

HYDRAULIC STUDY DEPARTMENT

OBJECTIVE

The objective of the Hydraulic Study Department in tune with Kolkata Port Trust (KoPT) Corporate Quality objectives are :

- To carry out Applied Research on the behavior of the Bhagirathi-Hugli river system and formulate necessary River Regulatory Measures for its implementation towards the maintenance and continual improvement of depth in the Shipping channel of KoPT.
- To provide effective Navigational Aids like Differential Global Positioning System (DGPS) for Hydrographic Survey, Dredging and VTMS as a tool for surveillance & safe navigation of vessels in the Hugli Estuary.

BACKGROUND

The problem of navigation and inadequacy of depths has prompted the Commissioners of the Port of Calcutta, to set up a full-fledged department called Hydraulic Study Department under the stewardship of Dr. D.M. McDowell, a United Nations Hydraulic Expert, in 1962 . The Kolkata Port authorities had been consulting recognized experts of fame since long to assess the river conditions and suggest remedies. Whereas river training and dredging are most important methodologies for imparting navigational improvements, no significant training measure was taken up prior to 1954, It was realized that training measures and dredging schemes in the Hugli river / estuary would require systematic assessment of the mechanism of the tidal propagation in the tidal system as a whole. This called for specialized organizations completely devoted to the study of the tidal and riverine problem.

Soon after commissioning, the department took up systematic estuarine Data collection, analyses thereof and recommended several river training measures augmented with dredging to improve the navigability of the Hugli. Different schemes were taken up and they yielded satisfactory results – this includes the series of river training works taken up in the Ninan-Nurpur-Mayapur-Goriapole areas. Many foreign experts of fame came in association with the department and appreciated its functioning. The success of the department in serving the very purpose of its

creation was recognized by the Ministry of Science and Technology, Government of India, which accredited this department as a Research and Development unit. The department maintains close liaison with many scientific Institutions of National / International repute, some of which are University of Calcutta, Jadavpur University, B.E. College(Deemed University), Indian Institute of Technology (Kharagpur), Indian Institute of Technology (Chennai), Bose Institute, S.N. Bose Institute of Basic sciences, Saha Institute of Nuclear Physics, Geological Survey of India, Meteorological Department, Department of Space (Ministry of Science & Technology), Bhabha Atomic Research Centre, Central Water & Power Research Station (Pune), Water & Power Consultancy Services (WAPCOS), National Institute of Ocean Technology(Chennai), National Remote Sensing Agency (NRSA). University of Hamburg (Germany), Lanka Hydraulic Institute (Sri Lanka), Danish Hydraulic Institute etc.

This department also performed significant role in the commissioning of the Farakka Barrage Project which primarily was developed to ensure perennial upland discharge in the Hugli estuary. To observe the changes in the river after the barrage was constructed, Hydraulic Study Field Organisation, a field unit of this department was set up at Berhampore in 1975. Another discharge measurement station was also set up first at Samudragarh (Burdwan, W.B.) and then it was shifted to Swarupgunj(Nadia, W.B.), .

Since the late sixties onwards, global shipping industry underwent changes with the introduction of higher-drafted vessels. Calcutta Port authorities by that time realized that to arrest falling cargo-handling quantum, they should do away with the draft restriction existing throughout the 232 km long riverine passage. Accordingly, setting up of a deep-drafted dock complex at Haldia was contemplated by the CPT and finally it came in 1977-78.

ACTIVITIES

The department at present performs multi-faceted regular as well as consulting / depository activities as briefed below :

- a) **Data collection & Analysis** : Analytical Laboratory section collects the following data, on riverine characteristics, over a stretch of 500 km long Hugli – Bhagirathi river system, with the state of the art equipments viz. Acoustic Doppler Current Profiler (ADCP), Current Meter (Electro Magnetic type).

- Current Velocity
- Discharge
- Flux
- Water Salinity
- Water Temperature
- Sediment concentration
- Size distribution of bed materials

These data are analyzed in the laboratory with the aid of instruments like Salinity Meter, Turbidity Meter & Sieve Shaker.

