D/c

GOPALPUR PORTS LIMITED
CIN. NO. : U63032OR2006PLC008831

Ref: GPL/ENV/ 2024-25/26

Date: 05-10-2024

To,

The Director
Ministry of Environment, Forest & Climate Change
INDIRA PARYAVARAN, JOR BAG ROAD
NEW DELHI -110003

Subject: Development of Gopalpur Ports Ltd: Env. Compliance.
Ref : NO.10-12/2009-IA.III dt.30th March,2011, 14th August 2018.

Dear Sir,

With reference to the above, we are submitting herewith our compliance of the conditions as laid down in different permissions and clearances. The Compliance report till end of September 2024 is being enclosed for your kind consideration.

STATE POLLUTION CONTROL BOARD,ODISHA
REGIONAL OFFICE, BERHAMPUR
15 OCT 2024
RECEIVED
No.....
Dt.....

Yours faithfully.

For Gopalpur Ports Limited,

Authorized signatory

Copy to:

1. Additional Chief Secretary, Department of Forest & Wildlife, Govt. of Odisha, Secretariat, Bhubaneswar-751001.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-Cum-Office Complex, East Arjun Nagar, Delhi-110032.
3. Addl. Principal Chief Conservator of Forest (Central), Ministry of Environment, Forest and Climate Change, Regional Office (EZ), A/3, Chandrasekharpur, Bhubaneswar-71023.
4. The Member Secretary, Odisha State Pollution Control Board, Parivesh Bhavan, A/118, Nilakantha Nagar, Unit-VIII, Bhubansewar-751012.
5. The Regional officer, Odisha State Pollution Control Board, Berhampur, Ganjam.

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Gopalpur Ports Limited

Compliance Report for Environmental Clearance No.10-12/2009-IA-III Dated 30th March 2011

Sl. No.	Conditions	Compliance Status
6.	**SPECIFIC CONDITIONS**	
(i)	"Consent for Establishment" shall be obtained from State Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	Complied
(ii)	No construction work other than those permitted in Coastal Regulation Zone Notification, 2011 shall be carried out in Coastal Regulation Zone area.	Being Complied with
(iii)	The shore line map prepared by Institute for Ocean Management, Chennai with regard to the stretch at Gopalpur Port has been examined and it is observed that on the southern side of the port, the area is shown as high to medium accretion while, on the northern side the area is shown as low to medium erosion. This is because the net littoral drift is towards the northern side and due to the break water at the southern port there seems to be accretion at the southern breakwater and low to medium erosion on the northern side. This has to be ratified by adopting suitable sand bypass system from south break water to the northern side of the north break water.	Beach nourishment undertaken for 4 MCM in the groin field to address the erosional aspect. Environmental Monitoring report (From April'24 to Sept'24) attached.
(iv)	Controlled and proper methods of dredging including state of the art equipment and planning the dredging operation and disposal shall be employed.	Dredging carried out by use of controlled cutter suction. Other mitigation measures implemented to curtail the turbidity.
(v)	Technically qualified institution shall be engaged to monitor the impact right from the beginning to suggest scientifically accepted mitigation measures as and when required on annual basis at least for first 3 years, shall be obtained.	Department of Marine Sciences Berhampur University engaged to carry out the environmental monitoring project work of Gopal purport.
(vi)	A high-level expert committee shall be constituted including the experts from Monitoring the population of benthic life during and after the construction phase	High level expert committee has been constituted and periodically revies the compliance conditions stipulated in the clearance.

	and to ensure the compliance of other conditions stipulated in the clearance.	
(vii)	An additional substratum shall be provided with the breakwaters, thereby adding to the habitat of benthic community especially flora which is very low due to the present geo physical characteristics of the area.	Additional substratum provided during construction of break water and from the studies being carried out by department of Marine Science dept. Berhampur University. There is increase in habitat of benthic community.
(viii)	Oil spills if any shall be properly collected and disposed as per the Rules.	Oil Spill Contingency Plan (OSCP) is in place.
(ix)	There shall be no drawl of ground water in CRZ area.	Complied with.
(x)	Environment Management Plan as suggested shall be strictly complied with.	Complied with.
(xi)	There shall be no disposal of solid and liquid wastes into the Coastal areas.	Being complied with and taken care off.
(xii)	Sewage Treatment facility should be provided in accordance with the CRZ notification, 2011. Treated sewage shall be reused for flushing of toilets and horticulture purposes.	Sewage Treatment facility provided, and the treated sewage water used for plantation.
(xiii)	The solid waste shall be properly collected, segregated and disposed as per the provision of solid Waste (Management and Handling) Rules, 2000.	Waste Management Plan is in place.
(xiv)	Installation and operation of DG set if any shall comply with the guidelines of CPCB.	CPCB approved DG sets are installed.
(xv)	The approach channel shall be properly demarcated with lighted buoys for safe navigation and adequate traffic control guidelines shall be framed. The fishermen shall be suitably educated and informed about the traffic guidelines.	Channel Marker Buoys have been installed for safe navigation. Fishermen Sensitization is being done regularly for harmony with port operation.
(xvi)	The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Environment Management Cell has been created Headed by DGM Environment.
(xvii)	The project proponent shall take up mangrove plantation/green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such	Green Belt development work is in progress following land shaping and plantation work.

	mangrove development.	
(xviii)	The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	Adequate fund is ear-marked and available.
(xix)	Under the provisions of Environment (Protection) Act, 1986, legal action shall be initiated against the project proponent if it was found that the construction of the project has been started without obtaining environmental clearance.	Construction of the project commenced after obtaining the Environmental Clearance. Date of project commencement is 10th Nov.2011.
7.	**GENERAL CONDITIONS**	
(I)	Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during the construction phase of the project to avoid any damage to the environment.	Being complied with.
(ii)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	Being complied with.
(iii)	Borrow sites for each quarry sites for road construction material and dump sites must be identified keeping in view the following: a) No excavation or dumping on private property is carried out without written consent of the owner. b) No excavation or dumping shall be allowed on wetlands, forest areas or other ecologically valuable or sensitive locations. c) Excavation work shall be done in close consultation with the soil Conservation and Watershed Development Agencies working in the area, and d) Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the	Being complied with.

	ground water.	
(iv)	The construction material shall be obtained only from approved quarries. In case new quarries are to be opened, specific approvals from the competent authority shall be obtained in this regard.	Being complied with.
(v)	Adequate precautions shall be taken during transportation of the construction material so that it does not affect the environment adversely.	Being complied with.
(vi)	Full support shall be extended to the officers of this Ministry/Regional Office at Bhubaneswar by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	GPL is committed to provide necessary support.
(vii)	A Six-monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Bhubaneswar regarding the implementation of the stipulated conditions.	Being complied with.
(viii)	Ministry of Environment and Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary, in the interest of environment and the same shall be complied with.	GPL is committed to comply with such condition, if any
(ix)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.	Taken note of.
(x)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.	Will be complied, if any.
(xi)	The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.	Complied The land development work commenced on 10th November 2011 after approval of the project.
(xii)	A copy of the clearance letter shall be marked to concern Panchayat / local NGO, if any, from whom any suggestion /	Noted and complied.

	representation have been made, received while processing the proposal.	
(xiii)	Orissa Pollution control Board shall display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's Office/Tahsildar's office for 30 days.	Noted.
8.	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	Noted
9.	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.	Agreed
10.	The project proponent shall advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Environmental Clearance and copies of clearance are available with the State Pollution Control Board and may also be seen on the website of the Ministry of Environment and forests at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional Office of this Ministry at Bhubaneswar.	Complied, Vide Letter No.GPL/2011/59 dated:11/04/2011.
11.	Environmental clearance is subject to final order of the Hon'ble Supreme court of India in the matter of Goa Foundation vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this Project.	Agreed
12.	Status of compliance to the various	Complied.

	stipulated environmental conditions and environmental safeguards will be uploaded by the project proponent in its website.	
13.	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitoring data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complied
14.	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	Complied
Additional Conditions of the EC Validity Extension Order dated 14th August 2018		
1.	The Project Proponent will submit a Certified Compliance Report within 03 months issued by the MOEF & CC, Regional office or concerned Regional Office of the Central Pollution Control Board or the Member Secretary of the respective State Pollution Control Board for the conditions stipulated in the Environmental and CRZ Clearance issued earlier.	Being Complied
2.	The development plan shall be implemented strictly in accordance to the Coastal Zone Management Plan as drawn up in compliance to the orders of the NGT in this regard. A copy of the compliance report shall be submitted within 30 days to the MOEF & CC.	Being Complied.

3.	As per the Ministry's Office Memorandum F.No.22-65/2017-IA.III dated 1st May 2018, the project proponent is required to prepare and implement Corporate Environment Responsibility (CER) Plan. As per para 6(II) of the said O.M. appropriate funds shall be earmarked for the activities such as infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness topical farmers to increase yield of crop and fodder, rain water harvesting, soil moisture conservation works, avenue plantation, plantation in community areas etc. The activities proposed under CER shall be restricted to the affected area around the project. The entire activities proposed under the CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half yearly compliance report, and to the District Collector. It should be posted on the website of the project proponent.	As per the Para 6 (IX) of the said notification which states that the CER is not applicable in name change, transfer, amendment involving no additional project investment; this is not applicable to us, as there is no additional project investment.

ENVIRONMENTAL MONITORING OF GOPALPUR PORT

Report
April, 2024 to September, 2024,

Submitted to

Gopalpur Ports Limited
Arjeepalli, Via- Chhatrapur
PIN-761020, Ganjam, Odisha, India

Visiontek Consultancy Services Pvt .Ltd
(An Enviro Engineering Consulting Cell)

Prepared by

VISIONTEK Consultancy Services Pvt. Ltd.,
Nodal Expert, GPL Env. Monitoring Project
Plot No- M22 23, Chandaka Industrial Estate, Patia,
Bhubaneswar-751024

