



KOLKATA PORT TRUST
कोलकाता पत्तन न्यास
HALDIA DOCK COMPLEX
हल्दिया गोदी परिसर



Office of General Manger (Engg.), Jawahar Tower, 2nd floor

No.Ship/ENV/RJH-72/656.

Dated: 13, 03, 2018.

Sri Kushal Vashisht
Director (IA-III)
Ministry Of Environment, Forest and Climate Change
Indira Paryavaran Bhavan
Jor Bagh
New Delhi-3

Sub: Redevelopment of Cargo Handling Facilities at Outer Terminal-II at HDC,by Kolkata Port Trust : Submission of documents as per 25th. EAC minutes dtd.29/11/17

Ref: Proposal No.IA/WB/MIS/31632/2015: F No.10-27/2015-IA-III)

Sir,

This has reference to the Minutes of Meeting of 25th.EAC meeting(Infra -2) held on 29th.Novenber,2017, regarding the Environmental and CRZ Clearance of the above mentioned project. Accordingly, we would like to submit the point wise compliance to requirement given in Minutes of Meeting recorded vide item no.25.3.22.

Observation given in MoM of 25 th .EAC dtd.29.11.17	Response of HDC, Kolkata Port Trust
(i) No Objection Certificate from the concerned State Pollution Control Boards for the projects involving discharge of effluents, solid wastes, sewage and the like.	The Copy of the No Objection Certificate as per West Bengal Pollution Control Board in the form of Consent to Establish .is enclosed.
(ii) A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.	The requisite certificate from Haldia Development Authority vide Memo no.2582/HAD/IX-A-14/I/7 dtd.17.01.18 is enclosed.

<p>(iii) A detailed traffic management and traffic decongestion plan to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D. and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.</p>	<p>The subject Project is a Liquid Terminal Jetty at open River front wherein project cargo will be directly evacuated through Pipeline from jetty side to the Industry. Basically there is hardly any increase in cargo as the liquid cargo in this particular jetty is the shifting of the existing cargo which is being handled at present inside the impounded Dock to reduce Turnaround Time of Ships due Lock Constraint.</p> <p>Accordingly as the Liquid cargo will be transferred through the pipeline directly to the industry and as there will not be any additional Traffic load due to operation of the Jetty and also there will be no additional traffic load on the present Road infrastructure of Haldia Dock Complex.</p>
<p>(iv) The permission of the CGWA for abstraction of ground water and for basement/excavation dewatering.</p>	<p>There is no basement/excavation & Dewatering for this Project. There will be no use of Ground water for this particular project.</p>
<p>(v) A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.</p>	<p>The same has since been confirmed by the Power Supply agency "West Bengal State Electricity Distribution Company Limited" (WBSEDCL) vide their letter No.C/BC/MID/7/2201 dtd.16.01.2018. Copy enclosed.</p>
<p>(vi) A certificate from the competent authority for discharging treated effluent/ untreated effluents into the Public sewer/ disposal/drainage systems along with the final disposal point.</p>	<p>The NOC from West Bengal Pollution Control Board as per item no.1 has dealt the issue in this regard.However as per our EIA Report and Presentation no such discharge will be made in the River. The drainage system inside the Dock is maintained by Haldia Dock Complex and the same is treated in Treatment plant.</p>
<p>(vii) A copy of the Marine and riparian biodiversity management plan duly validated by the State Biodiversity Board.</p>	<p>Validation of Marine and Riparian Biodiversity Management Plan issued by West Bengal Biodiversity Board vide their letter no.237/4M(Bio)-1/2006 dtd.08.03.2013 is enclosed along with the Report</p>

(viii) A detailed Plan for green belt development	The same is enclosed please.
(ix) A certificate from the competent authority handling municipal solid wastes, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project.	Copy of the certificate from Haldia Municipality vide Memo no.424/HM/2018 is enclosed Please

In view of the submission of the Compliance, the Environmental and CRZ Clearance for the subject project may kindly be considered.

Encl : As above

Yours Sincerely



(A. Ganesan)
General Manager (Engineering)
Haldia Dock Complex
Kolkata Port Trust

WEST BENGAL POLLUTION CONTROL BOARD

Paribesh Bhawan
10A, Block-LA, Sector-III
Bidhannagar, Kolkata-700 098

Memo No. 130-2N-36/2013(E)Dated 13.03.2018

From :
Member Secretary,
West Bengal Pollution Control Board



To : **The General Manager (Engineering),
Haldia Dock Complex, PO-Chiranjeebpur, PS-Sutahata,
Dist.-Purba Medinipur, PIN - 721604, West Bengal.**

Sub : Consent to Establish (NOC) from Environmental Point of ViewRef : Your letter No. SDM/RZ/107/787 Dated 21.02.2018

Dear Sirs,

In response to the application for Consent to Establish (NOC) for proposed Unit of M/s Kolkata Port Trust, Haldia Dock Complex, redevelopment of cargo handling facilities at outer terminal (near 2nd oil Jetty). for expanding storage installation at Haldia Dock Complex, Kolkata Port Trust, Haldia, Purba Medinipur, West Bengal. this is to inform you that this Board hereby grants the Consent to Establish (NOC) from the environmental point of the above subject to the following conditions and special-conditions annexed.

1. The quality of sewage and trade effluent to be discharged from your factory shall satisfy the permissible limits as prescribed in IS : 2490 (Pt. I) of 1974, and/or its subsequent amendment and Environment (Protection) Rules 1986.
2. Suitable measures to treat your effluent shall be adopted by you in order to reduce the pollutional load so that the quality of the effluent satisfies the standards mentioned above.
3. You shall have to apply to this Board for its consent to operate and discharge of sewage and trade effluent according to the provisions of the water (Prevention & Control of Pollution) Act, 1974. No sewage or trade effluent shall be discharged by you without prior consent of this Board.
4. All emission from your factory shall conform to the standards as laid down by this Board.
5. No. emission shall be permitted without prior approval of this Board and you shall apply to this Board for its consent to operate and atmospheric emission as per provision of the Air (Prevention & Control Pollution) act, 1981.
6. No industrial plant, furnace, flues, chimneys, control equipment, etc. shall be constructed/reconstructed/erected/re-erected without prior approval of this Board.

7. You shall comply with
- (i) Water (Prevention and Control of Pollution) Cess Act, 1977, if applicable.
 - (ii) Water (Prevention and Control of Pollution) Cess Act, 1978, if applicable.
 - (iii) Environment (Protection) Act, 1986
 - (iv) Environment (Protection) Rules, 1986
 - (v) Hazardous Wastes (Management and Handling) Rules, 1989 and Amended Rules, 2000
 - (vi) Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 and Amended Rules, 2000
 - (vii) Manufacture, Use, Import and Storage and Hazardous Micro-Organisms, Genetically Engineered Organisms or Cell Rules, 1989
 - (viii) The Public Liability Insurance Act, 1991 and Amended Act, 1992
 - (ix) The Public Liability Insurance Rules, 1991 and Amended Rules 1993
 - (x) Biomedical Wastes (Management & Handling) Rules, 1998 and Amended Rules 2000 if applicable.
 - (xi) Recycled Plastics Manufacture and Usage Rules 1999, if applicable and
 - (xii) Ozone Depleting Substances (Regulation & Control) Rules, 2000, if applicable
8. You will have to abide by any other stipulations as may be prescribed by any authority/local bodies/Government Departments etc.

SPECIAL CONDITION :

See annexure.

Gross Capital Investment : Rs. 897800000/-

Any violation of the aforesaid conditions shall entail cancellation of this Consent to Establish (NOC)

Yours faithfully,

[Signature] 13.03.2018

Member Secretary/ SR, ENV, ENGR.
West Bengal Pollution Control Board (EIM CELL)

Memo No. - 2N-36/2013(E)

Copy forwarded for information to :

1. Chief Inspector of Factories, Government of West Bengal, N. S. Building, Kolkata-700 001
2. Director of Industries/Director of Cottage & Small Scale Industries, Government of West Bengal, N. S. Building, Kolkata-700 001
3. Guard file, West Bengal Pollution Control Board.
4. Environmental Engineer, I/II/Alipur R.O./Howrah R.O./Hooghly R.O./B.R.O./D.R.O./Haldia R.O./S.R.O./Asansol/ Sub-R.O./WBPC Board

Himalaya Bhawan
Delhi Road, Dankuni
Dist. Hooghly

Vill, Panpur
Kalyani Expressway
P.O. Narayanpur
Dist. 24 Pgs. (N)

Sahid Khudiram Sarani
City Centre, Durgapur-16
Dist. Burdwan

10, Camac Street
2nd Floor
Kolkata-700 017

Paribesh Bhawan
10A, LA-Block, Sector-III
Salt Lake City,
Kolkata - 700 098

Block-05 at 40
Flats Complex
Adjacent to Priyambada
Housing Estate
P.O. :Khanjanchak,
P.S. Durgachak
Haldia-721602
Dist. : Purba Medinipur

Paribahan Nagar
Matigara, Siliguri
Dist.-Darjeeling

Satya Chowdhury
Indoor Stadium
Baluzher Road

Asansol Sub-Regional Office
ADDA Commercial Market (2nd Floor)
Opposite Asansol Fire Station

Member Secretary./SR, E, E.

A. Emission:-

1. Liquid cargo must be transported from ships to designated stockyard through closed pipelines.

B. Effluent:-

Domestic – wastewater generated from the entire project shall be treated in existing STP of Haldia Dock Complex comprising of waste stabilization pond. Proper storm water pollution prevention plan should be developed and implemented. Under no circumstances untreated waste water from any source including ballast water to be discharged outside or in the river.

C. Solid Waste :-

1. Solid waste to be collected and disposed off through onsite compost plant regularly as per the Solid Waste Management Rules, 2016.
2. Provisions of Construction and Demolition Management Rules, 2016 and Guidelines of CPCB on Environment Management of Construction & Demolition Waste, March 2017 to be strictly followed.
3. Hazardous Waste to be collected and disposed of as per the Hazardous and Other Wastes (Handling and Trans-boundary Movement) Rules, 2016.

D. General:-

1. Water sprinkling arrangement should be ensured at every loading and unloading point to prevent spreading of dust. Rubbish, debris, broken materials and others must be kept properly within project area at suitable place with proper water sprinkling to prevent fugitive dust spreading.
2. Provision of drinking water, wastewater disposal and solid waste management should be ensured for labour camps. Proper sanitation facilities should be provided for construction workers to ensure environmental sanitation. Health and safety of the workers should be ensured during construction.
3. Necessary dust barrier should be provided during construction phase. Before taking up the construction work it is preferable to enclose the area with some enclosure.
4. Ground water should not be abstracted without obtaining prior permission of the Local body as well as the Competent Authority as per the West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005.
5. The proponent should strictly abide by The West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006 and subsequent rules. No trees can be felled without prior permission from the Tree Cutting Authority constituted as per the West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006 and subsequent rules. Adequate green belt is to be developed within the project site. Water intensive and/or invasive species should not be used for landscaping.
6. Adequate firefighting storage should be provided as per Rules. Necessary preventive measures to avoid fire and explosion hazards as well as oil spillage should be taken.
7. Onsite disaster management plan to be prepared and implemented.
8. Adequate parking space should be provided within the project site as per Rules.
9. Road design should be done with due consideration for environment and safety of users. The entry and exit points should be designed properly without disturbing the existing traffic.
10. No expansion of the project should be undertaken without prior permission of the State Board.
11. Project proponent should not undertake any activity on any portion of land which is not under their legal possession.

