	5.17	6.41	19.59	31.17
9	*Samania saman*	6.95	2.70	5.25	14.9
10	*Streblus asper*	4.17	5.41	3.65	13.23
11	*Callistemon subulatus*	5.56	10.81	1.99	18.36
12	*Casuarina equsetifolia*	8.34	5.41	1.07	14.82
13	*Trema orientales*	6.95	5.41	0.7	13.06
14	*Zizyphus jujube*	8.34	2.70	1.36	12.4

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15	*Ficus glomerata*	6.95	2.70	3.13	12.78
16	*Magnifera indica*	6.95	9.42	20.6	37.64
17	*Lagerostroemia perviflora*	12.51	10.82	14.05	36.57
		100.08	100.06	100.3	300.44

Photographs of Studied Sites

Photo -1: *Adhatodavesica,* an important medicinal plants.

Photo-2: *Datura metal*, an important medicinal plant.

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Photo-3:A water body near Haldia Bhawan

Photo – 4: *Tamarixtroupii*, the salt cedar.

Photo – 5:Wasteland behind central garage

Photo-6: Avenue tree of *S. macrophylla* and *D. regia*

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Photo-7: large *Albezialebbek* tree

Photo-8: Degraded land with scattered *Acacia arabica*.

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9.0 Conclusion

Environmental monitoring for the project was performed as per the given schedule in the contract and the sample were carried out for first season i.e.Oct-Dec-2019 and all the monitoring results of this report were checked and reviewed and this report provides an assessment of the most important impacts i.eAir quality, Noise measurements, Marine water quality for Physico –Chemical and Biological parameters and Marine Sediment quality for Physico-Chemical and Biological parameters along with the Green belt survey.

As per the tested and given results, we can say that no exceeded values of results was recorded, only noise monitoring level was recorded at the edge of standard values in few locations but it was found bit lower than standard the cause might be the sea shore as the monitoring site is just nearby of that sea edge, but there was no direct influence of any source.

However, still noise level is not considered as higher as the CPCB standard is 75dB for the industrial zones and the reported values are less than the standard.

Other than noise, the rest things are found in controlled condition and as per the Green belt survey, we came to know that Dock is maintaining very good Green belt in surrounding areas with several of species. The Green belt is found around more than 50% area of Dock premises and it will to help to minimize the level of Environmental parameters.

**********End of Report**********

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ENVIRONMENTAL MONITORING
POST MONSOON SEASON -OCT-DEC 2019

*at*KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

Submitted To:

KOLKATA PORT TRUST
Haldia Dock Complex
Haldia Townahip, Haldia
Distt: PurbaMedinpur (West Bengal)

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CONTENT

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1. Summary

Kolkata Port Trust, Haldia Dock Complexhasawardedtheprojecttitled"POST PROJECT MONITORING OF DIFFERENT ENVIRONMENTAL PARAMETERS UNDER HALDIA DOCK COMPLEX, HALDIA" to M/s. Eko Pro Engineers Private Limited, Ghaziabad vide work order No. I&CF/IZ&R/T/296/702 dated 10.10.2019.

The main objective of environmental Monitoring is to take the environmental observations, inside and outside the Dock complex.

A comprehensive environmental monitoring program has been planned to monitor data for the Yearly period of **October 2019 – December 2019**. The monitored data of Ambient Air Quality, Fugitive Emission, Ambient Noise Quality, Marine Water Quality, Sediment Quality and green belt study in an around Haldia Dock complex.

In this study, multiple and periodic sampling has been carried out for Ambient air Quality. The frequency of Air monitoring is followed twice a week for a season.

Ambient Noise monitoring is followed once in month i.e. Oct- Dec 2019. The observations of total twelve locations were taken.

Marine Water quality samples for Physico-Chemical Analysis and Biological Analysis are carried out once in season.

Marine Sediment Quality samples for physico-chemical analysis and biological analysisalso being carried out once as the frequency for the same is once in a season.

Green Belt Survey also been conducted in the Dock premises once in season.

Eko Pro Engineers Private Limited mobilized sampling team for conducting the Water, Noise, sediment and Air monitoring in Haldia Dock Complex.

All the work was carried out by team and submitted the samples in lab.

We are very thankful to the official staff of Dock complex to support us and make this successfully happen. A big support of official staff we had at site to get the study and sample collection job done and gave us such type of opportunity.

The results and interpretation of study and monitoring is follows

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2. Ambient Air Quality

2.1 Selection of Monitoring Station

Ambient Air Quality Monitoring (AAQM) stations were set up at four locations with due consideration of meteorological conditions on synoptic basis, topography of the study area, representatives of regional background air quality for obtaining baseline and consultation with Halia Dock Complex officials. The monitoring locations are given in **Table 2.1**

Table 2.1: Monitoring Station of Ambient Air Quality (AAQ)

S.NO.	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	AAQ-1	Near MBC Jetty	22°01'01.07"N	88°04'06.56"E
2	AAQ-2	Top of Marine House	22°01'32.55"N	88°05'17.88"E
3	AAQ-3	Top of RZ Office	22°01'21.80"N	88°03'43.83"E
4	AAQ-4	Chrinjibpur Office	22°03'08.55"N	88°05'48.64"E

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Figure 2.1 AAQ Location

2.2 Sampling Methodology and Parameter Selection

Ambient air quality monitoring has been carried out twice in each location during the study period (Post Monsoon-October to November). The baseline data of ambient air has been generated for the following parameters as mentioned below.

- SPM
- PM_{10}
- $PM_{2.5}$
- Sulphur-dioxide (SO_2)
- Oxides of Nitrogen (NO_X)
- Carbon monoxide (CO)

It was ensured that the equipment was placed at a height of at least 3 to 4 m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The distance of the sampler from

any air flow obstacle i.e. buildings, walls, was more than two times the height of the obstacle. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results. Monitoring has been carried out as per the latest CPCB and MoEF guidelines and notifications.

2.3 Sampling and Analysis Technique

With a view to collecting the samples, Envirotech Make Calibrated Respirable Dust Samplers (SL No.-2757-DTL-2019 & 2054-DTE-2016) along with Gaseous attachment and Fine Particulate Matter (FPS-Instrument SL No.115-A-2018 & 892-DTL-2019) have been used. The RDS is capable of drawing air at a flow rate of 0.95 to 1.3 m^3/min with very little pressure drop for RDS and FPS is designed to operate at an air flow rate of 1m^3/hr. Filter papers (MGF 2000 and PTFE (46.2 dia)) were used for the collection of particulate matters and heavy metals. SO_2&NOx were collected by drawing air at a flow-rate of 0.5 liters per minute (lpm) through an absorbing solution for the duration of 24 hrs. Ammonia and ozone were collected drawing air flow rate of 1 liter per minute (lpm) for the duration of 1 hour. Sampling and analysis methodology adopted is given in Table 2.2 and National Ambient Air Quality Standards is given in Table 2.3.

Table 2.1: Sampling & Analysis Methodology

Sl. No.	Parameter	Methodology
1	Suspended Particulate Matter (SPM) (µg/m^3)	Respirable Dust Sampler (Gravimetric method)
2	Particulate Matter 10 (PM 10) (µg/m^3)	Respirable Dust Sampler (Gravimetric method)
3	Particulate Matter 2.5 (PM 2.5) (µg/m^3)	APM 550 Fine Particulate Sampler (Gravimetric method)
4	Sulphur Dioxide SO_2 (µg/m^3)	West and Gaeke Method
5	Oxides of Nitrogen (µg/m^3)	IS 5182, Part 6, Jacob &Hochheiser modified
6	Carbon monoxide (mg/m^3)	IS 5182, Part 10, Non-dispersive Infrared Absorption method

2.4 Duration of Sampling

The duration of sampling of fine particulate matter ($PM_{2.5}$), Respirable particulate matter (PM_{10}), SO_2 and NOx was each twenty four hourly continuous sampling per day and CO was sampled for eight hours continuous monitoring. The monitoring was conducted for two days in a week for one month in each quarter. The monitoring parameters and frequency of sampling are describe in tabular below.

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Table- 2.3 Monitored Parameters and Frequency of Sampling

Parameters	Sampling Frequency
Fine Particulate Matter ($PM_{2.5}$)	24 hourly sample twice a week for one months
Respirable Particulate Matter (PM_{10})	24 hourly sample twice a week for one months
Sulphur dioxide (SO_2)	24 hourly sample twice a week for one months
Nitrogen dioxide (NO_2)	24 hourly sample twice a week for one months
Carbon Monoxide (CO)	8 hourly samples twice a week for one months

Table 2.4: National Ambient Air Quality Standards

Pollutant	Concentration in µg/m³ except for CO in mg/m³		
	Time	Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
Sulphur Dioxide (µg/m³)	Annual Avg.* 24 hours**	50 80	20 80
Nitrogen Dioxide (µg/m³)	Annual Avg. 24 hours	40 80	30 80
Carbon monoxide (mg/m³)	8 hours 1 hour	2 4	2 4
PM10 (µg/m³)	Annual Avg. 24 hours	60 100	60 100
PM2.5 (µg/m³)	Annual Avg. 24 hours	40 60	40 60
Ozone O_3 (µg/m³)	8 hourly 1 hourly	100 180	100 180
Lead Pb (µg/m³)	Annual Avg. 24 hours	0.50 1	0.50 1
Ammonia NH_3 (µg/m³)	Annual Avg. 24 hours	100 400	100 400
Arsenic As (µg/m³)	Annual Avg.	06	06
Nickel Ni (ng/m³)	Annual Avg.	20	20
Pyro Benzene (BaP) (ng/m³)	Annual Avg.	1	1

Source: Gazette of India Notification, dated 16th Nov, 2009

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**** Annual Arithmetic Mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals***
***** 24 hourly or 8 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed the limits but not on two consecutive days of monitoring***

2.5 Analytical Result

Table 2.5: Ambient Air Quality-1 (Near MBC Jetty)

S.No.	Parameters	AAQ – 1 Near MBC Jetty							
		1st Round	2nd Round	3rd Round	4th Round	5thRound	6th Round	7th Round	8th Round
		15.11.19	16.11.19	23.11.19	25.11.19	10.12.19	12.12.19	15.12.19	16.12.19
i	PM_{10} (µg/m³)	85.6	82.9	80.9	81.6	84.3	79.8	81.4	82.5
ii	$PM_{2.5}$ (µg/m³)	46.5	48.3	48.6	50.8	49.7	47.9	48.2	49.8
iii	SO_2(µg/m³)	9.25	10.2	10.6	9.56	9.45	9.36	10.4	10.8
iv	NO_2(µg/m³)	23.4	26.2	21.5	19.3	22.3	24.3	25.3	23.9
v	CO(mg/m³	0.65	0.69	0.71	0.69	0.72	0.73	0.71	0.68

Table 2.6: Ambient Air Quality-2 (Top of Marine House)

S.No.	Parameters	AAQ – 2 Top of Marine House							
		1stRound	2nd Round	3rd Round	4th Round	5th Round	6th Round	7thRound	8th Round
		19.11.19	22.11.19	24.11.19	28.11.19	30.11.19	03.12.19	08.12.19	10.12.19
i	PM_{10} (µg/m³)	92.3	94.2	90.4	89.4	88.3	89.5	91.7	89.1
ii	$PM_{2.5}$ (µg/m³)	52.6	51.7	53.8	51.9	50.9	53.2	52.7	51.6
iii	SO_2(µg/m³)	12.2	13.5	13.8	12.6	13.9	12.5	12.8	13.6
iv	NO_2(µg/m³)	30.4	32.6	29.5	28.3	30.4	30.3	32.4	31.6
v	CO(mg/m³	0.86	0.96	0.86	0.86	0.94	0.88	0.87	0.86

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Table 2.7: Ambient Air Quality-3 (Top of RZ Office)