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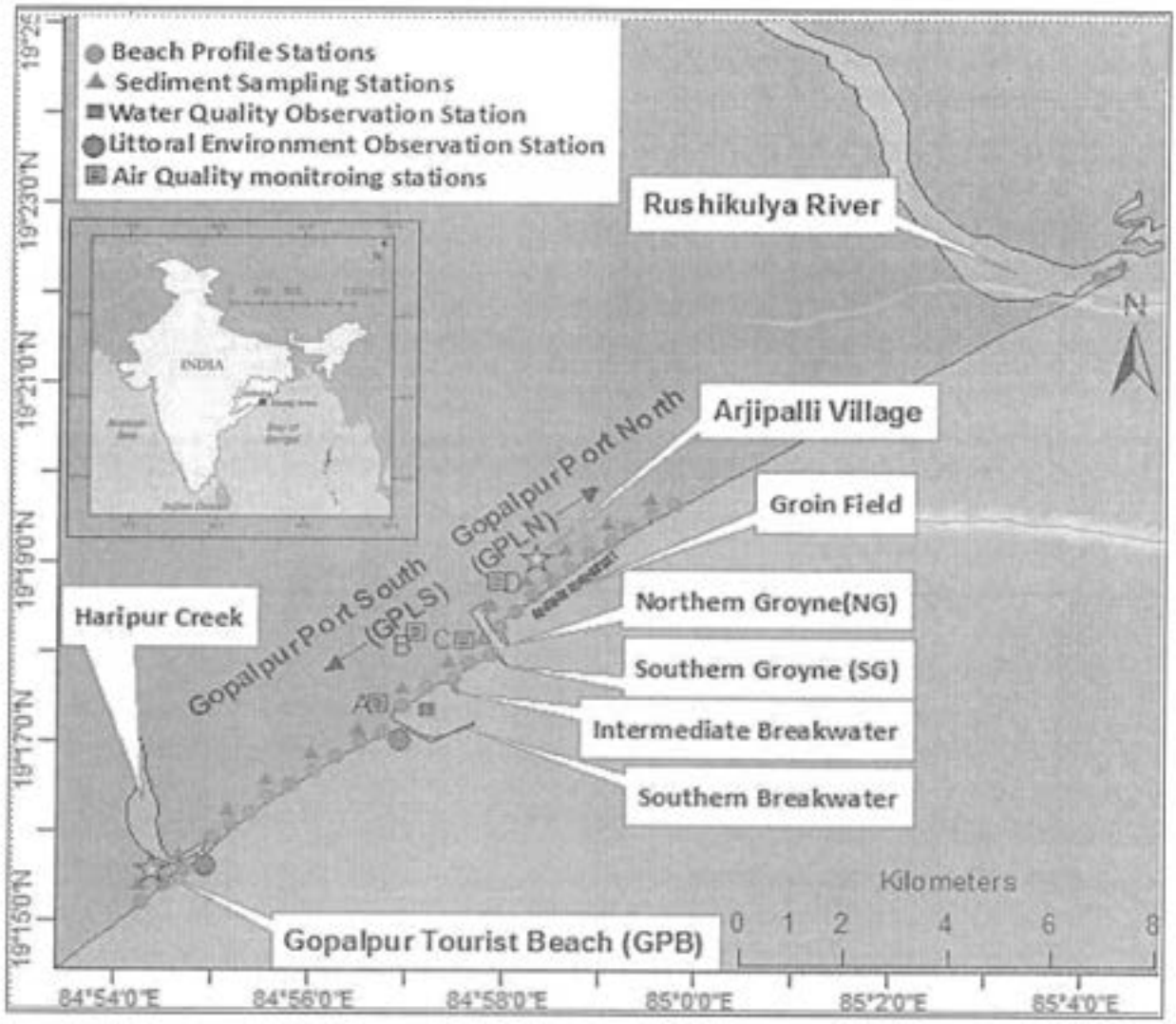


Figure 1: Sampling locations of different parameters near Gopalpur coast

OBJECTIVES:

1. Shoreline Monitoring

Monitoring the beach profile, erosion/accretion environment, shoreline change along a stretch of approximately 13km (from Gopalpur light house to Arjipalli village), which lies within the Port limit, on monthly basis.

Monitoring the sediment characteristics, littoral environment observations (LEO) were carried out along 13km stretch on monthly basis (Fig.1).

2. Monitoring of Ambient Air Quality

Monitoring of Ambient Air Quality were carried out at 4 stations; two in the windward side and two in the leeward side within the port premises for PM_{10}, $PM_{2.5}$, SO_2, NO_2 to measure the maximum ground level concentration (Fig.1).

3. Noise level monitoring

The noise level monitoring was carried out at 4 stations; two in the windward side and two in the leeward side within the port premises.

4. DG stack monitoring

DG stack monitoring was carried out on monthly basis from six DGs available in the port premises.

5. Domestic effluent

The Domestic effluent water was collected from the outlet of the sewage treatment plant available in the port for analysis of different parameters such as pH, BOD, COD, Suspended solid, Oil and grease.

6. Marine Water Sample

Chemical and microbial parameters

Coastal water samples were collected monthly from the harbor area for analysis of different parameters like pH, DO, Colour, Odour, Fecal Coliform, BOD, Salinity, EC, TDS, TSM, Phosphate, Nitrate, Chlorides, Sulphate, PHC, Lead, Hexavalent Chromium &Mercury were analyzed soon after the collection.

7. Sediment Sample

Chemical Parameters

Sediment samples were collected every month at same location near berth area and analyzed for the parameters like texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphate, PHC, Lead, Mercury, Hexavalent Chromium and Organic Carbon etc.

8. Potable water analysis

Potable water samples were collected every month and analyzed for color, order, turbidity, pH, Total hardness, Iron, Chloride, TDS, Calcium, Magnesium, Sulphate, Fluoride, Alkalinity, Salinity, Zinc, Lead and E.Coil.

9. Coal Stack yard

The water samples from the coal stack yard were collected monthly basis from coal stack yard available inside the port premises for analysis of different parameters such as pH, Electrical Conductivity and Total Dissolved Solid.

10. Biological Parameters

Biological parameters such as light penetration, chlorophyll, primary productivity, phytoplankton, zooplankton, benthic meio fauna and benthic macro fauna within the harbour were analyzed at every three month interval.

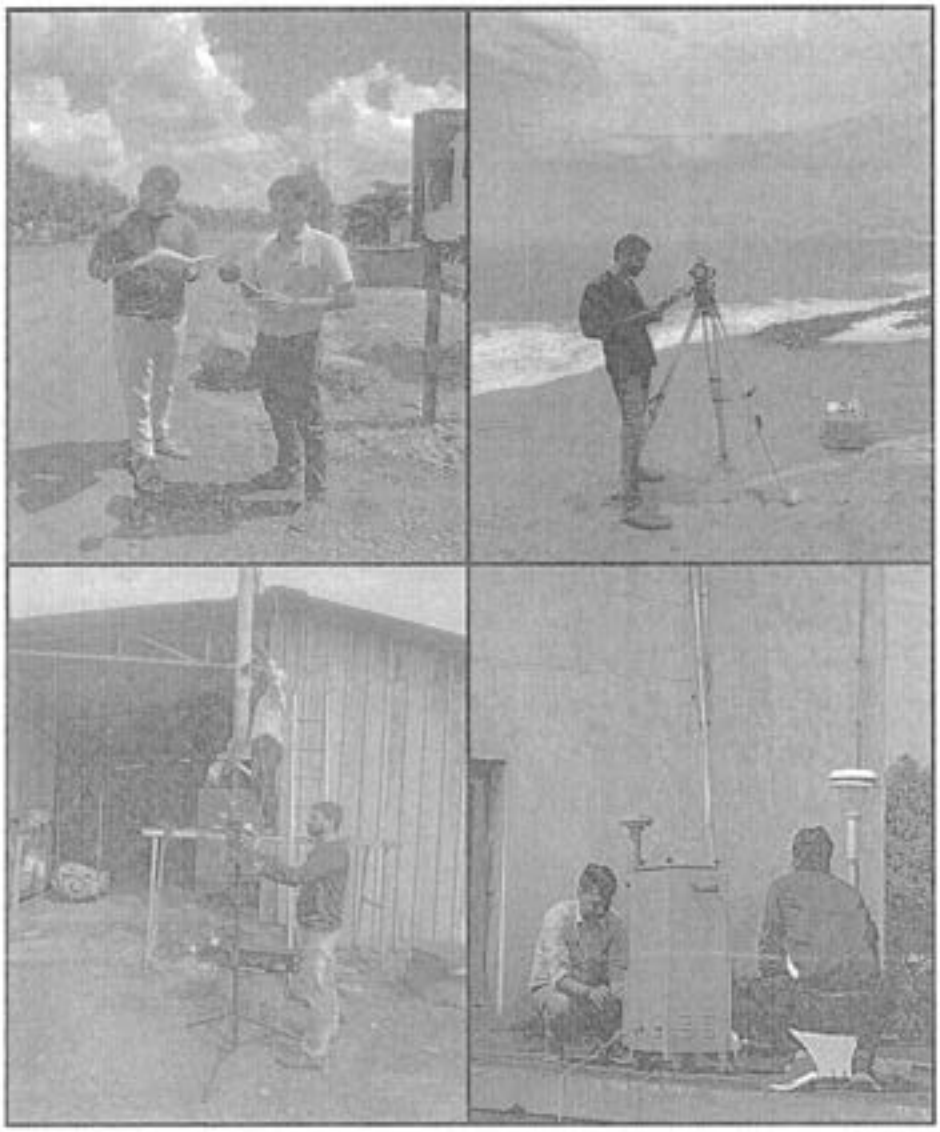


Figure 2: Sampling activities and field observation

Observation Schedule

Table 1: Types and frequency of Observations

Types of Observation	Scheduleof Observation	Spatial variability of observation
Shoreline (ARCPAD_DGPS)	Monthly	Mapping the berm line, representing the shoreline, within the port limit covering 26 km stretch
Beach Profile (RTK_GPS/TOTAL STATION)	Monthly	30 transects covering about 26 km stretch of the coast line (Fig. 1). Within 4.5km north and south of the port, the distance between two successive transects is maintained at 500m while for other locations, the distance is maintained at 1km.
Littoral Environmental Observations (LEO)	Monthly	At three points; Gopalpur port South, Gopalpur port North near and tourist beach (Fig. 1).
Sediment	Monthly	Sediment samples are collected for grain size analysis at backshore, midshore and foreshore of a transect at every 1km interval covering the 26 km stretch of the coast.
Ambient air quality (PM_{10}, $PM_{2.5}$, SO_2, O_2)	Twice in a Week	From the four sampling stations within the port environment (landward)(Fig. 2.1)
Noise level	Monthly	Within the port environment (landward) as per the guidelines of Central Pollution Control Board (CPCB)
DG stack monitoring	Monthly	Flue Gas Temperature, Average flue gas velocity,Quantity of emission,No+OH
Domestic effluents	Monthly	pH,BOD,COD,SuspendedSolids,oil&Grease
Coastal Water sample	Monthly	pH, DO, Colour, Odour, Fecal Coliform, BOD, Salinity, EC, TDS, TSM, Phosphate, Nitrate, sulphates, Chlorides, PHC, Lead, Mercury, Hexavalent Chromium,
Sediment sample a. Chemical parameters	Monthly	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates, PHC, Lead, Mercury, Hexavalent Chromium and Organic Carbon
Potable water	Monthly	Color, odour,Turbidity, pH, Total Hardness
Effluent from Coal Stack Yard	Monthly	pH, EC,TDS
b. Biological parameters	Quarterly	Light penetration, Chlorophyll,Primary productivity, phytoplankton, zooplankton within the harbour Benthic Meio-Fauna, Benthic Macro-Fauna

1. Shoreline monitoring:

Table 1.1 and Figure 3 present monthly measurements of shoreline distances (in meters) between the berm line and a reference line along Gopalpur Port South from April to September 2024. Measurements were taken at 0 km, 0.5 km, 1.0 km, 2.5 km, 3.0 km, 3.5 km, 4.0 km, and 4.5 km intervals. In April, distances ranged from 689.5 meters at 0 km to 783.2 meters at 4.5 km, peaking at 1126.4 meters at 2.5 km. May recorded a slight increase, with the maximum at 2.5 km reaching 1145.4 meters. June exhibited a noticeable decline, especially at 0 km, which decreased to 651.5 meters. July showed a marginal recovery at 0 km (688.7 meters) and 1.0 km (808.7 meters). August recorded the highest value at 2.5 km (1167 meters), while September saw a decrease, with the maximum returning to 1145.4 meters, similar to May. These monthly fluctuations, particularly at the 2.5 km mark, reflect dynamic coastal processes influenced by seasonal changes and geomorphological factors.

Table 1.2 and Figure 4 illustrate shoreline distances along Gopalpur Port North from April to September 2024. In April, distances varied from 308.2 meters at 0 km to 434.0 meters at 4.5 km. A general decrease followed in May, with the maximum at 4.5 km slightly reducing to 431.6 meters. This trend continued in June, with most points declining, except for an increase at 4.5 km to 437.7 meters. July recorded the lowest values, particularly at 0 km (255.7 meters) and 1.5 km (184.7 meters). August showed slight stability, with a peak of 412.6 meters at 4.5 km. By September, some points increased, notably at 0 km (278.1 meters), while a significant decrease to 345.8 meters occurred at 4.5 km.