1

Kumar 13.03.2018

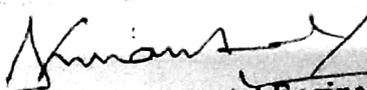
Environment & Forest Dept.
Pollution Control Board
of Environment, Govt of WB

consent to operate and atmospheric emission as per provision of the Air (Prevention & Control Pollution) act,
1981

Annexure to NOC Sl. No. NO153390

Special Conditions issued to M/s Kolkata Port Trust for redevelopment of Cargo Handling Facilities at outer terminal (near 2nd Oil Jetty) at Haldia Dock Complex, Kolkata Port Trust (West Bengal)

12. All necessary statutory clearances/licenses from competent authorities, as applicable to be obtained.
13. The unit should not start operation without obtaining 'Consent to Operate' from this Board.
14. This NOC is issued as per condition laid down by the Expert Appraisal Committee (Infra-2) of MoEF &CC in its 25th meeting held on 29-30 November 2017.
15. The project proponent must obtain Environmental Clearance as well as CRZ Clearance from the competent authorities before commencing project activity.
16. Environmental Management Plan (EMP), as proposed to be strictly complied with.
17. This NOC is valid up to 28.02.2025 for redevelopment of Cargo Handling Facilities at outer terminal (near 2nd Oil Jetty) at Haldia Dock Complex, Kolkata Port Trust (West Bengal).

 13.03.2018
Member Secretary/Sr. Environmental Engineer (EIM Cell)
West Bengal Pollution Control Board

Environmental Engineer
W.B. Pollution Control Board
Dept. of Environment, G. 133



SR. DY. MANAGER (IZ & R)
OFFICE DKT REGR. NO....
3598

17 JAN 2018

OFFICE OF THE CHIEF EXECUTIVE OFFICER
Haldia Development Authority (ISO 9001:2008 Certified)
(A Statutory Authority under Government of West Bengal)

City Centre, P.O. Debhog, Haldia-721657, Dist: Purba Medinipur
Ph.: (03224) 255926, Fax-255927, e-mail : ceo.hda@gmail.com Web.: www.hda.gov.in, Toll Free No. 1800-345-3224

Memo No.: 2582 /HDA/IX-A-14/I/7

Date: 17th, Jan., 2018

From : The Chief Executive Officer
Haldia Development Authority

To : The Sr. Dy. Manager (IZ & R),
I & CF Division,
Kolkata Port Trust, Haldia Dock Complex,
Jawhar Tower, Haldia Township,
Dist.- Purba Medinipur.

Sub. : Confirmation of water supply quantity for Liquid Cargo Handling Jetty (Outer Terminal-II) near 2nd Oil Jetty on the River Hooghly at Haldia Dock Complex, Kolkata Port Trust (Jetty structure including Escape Route).

Ref. : Your letter vide No. I&CF/IZ&R/T/230/923 dated 04.01.2018.

Sir,

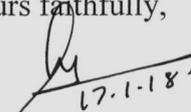
With reference to above, this is to inform you that this Authority hereby confirms to supply water from its surface water source for the proposed Liquid Cargo Handling Jetty (Outer Terminal-II) as per your stated requirement detailed below:

- i) For Construction purpose : 17 Kilolitre per Day
- ii) For Operational purpose : 274 Kilolitre per Day

This is for your information.

Thanking you.

Yours faithfully,


17.1.18
Chief Executive Officer

Haldia Development Authority

Memo No.: 2582/111 /HDA/IX-A-14/I/7

Date: 17th, Jan., 2018

Copy forwarded for kind information to:

- The Chairman, Haldia Development Authority.

Chief Executive Officer
Haldia Development Authority



West Bengal State Electricity Distribution Company Limited

Office of the Chief Engineer
Central Commercial Department

FAX: 033-2359-8398
Telephones : 2359-1927
2359-1930-40 Extn. : 310

Vidyut Bhavan (4th Floor)
DJ - Block, Sector - II
Salt Lake, Kolkata - 700 091

Ref. No. : C/BC/MID/7 / 2201

Date : 16 /01/2018

To,
Manager Plant & Equipment,
Haldia Dock Complex, Chiranjibpur,
P.O- Haldia, Purba Medinipur,
Pin-721604.

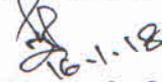
Sub: Confirmation regarding availability of power at Haldia Dock Complex area.
Ref: Your ref. no. GM(E)/15/1468 dated: 04.01.2018.

Dear Sir,

This is to inform you that there is no dearth of power at Haldia Dock Complex area. Hence we are in a position to provide you additional 0.7 MVA power at your Haldia Dock Complex including your existing connected demand. However, the technical & commercial formalities may be observed at the time of actual augmentation of load.
This is for your information and further action.

Thanking you.

Yours faithfully,


16-1-18

(P.K.Banerjee)
Chief Engineer(Comml.)



West Bengal Biodiversity Board

(Department of Environment, Government of West Bengal)

No. 237 /4M(Bio)-1/2006

पञ्जीकरण सं. 226 दि. 9.3.18
Regn. No.Dt.
कोलकाता पोर्ट ट्रस्ट
KOLKATA PORT TRUST
मुख्य अभियंता विभाग
Chief Engineer's Dept.

Date : 08/03/2018

From: Shri Sandipan Mukherjee, IFS
Member Secretary,
W.B. Biodiversity Board
Kolkata – 700106.

To: Shri G. Senthilvel,
Deputy Chairman,
Haldia Dock Complex,
Kolkata Port Trust,
Haldia, Purba Medinipur

Sub.: Marine & Riparian Biodiversity Management Plan by State Biodiversity Board in connection with the project “Redevelopment of cargo handling facilities at outer terminal (near 2nd. Oil jetty) at Haldia Dock Complex, Kolkata Port Trust”.

Ref.: Letter No. CIV/ENV/RJH- 72/221 dated 24.01. 18

Sir,

In response to your letter on the above mentioned subject, this is to inform you that the *Marine & Riparian Biodiversity Management Plan* for the project Redevelopment of cargo handling facilities at outer terminal (near 2nd. Oil jetty) at Haldia Dock Complex, Kolkata Port Trust, West Bengal, is hereby recommended by the W.B. Biodiversity Board subject to maintaining the following conditions.

During construction phase:

- i) No solid waste disposal should be made directly to the water/land.
- ii) Net enclosures using silt screens are to be placed around the construction / piling area.
- iii) Construction activities should be carried out under confined condition.
- iv) Vessels, operating during construction phase, should be equipped with spill response kits to stop accidental oil spills.
- v) Construction activities should not be done during fish breeding seasons.

cont.....p/2

During operational phase:

- i) Sewage water should be treated before disposal.
- ii) Solid wastes, particularly the non-degradable ones, should be managed properly; should not be thrown directly to the environment.
- iii) Oil Spill Contingency Plan should be prepared and kept ready to operate in emergency.
- iv) Guidelines issued by the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 should be followed strictly during marine transportation.

During construction and operational phase as well, life and livelihoods of the local people, particularly of the fisher-folk, should not be interfered.

Side by side, **Greenbelt** is to be developed on the surroundings of the proposed area of activity and that should be maintained properly involving the local people. Selection of species of plants should be done in consultation with the experts. W.B.Biodiversity Board may provide that expertise support.

Steps should also be taken to enrich the **Riparian vegetation**. For that plantation of mangroves and other plants, depending upon the habitats, should be done. In this case also selection of species is vital and to be done in consultation with the experts. Nearby Nayachar, another area is to be identified to create a green-zone covering mangroves/other plants within five years. In and around Haldia, on the banks of Hooghly/Haldi, considerable area is to be covered by the vegetation within five years. So that, the statement made in this report --- "The present study area did not show healthy riparian floral diversity which is also results in low riparian faunal accounts" --- will be reversed. Nurseries for mangroves and other plants should also be developed involving local people. Local Biodiversity Management Committee may be consulted for such activity.

Further, it may be recommended to assess the status of biodiversity of the area in every five years and to take necessary measures accordingly.

It may also be recommended to constitute an expert committee to supervise the activities towards biodiversity management surrounding the project area.

Thanking you,

Yours faithfully,



(Sandipan Mukherjee)

MARINE & RIPARIAN BIODIVERSITY MANAGEMENT PLAN

FOR

***REDEVELOPMENT OF CARGO HANDLING FACILITIES AT OUTER TERMINAL(NEAR 2ND
OIL JETTY)AT HALDIA DOCK COMPLEX KOLKATA PORT TRUST WEST BENGAL***

SPONSORED BY

**WAPCOS LIMITED
GURGAON,HARYANA**

PREPARED BY

**CENTRE OF ADVANCED STUDY IN MARINE BIOLOGY
FACULTY OF MARINE SCIENCES
ANNMALAI UNIVERSITY
PARANGIPETTAI
TAMILNADU**

JANUARY 2018

1 INTRODUCTION

Marine Ecological Survey was carried out in the study area to ascertain the impact of construction and operation phases of the proposed terminal. Experts from the Centre of Advanced Study in Marine Biology (CASMB) of Annamalai University, Tamilnadu visited site for Marine Ecological survey during February 2017. Water and sediment samples were collected from 9 locations in the study area during the survey and analysed for various physico-chemical parameters. Further, biological parameters such as phytoplankton, zooplanktons, Macro-benthos etc. were also investigated. The coordinates of various sampling stations are given Table-1 and the locations of sampling sites are depicted in Figure-1.

Table-1: Sampling Locations and its Geographical Coordinates

Station	Longitude (°E)	Latitude (°N)
St-1	21°57'41.31"N	88° 3'22.25"E
St-2	21°58'11.16"N	88° 2'16.94"E
St-3	21°59'17.19"N	88° 3'52.01"E
St-4	22° 0'3.68"N	88° 4'26.61"E
St-5	22° 0'58.83"N	88° 5'25.24"E
St-6	22° 1'43.38"N	88° 6'37.99"E
St-7	22° 1'38.61"N	88° 5'35.91"E
St-8	22° 1'12.63"N	88° 4'52.15"E
St-9	22° 0'57.85"N	88° 4'18.47"E

2. MARINE WATER QUALITY

2.1 Methodology Adopted for Marine Ecological Survey

Water and Sediment Sampling

Water samples were collected using Universal water (Niskin) sampler below the surface water and transferred to the pre-cleaned polypropylene and glass containers. Sediment samples were collected by using a Peterson Grab transferred to clean polythene bags and transported to the laboratory. The sediment samples were air-dried for sediment texture analysis and also heavy metal analysis. Separate set of sediment samples were sieved in the field itself for benthic faunal assemblage.