S.No.	Parameters	AAQ – 1 Top of RZ Office							
		1st Round	2nd Round	3rd Round	4th Round	5thRound	6th Round	7th Round	8th Round
		19.11.19	22.11.19	24.11.19	28.11.19	30.11.19	03.12.19	08.12.19	10.12.19
i	PM_{10} (µg/m³)	84.6	85.9	81.7	84.9	89.3	80.7	82.6	84.3
ii	$PM_{2.5}$ (µg/m³)	46.9	49.6	50.3	46.3	45.9	50.1	51.8	52.9
iii	SO_2(µg/m³)	8.36	9.26	8.36	9.12	9.58	10.2	9.36	9.14
iv	NO_2(µg/m³)	18.3	20.3	19.2	19.8	18.4	21.3	20.6	18.6
v	CO(mg/m³	0.56	0.62	0.65	0.62	0.63	0.59	0.58	0.62

Table 2.8: Ambient Air Quality-4 (Chrinjibpur Office)

S.No.	Parameters	AAQ – 4 Chrinjibpur Office							
		1stRound	2nd Round	3rd Round	4th Round	5th Round	6th Round	7thRound	8th Round
		13.11.19	14.11.19	20.11.19	21.11.19	05.12.19	06.12.19	15.12.19	16.12.19
i	PM_{10} (µg/m³)	95.3	91.7	93.7	94.2	90.5	95.1	91.8	93.2
ii	$PM_{2.5}$ (µg/m³)	55.9	52.7	57.3	52.9	54.3	54.9	52.8	55.8
iii	SO_2(µg/m³)	11.5	13.2	12.8	13.6	12.4	13.6	12.8	14.3
iv	NO_2(µg/m³)	32.5	33.6	32.5	31.6	30.4	32.8	31.2	32.4
v	CO(mg/m³	0.95	0.96	0.85	0.94	0.96	0.85	0.93	0.84

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2.6 Interpretation

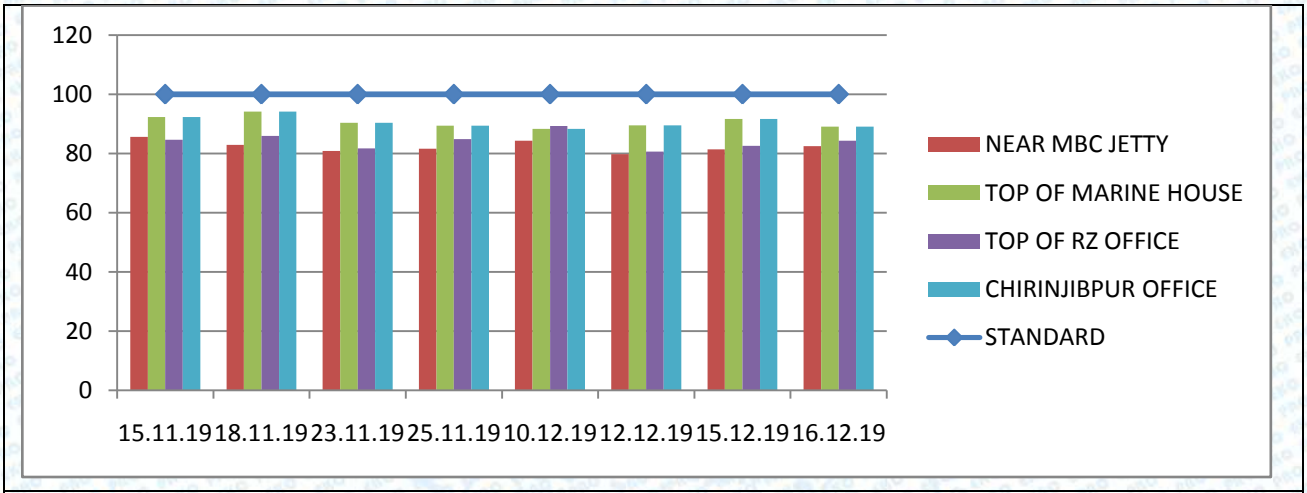

Figure 2.2: PM_{10}

The PM_{10} concentration varies between 79.8 µg/$m^3$to 95.3 µg/m^3during the study period (in post monsoon season October to December 2019). The results were compared with the National Ambient Air Quality Standards 2009. The values were found within the permissible limit. The various sources of air pollution are observed in the study area i.e. industrial, traffic, urban and rural activities.

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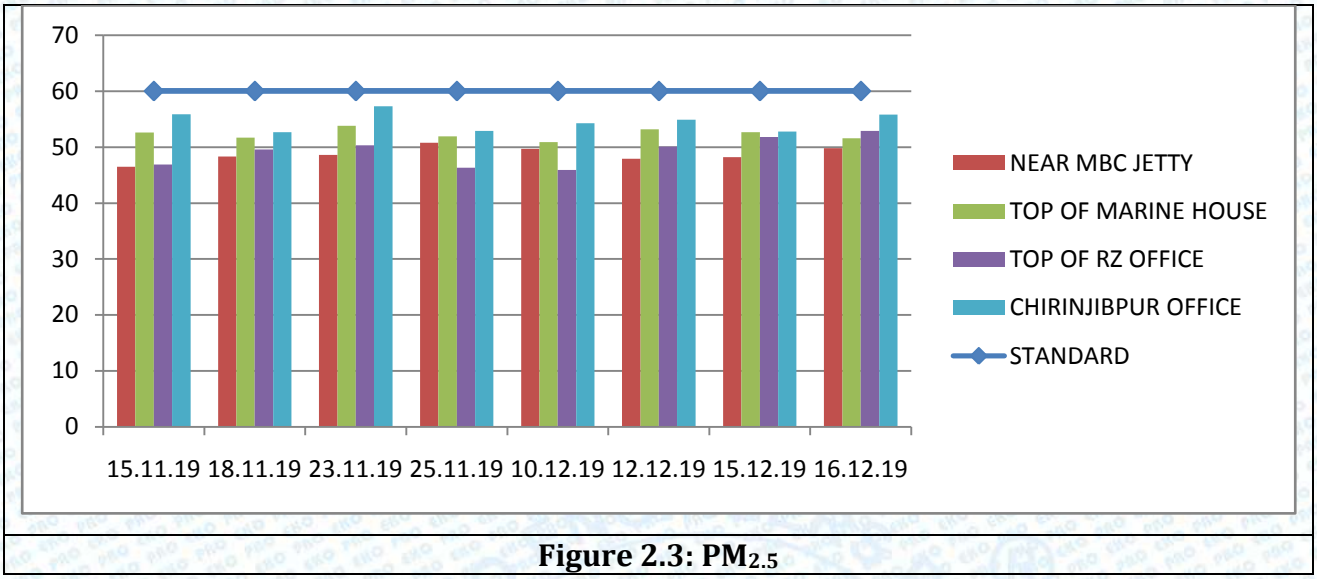

Figure 2.3: $PM_{2.5}$

The $PM_{2.5}$ concentration varies between45.9 µg/m^{3}to 57.3 µg/m^{3}in post monsoon season (October to December 2019). However, the levels for $PM_{2.5}$were found to be below the National Ambient Air Quality Standards (< 60µg/m^3) of NAAQS: 2012.Populations subjected to long-term exposure to particulate matter has a significantly higher cardiovascular incident and mortality rate. Short-term acute exposures subtly increase the rate of cardiovascular events within days of a pollution spike.

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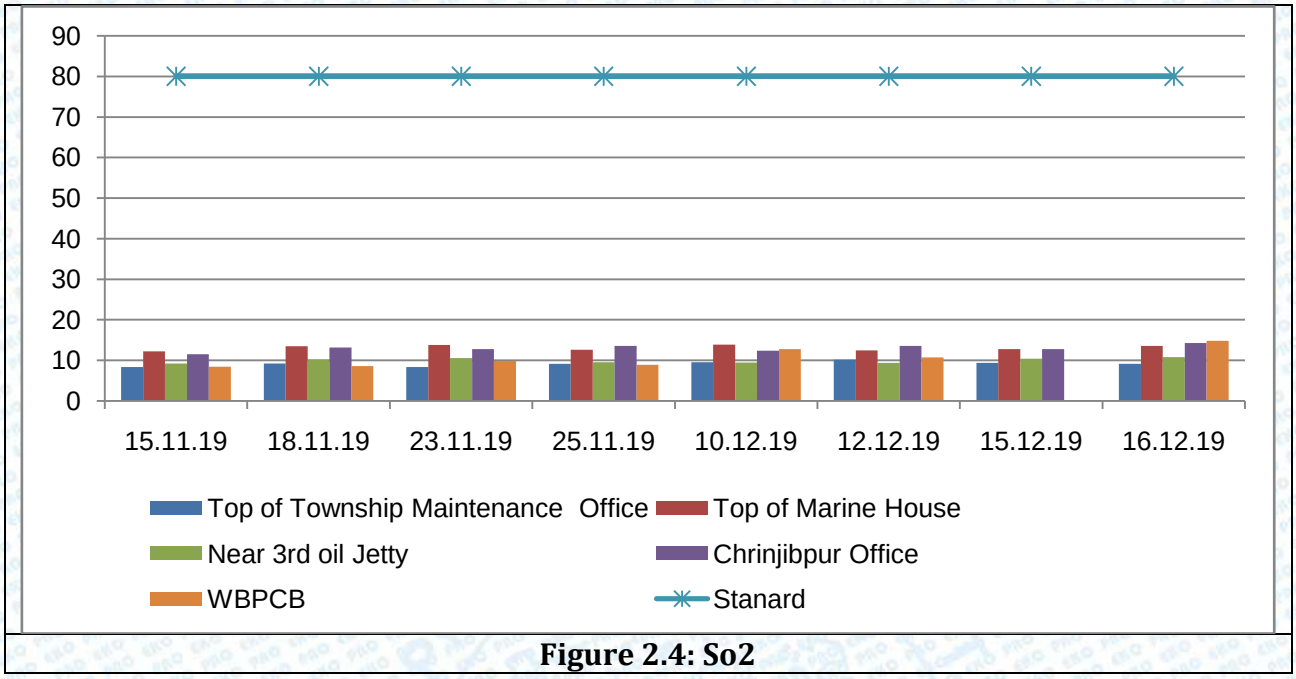

Figure 2.4: So2

The SO_2 concentration varies between 8.36 µg/m³to 14.3 µg/m³during the study period (October to December 2019), which is far below that national ambient air quality standard (< 80µg/M3) of NAAQS: 2012.The source of SO_2 in the study area is mainly from burning fuels containing sulfur. Other anthropogenic sources are emissions from domestic burning and vehicles Exposure to sulfur dioxide in the ambient air has been associated with reduced lung function, increased incidence of respiratory symptoms and diseases, irritation of the eyes, nose, and throat.