Table 1.3 and Figure 5 provide shoreline distances from April to September 2024 along Gopalpur Tourist Beach, measured from 0 km to 3.0 km. In April, distances ranged from 98.5 meters at 0 km to 742.2 meters at 3.0 km, peaking at 752.3 meters at 2.0 km. May showed minor changes, with the maximum distance at 3.0 km reaching 754.8 meters. June experienced a general decrease, particularly at 0 km (85.6 meters) and 2.5 km (692.2 meters), though an increase was noted at 1.5 km (135.2 meters). The lowest values were recorded in July, especially at 0 km (60.9 meters). August saw recovery with increases at 0.5 km (99.1 meters) and 2.5 km (734.1 meters). In September, slight overall increases were noted, except at 2.5 km, which declined to 636.4 meters.

Table 1.4 summarizes beach width and volume variations along the South and North of Gopalpur Port from April to September 2024. The Tourist Beach experienced a notable decrease in width from 56.0 meters in April to 37.7 meters in September, indicating erosion or sand

displacement. Similarly, near Haripur Creek, beach width declined from 135.4 meters to 103.3 meters, with a slight rebound to 106.6 meters in August. The Southern Breakwater beach width decreased from 489.8 meters in April to 349.7 meters in June, partially recovering to 390.8 meters by September. The Intermediate Breakwater followed a similar trend, declining from 343.1 meters to 272.3 meters, while the Southern Groin peaked at 437.8 meters in June before dropping to 290.0 meters by September.In terms of beach volume, the Tourist Beach volume decreased from 114.7 m^3/m in April to 83.5 m^3/m in September. Haripur Creek volume saw a drastic drop from 132.3 m^3/m to 40.5 m^3/m in July, recovering slightly to 76.6 m^3/m. The Southern Breakwater peaked at 1152.7 m^3/m in June, declining to 777.5 m^3/m by September. Other locations exhibited variable trends, indicating significant seasonal changes in beach dynamics.

Table 1.5 details sediment grain size characteristics at Gopalpur Port South, Port North, and Tourist Beach from April to September 2024. Tourist Beach showed fine sand in April, transitioning to medium sand in May. Haripur Creek varied from medium sand to coarse sand by June. The Southern Breakwater featured fine sand, while the Intermediate Breakwater maintained a fine sand profile. The Southern Groin exhibited similar trends, and the Northern Groin fluctuated between medium and coarse sand.

Table 1.6 presents littoral environmental conditions along Gopalpur Coast from April to September 2024, detailing variations in breaker types, heights, angles, wave periods, and hydrodynamic parameters. Gopalpur Tourist Beach predominantly featured spilling breakers, with heights increasing from 0.72 meters in April to 1.76 meters in August. The wave period fluctuated between 9.41 and 12.04 seconds. Gopalpur Port exhibited similar patterns, with heights ranging from 1.06 to 1.72 meters and the strongest uprush recorded at 1.85 m/s in August. These observations underscore the dynamic coastal processes and their implications for sediment transport and coastal management strategies.

Table 1.1: Shoreline (m) analysis along Gopalpur Port South (Shoreline represents the distance in meter between bermline and the reference line in Fig. 1)from April, 2024 to September, 2024.

GPLS	SG 0km	0.5 km	1.0 km	2.5 km	3.0 km	3.5 km	4.0 km	4.5 km
Apr_24	689.5	669.6	841.5	1126.4	1042.7	921.5	834.6	783.2
May_24	679.7	686.2	776.3	1145.4	1029.3	907.7	826.6	793.3
Jun_24	651.5	629.9	738.8	1126.6	992.5	850.5	789.4	746
Jul_24	688.7	649.5	808.7	1099.9	982.3	878.2	797.1	751.4
Aug_24	685.5	639.2	794.1	1167	1021	887.1	808	710.9
Sep_24	672.8	634.7	781.5	1145.4	992.3	890.8	793.5	694.9

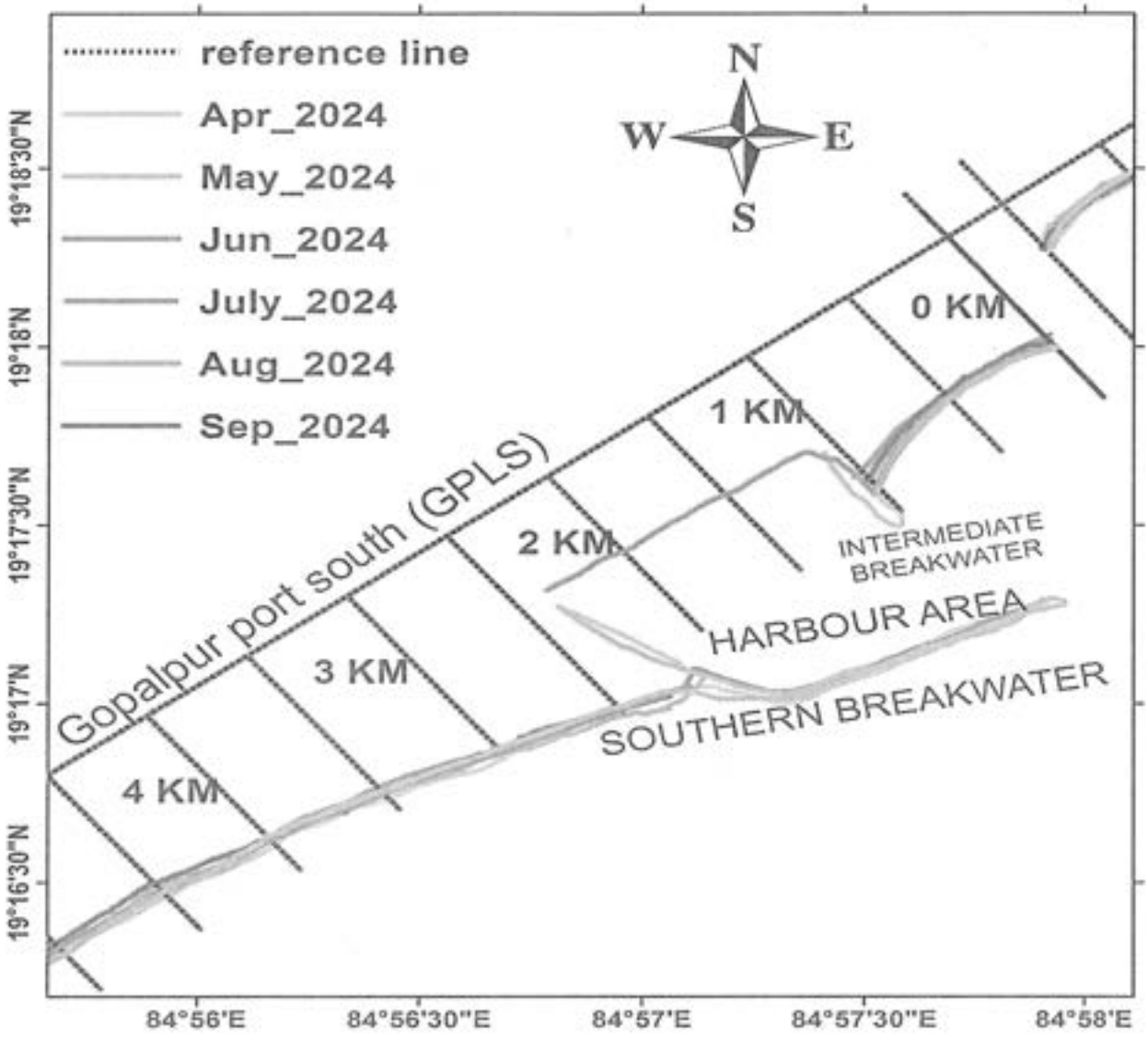


Figure 3: Shoreline change at south of Gopalpur port from April, 2024 to September, 2024.

Table 1.2: Shoreline (m) analysis along Gopalpur Port north (Shoreline represents the distance in meter between berm line and the reference line in Fig. 2) from April, 2024 to September, 2024.

GPLN	NG 0km	0.5 km	1.0 km	1.5 km	2.0 km	2.5 km	3.0 km	3.5 km	4.0 km	4.5 km
Apr_24	308.2	234.9	256.9	244.2	259.1	249.3	196.7	290.4	374.8	434.0
May_24	277.9	241.2	251.9	249.6	261.3	257.8	202.6	279.5	370.9	431.6
Jun_24	271.1	249.8	235.4	261.4	271.5	259.1	184.2	277.1	351.3	437.7
Jul_24	255.7	187.9	219.5	184.7	230.7	219.5	209.5	280.4	348.0	400.1
Aug_24	248.3	192.5	215.5	187.1	219.3	214.8	167.4	273.2	346.7	412.6
Sep_24	278.1	219.3	234.2	179.5	218.1	211.6	171.2	265.7	291.9	345.8