Temperature, Salinity and pH

The physical parameters such as temperature, salinity and pH, were measured *in-situ*. The surface water temperature was measured with a mercury thermometer having $\pm 0.1^\circ\text{C}$ accuracy and the pH of

water was measured by a calibrated pH pen (pH ep-3 model). The seawater salinity was measured using the refractometer (Erma Company, Japan).



Figure-1:

Map showing Marine Ecological Sampling location

Preservation and Laboratory Analysis

After collection, all samples were stored in ice box at 4°C and then brought to the laboratory. In the laboratory, water samples were filtered through Whatman GF/C filter paper and analyzed for organic matter and all other nutrients. Unfiltered samples were used for the estimation of total nitrogen and total phosphorus. All the analyses were carried out as per internationally used standard procedures described for samples of aquatic origin and are summarized in the following paragraphs..

Dissolved Oxygen (DO)

Modified Winkler's method described by Strickland and Parsons (1972) was followed for the estimation of dissolved oxygen fixed at the collection site.

Nutrient analysis

Water samples were taken from the sampling locations using polypropylene bottles transported to the lab by keeping them in a portable ice box. Concentration of water nutrients viz. ammonia (NH₄), silicate (SiO₃), inorganic phosphate (Po₄), nitrate (NO₃), and nitrite (NO₂) were determined by following the methods described by Strickland and Parsons (1972).

Chlorophyll 'a',

The samples were filtered through Whatman GF/C filter papers and the chlorophyll was extracted into 90% acetone. The resulting colored acetone extract was measured in a spectrophotometer at different wavelengths (630, 645, 647, 663, 664) and the same acetone extracts were acidified and measured for the phaeo-pigments. (UNESCO, 1994).

Heavy metal analysis in marine water and sediments

Heavy metal concentration in water and sediments samples were estimated by following the APHA method (22 edition) using the ICP-MS values were separated in terms of $\mu\text{g/L}$ for water and mg/kg for sediment. The interment was pre-calibrated with standard metals (MERCK).

Phytoplankton

Phytoplankton 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. Phytoplankton was identified using standard works of Hustedt (1930-1966), Venkataraman (1939), Cupp (1943), Subramanian (1946), Prescott (1954), Desikachary (1959 and 1987), Hendey (1964), Steidinger and Williams (1970) and Taylor (1976) and Anand *et al.* (1986).

Benthic Community

For studying benthic organisms, sediment samples were collected using a Petersen grab. The wet sediment samples were 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. For Meiobenthos, the lowest size attributed is 63 μm and the upper limit depends upon the mesh size of the sieve used for separating Macrobenthos from Meiobenthos. The sieved organisms were stained with Rose Bengal and sorted into different groups. The number of organisms in each grab sample was expressed in number per meter square.

2.2 Marine Water Quality

The water quality parameters analysed at various sampling sites is given in Table-2.

Physico-chemical Parameters

Water Temperature

The water temperature in the study area at different stations ranged between 22.6 °C and 24.6 °C. The

minimum temperature was recorded at St-4 B and the maximum was recorded at St- 6 S.

pH

The pH of the water samples in the study area varied from 8.1 to 8.2.

Dissolved Oxygen (DO)

The DO level ranged between 4.5 and 6.1 mg/l at various sampling locations. The minimum value was recorded at St- 3 B and St- 8 B the maximum was recorded at St-4 S and St-7 S.

Salinity

The salinity value in the water samples from the study area ranged between 6 and 11 ppt. The minimum value recorded at St-6 S and St-7 S and maximum values were recorded at stations St-1 B and St-2 B.

Nitrate

The nitrate concentration in the water samples collected from the study area ranged between 4.26 and 14.33 $\mu\text{mol/l}$. The minimum concentration was recorded at St- 3 S and the maximum was recorded at St-8 B.

Nitrite

Nitrite is the intermediate product of oxidation of ammonia to nitrate. The nitrite concentration in the study area at different locations varied from 0.90 to 2.35 $\mu\text{mol/l}$. The minimum concentration was recorded at St-3 B and maximum was recorded at St-8 S.

Table-2: Water Quality Analysis Results

Stations	Water temperature (°C)	Salinity (ppt)	pH	DO (mg/l)	Nitrate (µmol/l)	Nitrite (µmol/l)	Ammonia (µmol/l)	IP (µmol/l)	Silicate (µmol/l)	TSS (mg/l)
St-1 S	23.8	9	8.2	5.7	6.15	1.59	0.50	0.63	30.75	175.76
St-1 B	23.2	11	8.2	5.1	7.27	1.82	0.64	1.75	37.30	615.69
St-2 S	23.5	9	8.1	5.7	6.14	1.31	0.78	1.05	45.32	726.00
St-2 B	23.0	11	8.1	5.2	7.50	1.62	0.78	0.70	39.71	299.19
St-3 S	24.1	8	8.1	5.4	4.26	0.95	0.37	1.05	38.35	74.43
St-3 B	22.8	9	8.1	4.5	6.00	0.90	0.27	0.42	38.31	411.93
St-4 S	24.3	8	8.1	5.9	5.35	1.08	0.27	1.05	38.76	43.75
St-4 B	22.6	10	8.1	5.2	7.90	1.69	0.23	1.40	38.73	914.29
St-5 S	23.6	7	8.1	5.8	7.83	1.86	0.28	0.63	37.37	72.50
St-5 B	22.9	8	8.1	5.1	7.07	1.93	0.32	0.49	38.38	299.69
St-6 S	24.6	6	8.1	5.9	7.49	1.95	0.37	0.70	36.81	55.63
St-6 B	23.6	7	8.1	5.2	6.06	1.97	0.46	1.33	37.89	274.69
St-7 S	23.4	6	8.1	6.1	9.75	2.02	0.55	0.70	37.86	194.06
St-7 B	23.0	7	8.1	5.6	11.09	2.21	0.58	1.05	35.10	178.46
St-8 S	24.3	7	8.2	5.4	11.12	2.35	0.53	0.35	34.76	62.90
St-8 B	24.0	8	8.2	4.5	14.33	2.33	0.60	1.19	36.25	250.57
St-9 S	23.4	7	8.1	5.8	9.26	1.98	0.60	1.33	42.18	37.81
St-9 B	23.2	8	8.2	5.1	10.32	2.11	1.47	0.70	61.70	427.19

Note: S-Surface Water, B- Bottom water

Ammonia

The toxicity of ammonia depends on pH and temperature, the un-ionized form is more toxic than the ionized form. As pH increase, NH_4^+ is converted to NH_3 resulting in increase in toxicity. Higher temperatures also results in increase of conversion of NH_4^+ to NH_3 . The ammonia values along the study area ranged between 0.23 and 1.47 $\mu\text{mol/l}$. The minimum concentration was recorded at St-4 B and the maximum value was recorded at St-9 B.

Inorganic Phosphate

The inorganic phosphate concentration in the water samples along the study area varied from 0.35 to 1.75 $\mu\text{mol/l}$. The minimum concentration was recorded at St-8 S and the maximum value was recorded at St- 1 B.

Silicate

The silicate concentration of surface and bottom water samples from the study area varied from 30.75 to 61.70 $\mu\text{mol/l}$. The minimum concentration was recorded at St-1 S and the maximum was recorded at St-9 B.

Total Suspended Solids (TSS)

The total suspended solids in the water samples of the study area in different stations ranged between 37.81 and 914.29 mg/l with the minimum value was recorded at St- 9 S and the maximum value was recorded at St-4 B.

Chlorophyll 'a'

The chlorophyll a concentration in the water samples of the study area ranged between 0.38 and 0.87 $\mu\text{g/l}$. The minimum concentration was recorded at St- 9 S, whereas maximum value was recorded at St-2 S are given in Table-3.

Table –3 Chlorophyll 'a' concentration in the water samples

Station	Chl-a ($\mu\text{g/l}$)
St-1 S	0.87
St-1 B	0.68
St-2 S	0.46
St-2 B	0.41
St-3 S	0.67
St-3 B	0.51
St-4 S	0.67
St-4 B	0.53
St-5 S	0.73

Station	Chl-a ($\mu\text{g/l}$)
St-5 B	0.61
St-6 S	0.38
St-6 B	0.39
St-7 S	0.38
St-7 B	0.42
St-8 S	0.57
St-8 B	0.52
St-9 S	0.59
St-9 B	0.47

Minerals concentration in water samples

The mineral concentration observed at various marine water sampling locations is given in Table-4.

Table-4 Nutrients concentration in water samples

Station	Magnesium (ppm)	Chloride (ppm)	Potassium (ppm)
St-1 S	2.13	4562.3	19.33
St-1 B	2.11	4632.9	19.98
St-2 S	1.51	4638.6	23.42
St-2 B	1.52	4537.1	25.32
St-3 S	1.89	4582.1	24.78
St-3 B	1.98	4634.2	25.31
St-4 S	1.64	4529.6	21.48
St-4 B	1.44	4738.3	23.55
St-5 S	1.37	3125.6	24.38
St-5 B	1.54	3427.8	23.55
St-6 S	2.43	2548.3	26.43
St-6 B	2.41	2843.1	27.31
St-7 S	2.75	2645.3	21.43
St-7 B	2.53	2841.4	24.41
St-8 S	2.49	2142.6	22.43
St-8 B	2.44	2439	21.42
St-9 S	4.29	3127	24.35
St-9 B	3.21	3173.6	22.68

Chlorides

The chloride concentration in water samples at different stations ranged between 2142.6 and 4738.3 ppm. The minimum concentration was recorded at St- 8 S whereas the maximum value was recorded at St-4 B.

Magnesium

The magnesium concentration in water samples at different stations ranged from 1.37 and 4.29 ppm. The minimum concentration was recorded at St-5S whereas the maximum value was recorded at St-9S.

Potassium

The potassium concentration in water samples at different stations ranged between 19.33 and 27.31 ppm. The minimum concentration was recorded at St-1 S whereas the maximum value was recorded at St-6 B.

Heavy metals concentration in water samples

The heavy metal located at various marine water sampling locations is given in Table-5.

