



# NORTH 24 PARGANAS

## DOCUMENTATION OF GANGA FROM GOMUKH TO GANGASAGAR



Report submitted by:  
**The Natural Heritage Division**

## Indian National Trust for Art & Cultural Heritage



वंदीनेषुदयावतीतिविदितंयद्ब्रह्महस्ताश्रयं  
प्राप्ताऽथाच्युतपादसङ्गमहितापश्चाच्चनाकंगता ।  
सौवर्णाचलशृङ्गमेत्यमुदिताशम्भोःशिरःसङ्गताऽ  
प्यास्माकक्षितिमण्डलेत्रिपथगेतुष्टाऽस्यभीष्टप्रदा ॥ १५ ॥

*O Tripathagaa! It is (now) known that you have great compassion over the helpless; Because even though you have had the shelter of Brahma's hand and then had the great glory of obtaining union with lord Achyuta's feet; even though you reached the Swargaloka; (though) you reached the peak of the golden crowned MeruParvata and felt great joy; (and) reside on the head of Lord Rudra – you are here in our land to grant us all our desires!*

Tirthaprabandha, referring to the Ganga as the union of three streams, the *Tripathagaa*

**GNAMAMI  
GANGE**

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- I. Creating Sewerage Treatment Capacity
- II. Creating River-Front Development
- III. River Surface Cleaning
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## ABBREVIATIONS

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AISLUS	All India Soil & Landuse Survey
As	Arsenic
ASI	Archaeological Survey of India
BGL	Below Ground Level
BOD	Biochemical Oxygen Demand
CGWB	Central Ground Water Board
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPT	Calcutta Port Trust
DEM	Digital Elevation Model
DO	Dissolve Oxygen
DPMS	District Planning Map Series
DWF	Dry Water Flow
E-Waste	Electronic Waste
EC	Electrical Conductivity
EKW	East Kolkata Wetlands
EMP	Environmental Management Plan
ETM	Enhance Thematic Mapper
FCC	False Colour Composite
GAP	Ganga Action Plan
GCP	Ground Control Point
GIS	Geographic Information System
GOI	Government of India
GoWB	Government of West Bengal
GPS	Global Positioning System
GSI	Geological Survey of India
HWL	High Water Level
IMD	Indian Meteorological Department

INTACH	Indian National Trust for Art & Cultural Heritage
IWMED	Institute of Wetland Management & Ecological Design
K	Potassium
KEIP	Kolkata Environment Improvement Project
KIT	Kolkata Improvement Trust
KMA	Kolkata Metropolitan Area
KMC	Kolkata Municipal Corporation
KMDA	Kolkata Metropolitan Development Authority
LULC	Landuse Land cover
LWL	Low Water Level
MSL	Mean Sea Level
MSS	Multi Spectral Scanner
MWL	Mean Water Level
N	Nitrogen
Na	Sodium
NATMO	National Atlas & Thematic Mapping Organisation
NBSS&LUP	National Bureau of Soil Survey & Landuse Planning
NDVI	Normalised Differential Vegetation Index
NH	Natural Heritage
NMCG	National Mission for Clean Ganga
NTFP	Non Timber Forest Product
pH	Hydrogen Ion Concentration
PPT	Precipitation
RF	Rainfall
RGB	Red Green Blue
RS	Remote Sensing
SPM	Suspended Particulate Matter
SRTM	Shuttle Radar Topographic Mission
SWID	State Water Investigation Directorate
TM	Thematic Mapper



UNDP	United Nations Development Programme
USGS	United Nations Geological Survey
WBPCB	West Bengal Pollution Control Board
WF	Wetland Fauna

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# Chapter 1: Introduction

## 1.1.BACKGROUND OF THE PROJECT

**Namami Gange Programme**, is an Integrated Conservation Mission, approved as ‘Flagship Programme’ by the Union Government in June 2014 with the twin objectives of effective abatement of pollution, conservation and rejuvenation of National River Ganga.

### 1.1A. Key achievements under Namami Gange programme:

- a. **Creating Sewerage Treatment Capacity:-** 63 sewerage management projects under implementation in the States of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. 12 new sewerage management Projects Launched in these states. Work is under construction for creating Sewerage capacity of 1187.33 (MLD). Hybrid Annuity PPP Model based two projects has been initiated for Jagjeetpur, Haridwar and Ramanna, Varanasi.
- b. **Creating River-Front Development:-** 28 River-Front Development projects and 33 Entry level Projects for construction, modernization and renovation of 182 Ghats and 118 crematoria have been initiated.
- c. **River Surface Cleaning:-** River Surface cleaning for collection of floating solid waste from the surface of the Ghats and River and its disposal are afoot and pushed into service at 11 locations.
- d. **Bio-Diversity Conservation:-** Several Bio-Diversity conservation projects are namely: Biodiversity Conservation and Ganga Rejuvenation, Fish and Fishery Conservation in Ganga River, Ganges River Dolphin Conservation Education Programme has been initiated. 5 Bio-Diversity center’s at Dehradun, Narora, Allahabad, Varanasi and Barrackpore has been developed for restoration of identified priority species.
- e. **Afforestation:** Forestry interventions for Ganga through Wildlife Institute of India; Central Inland Fisheries Research Institute and Centre for Environment Education has been initiated. Forestry interventions for Ganga have been executed as per the Detailed Project Report prepared by Forest Research Institute, Dehradun for a period of 5 years (2016-2021) at project cost of Rs.2300 Crores. Work has been commenced in 7 districts of Uttarakhand for medicinal plants.
- f. **Public Awareness:** A series of activities such as events, workshops, seminars and conferences and numerous IEC activities were organized to make a strong pitch for public outreach and community participation in the programme. Various awareness activities through rallies, campaigns, exhibitions, *shram daan*, cleanliness drives, competitions, plantation drives and development and distribution of resource materials were organized and for wider publicity the mass mediums such as TV/Radio, print media advertisements, advertorials, featured articles and advertorials were published. Gange Theme song was released widely and played on digital media to enhance the visibility of the programme. NMCG ensured presence at Social Media platforms like Facebook, Twitter, YouTube etc.
- g. **Industrial Effluent Monitoring:** The number of Grossly Polluting Industries (GPIs) in April, 2019 is 1072. Regulation and enforcement through regular and surprise inspections of GPIs is carried out for compliance verification against stipulated environmental norms. The GPIs are also inspected on annual basis for compliance

verification of the pollution norms and process modification, wherever required through third party technical institutes. First round of inspection of GPIs by the third-party technical institutes has been carried out in 2017. Second round of inspection of GPIs has been completed in 2018. Out of 961 GPIs inspected in 2018, 636 are complying, 110 are non-complying and 215 are self-closed. Action has been taken against 110 non-complying GPIs and is issued closure directions under Section 5 of the E (P) Act. Online Continuous Effluent Monitoring Stations (OCEMS) connectivity established to CPCB server in 885 out of 1072 GPIs.

- h. **Ganga Gram:** Ministry of Drinking Water and Sanitation (MoDWS) identified 1674 Gram Panchayats situated on the bank of River Ganga in 5 State (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal). Rs. 578 Crores has been released to Ministry of Drinking Water and Sanitation (MoDWS) for construction of toilets in 1674 Gram Panchayats of 5 Ganga Basin States. Out of the targeted 15, 27,105 units, MoDWS has completed construction of 8, 53,397 toilets. Consortium of 7 IITs has been engaged in the preparation of Ganga River basin Plan and 65 villages have been adopted by 13 IITs to develop as model villages. **UNDP** has been engaged as the executing agency for rural sanitation programme and to develop Jharkhand as a model State at an estimated cost of Rs. 127 Crore.

**National Mission for Clean Ganga (NMCG)** endeavors to deploy best available knowledge and resources across the world for Ganga rejuvenation. Clean Ganga has been a perennial attraction for many international countries that have expertise in river rejuvenation. Countries such as Australia, United Kingdom, Germany, Finland, Israel etc. have shown interest in collaborating with India for Ganga rejuvenation. Memorandums of Understanding (MoUs) were signed with various Central Ministries viz.- Ministry of Human Resource Development, Ministry of Rural Development, Ministry of Railways, Ministry of Shipping, Ministry of Tourism, Ministry of Ayush, Ministry of Petroleum, Ministry of Youth Affairs and Sports, Ministry of Drinking Water & Sanitation and Ministry of Agriculture for synergizing the Government schemes.

### 1.1B. Why we need "Namami Gange" programmes:

- River Ganga has significant economic, environmental and cultural value in India.
- Rising in the Himalayas and flowing to the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of north and eastern India.
- The Ganga basin - which also extends into parts of Nepal, China and Bangladesh - accounts for 26 per cent of India's landmass.
- The Ganga also serves as one of India's holiest rivers whose cultural and spiritual significance transcends the boundaries of the basin.

### 1.1C. Aim & Objective of NMCG

The aims and objectives of NMCG are to accomplish the mandate of National Ganga River Basin Authority (NGRBA) are:

- To ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management and
- To maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.



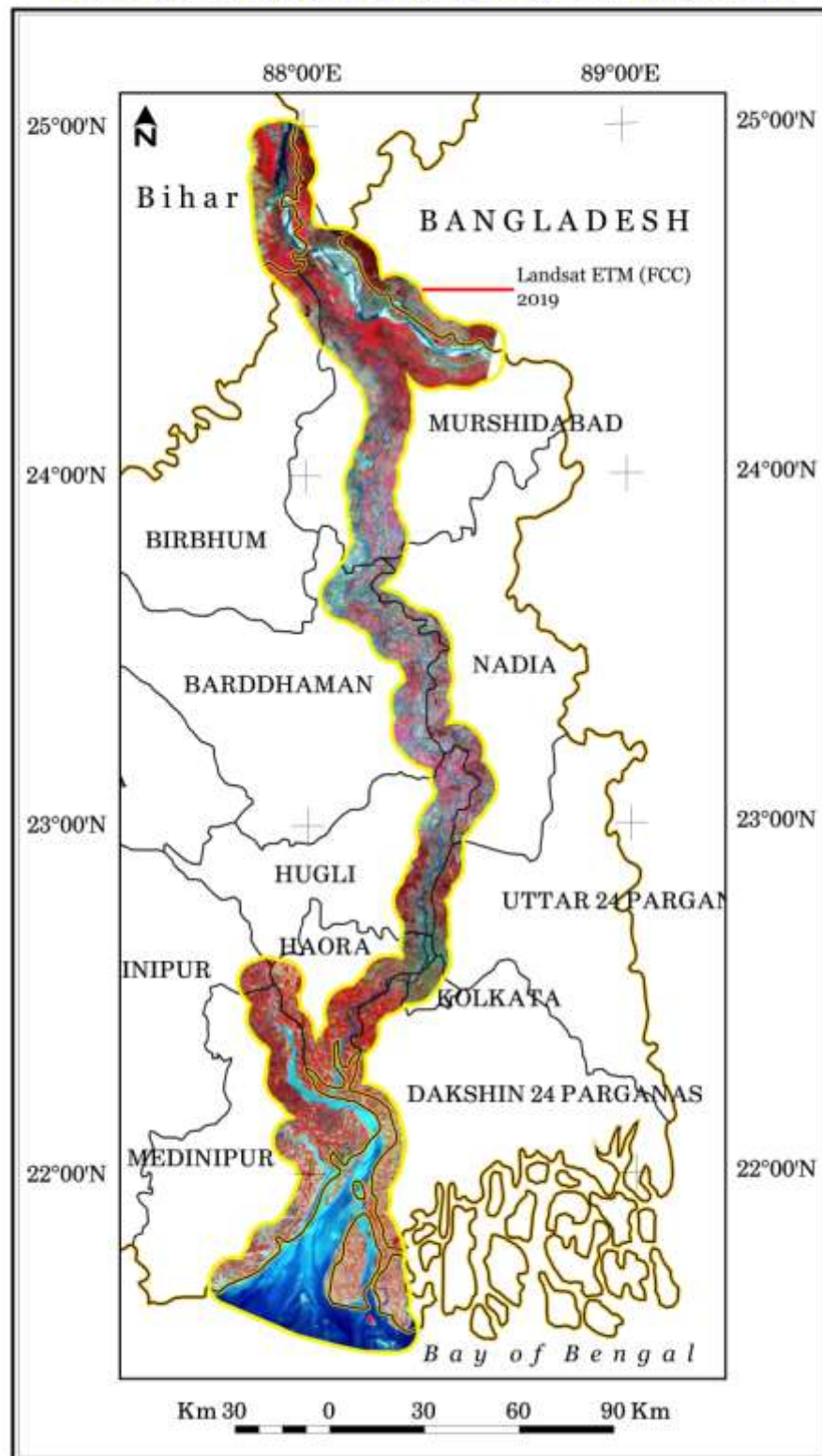
## 1.2. GANGA CULTURAL DOCUMENTATION

India is endowed with rich water resources with approximately 45,000 km long riverine systems criss-cross the length and breadth of the country. The Ganga river basin is the largest of the basins of India with an area of 8,61,452 Sq.km in India, draining into the 11 states of the country, Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal. The Ganga river has many tributaries, both in the Himalayan region before it enters the plains at Haridwar and further downstream before its confluence with the Bay of Bengal. The basin has a total drainage length of about 624235.73 Sq.km. The Ganga basin lies between east longitudes 73°2' to 89°5' and north latitudes 21°6' to 31°21' having maximum length and width of approx. 1,543 km and 1024 km. The average water resource potential of the basin has been assessed as 525020 Million Cubic Meters (MCM).

Sl.	Head Details		Quantitative Information		Remarks
1.	State Name: West Bengal		-	-	
2.	Geographical Extension of Bhagirathi-Hugli		N	E	
			N	E	
3.	Areal coverage in 5km Buffer				
4.	Areal coverage in 10km Buffer				
5.	Total Number of Districts coverage		10		
6.	District wise Police Station & Ward coverage	<b>District</b>	<b>Number of PS/ Wards</b>	<b>Length of Hugli River</b>	
		A Malda	04	88 Km	
		B Murshidabad	13	520 Km	
		C Nadia	09	112 Km	
		D Barddhaman	04	138 Km	
		E Hugli	09	91 Km	
		F Haora	09	69 Km	
		G Uttar 24 Parganas	09	42 Km	
		H Dakshin 24 Parganas	09	110 Km	
		I Kolkata	144 Wards	20Km	
J Purba Medinipur	06	92 Km			
7.	Total Length of the Bhagirathi-Hugli River in the Lower Part		1282 Km.		

## WEST BENGAL

Showing the area of study along Bhagirathi-Hugli River



Map 1 – Map of West Bengal showing the study area



### 1.3. DOCUMENTING NATURAL HERITAGE & ECOLOGICAL INTERDEPENDENCIES

Natural Heritage would not replicate the work of scientific institutions Biodiversity Conservation is being studied and implemented by Wildlife Institute of India to cover Golden Mahseer, Dolphins, Crocodiles, Turtles and Otters and other fauna under conservation programme. These studies would be referred to.

**1.3A. Changes in Flows, Water Levels:** The documentation of natural heritage at several sites and banks will look at the changes in flows, earlier course of the river if any and observable changes in water level as revealed in discussions with resource persons and local communities.

**1.3B. Floodplains** Crops and natural riparian flora and fauna, ox-bow lakes would be recorded

**1.3C. Species-Fauna, Flora, Birds and others:** Observations of riparian communities regarding changes in flora and fauna both riparian and in-stream would be recorded

**1.3D. Sacred Groves:** Landscapes that have both ecological and religious significance, where religion has ensured conservation of natural landscapes shall be noted

**1.3E. Sacred Species:** Certain species and specific trees are considered sacred because of associated religious beliefs or biological significance. It is because of their presence that several landscapes and sites stand safe. Many of these trees have a close association with the river during performance of some rituals. For instance, Bhojapatra is a birch tree native to the Himalayas, growing at elevations up to 4,500 m. The specific epithet, *utilis*, refers to the many uses of the different parts of the tree. The white, paper-like bark of the tree was used in ancient times for writing Sanskrit scriptures and texts. It is still used as paper for the writing of sacred mantras, with the bark placed in an amulet and worn for protection. In the sacred forests of Bhojwasa, around Gaumukh, such forests have been protected by pilgrims and resident communities, for eons.

**1.3F. Community Understanding of Riparian Rights:** Several communities, like the fishermen of the lower delta regions, have been caught in conflict with incumbent authorities in British and Independent India over riparian rights. The project aims to develop an understanding of what constitutes community riparian rights and whether communities are in conflict with authorities over the same.

**1.3G. Confluence Points:** The course of the Ganga is dotted with several confluence points of lower order streams which will be marked geospatially to understand the catchment and wider system of this river. The documentation also aims to name the minor tributaries that flow within this system and join it at various places.

**1.3H. Review of Scientific Research on the Waters:** Many scientific papers have been published on the Ganga and features of its water that keep it free of decay. These papers will be referred to recording what they suggest in terms of keeping the waters pristine.

## 1.4. METHODOLOGY

### 1.4A. Capacity Building:

- I. **Training arrangement:** Two phases of training have given to the Field Coordinators, Field survey staff and the Project Resource persons. First phase of training has conducted by the Project Funding Authority i.e. INTACH, Delhi and second phase of training will be conducted by the Project Implementing Agency i.e. RS-GIS, Kolkata.
- II. **Development of Project Team:** A Project team has formed according to the need of the objective of the present Project. It is formed headed by the coordinator and the Social Scientist. Other members of the Project team are the GIS-Remote Sensing Expert, Field assistant (Geography background), Local Resource persons, Camera person and Hydrologist, Soil Scientist, Botanist, Zoologist & Agriculture scientist.
- III. **Acquisition / Procurement/ Purchase of Gadgets /Equipments / Analysis:** Following Gadgets/Equipments have been purchased for the implementation of the Project work: GPS machine, Satellite Image (Two seasons, Recent Data), Soft / hard copy Cadastral maps, Soil / Water storage Kit, Measuring Tape/ Compass/ Dumpy level, Topographical / DPMS, Laboratory Test / Analysis, procurement of other secondary Data / Information / Maps from Census, Irrigation, Ground water, Soil, Agriculture, Forest etc. Purchase of Books, Reproduction of Survey formats & Stationeries etc.

### 1.4B. Pre-Field Survey:

- I. **Literature review:** Library work, Study of published and unpublished reports, News paper articles, Journals and Research papers.
- II. **Collection of Secondary Data/ Information (Maps) from Govt. Departments:** GSI, NATMO, CGWB, NBSS & LUP, IMD, SWID, PHED, KMC Office, Survey of India (SoI), KOPT, West Bengal Fisheries Corporation, Irrigation & Waterways GoWB, West Bengal Forest Deptt. PWD, Census of India, AISLUS etc.
- III. **Satellite Data Acquisition (Real-time):** NRSA Hyderabad, University of Calcutta (Deptt. of Geography), USGS Earth Explorer.
- IV. **Base-Map Preparation (for whole Project area):** Consulting Topographical maps, Census maps, DPMS & Recent Multi spectral Satellite Image.

### 1.4C. Field Survey:

- I. **Data-Information Collection & Measurements:** Collection of detail information with GPS locations, related to- Surface Morphology /Relief/ Physiography, Geology, Climatic conditions, Bank erosion, Embankment condition, Depth of river Bhagirathi-Hugli, Shifting river course and Paleo-channels, Status of Confluence and Off-take points of rivers, Canals, Flood events and Tide levels, Heritage water structures, Wetlands, Ground water regime, Soil, Water quality, Riparian Flora-Fauna, Sacred trees, Landuse-Land cover types, Impact of Dams/Barrages/Mining, Utilization of Flood plain, Riparian Rights etc.



- II. **Photo & Videography:** Professional photographers having enough experience of Physical, Social, Ecological & Environmental issues will be engaged for Digital documentation of different events related to the Natural phenomenon.

#### 1.4D. Post Field Analysis:

- I. **Collection & Scrutinization of Field Data/Survey sheets:** Region / Block/ PS/ Mouza wise *Proforma for Listing the Natural Heritage* survey sheets will be checked / verified with the concern persons.
- II. **GPS Data analysis:** Collecting the Ground Control Points (GCP's) & GPS-Tracks of Land surface & Waterbodies, the database will be processed through Map-Source Software
- III. **Water & Soil Sample data analysis:** Sample will be supplied for analysis in reputed Govt. Departments or Private agencies.
- IV. **Preparation of Theme Maps:** Location, Administrative, Relief, Geology, Geomorphology, Drainage, Waterbody, Canals, Groundwater, Soil, Rainfall-Temperature, Vegetation, Tidal fluctuations, Landuse-Land cover, Shifting of Rivers, Embankment status, Population growth, Flood condition, Watershed divisions, GPS locations of specific units, Urbanization level etc.

#### 1.4E. Validating Field & Analised Data:

- I. **Landuse Land cover units:** Physical & Cultural units on land surface to be verified after revisit the area with recent Satellite Image.
- II. **GPS locations:** After Overlaying the data on Satellite Image (Google Earth Image) Cross-checking will be done
- III. **Water Sample analysis data:** COD, BOD, pH, EC, DO, Turbidity analysis of Water samples.
- IV. **Flora/Fauna:** Riparian, Sacred Species with their environment.

#### 1.4E. Preparation & Submission of Report

- I. **Preparation of Draft Report:** Preliminary Draft Report in Soft & Hard copy mode (1 Colour Printed) of each District will be submitted to INTACH, Kolkata Convener for Verification / Correction
- II. **Report Correction:** Any corrections made by the funding authority will be incorporated judiciously into the Final Report.
- III. **Final Report Submission:** Final Report in form of Soft Copy will be submitted District wise and Hard copy Report will be submitted after completing the all Districts in three phases.

ডাহিনে হুগলি , বহে বামে ভাটপাড়া  
 পশ্চিমে বাহিল বোরো পূর্বে কাঙ্কীনাড়া  
 মূলাজোড় গাড়ুলিয়া বাহিল সঙ্ঘর  
 পশ্চিমে পাইকপাড়া বাহে ভদ্রেস্বর  
 চাপদানি ডাহিনে বামেতে ইচ্ছাপুর  
 বাহ বাহ বলি রাজা ডাকিছে প্রচুর  
 বামে বাকিকিবাজার বাহিয়া যায় রংগে  
 জমিন বাহিয়া রাজা প্রবেশ দিগঙ্গে  
 পূজিল নিমাইতীর্থ করিয়া উত্তম  
 নিমগাছে দেখে জবা অতি অনুপম  
 চানক বাহিয়া যায় বুড়নিয়ার দেশ  
 তাহার মেলান বাহে আকনা মাহেশ  
 খড়দহে শ্রীপাট করিয়া দণ্ডবত

বাহ বাহ রাজা ডাকে অবিরত –মনসামঙ্গল , বিপ্রদাস পিপলাই ,

(Manasa Mangal , Bipradas Piplai , 1495)

*Hugli in the right side , Bhatpara in the left*

*Boro in west and kakinara in the east*

*Mulajore , Garulia moved away fast*

*Paikpara in west and Bhadreswar in east*

*Chapdani in the left , Icchapur in the left*

*Raja is applauding by seeing all these places*

*Bikikibazar moves out in the left , now he moves inside Digange.*

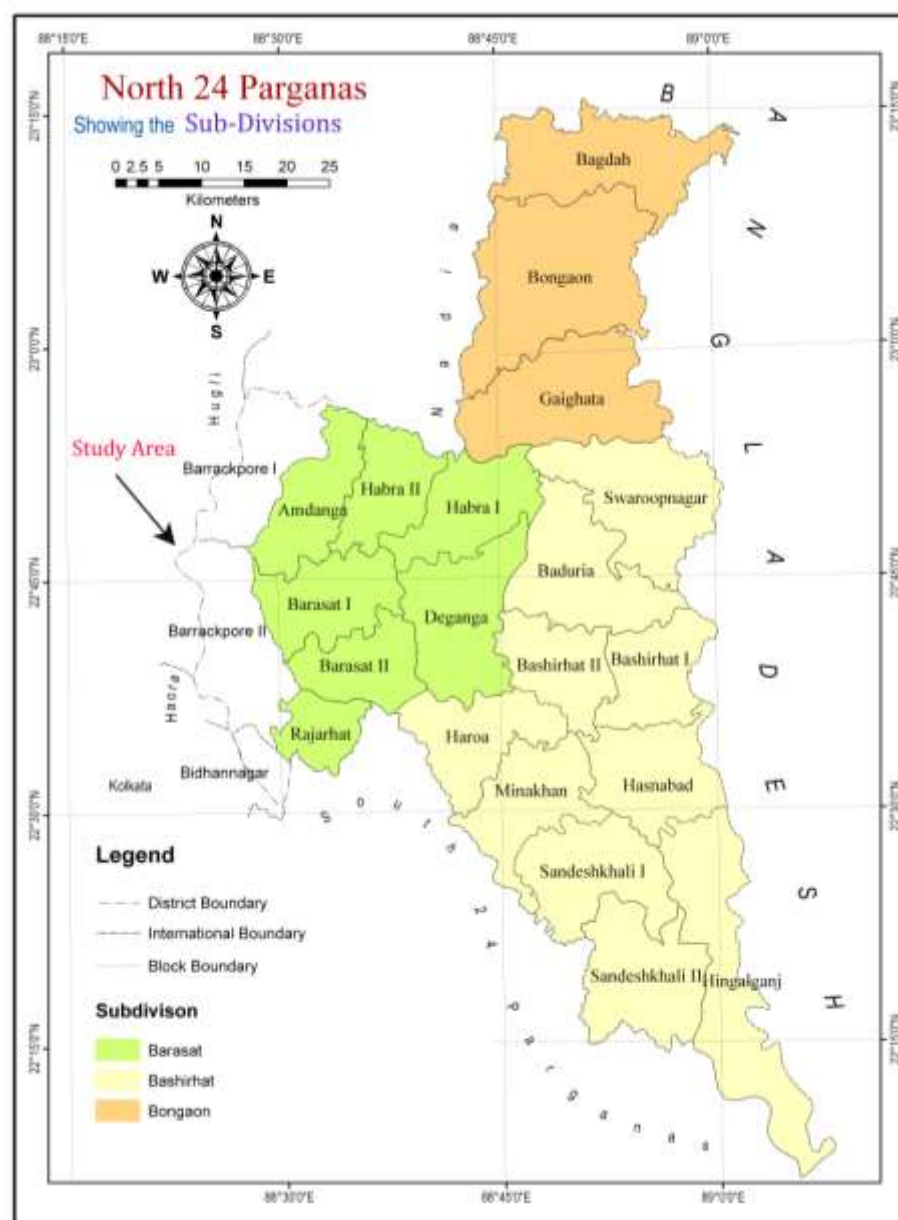
*Worshipped Nimaitirtha by seeing hibiscus in a Neem Tree.*

*Chanak moved away along with Mahesh and Akna.*

*Ultimately Shripaata anchored in Khardah. ( Manasa Mangal, Bipradas Piplai, 1495)*

## Chapter 2 : Location of the Study Area

2.1. Covering an area of **4094 sq.km**, North 24 District is one of the largest districts of West Bengal, bounded by Bangladesh in east, Hugli District in west, Nadia in north and Kolkata in south respectively. The District is divided into 5 Sub-Divisions – Barrackpore , Barasat , Bongaon , Bashirhat & Bidhannagar which is further subdivided into 22 Blocks namely – Amdanga, Bagda, Baduria, Barasat 1 & II, Barrackpore I & II, Bashirhat I &II , Bongaon , Deganga , Gaighata, Habra I & II , Haroa , Hasnabad ,Hingalganj ,Minakhan , Rajarhat , Sandeshkhali I & II and Swarupnagar.



2.2. Our Study area lies in Barrackpore Subdivision stretching 42 kms along the bank of River Hugli covering 13 Municipalities , 2 Blocks , 1 Cantontment area and 1 census town.

They are - 1.Kanchrapara 2.Halisahar 3.Naihati 4.Bhatpara 5.Garulia 6.North Barrackpore 7.Barrackpore

8.Titagarh 9.Khardah

10.Sodpur 11.Panihati

12. Kamarhati

13.Baranagar 14.

DumDum. The 2 Blocks

are – Barrackpore 1 &

Barrackpore II. The

Cantonment area is

Barrackpore and 1

Census Town –

Ichchapur Defense

Estate. We have also

included Kalyani ,a new

satellite township ,

developed taking land

from North 24 Parganas

and Nadia District. (in

order to include Jamuna

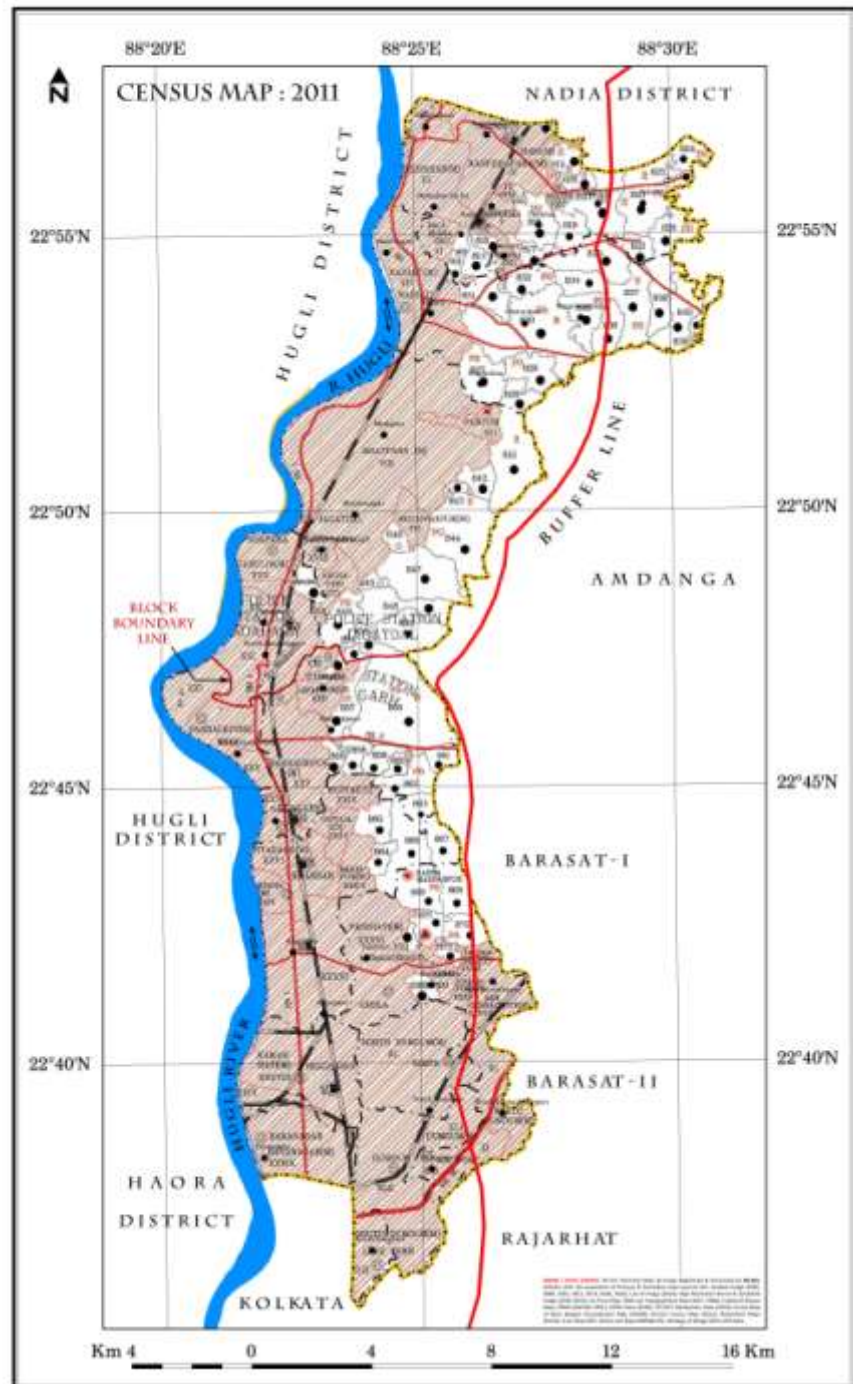
River Off Take point

,we have included a

small portion of Nadia

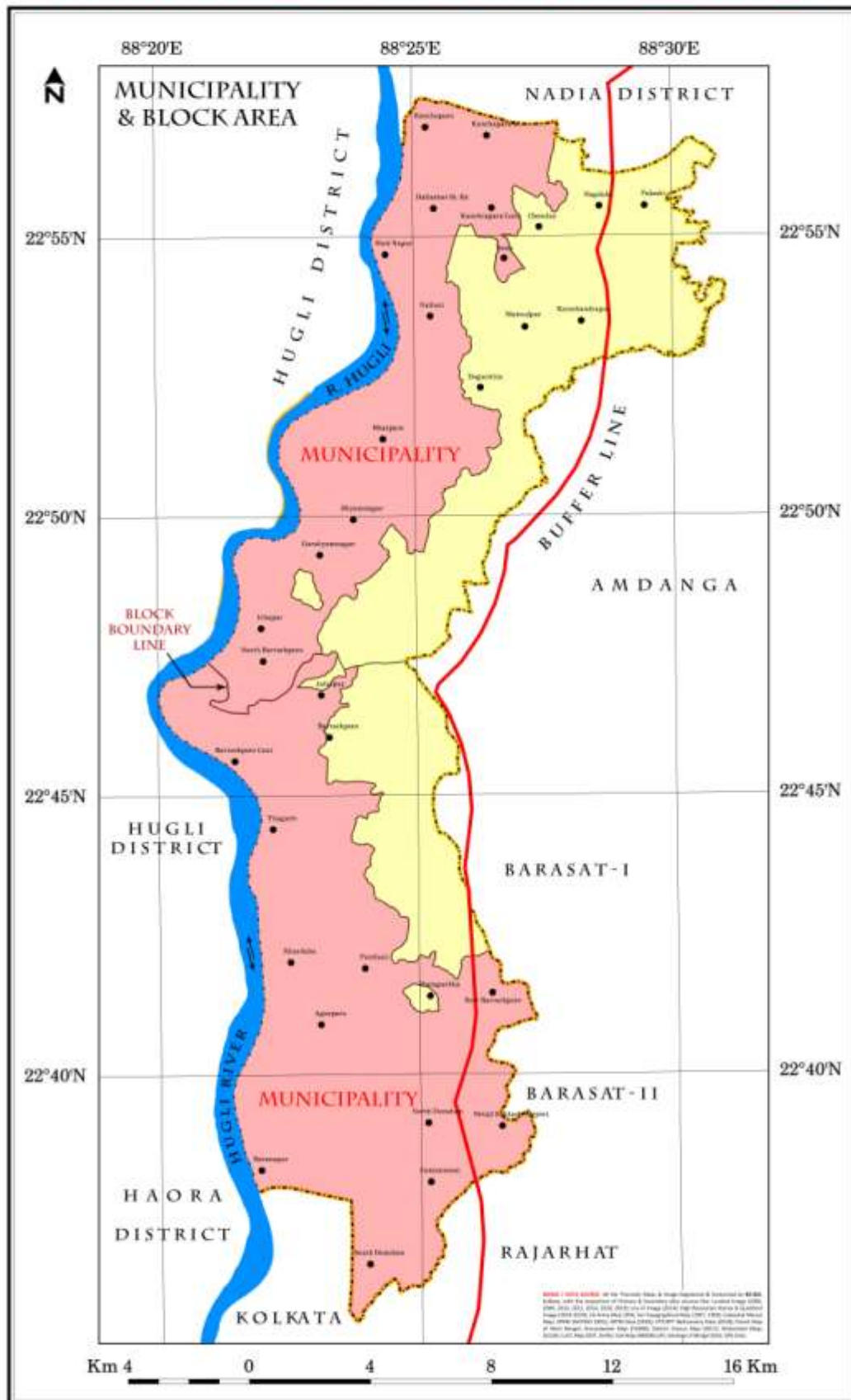
district)

**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)  
GANGA DODUMENTATION OF NATURAL RESOURCES**



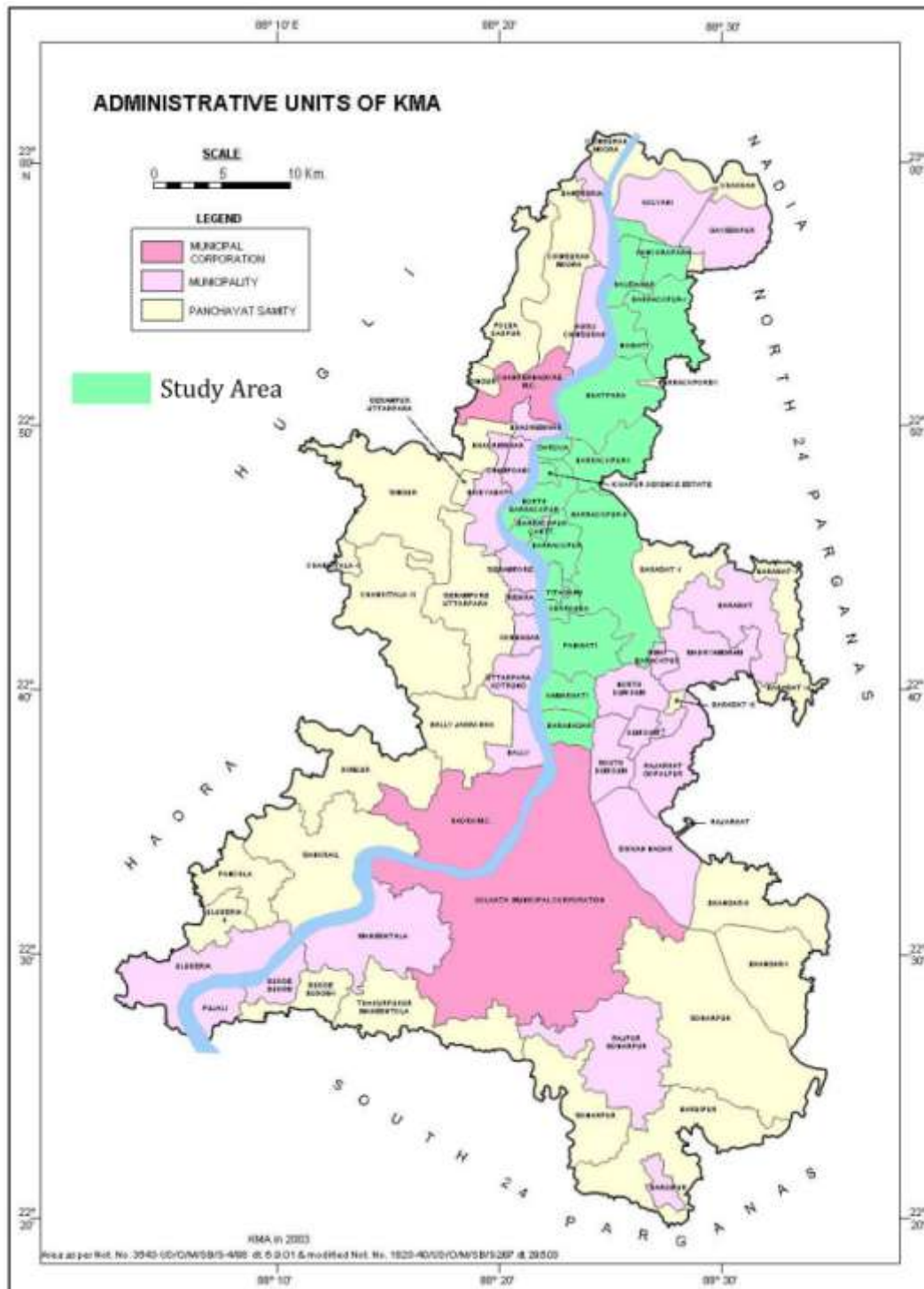
Map – 4 - Census Map showing the location of Study area

**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)  
GANGA DOCUMENTATION OF NATURAL RESOURCES**





2.3. Our Study area administratively also falls under –“The Kolkata Metropolitan Area” . It is a conurbation of cities, towns and adjoining rural areas spread over nearly 100 kilometers along both banks of the River Hugli in the southern part of the state of West Bengal, India. The Kolkata Metropolitan Area is the eighth largest urban agglomeration in the world and third largest in India, after Mumbai and Delhi (2011). Moreover, it is the largest and the only metropolitan area in eastern India.