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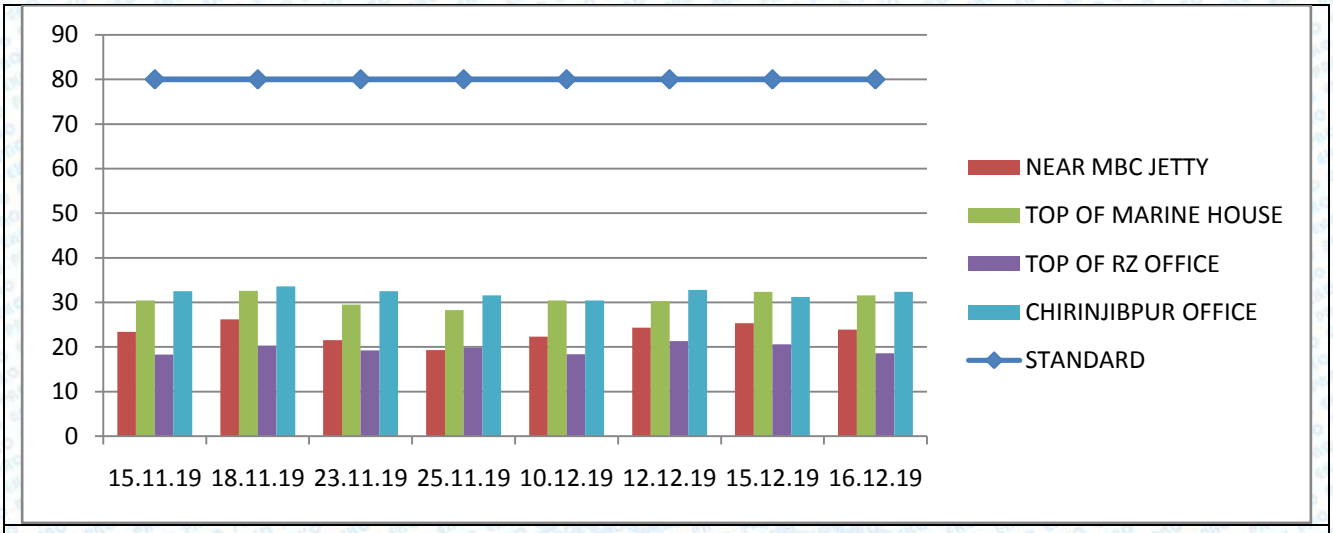

Figure 2.5: NO_{X2}

The NO_2 concentration varies between 18.3 µg/m³to 32.8 µg/m³ in post monsoon season. The values of Nitrogen dioxide were found well below the NAAQ standard. The primary sources of NO_2 are motor vehicles, electric utilities, and other industrial and residential sourcesthat burn fuels. NO_2 is one of the main ingredients involved in the formation of ground level zone, which can trigger serious respiratory problems.

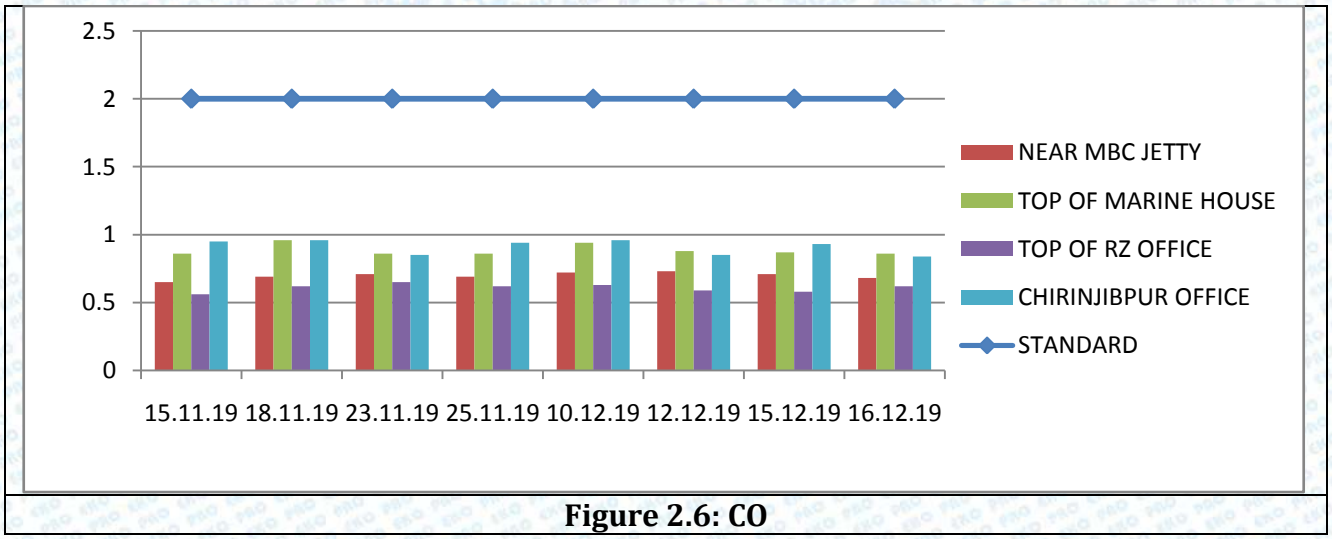

Figure 2.6: CO

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The CO concentration varies between 0.56 µg/m^{3}to 0.96 µg/m^3 in post monsoon season. The values of CO were found well below the NAAQ standard.

2.7 Air Quality Monitoring Site Photograph

AAQ1: Near MBC Jetty

AAQ2: Top of Marine House

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AAQ3: Top of RZ Office (Township)	AAQ4: Chrinjibpur Office

3. Ambient Noise Quality

3.1 Selection of Monitoring Station

Ambient Noise Quality Monitoring stations were set up at twelve locations for the period of October to December 2019. The monitoring station were setup by filed visit, identify the source noise, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 3.1**

Table 3.1: Monitoring Station of Ambient Noise Quality

S.NO	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	NQ-1	Chrinjibpur OB Gate	22°03'08.89"N	88°05'47.98"E
2	NQ-2	GC Berth Main Gate	22°02'45.86"N	88°05'12.08"E
3	NQ-3	Jawahar Tower Main Gate	22°01'05.98"N	88°04'02.71"E
4	NQ-4	MBC Jetty / Floating Jetty	22°01'11.83"N	88°04'34.53"E
5	NQ-5	CJB Gate	22°03'01.71"N	88°05'53.14"E
6	NQ-6	Lock Gate	22°01'29.11"N	88°05'06.40"E
7	NQ-7	Marine House	22°01'31.80"N	88°05'17.26"E
8	NQ-8	Master Control	22°02'02.16"N	88°05'25.13"E
9	NQ-9	Port Hospital (Township)	22°01'25.96"N	88°03'44.03"E
10	NQ-10	Cluster 4/61 (Township)	22°01'06.30"N	88°03'38.53"E
11	NQ-11	DAV School (Township)	22°01'25.33"N	88°03'34.30"E
12	NQ-12	Gate No.4 (Township)	22°01'35.06"N	88°03'54.55"E

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Figure 3.1 Ambient Noise Quality Location

3.2 Sampling Methodology and Parameter Selection

Noise monitoring has been carried out with using sound level meter ((HTC SL 1352) at monthly basis, in post monsoon season. (October - December, 2019). Noise level monitoring was carried out for 24 hours. Noise levels measured over a given period of time of interval, enable to describe scenario of noise using statistical techniques.

a) Leq (d)

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b) Leq(n)
c) L10
d) L50
e) L90
f) Lmax
g) Lmin
h) Ldn
i)

- Lday: Average noise levels between 6.00 hrs to 22.00hrs
- Lnight: Average noise levels between 22.00 hrs to 6.00hrs.

3.3. Sampling Techniques with Standards

The HTC make sound level meter was used to record the sound data and the model number of used device is SL 1352 i.e. designed on the basis of "Type 2" professional requirements. The instrument has a frequency weighting of "A" type and allows the user to select Slow or Fast mode of measurement. A built-in Data Logger can record all the important Sound Level parameters in Non-Volatile Flash memory for 24 hours making detailed field data collection very simple. Each record contains the observation of each second, with the detailed data, L_{EQ}, L_{MIN} and L_{MAX} and many others calculations also can be drawn. Sound Pressure Level and Sound Exposure Level (SEL) observed during the recording interval. A built-in Real Time Clock maintains a Date and Time stamp in the recorded data.

Noise survey is conducted in areas where noise exposure is likely to be maximum. Noise level refers to the level of sound. A noise survey involves measuring noise level at selected locations throughout an entire plant or sections to identify noisy areas. This is usually done with a sound level meter (SLM). A reasonably accurate sketch showing the locations of workers and noisy machines is drawn. Noise level measurements are taken at a suitable number of locations around the area. National Ambient Noise Quality Standards as per CPCB is given in Table 3.2 to compression with the observed results.

Table 3-2: Ambient Noise Quality Standards as per CPCB

Type of Area	Limits in dB(A) Leq*	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

*-dB (A) Leq denotes the time weighted average of the level sound in decibels on scale A which is relatable to human hearing
Source: Pollution Control Acts, Rule and Notifications issued there under, by Pollution Control Law Series: PCLS/02/2006(Fifth Edition) of Central Pollution Control Board, January 2006, pp 926. Day and Night time shall mean from 6:00 a.m. to 10:00 p.m. and 10:00 p.m. to 6:00 a.m. respectively.

3.4 Analytical Result

Table 3.3: Location wise Noise Quality Results

SN	Parameters	NQ-1 Chrinjibpur OB Gate	NQ-2 GC Berth Main Gate	NQ-3 Jawahar Tower Main Gate	NQ-4 MBC Jetty / Floating Jetty	NQ-5 CJB Gate	NQ-6 Lock Gate	NQ-7 Marine House	NQ-8 Master Control	NQ-9 Port Hospital Township	NQ-10 Cluster 4/61 (Township)	NQ-11 DAV School (Township)	NQ-12 Gate no.4 (Township)
1	Leq (d)	66.3	74.9	67.2	74.3	73.5	62.8	64.3	65.8	64.9	65.8	64.7	66.8
2	Leq(n)	49.5	53.8	48.3	55.3	52.3	50.2	48.3	49.8	48.6	47.3	48.3	49.2
3	L10	65.3	73.1	66.3	73.1	72.4	61.4	62.9	64.3	63.2	64.8	63.9	65.1
4	L50	59.3	64.2	58.3	66.8	63.2	57.9	58.3	58.4	57.3	57.9	58.3	59.8
5	L90	51.6	54.9	50.4	56.9	52.9	52.3	50.1	51.8	49.8	49.7	50.4	51.3
6	Lmax	78.3	81.3	85.4	85.3	80.2	75.3	74.3	76.5	77.4	76.5	78.3	78.9
7	Lmin	40.3	45.2	41.6	43.5	43.1	42.3	40.6	39.8	41.2	38.6	39.5	41.7
8	Ldn	57.9	64.4	57.8	65.3	62.9	56.5	56.3	57.8	56.8	56.6	56.5	**58.0**

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3.5 Interpretation

In the study area, noise source was observed only by vehicular movement & construction activities. High wind velocity in the river front area is another major source for high sound level in the study area. Noise levels were observed below the CPCB standards for Ambient Noise Quality in day time &night time.