Table – 5 Heavy metals concentration in water samples

Station	Mercury (ppm)	Cadmium (ppm)	Copper (ppm)	Lead (ppm)	Nickel (ppm)	Zinc (ppm)
St-1 S	BDL	0.02	0.063	0.047	0.046	9.55
St-1 B	BDL	0.02	0.066	0.048	0.048	11.54
St-2 S	BDL	0.01	0.069	0.043	0.044	9.37
St-2 B	BDL	0.01	0.064	0.041	0.052	9.88
St-3 S	BDL	0.03	0.074	0.049	0.049	9.83
St-3 B	BDL	0.03	0.065	0.066	0.044	11.32
St-4 S	BDL	0.02	0.045	0.069	0.038	14.37
St-4 B	BDL	0.03	0.046	0.061	0.037	13.5
St-5 S	BDL	0.01	0.055	0.052	0.037	8.34
St-5 B	BDL	0.02	0.059	0.059	0.052	8.46
St-6 S	BDL	0.03	0.083	0.055	0.052	7.47
St-6 B	BDL	0.03	0.091	0.058	0.051	8.48
St-7 S	BDL	0.016	0.042	0.053	0.046	9.81
St-7 B	BDL	0.02	0.044	0.062	0.043	10.45
St-8 S	BDL	0.03	0.068	0.058	0.048	12.43
St-8 B	BDL	0.04	0.054	0.058	0.041	11.84
St-9 S	BDL	0.04	0.055	0.073	0.046	11.42
St-9 B	BDL	0.03	0.061	0.042	0.042	12.49

Note: BDL: Below Detectable Limit

Zinc

The zinc concentration in water samples were ranged between 7.47 and 14.37 ppm. The maximum concentration was recorded at St-6 S, whereas the minimum value was recorded at St-4 S.

Nickel

The nickel concentration in water samples were ranged between 0.037 and 0.052 mg/l. The maximum concentration was recorded at St-4 B, whereas the minimum was recorded at St-6 S.

Cadmium

The cadmium concentration in water samples of Haldia Dock Complex ranged between 0.01 and 0.04 ppm. The maximum concentration was recorded at St- 8 B and St-9 S, whereas the minimum was recorded at St-2 S St- 2 B and St-5 S.

Lead

The lead concentration at various sampling locations were ranged between 0.041 and 0.073 mg/l. The maximum concentration was recorded at St-9 S, whereas the minimum was recorded at St- 2 B.

Copper

The copper concentration various sampling locations ranged from 0.042 to and 0.091 ppm. The maximum concentration was recorded at St-6 B, whereas the minimum was recorded at St-7 S.

2.3 Sediment Characteristics

The Haldia Dock Complex study area soil consists of sand, silt and clay in nature. In all the stations dominated by Sand except St-6 and St-7 were dominated by clay. The results of sediment analysis are given in Table-6.

Table-6: Sediment Quality at various Sampling Stations

Station	Sand	Silt	Clay	Magnesium	Potassium
St-1	72.6	19.6	4.7	5.31	1076.9
St-2	74.2	21.9	3.9	4.32	1388.1
St-3	69.9	13.8	16.3	4.28	1101.1
St-4	73.2	19.6	7.2	4.88	1241.7
St-5	62.4	17.2	20.4	5.39	1324.9
St-6	5.3	9.4	85.3	7.48	1216.4
St-7	4.2	7.5	88.3	6.38	1183.2
St-8	71.5	15.8	12.7	5.93	1930.59
St-9	68.3	18.3	13.4	6.19	1727.5

Magnesium

The magnesium concentration in sediment samples of Haldia Dock Complex at different stations ranged between 4.28 and 6.38 ppm. The minimum concentration was recorded at St-3 whereas the maximum was recorded at St-7.

Potassium

The potassium concentration in sediment samples of Haldia Dock Complex at different stations ranged between 1076.9 and 1930.59 ppm. The minimum concentration was recorded at St-1 whereas the maximum was recorded at St-8.

Heavy metals in sediments

The concentration of heavy metals in sediment samples indicates that it is well within the range which means there are no possibilities of Heavy metal contamination in the region. Similarly sediment samples showed more concentration compared to water samples. The results of analysis of heavy metal in the sediments are given in Table-7.

Table-7 Heavy metal concentration recorded in sediment

Station	Mercury (ppm)	Cadmium (ppm)	Copper (ppm)	Lead (ppm)	Nickel (ppm)	Zinc (ppm)
St-1	BDL	0.1	13.1	2.11	1.56	19.43
St-2	BDL	0.32	11.97	4.085	5.61	26.31
St-3	BDL	0.06	13.38	2.724	4.26	25.56
St-4	BDL	0.03	12.64	2.41	3.27	21.62
St-5	BDL	0.04	11.31	5.018	4.75	39.5
St-6	BDL	0.25	14.31	3.19	3.65	23.81
St-7	BDL	0.05	9.67	4.38	4.17	26.44
St-8	BDL	0.04	12.62	7.67	5.78	23.74
St-9	BDL	0.13	11.61	4.31	3.64	29.34

Note: BDL: Below Detectable Limit

Zinc

The zinc concentration in sediment samples were ranged between 19.43 and 39.5 ppm. The maximum concentration was recorded at St-5, whereas the minimum was recorded at St-1.

Nickel

The nickel concentration in sediment samples of Haldia Dock Complex ranged between 1.56 and 5.78 ppm. The maximum concentration was recorded at St-8, whereas the minimum was recorded at St-1.

Cadmium

The cadmium concentration in sediment samples were ranged between 0.03 and 0.32 ppm. The maximum concentration was recorded at St-2, whereas the minimum was recorded at St-4

Lead

The lead concentration in sediment samples ranged between 2.11 and 7.67 ppm. The maximum concentration was recorded at St-8, whereas the minimum was recorded at St-1.

Copper

The copper concentration in water samples ranged between 9.67 and 14.31 ppm. The maximum concentration was recorded at St-6, whereas the minimum was recorded at St-7.

2.4 Biological Parameters

Phytoplanktons

In the present survey, a total of 11 phytoplankton species were recorded from 9 different stations. The phytoplankton density ranged between 5282 and 10699 cells/l. The minimum density was recorded at St-9 and the maximum was recorded at St-1. As it was heavy water current and turbid in the study area resulting the diversity and density of the phytoplankton was at lower side. The abundance and density of Phytoplanktons at various sampling stations is given in Table-8.

Zooplanktons

In the present survey, a total of 15 zooplankton species were recorded from 9 different stations of Haldia dock complex. The zooplankton density ranged between 2293 and 3079 org./m³. The minimum density was recorded at St-9 and the maximum was recorded at St-2. As it was heavy water current and turbid and vessel movement in the study area the diversity and density of the zooplankton was at the lower side. The abundance and density of zooplanktons at various sampling stations is given in Table-9.

Table-8: Abundance and density of Phytoplanktons at various sampling stations (Unit :cells/l)

S.no	Species name	St-1	St-2	St-3	St-4	St-5	St-6	St-7	St-8	St-9
1	<i>Bacteriastrum delicatulum</i>	120	118	124	104	191	102	105	128	122
2	<i>Ceratiummas siliense</i>	711	132	142	173	169	122	121	147	183
3	<i>Ceratiumperu vianus</i>	721	143	291	218	173	192	188	214	105
4	<i>Ceratiumtrichoceros</i>	429	302	401	184	201	249	211	302	320
5	<i>Ceratiumtripos</i>	539	294	325	529	423	410	184	294	210
6	<i>Coscinodiscus centralis</i>	2718	1204	2173	1302	2913	1382	1832	1549	1620
7	<i>Coscinodiscus granii</i>	1291	492	1281	1391	1632	739	583	391	439
8	<i>Coscinodiscus marginatus</i>	1723	439	1632	711	629	592	938	744	581
9	<i>Coscinodiscus wailesii</i>	1273	832	2711	832	712	932	728	783	771
10	<i>Ditylumbrightwelli</i>	148	214	239	110	129	183	134	231	193
11	<i>Rhizosoleni aimbricata</i>	1026	1204	739	921	428	731	492	1023	738
	Density	10699	5374	10058	6475	7600	5634	5516	5806	5282

Table-9: Abundance and density of zooplankton at various sampling stations (Unit- Nos/m³)

S.no	Species name	St-1	St-2	St-3	St-4	St-5	St-6	St-7	St-8	St-9
1	<i>Tintinnopsis radix</i>	99	113	87	126	131	98	79	117	120
2	<i>Favella campanula</i>	132	213	113	132	0	212	165	142	132
3	<i>Sagitta sp.</i>	117	135	151	106	121	214	127	144	131
4	<i>Acrocalanus sp.</i>	152	162	0	0	124	133	145	162	108
5	<i>Microsetella sp.</i>	0	185	128	135	0	0	214	213	0
6	<i>Tintinopsissp</i>	172	243	120	188	195	211	104	137	119
7	<i>Euterpina sp.</i>	149	241	136	124	218	193	126	144	104
8	<i>Centropagesorsini</i>	213	265	184	241	0	0	417	185	179
9	<i>Centropagesp</i>	287	231	119	165	218	238	218	127	131
10	<i>Oithona nana</i>	276	421	378	455	675	438	329	288	428
11	<i>Oithonaplumifera</i>	166	261	217	120	313	279	137	127	211
12	<i>Calanopiasp</i>	238	129	359	187	279	317	0	269	316
13	Gastropod spot	98	107	209	142	168	313	211	179	0
14	Mysis larvae	142	244	189	316	231	108	127	219	217
15	<i>Temoraturbinata</i>	163	129	178	251	178	191	217	119	97
	Density	2404	3079	2568	2688	2851	2945	2616	2572	2293

Benthos

In the present survey, a total of, 22 benthic faunal species were recorded in 9 different stations. The benthos density ranged between 1644 and 3694 org/10 m². The minimum density was recorded at St-3 whereas the maximum was recorded at St-11. The abundance and density of Macrobenthos at various sampling stations is given in Table-10.

Table-10 : Abundance and density of benthos at various sampling stations (Unit- Nos/10m²)

S.no.	Macro Benthos	St-1	St-2	St-3	St-4	St-5	St-6	St-7	St-8	St-9
	Polychetaes									
1	<i>Aglaophamussp.1</i>	518	35	111	243	73	87	79	84	59
2	<i>Aglaophamussp.2</i>	68	85	217	0	0	0	0	71	0
3	<i>Nepthyspolybranchia</i>	93	83	481	0	0	0	0	69	0
4	<i>Nepthyssp.</i>	173	0	0	0	0	0	231	89	0
5	<i>Nephtystulearensis</i>	59	81	69	0	0	311	0	0	0
6	<i>Micronepthyssp.</i>	72	0	0	0	0	0	0	258	0
7	<i>Ceratonereissp.</i>	0	0	0	0	0	0	0	0	359
8	<i>Capitomastussp.</i>	77	69	0	0	214	134	0	0	539
9	<i>Capitellacapitata</i>	81	125	264	154	263	213	318	0	438
10	<i>Capitellasp.</i>	0	0	0	0	239	144	329	216	0
11	<i>Cirratulussp.</i>	182	133	144	143	179	216	0	279	253
12	<i>Lumbrinerisheteropoda</i>	98	0	0	0	219	0	89	233	68
13	<i>Lumbrinerissp.</i>		0	0	0	0	381	93	215	72
14	<i>Neanthes chingrighattensis</i>	0	0	0		0	3	99	0	0
15	<i>Perinereissp.</i>	0	213	243	43	55	69	75	86	175
16	<i>Notocirrusaustralis</i>	274	0	0	0	0	0	0	0	311
	Crustaceans									
17	<i>Ampeliscasp.</i>	154	0	518	171	89	0	68	83	271
18	<i>Ampithosesp.</i>	103	243	0	254	62	251	259	0	628
19	<i>Ceradocussp.</i>	0	285	593	173	71	0	217	0	0
20	<i>Urothoesp.</i>	0	0	317	218	0	95	182	0	0
21	<i>Megalopa larvae</i>	0	213	0	217	0	184	90	0	0
22	<i>Diogenidaesp.</i>	0	79	257	328	358	89	83	0	521
	Density	1952	1644	3214	1944	1822	2177	2212	1683	3694

2.5 Fisheries

Samples of fin and shell fish were collected from 3 stations, using a cast net within 3m diameter when spread, with 7mm mesh size. For effective sampling, the sampling points were fixed randomly. In each sampling points 10 hauls were done and CPUE (Catch Per Unit Effort) was calculated per hour. Fish species were identified according to the description given by the fish base. In the present survey, a total of 15 species of fin fishes were identified from 3 stations. Species availability at each station was given in Table- 11.