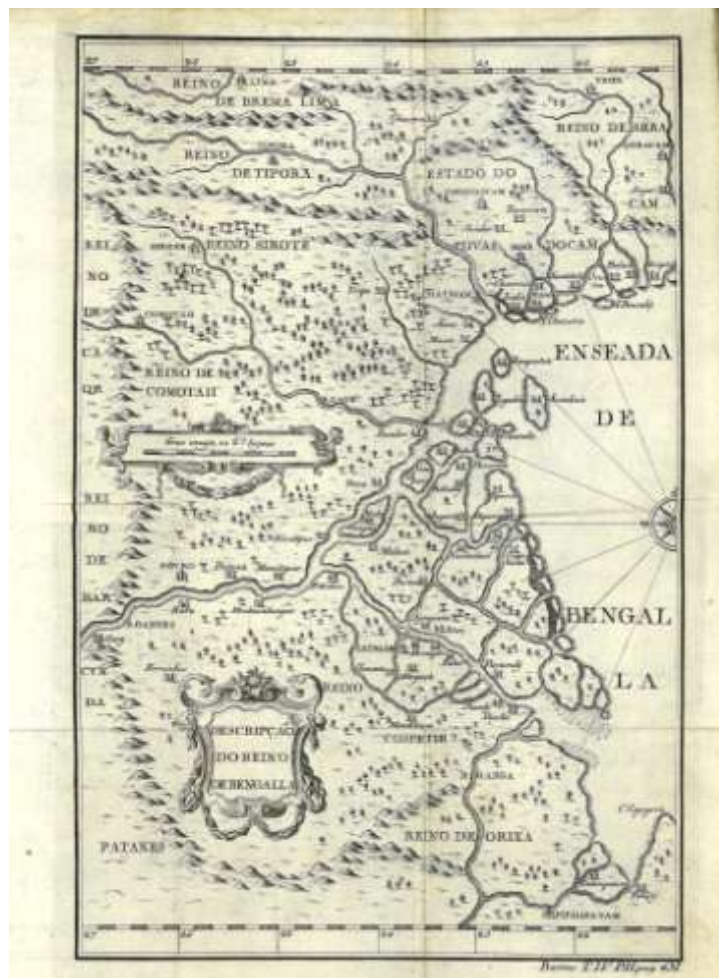


Map 6 : KMA Boundary showing our Study area

2.4. The undivided 24 Parganas was formed on the south-west of the river Hugli during the British Raj. The area belonged to the Presidency Division of Bengal, which was spread over about 4844 square miles. About 2941-square mile area belonged to the dense forests of Sundarbans, famous for its unique mangrove forests. The area was connected with Nadia and Jessore to the north and Khulna to the east. The Bay of Bengal lies to the south and the river Hugli flows down to the west.

2.5. Vijaygupta's **Padmapuran** written in 1495. Among the places mentioned in Vijaygupta's book from the river Ajay to the Bay are Nimai Tirtha (known as Manirampur now), Chanak (known as Barrackpore now), Kumarhatta, Bhatpara, Mulajore (now known as Shyamnagar), Sukhchar, Kamarhati, Ichhapur, Nawabganj or Bakibazar, Ariadaha, Deganga (known as Palta now).

2.6. In Bipradas Piplai's *Manasavijay*, the author mentioned many places along the banks of the Ganges while Chandsadagar was sailing his boat towards Singhal. Among them is Chanak village. The earliest map of Bengal Kingdom created by Joao de Barros in 1550 shows the location of Beranagar (Baranagar) and Agarpara along the bank of Hugli.



Map 7 : "Decadas da Asia" by Joao de Barros (1496-1570), is an epic historical account of the discoveries and conquests of the Portuguese in Asia, Africa and Brazil in the early 16th century. The 4th volume of this work, "Decadas Quarta da Asia", was published posthumously in 1615 with this map of the Kingdom of Bengal. The geographical information of this map dates from the period 1525-1535 CE. De Barros' work was continued by another historian Diogo do Couto, who actually lived in Portuguese India for a decade between 1559 and 1569.

2.7. Tribeni (Hugli District) located in the opposite bank of Kalyani Satellite Township ( N 24 Parganas and Nadia ) is believed to get its name from the divergence of three rivers, Yamuna, Ganga and Saraswati. The probable earlier names were "Muktaveni", which distinguished it from Prayag, Allahabad, known as Yuktaveni; it also featured in James Rennell's map of Bengal in 1781 where it was spelled as "Terbonee". The river Saraswati surfaces from the south of the famous Hindu cremate area, commonly known as 'Shashan ghat', westwards into Saptagram. The Yamuna, commonly pronounced as Jamuna in Bengali, had earlier branched off from the Ganges towards south east, but the confluence has silted up with course of time. This leaves the river Ganges, variedly known as Hugli or Bhagirathi to descend to the sea.



Hugli River Near Tribeni , with 2 major distributaries – River Jamuna &Saraswati





Plate 1 &2 – River Bhagirathi Hugli near Tribeni (Hugli District ) and Kalyani (N24 parganas&Nadia) ,  
22°59'27.19"N, 88°24'34.85"E

## Chapter -3 : Physical Environment

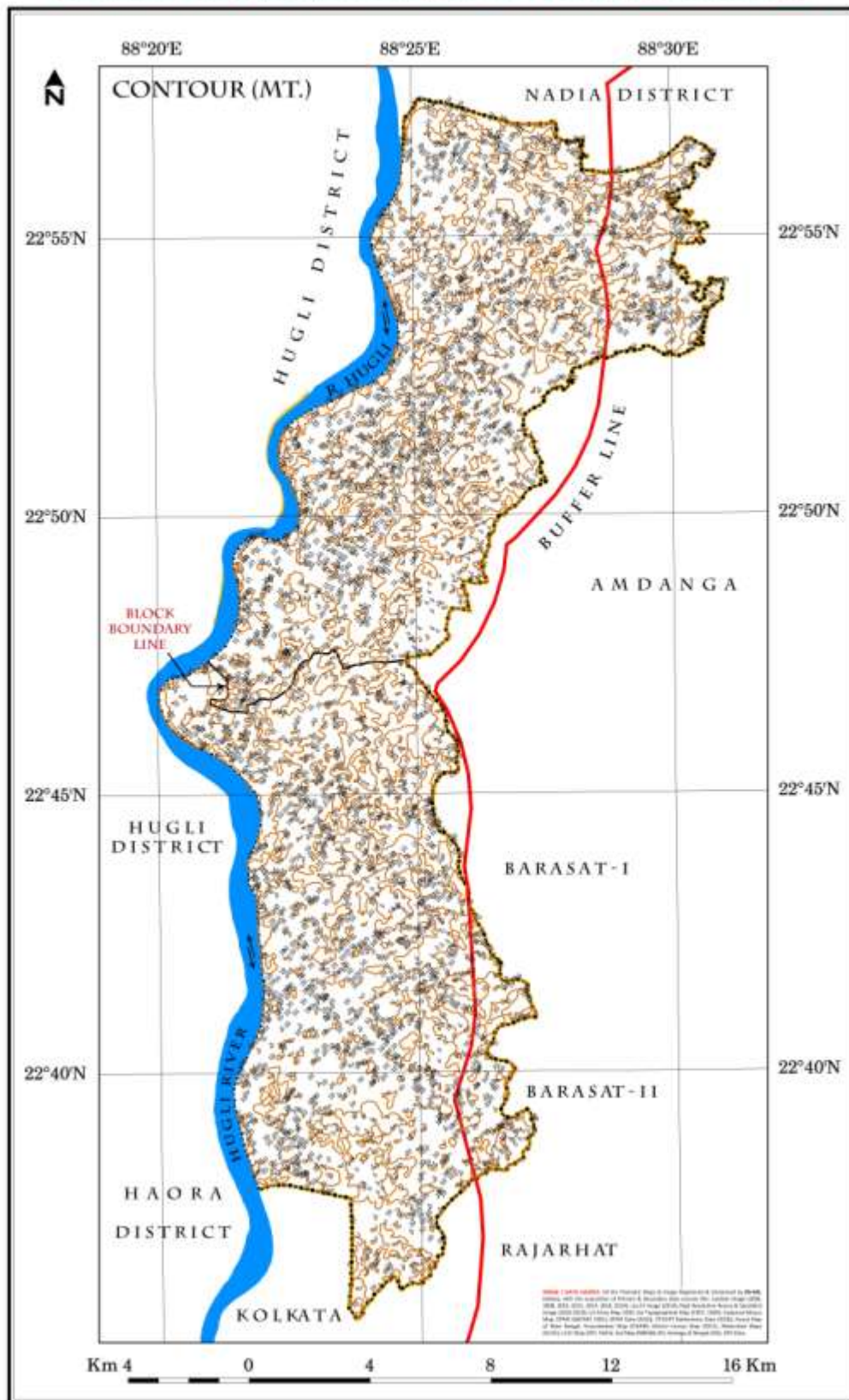
### 3.1.Relief & Physiography

The North 24 Parganas lies within the limits of the Ganga Delta and its physical features are those common to deltaic land. It is little raised above flood level and the highest ground is that bordering the river channels. While these are the general conditions, the district falls into two division with very different characteristics, viz. the northern inland tract, which is fairly well raised deltaic land of old formation, and the low lying Sundarbans toward the sea board on the south. The northern tract is a land of sluggish or stagnant rivers; the beds of which are out of reach of the scour of the tides and of inland depressions. The lowest part has shallow lakes of swamps which act as inland drainage basins, and the remaining portions are under agriculture (Nandi, 1993). The rivers having no off-take now from the main streams cannot bring down enough water and silt, even during flood. Being confined within high levees they are not in a position to inundate the entire area. As a result, land building has ceased and the delta has become *moribund* here. The high ground, along the natural levee of the Hugli River is also very densely settled (Bagchi, 1944). The Hugli marginal plain slopes more steeply than the interior plains, and hence is better drained. It is interesting to note that, instead of nearby Hugli River to the west, the far away Mathura *Beel*, Birati *Beel* and other smaller marshes to the east receive the drainage outfall of the congested Hugli industrial belt (Mitra, 2013).



Plate3 - Adjoining Panihati Giribala Temple , River Bhagirathi Hugli,  
22°43'9.82"N 88°21'50.37"E

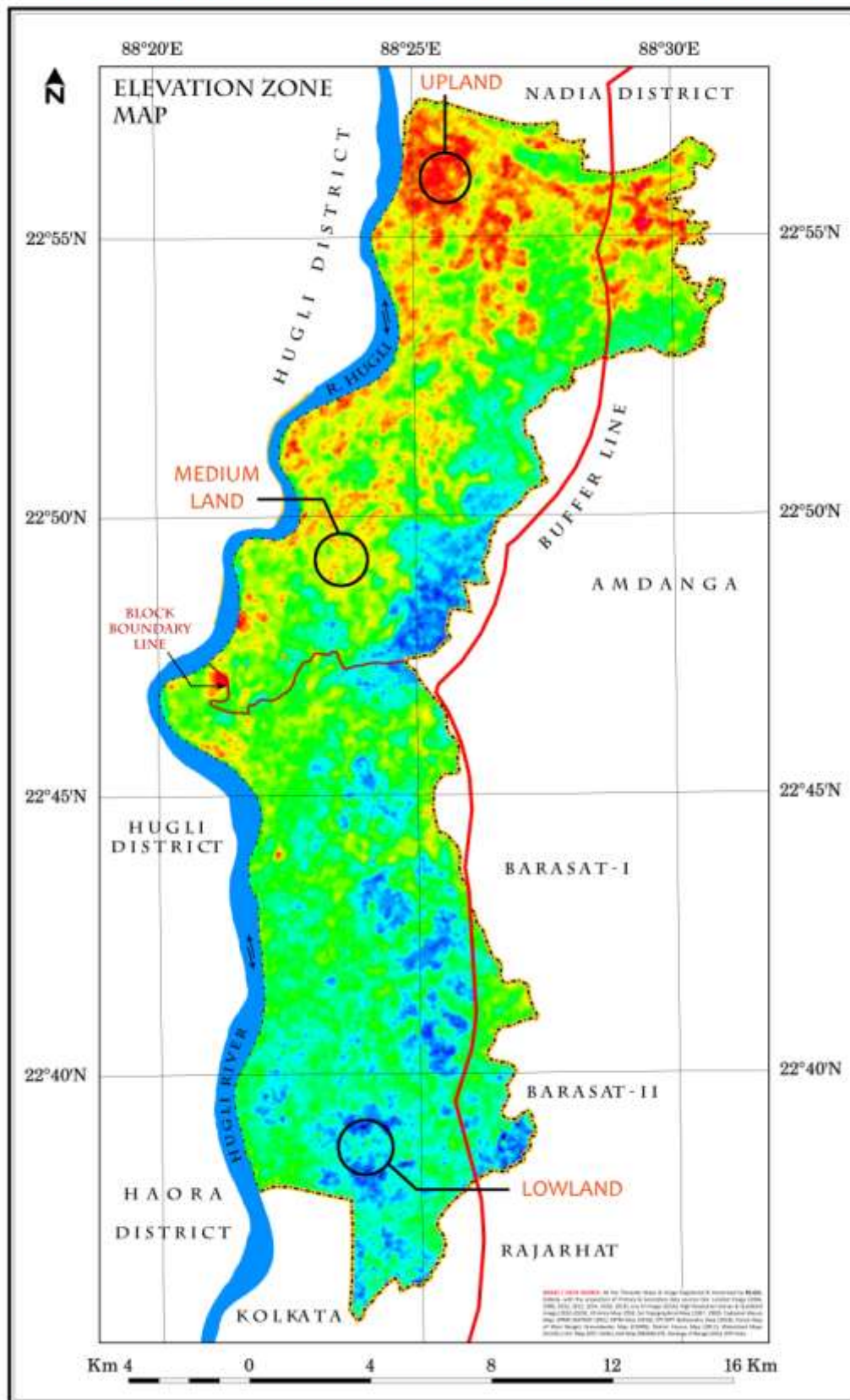
**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DODUMENTATION OF NATURAL RESOURCES**



Map 8 – Contour Map , Study area



**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DOCUMENTATION OF NATURAL RESOURCES**



Map 9 - DEM , Study area showing the relief condition



**3.2. Geology** - The Study Area is located in the lower deltaic plain on the composite Ganga Delta and is covered by the Quaternary sediments deposited by the Ganga and its tributaries. The top of the alluvium is clayey in nature with varying thickness of 15 to 75 metres. Fine sand and silty-clay capping also occurs in small patches in the alluvium (Pandey, 2010). Underlying the clay blankets occur a huge thickness of unconsolidated sediments composed of silt, fine to coarse grained sand and gravel with increasing thickness towards east-southeast. The gravel zone may be considered as a marker horizon which is underlain by another extensive clay zone at varying depths. Beneath this clay zone, occurs a second group of aquifers in the depth range of 160 to 360 metres with considerable aerial extent. These geological horizons are sloping gently towards south-southeast (Bell, 2007). The bedding of the post-Pliocene, i.e., Pleistocene, Recent and sub-Recent are the thickest of all formations. An examination of borehole logs reveal a succession of coarse to fine grained sand, sand mixed with clay, clay mixed with sand and kankar, and clay within a depth of 450 m below land surface (Niyogi, 1970).

Around Kolkata, a succession of sand and gravel zones occur inter-bedded with attenuated clay lenses. The deposition of these alluvial sediments commenced after the final upheaval of the Himalayas and continued all throughout the Pleistocene time into the Recent. These alluvial deposits have been classified into two groups: an Older and a Newer Alluvium.

A zone of unconformity separates the Tertiary and other older rocks from the Older and Newer Alluvium. The Recent to Sub- Recent Newer Alluvium is mostly confined to the banks and beds of the present day river channels. They consist of typically dark and loosely compact sediments having high water content and a good amount of organic matter (Pandey, 2010). The boundary between the new flood -plain alluvium and sediments of deltaic origin has not yet been precisely demarcated.

**3.3. Soil** - Soil status varies from alluvial to clay loam. Alfisols comprising loam and siltloam are found in the western and south eastern part of this sub-division. There are four types of soil categories in Barrackpore Sub-division, as follows: **Type- 1:** Very deep and fine loamy soils are found in the north eastern and south eastern parts i.e. Majhipara-Palashi, Jetia and Sibdashpur gram panchayet in Barrackpore Block-I and North Barrackpore municipality of this Sub-division. The soil is imperfectly drained.

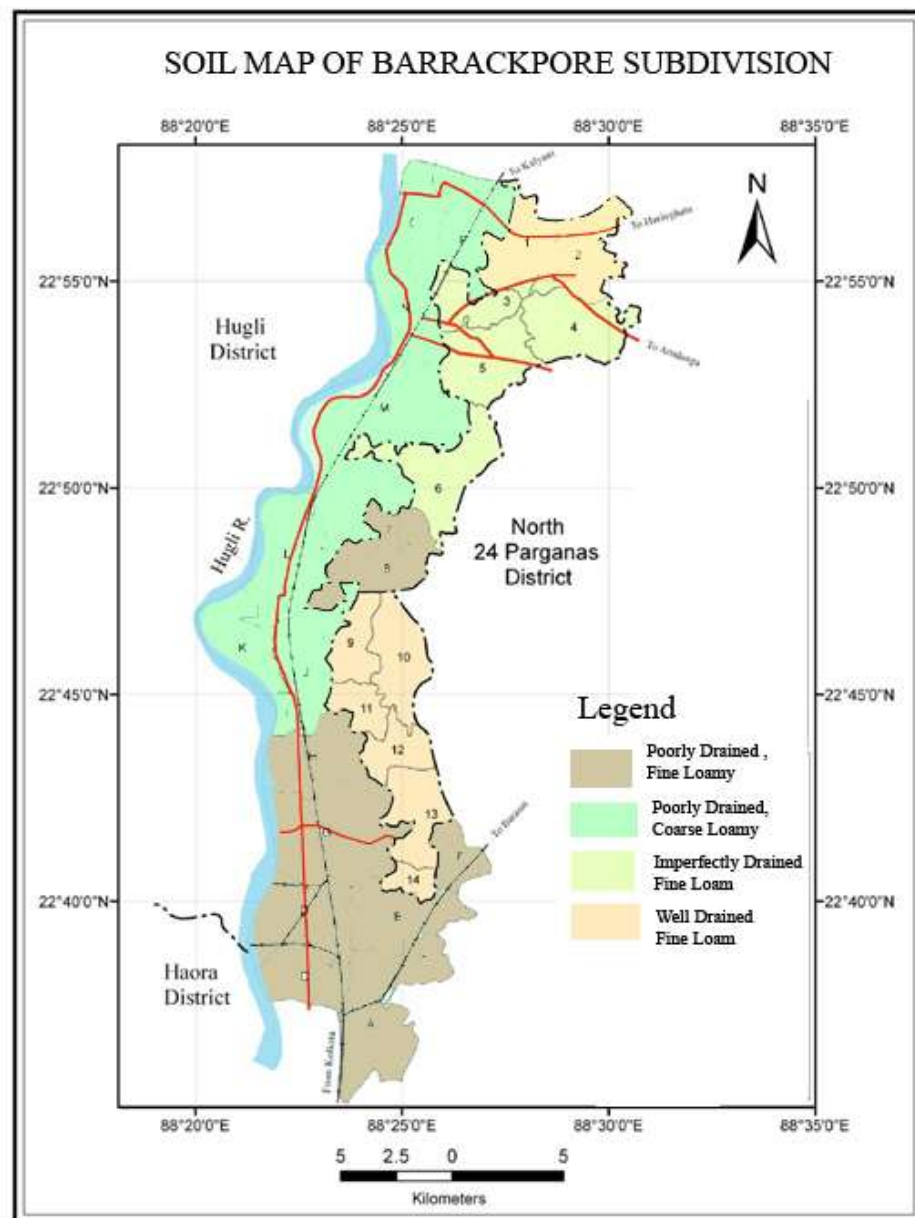
**Type-2:** This type of soil is found in the western and middle part i.e. North Barrackpore, Barrackpore, Garulia, Bhatpara, Naihati, Halisahar and Kanchrapara municipality of the Sub-

division the soil is moderately well to poorly drained, and coarse loamy to fine loamy in nature.

**Type-3:** It is observed in the northern most part of Barrackpore CD Block –I in Kampachakla, Majhipara-Palishi gram panchayet and it is moderately well drained and fine loamy in nature.

**Type-4:** It is seen in the southern and eastern part of this Sub-division ie. In South Dum Dum, Dum Dum, Baranagar, Kamarhati, North Dum Dum, New Barrackpore, Panihati, Khardah Titagarh municipality and Kowgachi-I, Kowgach-II mouzas in Block-I and

Map 7 – Soil Map of the Study area



Map 10: Soil Map

Mohanpur, Sewli, Patulia, Bandipur, Bilkinda-I and Bilkinda-II in Block-II; and it is poorly drained and fine loamy in nature.

The Indian Institute of Soil Science (IISC), Bhopal measures the various values of inorganic materials in soil. In Barrackpore Sub-division the pH values in soil varies between 6.5-7 (natural) and greater than 7 (alkaline). The electrical conductivity (Ds/m) in soil is less than 1.0 (normal). The organic carbon (in %) in soil varies between 0.50 to 0.75. The nitrogen (kg/ha) in soil is 280 (medium). The potassium (kg/ha) varies between 120 to 280 (medium). Phosphorus (kg/ha) in soil is less than 26 (high). The sulphur (mg/kg) varies between less than 10 (deficient) to greater than 10 (sufficient). The iron (mg/kg) is greater than 27 (high) in the whole Sub-division.

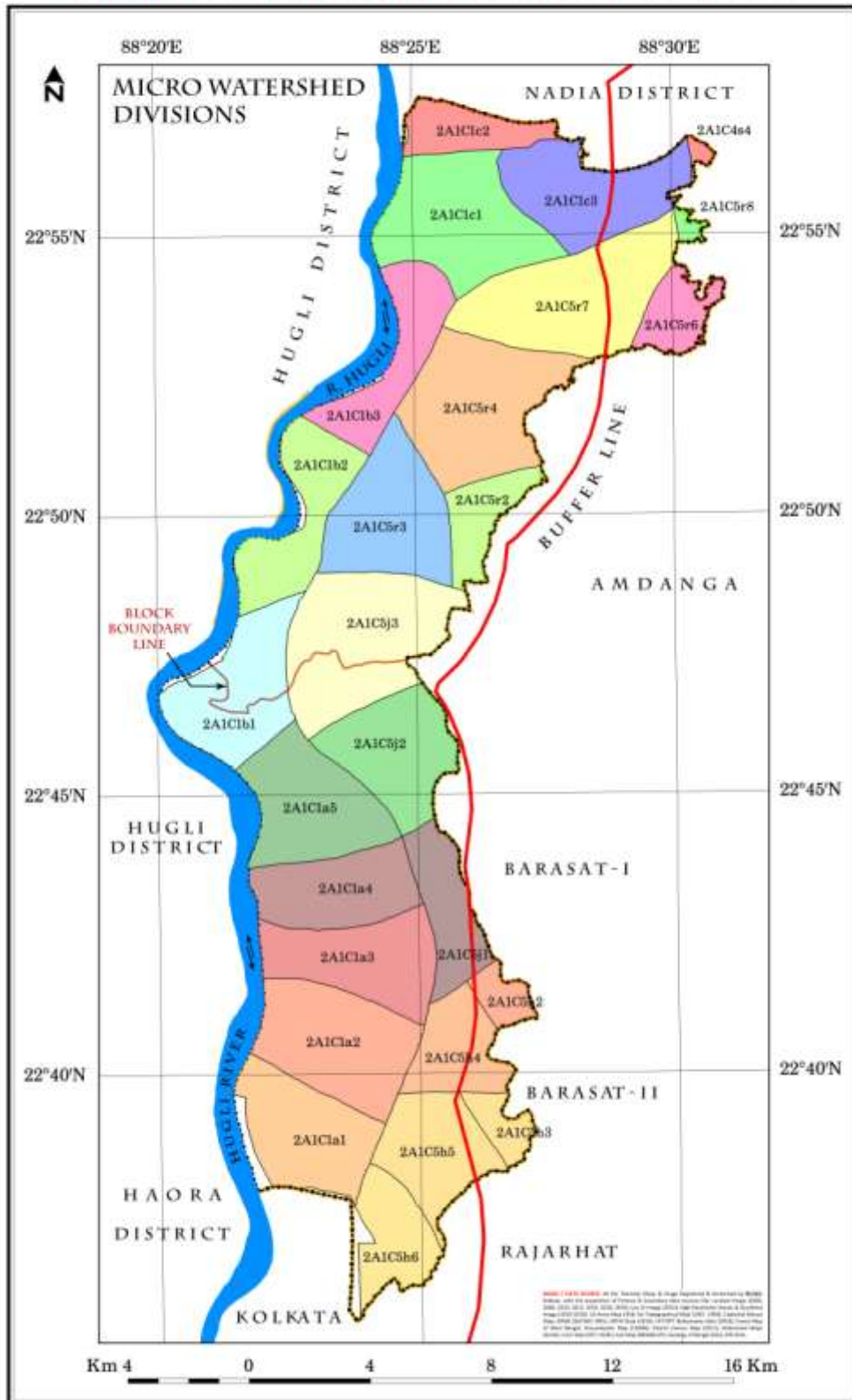
**3.4. Drainage Network** - The Bhagirathi flows for a stretch of about 600 km through the districts of Murshidabad, Nadia, Hugli, North 24 Parganas, Haora, Kolkata and South 24 Parganas before it empties into Bay of Bengal. At Nabadwip (23023'N, 88024'E in Nadia district), the **Jalangi** meets the **Bhagirathi**. The combined flow takes the name Hooghly and flow in a southerly direction to meet the Bay of Bengal. At Tribeni, the river diverge into 3 Rivers – Hugli, Jamuna and Saraswati . The 280 km stretch of the river below Nabadwip is tidal. Particularly this lower stretch is called as **Hugli River**. The Bhagirathi – Hooghly basin has a catchment area of **55617 km<sup>2</sup>**. According to SLUSI our Study area lies under Ganga Drainage System , the Watershed Codes are 2A1C5 Watershed and parts of 2A1C1Watershed.



Plate 4 – Bhagirathi Hugli near Khardah Ferry Ghat River 22°43'21.07"N , 88°21'45.05"E



**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DOCUMENTATION OF NATURAL RESOURCES**



Map 11 – Micro Watershed Map of the Study area



### 3.4.A. Morphological characteristics of the river in the study area -

This zone of the delta has not as yet reached the hydrological moribund condition. Such zones are developed due to the process of tidal action, huge siltation which results in decay of the river channel. As a result, not only the northern tidal limit is slowly receding towards the south, but the channels also are at places becoming choked with shoals and shoals and island (Mukherjee, 1996). The degeneration of many channels like the Bhagirathi Hugli in this part can be owed to intense anthropogenic activities and change in landuse pattern. The channels on both the banks are jacketed by continuous embankments and concrete ghats resulting in the gradual elevation of thalweg due to prolonged sediment accretion.

Previous works of Basu (1972, 1981) also clarifies various reasons behind decay of Bhagirathi in the post Farakka Period . With the diminution of the period and intensity of the supply of water from the parent river, the tidal forces had gained ground and the accumulation of silt in the tidal zones of the Hughli started to increase. Moreover during the freshet season the net drift of sediment, carried by the ebb current, is seawards, while during the rest of the year, due to much stronger flood currents, landward redistribution of sediments took place. This clarifies the background of the active sedimentation process in the studied reach.

However, for better understanding of the depth, accretion dynamics, bottom topography and change in thalweg, the bathymetric survey was conducted in 2 Zones within our Study area by us with the help of Echo sounder Garmin GPSMAP 585 PLUS. The sounding data derived from the Bathymetric survey has been incorporated in Geospatial environment and the data has been analyzed and compared with unpublished hydrographic charts of 2005, 2012 and 2018 surveyed by Kolkata Port Trust for the same purpose.

#### Case Study-1

**1. Garulia Municipality - Babughat** , Garulia Main Road on Hooghly River starting from Debitala Ferry Ghat (22.815034°N, 88.359371°E) upto Antpur Ferry Ghat covering Mullajore Ghat (22.829664°N, 88.377840°E) The area falls under mostly **Garulia Municipality**. The nearest railway station is **Shyam Nagar** which is within the city. Garulia is bounded by Bhatpara on the north, Garshyamnagar and Noapara on the east, North Barrackpur on the south and the Hooghly on the west.

**2. Barrackpur(N) and Titagarh Municipality (Part) – Du Paishar Ghat** , near S. N Bannerjee Road on Hooghly River starting from Du Paishar Ghat (22°46'40.29"N/ 88°20'0.88"E) upto Peer Ghat ( Titagarh )covering Mangal Pandey Ghat (22°45'37.80"N/ 88°21'10.60"E ) Gandhi Ghat (22°45'9.95"N/ 88°21'43.92"E) , Annapurna Ghat(22°44'56.63"N, 88°21'53.55"E) , Barrackpur Ferry Ghat (22°45'52.66"N, 88°20'41.00"E) The area falls under mostly **North Barrackpore Municipality**. The nearest railway station is **Barrackpore** which is within the city. Garulia is bounded by Bhatpara on the north, Garshyamnagar and Noapara on the east, North Barrackpur on the south and the Hooghly on the west.

*i. Detail Mapping Methodology under Remote Sensing & GIS Platform:*

Reconnaissance: As every project require a start-up plan to complete it effectively and economically, reconnaissance has to be undergone. A complete reconnaissance of whole survey area to choose the best possible site was undertaken. This would facilitate satisfactory completion of the survey in accordance with the requirements and specifications governing such work.

In line with the working plan the following Methodology is adopted for the Bed Level Survey and the preparation of Thematic Maps under Remote Sensing & GIS environment:

**A. Collection of source / Base maps / information:**

1. **Police Station Map** containing Block / Police Station & Mouza boundaries with JL. Numbers from DLLRO/BLLRO, GoWB.
2. **CD Block map** from Census of India (2011) containing Block / Police Station & Mouza boundaries with Census Code.
3. **Topographical Map** consulted from Survey of India (SoI).
4. Acquisition of **SRTM** (Shuttle Radar Topographic Mission, 2014) data from USGS.
5. Acquisition of **High Resolution Ikonos Image** (2016 - 2018) from USGS & NRSC.
6. Acquisition **Landsat Image** (2016 – 2018; MSS & PAN) from USGS.
7. Field Survey by using GPS, Auto Level and Echo Sounder instruments.

**B. Remote Sensing, GIS & GPS Softwares used:**

1. **ArcGis:** Version 10.2 for Mapping under GIS environment.
2. **Geomatica 2012:** Version 10.0.for Mapping under Remote Sensing environment.
3. **Erdas Imagine:** Version 9.2 for Mapping under Remote Sensing environment.
4. **Map Source:** Version 6.0.for Mapping with GPS Data.
5. **Google Earth Pro:** for GPS data monitoring & verification on High Resolution Ikonos Image.

**C. Projection system & Datum:**

1. All secondary image sources are **Geo-rectified / Georeferenced / Geo-coded** under **UTM Projection system** with **WGS 84 Datum** (i.e. UTM, Zone 45, Row Q, E012).
2. **Reprojection** has done with Survey of India (SoI) **Topographical Map** (Polyconic, Everest ellipsoid), **Police Station Map** (following SoI Topographical Map Coordinates), **SRTM data, Landsat Image & High Resolution Ikonos Image**.
3. The **GPS device** is configured under WGS 84 Datum during field data collection.

**A. Garulia Municipality** - We have surveyed **1.07sq km** area of the River and a stretch of **4.07 km** in length in its left bank, based on the predicted location point of the Intake Point starting from Debitala Ferryghat area to Mulajore Shyamnagar Ferry Ghat area.

**Depth Map** : Satellite Imageries were studied along with the **SRTM Data** to get the exact location of the area. The method started by locating **special horizontal control points along the bank line**.

**Locate Horizontal Control:** The horizontal control is necessary to locate all features of the land and marine in true relative positions. Hence a series of lines whose lengths and azimuths are determined by using Auto level in the adjoining bank line. The depth taken is analogous to the levelling.

With the help of the Echo Sounder we have generated about **1066 depth points** . We used Remote Sensing GIS platform to process the data and finally created a Depth Map ( Bathymetry Map )using colour coding. We have then draped the depth map on the High Resolution Satellite Image to give the exact feel and location of the Study area.