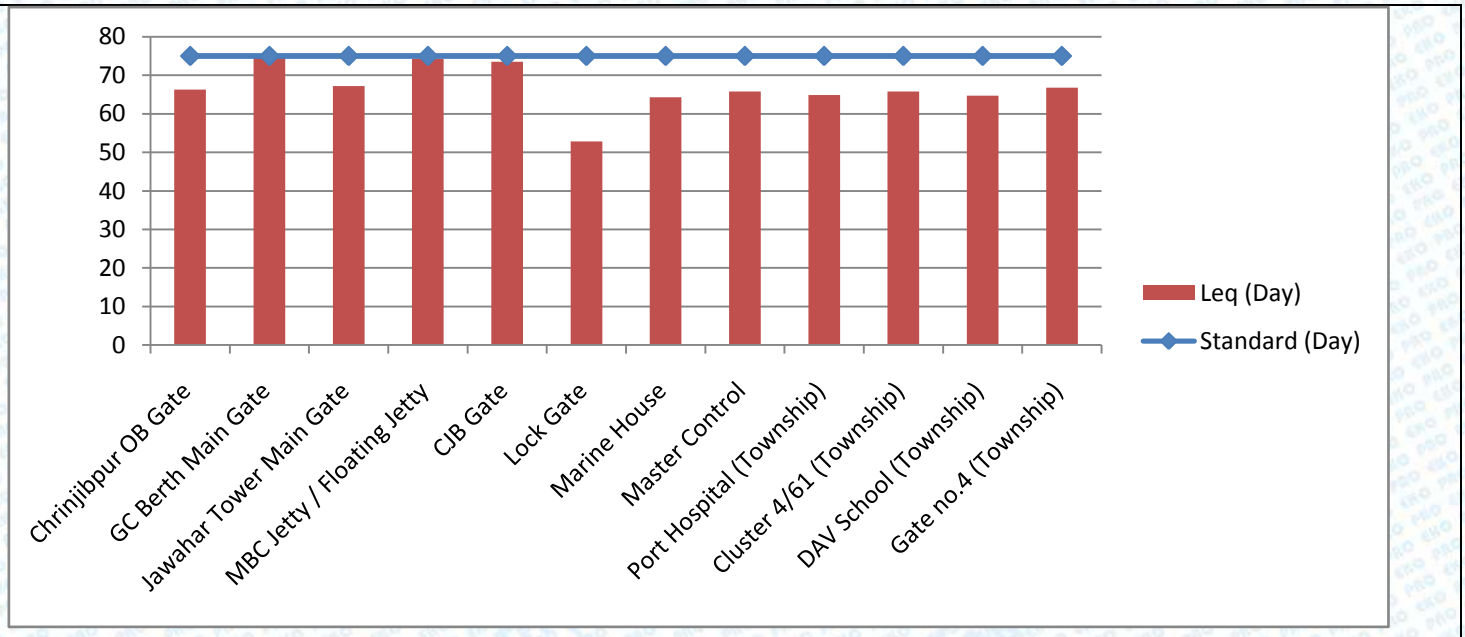

Fig:5 Noise Quality in Day Time

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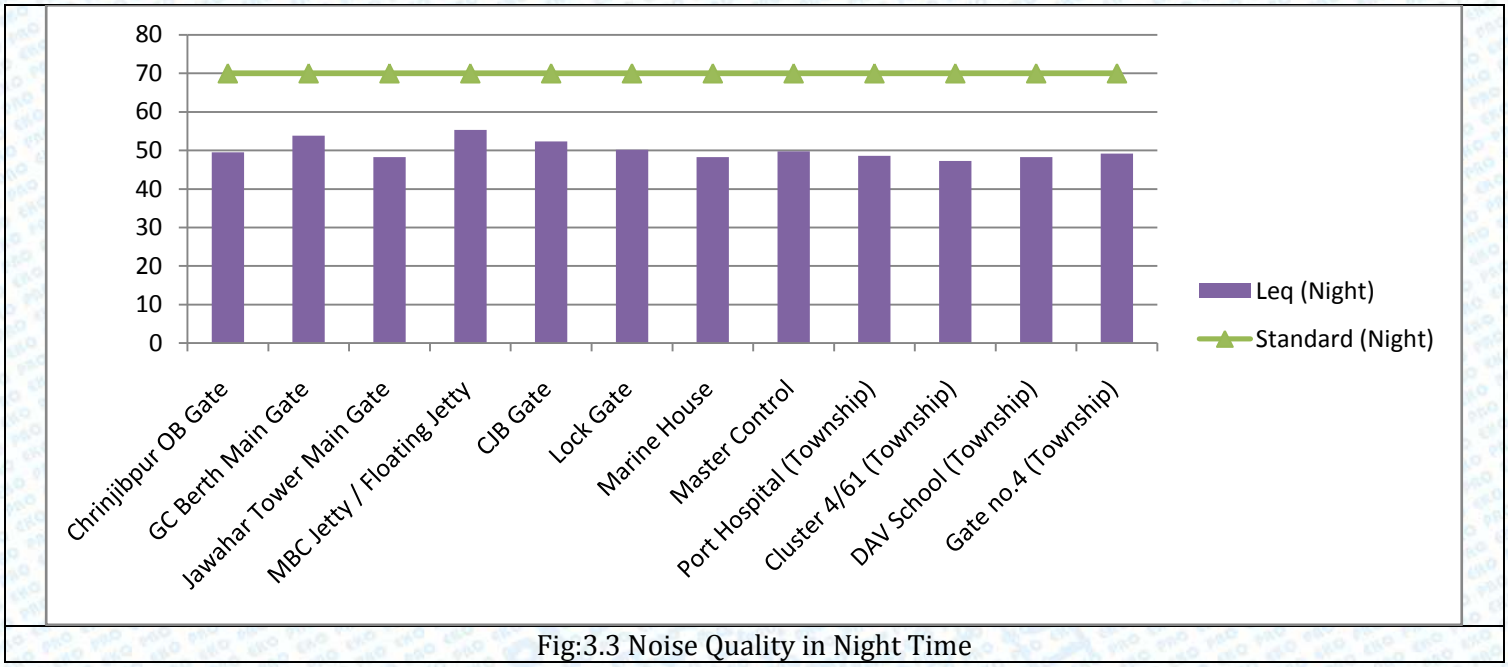

Fig:3.3 Noise Quality in Night Time

3.6 Noise Quality Monitoring Site Photograph

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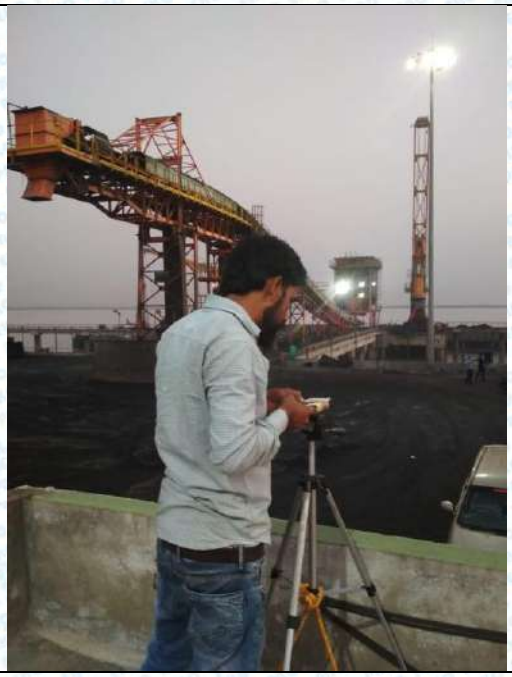
N1: ChrinjibPur Main Gate	N2: GC Berth Main Gate Noise
	
N3: Jawahar Tower	N4: MBC Jetty
	
N5: CJB gate	N6: Lock Gate

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N7: Marine House

N8: Master Control

N9: Port Hospital (Township)

N10: Gate No. 4 (Township)

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N11: DAV Schol (Township)	N12: Cluster 4 Quarter No 61

4. Water Quality

4.1 Selection of Monitoring Station

Water Quality Monitoring stations were set up at four locations. The monitoring stations were setup by filed visit, sensitive location of the site and official discussion with the Halia Dock Complex officials. The monitoring locations are given in **Table 4.1**

Table 4.1: Monitoring Station of Water Quality

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Amit Saxena
(Quality Manager)

S.No	STATION CODE	LOCATION	LATITUDE	LONGITUDE
1	WQ-1	Near 1st Oil Jetty	22°01'55.32"N	88°06'03.16"E
2	WQ-2	Near 2nd Oil Jetty	22°01'43.42"N	88°05'50.88"E
3	WQ-3	Near 3rd Oil Jetty	22°01'02.13"N	88°04'32.26"E
4	WQ-4	Near Lock Gate	22°01'19.59"N	88°05'11.12"E

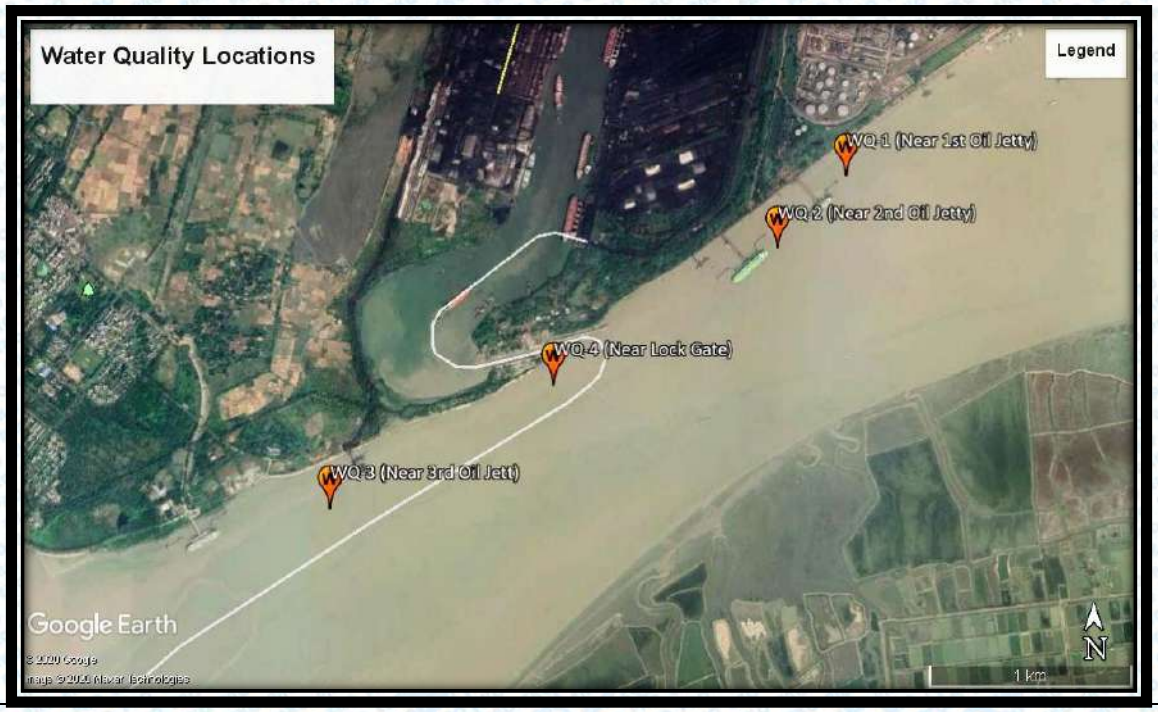

Figure 4.1 Water Quality Location

4.2 Sampling Methodology and Parameter Selection

The parameter selections for the marine sediment quality are described below.

A. Physio-Chemical Parameters

- Colour
- Turbidity
- pH
- Electrical Conductivity (EC)

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- Total Dissolve Solids (TDS)
- Total Suspended Solid (TSS)
- Floating matters
- Oil & Grease
- Petroleum Hydrocarbons
- Salinity
- Alkalinity as $CaCO_3$
- Total Hardness as $CaCO_3$
- Calcium as Ca
- Magnesium as Mg
- Sodium as Na
- Potassium as K
- Chloride as Cl
- Sulphate as SO_4
- Nitrate as NO_3
- Flouride as F
- Phenolic compound as C_6H_5OH
- Cyanide
- Aluminium
- Arsenic
- Cadmium
- Chromium as Cr^{+6}
- Iron
- Copper
- Lead
- Manganese
- Mercury
- Zinc
- Dissolve Oxygen
- BOD, 27°C 3 days
- COD
- Total coliforms

B. Biological Parameters

- Phytoplankton

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- Zooplankton
- Shell Fishes
- Fin Fishes
- Chlorophyll Content
- Gross Primary Productivity
- Net Primary Productivity
- Community Respiration

Marine water samples shall be collected at the rate of 2 samples per location (one sample at surface i.e. 0.3 meter depth and another sample form bottom (6 meter to 16 meter depth). Sampling for Marine water quality shall be conducted inside the protected water i.e., within break waters. The analysis of marine water for physico-chemical parameters as per the procedures specified in Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. Samples for physico-chemical analysis were collected in polyethylene and glass bottle and preserved as per standard procedure. Samples collected for metal content were acidified with 1ml HNO_3. Samples for bacteriological analysis were collected in sterilized bottles. The details sample collection procedures are described in below.