Table-11: Fish species distribution observed during sample trawling

S. no.	Scientific name	Station 1	Station 3	Station 7
	Fin fishes			
1.	<i>Anabas testudineus</i>	*	*	*
2.	<i>Catlacatla</i>	*	*	*
3.	<i>Cirrhinus mrigala</i>	*	*	*
4.	<i>Labeorohita</i>	*	*	
5.	<i>Latescalcarifer</i>	*	*	*
6.	<i>Mugil cephalus</i>	*	*	*
7.	<i>Oreochromis mossambicus</i>	*	*	
8.	<i>Thryssa sp.</i>			*
9.	<i>Kathala sp.</i>			*
10.	<i>Sauridatumbil</i>	*	*	
11.	<i>Tenualosailisha</i>	*		*
12.	<i>Tenualosatoli</i>	*		*
13.	<i>Liza parsia</i>	*	*	*
14.	<i>Gerres filamentosus</i>		*	*
15.	<i>Terapon puta</i>		*	*
	Total	11	11	12

Fin Fishes

The existing data indicate Haldia region and adjacent water spread area consisting rich fish diversities are available. In the present survey, a total of, 28 fin fishes were recorded in the study area. The list of fin fish species, reported in the study area along with their habitat, migration pattern and the IUCN status are given in Table-.12. A total of 8 shell fishes were recorded in the study area and details are depicted in Table-13.

Table-12 List of fish species reported in the study area

S. No.	Scientific name	Common name	Habitats	Migration	IUCN status
1	<i>Anabas testudineus</i>		Freshwater; brackish	Potamodromous	Data Deficient
2	<i>Catlacatla</i>	Common carp	Freshwater; brackish	Potamodromous	Least concern
3	<i>Channa striatus</i>	Striped snakehead	Freshwater; brackish		Least concern
4	<i>Cirrhinus mrigala</i>	Mrigal carp	Freshwater	Potamodromous	Least Concern
5	<i>Labeorohita</i>	rohu	Freshwater; brackish	Potamodromous	Least Concern
6	<i>Latescalcarifer</i>	Sea bass	Marine; freshwater; brackish	Catadromous	Not Evaluated
7	<i>Mugil cephalus</i>	grey mullet	Marine; freshwater; brackish	Catadromous	Least Concern
8	<i>Mystus vittatus</i>	Cat fish	Freshwater; brackish		Least Concern
9	<i>Oreochromis mossambicus</i>	Mozambique Tilapia	Freshwater; brackish	Amphidromous	Near Threatened
10	<i>Colossomabrachypomum</i>	<i>Rupchanda bhuna</i>			
11	<i>Thryssa sp.</i>				
12	<i>Kathala sp.</i>				
13	<i>Labeobata</i>	Bata	Freshwater; brackish	Potamodromous	Least Concern
14	<i>Labeocalbasu</i>	Kalbous	Freshwater; brackish	Potamodromous	Least Concern
15	<i>Osteobramacotio</i>	Chanda	Freshwater		Least Concern
16	<i>Puntius sophore</i>	Punthi	Freshwater; brackish	Amphidromous	Least Concern
17	<i>Clarias batrachus</i>	Magur	Freshwater; brackish	Potamodromous	Least Concern
18	<i>Heteropneustes fossilis</i>	Singi	Freshwater; brackish water		Least Concern
19	<i>Sauridatumbil</i>	Greater Lizardfish	Marine; reef-associated	Amphidromous	Not Evaluated
20	<i>Glossogobius giuris</i>	Beley	Marine; freshwater; brackish	Amphidromous	Least Concern
21	<i>Rastrelliger kanagurta</i>		Marine	Oceanodromous	Not Evaluated
22	<i>Tenualosailisha</i>		Marine; freshwater; brackish	Anadromous	Least Concern
23	<i>Tenualosatoli</i>		Marine; freshwater; brackish	Anadromous	Not Evaluated
24	<i>Liza parsia</i>		Marine; freshwater; brackish	Catadromous	Not Evaluated
25	<i>Selarcrumenophthamus</i>		Marine		Least Concern
26	<i>Harpadonnehereus</i>		Marine		
27	<i>Gerres filamentosus</i>		Marine		
28	<i>Terapon puta</i>		Marine; brackish water		

Table-13 : List of shellfishes recorded in the study area

S. No.	Scientific name	Common name
	Shrimp	
1	<i>Litopenaeusvannamei</i>	Whiteleg shrimp,
2	<i>Penaeus monodon</i>	Tiger shrimp
3	<i>Penaeusindicus</i>	Indian prawn
	Prawn	
4	<i>Macrobrachiummalcolmsonii</i>	Monsoon River Prawn
5	<i>M. rosenbergii</i>	Giant river prawn
	Crab	
6	<i>Scylla serrata</i>	Mud crab

Aquaculture

The brackish water aquaculture (shrimp) is practicing on the opposite bank (from construction site) of Haldia river, covering the total area. *Litopenaeus vannamei* is the candidate species after disease outbreak of *P. monodon*. Tide-cum-pump-fed ponds method was practiced; the water is pumped in to the reservoir during high tide period. The total culture area is approximately 2.5 km². The production ranged between 4 and 8 ton/ha at each culture period. The culture period approximately would be 120 days to 140 days practiced by the aquaculture farmers.

2.6 Mangroves

The proposed project is located on right bank of Hoogly river at about 100 km from sanheads. The site is located within Haldia Dock complex. The proposed site consisting of heavy water current and waves due to tidal action and vessel movement. A small mangrove patch covering total area of 0.7 acres observed on the bank of Hooghly river and behind the existing Oil Jetty 3. The patch consists of six species (*Sonneratiaapetala*, *Excoecariaagallocha*, *Avicennia officinalis*, *Rhizophora apiculata*, *Avicennia marina*, *Acanthus ilicifolius*). The dominant species is *Sonneratiaapetala*. A patch of Mangrove is observed at Nayachar island located about 2.5 km away from the proposed site. KoPT has undertaken mangrove plantation in Nayachar Island as a part of their Green initiative. KoPT has planted about 9.5 lakh mangroves over an area of about 4 ha at Nayachar Island.

2.7 Riparian Vegetation

The vegetation along the water margins and banks are called riparian vegetation. Riparian vegetation consists of macrophytes, native grasses, sedges, climbers, shrubs and trees. Riparian vegetation is similar to other types of forest in which

areas are generally composed of top storey, under storey, groundcover and macrophyte species each of which has a particular structural function and is found a predictable distance from the river channel. It also plays a critical role in supporting biodiversity.

The riparian plant communities of the Hoogly & Haldi river is not evenly distributed between major types of vegetation. At the project area, most of the riparian area along Hoogly river occupied by settlement and developed land. Some patches of mangrove & its associates were seen at water margin of Nayachar Island. The top canopy is mainly comprised of *Barringtonia acutangula*, *Cerbera odollum*, *Crataeva roxburghii*, *Phoenix* sp, *Ficus* sp, *Thespesia populnea*, *Derris indica*, *Dolichandron spathaceum*, *Kleinhovia hospital*, *Premna corymbosa*, *Syzygium* sp, *Trewia nudifolia*, etc. The characteristic of such type are *Acanthus ilicifolius*, *Caesalpinia crista*, *Clerodendrum inerme*, *Derris scandens*, *Derris ericoides*, *Desmodium umbellatum*, *Tamarix dioica*, *Tamarix ericoides* and few others. A number of climbers, twinning or spreading on such shrubby members are *Canavalia cathartica*, *Desmodium salicifolium*, *Sarcobolus carinatus*, *Finalaysonia obovata*, *Pentstemon piscapensis*, *Solanum surratense*, *Solanum trilobatum*, *Tylophora tenuis*. The herbaceous species including grasses and sedges stabilizing in riparian area are *Aeluropus lagopoides*, *Ammania baccifera*, *Conyza semipinnatifida*, *Cyperus exaltatus*, *Cyperus rotundus*, *Cyperus kyllingia*, *Cyperus procerus*, *Diplachne fusca*, *Aerva lanata*, *Eragrostis stenella*, *Cynodon dactylon*, *Heliotropium* sp, *Ipomoea pescapae*, *Salicornia brachiata*, *Launea armentosa*, *Leersia hexandra*, *Leptochloa chinensis*, *Phragmites karka*, *Scirpus littoralis*, *Pluchea indica*, *Lippia javanica*, *Rotala rotundifolia*, *Acorus calamus*, *Typha angustata*, *Alternanthera philoxeroides*, *Hygrophila auriculata*, *Eichhornia crassipes*, *Phylla nodiflora*, *Tribulus terrestris*, *Polygonum hydropiper*, *Polygonum glabrum*, *Fimbristylis* sp, *Potamogeton crispus*, *Suaeda maritima* and several others.

2.8 Riparian Fauna

A healthy riparian system supports a great diversity of upland and wetland-adapted plant species and provides habitat for both wildlife and aquatic organisms. The vegetation, logs and other debris along watercourses provides important feeding and breeding habitat for wide range of invertebrates, including amphibians and reptiles, whose life cycles are closely tied to the aquatic environment. The present study area did not show healthy riparian floral diversity which is also results in low riparian

faunal accounts. The reptilian species which are found both upland and water courses represented by snakes, lizards, water skinks & turtles. Snakes occasionally associated with riparian areas are the Yellow Banded Mangrove Snake (*Cantoria violacea*), Indian spectacled cobra (*Naja naja*) and Indian python (*Python molurus*) etc. As riparian area tend to contain moist terrestrial areas (woodlogs, leaf-litter and in thick vegetation) that provide habitat for amphibians (frogs and toads). Most species of frog live on adjacent land, although free water is required for their aquatic stages (eggs and tadpoles) and for rehydration. The crabs, shrips and the prawns are other important animal groups inhabiting riparian area at study site. The four common estuarine prawn occur in Hooghly estuaries viz. "Bagda chingri" (*Penaeus semisculatus* De hunn), "Chapda chingri" (*P. indicus* Edn.), Dhanbone chingri (*Metapenaeus brevicornis* Edw.) and "Karaney chingri" (*M. monaceras* Fab.) (Malvika & Brijgopal,2006). In addition, insects and macro-invertebrates are also found in significant account in the riparian area.