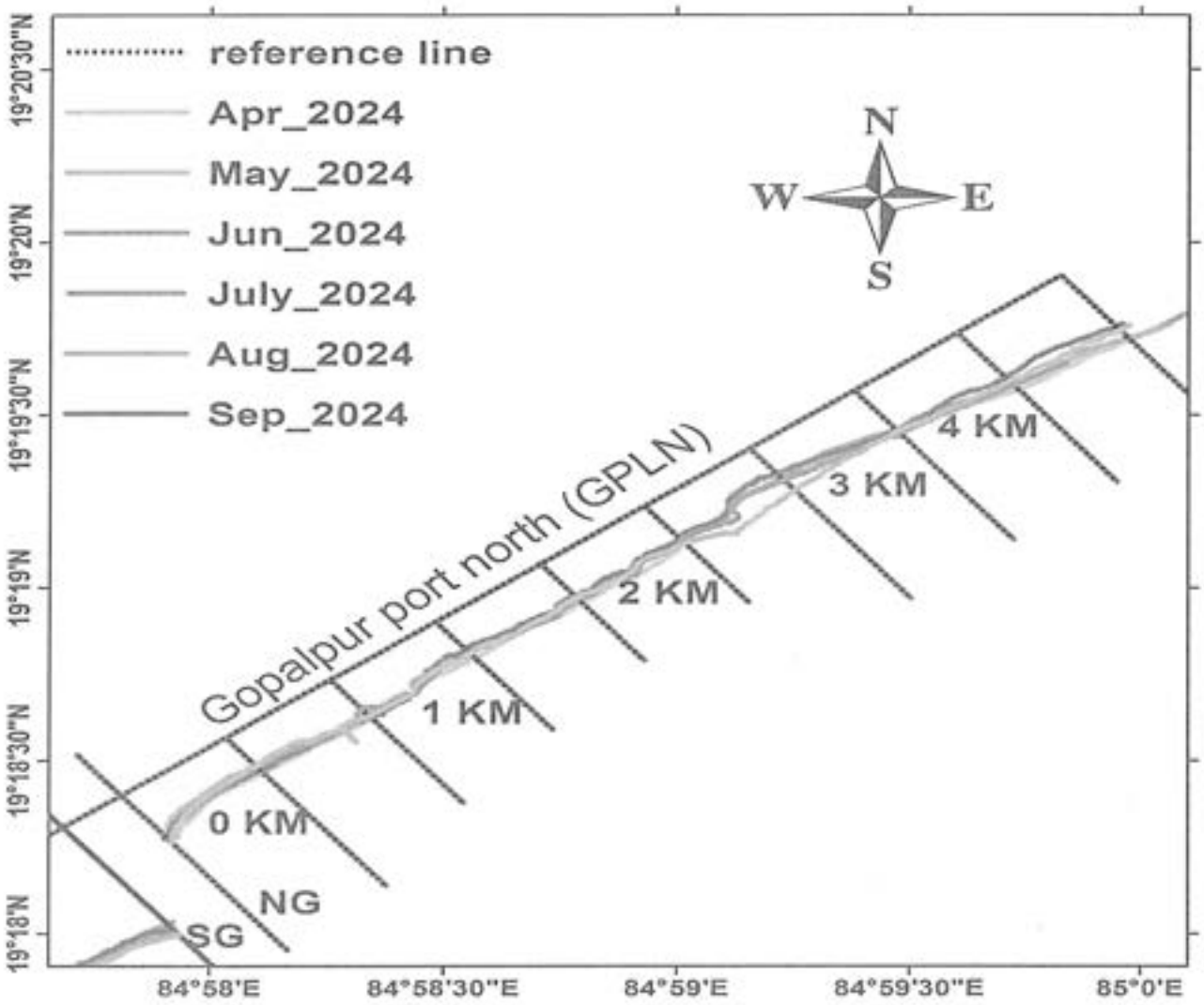
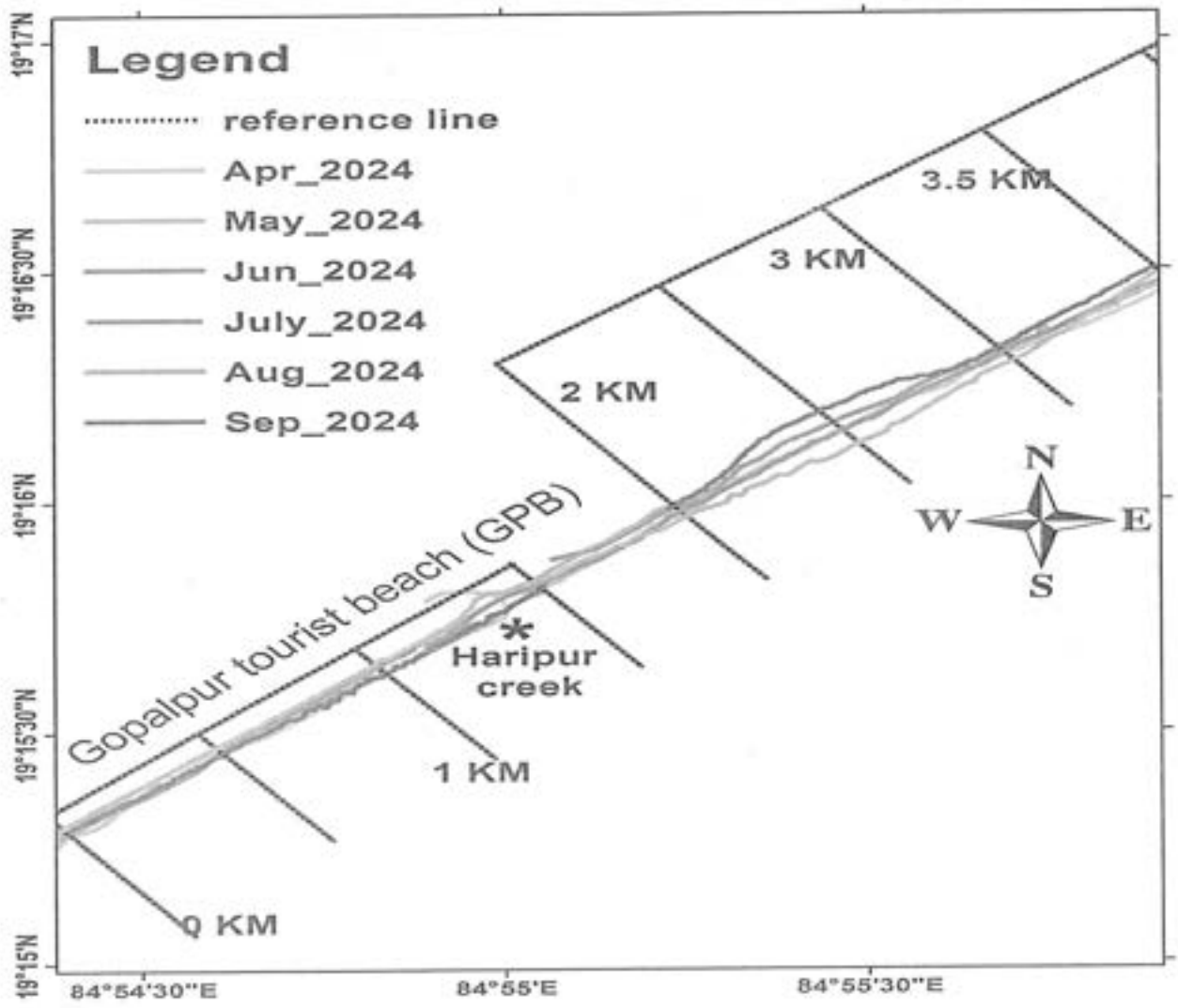


Figure 4: Shoreline changes at north of Gopalpur portfrom April, 2024 to September, 2024.

Table 1.3: Shoreline (m) analysis along Gopalpur tourist beach (Shoreline represents the distance in meter between berm line and the reference line in Fig. 3) from April, 2024 to

GPB	LH 0km	0.5 km	1.0 km	1.5 km	2.0 km	2.5 km	3.0 km
Apr_24	98.5	84.8	115.0	118.3	752.3	726.6	742.2
May_24	101.5	80.3	106.8	113.3	735.0	737.3	754.8
Jun_24	85.6	92.1	121.6	135.2	718.5	692.2	718.3
Jul_24	60.9	89.2	86.8	104.3	715.6	704.9	722.8
Aug_24	70.3	99.1	95.4	81.2	707.5	734.1	726.6
Sep_24	73.5	106.6	112.3	114.0	714.4	636.4	709.9



September, 2024.

Figure 5: Shoreline change at tourist beach of Gopalpur beach from April, 2024 to September, 2024.

Table1.4: Beach width and volume along Gopalpur port Southduring April, 2024 to September, 2024.

Beach Width (m)						
	Apr_24	**May_24**	**Jun_24**	**Jul_24**	**Aug_24**	**Sep_24**
Tourist beach	56.0	41.3	44.4	37.5	35.7	37.7
Haripur creek	135.4	105.4	103.5	92.0	106.6	103.3
Southern breakwater	489.8	438.1	349.7	407.3	401.8	390.8
Intermediate breakwater	343.1	300.1	330.7	315.0	282.4	272.3
Southern groin	364.8	336.4	437.8	376.4	350.7	290.0
Northern groin	86.1	85.2	86.1	84.8	84.8	85.6
Marine Thana	169.0	166.3	149.6	130.6	132.4	120.8
Arjipalli	87.8	81.5	81.3	69.1	73.1	67.8
Beach Volume (m^3/m)						
	Apr_24	**May_24**	**Jun_24**	**Jul_24**	**Aug_24**	**Sep_24**
Tourist beach	114.7	85.7	82.0	86.5	70.3	83.5
Haripur creek	132.3	82.7	72.1	40.5	85.1	76.6
Southern breakwater	939.1	903.8	1152.7	913.7	825.9	777.5
Intermediate breakwater	657.6	715.4	726.8	593.7	509.9	497.4
Southern groin	1054.1	1119.6	826.5	910.8	999.4	964.2
Northern groin	356.5	357.9	363.1	364.5	364.0	371.4
Marine Thana	1202.4	1160.1	1111.4	972.3	926.5	851.7
Arjipalli	374.0	349.6	343.7	296.1	267.4	324.5

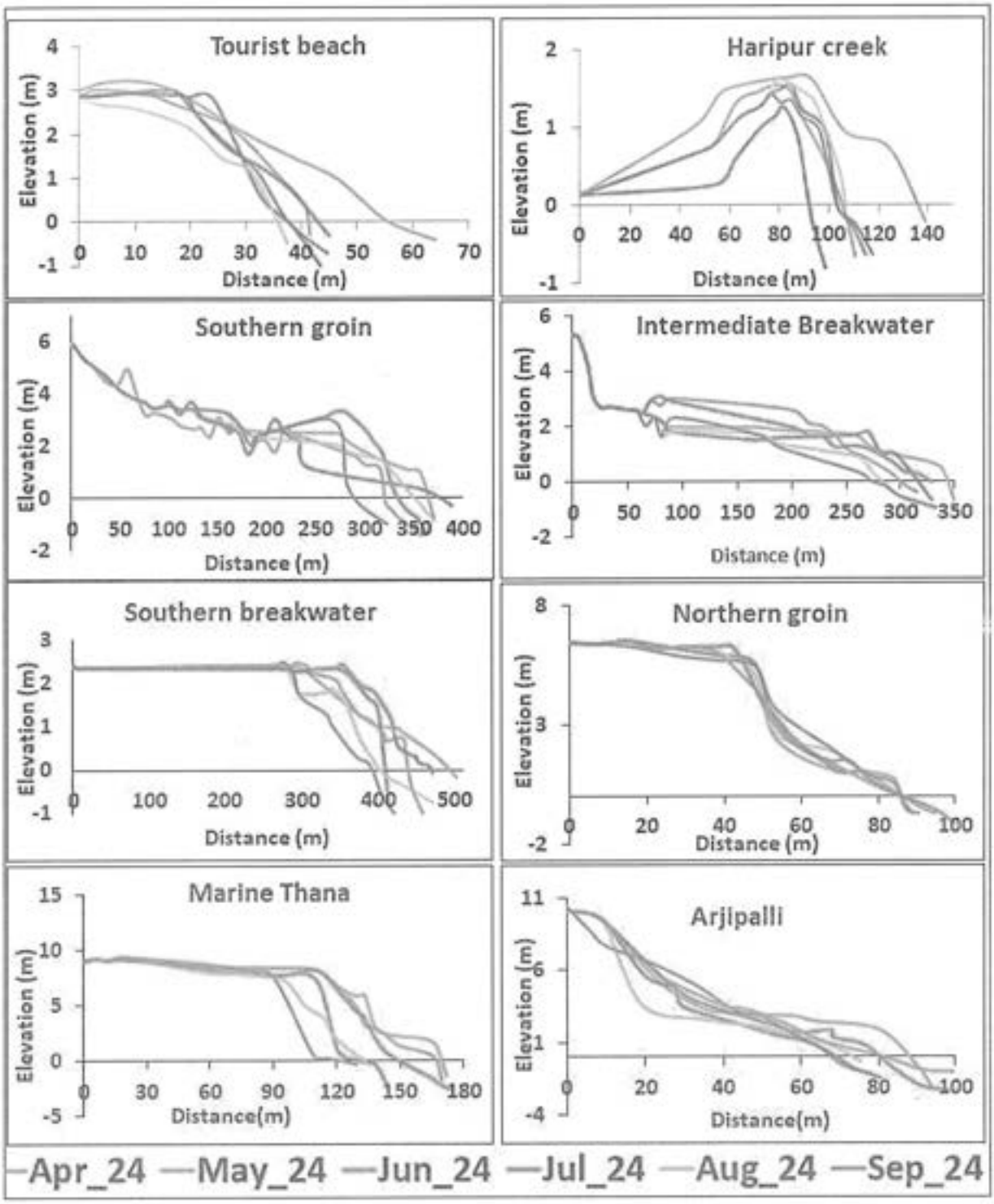


Figure 6: Beach profile at different stretches of Gopalpur port from April, 2024 to September, 2024.

Sediment Grain size

Table 1.5: Sediment grain size (Mean, Sorting) at Gopalpur port south, port north and tourist beach from April, 2024 to September, 2024.