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Table 4.2: Sample Collection Procedure

S.No	Parameter	Sample collection	Sample Size	Storage/ Preservation
1	pH, EC, TDS	Grab sampling Plastic container	50 ml	On site analysis
2	Other Physico-Chemical Parametrs	Grab sampling Plastic glass container	2000 ml	As per SOP
3	Oil & Grease	Wide mouth glass container	500 ml	Add HCl to pH>2, refrigeration, 28 days
5	Cyanide	Grab sampling glass container	500 ml	As per SOP
6	BOD	Grab sampling glass container	1000 ml	Cooling between 2 to 5 degree
7	COD	Grab sampling plastic container	100 ml	Add HNO3 to pH <2
8	Heavy Metals	Glass rinsed with 1+1 HNO_3	500 ml	HNO_3 to pH>2; Grab sample; 6 months
9	Biological Sample	Sterilized plastic container	500 ml	As per SOP

.

Plankton

Plankton samples were collected from the surface waters of the study areas by towing a plankton net (mouth diameter 0.35 m) made of bolting silk (No.25 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope

4.3 Analysis Technique

The analysis techniques were followed by Standard Methods for the Examination of Water and Wastewater published by American Public Health Association (APHA) and Lab SOP-W/66. After the analysis the results were compared as per the SW Class IV (CPCB). The instrument used for the above mention parameters are given below.

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Table 4.3: Instrument Used

S. No.	Parameters	Instrument Used
1	pH	pH meter
2	Turbidity	Nephelo Meter
3	Conductivity (at 25^0C)	Conductivity meter
4	Total Dissolve Solids	Gravimetric
5	Alkalinity as $CaCO_3$	Titrimetric Method
6	Total Hardness as $CaCO_3$	TitrimetricMethod
7	Calcium as Ca	Titrimetric Method
8	Magnesium as Mg	Calculation
9	Sodium	Flame Photometric
10	Potassium	Flame Photometric
11	Chloride as Cl	Argentometric
12	Sulphate as SO_4	Turbidimetric
13	Nitrate as NO_3	Spectro photometric
14	Phosphate	Spectrophotometric
15	Fluoride as F	Spectrophotometric
16	Phenolic compound as C_6H_5OH	Spectrophotometric
17	Cyanide	Spectrophotometric/Spot test
18	Dissolve Oxygen	Winkler Method
19	Oil & Grease	Gravimetric
20	Heavy Metal	Induced Couple Plasma- Mass Spectro Meter (ICP-MS)
21	Total Coliform	MPN Method
22	Plankton Study	Microscope

Onsite Parameter Analyses

pH, temperature and conductivity were analyzed at the time of sample collection. For dissolved oxygen, samples were collected in standard BOD bottle and fixed the oxygen by manganese oxide and alkaline iodide immediately after collection of the sample.

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4.4Analytical Result and Interpretation

A. Physio-Chemical Parameters

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINE (CLASS SW-IV)
			19.12.19	19.12.19	19.12.19	19.12.19	
(0.3 Meter Depth)							
1	Colour	Haze n	50	60	60	70	No visible colour
2	Turbidity	NTU	460	476	420	430	–
3	pH	–	7.87	7.91	7.98	7.99	6.5-9.0
4	Conductivity	µs/cm	4914	5180	7133	5157	–
5	Total Dissolved Soild	mg/l	3452	3620	4636	3760	–
6	Total Suspended Soilds	mg/l	574	718	615	229	–
7	Floating Matters	mg/l	0.2	0.25	0.2	0.2	10.0
8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	–
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	–
10	Salinity	mg/l	4760	4962	6920	5018	–
11	Alkalinity as CaCO3	mg/l	148	149	140	144	–
12	Total Hardness as CaCO3	mg/l	750	800	956	850	–

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13	Calcium as Ca	mg/l	90.1	70.1	80.5	70.2	–
14	Magnesium as Mg	mg/l	127.6	97.4	182.3	164	–
15	Sodium as Na	mg/l	889	894	1169	872	–
16	Potassium as K	mg/l	40	39.5	51.1	37.8	–
17	Chloride as Cl	mg/l	1759.5	1669.5	2299.3	1639.5	–
18	Sulphate as SO4	mg/l	278.1	273.3	423.9	279.6	–
19	Nitrate as NO3	mg/l	6.18	7.20	7.68	7.13	–
20	Flouride as F	mg/l	1.25	1.28	1.41	1.36	–
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	–
22	Cyanide	mg/l	Absent	Absent	Absent	Absent	–
23	Aluminium	mg/l	26.35	34.6	47.18	32.47	–
24	Arsenic	mg/l	0.016	0.011	0.034	0.096	–
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	–
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	–
27	Iron	mg/l	26.35	31.15	35.86	17.26	–
28	Copper	mg/l	0.21	0.22	0.31	0.23	–
29	Lead	mg/l	0.165	0.175	0.41	0.239	–
30	Mangnese	mg/l	1.36	1.2	1.62	1.069	–
31	Mercury	mg/l	<0.005	<0.005	<0.005	<0.005	–

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32	Zinc	mg/l	2.14	0.94	2.97	2.51	–
33	Dissolve Oxygen	mg/l	4.8	4.5	5.1	5.0	3.0
34	BOD, 27°C 3 Days	mg/l	6.0	8.0	4.0	3.0	5.0
35	COD	mg/l	33.6	37.8	25.2	21.7	–
36	Total Coliforms	MPN/100ml	1400	1300	1100	1400	–

In the physico –chemical analysis of the marine water quality from 0.3 meter depth, the pH variation was found from 7.87 to 7.99 , Conductivity is found from 4914 µs/cm to 7133 µs/cm, Magnesium is found from 97.4. mg\l to 182.3 mg\l and Calcium is found from 72.1 mg\l to 90.1 mg\l.

S. No.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate	CPCB GUIDELINES (CLASS IV)
			19.12.19	19.12.19	19.12.19	19.12.19	
(7 Meter Depth)							
1	Colour	Haze n	60	80	70	80	No visible colour
2	Turbidity	NTU	470	520	510	490	–
3	pH	–	7.89	7.82	7.96	7.98	6.5-9.0
4	Conductivity	µs/cm	5163	5298	7536	5429	–
5	Total Dissolved Soild	mg/l	3690	3790	4830	3970	–
6	Total Suspended Soilds	mg/l	610	750	680	240	–

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7	Floating Matters	mg/l	0.3	0.4	0.4	0.45	10.0
8	Oil & Grease	mg/l	<4.0	<4.0	<4.0	<4.0	–
9	Petroleum Hydrocarbons	mg/l	<0.01	<0.01	<0.01	<0.01	–
10	Salinity	mg/l	4930	5190	7340	5018	–
11	Alkalinity as CaCO3	mg/l	160	152	144	150	–
12	Total Hardness as CaCO3	mg/l	780	820	980	890	–
13	Calcium as Ca	mg/l	95.8	74.1	95.8	75.8	–
14	Magnesium as Mg	mg/l	131.5	154.3	180.1	170.3	–
15	Sodium as Na	mg/l	895	904	1120	893	–
16	Potassium as K	mg/l	42	35.9	56.9	40.1	–
17	Chloride as Cl	mg/l	1850.5	1760.3	2360.9	1740.5	–
18	Sulphate as SO4	mg/l	285.6	290.5	460.8	299.5	–
19	Nitrate as NO3	mg/l	7.23	8.25	8.69	9.14	–
20	Flouride as F	mg/l	1.65	1.98	1.45	1.98	–
21	Phenolic Compound as C6H5OH	mg/l	<0.001	<0.001	<0.001	<0.001	–
22	Cyanide	mg/l	Absent	Absent	Absent	Absent	–
23	Aluminium	mg/l	29.58	36.9	49.5	36.7	–

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24	Arsenic	mg/l	0.019	0.015	0.042	0.098	–
25	Cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	–
26	Chromium as Cr+6	mg/l	<0.05	<0.05	<0.05	<0.05	–
27	Iron	mg/l	28.69	35.24	38.69	19.58	–
28	Copper	mg/l	0.25	0.29	0.36	0.29	–
29	Lead	mg/l	0.198	0.189	0.425	0.369	–
30	Manganese	mg/l	1.45	1.36	2.45	1.39	–
31	Mercury	mg/l	<0.005	<0.005	<0.005	<0.005	–
32	Zinc	mg/l	3.24	0.98	3.24	2.39	–
33	Dissolve Oxygen	mg/l	4.5	4.2	5.0	4.9	3.0
34	BOD, 27°C 3 Days	mg/l	6.3	9.0	5.0	4.5	5.0
35	COD	mg/l	35.9	40.9	28.9	25.7	–
36	Total Coliforms	MPN/100ml	1600	1400	1200	1600	–

In the physico –chemical analysis of the marine water quality from 7 meter depth, the pH variation was found from 7.89 to 7.98, Conductivity is found from 5163 µs/cm to 7536 µs/cm, Magnesium is found from 131.5 mg\l to180.1mg\l and Calcium is found from 74.1 mg\l to 95.8 mg\l.

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5. Marine Biological Parameters

S.NO.	PARAMETERS		UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate
				19.12.19	19.12.19	19.12.19	19.12.19
1	**Phytoplankton**						
	1	Coscinodiscuscentralis	Cells/l	1076	1275	1293	2618
	2	Dinophysiscaudata	Cells/l	1064	1084	880	-
	3	Odontellaaurita	Cells/l	310	708	454	880
	4	Triceratiumbroeckii	Cells/l	740	1100	-	620
	5	Cerataulinapelagica	Cells/l	920	460	520	198
	6	Hemiaulussinensis	Cells/l	182	-	150	281
	7	Ceratiumsp	Cells/l	1100	910	1048	880
	8	Guinardiastriata	Cells/l	1237	840	950	460
	9	Coscinodiscuswailesii	Cells/l	-	750	880	776
	10	Lauderiaannulata	Cells/l	1100	589	-	-
	11	Achnanthessp	Cells/l	916	480	660	550
	12	Striatellaunipunctata	Cells/l	740	660	520	420
	13	Rhizosoleniasp	Cells/l	225	182	199	320

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2	**Zooplankton**						
	1	Parvocalanussp	Org./m³	160	150	114	182
	2	Centropagesorsini	Org./m³	180	140	159	206
	3	Oithona nana	Org./m³	210	40	88	114
	4	Oithonasp	Org./m³	115	118	216	-
	5	Mysis larvae	Org./m³	40	-	22	15
	6	Oikopleura larvae	Org./m³	120	100	90	101
	7	Oithonaplumifera	Org./m³	150	117	95	80
	8	Centropagessp	Org./m³	170	153	119	110
	9	Copepod nauplii	Org./m³	-	152	180	150
	10	Calanopiaeliptica	Org./m³	136	150	95	100
	11	Temora sp.	Org./m³	144	186	119	132
	12	Tintinnopsissp	Org./m³	65	89	-	75
	13	Calanopiasp	Org./m³	115	-	98	76
	14	Temoraturbinata	Org./m³	122	167	154	-
	15	Pseudodiaptomussp	Org./m³	-	78	87	93
3	**Shell Fishes (No Shrimps and Crabs were found)**						
4	**Fin Fishes**		-	Not found	Not found	Not found	Not found
5	**Chlorophyll Content**		-	Not found	Not found	Not found	Not found
6	**Light Penetration**		-	Not found	Not found	Not found	Not found

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7	**Gross Primary Productivity**	-	Not found	Not found	Not found	Not found
8	**Net Primary Productivity**	-	Not found	Not found	Not found	Not found
9	**Community Repiration**	-	Not found	Not found	Not found	Not found

4.5 Interpretation

A total number of 13 Phytoplankton species were found, out of which the higher number of Phytoplankton is Coscinodiscus centrails and the lowest number of Phytoplankton is Hemiaulus sinensis.

On the other hand, total 15 species were found of Zooplankton, out of which the higher number of Zooplankton is Oithona sp and the lowest number of Zooplankton is Mysis larvae.

No shellfishes and fin fishes were recorded during the marine biological survey carried out in the study area.

In addition, along with the above, some parameters also were not found i.e. shown in table.