Several avian species are strongly dependent on the woodland component associated with riparian corridors for nesting structure, breeding, and feeding requirements. Many species of kingfishers including brown-winged (*Pelargopsis amauropterus*), stork-billed kingfishers (*Pelargopsis.capensis*) and the magnificent white-bellied sea-eagle (*Haliaeetus leu-cogaster*) are quite common, as are many herons, egrets, storks, sandpipers, whimbrels, curlews and other waders. Great Cormorant (*Phalacrocorax carbo*) and Little Pied Cormorant (*Phalacrocorax melanoleucos*) are also present. There are also many species of gulls and terns, especially along the estuary and the larger waterways. Apart from the species particularly associated with the waterways and wetlands, there is also a considerable variety of forest birds, such as woodpeckers, barbets, shrikes, drongos, mynahs, minivets, babblers and many others (Salter, 1984).

3. IMPACTS ON BIODIVERSITY

3.1 Impacts during Construction Phase

Impacts on Water Environment

The labour population during construction phase would stay at the construction site, only during working hours. Considering the location of the project, the labour population involved in construction activities shall use the existing sanitation facilities of Haldia Dock Complex. Disposal of untreated domestic sewage from construction sites can lead to marginal adverse impacts on river water quality if it is disposed

without any treatment. Discharge of effluent into the river may harm biodiversity of the project area. It is proposed to treat the sewage from construction sites prior to disposal.

Impacts due to dredging and disposal of dredged material

The present project does not involve any dredging. Hence no impacts on biodiversity are envisaged due to dredging or disposal of dredged material.

Impacts on marine ecology

Construction activities may increase the turbidity during various construction activities and specially during piling activities, which may affect the water quality during construction phase. The project area has low to moderate productivity. There are no sites of ecological significance in and around the project area. Likewise, no breeding and spawning grounds were observed in the study area. There will be noise and vibration generated during piling activities. The fishes and other aquatic organisms are likely to be affected. The impact on this account is not expected to be significant.

Impacts due to settlement of suspended sediments during piling activity

Sediments dispersed during pile driving activity may resettle over the seabed and the animals and plants that live on and within it. This blanketing or smothering of benthic animals and plants may cause stress, reduced rates of growth or reproduction. However, considering the level of construction activities, impacts are not expected to be significant.

Impacts on fisheries

The most important impact on fishes may be suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during construction of piles, which may result in clogging of gills of fishes thereby causing asphyxiation. But since fishes are free swimming they will avoid such areas and move to safer areas. Once the turbidity disperses due to current and wave disturbances, they come back to the area. Due to this capability of the fishes there is virtually no impact on fisheries due to pile construction. The study also did not show the existence of breeding grounds for fisheries. Thus, no major impacts are anticipated

Impacts on phytoplanktons and primary productivity

Proposed project does not envisaged dredging dumping and reclamation. All the structures will be constructed on piles. Project involves the handling of liquid cargo and total cargo will be evacuated through pipelines. There will not be any liquid

discharge from the facility. Further, the site supports low benthic population; hence no major impacts are anticipated on phytoplankton and productivities. The proposed work does not deal with any hazardous materials and hence is not expected to cause any adverse impacts on the biota of the system. In the proposed jetty construction seagrass, corals or other ecologically important organisms are not reported. Hence, construction of jetties along these areas is not going to have any significant ecological impact in the system. Similarly, low benthic diversity from high sediment load also infers no significant impact of proposed work in the benthic system. The construction activities do not envisage interruption, flow in the system, thus, no impacts on the water system from the construction is expected.

The dissolved oxygen level is fairly good, largely due to the high water exchanges, and absence of organic pollution loading.

The growth of phytoplankton depends mainly on the availability of light in nutrient rich waters. Pile driving activity may lead to increase turbidity for a short duration, with corresponding reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, turbidity due to pile driving will be observed only in a localised area and for a very short duration. Hence these impacts are not expected to be significant in nature.

There are no records or sighting of rare / endangered / threatened organisms in the area. In general, the biodiversity profile of the proposed area is low.

Impacts on Riparian Vegetation

The proposed project envisages redevelopment of cargo handling facility at Outer Terminal-2 at Haldia Dock Complex. The entire facility will come within existing Port area. Land acquisition is not envisaged for the proposed development. Thus, no area with riparian vegetation at the proposed project site. The site of the proposed berth does not have major tree cover, flora, fauna, etc. Thus, no significant impact on terrestrial ecology is anticipated. However, during construction phase, marginal impacts are envisaged on the riparian vegetation in the area adjacent to the construction due to movement of construction equipment, increased turbidity levels, increased human interferences, etc. However, impacts on this account are expected to be marginal in nature and will last only during construction phase.

3.2 Impacts during Operation Phase

Impacts due to oil spills

Oil spills may occur accidentally during bunkering operations/loading & unloading operation/grounding & accidents of ships. Oil spills often pose a great threat to the natural resources, fisheries, birds and mammals as also to a wide range of subsurface marine organisms.

Spills are not anticipated to occur during normal operations, as the oil will be handled by specialised loading/unloading arms (Marine Transfer Arms). In the event of accidental oil spills during fuelling of port crafts/service barges and accidental spillage of oil from ships or offshore terminal, the marine water quality in the harbour basin will be impacted. To minimise the impacts on marine water quality, the spills will be recovered with state of art technologies.

Impacts on Biological Environment

The proposed project during project operation phase, is not going to generate solid wastes except some fugitive dust emissions. Thus, impacts due to generation of wastes are not expected to be significant. In addition, a green belt would be developed which will only improve the bio-aesthetic value of the area and provide avenue for reusing/recycling of wastewater. In addition, it will create a good habitat for the birds and other terrestrial fauna. The waste water shall be treated prior to discharge. Thus, there will be insignificant impact on the aquatic environment of the river. Waste water generated from the office/dock area will be treated as per CPCB standards. The treated water shall be used for greenbelt development/dust suppression.

Impacts of Bilge and Ballast Water Discharges

Bilge and ballast water, if not managed properly can lead to significant adverse environmental impacts particularly on surface water quality and aquatic life.

Oily bilge consists of, oily waste water. Oily water may also be found in on – board holding tanks, Bilge water contains pollutants like oil, grease, inorganic salts, metals etc.

Ballast is typically water that is intentionally pumped into certain tanks in a ship to improve the stability of the ship under various operating conditions.

Bilge and ballast water discharges can lead to following potential impacts:

- Bilge and ballast water may both contain metals and toxic organics, which can be risk to human and animal health.

- Bilge water contains oils, which can affect fish and marine organisms. Since these pollutants can float on the water surface and can be washed into the shoreline, they can affect with plant life cycles and respiration process. Birds, fishes and other animals are known to abandon nesting in areas affected by oil pollution. The exchange of ballast water will be made by following the IMO guidelines (MARPOL, 73/78) to minimize any adverse impacts.

HDC has facility for receiving bilge and ballast water, and Ballast Water Treatment Plant. Ballast Water Treatment Plant at Haldia is presently under used and has capacity of treating oily ballast water, slop oil, bilge oil, oil tank washings etc. from ships. The plant has slop oil receiving tank fitted with skimmer for separation of oil from water. Treated water conforming standard is will be used for meeting water requirement of greenbelt. The recovered oil are collected in dry slop oil storage tanks for subsequent disposal.

Effluents from the ships visiting Haldia Dock will be un-loading such effluents to Haldia dock for necessary treatment and ultimate disposal. The ETP has the capacity to treat the additional volumetric and organic loading on account of effluent likely to be generated by the proposed project. Alternatively oily wash water can be handed over to registered re-refiners for disposal. Thus, water quality of the area will not be affected, if the facility is properly used.

Impacts on Fishing Activities

Presence of heavy traffic and ship movement will impact the fishing activity in the region. In any case, fishing is not a permissible activity within the port limits and should not be carried out. As for fish, impacts may be on account of accidental oil spillage in case of handling/storage of oil/product, vessel movements during operation phase.

4. MANAGEMENT PLAN FOR MARINE AND RIPARIAN BIODIVERSITY

The activities envisages as a part of construction of proposed liquid cargo berth and laying of pipeline may have adverse impacts on surrounding environment project, if due care is not taken during the construction phase. The project is very small and only carrying oil (edible) through pipeline. It does not acquire any land in riparian zone. The project does not stop or create any barrier of the river flow. This project is not going to have any major impact on riparian and marine biodiversity. The following paragraphs describe measures to be adopted during the construction

phase and operation phase to mitigate the adverse impacts on Marine and Riparian Biodiversity:

4.1 Management Plan in Construction Phase

Management Measures for Water Environment

The major source of water pollution in construction phases is the sewage generated by the workers and employees. During construction phase, total increase in population is expected to be of the order of 150. It is proposed to construct two community toilets at the site for labours. The sewage from the toilets shall be treated in a package treatment plant and will be disposed in nearest stream.

The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment. The collected oily matter shall be stored in cans and sold to registered recyclers, identified by HDC, KoPT. No solid waste disposal will be made in the water environment.

Management measures for Marine biodiversity

The proposed project does not envisage the dredging and reclamation, however, spillage of oil from construction equipment and increase in turbidity due to piling work may affect the riverine ecology during construction phase. An important factor in minimizing adverse impacts would be optimizing the construction period and avoidance of activities in areas beyond the specified area of implementation. The key measures recommended to control marine pollution during construction phase are listed as below:

- Spillage of fuel/engine oil and lubricants from the construction equipment are unexpected source of organic pollution which impacts marine life, particularly benthic organisms. This shall be prevented by proper maintenance of construction equipment and by providing necessary arrangement to trap the spillage.
- Net enclosures using silt screens to be placed around the construction/piling area, wherever necessary, in order to control the spread of the turbid plume or any solid wastes.
- Proposed construction activity will be carried out under confined conditions, which will minimise the spread of sediments into the neighboring water column and cause minimum disturbance to the marine ecology of the area.

- Vessels operating during construction phase such as piling equipment shall be equipped with spill response kits.
- Construction work shall not be undertaken during fish breeding season and other special weather situations.