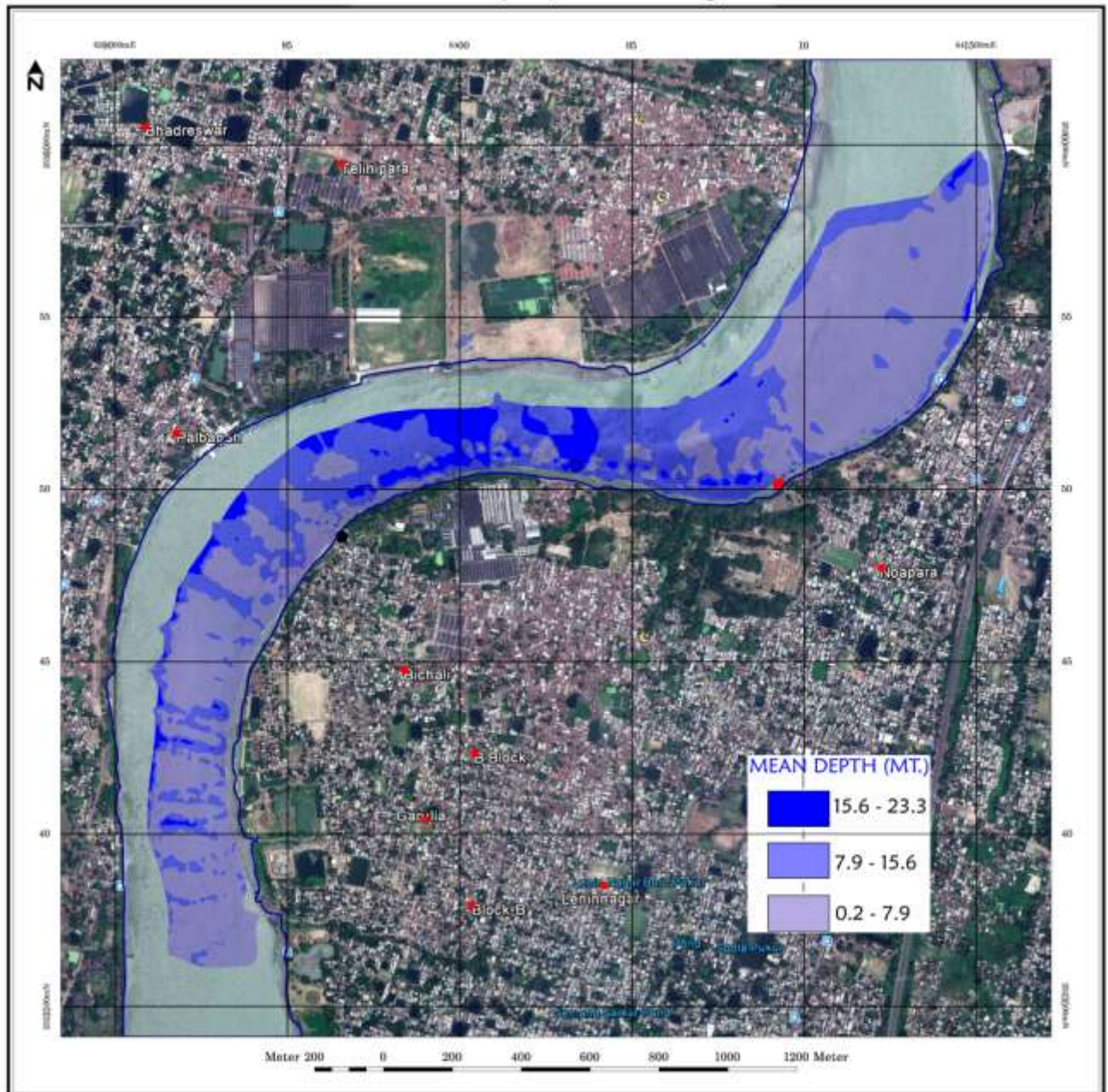
As the study reveals the in this meandering stretch of river the width varied from 0.44m to about 0.69 m with average depth varying from .2 m to 23.3 m. The northern and southern part of the river is comparatively shallower than the middle part . The **deepest stretch** lies in the of zone of 15.6-23.3 m lies little north of the old Jute mill about 1.5 km from the **Babughat Ferry Ghat**.



Map 12: High Resolution Image showing the case study area ( Bathymetry Zone 1)

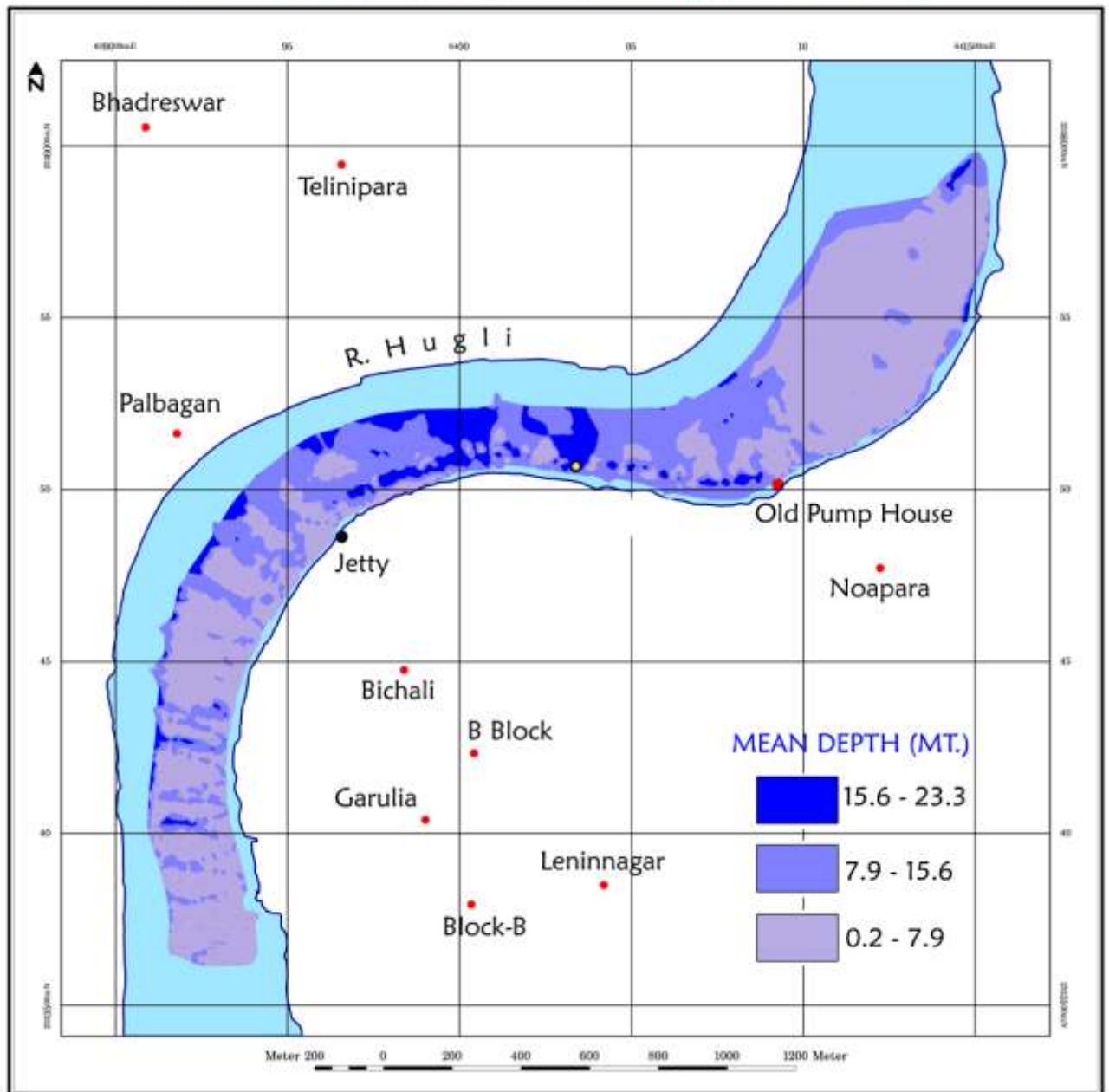


**High Resolution satellite image**  
**showing the Surveyed portion on river Hugli using Echo-sounder with varying depth (mt)**  
**Garulia Municipality, North 24 Parganas**

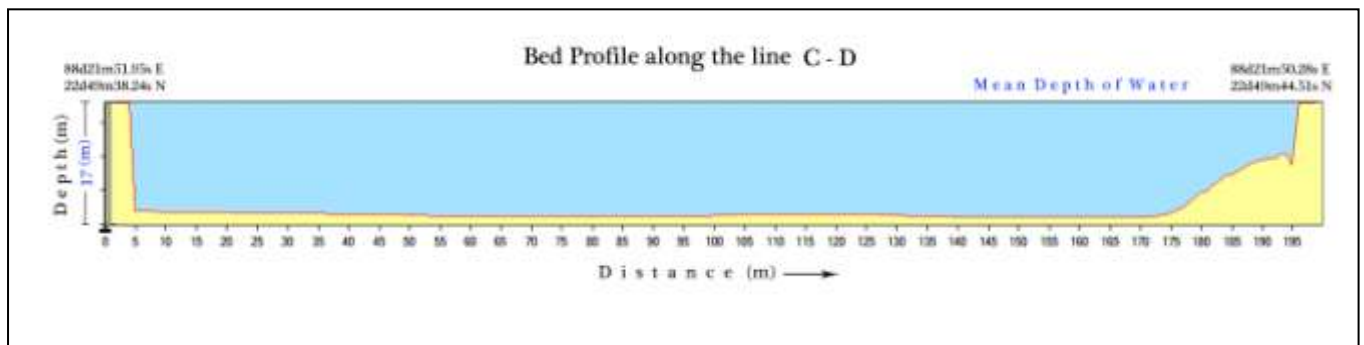
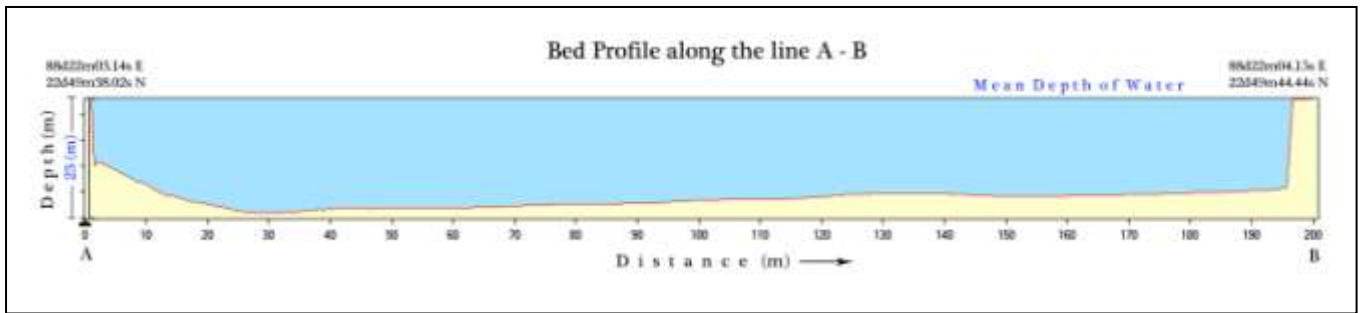


**Map 13:** Colour Code used to signify the different levels of the river depth and is draped on High Resolution Image. The depth of the surveyed area varied between 0.2 m to 23.3 m following the Mean Water level

Surveyed area with Echo-sounder showing Mean depth of water



Map 14 : Colour Code used to signify the different levels of the river depth. The depth of the surveyed area varied between 0.2 ft – 23.3 ft following the Mean water level



Map 15– Showing the Profile location.



***Bottom Configuration:***

Since the study area is located in the lower stretch of Hooghly River it is characterised by comparatively flat bottom with shallow depth ranging from 2 m to 23.3 m and a width of about 500 m and number of mid channel bars which attains almost 2m of average height. Tidal influence could be observed in this location with a fluctuation of 1.35 meter.

***Data analysis:***

About **1066 Ground Control Points** and **Depth data** were collected from an approximate area of **1.07sq km** with the help of Global Positioning System (WGS 84 Co-ordinate system and UTM Projection) and **Echo Sounder** (Garmin Echo 150). Since the river is in lower stretches, the river has a tidal nature where there is a daily fluctuation of water level following the High Tide and Low Tide. The Bench mark was set at **6 m /19.6 ft** at 22d33m25.4s and 88d20m0.08s. The Highest High Water Level was **3.32 m / 10.89m** from BM and the Lowest Low Water Level was recorded at about **1.97 m. /6.46 ft**. The Tidal

Fluctuation was observed as **1.35m /4.42 ft**. **The Mean Water Level is 2.64/ 3.38 ft from Mean Sea Level. (MSL)**.

*It is a norm that as the region is situated in the Tropical Belt, that there is a simultaneous High Tide and Low Tide occurring 4 times within a time frame of 24 hrs 52 minutes, each effecting about 6 hrs 13 minutes.*



Plate 5a: Babu Ghat , Garulia , 5b. Bench Mark was set at Babu ghat Ferry Ghat 5c. GPS and Echo Sounder is synchronised 5d. Bathymetric Survey Done through boat



Plate 6– Embankment Breaching because of unscientific River Training Work near Shyamnagar .



Plate 7- Bank Protection Work , Garulia



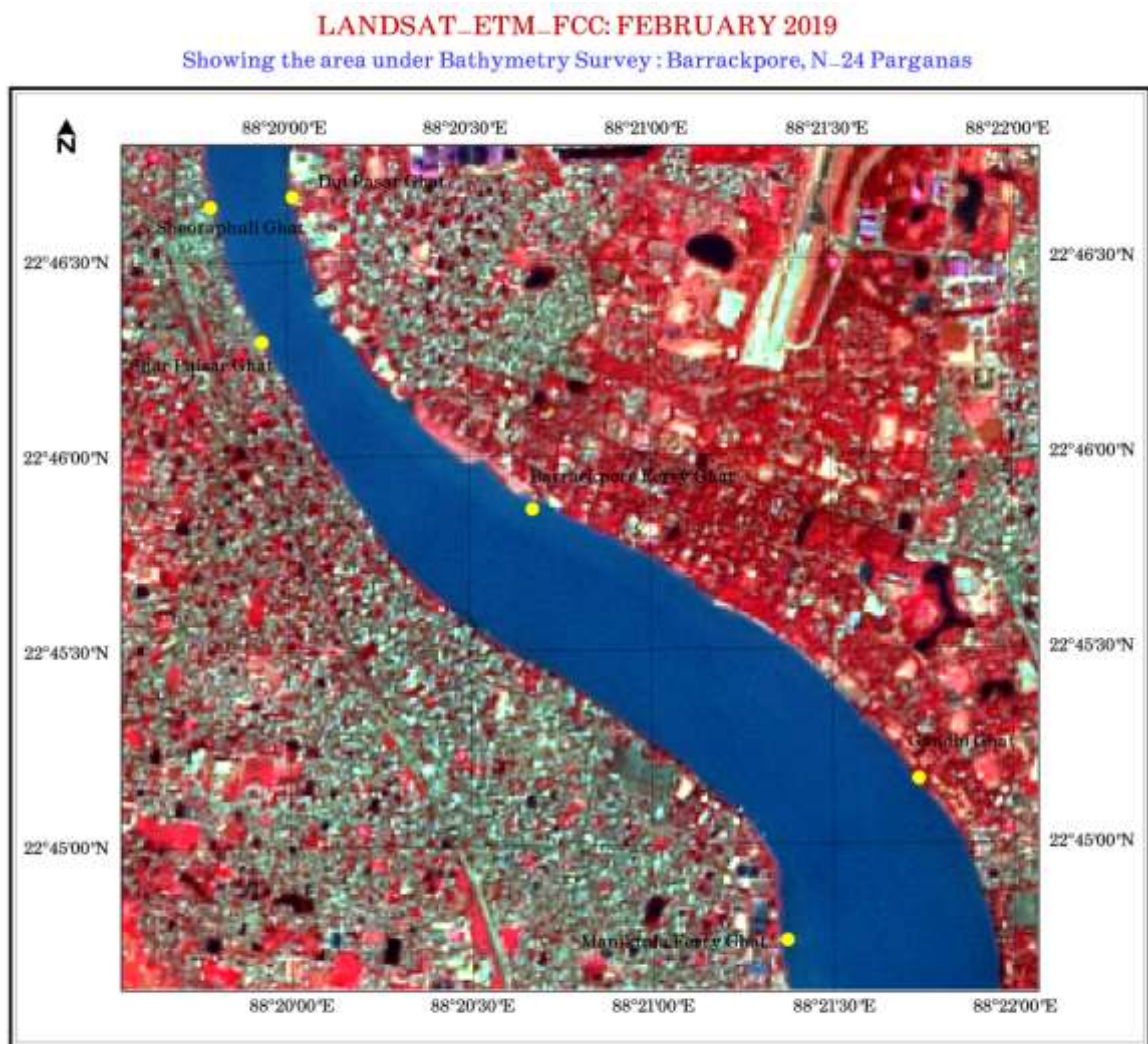
**2. Barrackpur(N) and Titagarh Municipality (Part) – Du Paishar Ghat** , near S. N Bannerjee Road on Hooghly River starting from Du Paishar Ghat (22°46'40.29"N/ 88°20'0.88"E) upto Peer Ghat ( Titagarh )covering Mangal Pandey Ghat (22°45'37.80"N/ 88°21'10.60"E ) Gandhi Ghat (22°45'9.95"N/ 88°21'43.92"E) , Annapurna Ghat(22°44'56.63"N, 88°21'53.55"E) , Barrackpur Ferry Ghat (22°45'52.66"N, 88°20'41.00"E) The area falls under mostly **North Barrackpore Municipality**. The nearest railway station is **Barrackpore** which is within the city. Garulia is bounded by Bhatpara on the north, Garshyamnagar and Noapara on the east, North Barrackpur on the south and the Hooghly on the west.

**Depth Map :** Satellite Imageries were studied along with the **SRTM Data** to get the exact location of the area. The method started by locating **special horizontal control points along the bank line**.

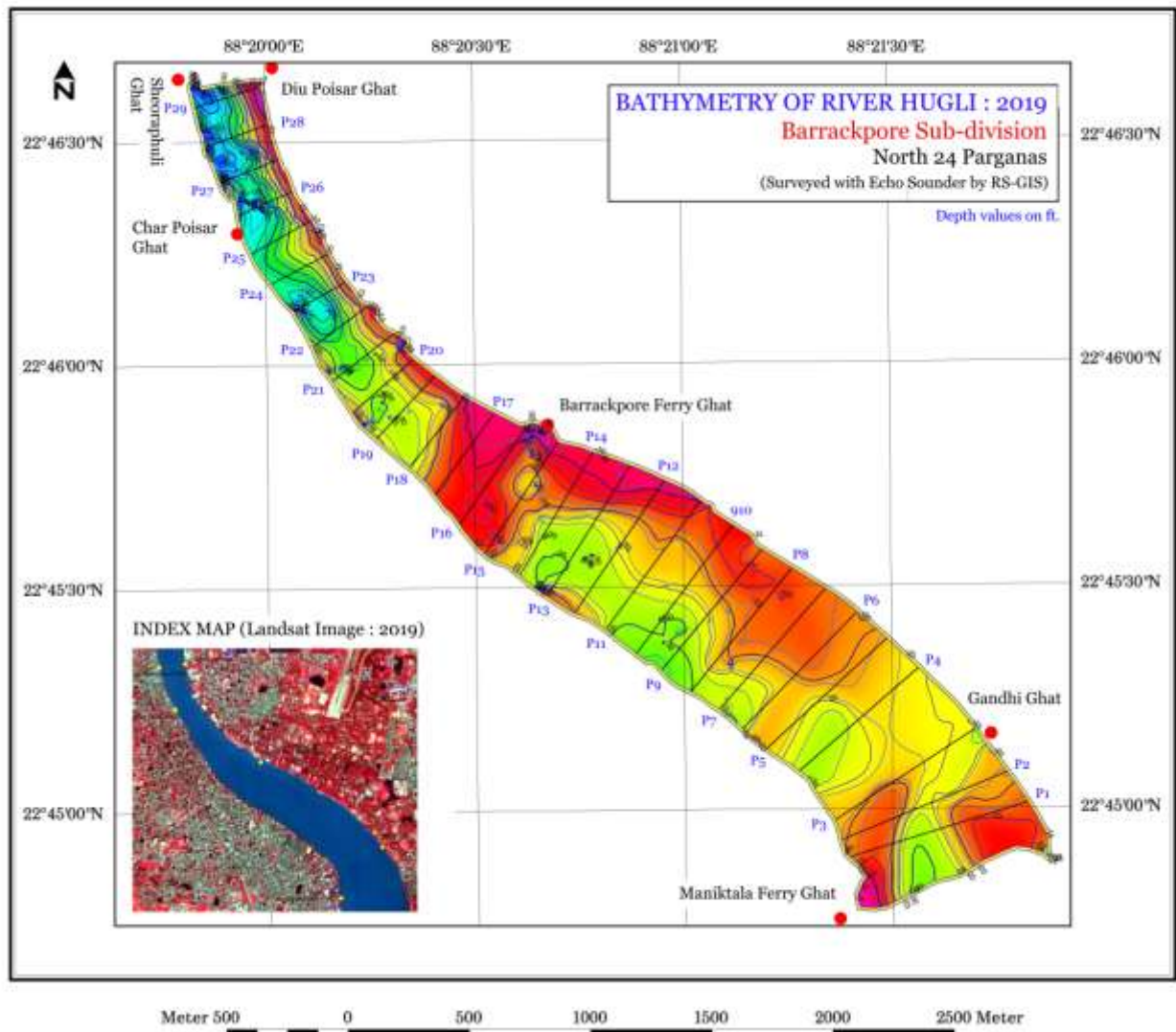
**Locate Horizontal Control:** The horizontal control is necessary to locate all features of the land and marine in true relative positions. Hence a series of lines whose lengths and azimuths are determined by using Auto level in the adjoining bank line. The depth taken is analogous to the levelling. We created the base station in Barrackpore Ferry Ghat.

With the help of the Echo Sounder we have generated about **2270 depth points** of an area of 2.9sq.km. The Perimeter covered – 10741.5 m . We used Remote Sensing GIS platform to process the data and finally created a Depth Map ( Bathymetry Map )using colour coding. We have then draped the depth map on the High Resolution Satellite Image to give the exact feel and location of the Study area. We have generated 41 profiles along this stretch.

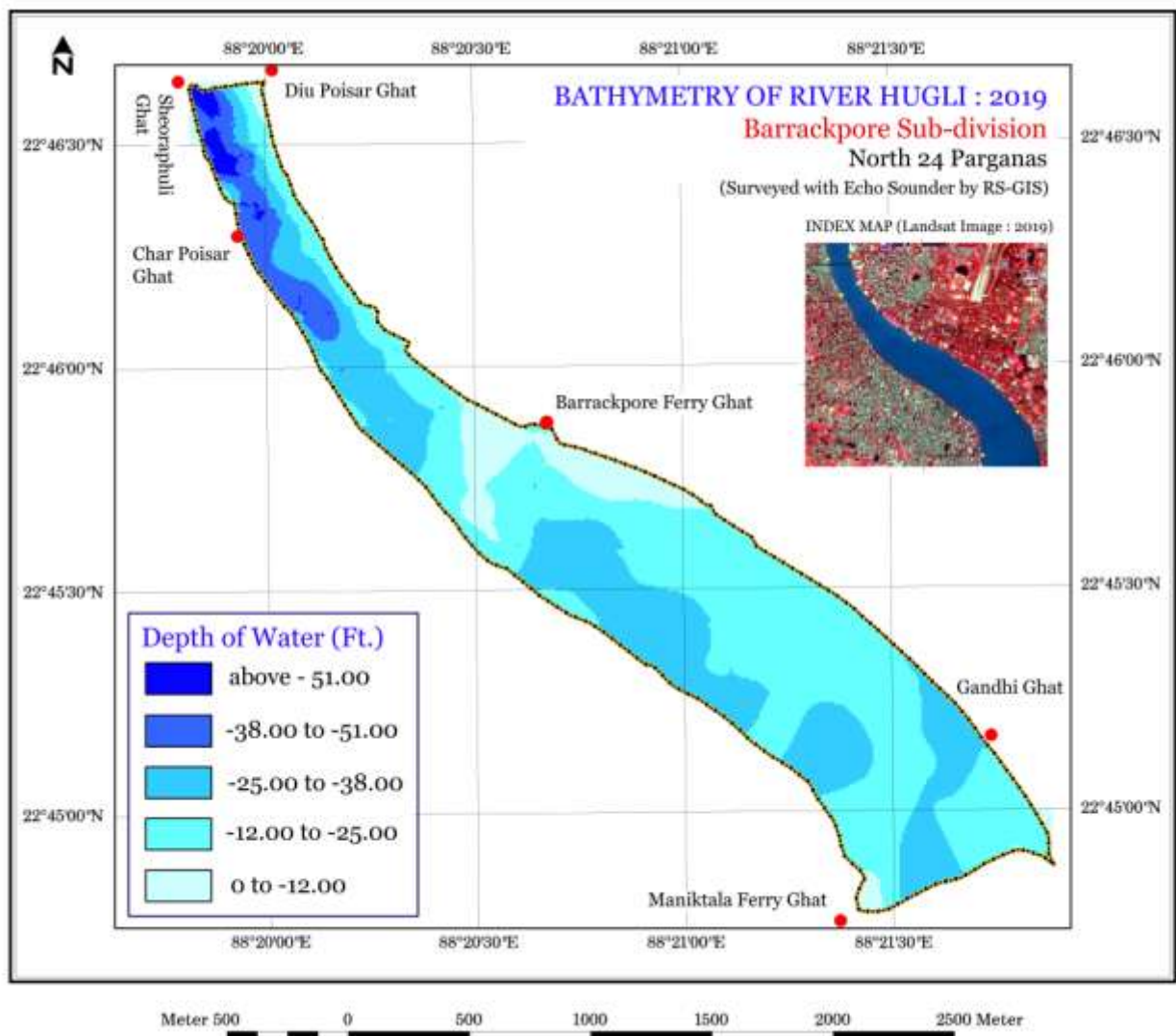
As the study reveals the in this stretch of river the width varied from 0.36m to about 784.07 m with average depth varying from 0.18 m to 18 m. The **deepest stretch** lies in the of northern part towards western bank ( Serampore side ) . The entire eastern bank is shallow and the lowest depth is recorded near Barrackpore Ferry Ghat.



**Bathymetry of River Bhagirathi through Echo-sounder Survey**



Map 17: Depth map showing the Bed Profile of the Surveyed area.



Map 18- Colour coding done to show the variation in depth of the River

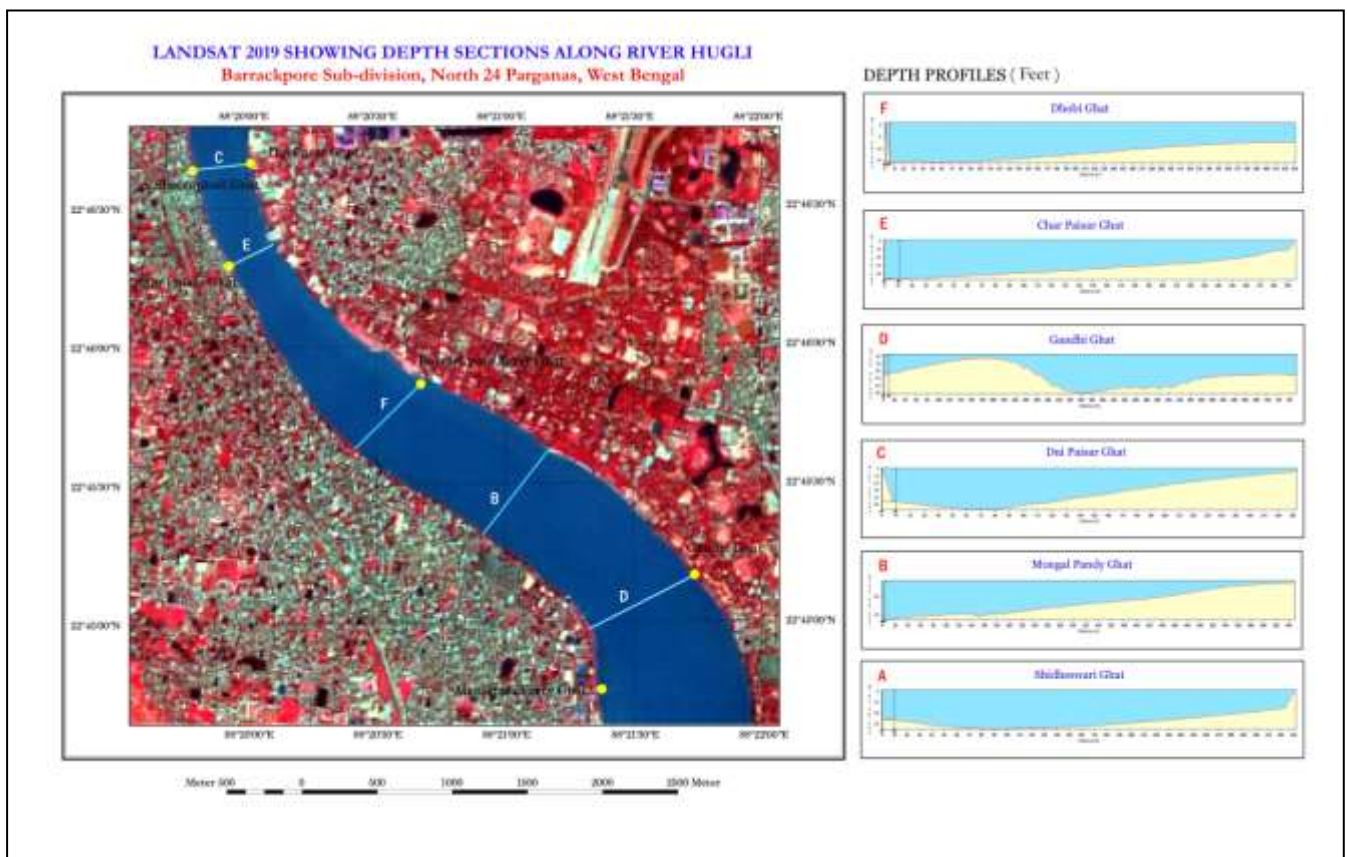


***Important Observation- Determination of Bottom Topography and Morphological Characteristics of Channel Bed***

Based on the Bathymetric Data , depth has been classified into five depth zones ranging from very deep(>12.8m) to very shallow(<1.4m) and Isobath lines of 2m and 5m interval have been generated with the help of Geomatica V.12 . Pseudo image of 2018 has also been generated for the purpose of depth classification , here also 5 classes are extracted varying from very deep to very shallow, which indicates a gradual elevation of thalweg in the lower reach of the study area implying a reduction in depth. Due to increased sedimentation along the left bank of the river, development of point bar can be observed along *Gola Ghat* and *Dhobi Ghat* shows the morphological characteristics of channel bed across 12 cross profiles . The depositional zone in most of the ghats can be observed along the western bank of the river. Asymmetrical profile can be observed due to scouring action along the right bank and deposition along the left bank. As water flows around the meander bend, the water tends to ‘pile up’ against the outer bank, resulting in localised increase in depth along the eastern bank. Therefore, the 6 profiles generated has helped in the understanding of morphological characteristics of the channel bed. After checking the profiles it can be observed that the ghats on the right banks are more perceptible to erosion while the left bank is prone to the process of accretion resulting in formation of point bars along *Dhobi Ghat* to *Gola Ghat*. Reduction of the cross-sectional area of the river clearly indicates induced sedimentation along the left bank.



Plate 15– Sedimentation near the left bank of Hugli River , Barrackpore side



Map 19 - Profiles of Hugli River, Barrackpur

**Conclusion** - The Bhagirathi Hooghly is morphologically a complex system of shoals and channels. The leading channel plagued with bars, bends and bores. The bathymetric and morphological characteristics of the river in the studied reach helped to understand the sedimentation process which is very significant and has led to the formation of different features like shoals, point bars and mid channel bars. The hydraulic radius of the studied reach indicates that the efficiency and carrying capacity of the channel has reduced due to accretion. Sedimentation being the major problem in the studied reach have resulted in the elevation of thalweg which in turn hinders navigational activities during low tide. Sedimentation along the stretch may also gradually result in decaying and degeneration of the channel. To increase the carrying capacity of the lifeline of Bengal and one of the major navigational route, measures like dredging, change in land-use pattern should be adopted by concerned authorities.



Plate9 &10 – Bathymetry Survey going on with GPS and Echo Sounder



**3.5. GROUND WATER SOURCES** - Based on the geological and geomorphological set up, characteristics of the aquifers and chemical character of ground water the district North 24 Parganas can be divided into two broad units. (CGWB, 2012) as follows: **Fissured**

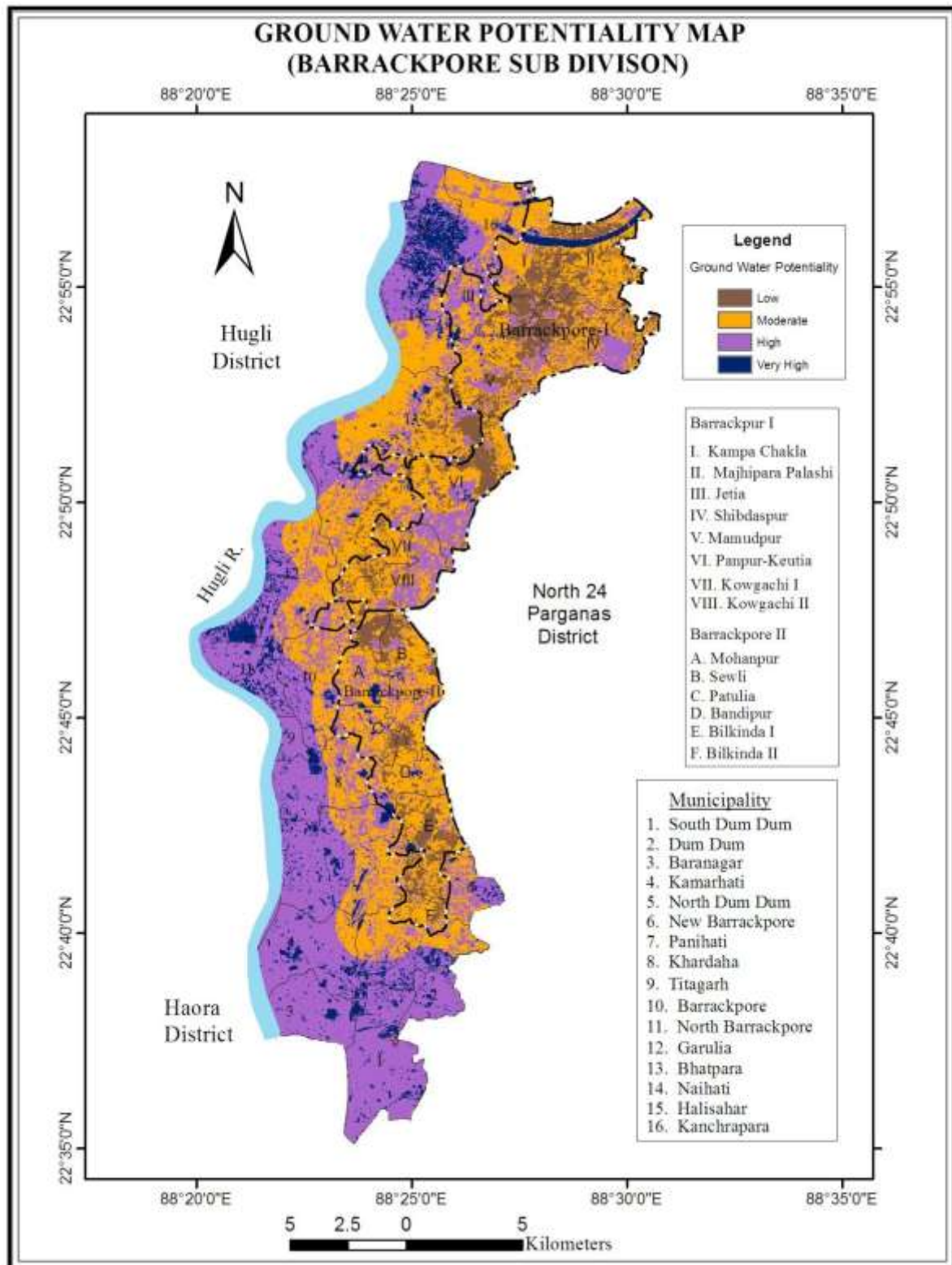
**Formations:** Ground water occurs in these formations in the upper weathered mantle (thickness 5-10m) and at deeper levels (60-100 m depth) in the fractures, fissures and joints where limited quantities of ground water (less than 20 m<sup>3</sup>/hr) may be available from bore wells and large dia dug wells.