Sediment						
	Apr_24	May_24	June_24	July_24	Aug_24	Sept_24
Tourist beach	Fine Sand/Moderately well Sorted	Medium Sand/Moderately well Sorted	Medium Sand/Moderately Sorted	Medium Sand/Moderately Sorted	Medium Sand/Moderately Sorted	Medium Sand/Moderately Sorted
Haripur creek	Medium Sand/Moderately Well Sorted	Medium Sand/Moderately Well Sorted	Coarse Sand/Moderately Well Sorted	Medium Sand/Moderately Well Sorted	Coarse Sand/Moderately Sorted	Coarse Sand/Moderately well Sorted
Southern breakwater	Fine Sand/ Well Sorted	Fine Sand/ Moderately Well Sorted	Medium Sand/ Moderately Well Sorted	Fine Sand/ Moderately Well Sorted	Fine Sand/ Moderately Well Sorted	Medium Sand/ Moderately Sorted
Intermediate breakwater	Fine Sand/Moderately well Sorted	Medium Sand/Moderately well Sorted	Medium Sand/Moderately Sorted	Medium Sand/Moderately well Sorted	Medium Sand/Moderately well Sorted	Medium Sand/Moderately Sorted
Southern groin	Fine Sand/Moderately well Sorted	Fine Sand/Moderately well Sorted	Fine Sand/Moderately Sorted	Medium Sand/Moderately well Sorted	Medium Sand/Moderately Sorted	Fine Sand/Moderately Sorted
Northern groin	Medium Sand/ Moderately well Sorted	Coarse Sand/ Moderately well Sorted	Coarse Sand/ Moderately Sorted	Coarse Sand/ Moderately well Sorted	Medium Sand/ Moderately Sorted	Medium Sand/ Moderately well Sorted
Marine Thana	Fine Sand/Moderately well Sorted	Fine Sand/ well Sorted	Medium Sand/ well Sorted	Coarse Sand/ Moderately well Sorted	Coarse Sand/ Moderately well Sorted	Coarse Sand/ Moderately well Sorted
Arjipalli	Fine Sand/Moderately well Sorted	Coarse Sand/ well Sorted	Coarse Sand/ Moderately well Sorted	Medium Sand/ Moderately Sorted	Medium Sand/ Moderately well Sorted	Medium Sand/ Moderately Sorted

Littoral Environment Observation

Table1.6: Littoral Environmental Conditions along Gopalpur Coast from April, 2024 to September, 2024.

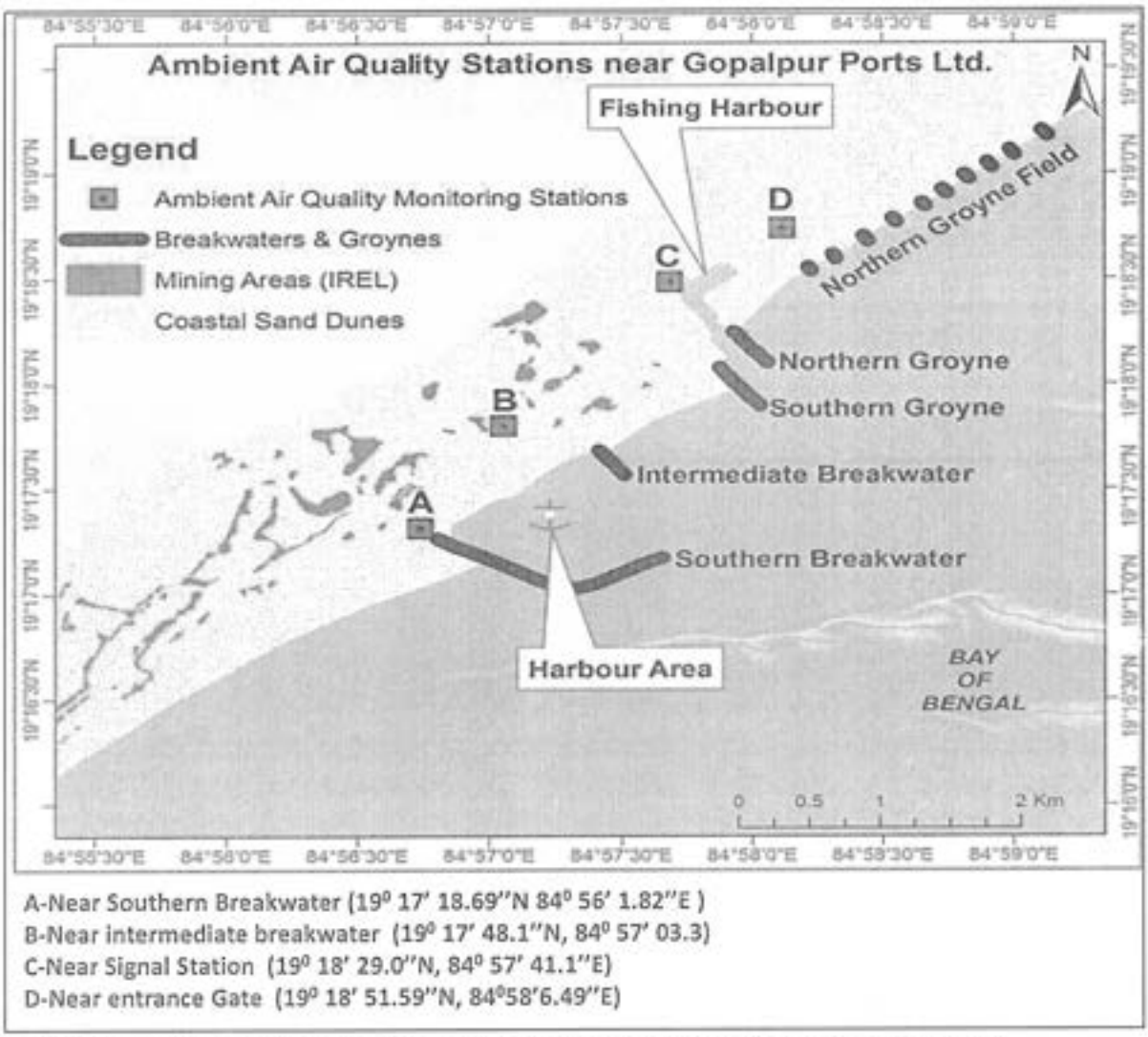
Month	Breaker type	Breaker height (m)	Breaker angle (deg)	Wave period (sec)	Wave direction	Uprush (m/s)	Backwash (m/s)	Surf zone width(m)
Gopalpur Tourist Beach								
Apr_24	Spilling	0.72	5	9.93	SSE	0.96	0.87	110
May_24	Spilling	1.16	10	9.41	SSE	1.01	0.88	95
Jun_24	Plunging	1.19	15	10.62	SSE	1.28	0.93	100
Jul_24	Spilling	1.68	20	9.72	SSE	1.3	1.0	105
Aug_24	Spilling	1.76	15	9.49	SE	1.78	1.03	80
Sep_24	Spilling/ Plunging	1.53	15	12.04	SSE	1.11	0.96	90
Gopalpur Port								
Apr_24	Spilling	1.06	0	10.92	SE	0.93	0.66	120
May_24	Spilling	1.24	5	8.31	SE	1.04	0.87	110
Jun_24	Spilling	1.53	15	9.61	SSE	1.41	1.18	105
Jul_24	Spilling	1.60	15	10.44	SE	1.3	1.01	110
Aug_24	Plunging	1.72	15	9.65	SSE	1.85	1.07	100
Sep_24	Spilling	1.50	20	11.28	S	1.16	0.93	110

2. Ambient air quality

Ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 andNO_2) was monitored around the Port premises at four points, two in the windward and two in the leeward sides (Figure 2.1) from April, 2024 to September, 2024. The coordinates of the four stations of air quality monitoring are; A (19^0 17' 17.72''N, 84^0 56' 51.72''E), B (19^0 17' 45.3''N, 84^0 57' 19.79''E), C (19^0 18' 29.18''N, 84^0 57' 40.84''E) and D (19^0 18' 51.59''N, 84^0 58'6.88''E) (Figure 1).The four points of monitoring are fixed in such a way that the impact of the port on air quality can be assessed up to a distance in down wind direction (both during strong sea breeze and land breeze time) where maximum ground level concentration is anticipated. Table-2.1, 2.2,2.3 and 2.4 depict the air quality values for the study period at the four points within the port premises along with the national ambient air quality standard (NAAQS) norms stipulated by MoEFCC.

The maximum PM_{10} (89.62$\mu g/m^3$) and $PM_{2.5}$ value (42.87 $\mu g/m^3$) were recorded during the month of April-2024 at station 'B' and during the month of July, 2024 at station 'D' respectively due to large number of vehicular emission and road dust whereas the minimum PM_{10} (57.16 $\mu g/m^3$) and $PM_{2.5}$ (21.24 $\mu g/m^3$) were recorded during the month of May,2024 and August,2024 at station 'A' respectively. The maximum SO_2 (5.57 $\mu g/m^3$) and NO_2 (7.96 $\mu g/m^3$) were recorded during the month of August, 2024 at station 'A' respectively due to high vehicular emission. Whereas the minimum SO_2 (0.82) was recorded at station 'C' during the month of May, 2024 and the minimum NO_2 (0.43) was recorded at station 'B' during the month of May, 2024.

The average value of the all ambient air quality monitored parameters at the four points within the port premises from April,2024 to September, 2024 are well within the NAAQ threshold limit stipulated by CPCB. Thus, the ongoing port operational activities are not detrimental to the air quality in the terrestrial environment.



A-Near Southern Breakwater (19^0 17' 18.69"N 84^0 56' 1.82"E)
B-Near intermediate breakwater (19^0 17' 48.1"N, 84^0 57' 03.3)
C-Near Signal Station (19^0 18' 29.0"N, 84^0 57' 41.1"E)
D-Near entrance Gate (19^0 18' 51.59"N, 84^{0}58'6.49"E)

Figure 7: Location of air quality monitoring stations within the Gopalpur Port area

Table 2.1: Ambient Air Quality within Gopalpur Port premises (A) (PM- Particulate matter, SO_2-Sulphur dioxide, NO_2-Oxides of nitrogen

STATION-A (Near SS-4)	Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
April_24	03.04.2024	64.38	24.38	2.63	1.54
	04.04.2024	68.46	27.62	2.48	1.92
	09.04.2024	76.28	23.49	1.92	2.43
	10.04.2024	79.42	28.64	2.57	2.71
	15.04.2024	64.39	25.73	2.86	1.88
	16.04.2024	80.16	24.82	3.43	3.14
	22.04.2024	84.61	22.47	3.76	2.48
	23.04.2024	82.44	21.92	2.64	2.37
May_24	06.05.2024	67.51	32.48	1.24	1.35
	07.05.2024	63.27	30.49	1.62	1.83
	13.05.2024	57.16	29.86	1.43	1.76
	14.05.2024	71.09	34.72	2.12	1.37
	20.05.2024	62.58	31.86	1.64	2.36
	21.05.2024	75.34	37.92	1.86	1.84
	27.05.2024	69.28	30.83	1.35	1.93
	28.05.2024	74.35	31.94	1.57	2.67
24-Jun	05.06.2024	68.19	33.72	1.34	1.66
	06.06.2024	64.62	31.07	1.62	1.54
	12.06.2024	67.38	32.43	2.07	2.43
	13.06.2024	69.52	34.27	1.83	1.86
	17.06.2024	73.92	35.24	1.57	1.91
	18.06.2024	78.37	38.26	1.92	2.17
	24.06.2024	72.51	34.83	0.86	1.32
	25.06.2024	69.54	34.15	1.74	1.73
July_24	04.07.2024	71.24	34.18	1.57	1.48
	05.07.2024	62.15	29.64	1.61	1.73
	11.07.2024	63.25	28.62	1.82	1.61
	13.07.2024	67.24	31.27	1.82	1.49
	16.07.2024	73.18	35.92	1.94	1.52
	17.07.2024	81.37	41.63	1.46	1.43
	26.07.2024	74.92	36.42	1.73	1.62
	27.07.2024	78.34	38.24	1.48	1.73
Aug_24	05.08.2024	62.37	24.18	3.24	3.44
	06.08.2024	68.42	26.37	2.43	4.38
	12.08.2024	57.92	21.24	2.86	4.18
	16.08.2024	65.27	25.73	3.57	3.62
	22.08.2024	68.43	26.49	2.62	3.37
	23.08.2024	64.18	24.87	3.48	3.83
	26.08.2024	71.92	28.92	3.14	3.76
	27.08.2024	73.46	29.64	3.64	3.82
Sept_24	05.09.2024	64.58	27.38	3.57	4.17
	06.09.2024	67.28	29.64	3.49	3.87
	12.09.2024	71.62	32.94	4.13	4.62
	13.09.2024	74.93	34.57	3.95	4.24
	19.09.2024	69.48	29.67	4.28	4.61
	20.09.2024	67.38	28.64	4.61	4.31
	24.09.2024	72.91	32.57	3.46	3.85
	25.09.2024	74.64	33.82	3.27	3.24
mean (range)		78.70 (57.16-84.61)	25.51 (21.24-41.63)	2.44 (0.86-4.61)	2.58 (1.32-4.62)
Reference value (NAAQS, 2009)		100	60	80	80