4.2 Management Plan in Operation Phase

Water Environment

A total of 30 persons (labour and staff) are likely to work at proposed jetty during operation phase. The domestic water requirement during operation phase would be of the order of 4.05 m³/day. The sewage generated would be of the order of 3.24 m³/day. It is proposed to construct two community toilets. The sewage from the toilets shall be treated in a package treatment plant and will be disposed in nearest stream.

Oil Spill Contingency Plan (OSCP)

To successfully combat an oil spill, the manpower needs to be thoroughly trained since quick and efficient response is the primary factor deciding the efficiency of the operation. It is also vital that all equipments are routinely inspected and regular mocks are held. The following issues will be earnestly addressed:

- Since, the proposed facility will be developed within Haldia Dock Complex, the SOPs laid down for HDC, will also be followed for proposed project.
- Oil Spill Control equipment will be stored in the vicinity of the oil berth and a suitable vessel will be always kept standby for quick response during loading / unloading operations of petroleum and while providing bunker.
- Mock drills will be held at least once in 3 months (deployment of critical oil spill containment and recovery equipment).
- Manpower dedicated to respond in the event of oil spills will be thoroughly trained in all facets of oil spill response.
- Oil spill combating equipment will be inspected regularly as recommended by the manufacturers and records of inspection will be maintained. Prompt action will be taken to attend to deficiencies, if identified during inspection.

Control of Water Pollution from Marine Transportation

The oil spills which may occur during bunkering operations is a potential source of water pollution. To combat oil pollution near the port, portable oil skimmers should be

available at the berth. A clean sweep oil recovery unit consisting of a power pack and the recovery unit mounted on a system can be utilized for this purpose. The recovery unit generally consists of a recovery drum, collecting trough, screw conveyor, discharge housing and wiper assembly. In addition, berths shall have chemical dispersants with spray pumps, catamarans for collection of debris and recovery of oil and tanker carriers for recovering sludge/bilge water.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 (MARPOL, 73/78), has issued guidelines for prevention of Marine Pollution. These are listed in subsequent paragraphs and should be strictly adhered to for prevention of marine pollution.

- Ships are prohibited to discharge oil or oily water such as oily bilge water containing more than 15 ppm of oil within 19 km (12 miles) of land.
- Chemicals are evaluated for environmental hazard which may cause environmental hazards if discharged into the sea (categories A, B, C and D). Discharge into the sea of the most harmful chemicals (category A) is prohibited. Tank washings and other residues of less harmful substances (categories B, C and D) may only be discharged keeping in mind certain conditions e.g. total quantity of discharge, distance from the shore, depth of water prescribed depending on the hazards. There are no restrictions on substances such as water, wine, acetone, etc.
- Harmful substances in the packaged form shall not be disposed into the sea.
- Sewage generated at the ship shall not be disposed off into the sea, unless it is treated or it is disposed off at a certain distance from land. Garbage produced on ship must be kept on board and discharged either ashore or into the sea under certain conditions, such as distance from the land; discharge of all plastics is prohibited.

Greenbelt Development

Halida Dock Complex has planted approximately 6 lakh trees. About 5000 saplings are planted annually at the Haldia Township and Dock area. In the year 2016, 7000 saplings were planted including avenue plantation etc. HDC is already developing greenbelt within the dock complex.

It is proposed to develop the green belt on the periphery of proposed facility and pipeline. The width of the proposed greenbelt will be 5 m. The area proposed for greenbelt development is about 5 ha. Maintenance of sapling planted as a part of Greenbelt Development shall be carried out for at least 5 (five) years to ensure survival of the saplings.

Management plan to improve the Riparian vegetation (Mangrove vegetation)

KoPT had already taken up plantation of mangrove and its associated species in Nayachar Island as a part of their Green initiative. Plantation of mangroves had already been taken up in and around 4ha of land around Nayachar Islands. Presently more than 13 lakhs of mangrove and its associates are surviving in the Islands. The major species that have already stabilized in the islands are given in Table-14:

Table-14 : Major Species already stabilized in Nyachar Island

S. No.	Scientific Name	Local Name
1.	<i>Acanthus Illicifolius</i>	Horgoza
2.	<i>Aegiceras Corniculatum</i>	Khalashi
3.	<i>Avicennia officinalis</i>	Peara Bain
4.	<i>Avicennia alba</i>	Sada Bain
5.	<i>Avicennia marina</i>	Kalo Bain
6.	<i>Bruguiera gymnorrhiza</i>	Kakra
7.	<i>Bruguiera parviflora</i>	Ban Bakul
8.	<i>Ceriops decandra</i>	Jhamti Goran
9.	<i>Cariops tagal</i>	Math Goran
10.	<i>Excoecaria agallocha</i>	Gawa
11.	<i>Heritiera fomes</i>	Sundari
12.	<i>Myriostachya wightiana</i>	Panighas
13.	<i>Nipa fruticans</i>	Golpata
14.	<i>Phoenix paludosa</i>	Hental
15.	<i>Porteresia Coarctata</i>	Dhani ghas
16.	<i>Rhizophora apiculata</i>	Garjan
17.	<i>Sonneratia apetala</i>	Keora
18.	<i>Xylocarpus granatum</i>	Dhundul
19.	<i>Xylocarpus mekongensis</i>	Passur

Now more and more numbers of mangrove are regenerating in the KoPT's 4.0 ha of land of Nayachar island which is under the control of KoPT. Among the above plants, luxuriant growth of *Sonneratia apetala* have been observed and dominated in the area. Due to fast regeneration; *Sonneratia apetala* has grown as the most dominant species. Other species found are *Excoecaria agallocha*, *Avicennia Bruguiera*. As a

part of Greenbelt Development, more and more numbers of mangroves species will be brought under plantation programme, which will upgrade the ecological status of the area and upgrade the riparian vegetation and its surrounding areas.

Mangrove swamps act as traps for the sediments and sink for the nutrients. The root systems of the plants keep the substrate firm, and thus contribute to a lasting stability of the coast. The ecosystem provides a source of food, breeding grounds and nurseries for many food fishes and shellfishes. Due to luxuriant growth of mangrove flora & fauna biodiversity of the area has increased a lot

Planting of mangroves is largely confined to two types:

- Direct planting of seeds or propagules in the muddy areas
- Planting of seedlings obtained from nurseries.

Rhizophora, *Nipa Bruguiera* and even *Heritiera fomes* can be planted directly, whereas the relatively small seeds or propagules of *Avicennia*, *Sonneratia* and *Excoecaria* can be raised in a nursery and then transplanted. A detailed survey was conducted with respect to existing vegetation types, vegetation diversity, etc. in the project area.

To improve ecological interactions at the intertidal zone; it is recommended to bring more areas under mangrove plantation programme. KoPT has already developed mangrove plantation over an area of 4 ha of land at Nayachar islands; about 2.5 km away from the proposed site. More than 13 lakh mangroves have been observed over an area of 4ha. It is recommended to develop mangrove in the intertidal zones which will not be used by the port as port operational areas. The non operational port area may be identified and be brought under mangrove plantation purpose to enrich biodiversity in the intertidal riparian zone.

Management plan to enhance fishery resources

Mangroves species such as *R. apiculata*, *R. mucronata*, *S. alba*, *A. marina*, *A. officinalis*, *H. fomes*, *K. candel* are recommended for coastal protection against tidal waters, erosion and cyclones while *Avicennia* spp. and *Bruguiera* spp can enhance the fishery resources . The study area exposed muddy during low tide time are best sites for transplanting *R. apiculata*, *R. mucronata*, moderate saline water suitable for *S. alba*, large freshwater supply will favour the growth of *B. gymnorrhiza* and *H. fomes*.

Plants ecosystems are a habitat for a wide variety of species, some occurring in high densities and provide food and shelter for a large number of commercially valuable finfish and shellfishes. The mangrove areas have shallow water level, warm water temperature, higher nutrients by various decaying activities. Hence ideal place for algae growth and for spawning ground for fish and marine animals. The fishes lay their eggs in tangled roots of mangrove trees and later hatch and grow with needed nutrients available. Thus, mangroves act as natural nursery grounds. They are breeding, feeding and nursery ground for estuarine organisms. Mangrove swamp is suitable place for crab, shrimp and mollusks habitat. The aerial roots establish a protected habitat for larvae and early juveniles and secondly the litter fall forms the source for the detrital food web on which many fish depend.

Mangroves serve as a critical nursery for young marine life and therefore play an important role in the health of fisheries and the economic well-being of fishermen. The ecosystem is also considered as most productive and biodiversity providing significant functions in the coastal zones as buffer against erosion, storm surge and tsunamis. Afforestation of mangrove areas on a large scale is the most urgent need of today, if the coastal environment is to be brought back again to its earlier pristine glory.

GREENBELT DEVELOPMENT PLAN FOR REDEVELOPMENT OF CARGO HANDLING FACILITY AT OUTER TERMINAL-2, HDC, WEST BENGAL

1. GENERAL

The Haldia Dock Complex, commissioned during 1977, is an integral part of Kolkata Port Trust (KoPT). HDC handles a major share of Kolkata Port traffic. The Haldia Dock Complex has the cargo handling capacity of 46.70 million tonnes, which includes bulk cargo, crude/ POL traffic and container cargo. Haldia Dock presently has 17 berths, of which three oil berths (HOJ-I to HOJ-III) are located in the river and remaining 14 berths (berth No. 2 to berth No. 13) are inside the impounded dock. The Berth No. 4 has been marked as berth No. 4, 4A and 4B.

In spite of large number of favorable factors and heavy growth potential, HDC is not able to attract increased volume of traffic primarily due to deteriorating draft situation in the river Hooghly. At the same time vessel movement in and out of the Dock takes place only during high tides windows which occurs twice in a day. This has resulted in only smaller vessel/ vessel with smaller parcel size calling at Port. Hence, improvement in traffic is only possible by maximizing the utilization of the existing facilities by relocating / regrouping of cargo mix to be handled at various berths inside Dock and creating new berth outside the Lock Gate to bring down Turn Around Time (TAT) of the vessels as the vessels will be free of Lock restriction.

Hence, HDC proposes to develop the development of Cargo Handling Facility at Outer Terminal-2 for liquid bulk. The proposed site is located at about 365m East of the Eastern end of the lead in jetty and upstream of existing 2nd Oil Jetty at Haldia Dock Complex, KoPT.

The total land requirement for the project is 14,000 m², which includes 10000 m² on land side and 4,000 m² on river side. Proposed site is located within HDC and no private land acquisition is envisaged for the project. The layout of Haldia Port is depicted in Figure-1. The proposed liquid cargo terminal envisages the construction the following components:

- Service Platform
- Berthing Dolphin
- Approach Trestle
- Mooring Dolphin
- Walk Way to connect berthing dolphins
- Emergency exit walkway
- Pump house
- Guest house, Reservoir tank



Figure-1: Project layout superimposed on Google image

2. GREENBELT DEVELOPMENT

Proposed facility envisages the construction and operation of liquid cargo handling facility within HDC complex. Proposed site is located within HDC and no private land acquisition or tree cutting is envisaged for the project. The construction activities might lead in the increase of exhaust emissions and fugitive dust suspension from construction equipment and transport vehicles. However, no impacts on fugitive emissions or noise level is anticipated during operation phase, as total cargo will be transported through pipelines.