**Porous Formations:** Ground water occurs in this formation both under water table and confined condition. In North 24 Parganas districts down to 150m there is absence of any significant clay beds making the entire aquifer up to 150m depth to occur under water table condition. The potentiality of this aquifer is very poor. By and large yield of the tube well (down to 100-400mbgl) varies from 80-100 m<sup>3</sup>/hr.

In general, occurrence of fresh ground water bearing aquifers at depths 180-360 mbgl within the drilled depth of 600 mbgl has been established (Boberg, 2005). The fresh group of aquifers is sandwiched between saline/brackish aquifers. The top saline/ brackish aquifer lies within the depth span of 20-180m with maximum depth of 320 mbgl. Suitably constructed tube well tapping 35 m cumulative thickness within the depth span of about 180-360 mbgl, to be identified with the help of geophysical survey, can yield 100-150 m<sup>3</sup>/hr. Proper cement sealing is required to be placed against a clay layer above the zone to be tapped, in order to prevent vertical percolation of brackish water. The wells discharge in the ranges of 80 to 250 m<sup>3</sup>/ hr. Cautious approach towards development of ground water has also to be adopted to restrict landward migration of fresh water /saline water wedge (CGWB, 2016).

**3.5.1. Sources of Water Supply in the Study area** - Deep tube wells are the major source of municipal water supply system in Barrackpore Sub-division. Deep tube wells operate in suction mode from deep aquifer. For deep tube wells 76mm dia housing or casting pipe length is extended up to a certain depth depending on the water table and piston assembly of the pump is set at that level by connecting a pump rod to the handle. The piston remains in submerged condition below water table. A well designed deep tube wells on an average is able to deliver 20000 to 30000 gallons per hour. The tube wells run for 12 to 16 hours daily. Demand can be met by running stand-by tube wells during additional hours in summer (CMDA, Report-228, 1990). In this Sub-division, the deep tube wells are of both heavy duty and low duty in nature (DDP by KMDA, 2000). In this Sub-division, the deep tube wells are of both heavy duty and low duty in nature (DDP by KMDA, 2000).





Map 20– Ground Water Potential , based on LULC Map

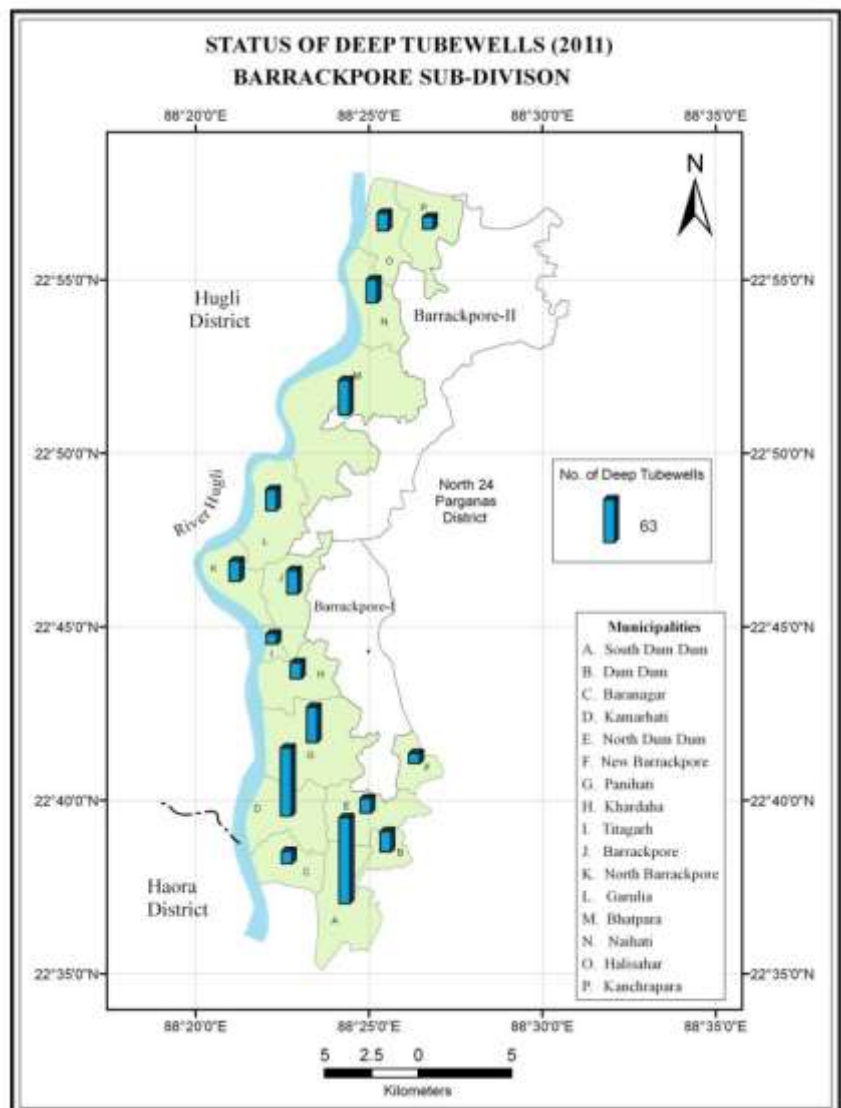
- Heavy duty tube wells (>100 m<sup>3</sup> / hr.) of 150-300 m depth with housing about 35-40 m, is fitted with 18-20 HP pump yielding about 150-200 m<sup>3</sup> /hr.
- Low duty tube well (50 m<sup>3</sup> /hr.) of 60 m depth tapping cumulative 8-10 m thick granular zones and fitted with 5 HP centrifugal / submersible pumps (depending on the depth to water Level), may yield around 30 m<sup>3</sup>/hr. Boring, at the present days is generally carried out mechanically. The equipment used for boring, depends upon the topographical features of the soil where boring is to be carried out, up to depth where the quality of water is satisfactory, fit for drinking purposes and sufficient quantity of water is available for at least 10 years since installation. Only then it will be economical. Once boring has been completed, casing pipe, perforated pipes for water to come into the well and then submersible pump to extract water is generally provided around the perforated pipes (Micheal, 2008).

**Average boring depth of deep tube wells of different municipalities**

(Data Source: Municipalities office of the Barrackpore Sub-division, 2011)

- Baranagar -91
- Barrackpore -152
- Bhatpara- 137
- Dum Dum -137
- Garulia -137
- Halisahar- 137
- Kamarhati- 122
- Khardah- 91
- Naihati -152
- New Barrackpore -152
- North Barrackpore -137
- North Dum Dum- 152
- Panihati -152
- South Dum Dum -137
- Titagarh -122
- Kanchrapara -122

Map 21- Status of Deep Tube Wells



### **3.5.B Chemical Quality of Ground water**

Groundwater is, in general, neutral to slightly alkaline type and Calcium- Magnesium-Bicarbonate type, Sodium Bicarbonate type. Specific Conductance of ground water, in general, ranges between <500 and 2000 micromhos/ cm at 25°C (N.Rajvaidya,2005). However, Specific Conductance of the deeper aquifers in the southern part of the Sub-division ranges from 1000 to 2000 micromhos/cm at 25°C, whereas the upper aquifers in the same tract shows that the value of Specific Conductance increases towards southeast from 5000 micromhos/cm in the northwest to 20000 micromhos/cm at 25°C. Iron content in ground water in the entire Sub-division is in general less than 1.0 mg/l, except in some isolated patches of the study area, where ground water in near surface aquifers have iron as high as more than 3.00 mg/l, even more than 10.00 at few places (CGWB, 2009).

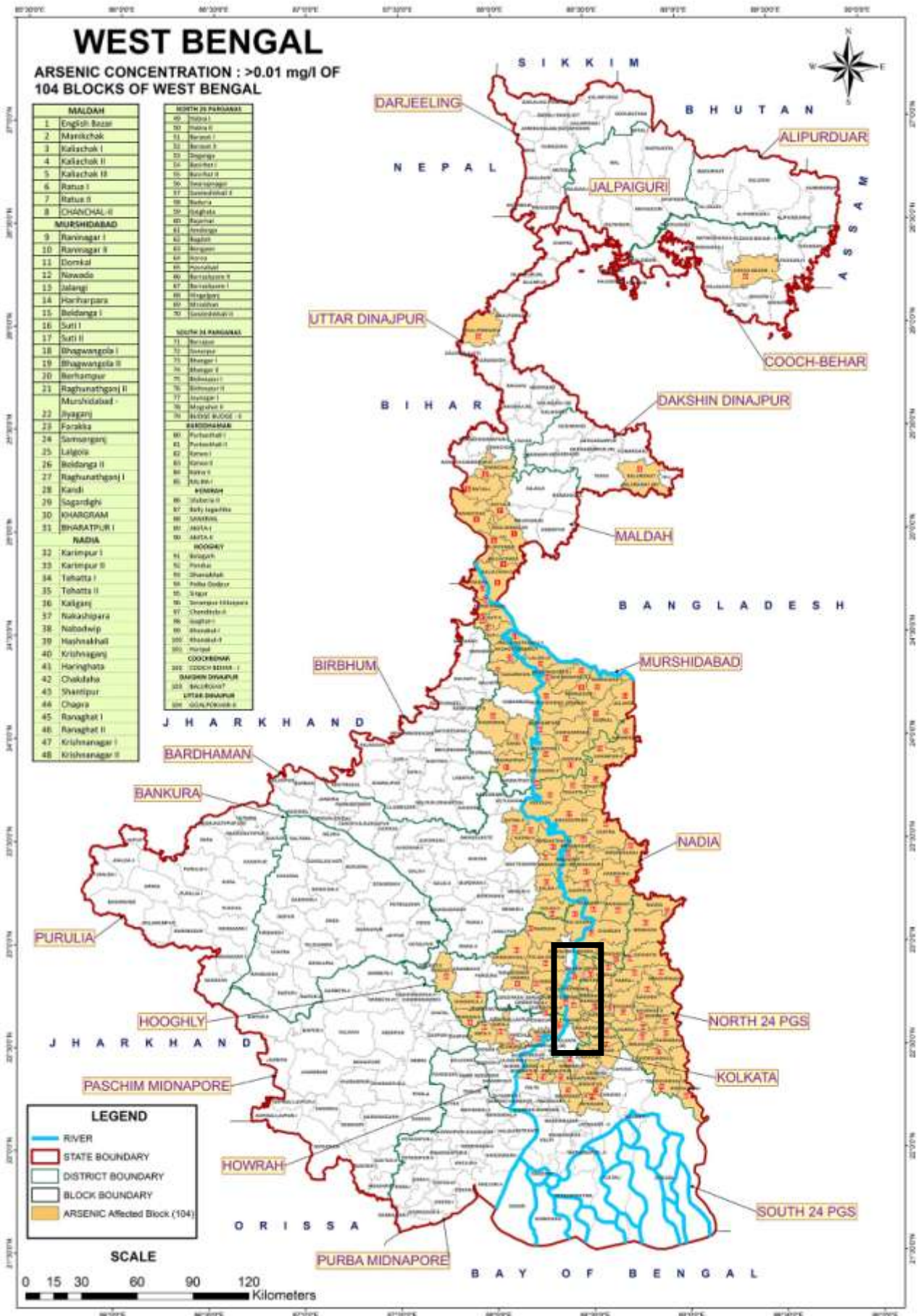
#### **3.5. B.i Arsenic Contamination in the Groundwater of the Study area**

The contamination of groundwater with Arsenic is one of the serious problems encountered in developing countries. The present study was an effort to map arsenic concentration in a district level that might lead to a broader understanding of its regional presence and significance.

Hydro-geologically the North 24 parganas district is mainly within the upper delta plain of Ganga-Bhagirathi river systems. Arsenic in ground water is mainly restricted in shallow aquifer (depth 15 to 70mbgl) which is mainly built up of sediments deposited by meandering streams and levees. The migration of the meander belts, lag front bars, levee back swamp with fining upward sequence in a vertical section depending upon the density of channel network the composition of sediments changes laterally across delta plain even within a few meter to several hundreds of metres. This may responsible for lateral variation of arsenic in ground water.

**In the study area, Bhatpara Municipality and parts of Kanchrapara Municipality are specifically affected by Arsenic.**





Map 22- West Bengal showing blocks affected by Arsenic , Source -Phed

**3.7. Natural Vegetation-** Primarily being an urbanised zone, this stretch of area is not very rich in natural vegetation. But still, in the bank of River Hugli , especially in Barrackpore ,Panihati Municipality ,there are big ancient trees . When Marquess Wellesley took over the Commander-in-Chief's residence in 1801, he decided to make improvements to the area. He created a summer residence for future Governor-Generals' and he landscaped the gardens while adding an aviary, a menagerie and a theatre. As a result, Barrackpore Park became a popular place for leisure pursuits. There are series of paintings and photographs of Barrackpore area by British artists documenting the River side view . All of them shows that the River bank had thick vegetation cover.



Plate - Hindoo Pagodas below Barrackpore on the Ganges. Geoge Hunt. 1824. Courtesy: British Library





Plate - Barrackpore Ghaut, A hand-coloured photograph by Frederick Fiebig. 1851. Courtesy British Library



Plate - Lipoo Tree at Riverside, the natural landscape outside Park. Artist: William Prinsep. 1827

### 3.7.A . Present Condition of Flora and Fauna of the Study Area

Though we don't find much of the yesteryears greenery and tranquillity along the river banks but still many old trees are still visible in the entire stretch especially from Barrackpore to Panihati. Here we have attempted to list down major species of Trees, Aquatic Plants herb, creepers , Grass etc.

*Brief methodology for the floral and faunal survey is given below.*

1. Sampling was done mostly in random manner. 2. The total area was surveyed by walking at day time. 3. Surveys were conducted for the maximum possible hours in day time. 4. Tree species were documented through physical verification on foot and photographed each species as much as possible. 5. For faunal species we emphasized mainly on the direct sighting. Also call of various birds and amphibians and nesting of some faunal species were considered as direct evidences. 6. Observing mammals depend critically on the size of the species and its natural history. Diurnal species are common and highly visible. Nocturnal species, however, are rare and difficult to detect. Small mammals like the field rats were found near their burrows, particularly during their entry or exit times in or out from their burrows respectively. In some cases, dung deposits and footprints were also observed that served as a potential clue for the presence and absence of the concerned species. These secondary evidences were all noted with time and space co-ordinates.

**Table 2– List of Trees in the study area**

Sl.1	Name of the species	Scientific name	Family
1	African Tulip	<i>Spathodia campanulata</i>	Bignoniaceae
2	Allspice Tre	<i>Pimenta dioica</i>	Myrtaceae
3	Amla	<i>Embllica officinalis</i>	Euphorbiaceae
4	Ashoka Tree	<i>Saraca asoka</i>	Fabeceae
5	Bahera	<i>Terminalia bellirica</i>	Combretaceae
6	Banyan Tree	<i>Ficus benghalensis</i>	Moraceae
7	Bhawarmal, Bohar Biharukh	<i>Hymenodictyon orixense</i>	Rubiaceae
8	Buddha Coconut	<i>Pterygota alata</i>	Sterculiaceae
9	Burma Teak	<i>Tectona grandis</i>	Verbenaceae
10	Butterfly Tree	<i>Bauhinia purpurea</i>	Caesalpiniaceae
11	Caledonia Pine/ Christmas Tree	<i>Araucaria cookii</i>	Arucariaceae
12	Banana	<i>Musa</i>	Bananas
13	Chhatiyan / Devil's Tree	<i>Alstonia scholaris</i>	Apocynaceae
14	Cluster Fig	<i>Ficus glomerata</i>	Moraceae
15	Copper Pod Tree	<i>Peltoforum pterocarpum</i>	Caesalpiniaceae
16	Custard Apple	<i>Annona reticulata</i>	Annonaceae
17	Drumstick Tree	<i>Moringa oleifera</i>	Moringaceae
18	Dysoxylum	<i>Dysoxylum sp. Dysoxylum costulatum Miq.</i>	Miliaceae
19	Elephant Apple	<i>Dillenia indica</i>	Dilleniaceae



20	Eucalyptus	<i>Eucalyptus spp.</i>	Myrtaceae
21	False White Teak	<i>Trewia nudiflora</i>	Euphorbiaceae
22	Ficus	<i>Ficus sp.</i>	Moraceae
23	Flame tree	<i>Butea monosperma</i>	Faboideae
24	Gardenia,	<i>Cape jasmine Gardenia jasminoides</i>	Rubiaceae
25	Gliricidia	<i>Gliricidia sepium</i>	Fabaceae
26	Gold Mohur	<i>Flame Tree Delonix regia</i>	Caesalpiniaceae
27	Golden Apple	<i>Aegle marmelos</i>	Rutaceae
28	Golden Shower	<i>Acacia auriculiformis</i>	Fabaceae
29	Guava	<i>Psidium guajava</i>	Myrtaceae
30	Gulab Jamun	<i>Syzygium jambos</i>	Myrtaceae
31	Haritaki	<i>Terminalia chebula</i>	Combretaceae
32	Indian Almond	<i>Terminalia catappa</i>	Combretaceae
33	Indian Blackberry	<i>Syzygium cumini</i>	Myrtaceae
34	Indian Blackberry (Small)	<i>Syzygium sp.</i>	Myrtaceae
35	Indian Cork Tree	<i>Millingtonia hortensis</i>	Bignoniaceae
36	Indian Fir / Cementry Tree	<i>Polialthia longifolia</i>	Annonaceae
37	Indian Jujube	<i>Ber Ziziphus mauritiana</i>	Rhamnaceae
38	Indian Lilac Tree	<i>. Melia azedarach</i>	Meliaceae
39	Indian Mehoginy	<i>Cedrela toona</i>	Meliaceae
40	. Indian Rubber Tree	<i>Ficus elastica</i>	Moraceae
41	Indrajao	<i>Holarrhena pubescens</i>	Apocynaceae
	Jack Fruit	<i>Artocarpus heterophyllus</i>	Moraceae
42	Kadam	<i>Anthocephalus chinensis</i>	Rubiaceae
43	Lichi	<i>Litchi chinensis</i>	Sapindaceae
44	Longan	<i>Euforia longan</i>	Sapindaceae
45	Mango	<i>Mangifera indica</i>	Anacardiaceae
46	Neem Tree	<i>Azadirachta indica</i>	Meliaceae
47	Pomelo	<i>Citrus maxima</i>	Rutaceae
48	Pongam Tree	<i>Pongame Oil Tree Pongamia pinnata</i>	Fabaceae
49	Pride of India	<i>Lagerstroemia speciosa</i>	Lythraceae
50	Putranjiva / Lucky Bean Tree	<i>Putranjiva roxburghii</i>	Euphorbiaceae
51	Queen of the night	<i>Nyctanthes arbortristis</i>	Oleaceae
52	. Rain Tree	<i>Samanea saman</i>	Mimosaceae
53	Red Jasmine Tree	<i>Plumeria rubra</i>	Apocynaceae
54	Red Silk Cotton Tree	<i>Bombax ceiba</i>	Malvaceae
55	Sabeda	<i>. Manikara sapota</i>	Sapotaceae
56	Sand Paper Tree	<i>Streblus asper</i>	Moraceae
57	She-Oak / Indian Christmas Tree	<i>Casuarina equisetifolia</i>	Casuarinaceae
58	Small-leaved Mahogany	<i>Swietenia mahagoni</i>	Meliaceae
59	Spanish cherry / Bakul	<i>. Mimusops elengi</i>	Caesalpiniaceae
60	. Star Fruit	<i>Averrhoa carambola</i>	Averrhoaceae
61	Subabul Leucena	<i>leucocephala</i>	Mimosaceae
62	Tamarind	<i>Tamarindus indica</i>	Caesalpiniaceae
63	Vilayati Babul	<i>Pithecolobium dulce</i>	Mimosaceae
64	Water Apple Bay Cedar	<i>Guazuma ulmifolia</i>	Malvaceae
65	White Fig	<i>Ficus infectoria</i>	Moraceae
66	Wild Mango	<i>Spondias pinnata</i>	Anacardiaceae

SI	Aquatic Plants	Scientific Name	Family
79	Alligator weed	<i>Alternanthera philoxeroides</i>	Amaranthaceae
80	Duck lettuce	<i>Ottelia alismoides</i>	Hydrocharitaceae
81	Tape grass	<i>Vallisneria spiralis</i>	Hydrocharitaceae
82	Taro	<i>Colocasia esculenta</i>	Araceae
83	Water hyacinth	<i>Eichhornia crassipes</i>	Pontederiaceae
84	. Water lily	<i>Nymphaea nouchali</i>	Nymphaeaceae
85	Waterthyme	<i>Hydrilla verticillata</i>	Hydrocharitaceae

Table 3- List of Grasses in the study area

SI	Grasses	Scientific name	Family
74	Bamboo	<i>Bambusa sp.</i>	Poaceae
75	Common Carpet grass	<i>Axonopus sp</i>	Poaceae
76	Durba	<i>Cynodon dactylon</i>	Graminae
77	Hogla Grass	<i>Typha elephantine, T. Latifolia</i>	
78	Kans Grass	<i>Saccharum spontaneum</i>	

Table 4– List of Herbs in the study area

	Herbs	Scientific Name	Family
86	Achyranthes	<i>Achyranthes aspera</i>	Amaranthaceae
87	Ageratum	<i>Ageratum conyzoides</i>	Asteraceae
88	Alocasia	<i>Alocasia indica</i>	Arecaaceae
89	Aloe Vera	<i>Aloe barbadensis</i>	Liliaceae
90	Alternanthera	<i>Alternanthera philoxeroides</i>	Amaranthaceae
91	Alternanthera	<i>Alternanthera paronychioides</i>	Amaranthaceae
92	Alternanthera	<i>Alternanthera sessilis</i>	Amaranthaceae
93	Amaranthus	<i>Amaranthus viridis</i>	Amaranthaceae
94	Amaranthus	<i>Aerva javanica</i>	Amaranthaceae
95	American Mint	<i>Anisomeles indica</i>	Lamiaceae
96	Asian Spiderflower	<i>Cleome viscosa</i>	Cleomaceae
97	Bachelor Button Flower	<i>Gomphrena globosa</i>	Amaranthaceae
98	Ban Dhona / Mitha Pata	<i>Scoparia dulcis</i>	Scrophulariaceae
99	Banana Tree	<i>Musa sp.</i>	Musaceae
100	Bengal Arum	<i>Typhonium trilobatum</i>	Areceae
101	Bhringaraj	<i>Wedelia trilobata</i>	Asteraceae
102	Bhuin Okra	<i>Phyla nodiflora</i>	Verbenaceae
103	Black Nightshade	<i>Solanum</i>	Solanaceae
104	Bluebell	<i>Ruellia prostrata</i>	Acanthaceae
105	Boatlily,	<i>Moses-in-the-cradle Tradescantia spathacea</i>	Commelinaceae
106	Bon Tepari	<i>Physalis minima</i>	Solanaceae
107	Bon Tulshi	<i>Croton bonplandianum</i>	Euphorbiaceae
108	Calendula,	<i>Common Marigold Calendula officinalis</i>	Asteraceae
109	Chrysanthemums	<i>Chrysanthemum sp.</i>	Asteraceae
110	Coat Buttons	<i>Tridax Daisy Tridax procambens</i>	Lamiaceae

		<i>Asteraceae</i>	
111	Coleus	<i>Coleus sp.</i>	Lamiaceae
112	Commelina	<i>Commelina benghalensis</i>	Commelinaceae
113	Dahlia	<i>Dahlia sp.</i>	Asteraceae
114	Diamond Flower	<i>Corymbose hedyotis Hedyotis corymbosa</i>	Rubiaceae
115	Famine Weed	<i>Parthenium hysterophorus</i>	Asteraceae
116	Gerbera	<i>Gerbera jamesonii</i>	Asteraceae
117	Graceful Pouzalz's Bush	<i>Pouzalzia indica</i>	Urticaceae
118	Heartleaf Fanpetals	<i>Sida humilis</i>	Malvaceae
119	Holy Basil	<i>Tulasi Ocimum sanctum</i>	Lamiaceae
120	Impatiens, Touch-me-not	<i>Impatiens</i>	Balsaminaceae
121	Indian Cress	<i>Nasturtium indicum</i>	Brassicaceae
122	Indian Water Navelwort	<i>Centella asiatica</i>	Apiaceae
123	Kalmegh., Green chirayta	<i>Andrographis paniculata</i>	Acanthaceae
124	Keshut	<i>Eclipta alba</i>	Asteraceae
125	khirika	<i>Euphorbia hirta</i>	Euphorbiaceae
126	Krishna Tulsi	<i>Ocimum tenuiflorum</i>	Lamiaceae
127	Kukurshoka	<i>Blumea laciniata</i>	Asteraceae
128	Kulekhara	<i>Hygrophila schulli</i>	Acanthaceae
129	Lobster claw Hanging heliconia	<i>Strelitzia reginae</i>	Musaceae
130	Marigold Flower	<i>Tagetes sp.</i>	Asteraceae

131	Agave sp.	<i>Agave sp.</i>	Asparagaceae
132	Ban jamir	<i>Glycosmis pentaphyla</i>	Ruraceae
133	Bleeding Heart	<i>Clerodendrum thomsoniae</i>	Lamiaceae
134	Castor Oil Plant	<i>Ricinus communis</i>	Euphorbiaceae
135	China Rose	<i>Hibiscus rosa</i>	Malvaceae
136	Chitrak , Plumbago, White leadwort	<i>Plumbago zeylanica</i>	Plumbaginaceae
137	Citrus	<i>Citrus acida</i>	Rutaceae
138	Citrus/	<i>Citron Citrus medica</i>	Rutaceae
139	Clerodendrum	<i>Clerodendrum viscosum</i>	Verbenaceae
140	Common Wireweed	<i>Sida acuta</i>	Malvaceae
141	Croton	<i>Codiaeum sp var.</i>	Euphorbiaceae
142	Devil's cotton	<i>Abroma augustum</i>	Sterculiaceae
143	Devil's Trumpets	<i>Datura sp.</i>	Solanaceae
144	Dracaena	<i>Pleomele reflexa 'Variegata'</i>	Asparagaceae
145	Duranta	<i>Duranta repens</i>	Verbenaceae
146	Fever tea	<i>Lemon Bush Lippia javanica</i>	Verbenaceae
147	Fever tea/	<i>Lemon Bush Lippia javanica</i>	Verbenaceae
148	Garden Cosmos	<i>Cosmos bipinnatus</i>	Asteraceae
149	Giant Milkweed	<i>Calotropis gigantea</i>	Asclepiadaceae
150	Green Chili	<i>Capsicum sp.</i>	Solanaceae
151	Ground Fig	<i>Ficus heterophylla</i>	Moraceae
152	Heliconia	<i>Strelitzia. sp.</i>	Musaceae
153	Indian heliotrope	<i>Heliotropium indicum</i>	Boraginaceae
154	Ixora	<i>Ixora sp</i>	Rubiaceae
155	Jasmine	<i>Jusminum pubescens</i>	Oleaceae
156	Karipata	<i>Murraya koenigii</i>	Rutaceae

157	Kasunda	<i>Baner Cassia sophera</i>	Fabaceae
158	. Lagerstroemia	<i>Lagerstroemia indica</i>	Lythraceae
159	Lantana	<i>camara</i>	Verbenaceae
160	Lime	<i>Citrus acida</i>	Rutaceae
161	Milk Flower (Double)	<i>Tabernaemontana coronaria</i> <i>Apocynaceae</i>	Apocynaceae
162	Milk Flower (Dwarf)	<i>Tabernaemontana divaricata</i> <i>Apocynaceae</i>	Apocynaceae
163	Milk Flower (Plain)	<i>Tabernaemontana divaricata</i> <i>Apocynaceae</i>	Apocynaceae
164	Milli	<i>Euphorbia milli</i> <i>Ericaceae</i>	Ericaceae
165	Muktojhuri	<i>Acalypha indica</i>	Euphorbiaceae
166	Musaenda	<i>Mussaenda sp.</i>	Rubiaceae
167	Oleander	<i>Nerium oleander</i>	Apocynaceae
168	Orange Jasmine	<i>Murraya paniculata</i>	Rutaceae
169	Philippine Violet	<i>Barleria strigosa</i> <i>Acanthaceae</i>	Acanthaceae
170	Plumed Cockscomb	<i>Woolflower Celosia argentea</i>	Amaranthaceae
171	Poinsettia	<i>Euphorbia pulcherrima</i>	Euphorbiaceae
172	Powder Puff	<i>Calliandra sp.</i>	Euphorbiaceae
173	Ravenia Pink	<i>Lemonia Ravenia spectabilis</i>	Fabaceae
174	Roast Potato	<i>Phyllanthus reticulatus</i>	Rutaceae
175	Plant Poir.	<i>Euphorbiaceae</i>	Euphorbiaceae
176	Rose	<i>Rosa</i>	Rosaceae
177	Salparni	<i>Desmodium gangeticum</i>	Fabaceae
178	Scarlet Sage	<i>Salvia splendens</i>	Lamiaceae
179	Shooting Star Star Flower	<i>Pseuderanthemum sp</i>	Acanthaceae
180	. Siam Weed	<i>Bitter bush Eupatorium odoratum</i>	Asteraceae
181	Slipper Plant	<i>Pedilanthus tithymaloides</i>	Euphorbiaceae
182	Spicy Jatropha	<i>Jatropha panduraefolia</i>	Euphorbiaceae
183	Stinking Cassia	<i>Cassia tora</i> <i>Fabaceae</i>	Fabaceae
184	Tecoma	<i>Tecoma gaudichaudi</i>	Bignoniaceae
185	Thuja	<i>Thuja orientalis</i>	Cupressaceae
186	Wild Eggplant	<i>Solanum torvum</i>	Solanaceae
187	Bridal Bouquet	<i>Plumeria pudica</i>	Apocynaceae
188	Yellow Cosmos	<i>Cosmos sulphureus</i>	Asteraceae
189	Yellow oleander	<i>Cascabela thevetia</i>	Apocynaceae

**Table 5 : List of Creepers in the Study Area**

	Creepers	Scientific Name	Family
189	Allamanda	<i>Allamanda sp.</i>	Apocynaceae
190	Aparajita	<i>Clitoria ternatea</i>	Fabaceae
191	Bengal Trumpet Vine,	<i>Thunbergia grandiflora</i>	Acanthaceae
192	Birdfoot Grape	<i>Cayratia pedata</i>	Vitaceae
193	Birdfoot Grape-	<i>Cayratia sp.</i>	Vitaceae
194	Bougainvillea	<i>Bougainvillea sp.</i>	Nyctaginaceae
195	Cayratia	<i>Cayratia trifolia</i>	Vitaceae
196	Chinese creeper	<i>Micania micrantha</i>	Asteraceae
197	Climbing Mallotus	<i>Mallotus repandus</i>	Euphorbiaceae
198	Coral Creeper / Antigonum	<i>Antigonon leptopus</i>	Polygonaceae
199	Corkystem Passionflower	<i>Passiflora suberosa</i>	Passifloraceae
200	Gulanchalata	<i>Tinospora cordifolia</i>	Menispermaceae
201	Hemigraphis	<i>Hemigraphis hirta</i>	Acanthaceae
202	Indian Stinging Nettle	<i>Tragia involucrata</i>	Euphorbiaceae
203	Ipomoea	<i>Ipomoea aquatica</i>	Convolvulaceae



204	Justicia	<i>Justicia simplex</i>	Acanthaceae
205	Money Plant, Ivy A	<i>Epipremnum aureum</i>	Areceae
206	Passion Flower	<i>Passiflora suberosa</i>	Passifloraceae
207	Philodendron	<i>Philodendron</i> sp.	Areceae
208	Rangoon Creeper	<i>Combretum indicum</i>	Combretaceae
209	Roundleaf Bindweed	<i>Evolvulus nummularius</i>	Convolvulaceae
210	Small White Morning Glory	<i>Ipomoea obscura</i>	Convolvulaceae
211	Snake Vine	<i>Stephania japonica</i>	Menispermaceae
212	Telakuchu	<i>Coccinia grandis</i>	Cucurbitaceae
213	Tiliacora	<i>Tiliacora racemosa</i>	Menispermaceae



Plate 11– Full Bloom Krishnachura in Mangal Mandey Ghat





Plate 12 – Banana Trees in the adjoining area of Khardah Khal, Plate 13 – Exotic Tree at Lat Bhawan







Plate 14: Panihati Bajar Ghat, A pair of Mango Trees



Plate 15 - Kans grass , *Saccharum spontaneum* is the most common grass found in the adjoining bank of Bhagirathi Hugli River. 22°59'51.06"N 88°24'53.67"E





Plate16- Hogla Grass , Hogla Grass , Typha elephantine found adjoining Halisahar Khal  
22°57'22.09"N, 88°25'4.08"E



Plate 17– Riparian Grasses along River Hugli , Garulia Municipality, 22°48'21.40"N 88°21'34.80"E

**3.8. WILDLIFE**

Between 1798-1805, Marquess Wellesley took over the Commander-in-Chief's residence, he decided to make improvements to Barrackpore. He created a picturesque garden on the banks of the Ganges in Barrackpore spreading across 1006 bighas of land. This garden is today, called Laat Bagan or Mangal Pandey Park. Right next to this garden, he built a gigantic house which resembled no less than a castle. Later, this house was named Barrackpore Government House. Lord Wellesley also felt the need of making a detailed description of the animals in Asia. He landscaped the gardens and added an aviary, a menagerie and a theatre. This was primarily because the Europeans were mostly ignorant when it came to the category of Indian animals. He started working on the first Natural Research Center in Asia, the 'National Heritage of India.' Various animals were required to be collected. Barrackpore Zoo was built to store these animals and birds. Until 1804, Rs 2,791 was invested in the cost of maintenance of these animals and birds. And this was indeed a whooping amount!

The London Zoo was built in 1828. Barrackpore Zoo was built even before that. Between 1817 and in 1819, two more bird aviaries and animal centres were built. The zoo had animals such as the African donkey, tiger, bear, bison, leopard, mouse deer, kangaroos, monkeys and various species of birds. There were separate ponds dedicated to rhinoceros and deer. Unfortunately, Barrackpore no more has traces of this historical zoo created by Wellesley.