Table 2.2: Ambient Air Quality within Gopalpur Port premises (B) (PM- Particulate matter, SO_2-Sulphur dioxide, NO_2-Oxides of nitrogen

STATION-B (Near SS-2)	Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
April_24	03.04.2024	72.52	21.67	3.04	1.92
	04.04.2024	78.94	30.49	2.57	2.73
	09.04.2024	82.43	28.76	2.64	2.42
	10.04.2024	76.19	22.84	2.92	2.51
	15.04.2024	74.28	26.37	3.11	2.86
	16.04.2024	86.73	29.46	2.76	2.49
	22.04.2024	81.84	23.52	2.58	2.64
	23.04.2024	89.62	24.14	2.64	2.18
May_24	06.05.2024	71.68	36.43	1.38	1.67
	07.05.2024	64.94	32.94	2.13	0.43
	13.05.2024	64.93	31.62	2.37	1.92
	14.05.2024	76.08	37.38	1.42	1.67
	20.05.2024	76.22	34.27	1.64	1.73
	21.05.2024	67.64	35.92	1.28	0.75
	27.05.2024	81.94	39.64	1.67	1.42
	28.05.2024	73.28	36.84	2.35	2.11
24-Jun	05.06.2024	76.27	36.54	1.37	1.53
	06.06.2024	68.27	33.94	2.1	1.72
	12.06.2024	62.84	30.73	2.64	1.91
	13.06.2024	74.39	35.73	2.48	1.22
	17.06.2024	77.58	36.94	2.62	1.64
	18.06.2024	80.49	35.92	1.76	0.97
	24.06.2024	78.92	39.64	1.89	1.37
	25.06.2024	75.61	35.27	1.46	1.28
July_24	04.07.2024	64.92	29.37	1.34	1.61
	05.07.2024	71.83	34.53	1.62	1.49
	11.07.2024	64.27	31.57	1.48	1.57
	13.07.2024	83.46	40.68	0.95	1.62
	16.07.2024	81.75	42.75	1.73	1.76
	17.07.2024	74.64	36.27	1.42	2.16
	26.07.2024	64.24	28.94	1.87	1.56
	27.07.2024	65.49	29.58	1.36	1.83
Aug_24	05.08.2024	68.37	26.43	4.12	4.42
	06.08.2024	71.82	29.13	4.32	3.37
	12.08.2024	73.48	31.46	3.48	3.62
	16.08.2024	64.28	24.57	3.64	4.48
	22.08.2024	71.92	29.37	2.79	3.63
	23.08.2024	66.49	24.82	3.84	4.18
	26.08.2024	68.27	25.97	3.45	3.57
	27.08.2024	64.38	25.13	2.73	3.92
Sept_24	05.09.2024	73.64	31.67	4.28	4.39
	06.09.2024	78.29	35.46	3.95	4.12
	12.09.2024	75.17	32.92	4.16	4.73
	13.09.2024	73.92	30.61	4.53	4.38
	19.09.2024	74.58	31.76	4.84	4.57
	20.09.2024	76.27	33.27	3.27	3.84
	24.09.2024	69.57	29.57	2.64	2.68
	25.09.2024	61.38	25.81	2.97	3.28
mean (range)		73.25 (61.38-89.62)	31.63 (21.67-42.75)	2.57 (0.95-4.84)	2.49 (0.43-4.73)
Reference value (NAAQS, 2009)		100	60	80	80

Table 2.3: Ambient Air Quality within Gopalpur Port premises (C) (PM- Particulate matter, SO_2-Sulphur dioxide, NO_2-Oxides of nitrogen

STATION-C (Near Signal Station)	Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
April_24	05.04.2024	80.43	27.91	2.88	3.35
	06.04.2024	76.27	26.43	2.49	2.92
	11.04.2024	68.34	25.79	2.61	2.76
	12.04.2024	83.49	24.62	3.17	2.51
	18.04.2024	79.64	21.83	2.84	2.43
	19.04.2024	81.83	28.76	2.43	3.14
	25.04.2024	62.53	30.94	2.79	2.66
	26.04.2024	79.48	25.44	3.13	2.13
May_24	09.05.2024	57.34	25.61	1.38	2.73
	10.05.2024	61.58	29.43	1.09	1.82
	16.05.2024	68.91	34.86	1.42	2.59
	17.05.2024	80.46	39.43	1.67	1.46
	23.05.2024	64.34	32.73	0.82	1.38
	24.05.2024	78.52	38.61	1.63	1.47
	29.05.2024	67.38	28.62	2.47	1.92
	30.05.2024	62.49	24.28	2.38	2.08
24-Jun	07.06.2024	63.84	31.83	1.34	1.95
	08.06.2024	68.42	33.95	2.46	2.46
	14.06.2024	72.64	33.73	1.86	2.57
	15.06.2024	78.28	37.61	1.57	2.91
	19.06.2024	69.27	34.67	1.38	2.73
	20.06.2024	74.58	34.97	1.64	2.83
	27.06.2024	83.46	37.25	1.37	2.72
	28.06.2024	76.57	35.46	1.95	1.64
July_24	04.07.2024	58.91	26.48	1.27	2.18
	05.07.2024	72.64	35.73	1.63	1.73
	11.07.2024	63.81	28.47	1.94	2.49
	13.07.2024	62.46	26.73	2.48	1.91
	16.07.2024	69.73	29.43	1.61	2.46
	17.07.2024	67.42	33.71	2.37	2.43
	26.07.2024	76.18	38.49	1.73	2.17
	27.07.2024	79.63	40.48	1.94	1.85
Aug_24	05.08.2024	70.58	28.99	4.76	5.64
	06.08.2024	73.46	31.64	3.88	5.50
	12.08.2024	74.94	32.48	3.99	6.65
	16.08.2024	69.41	30.17	4.79	6.35
	22.08.2024	78.27	34.29	3.96	6.31
	23.08.2024	67.46	24.38	3.47	7.68
	26.08.2024	68.27	29.56	3.23	7.08
	27.08.2024	73.48	32.62	2.89	7.30
Sept_24	05.09.2024	72.91	30.49	3.84	4.92
	06.09.2024	76.27	34.28	4.29	4.87
	12.09.2024	68.54	30.73	4.62	5.34
	13.09.2024	76.17	32.59	5.27	5.94
	19.09.2024	79.64	38.42	4.28	4.83
	20.09.2024	81.94	39.75	4.61	5.61
	24.09.2024	71.62	29.84	3.14	5.42
	25.09.2024	85.43	41.83	2.67	4.27
mean (range)		72.48 (57.34-85.43)	31.79 (21.83-41.83)	2.65 (0.82-5.27)	3.50 (1.38-4.07)
Reference value (NAAQS, 2009)		100	60	80	80

Table 2.4: Ambient Air Quality within Gopalpur Port premises (D) (PM- Particulate matter, SO_2-Sulphur dioxide, NO_2-Oxides of nitrogen

STATION-D (Near entrance gate)	Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
April_24	05.04.2024	83.43	27.64	1.95	2.09
	06.04.2024	78..18	29.37	2.42	2.17
	11.04.2024	84.25	22.46	2.62	1.63
	12.04.2024	86.47	25.84	2.73	2.84
	18.04.2024	64.42	31.09	3.88	2.42
	19.04.2024	88.91	24.66	2.97	1.64
	25.04.2024	73.27	22.93	2.48	2.51
	26.04.2024	85.94	20.78	2.64	2.17
May_24	09.05.2024	79.45	35.27	1.34	2.46
	10.05.2024	81.39	38.64	1.2	1.94
	16.05.2024	89.43	39.43	0.92	1.73
	17.05.2024	69.27	27.53	1.64	2.55
	23.05.2024	87.61	32.64	2.37	1.67
	24.05.2024	74.38	29.76	2.61	2.76
	29.05.2024	74.62	28.51	1.83	2.48
	30.05.2024	84.69	39.82	2.47	1.86
24-Jun	07.06.2024	87.54	41.62	1.24	2.37
	08.06.2024	83.43	37.81	2.37	2.42
	14.06.2024	79.54	38.23	2.68	2.68
	15.06.2024	76.18	35.41	1.92	2.46
	19.06.2024	86.73	40.67	1.73	3.12
	20.06.2024	73.27	34.16	1.57	2.83
	27.06.2024	81.57	36.54	2.07	1.84
	28.06.2024	84.62	39.93	2.43	2.49
July_24	04.07.2024	74.92	36.49	1.63	1.94
	05.07.2024	62.58	27.52	1.78	2.18
	11.07.2024	76.27	38.64	1.54	1.67
	13.07.2024	72.61	34.58	1.46	2.43
	16.07.2024	74.28	37.46	1.76	2.76
	17.07.2024	83.49	42.87	2.18	2.49
	26.07.2024	74.38	37.18	1.94	2.57
	27.07.2024	62.18	26.73	1.82	2.46
Aug_24	05.08.2024	61.37	22.51	4.56	6.23
	06.08.2024	58.42	21.62	4.14	6.09
	12.08.2024	59.84	23.47	5.54	7.54
	16.08.2024	61.67	23.18	5.57	6.46
	22.08.2024	64.19	24.57	5.14	7.61
	23.08.2024	57.84	20.43	4.29	7.54
	26.08.2024	62.97	22.69	3.64	7.73
	27.08.2024	70.19	27.84	3.25	7.96
Sept_24	05.09.2024	69.26	29.63	4.37	6.17
	06.09.2024	68.27	30.58	3.64	6.73
	12.09.2024	65.19	26.79	3.57	5.98
	13.09.2024	71.34	31.58	4.18	5.84
	19.09.2024	68.24	29.37	4.68	5.37
	20.09.2024	66.57	26.71	3.49	6.21
	24.09.2024	68.49	28.94	3.62	4.29
	25.09.2024	72.37	32.46	3.27	4.83
mean (range)		74.19 (57.84-89.43)	30.92 (20.43-42.87)	2.77 (0.92-5.57)	3.67 (1.63-7.96)
Reference value (NAAQS, 2009)		100	60	80	80

3. Noise level monitoring: The noise level monitoring was carried out at different selected locations according to its importance. The highest average noise level was recorded at station "D" (Near entrance gate) due to high vehicular movement and the lowest value was recorded at station "B". The average day and night noise level monitoring values at station A (19^0 17' 17.72''N, 84^0 56' 51.72''E), B (19^0 17' 45.3''N, 84^0 57' 19.79''E), C (19^0 18' 29.18''N, 84^0 57' 40.84''E) and D (19^0 18' 51.59''N, 84^0 58'6.88''E) from April,2024 to September,2024 are presented in Table 3.1.