However, Halida Dock Complex is committed to enhance and maintain the greenery in the port complex and planted approximately 6 lakh trees and covered about 434 ha of area under green belt. In continuation of the commitments towards environment, HDC proposes to develop greenbelt in an area of 5 ha, as a part of the proposed project. Greenbelt will be developed on the periphery of proposed facility and pipeline, which will help to control air and noise pollution and will improve the bio esthetics of the area.

The greenbelt development plan aims to improvement the environmental conditions of the region. The greenbelt development will address various issues such as prevention of land degradation due to activities during construction phase; enhance the forest cover for increasing the biodiversity of the region; providing aesthetic value

enhancing the ecological equilibrium of the area; and to a large proportion in combating soil erosion. Although the forest loss due to reservoir submergence and other project appurtenances have been compensated as a part of compensatory afforestation. It is proposed to develop greenbelt around the periphery of various project appurtenances, selected stretches along reservoir periphery. The green belt will reduce the impacts of air pollution and dust as trees and shrubs are known to be natural sink for air pollutants. It can also reduce the impact of ever increasing noise pollution caused due to increase vehicular activities and other port operations.

3. GREENBELT DEVELOPMENT GUIDELINE & TECHNIQUES

It is proposed to develop the green belt on the periphery of proposed facility and pipeline. The width of the proposed greenbelt will be 5 m. The area proposed for greenbelt development is about 5 ha. The greenbelt development plan is shown in Figure-2. The details of Greenbelt development are given as below:

- Plantation will be done along the boundaries of project colony
- The inter-connecting/approach roads of various project components, within the colonies, working sites, etc. shall be covered with avenue plantation.
- Available space within the colonies will be brought under Greenbelt for plantation of fruit, ornamental and shade trees along with shrubs, climbers etc. Fruit trees can be protected with angle iron guards.
- During the initial phase of plantation and summer seasons, weakly watering of plants can be done. In addition if required farm yard manure (FYM), agro-chemicals and insecticides can also be applied.
- Along the road sides, 2 to 3 rows of ornamental trees can be planted.
- The outer most layers will be planted by tree species & inner most layer will be planted by shrub species.
- A total of about 8,000 plants will be planted by planting 1600 saplings per ha.
- Single row of each tree and shrub has been proposed with a spacing of 2.5 m x 2.5 m for trees and 2m x 2m for shrubs.
- The pit size has been recommended as 45 cm x 45 cm x 45 cm for trees and 30 cm x 30 cm x 30 cm for shrubs.
- At the construction site and colony sites, the width of Greenbelt development can be increased depending on the quantum of land available.
- Thickness of greenbelt along reservoir periphery can be about 4 – 6 m.

- The saplings for Greenbelt can be processed from nearby nurseries of the Forest Department.

On the completion of plantation, maintenance (soil working, watering, weeding, transplanting etc.) of the above sapling will be carried out for at least 5 (five) years from the date of plantation for getting effective result. While selecting plant species, following criteria will be kept in view:

- Native plant species will be preferred
- Fast growing plants will be planted
- Plants having thick canopy cover will be used
- Preferably perennial and evergreen species will be selected
- Plants having large leaf area index will be considered
- Shoreline / marshy area will be planted with mangrove vegetation
- Road sides will be planted with local vegetation

The details of plant recommended for green belt is given in Table-1.

Table-1: Species recommended for greenbelt development

Scientific Name	Local Name
Flowering, Ornamental and Timber trees	
<i>Albizia lebbbeck</i>	Siris
<i>Azadirachta indica</i>	Neem
<i>Cassia fistula</i>	Sondal/Amaltas
<i>Casuarina equisetifolia</i>	Bilati Jhau
<i>Swietenia mahogani</i>	Mahogany
<i>Acacia arabica</i>	Babool
<i>Lagerstroemia speciosa</i>	Jarool
<i>Mimusops elengi</i>	Bakul
<i>Syzygium javanica var: alba</i>	Jamrul
<i>Pongamia pinnata</i>	Karanji
<i>Terminalia arjuna</i>	Arjun
<i>Terminalia belerica</i>	Bheda
<i>Terminalia chebula</i>	Haritaki
Shrubs	
<i>Thevetia peruviana</i>	Kulkiphool
<i>Michelia champaca</i>	Swarna Champa
<i>Anona squamosa</i>	Custard apple
<i>Bougenvalia spectabilis</i>	Bangabilas
<i>Calotropis procera</i>	Akando
<i>Nerium indicum</i>	Lal kaner
<i>Ixora coccinea</i>	Rangan
<i>Zizyphus sp</i>	Kul/Ber
<i>Tecoma stans</i>	Yellow trumpet bush

4. Protection measures

The fencing of single row plantations will be done by using iron /wooden guards. The fencing of multiple row plantations will be done preferably by barbed wire. A four strand barbed wire fencing, with cross strands, stretched on iron/cement poles fixed at a distance of 4 meter from one another; is recommended. Using the appropriate protection measures, the survival rate of sapling should be 90% after raising the plantation of age one year at any stage during contractual period with normal shape and size.

5. BUDGET

An amount of Rs. 10.0 lakh is earmarked for this purpose (Table-2). The budget also includes maintenance of the executed work. A layout map showing greenbelt proposed as a part of the project is enclosed as Figure-2. As per the guidelines of CPCB, various plant species have been suggested for the plantation programme outside port area. The plantation for this purpose will be carried out by Forest Department, state government of West Bengal.

Table-2: Summary of cost for green belt development

S. No.	Components	Cost (Rs. in lakh)
1	Procurement of sapling (Cost @Rs.20 /sapling for 1600 sapling/ha)	1.60
2	Digging of pits (Cost @Rs. 5/sapling for 1600 sapling/ha)	0.40
3	Barbed wire fencing @50000/ha	2.50
4	Application of fertilizer, insecticides, etc (Cost @10,000/year)	0.50
5	Maintenance cost for 5 years (One Gardner @Rs.7000 per month @ 10% escalation)	5.128
	Total	10.128 Say Rs.10 lakh

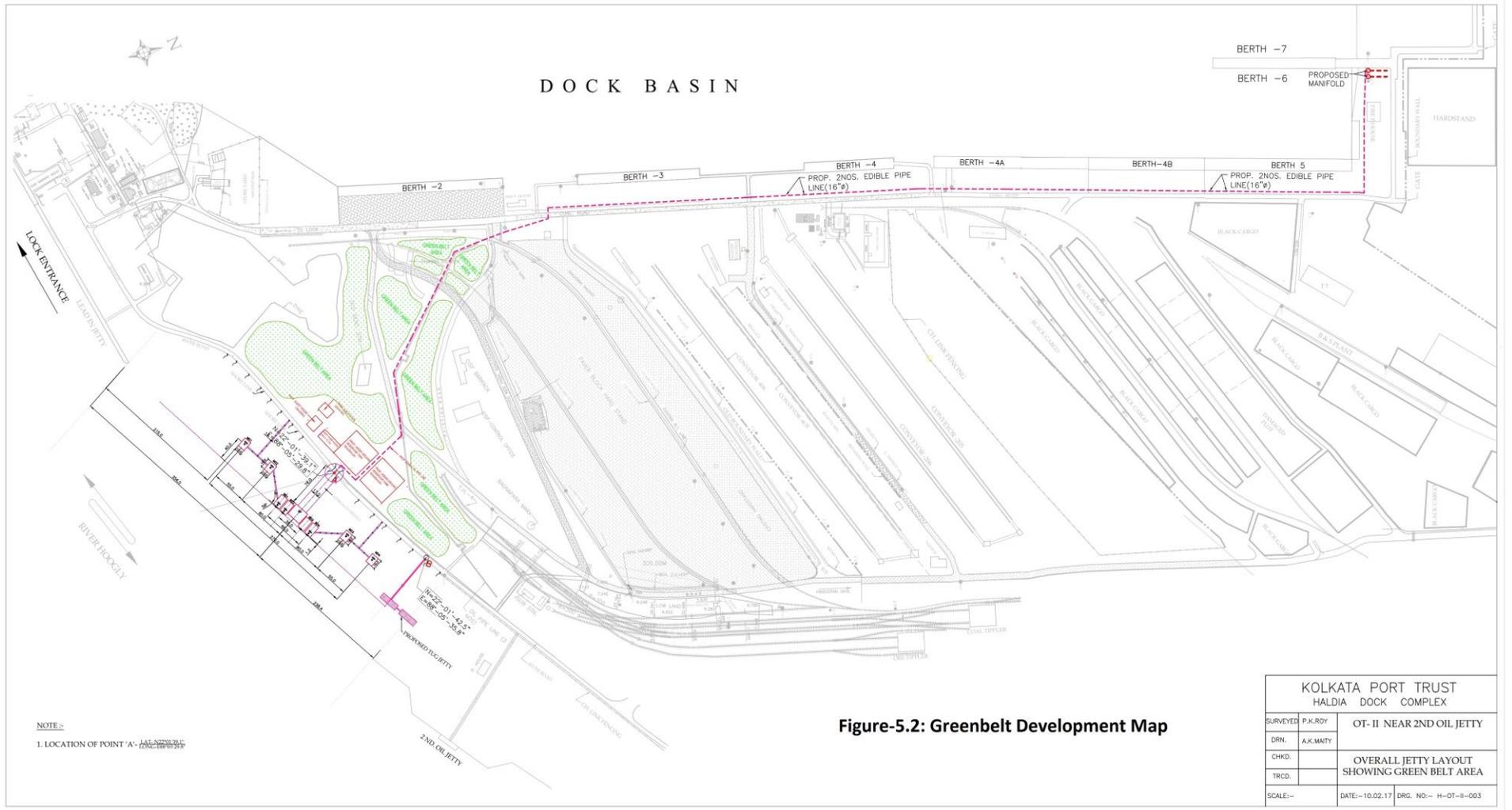


Figure-2: Greenbelt Development Plan



Office of the
Haldia Municipality

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Memo No.:

424/H.M./2018

SR. DY. MANAGER,
OFFICE DKT REGR. NO...

3595

17 JAN 2018

Date:

17.1.18

TO WHOM IT MAY CONCERN.

**Sub : Redevelopment of Cargo Handling
Facilities at Outer Terminal (near
2nd Oil Jetty) at Haldia Dock Complex,
Kolkata Port Trust.**

This is to confirm that we have adequate capacity to handle the solid waste which will be generated from the presence of 30 nos. of employees proposed to be engaged for the operation of the subject project. This amount is considered to be very minimum as our present existing capacity of handling solid waste is 120 MT per day.


Chairman,
Haldia Municipality