6.Marine Sediment Quality

6.1 Selection of Monitoring Station

Sediment Quality Monitoring stations were set up at four locations. The monitoring stations were setup by filed visit, sensitive location of the site and official discussion with the Haldia Dock Complex officials. The monitoring locations are given in **Table 3.1**

Water Quality Location				
1	S 1	Near 1st Oil Jetty	22° 1'55.63"N	88° 5'58.27"E
2	S 2	Near 2nd Oil Jetty	22° 1'46.05"N	88° 5'43.49"E
3	S 3	Near 3rd Oil Jetty	22° 1'03.26"N	88° 4'25.38"E
4	S 4	Near Lock Gate	22° 1'20.72"N	88° 5'06.04"E

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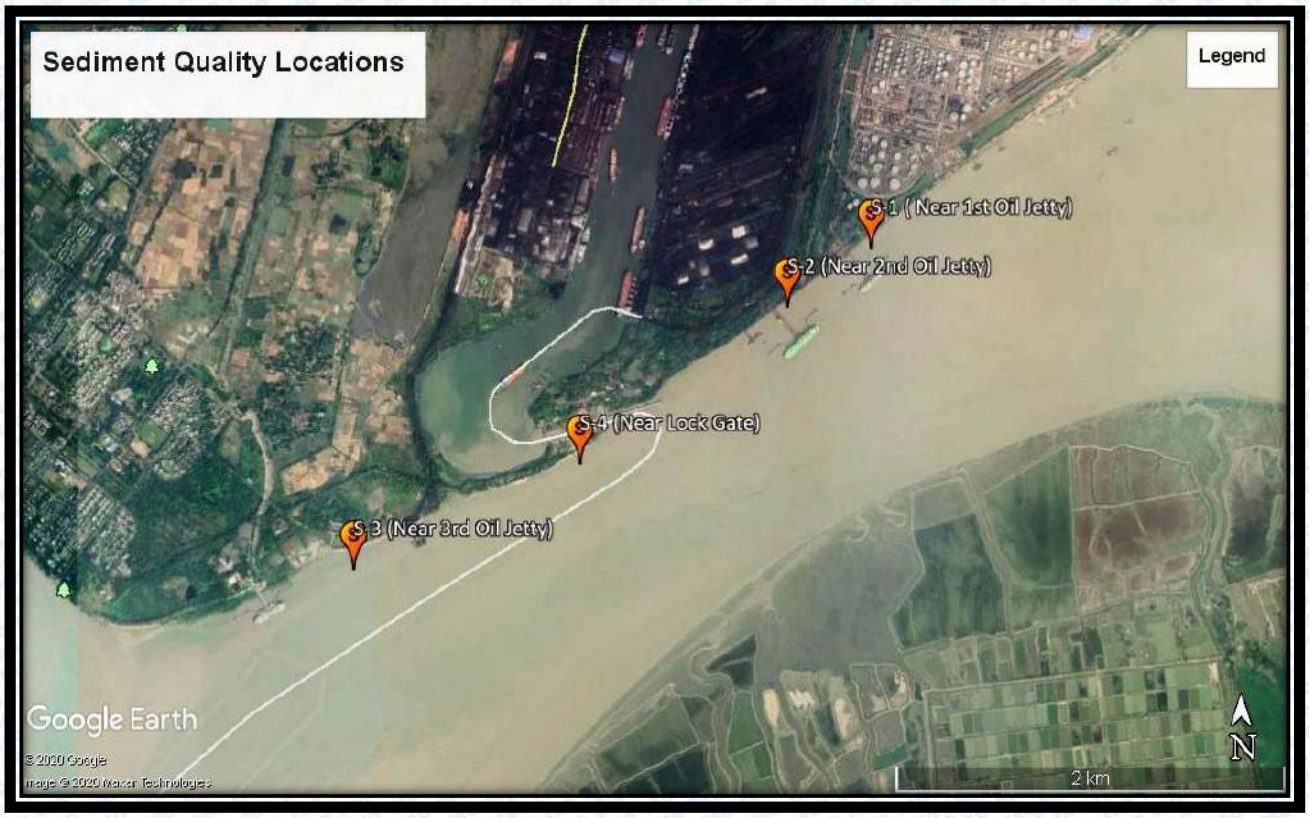

Figure 5.1 Sediment Quality Location

6.2 Sampling Methodology and Parameter Selection

The samples were collected and analyzed as per the procedures specified in Standard existing procedure. Sediment samples are collected as grab sampling procedure. The samples were collected using a Petersen grab sampler from bottom of the river. The collected samples were taken by a fresh plastic container and marked the lab code for physico-chemical analysis. The samples were taken into the laboratory and dry in normal temperature. .

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The biological analysis for microbenthic, meiobenthic and macrobenthic community structure, samples were also collected using a Petersen grab sampler and collected sample were taken in the sterilized plastic container.

The parameter selections for the marine sediment quality are described below.

C. Physio-Chemical Parameters

- Texture
- pH
- Sodium as Na
- Potassium as K
- Cadmium as Cd
- Copper as Cu
- Lead as Pb
- Zinc as Zn
- Magnesium as Mg
- Arsenic as As
- Phosphate as PO4
- Chloride as Cl
- Sulphate as SO4

D. Biological Parameters

- Meiobenthos
- Microbenthos
- Macrobenthos

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6.3 Analysis Technique

The samples were analyses in laboratory with the procedures of APHA 22nd Edition and SOP (Standard Operating Procedure) of the Laboratory. For the biological analysis the collected wet sediment samples are sieved with varying mesh sizes for segregating the organisms. Macrobenthos are organisms which are retained in the sieve having mesh size between 0.5 and 1 mm. The term meiofauna loosely defines a group of organisms by their size, larger than microfauna but smaller than macrofauna, rather than a taxonomic grouping. In practice, that is organisms that can pass through a 1 mm mesh but will be retained by a 45 µm mesh. Organisms below size of 45 µm are regarded as microbenthos. The sieved organisms are then stained with Rose Bengal and sorted into different groups. The number of organisms in each grab sample is expressed in number per meter square.

6.4 Analytical Result

A. Physico-chemical Parameter

S.NO.	PARAMETERS	UOM	S-1 Near Ist Oil Jetty	S-2 Near 2nd Oil Jetty	S-3 Near 3rd Oil Jetty	S-4 Near Lock Gate
			19.12.19	19.12.19	19.12.19	19.12.19
1	Texture	–	Silty Clay	Silty Clay	Silty Clay	Silty Clay
2	pH	–	7.12	7.62	7.57	7.88
3	Sodium as Na	mg/kg	982.0	1192.0	1210.0	1179.3
4	Potassium as K	mg/kg	516.0	818.0	820.0	791.4
5	Cadmium as Cd	mg/kg	<1.0	<1.0	<1.0	<1.0
6	Copper as Cu	mg/kg	<1.0	<1.0	<1.0	<1.0
7	Lead as Pb	mg/kg	<1.0	<1.0	<1.0	<1.0

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8	Zinc as Zn	Mg/kg	2.86	2.70	2.90	2.13
9	Magnesium as Mg	Mg/kg	926.8	966.0	945.0	907.4
10	Arsenic as As	Mg/kg	<1.0	<1.0	<1.0	<1.0
11	Phosphate as PO4	Mg/kg	210.0	213.0	220.0	208.3
12	Chloride as Cl	Mg/kg	640.0	702.0	680.0	675.3
13	Sulphate as SO4	Mg/kg	320.4	348.8	332.7	307.7

7.0 Marine Sediment Quality- Biological Parameters

S.NO.	PARAMETERS	UOM	WQ-1 Near Ist Oil Jetty	WQ-2 Near 2nd Oil Jetty	WQ-3 Near 3rd Oil Jetty	WQ-4 Near Lock Gate
			19.12.19	19.12.19	19.12.19	19.12.19
1	Meiobenthos	Org./10 m^2	NIL	NIL	NIL	NIL
2	Microbenthos	Org./10 m^2	NIL	NIL	NIL	NIL
3	Macrobethos					
3.1	Capitellacapitata	Org./10 m^2	148	44	15	16
3.2	Neantheschingrighattensis	Org./10 m^2	36	45	15	30
3.3	Ceratonereis sp.	Org./10 m^2	110	-	120	130

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3.4	Nepthyspolybranchia	**Org./10 m²**	132	45	46	149
3.5	Perinereis sp.	**Org./10 m²**	46	32	28	40
3.6	Notocirrusaustralis	**Org./10 m²**	-	164	56	-
3.7	Nereiscapensis	**Org./10 m²**	99	15	66	151

6.5 Interpretation

As per the analysis of Biological parameters of Sediment quality, Meiobenthos and Microbenthos, both were found nil and Marcobenthos found with its 7 species i.e reported above in table

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Sediment Quality Monitoring Site Photograph

S 1: Near 1st Oil Jetty

S 3: Near 3rd Oil Jetty

S 2: Near 2nd Oil Jetty

S 4: Near Lock Gate

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8.0 Green Belt Survey

8.1 Selection of monitoring station

In the whole proposed project area, stratified random samples were taken to study intensively various ecological parameters so as to understand the ecological structure and functions of the study area. The project area is triangular one. It has been started from Haldia Port office to bank of Ganga River (Fig.- 4 & 5). There are few offices, degraded area, waste land, paddy field and a small village within the study area. Most of the area is blank. But there are thick vegetation near to the river and floating jetty. Four (4) study sites have been randomly selected throughout the proposed area (Table-1). Brief description of study sites are as follows.

Site – 1 - This site is on the bank of Ganga River and near to floating jetty. The bank road is planted by Arica palm. There is open land in parallel to the river. This area is covered by scrubby plants, one or two tress are seen here and there.

Site –II - This site is located beside Haldia Bhawan. A green patch is partly surrounded by a concrete wall. A small pond is within this area. Large tree like *Eucalyptus sp. Bauhinia sp, Lagerostroemia sp.* Etc. are available here. This area is dense and with shrubby plant like *Eupatorium odoratum* species.

Site –III - This site is located behind central garage. A small waste area is seen behind this garage. This area is water lagged. The dominant species of this area is *Typha angustifolia*. Beside this a mangrove fern like *Acrostichium aurious* is also seen. Another species such as *Tamarix troupi, Callistemon sp. Casuarina equsetifolia, Delonix regia, Ficus glomerata* etc. are also seen.

Site –IV - This is a road from township gate to floating jetty. Roadside plantation was both side of the road. One side by *Swetenia macrophyla* and other side is *Delonix regia*. GBH of *Swetenia macrophyla* are varies from 39 cm to 126cm and heights are 4 to 6 m. whereas GBH of *Delonix regia* varies from 36to116cm and heights are 4 to 7m.