- b) **Mathematical Modelling** : The department utilizes the state-of-the-art scientific software(MIKE 11, MIKE 21 etc) for formulation of the Mathematical model of river Bhagirathi, Hugli, Hatania-Doania et al based on partial differential solution of system of equations derived from Newtonian Conservation Laws of Momentum & Mass. This model coupled with the Physical model, is run to justify any proposed scheme.
- c) **Remote Sensing & Geographical Information System** : The department procures satellite digital data from National Remote Sensing Center, Hyderabad (NRSC) for critical reaches of river Bhagirathi & Hugli . The raw data is analyzed through software like ERDAS, Image Analyst & Geomedia. The interpreted information help to understand the riverine parameters / system and subsequent formulation of the River Regulatory Measures.
- d) **Physical Modelling of river & estuary** : Set up in the year 1974, it's a scaled replica of the Hugli estuary laid over a few acres of land at Circular Garden Reach Road, Calcutta. Prior to taking up of any river training works, the scheme is invariably tested in this model to judge the efficacy of the selected scheme.
- e) **Instrumentation** : The department has a fully-equipped Electronic / Instrumentation wing, which looks after the sophisticated instruments used by this department for Data collection (ADCP, Current Meter, Echo Sounder etc) and also for the Navigational Aids like VTMS, DGPS(compatible to MF correction signal fed by Directorate

General of Light House & Light Ships (DGLL)), Government of India. Presently KoPT has two VTM Systems with RADAR & AIS : One Stand-alone(X-band radar) system having Control console at Sagar Pilot Station. Another microwave linked VTM System with Control console (X-band radar) at Haldia Jawahar Tower and two remote sites at Sagar & Frasergunj (S-band radars & AIS base stations)

- f) **Hydrographic Survey of river Bhagirathi** : One field unit of this department named Hydraulic Study Field Organisation (HSFO), located at Berhampore (Murshidabad, W.B.) carries out hydrographic survey of the river Bhagirathi between Farakka (Murshidabad, W.B.) & Nabadwip (Nadia, W.B.) and prepares Annual Report in the following four volumes, for eventual submission to the Study Team constituted by the Government of India.

Volume-I : Effect of perennial discharges on the morphology of the River Hugli

Volume-II : Effect of the [perennial discharge on the morphology of the river Bhagirathi.

Volume-III : Effect of the perennial discharge on the navigability of the river Hugli

Volume-IV : Effect of the perennial discharge on siltation in the upper tidal compartment of the river Hugli.

- g) **Discharge & Water Level Measurement in river Bhagirathi**: Discharge & Water level measurements are done at different locations of river Bhagirathi at Jangipur, Jiagunj, Berhampore, Plassey, Natungram, Katwa, Kalikapur, Swarupgunj (Daily) in pre-monsoon, monsoon & post-monsoon seasons.

- h) **Research work** :

- Morpho-dynamic behaviour of the Hugli Estuary by Geo-morphological studies using Remote Sensed Digital Image processing technique with GIS facilities
- Mathematical Model studies of flow in the Hugli-Bhagirathi river system under the influence of non-linear interaction of tides and perennial upland flow in one and two Dimensions. and Sediment budgeting thereof

- Behaviour of the river Hugli under the joint action of variability of seasonal (monsoon / non-monsoon) discharge against semi-diurnal tides and occurrence of tidal bores
- Tracking of movement of dumped dredged spoils using Radio Active Tracer in the Hugli estuary.
- Environmental impact assessment and environmental management plan formulation of tidal and non-tidal rivers.

i) **River Training Works already executed / under execution / to be executed:** The following works for Hugli river / estuary were/are formulated & monitored by this department. The works were / are executed by the River Training Wings of Kolkata Port Trust.

i) **Already Executed:**

- Nourishment of Spur Nos. 92A, 93 at Moyapur region and Spur nos. 120,122 & 124 at Falta region
- Bank Protection Work near Sondia Column
- Bank Protection Work near 3rd Oil Jetty
- Construction of a guidewall at the northern tip of Nayachar Island
- Construction of a submerged guidewall at Jellingham area (Pilot projet)
- Bank protection works at Nischintapur & Ghoramara island
- Removal of impediment at Balari Passage

ii) **Under Execution :**

- Removal of impediment at Auckland

iii) **To be Executed :**

- Nourishment of Spur Nos. 130,132 & 134 at Ninan-Nurpur area

- j) **Publication** : There is a sizable in-house publication of technical reports many of which were later published in National/International journal of repute.

DEVELOPMENTAL PROJECTS

Contents will be updated from this department time to time.

HUMAN RESOURCE

Presently headed by the Chief Hydraulic Engineer [Sri Bikas Chaudhuri, ME(Hydraulics), BE (Civil); che@kopt.in], the department is endowed with a pool of Engineers & Scientists from various academic backgrounds viz. Civil Engineering, Electronics Engineering, Computer Science, Physics, Applied Mathematics, Chemistry & Geology.

LOCATION

The Main Office of HSD is located at 20, Garden Reach Road, Kolkata -700 043 [Tel : (+9133) 2409-3029, 31, 32, 2439-6780, 7910, Fax : (+9133) 2409-3031,36] with different offices situated all over West Bengal starting from Berhampore, Swarupgunj, Kolkata, Falta, Roychawk, Haldia, Saugor, Frasergunj, Dadanpatra etc.