**3.8.A. Present Documentation of Faunal Diversity in the Study Area****Table 6– Different Species of animal in the study area**

Sl.no	Mammals	Scientific Names
1	Asian Palm Civet	<i>Paradoxurus hermaphroditus</i>
2	Common Pipistrelle	<i>Pipistrellus pipistrellus</i>
3	Five-striped Palm Squirrel	<i>Funambulus pennantii</i>
4	Fruit Bat	<i>Pteropus sp.</i>
5	Gray Langur	<i>Semnopithecus sp.</i>
6	Indian Flying Fox	<i>Pteropus giganteus</i>
7	Indian Grey Mongoose	<i>Herpestes edwardsi</i>
	Birds	Scientific Names
1	Alexandrine Parakeet	<i>Psittacula eupatria</i>
2	Asian Koel	<i>Eudynamys scolopaceus</i>
3	Asian Openbill	<i>Anastomus oscitans</i>
4	Asian Palm Swift	<i>Cypsiurus balasiensis</i>
5	Asian Pied Starling	<i>Gracupica contra</i>
6	Black Drongo	<i>Dicrurus macrocercus</i>
7	Black Kite	<i>Milvus migrans</i>
8	Black-hooded Oriole	<i>Oriolus xanthornus</i>
9	Black-naped Monarch	<i>Hypothymis azurea</i>
10	Indian Pond Heron	
11	Jungle Babbler	<i>Turdoides striatus</i>
12	Jungle Myna	<i>Acridotheres fuscus</i>
13	Lesser Goldenback	<i>Dinopium benghalense</i>
14	Lineated Barbet	<i>Megalaima lineata</i>
15	Marsh Sandpiper	<i>Tringa stagnatilis</i>
16	. Oriental Magpie Robin	<i>Copsychus saularis</i>
17	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>
18	Purple Heron	<i>Ardea purpurea</i>
19	Purple Sunbird	<i>Nectarinia asiatica</i>
20	Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>
21	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>
22	House Sparrow	<i>Passer domesticus</i>
23	House Crow	<i>Corvus splendens</i>
24	Green Bee-Eater	<i>Merops orientalis</i>
25	Fulvous-breasted Woodpecker	<i>Centropus sinensis</i>
26	Greater Coucal	<i>Dendrocopos macei</i>
27	Eurasian Collared Dove	<i>Streptopelia decaocto</i>
28	Eastern Jungle Crow	<i>Corvus levaillantii</i>
29	Coppersmith Barbet	<i>Megalaima haemacephala</i>
30	Common Tailorbird	<i>Orthotomus sutorius</i>
31	Common Sandpiper	<i>Actitis hypoleucos</i>
32	. Common Pigeon	<i>Columba livia</i>
33	Common Myna	<i>Acridotheres tristis</i>
34	Common Kingfisher	<i>Alcedo atthis</i>
35	Common Iora	<i>Aegithina tiphia</i>
36	. Common Hoopoe	<i>Upupa epops</i>
37	Common Hawk Cuckoo	<i>Hierococcyx varius</i>
38	Cattle Egret	<i>Bubulcus ibis</i>

39	Blue-throated Barbet	<i>Megalaima asiatica</i>
40	Black-naped Oriole	<i>Oriolus chinensis</i>
41	Red-vented Bulbul	<i>Pycnonotus cafer</i>
42	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
43	Rose-ringed Parakeet	<i>Psittacula krameri</i>
44	Rufous Treepie	<i>Dendrocitta vagabunda</i>
45	Shikra	<i>Accipiter badius</i> Accipitridae
46	Spotted Dove	<i>Stigmatopelia chinensis</i>
47	Spotted Owlet	<i>Athene brama</i>
48	Stork-billed kingfisher	<i>Pelargopsis capensis</i>
49	White Wagtail	<i>Motacilla alba</i>
50	Taiga Flycatcher	<i>Ficedula albicilla</i>
51	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>
52	White-throated Kingfisher	<i>Halcyon smyrnensis</i>
53	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>
	<b>Reptiles</b>	<b>Scientific Names</b>
1	Bengal Monitor Lizard	<i>Varanus bengalensis</i>
2	Buff Striped Keelback	<i>Amphiesma stolatum</i>
3	. Checkered Keelback	<i>Xenochrophis piscator</i>
4	Common House Gecko	<i>Hemidactylus frenatus</i>
5	Oriental Garden Lizard	<i>Calotes versicolor</i>
6	Rat Snake	<i>Zamenis longissimus</i>
7	Russell's Viper	<i>Daboia russelii</i>
8	Skink	<i>Lampropholis sp.</i>
	<b>Butterflies</b>	<b>Scientific Names</b>
1	Angled Castor	<i>Ariadne ariadne</i>
2	Blue Mormon	<i>Papilio polymnestor</i>
3	Brown Awl	<i>Badamia exclamationis</i>
4	Blue Tiger	<i>Tirumala limniace</i>
5	Chestnut Palm	<i>Bob iambrix salsala</i>
6	Chestnut-streaked	<i>Sailer Neptis jumbah</i>
7	Commander	<i>Moduza procris</i>
8	Common Banded Awl	<i>Hasora chromus</i>
9	Common Baron	<i>Euthalia aconthea</i>
10	Common Bushbrown	. <i>Mycalesis perseus</i>
11	Common Castor	<i>Ariadne merione</i>
12	. Common Cerulean	<i>Jamides celeno</i>
13	Common Crow	<i>Euploea core</i>
14	Common Evening Brown	<i>Melanitis leda</i>
15	Common Five-ring	<i>Ypthima baldus</i>
16	Common Four-ring	<i>Ypthima huebneri</i>
17	Common Grass Yellow	<i>Eurema hecabe</i>
18	Common Guava Blue	<i>Virachola isocrates</i>
19	Common Gull	<i>Cepora nerissa</i>
20	Common Jay	<i>Graphium doson</i>
21	Common Jezebel	<i>Delias eucharis</i>
22	Common Leopard	<i>Phalanta phalantha</i>
23	Common Lineblue	<i>Prosotas nora</i>
24	Common Mime	<i>Papilo clytia</i>
25	Common Mormon	<i>Papilo polytes</i>
26	Common Palmfly	<i>Elymnias hypermnestra</i>



27	Common Pierrot	<i>Castalius rosimon</i>
28	Common Quaker	<i>Neopithecops zalmora</i>
	<b>Odonates</b>	<b>Scientific Names</b>
1	Black Marsh Dart	<i>Onychargia atrocyana</i>
2	Black Marsh Trotter	<i>Tramea limbata</i>
3	. Common Picturewing	<i>Rhyothemis variegata</i>
4	Coral Tailed Cloud-wing	<i>Tholymis tillarga</i>
5	Coromandel Marsh Dart	<i>Ceriagrion coromandelianum</i>
6	. Crimson-tailed Marsh Hawk	<i>Orthetrum pruinosum</i>
7	Ditch Jewel	<i>Brachythemis contaminata</i>
8	Estuarine Skimmer	<i>Macrodiplax cora</i>
9	Fulvous Forest Skimmer	<i>Neurothemis fulvia</i>
10	Granite Ghost	<i>Bradinopyga geminata</i>
11	Green Darner	<i>Anax junius</i>
12	Green Marsh Hawk	<i>Orthetrum sabina</i>
13	Ground Skimmer	<i>Diplacodes trivialis</i>
14	Little Blue Marsh Hawk	<i>Brachydiplax sobrina</i>
15	Orange Tailed Marsh Dart	<i>Ceriagrion cerinorubellum</i>
16	Pied Paddy Skimmer	<i>Neurothemis tullia</i>
17	. Pygmy Dartlet	<i>Agriocnemis pygmaea</i>
18	Ruddy Marsh Skimmer	<i>Crocothemis servilia</i>
19	Rufous Marsh Glider	<i>Rhudothemis rufa</i>
20	Faced Blue Dart	<i>Saffron Pseudagrion</i>
21	Scarlet Marsh Hawk	<i>Aethriamanta brevipennis</i>
22	Senegal Golden Dartlet	<i>Ischnura senegalensis</i>
23	Three lined Dart	<i>Pseudagrion decorum</i>
24	Tiny Hooded Dartlet	<i>Agriocnemis kalinga</i>
25	Wondering Glider	<i>Pantala flavescens</i>
26	Yellow-tailed Ashy Skimmer	<i>Potamarcha congener</i>



Plate 19– Brahminey Sterling in Dakhineswar Temple Complex Plate 20– Rose Ring Parrot , Barrackpur Ghat



Plate 21– Pond Heron, Mathura Beel



Plate 22– Common Hoopoe , Barrackpur Gandhi Ghat





Plate – Lesser Whistling Ducks , Mathura Bill , North 24 Parganas

Plate – Bronze Wing Jacana ,  
Gayeshpur Jheel







Plate 23– Egret , adjoining Khardah Khal



Plate 24 – Squirrels at Mangal Pandey Ghat area, Barrackpore

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## Chapter 4 – Documenting Nature & Properties of Natural Heritage

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The deltaic region in West Bengal which is a distinct entity from rest of the riparian tracts, is geographically one of the most dynamic natural regions (Basu, 1978). The entire Ganges Delta has been classically divided into three sectors: (a) Moribund, (b) Mature and (c) Active (Bagchi, 1945).

In the moribund sector the delta forming processes have ceased and the drainage channels have become functionally inoperative. The rivers are at a loss to find a perceptible slope and consequently have extremely intricate meandering course. At some places the course of a river has taken complete turn around (Basu, 1978). Detached lengths of old courses (including ox-bow lakes and bills) are strewn over the entire area indicating the extent of degeneration of the drainage condition (Sen and Basu, 1974; Basu, 1976). Unlike the moribund part, the matured delta comprising northern and southern-western sections of 24 Parganas have not yet reached the hydro logically inactive state or moribund condition primarily because of the tidal action, although huge siltation has plagued the river channels due to lowering of fresh water discharge from *Bhagirath-Hugli, Gobra, Chhota Bhagirathi, Bhairab-Jalangi, Sialmari, Churni, Ichhamati, Mathabhanga* etc. (Basu, 1978).

There is a great influence of the Bhagirathi Hugli, in the eastern part to develop the deltaic zone of the river Ganga with the sedimentation process. The Bhagirathi Hugli, flows through this deltaic tract in more or less stable manner. Natural levee deposit, older and younger flood plains, palaeo channels in older flood plains are some of the common geomorphic features in this tract. South of this zone lies the truly active zone of the delta comprising the uninhabited Reserved Forest areas of *Sundarbans*. Here the land building process is active through siltation and as a result, the peripheral limits of the islands are advancing towards the water-front.



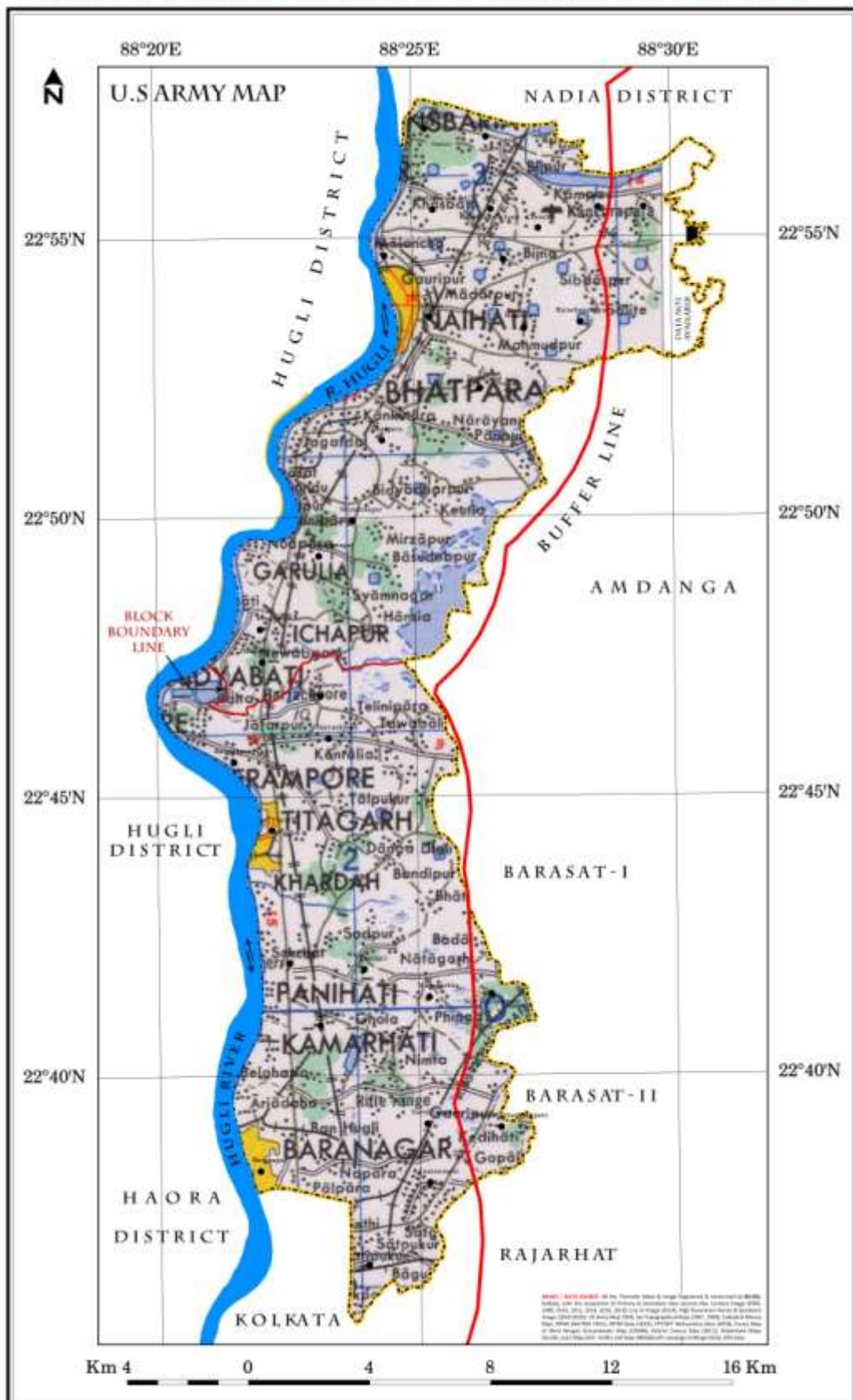
#### 4.1. DESCRIPTION OF MAJOR DRAINAGE CHANNELS DRAINING BARRACKPUR SUB DIVISION AREA \_TABLE 7.

S l n	Name	Source	Outfall	Length	Area covered	Remarks
1	River Jamuna	Bhagirathi-Hugli River (22°59'25.52"N 88°24'34.30"E)	Ichchamati River near Tibi Village (Not Found)	Only existing in few areas.	Kanchrapara Halisahar Chouberia , Jaleswar, Ichhapur, Gobardanga,	This historically significant river has almost died because of ill maintenance.
2	Bager Khal	Mathura Bil 22°56'55.03"N 88°27'13.42"E	Hugli River 22°57'36.45"N 88°24'41.22"E	7.5 km	Kanchrapara, Halisahar and areas bordering Kalyani and Gayeshpur municipalities	Encroachment along canal and dumping of municipal wastes resulting in rapid siltation and obstructed flow
3	Ichhapur Khal and its two branches - Shyamnagar and Babunpur canals with two sub branches	Barti Bill 22°56'59.08"N 88°27'14.22"E	Hugli River 22°48'24.20"N 88°21'35.13"E	10.5	North Barrackpur	Indiscriminate dumping of market wastes, household garbage and solid wastes resulted in rapid siltation and obstructed flow.
4	Khardah Khal	Near Khebla Bil 22°43'14.31"N 88°24'24.59"E	Hugli River 22°43'36.92"N 88°21'42.21"E	7.0	Barrackpur, Titagarh ,Panihati	Heavy siltation due to dumping of households and industrial wastes. Alignment of Anti Malaria Khal (tributary of Khardah Khal) partially obstructs the discharge of main Khardah Khal.

5	6. Upper Bagjola Khal with three branches- Sonai, Udaypur and Cantonment Khal	Starts from Kulti Lock Gate as Krishnapur Canal and then from V.I.P Road takes the name as Bagjola Canal	Outfall has been disconnected near Kamarhati 22°40'03.5"N 88°22'34.3"E	26 km (app)	Panihati, Kamarhati, Baranagar, Dum Dum, North Dum Dum and South Dum Dum	Rapid siltation due to disposal of household wastes all along the length and cattle shed effluents causing blockage of drainage path. The desired quantum of diversion to Kestopur Khal from Upper Bagjola (about 55% of total designed discharge) is not actually taking place due to raised bed level of Kestopur Khal and high tide level in the River Hugli.
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**4.1.A. River Jamuna** – Historically this is the next important river of the study area. The presence of this river can be found in Chouberia, Jaleswar, Ichapur, Gobardanga of North 24 Parganas. Later on it moves to South 24 Parganas and meet with Ichhamati River near Tibi Village. But at present the presence of the Mathura Bill in Kanchrapara and Bagher Khal in Halisahar are the only remains of Jamuna River. Even in 1767 when James Renell surveyed the area to create Bengal Basin Map, he showed Jamuna as a navigable river. According to the Statistical Account of Bengal by **Hunter**, we come to know that once there were number of Sugar Mills along the bank of Jamuna. This river had a huge strategic importance as it connects Hugli River with that of Ichhamati River which in turn actually joins with Padma in Bangladesh. In the past huge amount of trading used to take place through this river. Even it served as a political path for Pathans and Mughals. A huge battle between Prapaditya of Jessore and Mughal Emperor Akbar took place in a place called Shalka located beside the confluence of Jamuna and Ichhamati. So this river carries immense amount of history and heritage in its flow. Because of ill maintenance the condition of the river has become worse. Still now if the course of this river can be rejuvenated, the sweet water of Hugli can be transferred to the South Bengal and can be hugely be utilised for irrigation.

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Map 23– US Army Map , showing the study area



Plate 25 & 26 –Jamuna River , 22°59'24.48"N , 88°24'33.85"E





**4.1.B.The Bager Khal**, draining the north eastern part of KMA, originates from Mathura Bil. This canal drains the Kanchrapara and Halisahar municipalities and outfalls into River Hugli. The flow of the khal is greatly obstructed and reduced due to encroachment of the khal by slums and dumping of municipal wastes into the khal.

History – There is a lot of curiosity cantering around the name Bagher Khal. Bagh in local language means Tiger and thus many people think that might be there were once tigers in the locality which induced the name Bagher Khal. But it is not so. In the early years of 17<sup>th</sup> century there was an exiled Mughal Empire official named Mir Ahmad Baig who settled down in Kanchanpally (Kanchrapara) and Kumarhatta ( Halisahar ) of 24 Parganas. He became very popular because of many humanitarian works. Amongst them one was re excavation of the holy Jamuna River. We have mentioned earlier that in Tribeni , Ganga diverts into 3 channels-Saraswati,Jamuna and Hugli . But because of siltation the offtake point of Jamuna was cut out from the main channel. Mir Ahmad Baig took the initiative of connecting again the Jamuna River with the main channel by channelizing water from Mathura Bill(old course) That re excavated canal came to be known as “Bagher Khal” from his name Baig’s khal.



Plate 27 – Bagher Khal Off Take in Halisahar 22°57'36.17"N , 88°24'41.71"E



Map 24– High Resolution Image showing the mouth of Bagher Khal



Plate 28- Khardah Khal mouth, 22°43'37.29"N, 88°21'42.03"E



**4.1.C. The Ichhapur Khal** originates from Barti Bil and drains the North Barrackpur municipality area. Flowing through a congested market area of the municipality, it outfalls into the River Hugli. The flow of the khal is greatly obstructed due to indiscriminate dumping of wastes.



Plate 29 &30– Icchapur Canal Off Take point , 22°48'24.22"N 88°21'35.99"E



**4.1.E Khardah Khal** is a storm water drainage canal originated about 4.45 km south-east of Khardah Railway Station and travelled across the railway track of Sealdah – Ranaghat Main Line of Eastern Railway and flows more or less in the direction of south-east to north-west. The canal changed its course towards the West while it crossed the railway track and also Barrackpore Trunk Road (B. T. Road) before being finally discharged to the River Hugli. The canal has divided the municipal town in two halves.

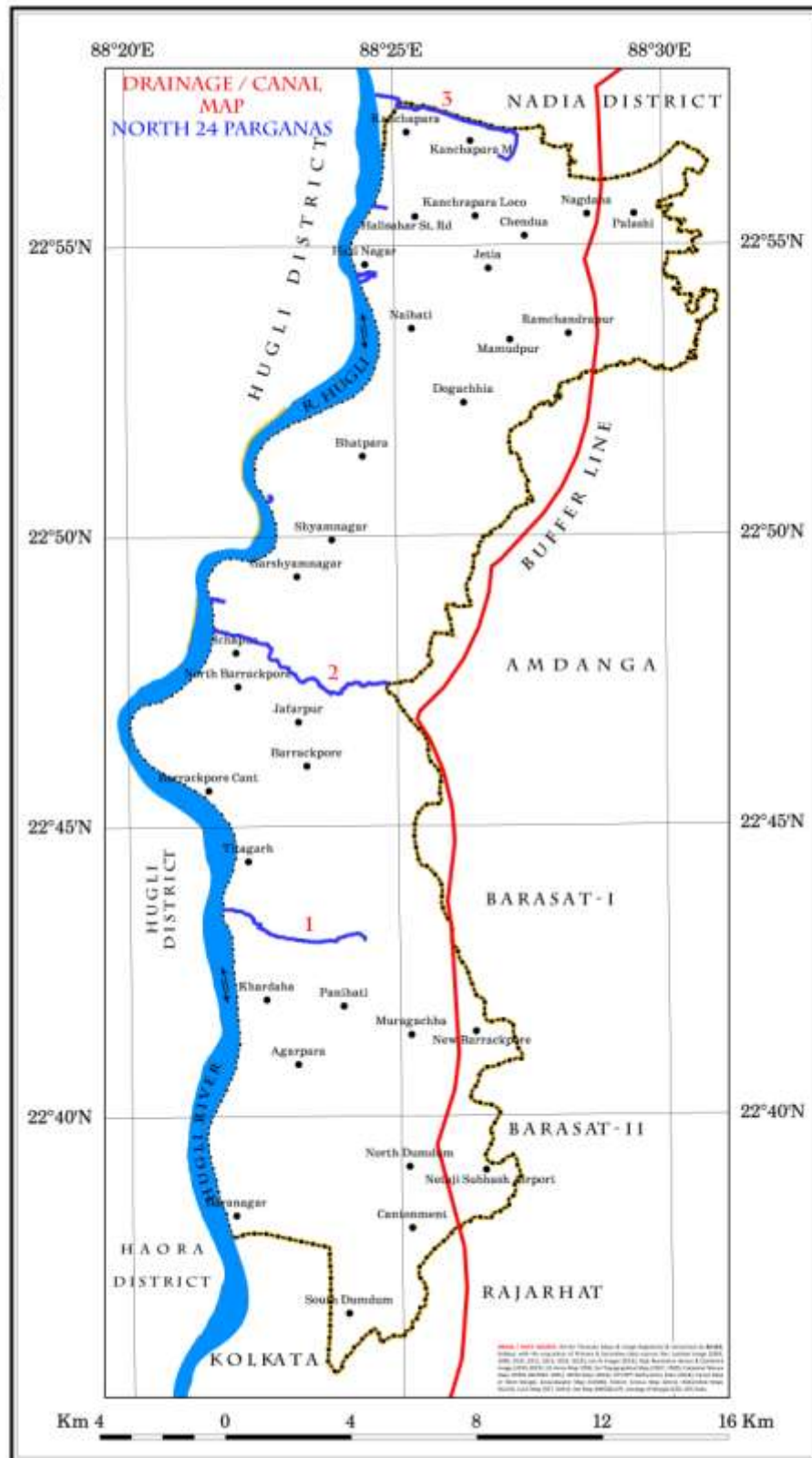


Plate 31– Khardah Khal , 22°43'36.37"N 88°21'42.50"E

**4.1.F. The Bagjola drainage** basin comprises of the Upper Bagjola Canal and the Lower Bagjola Canal. The basin area of Upper Bagjola comprises the municipalities of Panihati, Kamarhati, Baranagar, Dum Dum, North Dum Dum and South Dum Dum. It is designed to carry a discharge of 1650 cusec but rapid siltation due to disposal of household wastes and semi solid cattle shed effluents, is causing absolute blockage of drainage path. Heavy encroachment along a substantial length of the channel mainly under Baranagar Municipality and partly under Kamarhati Municipality has also resulted in reduction of flow of the channel.



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Map 25– Major Drainline of the Study area

#### 4.2. MINOR KHALS AND SEWER LINES DRAINING BARRACKPORE SUB DIVISION AREA-TABLE 8.

SL NO	Name of the Khal	Coordinates	Remarks
1	Drain Line , Ariadaha	N22.652584	N88.358235
2	Drain line , Panihati	N22.699805	N88.365950
3	Drain Line Mouth Laxmi Ghat (Titagarh)	N22.733644	E88.363551
4	Canal Mouth (Kesto Mukherjee Ghat) Titagarh	N22.747901	E88.365539
5	Mouth of Pocha Khal	N22.81580	E88.35922
6	Drain Line Meets Hugli (Garulia)	N22.82056	E88.35798
7	Garulia Bichalighat Nala Outlet	N22.82281	E88.35876
8	Panchannatala Ghat	N22.84045	E88.37819
9	Protapnagar Khal Mouth	N22.84337	E88.37695
10	Drain line beside (Nalhati Ferry Ghat)	N22.89011	E88.41205
11	Mouth of Naihati Khal	N22.89329	E88.41133
12	Drain line mouth Ramghat	N22.90699	E88.40588
13	Halisahar Drain (line under the main road Bridge)	N22.95536	E88.42384
14	Drain beside Mahakal Mandir	N22.93927	E88.41435



Plate 32 –Drain Line near Ariadaha , Kamarhati Municipality





Plate 33 – Drain line Mouth, Laxmighat, Titagarh



Plate 34– Pratapgarh Khal Mouth





Plate 35– Garulia Khal Mouth , Plate 36 – Sewerline Mouth,Garulia







Plate 37- Paanchanan Tola Mandir Drain, Bhatpara Municipality , Plate 38 – Khal near Garulia Kali Mandir





Plate 39 – Ram Ghat Canal Mouth , Plate 40 – Chai Ghat Canal Mouth







Plate 41– Halisahar Canal , Plate 42 – Halisahar Drain line







Plate 43- Drainline in Naihati Plate 44– Naihati Khal bordering Naihati and Halisahar Municipality





### 4.3 PALEOCHANNELS OF RIVER BHAGIRATHI-HUGLI

From Halisahar to Budge Budge , the bank of the River Bhagirathi Hugli has been paved from the historical times. Only in the extreme northern part of the study area, we find a scar or paleochannel of the river sharing both the districts of North 24 Parganas and Nadia. The southern bend lies in our study area which has been modified into a canal called as Bagher Khal . This Canal has joined the main Channel of Bhagirathi Hugli with that of the old course which is commonly said to be as the Gayeshpur Kulia Jheel  $22^{\circ}56'57.77''N$ ,  $88^{\circ}27'21.97''E$  and Mathura Beel  $22^{\circ}56'10.06''N$  ,  $88^{\circ}27'50.48''E$ . The satellite township of Kalyani ( Nadia District ) lies in the flood plain of this zone.

The **Gayeshpur Kulia Jheel /lake** was once interconnected with the Hugli river and surface run off drainage connected to the Bagher khal. Once, part of Hugli river, part of natural drainage system and ecosystem is now cut off from all connections. Surrounded by unplanned human settlements, encroachment and given permanent residence. A considerable portion of this lake has vanished. At present the length of the lake is 4.5 km shared between Nadia and North 24 Parganas. It primarily serves the satellite township of Kalyani.

**Mathura beel** is a floodplain Wetland spreading across the districts of Nadia and 24 Parganas (N), West Bengal. The water body is unique in its type having the agricultural fields and human settlements surroundings it, thus contributing varied qualities of water. Though the beel has no point source of waste water, it receives heavy run-off silt, chemicals and fertilizers from the agricultural land which is the most threatening effect on beel productivity in near future. At present the length of this lake is 13.8 km with 8 km being active.



Map 26– High Resolution Image showing Gayeshpur Kulia Jheel and Mathura Jheel



Plate 45– Gayeshpur Kulia Beel near Barrackpur – Kalyani Highway ,22°57'18.47"N 88°28'2.99"E



Plate 46- Gayeshpur Kulia Beel near Barrackpur – Kalyani Highway , 22°56'56.71"N 88°27'24.75"E





Plate 47 – Mathura Beel near Kanchrapara Haringhata Road , 22°56'17.09"N 88°27'26.10"E



Plate 48– Mathura Beel near Haringhata , 22°55'57.53"N 88°28'18.76"E



**7.0. FLOODPLAIN OF RIVER GANGA IN NORTH 24 PARGANAS** –The total stretch of North 24 Parganas along Hugli River is heavily urbanised and industrialised. The river has been jacketed long time ago by the Britishers. So the main river do not deposit silt in the adjoining banks. Rather there is a major problem of in stream deposition of sediments in this stretch. The entire stretch falls under the Hugli Industrial Belt and thus dotted with number of industries like – Jute , Paper, Fertilisers & Chemicals etc.

However in the extreme northern side of our study area , sharing with Nadia district we find a stretch of agriculture in the low lying land between Gayeshpur Kulia Beel and Mathura Beel. Mostly vegetables like raddish,ladies finger, sugarcane & corn are produced for serving the adjoining township of Kalyani. According to local farmers , boro rice is also cultivated during winter season. However , because of the high demand of land for settlement , slowly there is conversion of landuse landcover.



Plate 49- Raddish Cultivation in the floodplain area, adjoining Mathura Beel





Plate 50 – Leafy Vegetables cultivation in the adjoining areas of Kulia Beel



Plate 51a – Sugarcane Plantation in the Kulia Beel area





Plate 51b&c– Vegetable Cultivation ( Cauliflowers ) in the Panpur-Keutia Mouza 22°49'33.18"N 88°24'30.45"E. In winters , vegetables are cultivated while in Kharif mostly paddy.





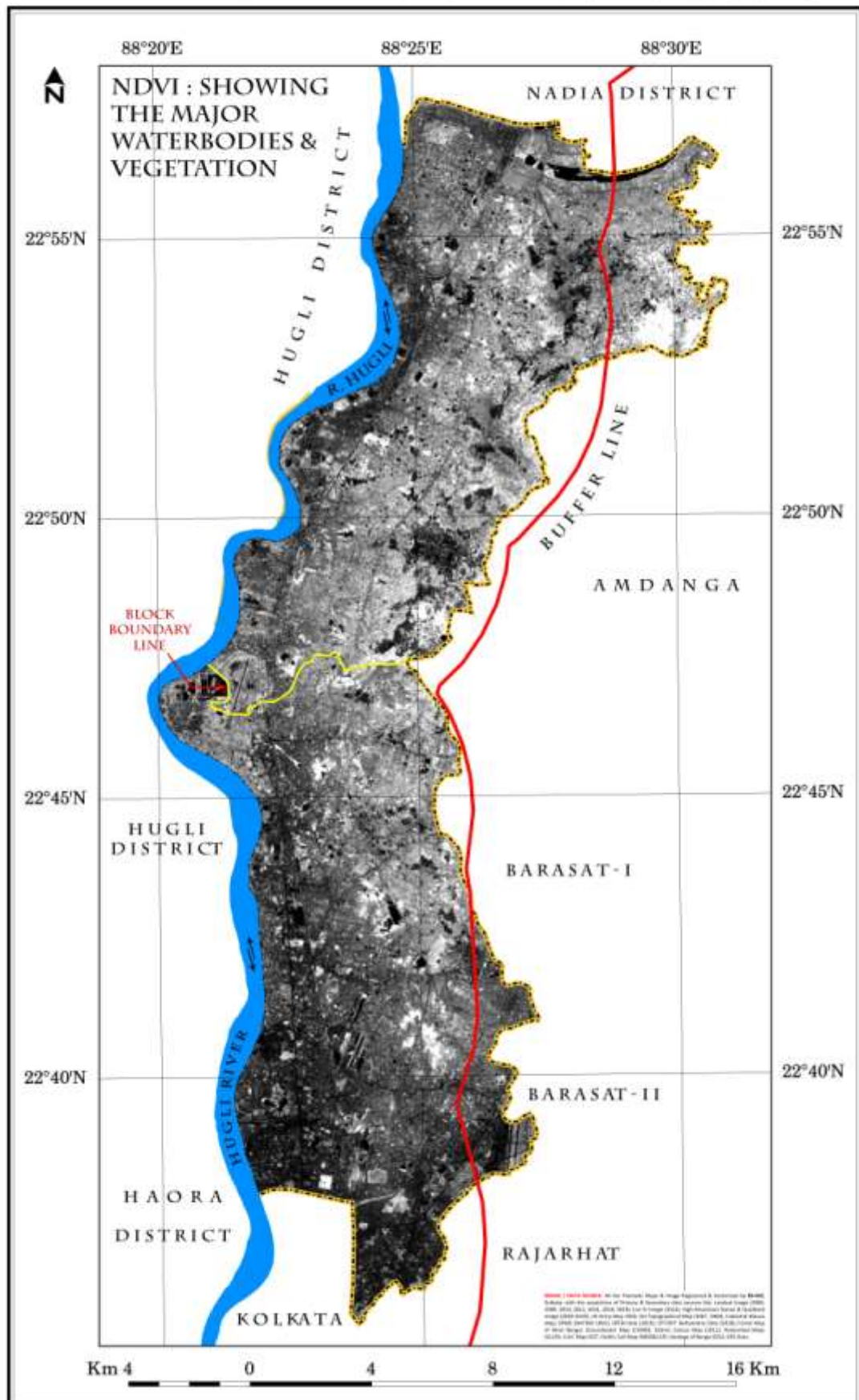
#### **4.5. WETLANDS IN THE STUDY REGION**

The wet lands in this Sub-division are formed by the natural and anthropogenic causes and are scattered all over the area. There are numerous small tanks of the size of less than 5000sq. metres on one hand, and large wetlands of more than 16,000 ha on the other. Generally depths of the wetlands are never more than 3 metres and most are much shallower (District Statistical Handbook, North 24 Parganas, 2007). Fluvial action has been the chief cause of creation of the natural wetlands in this region. Man-made water bodies found in the region are either for water supply or are borrow pits found along the highways, railways and in brick-fields. Small tanks less than 5000 sq. metres in the area are mostly dug by man.

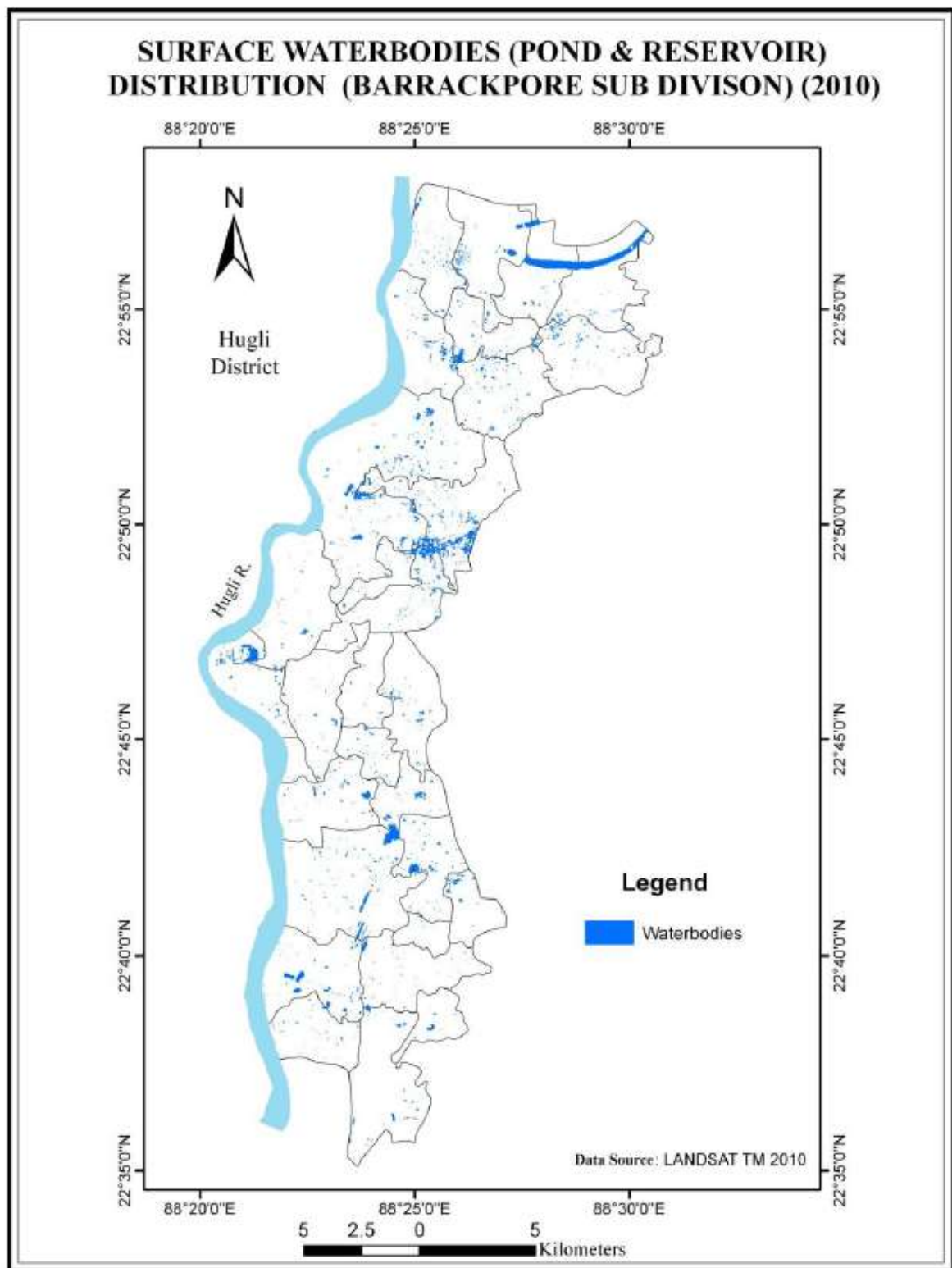
There are two major Paleochannel Wetlands within the study area . They are – Mathura Beel and Gayeshpur Kulia Jheel . Both these wetlands are considered as biologically sensitive habitat varying widely in shape, size and offer tremendous scopes for expanding both capture and culture fisheries. But because of extreme land pressure, they are slowly shrinking in size. In Panpur-Keutia Mouza near Basudevpur , there is another big Wetland covering 6 sq.km of area where mostly fishing is done . In the adjoining areas of wetlands lots of orchards (banana, papaya etc) are also planted. The water is used for irrigating the cultivated lands of the vicinity.