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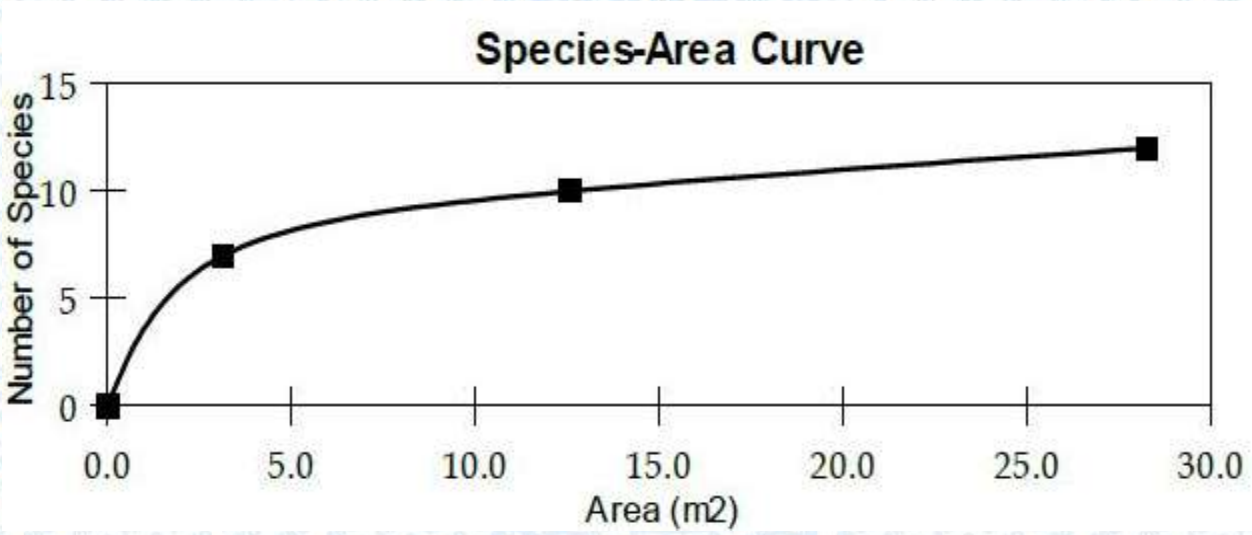
8.2 Sampling Methodology

The study of biodiversity in the study area includes the study of flora and qualitative and /or quantitative enumeration and their socio-ecological framework, but also the study of ecosystems and habitat characteristics, of which they are part. The scope of the study covers all these factors along with impact identification and or prediction and conservation measures.

8.3 Analysis Technique

1. **Quantitative enumeration:** The terrain of the proposed study site is flat so quadrate method is adopted for ecological study. The size of quadrate is determined by species-area curve as stated below.



In this case size of tree quadrate is determined 10m x 10m, for shrubs 5m x 5m and for herbs is 1m x 1m.

2. **Ecosystem diversity:** diversity of different habitats (Terrestrial, Aquatic and Ecotone zone) within this ecosystem and their habit characterization is done. Besides species listing other studies like phyto-sociology of plants in different habitats of the study area is done with the following tools. Habitats are treated separately while making such calculations).

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Importance Value Index (IVI = Relative Density + Relative Dominance + Relative Frequency

Relative Frequency (R F) = Frequency of a species x 100/ Total Frequency of all species

Relative Dominance (R Dom) = Dominance of a species x 100/ Total dominance of all Species

Relative Density (R Den) = Density of a species x 100/ Total Density of all species

Species Richness - Species richness is a measure of the number of species found in a sample. Since the larger the sample, the more species we would expect to find, the number of species is divided by the square root of the number of individuals in the sample. This particular measure of species richness is known as D, the Menhinick's index. $D = s \sqrt{N}$

where s equals the number of different species represented in your sample, and N equals the total number of individual organisms in your sample.

Diversity Index - As a measure of species diversity, we will calculate the Shannon Wiener Diversity Index. It turns out that the mathematical relationships hold true whether one is dealing with molecules in solution or species in an ecological community.

$H = \sum (pl) |\ln pl|$

Where (pl) is the proportion of the total number of individuals in the population that are in species "l".

3. Identification and preservation of specimen - An intensive literature survey has been carried out for assemblage of existing information on various uses of the coastal plain and sand dune species at different parts of the coast of Midnapore. Each of the plant material has been assigned a field note books and documented as to Binomials with family, local name, part used and therapeutic uses, plant parts that were identified as useful in ethno-botany were collected, compressed, the voucher specimens have been collected and identified by referring to standard flora (Prain,1903).

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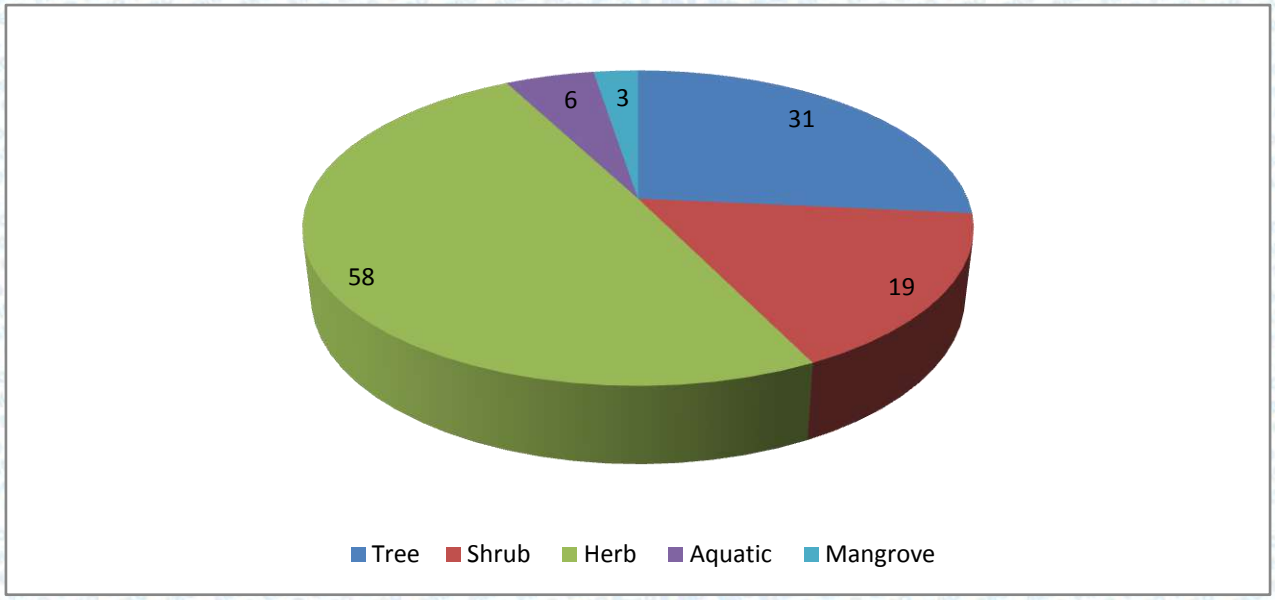
8.4 Analytical results and interpretation

Biodiversity Resources

Floral Diversity

The study area has 31species of trees, 19 species of shrubs and 58 species of herbs (Table-3). There are also 6 aquatic and 3 mangrove species (Table-3D & 3E). Presence of 117 number of plant species (Fig.-1) within only a small part of Haldia Port area is highly diverse in its vegetation composition.

Fig.-1: Vegetation composition of study area



Presence of species like *Enhydra fluctuans (Hincha),Marselia quadrifolia* (Susni), *Ipomoea carnea* and *Commelina benghalnensis* (Kansira**)** etc shows that the ecotone zone in between the water body and the road is rich in diversity. The above-mentioned species are medicinally important and the first two species like *E. fluctuans* and *M. quadrifolia* are commercially important as these are considered as very precious herbs in Bengali kitchens. Species like *Eupatorium odoratum* is considered to be deadly invasive

and therefore needs to be controlled in general and not particularly for this project. The only way to manage these species is increasing the frequency of indigenous species.

Heliotropium indicum

In the tree level species like *Albezia lebbek (Siris), Samania saman (Khiris)*, *Borassus flabellifer (Tal), Cocos nucifera (narkel), Azadirachta indica (Neem), Mangifera indica* (Mango)etc. are commercially very important species. Species like *Ficus beghalensis,* and *Ficus religiosa* are considered to be "key stone" species as it provides shelter to many animal as well as plant species. During plantation and rehabilitation work emphasis will be given on plantation of these species so as to compensate the loss to the ecosystem. Presence of a large number of *Roystonea regia* (Plam) is a very interesting aspect of the ecological setting of the study area. It is said that the plantation of this monocot tree species is works as soil binder in bank area. The ecological set up seems to be suitable for such plantation. Therefore, it is necessary to replicate this habitat at least with its structural components.

Importance Value Index (IVI) of trees

The IVI results show that within 17 species there are 6 (six) species having importance value more than 15. *Lagerostroemia perviflora* has the highest IVI (Table-4) followed by *Sweitenia macrophylla*. *Bauhinia purpuria* has the lowest IVI followed by *Delonix regia, Zizyphus jujube, Albizea procera.* Importance Value Index is a measure of how dominant a species is in the study area. Here Relative frequency, Relative density and Relative Abundance of the highest IVI value is the dominant species. A graphical presentation is followed of comparative importance values in given in Fig.-2.

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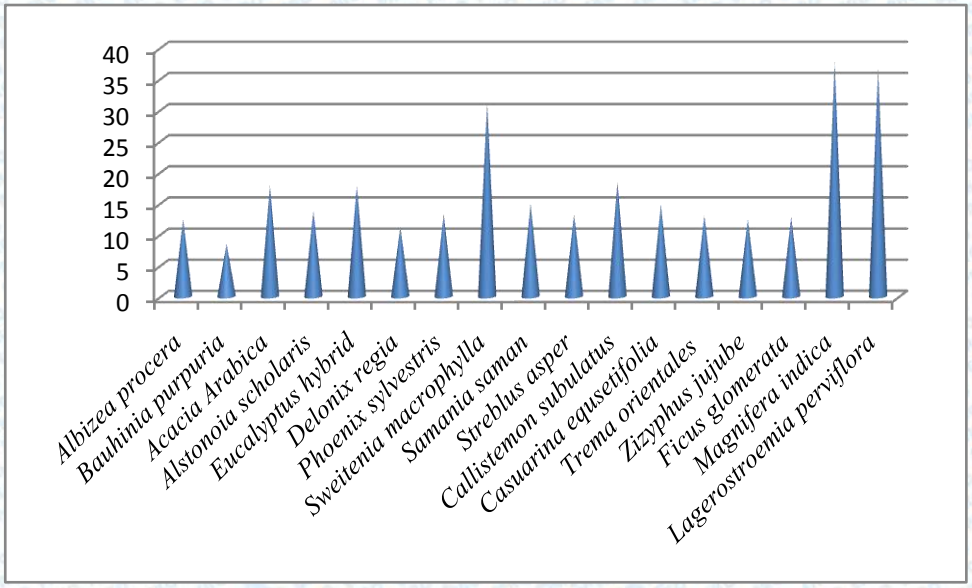
Fig.-2: IVI of tree species in the study area



Canopy cover – a 10m /2m rectangle is used for canopy percentage calculations. It has been found that canopy cover is varies from 5% to 30% throughout the study area.

Diversity Index

The Diversity Index (H') of tree species is 1.23. Shrub and herb diversity index are 1.47 and 1.51 respectively. Though there is dense vegetation near and within the township area but less vegetation is outside the township.

Some Important Ecological notes

Coastal morphology shows the natural structure which protects the coastal environment by absorbing energy from wind, tide and wave action. These species are playing a crucial role in protecting the coast from erosion and flooding (Desai, 2000). There are *Ficus benghalnensis* and *Ficus religiosa*. These are keystone species and, therefore support a lot of faunal species. Ecotone zone of the water body supports

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like *Cassia tora* which in turn is a host plant for butterflies of different species. Swampy marshland behind the Central garage is an ideal habitat for birds, small mammals and reptiles like land monitors, otters etc.

ANNEXURES

TABLE-1: DETAILS OF DIFFERENT STUDY SITES FOR THE ASSESSMENT OF BIODIVERSITY AND ECOLOGICAL STUDY WITHIN HALDIA DOCK AREA.

Sl. No	Site No	Site details	GPS bearing
1	Site – I	The bank of Ganga River and near to floating jetty	22^0 1/ 1// N / 88^0 4/ 17// E
2	Site – II	Beside Haldia Bhawan	22^0 1/ 33// N / 88^0 4/ 52// E
3	Site – III	Behind central garage	22^0 1/ 22// N / 88^0 4/ 14// E
4	Site – IV	Road from township gate to floating jetty	22^0 1/ 29// N / 88^0 4/ 17// E

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TABLE-2: DETAILS OF DIFFERENT STUDY SITES FOR THE ASSESSMENT OF BIODIVERSITY AND ECOLOGICAL STUDY WITHIN PROPOSED AREA.