The noise level monitored during the day and night time is also well within the NAAQ thresholds stipulated by MoEFCC for industrial 75dB in day time and 70dB during night time zones during day time.

Table 3.1: Noise level (dB)within Gopalpur Port premises at station A, B, C, and D

	OBSERVATION LOCATIONS			
Months	A Near South break water	B Near intermediate break water	C Near signal Station	D Near Entrance Gate
April,2024	62.4	64.3	58.8	61.4
May,2024	58.46	61.34	64.34	59.28
June,2024	61.83	60.52	63.48	66.27
July,2024	57.64	61.92	63.48	64.32
Aug,2024	63.7	53.6	64.1	69.1
Sept,2024	56.1	55.5	61.6	63.3
Average	60.02	59.53	62.63	63.95

4. The DG Stack monitoring: DG stack available inside the port premises and their observed values from April, 2024 to September, 2024 are presented In Table 4.1.

Table 4.1: DG stack parameters with in Gopalpur Port (DG-1, DG-2, DG-3, DG-4, DG-5, DG-6)

DG-1, 250 KVA (near Central Store)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	404	396	378	390	394	412	395.67
Flue Gas Velocity (m/s)	7.76	7.59	7.76	8.06	7	8.02	7.70
Quantity of emission (m^3/hr)	374.52	381.56	373.84	330.22	234	218	318.69
PM (g/kwh)	0.12	0.09	0.11	0.12	0.11	0.09	0.11
SO_2(g/kwh)	0.15	0.14	0.13	0.1	0.09	0.1	0.12
NO_x + HC (g/kwh)	0.19	0.18	0.17	0.14	0.13	0.12	0.16
Co(g/kwh)	0.21	0.19	0.21	0.19	0.18	0.17	0.19
DG-2, 250 KVA (Meter Room)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	382	379	381	377	413	410	390.33
Flue Gas Velocity (m/s)	7.58	7.63	7.72	7.1	7.21	9.47	7.79
Quantity of emission (m3/hr)	382.64	374.52	382.17	300.97	239	239	319.72
PM (g/kwh)	0.14	0.12	0.13	0.11	0.11	0.1	0.12
SO2(g/kwh)	0.14	0.12	0.16	0.09	0.1	0.11	0.12
NOx + HC (g/kwh)	0.17	0.19	0.15	0.14	0.15	0.14	0.16
Co(g/kwh)	0.19	0.2	0.18	0.18	0.16	0.19	0.18
DG-3, 250 KVA (Substation -4)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	415	406	419	407	429	496	428.67
Flue Gas Velocity (m/s)	8.48	7.92	7.84	6.76	6.62	9.56	7.86
Quantity of emission (m3/hr)	397.62	392.43	401.82	286.08	198	246	320.33
PM (g/kwh)	0.13	0.14	0.15	0.09	0.08	0.13	0.12
SO2(g/kwh)	0.19	0.16	0.14	0.11	0.11	0.13	0.14
NOx + HC (g/kwh)	0.16	0.17	0.18	0.12	0.12	0.15	0.15
Co(g/kwh)	0.22	0.24	0.23	0.17	0.18	0.21	0.21

DG-4,100 KVA (Meter Room)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	377.00	381.00	365.00	358.00	363.00	392.00	372.67
Flue Gas Velocity (m/s)	8.18	8.24	8.16	9.34	11.04	11.55	9.42
Quantity of emission (m^3/hr)	435.83	368.18	357.49	461.41	286.00	278.00	364.49
PM (g/kwh)	0.12	0.11	0.10	0.14	0.14	0.14	0.13
SO_2(g/kwh)	0.13	0.12	0.14	0.11	0.13	0.15	0.13
NO_x + HC (g/kwh)	0.14	0.12	0.14	0.16	0.17	0.17	0.15
Co(g/kwh)	0.13	0.18	0.20	0.23	0.28	0.25	0.21

DG-5,100 KVA (Colony)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	372	364	372	365	380	367	370.00
Flue Gas Velocity (m/s)	6.84	6.92	6.72	6.13	10.27	6.97	7.31
Quantity of emission (m3/hr)	357.61	372.94	362.71	298.57	270	234	315.97
PM (g/kwh)	0.11	0.13	0.13	0.111	0.12	0.1	0.12
SO2(g/kwh)	0.12	0.14	0.12	0.08	0.11	0.1	0.11
NOx + HC (g/kwh)	0.15	0.16	0.17	0.11	0.16	0.13	0.15
Co(g/kwh)	0.16	0.21	0.18	0.16	0.26	0.21	0.20

DG-6,100 KVA (Substation -1)							
Parameters	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
Flue Gas Temperature (k)	360	372	356	363	377	379	367.83
Flue Gas Velocity (m/s)	6.82	6.76	6.83	10.73	12.4	10.33	8.98
Quantity of emission (m3/hr)	382.49	367.48	364.27	474	306	264	359.71
PM (g/kwh)	0.12	0.12	0.11	0.14	0.15	0.12	0.13
SO2(g/kwh)	0.11	0.13	0.14	0.12	0.14	0.5	0.19
NOx + HC (g/kwh)	0.13	0.14	0.12	0.15	0.17	0.16	0.15
Co(g/kwh)	0.11	0.14	0.16	0.26	0.34	0.28	0.22

5. Domestic effluent water

The domestic effluent water sample was collected from the outlet of the sewage treatment plant inside the Gopalpur port. Different water quality parameters were analyzed to understand the water quality of the domestic effluent discharge. The average value of the different parameters like pH (7.3), BOD (15.00), COD (91.8), Suspended solid (30.34) and oil and grease (2.13) during the last six months (April, 2024 to September, 2024) and the monthly analyzed values are depicted in table 5.1

Table 5.1 Domestic effluent parameters of the Gopalpur port

Parameter	Apr,2024	May,2024	June,2004	July,2024	Aug,2024	Sept,2024	Average
pH (mg/L)	7.13	7.26	7.13	7.8	7.4	7.2	7.3
BOD (mg/L)	19.37	18.62	19.43	9.43	10.64	12.53	15.0
COD (mg/L)	89.46	91.37	93.58	82.37	91.48	102.6	91.8
Suspended Solids (mg/L)	29.74	31.46	32.51	23.61	21.37	43.37	30.34
Oil & grease (mg/L)	2.94	2.87	2.79	1.41	1.12	1.64	2.13

6. Marine Water quality

Water samples were collected from port berth area (19^0 17' 21" N, 84^0 56' 55" E) for determination of their physico-chemical and biological properties.the samples were taken so to the laboratory soon after the collection. Due care was taken to avoid contamination during sampling. The chemical and biological properties of water and sediment samples were measured following prescribed methods by Indian Standards. The detail observed/analyzed parameters and their threshold values are provided below.

Water quality parameters such as pH, dissolved oxygen (DO), color and odour, fecal coliform, biological oxygen demand (BOD), salinity, electrical conductivity (EC), Total dissolved solids (TDS), total suspended matter (TSM), phosphate, nitrate, chloride, Sulphate, lead, mercury, hexavalent chromium and petroleum hydrocarbon for the period from April,2024 to September, 2024of Gopalpur port (harbour area) are presented in Table 6.1.It is evident that most of the parameters are well within the permissible limit/standard. During the observation period it is noticed that pH of water ranged from 7.1-7.4 with mean value of 7.2. representing alkaline nature of the harbour area. The maximum and minimum vales were recorded during July,2024 and April, 2024 respectively The Dissolved Oxygen ranges from 6.7-7.1 with average value of 6.89 mg/l for last six month.

The maximum Dissolved Oxygen was recorded during June, 2024 and the minimum value was recorded during August,2024. Fecal coliform values ranged from 680-1800 CFU/ml with average value of 1180 CFU/ml. The maximum value was recorded during April,2024. and the minimum value was recorded during September,2024.The BOD value ranged from 3.2-3.8 with average value of 3.54 mg/l. The maximum value was recorded during April, 2024. and the minimum value was recorded during September 2024.The Salinity value is ranged from 29.46-33.71PSU with average value of 31.67. The minimum value was recorded during September, 2024 due to the monsoonal effect and the maximum values was recorded during April, 2024. The Electrical Conductivity ranged from 48.37-51.37ms/cm with average value of 47.32ms/cm. The TDS and TSM value ranged from 27.8-33.27-and 0.59-1.46gm/l with average value of 30.81 and 1.25 gm/l respectively. TheSulphate value was ranged between 886.7-2138.37 mg/l with average value of 1868.3 mg/l for last six month. The Phosphate concentration was ranged between BDL to 0.17 with average value of 0.11 mg/l during last six months. Nitrate concentration ranged between 0.41 to 0.83 mg/l with average value of 0.68mg/l. the maximum value recorded during the month of July,2024 due to the monsoonal effect while the minimum value recorded during the month of May,2024.Chloride level of sea water varied from 13974.7-19450 mg/l with mean value of 16095 mg/l. The level of petroleum hydrocarbon was ranged between 0.38-0.69mg/l. with average value of 0.53 mg/l The level of lead varied from 0.007-0.02 mg/l with average value of 0.02 mg/l. The mercury value recorded BDL over the last six months. The Hexavalent chromium varied from 0.0021 to 0.01 mg/l with average value of 0.01 mg/l.

From the analysis of water quality parameters, it can be stated that the water quality of harbour area is good as almost all parameters are well within the permissible limits.

Table 6.1: Marine Water Quality parameters during April, 2024, to September, 2024 from Gopalpur port, harbor area.

Parameter	Apr,24	May,24	June,24	July,24	Aug,24	Sept,24	Average	Standard	Methods
pH	7.1	7.2	7.1	7.4	7.3	7.3	7.2	6.5-9[1]	Microprocessor based pH system
DO (mg/l)	6.76	6.93	7.14	6.84	6.73	6.91	6.89	> 3mg/L [1]	Winkler's Titration method following Grasshoff et al (1999)
Fecal coliform	1800	900	1700	950	1050	680	1180.00		APHA, 1999
BOD (mg/L)	3.89	3.42	3.37	3.73	3.64	3.19	3.54	--	Winkler's Titration method following Grasshoff et al. (1999)
Salinity (PSU)	33.71	32.1	32.96	31.38	30.42	29.46	31.67	< 5 [1]	Mohr-Knudsen Argentometric titration method
EC (mS/Cm)	49.84	48.6	51.37	45.46	45.46	43.18	47.32	--	YSI portable multi parameter water quality meter
TDS (PPT)	32.18	33.27	32.31	30.17	29.1	27.8	30.81	--	multi parameter water quality meter
TSM($g.l^{-1}$)	1.397	1.428	1.297	1.304	1.462	0.594	1.25	--	Filtration method using Vacuum pump and filtration unit
Sulphate (mg/L)	2086.49	2063.42	2138.73	2057.62	1976.84	886.7	1868.30	--	APHA 4500 PD
Phosphate (mg/L)	0.03	0.04	0.17	BDL	0.159	0.146	0.11	0.1 mg/L	APHA 4500 NO_2 E
Nitrate (mg/L)	0.48	0.41	0.83	0.87	0.73	0.746	0.68	1.0 mg/L[m]	APHA 4500 SO_4^{2-}E
Chloride (mg/L)	19450	19450	14937	13974.7	13977	14784.6	16095.17	--	APHA 4500 CL^- B
PHC (mg/L)	0.69	0.69	0.47	0.56	0.38	0.41	0.53	--	EPA 3510
Lead(mg/L)	0.011	0.011	0.026	0.024	0.017	0.007	0.02	10 mg/L[1]	APHA 311 B.C
Mercury (mg/L)	BDL	BDL	0.001	0.001	0.001	0.001	0.00	0.1 mg/L[3]	APHA 5500 Hg
Hexavalent Chromium (mg/L)	0.01	0.01	0.02	0.014	0.012	0.002	0.01	0.01 mg/L[1]	APHA 3500 Cr B

Sources:

1. Primary water quality criteria for class SW-IV waters (Harbour) as per EPA, 1986
2. Guidelines for coastal water quality, Dept. of Environment, Govt. of India, General notice no 620 of 1999.
3. Central Pollution Control Board, PollutionControl Acts, Rules and Notifications, Fourth Edition, Ministry of Environment and Forests, 2001, 897pp.