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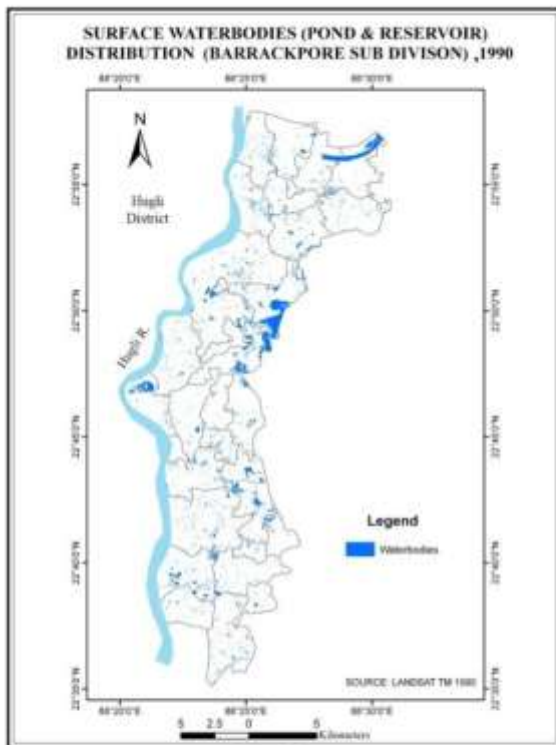
Map 27a– Application of NDVI technique to get Waterbodies of the locality



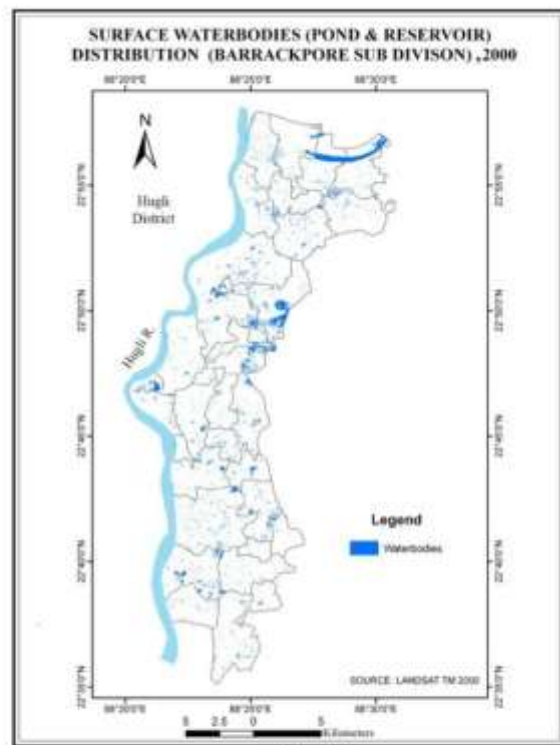
Map 27b- Waterbodies map of Barrackpore Subdivision Map



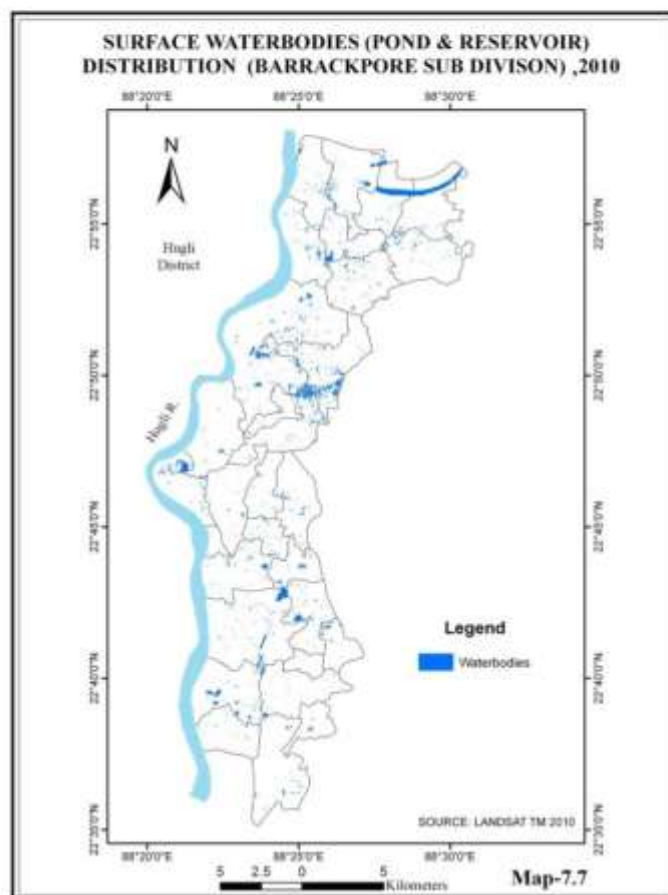
### SURFACE WATER BODIES (POND AND RESERVOIRS)



Map-7.5



Map-7.6



Map-7.7

Map 28- Showing the changes of water bodies over the period of time

**The major waterbodies of the locality are as follows-Table 9**

Sl no	Location	Ground Control Points	
		Latitude	Longitude
1.	Haisahar Municipality	22°57'28.50"N	88°24'54.02"E
2	Haisahar Municipality	22°57'19.57"N	88°24'56.71"E
3	Haisahar Municipality	22°56'48.78"N	88°25'18.70"E
4	Haisahar Municipality	22°57'1.04"N	88°25'2.87"E
5	Haisahar Municipality	22°56'42.53"N	88°25'5.63"E
6	Haisahar Municipality	22°56'21.68"N	88°25'16.27"E
7	Haisahar Municipality	22°56'5.67"N	88°25'11.46"E
8	Haisahar Municipality	22°56'5.67"N	88°25'11.46"E
9	Haisahar Municipality	22°55'13.37"N	88°25'59.24"E
10	Haisahar Municipality	22°55'50.06"N	88°25'59.08"E
11	Haisahar Municipality	22°55'38.60"N	88°26'10.20"E
12	Haisahar Municipality	22°55'25.47"N	88°26'31.37"E
13	Haisahar Municipality	22°53'49.11"N	88°25'58.36"E
14	Haisahar Municipality	22°56'3.19"N	88°24'54.25"E
15	Haisahar Municipality	22°55'50.96"N	88°24'59.56"E
16	Haisahar Municipality	22°55'51.20"N	88°24'57.50"E
17	Haisahar Municipality	22°55'48.52"N	88°25'0.70"E
18	Haisahar Municipality	22°55'43.69"N	88°24'55.08"E
19	Haisahar Municipality	22°55'42.36"N	88°24'48.39"E
20	Haisahar Municipality	22°55'38.84"N	88°24'47.05"E
21	Haisahar Municipality	22°55'33.23"N	88°24'43.48"E
22	Haisahar Municipality	22°55'28.35"N	88°24'47.92"E
23	Haisahar Municipality	22°55'27.93"N	88°24'49.94"E
24	Haisahar Municipality	22°55'24.59"N	88°24'52.18"E
25	Haisahar Municipality	22°55'15.13"N	88°24'50.92"E
26	Haisahar Municipality	22°55'19.68"N	88°24'51.63"E
27	Haisahar Municipality	22°55'28.91"N	88°24'48.36"E
28	Haisahar Municipality	22°55'15.57"N	88°24'58.04"E
29	Haisahar Municipality	22°55'28.23"N	88°24'48.96"E
30	Haisahar Municipality	22°55'2.58"N	88°25'9.10"E
31	Haisahar Municipality	22°55'2.66"N	88°24'56.18"E
32	Haisahar Municipality	22°54'53.60"N	88°25'10.68"E
33	Haisahar Municipality	22°54'54.17"N	88°25'16.83"E
34	Haisahar Municipality	22°54'46.79"N	88°25'10.78"E
35	Haisahar Municipality	22°54'46.24"N	88°25'18.00"E
36	Haisahar Municipality	22°54'41.29"N	88°25'10.06"E
37	Haisahar Municipality	22°54'49.91"N	88°25'4.15"E
38	Haisahar Municipality	22°55'3.05"N	88°25'8.58"E
39	Haisahar Municipality	22°54'51.89"N	88°25'16.79"E
40	Haisahar Municipality	22°54'42.70"N	88°24'53.88"E
41	Haisahar Municipality	22°54'32.32"N	88°24'51.87"E
42	Haisahar Municipality	22°54'41.70"N	88°24'25.28"E
43	Haisahar Municipality	22°55'15.70"N	88°24'51.07"E
44	Haisahar Municipality	22°54'53.08"N	88°24'57.17"E
45	Haisahar Municipality	22°54'37.20"N	88°24'25.20"E
46	Haisahar Municipality	22°54'37.26"N	88°24'16.76"E
47	Haisahar Municipality	22°54'23.90"N	88°25'14.60"E
48	Haisahar Municipality	22°54'16.19"N	88°25'28.46"E
49	Haisahar Municipality	22°54'1.19"N	88°24'48.91"E

50	Naihati Municipality	22°54'8.07"N	88°25'9.60"E
51	Naihati Municipality	22°54'4.58"N	88°25'8.96"E
52	Naihati Municipality	22°53'56.47"N	88°25'6.14"E
53	Naihati Municipality	22°53'46.80"N	88°25'6.94"E
54	Naihati Municipality	22°53'40.76"N	88°25'2.97"E
55	Naihati Municipality	22°53'36.30"N	88°24'59.40"E
56	Naihati Municipality	22°53'36.58"N	88°24'57.90"E
57	Naihati Municipality	22°53'34.54"N	88°25'1.06"E
58	Naihati Municipality	22°53'41.20"N	88°25'2.92"E
59	Naihati Municipality	22°53'38.58"N	88°25'8.22"E
60	Naihati Municipality	22°53'34.55"N	88°25'4.87"E
61	Naihati Municipality	22°53'31.88"N	88°25'6.93"E
62	Naihati Municipality	22°53'25.89"N	88°25'6.77"E
63	Naihati Municipality	22°53'30.33"N	88°24'42.62"E
64	Naihati Municipality	22°53'26.78"N	88°24'42.64"E
65	Naihati Municipality	22°53'9.88"N	88°24'57.37"E
66	Naihati Municipality	22°53'1.83"N	88°24'53.19"E
67	Naihati Municipality	22°53'2.22"N	88°24'50.65"E
68	Naihati Municipality	22°53'3.23"N	88°24'46.95"E
69	Naihati Municipality	22°53'5.07"N	88°24'43.56"E
70	Naihati Municipality	22°52'54.62"N	88°25'4.30"E
71	Naihati Municipality	22°52'38.05"N	88°25'13.19"E
72	Naihati Municipality	22°52'33.74"N	88°25'5.23"E
73	Naihati Municipality	22°52'31.25"N	88°25'2.52"E
74	Naihati Municipality	22°52'25.30"N	88°25'2.64"E
75	Naihati Municipality	22°52'5.64"N	88°24'30.45"E
76	Naihati Municipality	22°52'3.96"N	88°24'32.76"E
77	Naihati Municipality	22°52'0.56"N	88°24'37.14"E
78	Naihati Municipality	22°51'56.91"N	88°24'36.85"E
79	Naihati Municipality	22°51'56.28"N	88°24'41.67"E
80	Naihati Municipality	22°51'52.79"N	88°24'44.49"E
81	Naihati Municipality	22°51'55.85"N	88°25'3.57"E
82	Naihati Municipality	22°51'56.25"N	88°25'13.27"E
83	Naihati Municipality	22°51'48.66"N	88°25'9.43"E
84	Naihati Municipality	22°51'44.41"N	88°25'15.53"E
85	Naihati Municipality	22°51'39.53"N	88°25'20.81"E
86	Naihati Municipality	22°51'33.70"N	88°25'21.18"E
87	Naihati Municipality	22°51'31.61"N	88°25'19.66"E
88	Naihati Municipality	22°51'30.95"N	88°25'22.02"E
89	Naihati Municipality	22°51'32.63"N	88°25'23.66"E
90	Naihati Municipality	22°51'25.64"N	88°25'23.34"E
91	Naihati Municipality	22°51'23.87"N	88°25'24.15"E
92	Naihati Municipality	22°51'21.46"N	88°25'23.43"E
93	Naihati Municipality	22°51'19.81"N	88°25'24.58"E
94	Naihati Municipality	22°51'24.38"N	88°25'28.61"E
95	Naihati Municipality	22°51'20.16"N	88°25'35.53"E
96	Naihati Municipality	22°51'29.26"N	88°25'34.17"E
97	Naihati Municipality	22°51'20.35"N	88°25'43.54"E
98	Naihati Municipality	22°51'15.58"N	88°25'29.71"E
99	Naihati Municipality	22°51'5.34"N	88°25'30.92"E
100	Naihati Municipality	22°50'59.49"N	88°25'27.25"E
101	Naihati Municipality	22°51'11.41"N	88°24'54.66"E



102	BhatparaMunicipality	22°51'0.09"N	88°25'28.47"E
103	BhatparaMunicipality	22°51'17.89"N	88°22'57.81"E
104	BhatparaMunicipality	22°51'15.59"N	88°23'18.39"E
105	BhatparaMunicipality	22°50'47.38"N	88°23'8.58"E
106	BhatparaMunicipality	22°50'47.45"N	88°23'9.05"E
107	BhatparaMunicipality	22°48'53.23"N	88°22'20.21"E
108	BhatparaMunicipality	22°48'54.02"N	88°22'14.03"E
109	BhatparaMunicipality	22°48'44.88"N	88°22'17.90"E
110	Garulia Municipality	22°48'46.59"N	88°22'12.90"E
111	Garulia Municipality	22°48'39.85"N	88°22'7.61"E
112	Garulia Municipality	22°48'42.33"N	88°22'1.62"E
113	Garulia Municipality	22°49'0.06"N	88°21'40.45"E
114	Garulia Municipality	22°48'48.11"N	88°21'52.10"E
115	Garulia Municipality	22°49'0.76"N	88°21'41.10"E
116	Garulia Municipality	22°48'0.03"N	88°22'34.48"E
117	Garulia Municipality	22°47'56.61"N	88°22'31.82"E
118	Garulia Municipality	22°47'52.61"N	88°22'32.16"E
119	Garulia Municipality	22°47'48.00"N	88°22'34.03"E
120	Garulia Municipality	22°47'44.95"N	88°22'28.45"E
121	Garulia Municipality	22°47'30.31"N	88°22'26.63"E
122	Garulia Municipality	22°47'24.03"N	88°22'34.24"E
123	Garulia Municipality	22°47'7.88"N	88°22'47.24"E
124	N Barrackpore Municipality	22°46'58.17"N	88°22'48.53"E
125	N Barrackpore Municipality	22°46'42.26"N	88°23'2.33"E
126	Palta Water Works	22°47'1.67"N	88°21'16.13"E
127	N Barrackpore Municipality	22°46'31.74"N	88°21'10.89"E
128	N Barrackpore Municipality	22°46'9.41"N	88°20'49.28"E
129	N Barrackpore Municipality	22°45'47.19"N	88°21'3.27"E
130	N Barrackpore Municipality	22°45'34.93"N	88°21'51.05"E
131	N Barrackpore Municipality	22°45'23.03"N	88°21'57.47"E
132	N Barrackpore Municipality	22°43'51.89"N	22°43'51.89"N
133	Khardah Municipality	22°43'47.01"N	88°22'53.48"E
134	Khardah Municipality	22°43'33.35"N	88°23'17.91"E
135	Khardah Municipality	22°43'5.94"N	88°23'24.33"E
136	Khardah Municipality	22°43'43.84"N	88°23'54.91"E
137	Khardah Municipality	22°42'28.65"N	88°23'46.63"E
138	Khardah Municipality	22°42'22.99"N	88°22'47.31"E
139	Khardah Municipality	22°41'58.26"N	88°21'31.27"E
140	Khardah Municipality	22°41'51.08"N	88°23'32.57"E
141	Panihati Municipality	22°41'20.28"N	88°23'19.02"E
142	Panihati Municipality	22°41'18.10"N	88°23'24.32"E
143	Panihati Municipality	22°41'6.28"N	88°23'32.14"E
144	Panihati Municipality	88°23'32.14"E	88°23'44.13"E
145	Panihati Municipality	22°40'33.23"N	88°22'30.70"E
146	Panihati Municipality	22°40'3.32"N	88°22'15.74"E
147	Panihati Municipality	22°39'32.50"N	88°22'2.05"E
148	Panihati Municipality	22°39'32.46"N	88°22'19.11"E
149	Kamarhati Municipality	22°39'12.05"N	88°22'13.89"E
150	Kamarhati Municipality	22°38'55.77"N	88°22'17.96"E
151	Kamarhati Municipality	22°39'18.03"N	88°21'29.35"E
152	Kamarhati Municipality	22°39'5.49"N	88°21'33.80"E
153	Kamarhati Municipality	22°39'18.13"N	88°21'28.96"E

154	Kamarhati Municipality	22°39'6.77"N	88°21'33.70"E
155	Kamarhati Municipality	22°38'28.25"N	88°21'56.30"E
156	Kamarhati Municipality	22°38'28.92"N	88°22'2.23"E
157	Kamarhati Municipality	22°38'13.78"N	88°21'52.00"E
158	Kamarhati Municipality	22°38'14.88"N	88°21'58.44"E
159	Baranagar Municipality	22°38'15.41"N	88°22'1.38"E
160	Baranagar Municipality	22°37'58.70"N	88°22'13.56"E
161	Baranagar Municipality	22°37'59.03"N	88°22'5.37"E
162	Baranagar Municipality	22°37'58.93"N	88°22'13.46"E
163	Baranagar Municipality	22°37'57.07"N	88°22'26.83"E
164	Baranagar Municipality	22°38'4.50"N	88°22'28.48"E
165	Baranagar Municipality	22°38'8.87"N	88°22'47.27"E
166	Baranagar Municipality	22°38'13.19"N	88°22'42.35"E
167	Baranagar Municipality	22°38'19.32"N	88°22'36.65"E
168	Baranagar Municipality	22°41'19.65"N	88°23'19.46"E
169	Baranagar Municipality	22°41'6.38"N	88°23'30.95"E
170	Baranagar Municipality	22°41'0.63"N	88°23'37.06"E
171	Baranagar Municipality	22°41'0.63"N	88°23'37.06"E
172	Baranagar Municipality	22°43'51.38"N	88°22'38.16"E
173	Baranagar Municipality	22°43'43.34"N	88°22'38.91"E
174	Baranagar Municipality	22°43'44.50"N	88°22'54.66"E
175	Baranagar Municipality	22°43'33.18"N	88°22'46.81"E
176	Baranagar Municipality	22°43'14.17"N	88°22'45.40"E
177	Titagarh Municipality	22°43'18.71"N	88°22'27.41"E
178	Titagarh Municipality	22°43'15.32"N	88°22'12.18"E
179	Titagarh Municipality	22°43'0.31"N	88°22'11.93"E
180	Titagarh Municipality	22°43'7.40"N	88°22'4.91"E
181	Titagarh Municipality	22°42'42.42"N	88°21'59.24"E
182	Titagarh Municipality	22°42'40.95"N	88°22'5.55"E
183	Titagarh Municipality	22°42'44.12"N	88°21'56.64"E



Map 29- High Resolution Satellite Image showing Palta WaterWorks , Barrackpore



Plate 54 – Deshbandhunagar Pond , Garulia Municipality, N22.81722, E88.36065



Plate 55 – Kantapukur , Bhatpara Municipality 22°51'48.42"N 88°24'6.14"E





Plate 56 – Yamuna Das Pond , in Khardah Municipality, 22.722092, 88.366256



Plate 57 – Waterbody near 26 Shiva Mandir , Khardah, 88.362856

**WETLANDS IN PANPUR-KEUTIA MOUZA OF BARRACKPUR 1 BLOCK-**

Plate 57 b,c,d,e-There is a huge Wetland in the Panpur Keutia Mouza of Barrackpur 1 Block outside the Municipality area known as Basudevpur Wetlands  $22^{\circ}49'38.28''\text{N}$   $88^{\circ}25'14.89''\text{E}$ . This wetland covers an approximate area of 6sq.km. The Wetland is mostly used for fishing & irrigation purpose.







Plate 57 b,c,d,e-There is a huge Wetland in the Panpur Keutia Mouza of Barrackpur 1 Block outside the Municipality area . It is known as Basudevpur Wetlands 22°49'38.28"N 88°25'14.89"E. This wetland covers an approximate area of 6sq.km. The Wetland is mostly used for fishing & irrigation purpose.





**4.7. SACRED TREES AND GROVES-**

Sacred Groves and Sacred Trees are accompanied with virgin diversities. Those diversities are protected by regional and local communities since long time due to culture and belief, that the deity reside in those sacred groves and sacred trees and that can protect all the local and regional people from all sorts of calamities. The entire eastern stretch of Hugli River in our Study area there are numerous Sacred Trees and groves. Trees like Banyan, Neem, Peepul, Kath Champa, Aakondo, Fani Monsha, Tulsi, Sirish, Seora, Bel trees and shrubs are treated as sacred. They are mostly found within 250 m from the river and are associated with various deities. Here is a list of 129 sacred groves and trees spreaded in 8 municipalities. However the most sacred tree is the Great Banyan Tree of Panihati Mahatsabtala Ghat where Shri Chaitnya Mahaprabhu stayed and did Danda Chira Utsab with Nityananda, Raghav Goswami. Shri Shri Ramkrishna, Vivekananda, Mahatma Gandhiji and many other famous personalities came to this spot. It is said that this tree is about 800 years old.

**Table 10- Here is a detail list of the trees with GPS locations**

Municipality	Name of the Trees	Location	Deity associated	Distance from Hugli River
Kamarhati Municipality	Ganja Baba-1	22°39'51" N 88°21'23" E	Shiv,	Within 250 m
	Ganja Baba 2	22°40'02" N 88°21'36" E	Shiv, Chhinnamasta, Krishna, Kali	Within 250 m
	Maa Avaya Mandir	22°40'10" N 88°21'36" E	Shiv, Manasha	Within 250 m
	Maa Avaya Mandir 2	22°39'55" N 88°21'30" E	Shani	Within 250 m
	Pathbari	22°40'06" N 88°21'33" E	Krishna	Within 250 m
	Garan ghat	22°40'08" N 88°21'33" E	Shiv	Within 250 m
	Mallikbagan	22°40'10" N 88°21'35" E	Ganesh, Shiv, Loknath, Jagannath	Within 250 m
	Bat tala Ghat	22°40'20" N 88°21'40" E	Shiv, Santoshi Maa	Within 250 m
	Rathtala Mandir	22°40'19" N 88°21'50" E	Shiv	750 m
	Rathtala Mandir 2	22°40'24.07" N 88°21'45.12" E	Ganesh	Within 250 m
	Ganeshbaba	22°40'47.90" N 88°22'06.09" E	Shiv	750-1000m
	Titli Ghat 1	22°40'49.92" N 88°21'55.77" E	Shiv	Within 250 m
	Titli Ghat 2	22°40'51.03" N	Shiv	Within 250 m

		88°21'55.02" E		
	Titli Ghat 3	22°40'50.88" N 88°21'55.00" E	Shiv	Within 250 m
	Malapara Ghat 1	22°40'55.56" N 88°21'57.76" E	Shiv	Within 250 m
	Malapara Ghat 2	22°40'57.26" N 88°21'57.46" E	Shani	Within 250 m
	Malapara Ghat 3	22°40'57.26" N 88°21'57.46" E	Chhot Puja	Within 250 m
Panihati Municipality				
	Piyari Bostum Ghat	22°41'02.99" N 88°21'58.29" E	Shiv, Ganesh	Within 250 m
	Anandamoyi Ghat	22°41'09.78" N 88°21'59.69" E	Shiv	Within 250 m
	Giribala Ghat 1	22°41'21.93" N 88°21'59.72" E	Boishno Debi, Durga	Within 250 m
	Giribala Ghat 2	22°41'23.43" N 88°22'00.59" E	Shiv, Kali	Within 250 m
	Bosher Ghat 1	22°41'27.22" N 88°22'59.94" E	Shiv	Within 250 m
	Bosher Ghat 2	22°41'27.22" N 88°22'59.94" E	Krishna, Kali	Within 250 m
	Rakshya Kali Mandir	22°41'32.18" N 88°22'00.33" E	Shiv, Rakshya Kali	Within 250 m
	Bazarpara Ghat 1	22°41'38.77" N 88°21'59.15" E	Shiv, Manasha	Within 250 m
	Bazarpara Ghat 2	22°41'40.88" N 88°21'59.02" E	Shiv, Tara	Within 250 m
	Mahyotsab Tala Ghat 1	22°41'44.51" N 88°21'58.67" E	Loknath Baba	Within 250 m
	Mahyotsab Tala Ghat 2	22°41'47.55" N 88°21'58.05" E	Chaitanya Mahaprabhu, Shiv	Within 250 m
	Sukhchar Taorapara Ghat	22°42'36.59" N 88°21'53.86" E	Shiv, Ganesh, Durga	Within 250 m
Khardah & Titagarh Municipality	Biharilal Painer Thakur bari	22°42'42.82" N 88°21'54.12" E	Radha Gobindo	Within 250 m
	Girish Ghosh er Baganbari or Camper Ghat 1	22°42'49.50" N 88°21'53.29" E	Shiv	Within 250 m
	Girish Ghosh er Baganbari or Camper Ghat 2	22°42'54.77" N 88°21'52.88" E	Shiv	500 m
	Nathupal crematorium	22°43'07.21" N 88°21'51.96" E	Shiv	Within 250 m
	Shitala Matar	22°43'12.91" N	Shitala	750 m

	Mandir	88°21'50.02" E		
	Rashkhola Ghat	22°43'14.89" N 88°21'49.07" E	Kali, Shiv	Within 250 m
	Khardah Ferry Ghat or Shyamsundar Ghat	22°43'21.54" N 88°21'46.02" E	Shiv	Within 250 m
				Within 250 m
	Babur Ghat	22°43'31.62" N 88°21'44.60" E	Shiv, Ganesh, Hanuman, Krishna	Within 250 m
	Jute mill Ghat	22°43'52.26" N 88°21'44.43" E	Shiv	Within 250 m
	Laxmi Ghat 1	22°44'01.71" N 88°21'48.86" E	Shiv	Within 250 m
	Laxmi Ghat 2	22°44'00.94"N 88°21'52.60" E	Ganesh, Shiv, Krishna, Sain Baba	500m
	Laxmi Ghat 3	22°44'01.52" N 88°21'55.56" E	Shiv	500m
	Laxmi Ghat 4	22°44'01.41" N 88°21'56.08" E	Shiv	750m
	Glass kol Ghat 1	22°44'14.77" N 88°21'58.29" E	Hanuman, Kali, Saraswati	Within 250 m
	Glass kol Ghat 2	22°44'14.95" N 88°21'58.42" E	Hanuman	500m
	Glass kol Ghat 3	22°44'15.10" N 88°21'56.02" E	Shitala, Kali, Durga, Saraswati,	Within 250 m
	Glass kol Ghat 4	22°44'15.25"N 88°21'56.12"E	Krishna, Tirupati	Within 250 m
	Glasskol Ghat 5	22°44'15.46"N 88°21'55.40"E	Shiv	Within 250 m
	Glasskol Ghat 6	22°44'14.62" N 88°21'59.86" E	Shiv	Within 250 m
North Barrackpur Municipality	Baranashi Ghosh er snaner Ghat	22°44'53.54" N 88°21'55.30" E	Sherabali, Baishnovdebi	Within 250 m
	Barrackpur Burning Ghat	22°44'53.94"N 88°21'54.88" E	Shiv, Kali, Radhakrishna,	Within 250 m
	Arnapurna Ghat	22°44'56.85" N 88°21'53.66" E	Shiv, Kali, Radhakrishna,	Within 250 m
	Gandhi Ghat	22°44'56.85" N 88°21'53.66" E	Shiv, Kali, Radhakrishna,	Within 250 m
	Shiv Ghat	22°45'20.66" N 88°21'34.40" E	Shiv, Hanuman, Loknath baba,	Within 250 m



			Kali	
	Mangal Pandey Ghat	22°45'37.80" N 88°21'10.91" E	Shiv,	Within 250 m
	Gola Ghat 1	22°46'00.98"N 88°20'33.02"E	Ganesh, Shiv	Within 250 m
	Gola Ghat 2	22°45'59.28" N 88°20'33.91" E	Baishnovdebi,	Within 250 m
	Gola Ghat 3	22°46'15.56" N 80°20'13.25" E	Shiv	Within 250 m
	Char paiser Ghat	22°46'22.62" N 88°20'08.58" E	Shiv	Within 250 m
	Barrackpur Smanan Ghat	22°46'26.09" N 88°20'06.37" E	Shiv	Within 250 m
	Barrackpur Jetty Ghat	22°46'38.76" N 88°20'02.62" E	Shiv	Within 250 m
	Palta Shitala Ghat	22°47'35.04" N 88°21'13.97" E	Hanuman, Shiv, Loknath Baba	Within 250 m
	Kali Bari Ghat	22°47'43.65" N 88°21'20.31" E	Shoni, Kali, Shiv	Within 250 m
	Gazi Ghat	22°47'59.03" N 88°21'28.51" E	Shoni, Hanuman	Within 250 m
	Debitala Crematorium 1	22°48'43.99" N 88°21'28.51" E	Durga, Shiv, Ganesh	Within 250 m
	Debitala Crematorium 2	22°48'43.68" N 88°21'35.37" E	Shiv	Within 250 m
	Neemtala Ghat	22°48'59.98" N 88°21'31.60" E	Durga, Shiv	Within 250 m
Garulia Municipality				
	Garulia Crematorium 1	22°49'02.36"N 88°21'20'25"E	Shiv	Within 250 m
	GaruliaCrematorium 2	22°49'14.61"N 88°21'29.16"E	Kali,Loknath Baba	Within 250 m
	Girish Ghat	22°49'26.34" N 88°21'35.33" E	Shiv	Within 250 m
	Babu Ghat	22°49'32.35" N 88°21'39.05" E	Shiv	Within 250 m
	Kangali Ghat	22°49'15.72" N 88°22'36.98" E	Shiv	Within 250 m
	Kangali Ghat ferry	22°49'37.62" N 88°22'05.79" E	Hanuman, Ganesh, Shiv	Within 250 m
Bhatpara Municipality	Char number gate (Gate No. 4) Shaymnagar	22°49'29.72" N 88°22'26.85" E	Hanuman, Shiv	Within 250 m
	Shiv Mandir	22°49'31.14"N 88°22'27.55" E	Shiv	500m
	Bajrangbali Mandir	22°49'37.11" N 88°22'34.06"E	Hanuman	500m
	Shiv Mandir 1	22°49'38.97" N	Shiv	500m

		88°22'36.26" E		
	Shiv Mandir 2	22°49'43.80"N 88°22'38.63"E	Loknath Baba, Shiv	500m
	Kalibari Ferry Ghat	22°49'46.22"N 88°22'41.25"E	Shiv, Radha Krishna	Within 250 m
	Nona Babur Ghat	22°49'52.62" N 88°22'45.66" E	Shiv, Hanuman, Saraswati, Ganesh	Within 250 m
	Amal Basu Smriti Mandir Ghat or Sati Ghat	22°50'07.93"N 88°22'48.74"E	Shiv	Within 250 m
	Dadosh Shiv Mandir	22°50'06.57" N 88°22'51.73" E	Shiv, Hanuman	Within 250 m
	Panchanantola Seva Samiti	22°50'30.50"N 88°22'52.88"E	Shiv	500m
	Panchanantola 1	22°50'30.60"N 88°22'47.45"E	Shiv	500m
	Panchanantola 2	22°50'29.90"N 88°22'46.88"E	Shiv	500m
	Aathpur Ferry Ghat	22°50'43.37"E 88°22'39.70"E	Shiv	500m
	Aathpur Ferry Ghat 1	22°50'39.56"N 88°22'34.78"E	Shiv	Within 250 m
	Aathpur Ferry Ghat 2	22°50'40.18"N 88°22'34.51"E	Shiv, Kali	Within 250 m
	Maa Sarbeswari Kali Mandir	22°50'41.28"N 88°22'35.89"E	Hanuman, Shiv	500m
	Hanuman Mandir	22°51'22.11"N 88°22'48.49"E	Shiv, Hanuman	750m
	Jagatddal Ferry Ghat 1	22°51'29.71"N 88°22'28.82"E	Shiv	Within 250 m
	Jagatddal Ferry Ghat 2	22°51'28.78" N 88°22'28.23" E	Shiv	Within 250 m
	Shitala Mata Mandir	22°51'28.08" N 88°22'34.21" E	Shiv	500m
	Bichuli Ghat 1	22°51'21.98" N 88°22'49.00" E	Shiv	Within 250 m
	Bichuli Ghat 2	22°51'21.98" N 88°22'49.00" E	Shiv	Within 250 m
	3 no. Ghat 1	22°52'58.74" N 88°23'05.40" E	Shiv, Hanuman, Ganesh, Ram, Sita, Laxman	Within 250 m
	3 no. Ghat 2	22°52'00.28" N	Saraswati,	Within 250 m

		88°23'16.50" E	Serabali	
	3 no. Ghat 3	22°52'00.96" N 88°23'17.08" E	Krishna, Ganesh , Shiv, Laxmi, Bramha, Bishnu,	Within 250 m
	Shree Panchamukhi Hanuman Mandir	22°51'59.86" N 88°23'47.49" E	Shiv, Hanuman, Durga	500m
	Kankinara Paper Mill 1	22°52'09.75" N 88°23'38.77" E	Shiv	Within 250 m
	Kankinara Paper Mill 2	22°52'10.35" N 88°23'39.03" E	Shiv	Within 250 m
	Kankinara Paper Mill 3	22°52'10.40" N 88°23'38.85" E	Shoni	Within 250 m
	Hanuman Mandir	22°52'03.75" N 88°24'02.58" E	Hanuman	500m
	Shiv Mandir	22°52'04.25" N 88°24'03.28" E	Shiv	500m
	Clerk Ghat	22°52'16.54" N 88°23'56.55" E	Shiv, Durga, Kali, Shitala	Within 250 m
	Gure Ghat 1	22°52'16.47" N 88°24'12.04" E	Shiv, Hanuman	Within 250 m
	Gure Ghat 2	22°52'20.81" N 88°24'07.35" E	Shiv, Ganesh	Within 250 m
	Mute Ghat (Nabasangha)	22°52'23.90" N 88°24'12.34" E	Anukul Thakur, Radhakrishna, Shiv, Ganesh	Within 250 m
	Rup Dash Babur Ghat 1	22°52'24.29" N 88°24'13.84" E	Shiv	Within 250 m
	Rup Dash Babur Ghat 2	22°52'25.89" N 88°24'15.10" E	Shiv	Within 250 m
	Bakultala Ghat	22°52'28.45" N 88°24'18.10" E	Shiv	Within 250 m
	Vanga bandha Ghat	22°52'30.87" N 88°24'21.86" E	Bishnu, Shiv	Within 250 m
	Shiv mandir, Panchabramhasan	22°52'37.86" N 88°24'31.85" E	Shiv	500m
	Malapara Ghat	22°52'46.11" N 88°24'35.05" E	Shiv	Within 250 m
	Bhatpara Muktapur Crematorium 1	22°52'48.41" N 88°24'36.50" E	Shiv	Within 250 m
	Bhatpara Muktapur Crematorium 2	22°52'49.70" N 88°24'36.98" E	Shiv	Within 250 m
	Burning Ghat Line	22°52'49.90" N 88°24'36.98" E	Shoni	500m



	no. 6 (1)			
	Burning Ghat Line no. 6 (2)	22°52'53.76" N 88°24'50.26" E	Shiv	Within 250 m
				Within 250 m
Naihati Municipality	Bhulu Babur Ghat	22°53'07.80" N 88°24'42.38" E	Shiv RU	Within 250 m
	Naihati Ferry Ghat 1	22°53'21.79" N 88°24'42.87" E	Shiv	Within 250 m
	Naihati Ferry Ghat 2	22°53'24.13" N 88°24'44.60" E	Shiv	Within 250 m
	Loha Ghat	22°53'32.27" N 88°24'48.20" E	Shiv	500m
	Banerjeepara Snaner Ghat	22°53'36.75" N 88°24'44.54" E	Serabali, Laxmi, Narayan	Within 250 m
	Goalapara Ghat	22°53'46.73" N 88°24'39.43" E	Laxmi, Hanuman	Within 250 m
	Chai Ghat	22°54'08.98" N 88°24'30.74" E	Shiva	Within 250 m
	Siri Ghat 1	22°54'12.03" N 88°24'33.30" E	Hanuman, Durga, Kali, Shiv, Ganesh	Within 250 m
	Siri Ghat 2	22°54'11.11" N 88°24'29.77" E	Durga, Shiv, Shitala, Tara	Within 250 m
	Siri Ghat 3	22°54'13.54" N 88°24'33.30" E	Shiv, Krishna, Hanuman	500m
	Ram Ghat 1	22°54'24.13" N 88°24'25.08" E	Shiv, Santoshi Maa	Within 250 m
	Ram Ghat 2	22°54'23.37" N 88°24'24.45" E	Shiv,	Within 250 m
	Halisahar Municipality	Ramprasader Ghat	22°56'39.40"N 88°24'48.48"E	Maa Kaali



Plate 58 & 59 – Panihati Baro Mahotsavtala , with the oldest tree of the locality . Chaitnya Mahaprabhu halted here under this 700 year old Banyan Tree and did Danda Cheera Utsav. One of the most sacred tree of the entire stretch.