Site – 1

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Acacia arabica*	28	5
2.	*Samania saman*	35	5

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	15
2	*Adhatoda vesica*	6
3	*Solanum xanthocarpon*	2
4	*Ipomoea batatas*	6
5	*Cassia alata*	1
6	*Datura stramonium*	3

Herb

Sl. No.	Name of species	No.
1	*Blumea lacera*	13
2	*Hemigraphis hirta*	36
3	*Cyanodon dactylon*	96

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Site –II

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Bauhinia purpuria*	34	5
2	*Lagerostroemia perviflora*	68	7
3	*Eucalyptus hybrid*	76	12
4	*Eucalyptus hybrid*	110	14
5	*Callistemon subulatus*	40	5
6	*Casuarina equsetifolia*	45	8

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	1
2	*Ventilago denticulate*	1
3	*Zizyphus oenopliea*	1
4	*Eupatorium odoratum*	67

Herb

Sl. No.	Name of species	No.
1	*Rungia pectinata*	14
2	*Hemigraphis hirta*	18
3	*Cyanodon dactylon*	24
4	*Vernonia ceneria*	1

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Site –III

Tree

Sl. No.	Name of species	GBH (in cm)	Height (in m)
1	*Delonix regia*	136	8
2	*Delonix regia*	96	9
3	*Eucalyptus hybrid*	70	9
4	*Eucalyptus hybrid*	110	14
5	*Phoenix sylvestris*	55	4

Shrub

Sl. No.	Name of species	No.
1	*Clerodendron inflotunatum*	15
2	*Flacourtia indica*	1

Herb

Sl. No.	Name of species	No.
1	*Rungia pectinata*	9
2	*Blumea lacera*	2
3	*Desmodium triflorum*	15
4	*Cyperus rotundus*	6
5	*Cyanodon dactylon*	5
6	*Evolvulus alsenoides*	13
7	*Evolvulus numularius*	4

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Site –IV

This is a road from township gate to floating jetty. Roadside plantation was both side of the road. One side by *Swetenia macrophyla* and other side is *Delonix regia*. GBH of *Swetenia macrophyla* are varies from 39 cm to 126cm and heights are 4 to 6 m. whereas GBH of *Delonix regia* varies from 36to116cm and heights are 4 to 7m.

TABLE-3: PLANT SPECIES DIVERSITY IN THE STUDY AREA

Table-3A: Tree species

Sl. No.	Scientific name of Plants	Family
1	*Acacia Arabica*	fabaceae
2	*Acacia auriculiformis*	Fabaceae
3	*Albizea procera*	Fabaceae
4	*Alstonia scholaris*	Apocynaceae
5	*Araucaria heterophylla*	Araucariaceae
6	*Azadirachta indica*	Meliaceae
7	*Bauhinia purpuria*	Fabaceae
8	*Borassus fabilifer*	Arecaceae
9	*Callistemon subulatus*	Myrtaceae
10	*Casuarina equsetifolia*	Casuarinaceae
11	*Cocos nucifera*	Arecaceae
12	*Dalbergia sissoo*	Fabaceae

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13	*Delonix regia*	Fabaceae
14	*Eucalyptus hybrid*	Myrtaceae
15	*Eujenia jambolana*	Myrtaceae
16	*Ficus benghalensis*	Moraceae
17	*Ficus infectoria*	Moraceae
18	*Ficus religiosa*	Moraceae
19	*Lagerstromia perviflora*	Lythraceae
20	*Mangifera indica*	Anacardiaceae
21	*Mymusops elangi*	Sapotaceae
22	*Phoenix sylvestris*	Arecaceae
23	*Roystonea regia*	Arecaceae
24	*Samania saman*	Fabaceae
25	*Saraca asoca*	Fabaceae
26	*Streblus asper*	Moraceae
27	*Swietenia macrophylla*	Meliaceae
28	*Tabernaemonta divaricata*	Apocynaceae
29	*Techtona grandis*	Lamiaceae
30	*Trema orientales*	Urticaceae
31	*Zizyphus jujube*	Rhamnaceae

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Table-3B: Shrub species

Sl. No.	Scientific name of Plants	Family
1	*Adhatoda vesica*	Acanthaceae
2	*Calotropis procera*	Apocynaceae
3	*Cassia alata*	Fabaceae
4	*Clerodendron infortunatum*	Verbenaceae
5	*Datura metal*	Solanaceae
6	*Eupatorium odoratum*	Asteraceae
7	*Euphorbia nerrifolia*	Euphorbiaceae
8	*Ficus hispida*	Moraceae
9	*Flacourtia indica*	Flacourtiaceae
10	*Ipomoea batatas*	Convolvulaceae
11	*Pedilanthus sp.*	Euphorbiaceae
12	*Polyalthia cerasoides*	Fabaceae
13	*Polygonum barbatum*	Polygonaceae
14	*Ricinus communis*	Euphorbiaceae
15	*Solanum xanthocarpon*	Solanaceae
16	*Typha angustifolia*	Typhaceae
17	*Ventilago denticulate*	Rhamnaceae

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18	*Vitex negundo*	Verbenaceae
19	*Zizyphus oenopliea*	Rhamnaceae

Table-3C: Herb species

Sl. No.	Scientific name of Plants	Family
1	*Aerva aspera*	Amaranthaceae
2	*Ageratum conyzoides*	Asteraceae
3	*Alocasia esculanta*	Liliaceae
4	*Alternanathera philoxeroides*	Amaranthaceae
5	*Alternanathera sessiles*	Amaranthaceae
6	*Amaranthus viridis*	Amaranthaceae
7	*Andropogon aciculatus*	Poaceae
8	*Blumea lacera*	Asteraceae
9	*Boerhavia repens*	Nyctaginaceae
10	*Brachiaria reptans*	Poaceae
11	*Cassia tora*	Malvaceae
12	*Centella asiatica*	Apiaceae
13	*Chenopodium album*	Chenopodiaceae
14	*Chrysopogon aciculatus*	Poaceae

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15	*Coccinia grandiflora*	Cucurbitaceae
16	*Commelina benghalensis*	Commelinaceae
17	*Commelina diffusa*	Commelinaceae
18	*Croton bonplandianum*	Euphorbiaceae
19	*Crozophora sp.*	Euphorbiaceae
20	*Cuscuta reflexa*	Cucutaceae
21	*Cyanodin dactylon*	Poaceae
22	*Cyperus articulantus*	Cyperaceae
23	*Cyperus corymbosus*	Cyperaceae
24	*Cyperus difformis*	Cyperaceae
25	*Cyperus distans*	Cyperaceae
26	*Cyperus iria*	Cyperaceae
27	*Cyperus kyllinga*	Cyperaceae
28	*Cyperus rotundus*	Cyperaceae
26	*Dactyloctenium egypticum*	Poaceae
30	*Dentella repens*	Rubiaceae
31	*Desmodium triflorum*	Fabaceae
32	*Digitaria sanguinales*	Poaceae
33	*Eclipta alba*	Asteraceae

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34	*Eclipta protrata*	Asteraceae
35	*Eleusine indica*	Poaceae
36	*Evolvulus alsenoides*	Convolvulaceae
37	*Evolvulus numularius*	Convolvulaceae
38	*Fimbristylis japonicum*	Cyperaceae
39	*Grangea madaraspatana*	Asteraceae
40	*Heliotropium indicum*	Boraginaceae
41	*Hemigraphis hirta*	Acanthaceae
42	*Hygrophila difformis*	Acanthaceae
43	*Ipomoea aquatic*	Convolvulaceae
44	*Mukia scabroides*	Cucurbitaceae
45	*Murdania vaginata*	Commelinaceae
46	*Oldenlandia corymbosa*	Rubiaceae
47	*Oxalis corniculata*	Oxalidaceae
48	*Panicum paludosum*	Poaceae
49	*Paspalidium punctatum*	Poaceae
50	*Perotis indica*	Poaceae
51	*Phyla nodiflora*	Verbenaceae
52	*Polygonum barbetum*	Polygonaceae

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53	*Ruellia tuberose*	Acanthaceae
54	*Rungia pectinata*	Asteraceae
55	*Solanum nigram*	Solanaceae
56	*Spilanthus acmella*	Asteraceae
57	*Vernonia cineria*	Asteraceae
58	*Wedelia chinensis*	Asteraceae

Table-3D: Aquatic species

Sl. No.	Scientific name of Plants	Family
1	*Colocasia esculentans*	Araceae
2	*Eichorrnia crassipes*	Pontederiaceae
3	*Enhydra fluctuans*	Ateraceae
4	*Lemna perpusilla*	Araceae
5	*Marsilea minuta*	Marsileaceae
6	*Pistia stratiotes*	Araceae

Table-3E: Mangrove species

Sl. No.	Scientific name of Plants	Family
1	*Acanthus volubilis*	Acanthaceae

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2	*Acrostichium aureum*	Pteridaceae
3	*Tamarix troupii*	Tamaricaceae

TABLE – 4: IVI OF TREE SPECIES IN THE STUDY AREA

Sl. No.	Species	R Den	RF	R Dom.	IVI
1	*Albizea procera*	4.17	5.41	2.84	12.42
2	*Bauhinia purpuria*	2.78	5.41	0.28	8.47
3	*Acacia Arabica*	4.17	5.41	8.24	17.82
4	*Alstonoia scholaris*	4.17	5.41	4.19	13.77
5	*Eucalyptus hybrid*	4.17	5.41	8.24	17.82
6	*Delonix regia*	5.56	5.41	0.2	11.17
7	*Phoenix sylvestris*	4.17	5.41	3.65	13.23
8	*Sweitenia macrophylla*	5.17	6.41	19.59	31.17
9	*Samania saman*	6.95	2.70	5.25	14.9
10	*Streblus asper*	4.17	5.41	3.65	13.23
11	*Callistemon subulatus*	5.56	10.81	1.99	18.36
12	*Casuarina equsetifolia*	8.34	5.41	1.07	14.82
13	*Trema orientales*	6.95	5.41	0.7	13.06
14	*Zizyphus jujube*	8.34	2.70	1.36	12.4

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15	*Ficus glomerata*	6.95	2.70	3.13	12.78
16	*Magnifera indica*	6.95	9.42	20.6	37.64
17	*Lagerostroemia perviflora*	12.51	10.82	14.05	36.57
		100.08	100.06	100.3	300.44

Photographs of Studied Sites

Photo -1: *Adhatodavesica,* an important medicinal plants.

Photo-2: *Datura metal*, an important medicinal plant.

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Photo-3:A water body near Haldia Bhawan

Photo – 4: *Tamarixtroupii*, the salt cedar.

Photo – 5:Wasteland behind central garage

Photo-6: Avenue tree of *S. macrophylla* and *D. regia*

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Photo-7: large *Albezialebbek* tree

Photo-8: Degraded land with scattered *Acacia arabica*.

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9.0 Conclusion

Environmental monitoring for the project was performed as per the given schedule in the contract and the sample were carried out for first season i.e.Oct-Dec-2019 and all the monitoring results of this report were checked and reviewed and this report provides an assessment of the most important impacts i.eAir quality, Noise measurements, Marine water quality for Physico –Chemical and Biological parameters and Marine Sediment quality for Physico-Chemical and Biological parameters along with the Green belt survey.

As per the tested and given results, we can say that no exceeded values of results was recorded, only noise monitoring level was recorded at the edge of standard values in few locations but it was found bit lower than standard the cause might be the sea shore as the monitoring site is just nearby of that sea edge, but there was no direct influence of any source.

However, still noise level is not considered as higher as the CPCB standard is 75dB for the industrial zones and the reported values are less than the standard.

Other than noise, the rest things are found in controlled condition and as per the Green belt survey, we came to know that Dock is maintaining very good Green belt in surrounding areas with several of species. The Green belt is found around more than 50% area of Dock premises and it will to help to minimize the level of Environmental parameters.

**********End of Report**********

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