7. Sediment Quality

Sediment samples were collected from port berth area (19^0 17' 21" N, 84^0 56' 55" E) for determination of their physico-chemical properties. The sediment pH varied from 6.76 to 7.7.07 with mean value of 6.92 indicating prevalence of alkali medium within the sedimentary environment (Table 7.1). Sodium level in sediment varied from 648-878 mg/kg with mean value of 730.6mg/kg. Maximum values were observed during June, 2024 and minimum during September, 2024. Potassium values are varied from 11.76-13.61 mg/kg with mean value of 12.75 mg/kg. The sediment phosphate value is ranged from 21.52-26.49 mg/kg with average value of 23.41mg/kg. The maximum value recorded during the month of April, 2024 where as the minimum value recorded during the month of August,2024. The sediment chloride value varied from 3167mg/kg to 3367mg/kg with average value of 3247mg/kg. The maximum value recorded during August, 2024 whereas the minimum value recorded during September, 2024. The maximum Sulphate value (388.4) was observed during May 2024 while it was minimum (294.6)in the month of September, 2024. The value of petroleum hydro carbon (PHC) was ranged from 0.002-0.002µg/L with mean value of 0.004 during the sampling period. The maximum and minimum values are recorded during the month of April,2024 and September,2024 respectively. The value of lead observed very low which varied from 0.001-0.013 gm/kg during the entire sampling period. The Levels of hexavalent chromium ranged from 0.08-13.9 with average value of 3.89mg/kg. The mercury value was varied from 0.002-0.007 with average value of 0.003. The Percentage of organic carbon varied from 0.09 -0.24% . with average value of 0.17.

From the analysis of Sediment quality parameters of the harbor area, it can be stated that the Sediment quality of harbour area is good as almost all parameters and parameters are well within the permissible limits.

Table 7.1 Sediment parameters during April, 202 to September, 2024

Sediment parameters	Apr.24	May.24	June.24	July.24	Aug.24	Sept.24	Range	Mean	Methods
pH	6.84	6.76	6.89	7.02	7.07	6.94	6.76-7.07	6.92	Potentiometric method
Sodium (mg/kg)	673	682	878	753.61	748.63	648.57	648.57-878	730.64	Flame photometry
Potassium (mg/kg)	12.42	13.61	12.83	11.76	12.38	13.48	11.76-13.61	12.75	Flame photometry
Phosphate (mg/kg)	26.49	24.35	21.94	22.68	21.52	23.49	21.52-26.49	23.41	
Chlorides (mg/kg)	3294	3168	3264	3226	3367	3167.4	3167.4-3367	3247.73	USDA:1954 US -affirmed 2010
Sulphates (mg/kg)	387.2	388.43	372.61	327.83	318.94	294.6	294.6-388.43	348.27	Methods of analysis of soil by HLS Tandon*
PHC (µg/L)	0.004	0.003	0.004	0.005	0.003	0.002	0.002-0.005	0.004	UNEP 1992
Lead (gm/kg)	0.001	0.002	0.006	BDL	0.013	0.013	0.001-0.013	0.005	EPA 3050 B
Mercury (mg/kg)	0.003	0.003	0.002	0.003	0.002	0.007	0.002-0.007	0.003	EPA 3050 B
Hexavalent chromium (mg/kg)	0.07	0.08	0.09	0.07	9.2	13.9	0.08-13.9	3.89	Methods of analysis of soil by HLS Tandon*
Organic carbon (%)	0.1	0.09	0.24	0.19	0.18	0.24	0.09-0.24	0.17	Methods of analysis of soil by HLS Tandon*

8. Potable Water

The potable water was collected from the drinking water available inside the port and analyzed for different water quality parameters like, Turbidity, pH, Total Hardness, Iron, Chloride, Total Dissolved Solid (TDS), Calcium, magnesium, Sulphate, Flouride, Alkalinity salinity, Zinc and lead and the values are within the permissible limit. The monthly values and the average values are depicted in Table 7.1

Table 8.1 Potable Water parameters during April, 2024 to September, 2024

Water parameters	Apr,24	May,24	June,24	July,24	Aug,24	Sept,24	Average	Standard
Turbidity (ntu)	0.73	0.76	0.81	0.69	0.62	0.58	0.70	1
pH	7.28	7.31	7.28	7.26	7.18	7.24	7.26	6.5-8.5
Total Hardness (mg/l)	165.12	174.84	172.07	165.66	173.56	177.3	171.43	200
Iron(mg/l)	0.19	0.21	0.24	0.22	0.21	0.19	0.21	0.3
Chloride (mg/L)	55.6	58.9	61.37	64.58	67.59	49.55	59.60	250
TDS (mg/l)	328.9	334.6	334.6	318.57	321.67	318.49	326.14	500
Calcium(mg/l)	33.84	34.68	28.31	27.46	26.73	26.73	29.63	75
Magnesium(mg/l)	19.58	21.43	24.62	23.58	25.94	26.85	23.67	30
Sulphate(mg/L)	19.4	22.6	26.37	21.37	23.57	14.57	21.31	200
Flouride(mg/l)	BDL	BDL	BDL	BDL	BDL	BDL	#DIV/0!	
Alakalinity(mg/l)	169.5	172.8	168.24	183.2	175.6	189.7	176.51	200
Salinity(ppt)	0.24	0.22	0.25	0.29	0.27	0.29	0.26	--
Zinc(mg/l)	0.03	0.02	0.02	0.02	0.0005	0.0006	0.02	5
Lead(mg/L)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
E. Coli (MPN/100 ml)	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	BDL	

9. Effluent from coal stack yard:

The water from the coal stack yard was collected from coal stack yard available inside the port premises for analysis of different parameters such as pH, Electrical Conductivity and Total Dissolved Solid. The monthly average value of the parameters are depicted in table 9.1

Table 9.1 Coal stack yard parameters during June, 2024 to September, 2024

COAL STACK YARD-1			
Months	pH	EC (µS/Cm)	TDS (mg/l)
June,2024	7.27	458.2	294
July,2024	8.3	442	282.8
Aug,2024	7.8	448	286.7
Sept,2024	7.9	428	274.8
Average	7.82	444.05	284.57

COAL STACK YARD-2			
Months	pH	EC (µS/Cm)	TDS (mg/l)
June,2024	7.34	473.6	303.1
July,2024	8.2	471	301.4
Aug,2024	8.1	436	279
Sept,2024	8.1	419	268.3
Average	7.93	449.90	287.95

COAL STACK YARD-3			
Months	pH	EC (µS/Cm)	TDS (mg/l)
June,2024	7.39	442.8	284.2
July,2024	7.9	468	299.8
Aug,2024	8.3	478	305.9
Sept,2024	7.6	452	289.4
Average	7.80	460.20	294.82

COAL STACK YARD-4			
Months	pH	EC (µS/Cm)	TDS (mg/l)
June,2024	7.21	481.4	307.4
July,2024	8.2	456	291.8
Aug,2024	7.7	462	295.6
Sept,2024	7.4	472	302.7
Average	7.63	467.85	299.37

Biological Parameters

Biological samples (water and sediment) were collected from port berth area (19^0 17' 21" N, 84^0 56' 55" E) for determination of their biological properties. Due care was taken to avoid contamination during sampling. The biological properties of the samples were measured adopting prescribed methods by Indian Standards. Biological parameters such as chlorophyll, primary productivity, phytoplankton and zooplankton, macrobenthos and meiobenthos samples were collected and analysed on quarterly basis from April,2024 to September,2024 and are depicted in Table 9.1. Quarter 1 (Q1) represents for months April, 2024 to June,2024 and Quarter 2 (Q2) represents for July,2024 to September,2024.

Table 9.1. Biological parameters of Gopalpur Port during quarter 1 (April, 2024 to June, 2024) and quarter2 (July, 2024 to September, 2024)

Station	Sample	Parameters	Results Q-1	Results Q-2
Harbour Area Latitude- 19^0 17' 21" N Longitude- 84^0 56'55"E	Marine Water	Light penetration (m)	2.1	1.9
		Chlorophyll (mg/m^3)	2.5	1.36
		Primary productivity (g.C/m^3/hr)	0.093	0.028
		Phytoplankton (no. of cells/l)	3462	469
		Zooplankton (no. of individuals/l)	974	774
	Sediment	Benthic meiofauna (per m^2)	2475	4800
		Benthic macrofauna (per m^2)	2946	5600

10. Conclusion:

The shoreline measurements from April to September 2024 along Gopalpur Port South and North, as well as Gopalpur Tourist Beach, reveal significant temporal fluctuations influenced by dynamic coastal processes. At Gopalpur Port South, the maximum shoreline distance peaked at 1167 meters in August, while Gopalpur Port North exhibited a notable decline, with the lowest distance recorded at 255.7 meters in July. The Tourist Beach showed a consistent decrease in width, dropping from 56.0 meters in April to 37.7 meters in September, indicative of erosion. Sediment grain size varied from fine to medium sand, reflecting changes in environmental conditions. Additionally, littoral conditions demonstrated increasing breaker heights, with Gopalpur Tourist Beach experiencing heights rising from 0.72 meters in April to 1.76 meters in August. These findings underscore the importance of continuous monitoring and assessment of coastal dynamics to inform management strategies, particularly in light of the observed seasonal variations in beach width, sediment characteristics, and wave conditions. Overall, the study highlights the complexity of coastal processes at Gopalpur and the necessity for adaptive management in response to these changes.

Ambient air quality such as PM_{10}, $PM_{2.5}$, SO_2, NO_2 were monitored twice weekly at the four points within the port premises from April, 2024 to September,2024. It is observed that air pollution is mainly due to high particulate matter. The maximum Particulate matter recorded at station 'A' where major port activities are in progress. The maximum SO_2 and NO_x were recorded at station "D" due to high vehicular movement. The values observed are well within the NAAQ norms stipulated by MoEFCC and Environment (protection) Act, 1986. Further, sound level monitored during the day and night time is within the permissible limits stipulated by CPCB for industrial 75dB in day time and 70dB in the night time. Thus, the ongoing port activities at present are not detrimental to the air quality and noise level and indicates a pollution free terrestrial port environment.

Water quality parameters of port harbour area monitored for the period from April,2024 to September, 2024 include, pH, DO, colour, odour, Fecal Coliform, BOD, Salinity, EC,TDS, TSM, Phosphate, Nitrate, Sulphate, Chloride, PHC, lead, mercury and Hexavalent chromium. All the parameters are well within the standard limit during the sampling period.

Sediment quality of port harbour area was assessed by examining sediment texture (mean grain size, sorting, skewness and kurtosis), pH, sodium, potassium, phosphate, chloride, sulphate, PHC, lead, mercury, organic carbon and hexavalent chromium. Sediment is alkaline in nature while phosphate, PHC, mercury, organic carbon and hexavalent chromium are present in trace amount. The metal concentrations both in water and sediment are within the permissible limit. The biological

parameters like Phytoplankton and Zoo plankton were higher in Q1 (April-June, 2024) compared to Q2 (July-September,2024) Higher value of chlorophyll and primary productivity during Q1can be attributed to higher value of phytoplankton. The Macrobenthos and meobenthos abundance were higher during Q2 compared to Q1.

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