Plate 60- Ganja Baba-1 in Kamarhati Municipality



Plate 61 - Piyari Bostum Ghat, Panihati Municipality





Plate 62 - Girish Ghosh er Baganbari or Camper Ghat 1, Khardah Municipality



Plate 63- Maa Sarbeswari Kali Mandir Ghat , Bhatpara Municipality





Plate 64– Kunja Vatika , Khardah Municipality



Plate 65 - Nona Babur Ghat, Bhatpara Municipality





Plate 66– Ramprasader Ghat , Halisahar Municipality



Plate 67- Ganja Baba 2, Kamarhati Municipality





Plate 68 - Maa Sarbeswari Kali mandir , Naihati Municipality



Plate 69- Dakhineswar Temple complex, Kamarhati Municipality

## CHAPTER 5 – DOCUMENTING STRUCTURES IN THE RIVER

**5.1. MAJOR BRIDGES** - There are 4 bridges on River Bhagirathi-Hugli in this stretch . They are –

**A. VIVEKANANDA SETU** (also called **Willingdon Bridge** and **Bally Bridge**)  $22^{\circ}39'12.29''N$   $88^{\circ}21'27.36''E$  is a bridge over the Hugli River in West Bengal, India. It links the city of Howrah, at Bally, to its twin city of Kolkata, at Dakshineswar. Completed on 12 December 1930 & opened on 28 December 1930, it is a multispan steel bridge and was built to provide



Plate 70– Vivekananda Setu

road and rail links between the Kolkata Port and its hinterland. It is 2,960 feet (900 m) long having 9 Spans in total. The famous Dakshineswar Temple is situated on the banks of the Hugli River near the Bally Bridge. This bridge is the 2nd Oldest Bridge linking Howrah and Kolkata. The Bridge is about 90 years old and still standing tall. Since 2007, it's been accompanied by a new bridge, **Nivedita Setu**, 50m downstream. The bridge was originally named **Willingdon Bridge** after Viceroy of India, Freeman Freeman-Thomas, 1st Marquess

of Willingdon, who inaugurated it. It was eventually renamed Bally Bridge, before officially becoming known as Vivekananda Setu. The erection and Caissoning of the bridge was done by noted Kutchi-Mestri railway contractor and Industrialist Rai Bahadur Jagmal Raja. His nameplate can still be seen on each girder of the bridge. The construction of bridge started in year 1926 and was completed in year 1932. The fabrication of the bridge was done at works of Braithwate & Company, Calcutta. The Bridge was built with eight spans laid at distance of 300 ft each. The length of bridge is almost half mile with 10 km approach roads on both sides. The foundation laid with well-sinking 100 ft down the river beds, girding, erection of abutments, arching was all done by Jagmal Raja. This Railway bridge is also important in annals of History of Railway in India because the Railway for the first time crossed over River Hugli and reached Calcutta at Sealdah Terminus. The first train that ran across the bridge was named Jagmal Raja Howrah Express by the British, acknowledging the feat of Rai Bahadur Jagmal Raja. The bridge cost over ₹ 1 crore (US\$140,000) in those years.



Plate 72- Willingdon Bridge , Plaque in Vivekananda Bridge



**B. The Jubilee Bridge** (22°54'26.53"N, 88°24'18.61"E) is a former rail bridge over the Hugli River between Naihati and Bandel in West Bengal, India. It provided an important connection between Garifa railway station and Hugli Ghat railway station. The Jubilee Bridge was opened on 16 February 1885 in the fiftieth, or jubilee, year of the reign of Queen Victoria. Construction began in 1882 and was completed in 1887. The Chief Engineer in charge of construction works was Lt Col Arthur John Barry, nephew of Sir John Wolfe-Barry, project engineer of the London Tower Bridge. The Bridge was designed by Sir Bradford Leslie, Chief Engineer in India and Alexander Meadows Rendel. Its steel was manufactured by Hawks Crawshay of Gateshead in England and James Goodwin of Motherwell in Scotland. Bradford Leslie also designed the floating pontoon bridge across the Hugli in Calcutta, which was replaced by the Howrah Bridge in 1942 and the Gorai River Railway Bridge near Kushtia in Bangladesh. He was a son of the American painter Charles Robert Leslie, ultimately Professor of Painting at the Royal Academy in London. The Jubilee Bridge is noteworthy in that it is a cantilever truss bridge, constructed entirely by riveting, without any nuts or bolts used in the construction.



Plate 73– Jubilee Bridge on River Hugli connecting Naihati , N 24 Parganas with Hugli



Map- Location of Jubilee Bridge connecting Naihati with Hugli



Map – Connecting 2 Districts, Vivekananda Setu and Nibedita Setu

**C. Nivedita Setu** (also called Second Vivekananda Setu) 22°39'10.33"N, 88°21'28.07"E is a multi-span extradosed bridge completed 2007 over Hugli River connecting Howrah with Kolkata, in West Bengal. It runs parallel to and about 50 m downstream of the old Vivekananda Setu opened in 1932. The bridge is named after Sister Nivedita, the social worker-disciple of Swami Vivekananda. Belghoria Expressway that connects the meeting point of NH 16 with NH 19 at Dankuni to NH 12, NH 112, Dumdum/Kolkata Airport and northern parts of Kolkata passes over the bridge. The bridge is designed to carry 48,000 vehicles per day.

The 1932 Vivekananda Setu had become weak as a result of ageing and with heavy traffic even repairs became difficult. There was need for a second bridge.

The main challenge was to design and construct a new bridge that did not mar the view of the old Vivekananda Setu, did not dwarf the historically important Dakshineswar Kali Temple which is located well within visible distance, and carry substantially higher levels of fast traffic for around half a century. The bridge rests on deep-well foundations going down to the river bed level. It carries six lanes for high speed traffic. The carriageway is supported by 254 pre-stressed concrete girders. Cables from 14m high pylons extend additional support. Nivedita Setu is the first bridge in the country that is a single profile cable-stayed bridge. By design, the height of the columns is lower than the tip of the Dakshineswar temple.





**D. Sampreeti Setu** (22°54'25.77"N, 88°24'19.43"E) is a railway bridge on Hugli River. This bridge was inaugurated on 17 April 2016. It is situated between Garifa railway station and Hugli Ghat railway station in the Naihati-Bandel branch line. This bridge has been built as an alternative to the Jubilee Bridge (India). The bridge is 415 meters long. In 2000, the Indian Railway minister took the project to build this bridge, but the project got clearance in 2007 and construction commenced thereafter. The bridge was inaugurated in April, 2016. Contractor-Tantia Constructions Ltd.



Plate 75 – Sampreeti Bridge on River Hugli.

**5.2.MAJOR GHATS IN THE BANK OF RIVER HUGLI -**

The Hugli is the major river which flows all along the western stretch of about 50 km of the Barrackpore Sub-division. This river is also known as the Bhagirathi or the Ganga / Ganges. There are nos. of ghats built along the river. The Ghats were built for bathing purpose, trading activities, crematoriums and resting places. Some ghats have mandirs and ashrams also. Many has eye pleasing constructions. This culturally rich area oozes out history and heritage through its Ghats and cultural practises associated with them. Table 11- Important Ghats of the Study area.

Sl.n	Name of the Ghats	Location	GCP	Purpose
1	Rani Rashmoni Ghat	Halisahar	22°57'28.23"N 88°24'44.93"E	Domestic
2	Ittkhola Ghat	Halisahar	22°56'41.37"N 88°24'47.67"E	Domestic
3	'Sreemat Swami Nigamananda Swaraswati Ashram Ghat	Halisahar	22°56'26.20"N 88°24'49.98"E	Domestic
4.	Halisahar Launch Ghat	Halisahar	22°56'17.24"N 88°24'49.23"E	Ferry
5	Ramprasad Ghat	Halisahar	22°56'19.68"N 88°24'49.21"E	Domestic
6	Bandhaghat Park	Halisahar	22°56'3.37"N 88°24'46.19"	Domestic
7	Boldeghata Park	Halisahar	22°56'2.72"N 88°24'45.87"E	Domestic
8	Balida Ghata Siddheswari Ghat	Halisahar	22°55'55.16"N 88°24'43.83"E	Domestic
9	Jagannath Temple Ghat of Halisahar	Halisahar	22°55'28.22"N 88°24'28.51"E	Domestic
10	Chandani Ghat Jagannath Temple	Halisahar	22°55'0.40"N 88°24'12.24"E	Domestic
11	Halisahar Maha Swamsan Ghat -	Halisahar	22°54'57.03"N 88°24'12.77"E	
12	Garifa-Hugli Ghat Ferry Service	Naihati	22°54'22.15"N , 88°24'19.96"E	Ferry
13	Sidi Ghat / Sita Ghat	Naihati	22°54'7.94"N, 88°24'27.24"E	Domestic
14	Naihati Ferry Service Pier (Naihati Ghat)	Naihati	22°53'24.21"N 88°24'41.09"E	Ferry
15	Lichubagan Ghat	Naihati	22°53'8.17"N 88°24'42.24"E	Domestic
16	Muktarpur Burning Ghat		22°52'48.77"N 88°24'36.13"E	Domestic
17	Kalimandir Ghat and Park	Bhatpara	22°52'35.64"N 88°24'26.30"E	Domestic

18	Meye Ghat & Park	Bhatpara	22°52'35.46"N 88°24'26.28"E	Domestic
19	Raj Krishna Ghat & Park	Bhatpara	22°52'20.64"N 88°24'7.72"E	Domestic
20	Kankinara Ghat	Bhatpara	22°52'9.44"N 88°23'37.10"E	Domestic
21	Jagaddal Raw Water Pump Station	Bhatpara	22°51'51.00"N 88°22'51.43"E	Ferry
22	Jagaddal Ghat	Bhatpara	22°51'30.56"N 88°22'27.04"E	Domestic
23	Athpur Ferry Ghat	Bhatpara	22°50'40.24"N 88°22'31.86"E	Ferry
24	Shyamnagore Mulajore Ferry Ghat	Garulia	22°49'46.50"N 88°22'40.74"E	Ferry
25	Ratneswar Ghat	Garulia	22°49'37.29"N 88°22'23.99"E	Domestic
26	Babu Ghat	Garulia	22°49'32.70"N 88°21'39.51"E	Domestic
27	Debitala Ferry Ghat	Garulia	22°48'37.03"N 88°21'32.01"E	Ferry
28	Debitala Shamshan Ghat	Garulia	22°48'43.08"N 88°21'35.07"E	
29	Gaji Sahebtala Ghat	Garulia	22°47'49.95"N 88°21'21.92"E	Domestic
30	Mondal Ghat	Nababgang	22°47'47.56"N 88°21'22.42"E	Domestic
31	Du Paisar Ghat	Barrackpur	22°46'40.22"N 88°20'1.11"E	Ferry
32	College ghat or Manirampur ghat	Barrackpur	22°46'21.71"N 88°20'6.69"E	Domestic
33	Dhobighat, Barrack Pore	Barrackpur	22°45'54.91"N 88°20'39.77"E	Ferry
34	Shib Mandir	Barrackpur	22°45'37.60"N 88°21'10.92"E	Domestic
35	Gandhi Ghat	Barrackpur	22°45'9.86"N 88°21'44.14"E	Domestic
36	Rasmani Ghat	Barrackpur	22°44'57.46"N 88°21'53.36"E	Domestic
37	Lakhi Ghat	Titagarh	22°43'53.13"N 88°21'44.39"E	Domestic
38	Shayam Sundar Ghat	Titagarh	22°43'22.00"N 88°21'43.24"E	Domestic
39	Nathupal Ghat Shamsan	Titagarh	22°43'7.42"N 88°21'50.99"E	
40	Baro Mandir Ghat Panihat	Panihati	22°42'12.37"N 88°21'56.40"E	Domestic
41	Tranbabu Ghat / SATSANG GHAT	Panihati	22°41'59.70"N 88°21'57.15"E	
41	Shri Shri Chaitanya Mahaprabhu Temple Panihati	Panihati	22°41'48.75"N 88°21'56.60"E	Domestic
42	Panihati Ferry Ghat	Panihati	22°41'45.45"N 88°21'56.88"E	Ferry



43	Giribala Temple	Panihati	22°41'21.98"N 88°22'0.74"E	Domestic
44	Saheb Kutir	Panihati	22°41'16.70"N 88°21'59.91"E	Domestic
45	Anandamayee Ashram	Panihati	22°41'10.58"N 88°22'0.67"E	Domestic
46	Kamarhati Pituri Ghat	Kamarhati	22°40'50.83"N 88°21'54.64"E	Domestic
47	Muktokeshi Mandir	Ariadaha	22°39'59.73"N 88°21'29.34"E	Domestic
48	Ganga Mata Temple	Ariadaha	22°39'57.16"N 88°21'28.43"E	Domestic
49	Dakshineswar - Belur Motor Boat Termina	Dakhineswar	22°39'23.12"N 88°21'24.42"E	Ferry
50	Joy Mitr Kalibari, Kali Temple	Baranagar	22°38'22.47"N 88°21'40.25"E	Domestic
51	Kuthi Ghat	Baranagar	22°38'7.21"N 88°21'48.20"E	Ferry
52	Satidaha Ghat	Baranagar	22°37'57.23"N 88°21'50.44"E	Domestic



Plate 76– Kuti Ghat, Baranagar Municipality



Plate 77– Bamboos are stacked in Kamarhati Pituri Ghat



Plate 78– Babu Ghat , Garulia Municipality





Plate 79- Ramprasad Ghat , Halisahar Municipality



Plate 80– Glass Khal Ghat , Titagarh Municipality





Plate 81– Titagarh Ferry Ghat , Titagarh Municipality



Plate 82 - Baro Mandir Ghat , Panihati Municipality



Plate 83 - Debitala Cremation Ground , Garulia Municipality



Plate 84 - Bhatpara Kalimandir Ghat



Plate 85 – Khardah 26 Mandir Ghat



Plate 86- 26 Temple Complex





Plate 87 – Camper Ghat with 200 Old Tree



Plate 88– Khardah Ferry Ghat



Plate 89 - Rajkrishna Ghosh Ghat , Bhatpara

Plate 90– Kamarhati Ghat, 22°41'22.32"N 88°21'59.49"E



### **5.3. INDIRA GANDHI WATER WORKS - 22°46'56.87"N, 88°20'41.40"E**

Hugli River is the main source of potable surface water for the city of Kolkata supplied from the age-old Palta Water Works now rechristened as Indira Gandhi Water Treatment Plant. The Palta Water Works, spreading over a sprawling stretch of 480 acres, was the first intake point constructed during 1864-1870 for generation and supply of water. Initiated with a humble capacity of 6 mgd (million gallon per day), filtered water was generated through sedimentation in pre and final settling tanks and slow sand filtration in the Old Series of 12 filter beds. Further addition of 24 beds with a capacity of 1 mgd per bed, was made during the period 1888-1893. In 1905, filter beds with 2 mgd capacity, called New Series was started. Further addition took place in between 1920 and 1936 when 17 nos. of 3mgd capacity and 1 no. of 2mgd capacity filter beds, called Extension Series were introduced.

It is said that old is gold and the relentless service of this age-old pumping station is certainly proving the point. With an output of 130 mgd, the plant seems to have perennial capacity to serve. The slow sand filtration system is an effective and reliable system which does not require daily washing. A single bed can work up to 100 to 120 days. Formation of a biological mat soon after effective charging removes turbidity, colour and microorganisms, by 95%. Due to this process, requirement of chlorine as a disinfectant of about 10 to 20 mm of top sand layer every 100 days, make the bed ready for reuse.

Further development took place with the introduction of rapid gravity filter with 12 beds and 20 mgd capacity during 1952. This process helped in reducing the sedimentation time. In 1968, another 60 mgd rapid gravity filtration unit was added. The present arrangement did not however, seem to suffice the demand level. In 2002, KMC supplied 281 mgd of water, falling short of the demand by almost 50 mgd. However, in 2003, the average supply rose to 334 mgd, meeting nearly 90% of requirement. Keeping in tune with the growing rate of population and proportionally accelerating rate of demand, KMC has undertaken several capacity enhancement and upgradation programmes and hopes to exceed the demand by 2005.

**New Palta Water Works at Indira Gandhi Water Treatment Plant**, is a notable step in this development process. It is a 100 mgd water generation project. This scheme, which is to be commissioned on 29th July 2004, further augments the capacity of Palta by 60 mgd, taking the already commissioned 20 mgd treatment plant, out of the planned 100 mgd additional



supply. This ,along with the increased supply from Garden Reach Water Works,will increase the per capita water supply to 234 liters per day from the present 202 liters per day. This would indeed be a feather in the cap of KMC,as it benchmarks the highest water supply level in the country.



Plate – Indira Gandhi Water Works, Map – Showing the location on Satellite Image, Restricted Area ( Photography is not allowed)

**5.4. INLAND NAVIGATION-**

Our study area falls under the National Waterway 1 or NW-1 or Ganga-Bhagirathi-Hugli as it runs from Haldia (Sagar) to Prayagraj across the Ganges, Bhagirathi and Hugli river systems. One of the major challenges of the navigation is the heavy silt load and fluctuation in the depth of the river.

**Ferry Services** – North 24 Parganas is a densely populated area which is connected with Haora and Hugli district with Ferry services. There are 16 Ferry Services routes in the entire 42 stretch. Table 12- Ferry Service in the Study area.

Sl.N	Ferry Service Location (From)	Ferry Service Location (Upto)	GCP
1	Kutighat , Baranagar Municipality	Belur , Haora District	22°38'7.19"N 88°21'46.37"E
2	Dakshineswar , Kamarhati Municipality	Belur, Haora District	22°39'23.27"N 88°21'24.12"E
3	Ariadaha , Kamarhati Municipality	Uttarpara , Haora District	22°40'0.20"N 88°21'28.20"E
4	Panihati , Panihati Municipality	Konnagar , Haora District	22°41'45.49"N 88°21'56.62"E
5	Khardah Shyamsundar Ghat,Khardah Municipality	Rishra , Haora District	22°43'22.13"N 88°21'43.72"E
6	Peer Ghat ,Titagarh Municipality	Mahesh , Hugli District	22°44'45.98"N 88°21'57.28"E
7	Barrackpur Ghat , Barrackpur	Serampore , Hugli District	22°45'52.04"N 88°20'40.78"E
8	Du Poishar Ghat, Barrackpur	Sheoraphully,Hugli District	22°46'39.93"N 88°20'1.01"E
9	Debitala Ghat , Garulia	Bhadreshar , Hugli District	22°48'53.40"N 88°21'32.97"E
10	Babu Ghat , Garulia	Bhadreshar , Hugli District	22°49'33.17"N 88°21'39.77"E
11	Shyamnagar Mulajore	Telinipara , Hugli District	22°49'47.24"N 88°22'40.94"E
12	Anthpur , Jaggadal	Gondalpara, Hugli	22°50'40.18"N 88°22'33.69"E
13	Jagaddal , Jaggadal	Chandannagar, Hugli	22°51'31.09"N 88°22'27.67"E
14	Machubazaar , Naihati	Chinsurah, Hugli	22°53'24.48"N 88°24'41.49"E
15	RamGhat , Naihati	HugliGhat , Hugli	22°54'20.46"N 88°24'21.15"E
16	Halisahar , Halisahar	Bansdroni , Hugli	22°57'58.12"N 88°24'32.60"E



Plate 91– Khardah Ferry Ghat , 22°43'22.13"N 88°21'43.72"E



Plate 92– Jaggadal Ferry Ghat, 22°51'31.09"N, 88°22'27.67"E





Plate 93 – Naihati Ferry Ghat  $22^{\circ}53'24.48''N$  ,  $88^{\circ}24'41.49''E$



Plate 94–Babu Ghat , Garulia  $22^{\circ}49'33.17''N$   $88^{\circ}21'39.77''E$

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## Chapter 6 - DOCUMENTING LIVELIHOOD PATTERN & ACTIVITIES IN AND AROUND THE RIVER HUGLI.

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### 6.1. LANDUSE PATTERN OF THE STUDY AREA

Land Use Land Cover (LULC) Map of the study area has been prepared from Landsat imagery of 1990 & 2019. Using unsupervised classification system we have kept 5 major LULC classes like – Waterbody/Wetland , Vegetation , Settlement ( urban area ), Fallow land . In both the cases the maximum land is under urban settlement followed by vegetation, waterbody and fallow land . Since the entire stretch covers very old municipalities like Halisahar, Naihati, Bhatpara, Kamarhati,Panihati , Barrackpore etc ,it is obvious that these area has a predominant urban agglomeration.

6.2 The total study area constitutes 729.26 sq.km. overing the Barrackpur Subdivision ,of North 24 Pargans . .

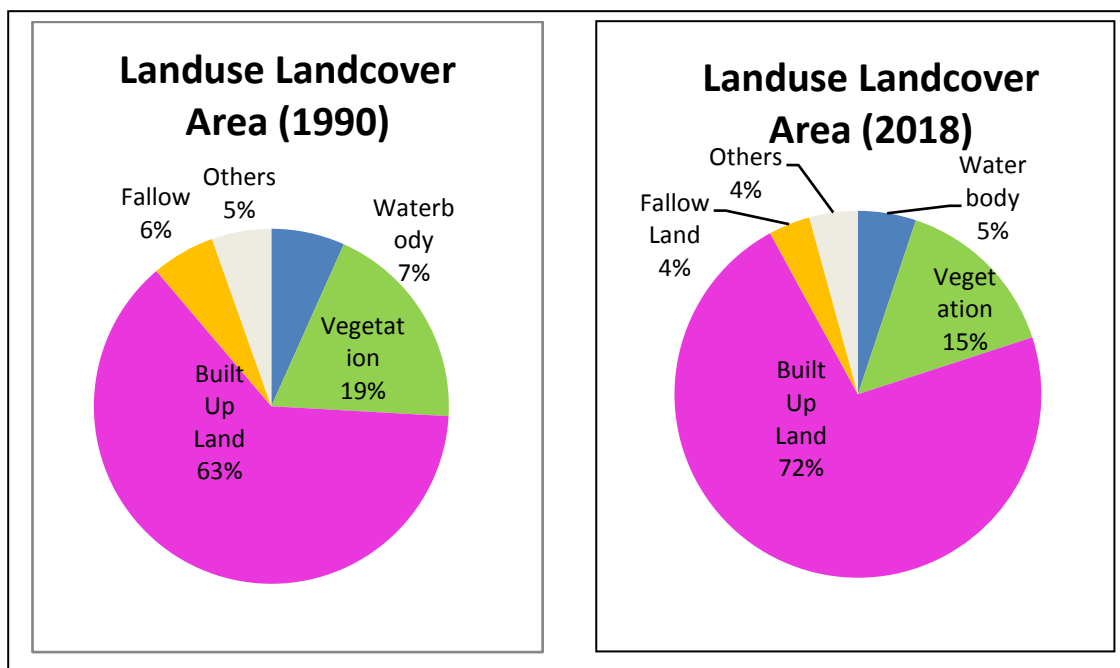
- Settlement area ( Urban, Built Up area ) has a distribution of 525.65 sq.km that is about 72.08 % in the year 2019 which was 62.90% in 1990. This class also includes Industrial Belt all along the Hugli River.
  - It is very much evident from the data that this area has a rapid urbanisation history indicating the change in area cover from 62.90 % to 72.08% within a span of 18 years People move into urban areas from the rural area of Barrackpore CD Block-I and II of Barrackpore Sub-division to seek economic opportunities. A major contributing factor is known as "rural flight". In rural areas, often on small family farms, it is difficult to improve one's standard of living beyond basic sustenance. Farm living is dependent on unpredictable environmental conditions, and in times of drought, flood or pestilence, survival becomes extremely problematic. Barrackpore Sub-division houses traditional, historical as well new blue chip industrial units. It also houses some of the most prestigious public sector undertakings of national importance like Ichapore Rifle Factory, Gun and Shell Factory, Kancharapara Railway Workshop, Jessop & Co., Bengal Chemicals, Bengal Water Proof, Tractor

India Ltd., Esab India Ltd., India Foils, Worthington Pumps, Electro Steel, Texmaco, Modern Engineering etc.

- Waterbody / Wetlands occupy the next category of Land Cover Class with the distribution of 37.18 sq.km which is 5.12 % in 2019 . In 1990 , however the this class was 6.70 %.
- Vegetation and Scrub land together constitute 14.86% of the total study area. This includes urban green spaces in the various Municipalities of the study area. Riparian vegetation patches and vegetation on riverine islands are negligible.
- Fallow/Open land has a distribution of 3.67% of total study area. It covers river bed, abandoned construction sites, brick kiln areas **Brick kin area comprises 2 % of the over all area. Table 13 – LULC Categories with area**

Sl.No	Landuse / Landcover	Year	
		1990	2019
1	Waterbody/Wetland	48.86 sq.km (6.70%)	37.18 sq.km 5.12%
2	Vegetation	139.94sq.km (19.19%)	108.36sq.km 14.86%
3	Built Up area (Settlement/Industrial/Commercial)	458.70sq.km(62.90%)	525.65sq.km (72.08%)
4	Fallow	42.15sq.km(5.78%)	26.76sq.km(3.67%)
5	Other	39.59sq.km(5.43%)	31.13sq.km(4.27%)
	Total	729.26sq.km(100%)	729.26sq.km(100%)

Based on Landsat data – 1990/2019.



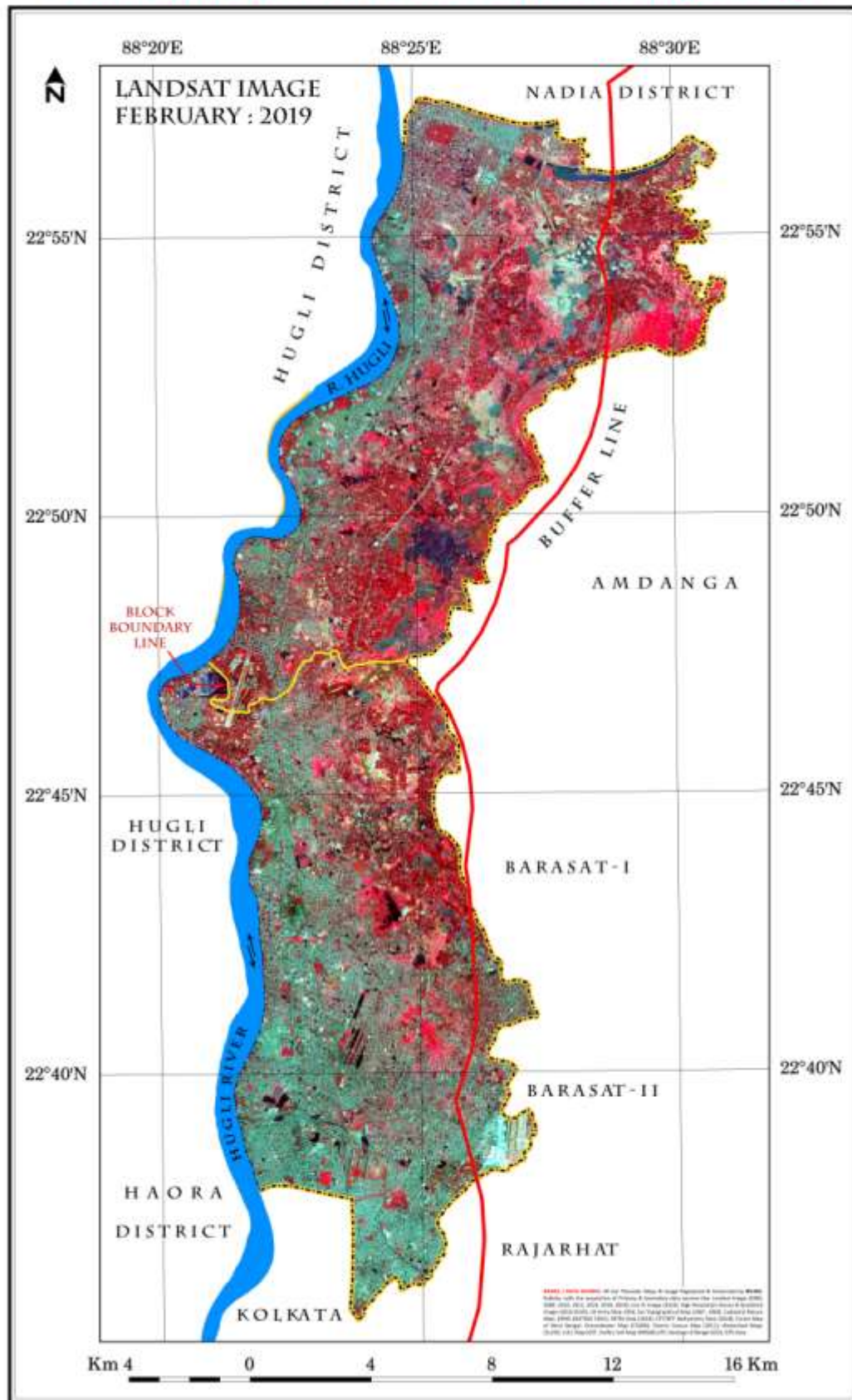


**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DOCUMENTATION OF NATURAL RESOURCES**

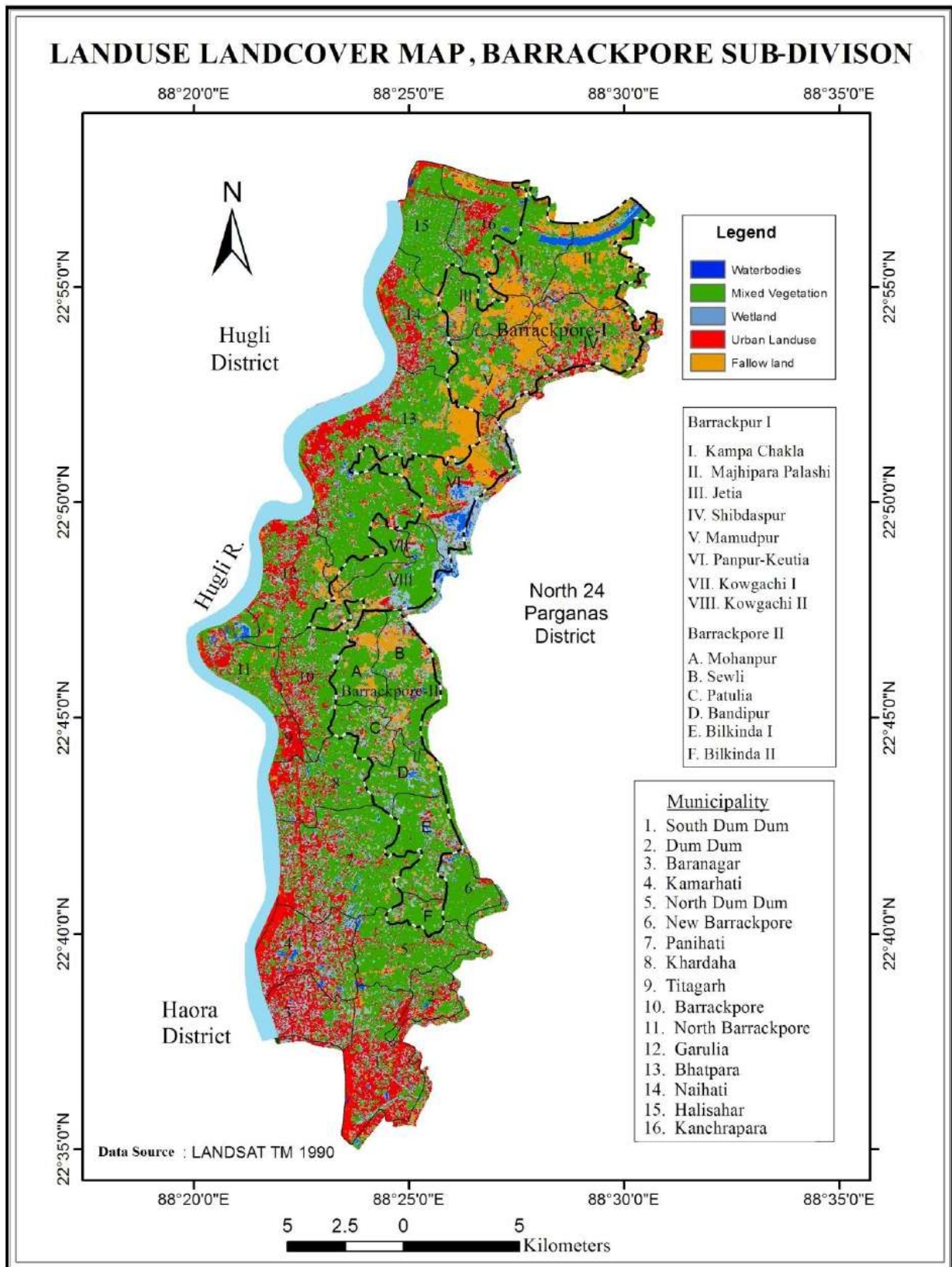


Map 30 : High Resolution Image , Barrackpore Subdivision

**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)  
GANGA DOCUMENTATION OF NATURAL RESOURCES**



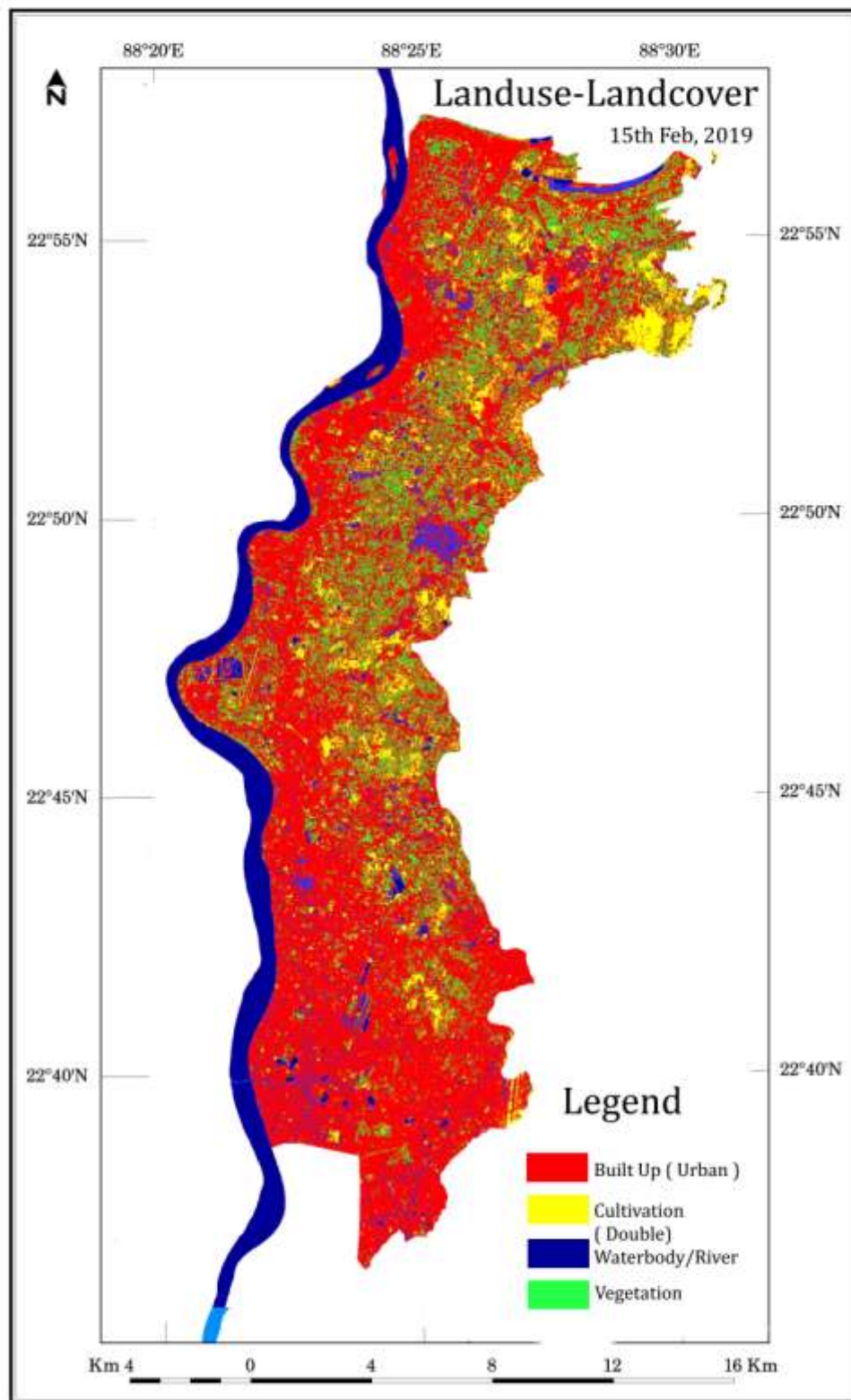
Map 31- Landsat FCC Image , 2018 , showing the study area



Map 32 : Landuse Landcover Map ,Barrackpore Subdivision 1990

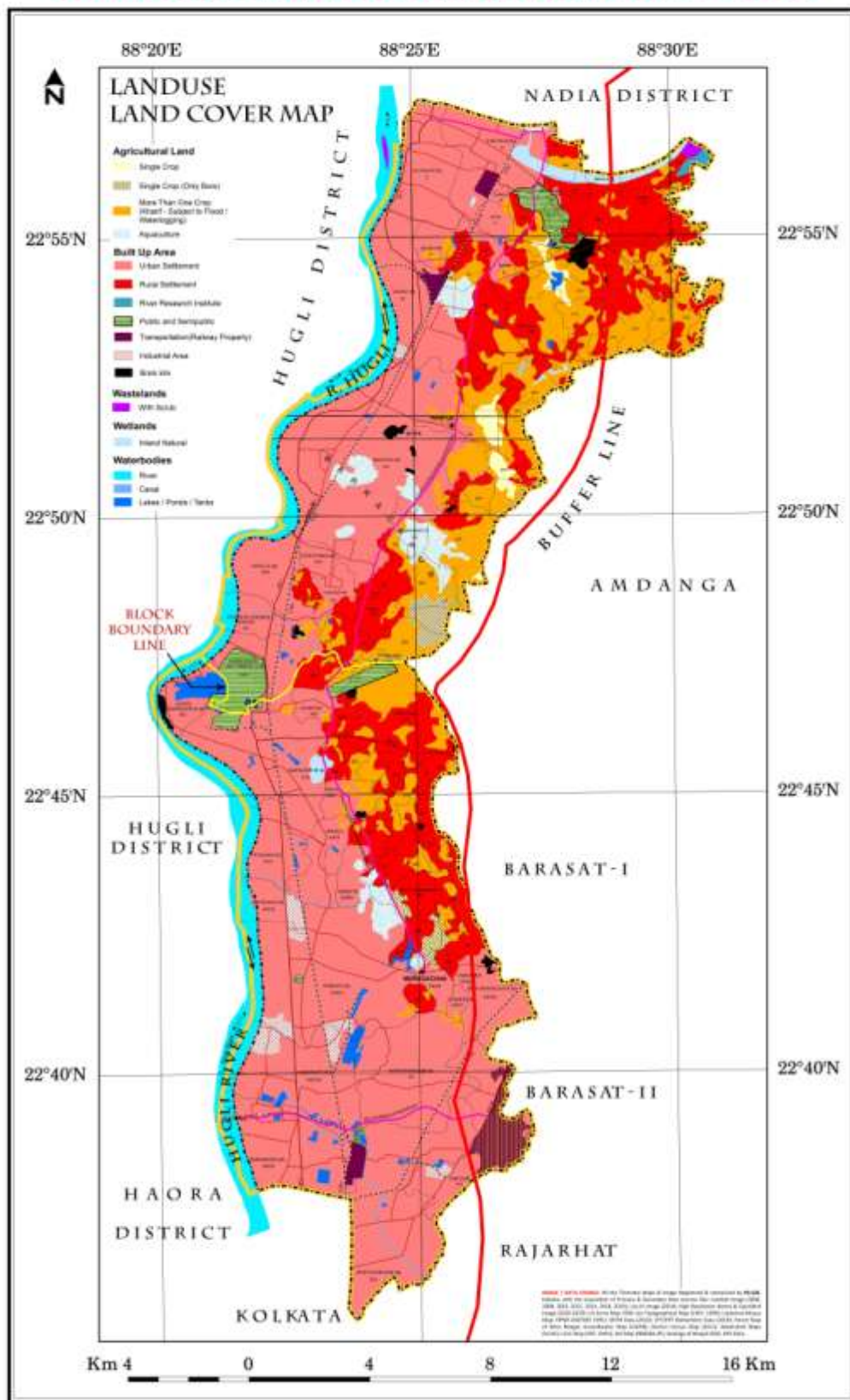


**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DOCUMENTATION OF NATURAL RESOURCES**



Map 33 : Landuse Landcover Map ,2019

**BARRACKPORE I & II BLOCK (NORTH 24 PARGANAS)**  
**GANGA DOCUMENTATION OF NATURAL RESOURCES**



Map 34– Landuse Landcover Map , Source DPMS ( District Planning Map Series )

## 6.2. RIVER / CHANNEL BANK USING FOR VARIOUS ECONOMIC ACTIVITIES

### 6.2A. Industrial & Manufacturing economy: Past & Present

Barrackpore Subdivision ( our Study area ) falls under the “ The Hugli Industrial Belt” or “Kolkata Industrial Belt”. It is India's oldest and second largest Industrial area (Silpancalasilpancalati) the banks of the Hugli river in the north to the south of Triveni-Kalyani, Uluberia-Biralapura 100 km long and 15–10 km wide zone to the industrial development of the Kolkata district and some part of North 24 Parganas, South 24 Parganas, Nadia, Hugli district and Howrah district.

#### The major industries of Barrackpore Sub Division are –

Historically the Barrackpore Subdivision was one of the famous subdivisions not only in the state but also in India with a large nos of Jute, Engineering, Textile, Paper, Chemicals, Aluminum, Enamel, Ordnance factories etc. Old time industries included handloom weaving cotton, leather tanning, brass and bell metal industries, pottery, embroidery, handicraft etc. Industrial development in this region dates back to the latter part of the 19th century when jute mills were set up along both sides of River Hugli. These were followed by the large scale industries such as: (i) Jute and textile, (ii) Iron & steel, (iii) Engineering, (iv) Chemicals, (v) Paper, and (vi) Cotton textile.

#### i. Jute Industry-

All the jute industries were clustered on the banks of Hugli in Barrackpore / Naihati region. Important concentrations are at Titagarh and Jaggadal. The items of jute goods produced include **hessian, sacking bags and twill, sacking and decorative fabrics, fine scale yarn, carpet backing cloth, carpet and wobbling , canvas** of A twill and B twill, D.W tarpaulins etc.

After the Second World War was over, came the partition on 15th August 1947 as a result of which most of the jute growing areas went to East Pakistan (now Bangladesh) where all the jute mill excepting a few remained in the Indian Union on both side of the River Hugli. There was very little expansion of the industry during the years of the Second World War; nevertheless, at the end of the war that is in 1945 there were 111 mills with an installed capacity of 68,542 looms. The industry has completed its hundred forty five years of existence. Its productive capacity has increased from 1.2 million tons per year in the First



Plan Period to 1.4 million tons at the end of the Second Plan period and 1.6 million tons at the end of this century (The Bengal Chamber of Commerce and Industry, 1971).

Some of the major Jute Mills are –

1. Agarpara Jute Mills Ltd.
2. Anglo India Jute Mills Ltd.
3. Auckland International Ltd.
4. Barnagore Jute Factory
5. Empire Jute Co. Ltd.
6. Eastern Jute Mills
7. Meghna Jute Mills
8. Titaghar Jute Mills
9. Baranagar Jute Mills
10. Nellimarla Jute Mills
11. Kamarhatty Co. Ltd.
12. Kanknarrah Co. Ltd.
13. Kelvin Jute Co. Ltd.
14. Ludlow Jute Mills
15. Naihati Jute Mills Ltd.
16. National Jute Mfg. Corpn. Ltd. (Khardah)
17. Reliance Jute Ltd.  
(International Ltd.)
18. Titaghar No. 2 Jute Mills
19. Victoria Jute Co. Ltd.  
(RDB Textiles)
20. Kevin Jute Mill
21. Kinnison Jute Mill
22. Weaverly Jute Mills
23. Hoogli Mill
24. Jagatdal Jute Mill
25. Dedico Vyapaar Private Limited



Plate 95– Jai Jute Industries Ltd, Nahati Municipality , N22.88450 ,E88.41270 ,



Plate 96– Khardah Jute Mill, Source – Website Khardah Jute Mill )

British jute businesses exited India and the jute mills were soon taken over by Indian traders, motivated to earn short-term profits. Signs of rot in the industry started showing up in the 70s and today, the jute industry lies in shambles. The slow economic decline of West Bengal is being blamed for the closure of industrial units and the loss of employment for many. This industry provides a livelihood to more than 3 lakh mill workers and more than 4 million families. However, low and irregular wages, alleged exploitation of workers, and a host of other problems have led to mills shutting down in the state. Even jute mill owners are not faring well, and many have shut down or are struggling to pay their workers. In its heyday, the jute industry had drawn thousands of workers from Bihar, Odisha, Uttar Pradesh and Madhya Pradesh to West Bengal, but many have since returned. Hundreds of local labourers have either opted for menial work or migrated to other states in search of work. The jute industry is also facing a challenge from alternative materials/fabrics available in the market. Low awareness among consumers of the versatility and eco-friendly nature of the jute fabric have also been a stumbling block in making it popular. Another major issue is the availability of good quality raw jute.



Plate 97- The Nuddea Mills Company Limited





Plate 98a - Kelvin Jute Mill , Titagarh 22.74763, 88.36940, Plate 98b-The Naihati Jute Mills



ii. **Engineering Industry**-Barrackpore Sub-division is one of the leading areas in the production and export of engineering goods from West Bengal. A large number of private and public sector units are participating in the product of various engineering goods. 60% of total engineering exports are done from West Bengal (Bagchi, 2006). Major engineering industries in this Sub-division include machine tools, textile machinery, transport equipment, railway engine, wagon manufacturing, precision engineering goods, etc. Decline of jute textiles has made engineering the most important type of industry of this industrial region in the recent years. But unlike jute, this industry varied most widely from a very humble small scale type to highly modernized capital-intensive types (Balio, 1985)

iii. **Cotton Textile Industry**-On 25th September, 1934, a cotton industry was established at Panihati, named “BASANTI COTTON MILL” which was organized by Sri Subodh Chandra Mitra. This industry was inaugurated by Rabindranath Tagore and was presided over by Acharya Prafulla Chandra Roy. The name BASANTI was taken from the name of the wife of DESHBANDHU CHITTARANJAN DAS. Another two cotton industries were found by Ray Bahadur D.N. Chowdhury and his son Sri Chandrachur Chowdhury. These industries were called “BANGASHREE” and “SODEPUR COTTON MILLS”. Now these two industries are under the NATIONAL TEXTILE CORPORATION, Govt. of India.

#### **iv. Hosiery Industry-**

It is an important segment of textile industry. Hosiery industry in this Sub-division has a huge growth potential; corrective measures are required to be implemented expeditiously to harness the potential (Sharma, 2001). This industry mainly consists of small and medium enterprises (SMEs) and it plays a vital role in the economy of this Subdivision in view of its labour intensive decentralized character, job creation capacity and the prospects for earning exchange through exports. Hugli industrial region was the birthplace of hosiery industry in India. The first hosiery factory in the country was established at Kidderpore, more than a century ago. This Sub-division maintained its position as the top most hubs of hosiery goods manufacturing and trade for quite a long period.

#### **v. Paper Industry-**

Consumption of power in paper industry is significantly high. Requirement of power is equivalent to four tons of coal per ton of paper. Initially coal from Raniganj was used as fuel. Later, the industry began to use electricity generated by thermal power stations (Sen, 2006).

Present location pattern shows that there are three large paper mills in this region. These are located at (i) **Titagarh (Titagarh Paper Mills Ltd.)**, (ii) **Naihati (Indian Paper and Pulp Co. Ltd.)**, (iii) **Dakshineswar (WIMCO) Paper Mills Ltd.**

**vi. Bengal Chemicals and Pharmaceuticals-** Bengal Chemicals & Pharmaceuticals Ltd. (BCPL), formerly Bengal Chemical & Pharmaceutical Works Ltd. (BCPW), is an Indian public sector chemical and pharmaceutical company. A unit under the Ministry of Chemicals and Fertilizers, it manufactures industrial chemicals, pharmaceuticals like antibiotic injectables, tablets and capsules; and household products.

Established in Kolkata, West Bengal in 1901 by Prafulla Chandra Ray, it is **India's first pharmaceutical company**. In 1920, about 133 bigha land was bought in Panihati for a further large factory set up. Big names like Rashbihari Ghosh, Rajsekhar Bose were integrally related with this industry. While initially successful, the company started making losses in the mid-1950s. The management of the company was taken over by the Union government on 15 December 1977, and the company was nationalised on 15 December 1980. Following decades of losses, BCPL returned to profitability in financial year 2016-17.



Plate 99 - Bengal Chemicals and Pharmaceutical Company, Panihati



**vii. Bengal Waterproof** - The famous Duckback from Bengal Waterproof Ltd is a name synonymous with waterproof wearables in India, as it was the first. Founded in 1920, Bengal Waterproof Limited, much like Bengal Chemicals and G.D. Pharmaceuticals Private Limited (Boroline), was a fruit of the bubbling swadeshi zeal.

**viii. Rifle Factory Ishapore-** The first arms manufacturing facility on the site was a gunpowder factory, which was started in 1787 and began production in 1791, whilst a gun & carriage manufacturing facility was set up nearby in 1801. In 1904, a rifle factory was established by the British at Ichhapur, anglicized as Ishapore, and began production of the Lee–Enfield rifle, which has continued- more or less- until the mid-1980s, and possibly the present. The factory also manufactured the Vickers-Berthier (VB) light machine gun, which was adopted in 1932 by the Indian Army and still remains in reserve use.

Military rifles manufactured at Ishapore 1949 and pre-1949 are stamped "GRI" on the buttsocket, referring to George Rex, Emperor (i.e. King George VI, last Emperor of India), whilst military rifles manufactured 1949 and post-1948 are stamped "RFI", which stands for Rifle Factory, Ishapore.

The .303 British calibre Short Magazine Lee–Enfield Mk III, the 7.62×51mm NATO calibre Ishapore 2A1 rifle and the 7.62mm NATO L1A1 Self-Loading Rifle were manufactured at the factory. It now manufactures the 5.56mm INSAS rifle assault rifle, Kalantak rifle, Ghatak rifle (7.62×39mm AKM-style assault rifle)[2][3] and Pistol Auto 9mm 1A for military and other firearms such as IOF .22 revolver, IOF .315 sporting rifle, IOF .30-06 sporting rifle and IOF .22 sporting rifle[4] for civilian customers. The factory is administered by the Ordnance Factory Board of India.



Plate 100 – Ishapore Rifle Factory , Source – Wikipedia (Restricted for photography .)

**6.2.B Agriculture as a livelihood** – In the Mouzas of Barrackpur 1 and 11 blocks of the study area we found the rural economy where people are engaged in agricultural activities. This zone is almost 5 kilometre away from Bhagirathi Hugli river. Paddy is mainly cultivated during Monsoon time and vegetables in the winter season. In the low lying areas Jute is planted also. Shankar Das , one of the farmer said that people are now converting agricultural lands into *Bheris* where fishing is done. The major vegetables are – Cauliflower , cabbage, leafy vegetables like raddish & spinach , gourds , pumpkins, brinjal, ladies finger etc.



Plate 101 a–Gourds and Pumpkins are cultivated adjoining the wetland area, Keutia Mouza





Plate 101b&c– Leafy Vegetables are cultivated in Mohanpur Mouza, Bararckpur II Block





**6.2.C Fishing as a livelihood:** Though this entire stretch is heavily urbanised , there are few pockets where some communities still pursue fishing activities . Traditional methods of fishing and traditional fishing gears are used for fishing. As we surveyed , we found that mostly *Ber jaal* (Siene Net), *Khapla Jaal* (Cast Net) , *Khuchni Jaal* (Push Net)and *Phasa Jaal* (Gill Net) are used for fishing . The major fish available are – Indian Major Carps, *Puntius chola*, *P. sophore*, *Pethia conchoni*, *Trichogaster fasciatus*, *T.sota*, *Nandus nandus*, *Parambassis ranga*, *Chanda nama*, *Salmophasia bacaila*, *Amblypharyngodon mola*, *Xenentodon cancila*.

Locations -

**i. Near Khardah Ferry Ghat -** There are some fishermen who have migrated from Paschim Medinipur ( Mahato ) have settled down and spend their livelihood by fishing. They mostly do fishing between Khardah to Barrackpur. They mostly use traditional methods of fishing .



Plate 101 - Location 1 Near Khardah Ferry Ghat ( 22.725231, 88.362534 )- Fishing is done by Mahato families

**ii.Lohaghat (Halisahar )** – There is a fishermen settlement near Halisahar Lohaghat N22.95565, E88.42388 where 20 families still practise fishing. They do fishing between Halisahar and Naihati mostly north of Jubilee Bridge.



**iii.Jamuna ( Halisahar / Kalyani )** – While surveying we found few fishermen in the Jamuna River mostly with Khuchni Jaal (Push Net) . They mostly fish *Puntius sp*, *Chanda nama*, prawns, crabs, snails *etc.*





**iv. Halisahar Khal** – N22.95565 E88.42388, There are few fisherman families who lives adjoining Halisahar Khal and are primarily involved in Fishing. They use Cast Nets to catch fish and do fishing in Halisahar Khal and also in Hugli River.



**v. Laxmi Ghat , Titagarh,** 22.733810, 88.363524 – Just near the Titagarh Jetty there are few fishermen who lead their livelihood primarily by fishing.







Plate 102 - Net Making in Laxmi Ghat area, Titagarh



Plate 103 - Traditional Method of Net Making in Laxmi Ghat area, Titagarh



Plate 104 - Net Making near Khardah Ferry Ghat , 22°43'21.28"N 88°21'44.24"E



Plate 105a - Fishing is done in Mathura Beel, 22°56'9.59"N 88°27'47.17"E





Plate 105 b&c – Fishing is done in the wetlands of Panpur-Keutia Mouza area. 22°49'37.28"N 88°25'11.34"E. Potash and Lime is sprinkled to keep away infection of fishes.





**6.2.D Boat Making & Repairing** – As these fishermen lead their livelihoods by mostly fishing with their boats , there are 2 major areas found in the locality where repairing of the boat is done. They mostly get their new boats from Balagarh , Hugli District .

**a. Near Garulia Municipality**



Plate 106 – Boat Repairing Work near Bichali ghat , Garulia Municipality

**b. Near Naihati Ferry Ghat , 22°53'22.09"N 88°24'42.39"E**

A very small unit of boat repairing can be identified in the Naihati Ferry Ghat. Few of the household are engaged in repairing and making boats.



Plate 107 – Boat Making , Naihati Ferry Ghat



**6.2E. Pottery as a traditional livelihood** – The bhar, like small pieces of disposable art, are bearers of the age-old Bengali tradition of clay-pot making. Each cup is made by hand, from clay dug out of the Ganges river. Communities of potters, who have maintained the craft for centuries, sell them to tea vendors across the cities, who operate their stalls from dawn until the late hours of evening. In our study area we find 2 major centres where Tea Bhars are prepared along the River Bank. There are 2 Busteas (Settlement Clusters) where all the family members are engaged in preparation of potteries. They mostly prepare Bhars or Kulhars but also engage themselves in preparation of Diyas, lamp shades and also idols.

**i. Titagarh Bhar Patti - 22.738040, 88.370905**

About 20 households are involved in making Bhar (Kulhar / Earthen tea Cups) in this area. They are mostly Sahoos and Yadavs from Bihar. Their ancestors have come to this place as for working in the adjoining papermills and jute mills. As the condition of the industries deteriorated, they engaged themselves in making earthen potteries.



Plate 108– Swapan Sahu is busy in preparation of earthen cups in a manual wheel, Titagarh Bhar Patti





Plate 109– Cups are kept for drying . Titagarh Bhar Patti



Plate 110– Cups are burnt in the Vatti for giving reddish colour, Titagarh Bhar Patti



**ii. Ramghat Area - N22.90610 , E88.40568**

In the junction of Naihati and Halisahar Municipality we find a cluster of potters who mostly prepare Dhunuchi , Incense Burner ( Religious Purpose ) and earthen pots for religious purpose. There are 12 households who all are involved in making this pottery.



Plate 111 & 112 – Dhunuchi , Incense Burner is getting prepared in the Ramghat Area.



**6.3. Brick Kilns of the study area** -In West Bengal several units of brick industry were established under both Government and private enterprise. The Government of West Bengal set up a separate directorate in 1970 for brick production under the administrative control of the Housing department which belongs to the Housing and Public Health Engineering Ministry of the Government of West Bengal. The directorate was set up by way of converting the Brick and Tile Board which had been set up in 1961 for production of under both manual and mechanised processes using river silt as the chief raw material. The Government took up the business with a view to stabilizing the price of brick and brick materials as well as saving valuable agricultural land by making extensive use of river silt. In this state more than 700 crore of bricks are produced every year, whereas only 7 crores of bricks are produced in the Government sector. A large section of the brick fields worked under the control of the state directorate. Among the various kilns, the **Palta mechanized kilns** and the Akra manual kilns deserve a special mention.

#### **i. Palta mechanized kilns**

A mechanized brick factory was set up at Palta, 24 Pgs (N) within the compound of the Palta water works of the Kolkata Corporation and was put to commission in 1966. The principal raw-material for manufacturing bricks, namely, silt is obtained from the pre-setting tanks of the Kolkata Corporation at Palta. It also helps the Corporation to clear off the deposited silt of these tanks.



Plate 113 – Mechanised Brick Production , Palta ( Source – Website ) Restricted area





Plate - Palta Brick Field Park, 22°47'19.13"N, 88°21'10.26"E

#### PRODUCTION OF MACEHANISED BRICKS AT THE PALTA BRICK FIELD

Sl n	Year	Quantity of bricks produced
1	1995-96	5534000
2	1996-97	4169000
3	1997-98	4531000
4	1998-99	4411000
5	1999-00	5418000
6	2000-01	5106000
7	2001-02	5721000
8	2002-03	6844642
9	2003-04	5801078
10	2004-05	5017434

(Source: The Directorate of Brick Production Department, Government of West Bengal)

**ii. Other Brick Kilns** are under unorganised sector-There are number of brick kilns all along the river Hugli which are under private sector. The labours are mostly from Jharkhand , Bihar and Uttar Pradesh .Most of these labours are underpaid and are exploited to maximum extent. Based on our survey we found that there are about 8 active & 3 abandoned Brick Kilns in the study area . About 14.58 sq.km of the total land use landcover is under Brick Kilns. Concentration of Brick Kilns are more found in the northern part of the study area mostly in Naihati and Halisahar Municipality. However, it has been found that brick kiln sites in flood plain areas contribute to soil erosion during flood. Table -14-Location of Brick Kiln.

Sl. No	Locations of the Brick Kilns	GCP	Remarks
1.	BSS Brik Lin-NorthBarrackpore	N22.81324 E88.35970	Temporarily not working
2	Uttam Brik Kiln Naihati	N22.90935 E88.40682	Temporarily not working
3	KBW Brick Kiln (Halisahar)	N22.95524 E88.41361	Working
4	Singh Brick Kiln	N22.95327 E88.41474	Working
5	Brick Kiln	N22.95326 E88.41345	Working
6	BKS Brick Kiln	N22.95150 E88.41345	Working
7	PNS Brick Kiln	N22.94967 E88.41408	Working
8	Shaw Brick Kiln	N22.94905 E88.41255	Working



Plate114 - A Brick Field in Naihati , 22°56'56.79"N 88°24'50.71"E



Plate 115 & 116 - SDS Brick Kiln , Halisahar Municipality





Plate 117 & 118 – Singh Brick Kiln , Halisahar 22°57'55.54"N 88°24'38.49"E



Plate 119 – KBW Brick Kiln N22.95524 E88.41361, Plate 120- KBW Bricks





There are 3 abandoned Brick Kilns found in the study area . They are –

Sl.no	Location of the Brick Kiln	GCP	Remarks
1	Sundar Brick Kiln , Garulia Municipality	N22.81827 E88.35878	Closed
2	RNS Brick Kiln , North Barrackpore	N22.81521 E88.35979	Closed
3	RKG Brick Kiln, Anthpur	N22.84468 E88.37579	Totally under water



Plate 121- RKG Brick Kiln, near Anthpur Ferry has been inundated





Plate 122- RNS Brick Kiln , North Barrackpore



Plate 123a- Sundar Brick Kiln , Garulia Municipality



Plate 123 b& c– Brick Kilns are found along the Rver , Char Kanchrapara, 22°57'50.43"N  
88°24'40.87"E



## Chapter VII: Documenting Environmental Problems

North 24 Parganas is vulnerable to Environmental hazards of various kinds because of its – location, natural settings as well as anthropogenic activities. The entire North 24 Parganas district is vulnerable to multi-hazards e.g. natural calamities like Flood, Cyclone, Hailstorm–Kalbaishakhi (Summer Storm), Earthquake, Drought and Embankment Erosion. In fact there are High Risk Multi-Hazard Zones. However in our study area which lies in the extreme western part of the district, the burning issue is growing urbanisation exerting too much pressure on infrastructure of the area. Arsenic in drinking water is also another critical problem of the study area.

**7.1. SEISMICITY-** 73 % of the total area comes under High Damage Risk Zone (Zone IV) and 27 % of the total area comes under Moderate Damage Risk Zone (Zone III). Part of Bangaon, Barasat and Barrackpore Sub divisions come under Zone IV. Entire Basirhat Subdivision containing the entire Sunderban area under this district is highly vulnerable to Earthquake and Tsunami.

### **7.2. FLOOD EVENTS / WATER LOGGING**

19.16% of the population lives in flood-prone areas. However our study area do not fall under the major flood-prone areas. Water logging happens in certain municipalities because of poor drainage facilities.

**7.3. CYCLONES-** The entire district is in Very High Damage Risk Zone due to Wind & cyclones. Very recently the district experienced Cyclone Amphan (maximum wind speed 130 Kmph) on 20th May, 2020. Before that Cyclone Aila also created a havoc in the district.

**7.4. RIVER BANK EROSION / CONDITION OF EMBANKMENT** – River Bank erosion is the most common hazard of the people living in the bank of River Bhagirathi Hugli. However the major impact is felt in the districts of Maldah, Murshidabad and Bardhaman District. The stretch of Hugli River between Kolkata and North 24 Parganas has been jacketed by the British people and thus the impact of Bank Erosion is comparatively less in this area. However, in our entire stretch of 42km we have observed certain zones where it is very severe. Irrigation and Waterways Department has taken some measures to check the erosion. Sand filled bags, logs were used to mitigate the erosion. . But as we surveyed, we observed that there are certain zones where embankment requires immediate repairing.



**Table 15-Condition of Embankment in the Study area.**

SI No	Location	GCP	Condition of Embankment
1.	Baranagar Municipality	a. South of Kuti Ghat 22°38'13.93"N 88°21'44.82"E	Needs Repairing
		b. North of Kuthi Ghat 22°38'29.90"N 88°21'39.32"E	Needs Repairing
2.	Kamarhati Municipality	c. Near Gopal Lal Mukherjee Road 22°40'23.01"N 88°21'41.74"E	Needs Repairing
4	Khardah Municipality	d. Near Khardah Khal 22°43'10.17"N 88°21'49.68"E	Needs Repairing
3	Garulia Municipality	e. Near Bichali Ghat 22°49'21.90"N 88°21'31.63"E	Repaired but needs more attention
		f. Near Babu Ghat 22°49'33.12"N 88°21'40.18"E	
		g. Near Nimtala Ghat 22°49'39.88"N 88°22'31.29"E	
4	Bhatpara Municipality	h. Near Bhatpara Kali ghat 22°51'32.80"N 88°22'30.77"E	Total collapse of the bank
		i. Near Anthpur Ferry Ghat 22°50'37.69"N 88°22'34.54"E	
5	Naihati Municipality	i. Naihati burning ghat 22°53'35.80"N 88°24'40.54"E	Needs Repairing
6.	Halisahar Municipality	j. Near the mouth of Jamuna 22°59'48.78"N 88°24'57.98"E	Needs Embankment



Plate 124- River Bhagirathi - Hugli with Emabankment in Khardah Municipality.



Plate 125– Breach of Embankment in the Shyamnagar area , Garulia Municipality,  
22°49'42.68"N 88°22'36.28"E



Plate 126– Logs are used to check bank erosion , Bhatpara Municipality, 22°51'32.80"N  
88°22'30.77"E ,





Plate 127– Logs are used for checking Bank Erosion , Kamarhati Municipality , 22°38'59.93"N  
88°21'30.79"E



Plate 128 – Sand filled bags used for protecting river banks , Naihati Municipality, 22°53'35.80"N 88°24'40.54"E





Plate 129– Sand filled Bags are used to check soil erosion near Bichali Ghat , Garulia Municipality, 22°49'24.56"N 88°21'32.91"E



Plate 130 – Bank erosion observed in Ariadaha area , Kamarhati Municipality, 22°41'18.20"N 88°21'59.24"E





Plate 131 & 132 - Rectangular White Polypropylene Non Woven Geo Bags filled with sand are used for Bank Protection , Near Nimtala Ghat , Garulia Municipality .





Plate 133 – Mouth of Jamuna River , Boundary of North 24 Parganas and Nadia District



Plate 134– Collapsed river Bank near Anthpur Ferry Ghat , 22°50'37.69"N 88°22'34.54"E



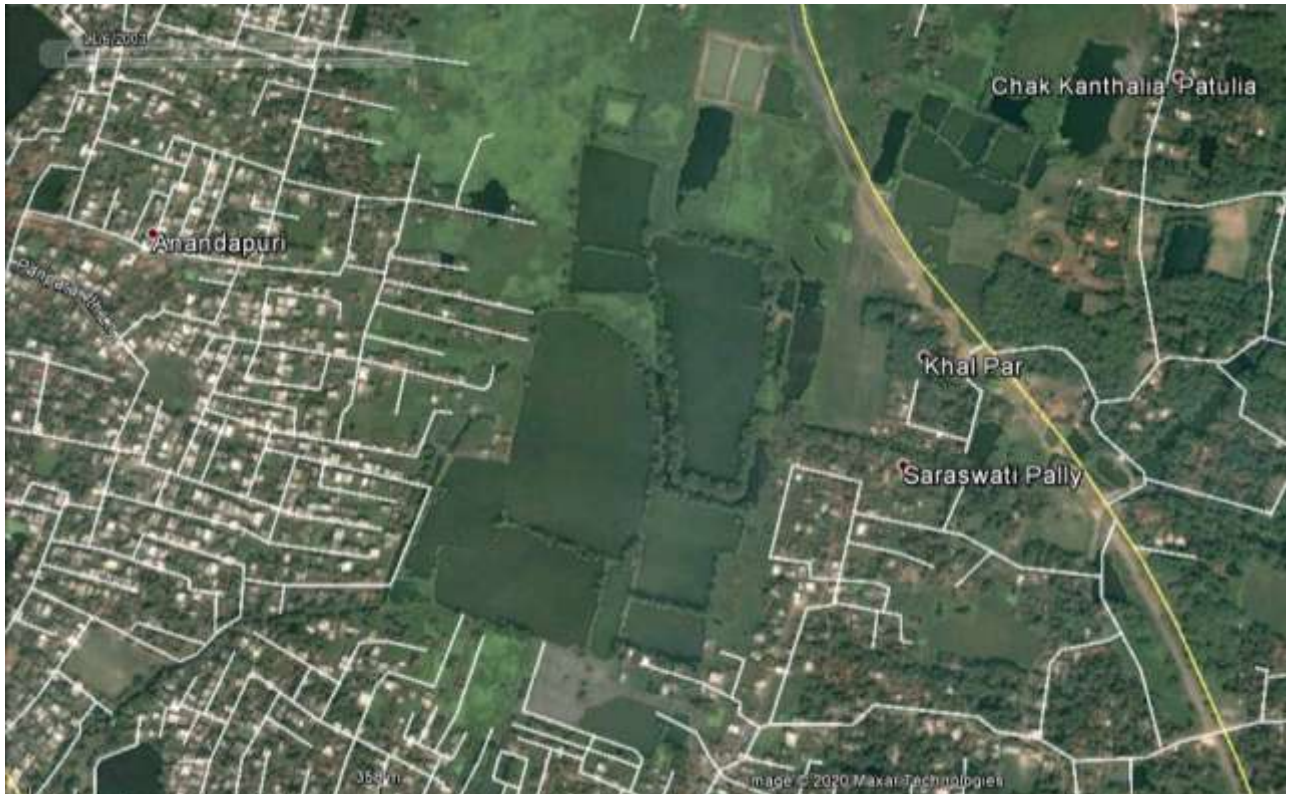
**7.5. SHRINKING WETLANDS** – As the population pressure is rising in the Barrackpore Sub Division Area , there is a huge demand of land . Naturally there is pressure on the waterbody. The natural Waterbodies present in the study area are Mathura Bill and Bairati Bill. Both of them were actually the PaleoChannels of Bhagirathi Hugli River. But, long time back they got cut off from the main flow. Both the Waterbodies are extensively used for irrigation and fishing. Over the years, it is found that there has been shrinking of these Waterbodies. **Table 17- Location of Wetlands**

Sl.n	Name of the Wetland	Location	Area in km <sup>2</sup>			Present status
			1922 (SOI Toposheet)	1959 (US Army Toposheet)	2019 (Satellite Image)	
1	Mathura Beel	22°56'00"N - 88°27'15"E 22°57'52"N - 88°31'00"E	8	8	6.23	Used for fishing and recreational purposes
2	Barti Beel	22°47'25"N-88°25'16"E 22°48'32"N -88°26'30"E	18.49	2.57	Non Existent	Land reclaimed for settlement and Cultivation
3	Beels to the east of Barti	22°48'33"N-88°26'38"E 22°49'32"N -88°27'3"E	13.10	1.02	Non Existent	Land reclaimed for settlement and cultivation
4.	Gayeshpur Kulia Beel	22°57'10.13"N88°26'24.9 2"E 22°58'32.88"N 88°28'40.01"E	8.7	8.2	5.6	Land reclaimed for settlement and cultivation



Plate 135– The Waterbodies are getting depleted because of huge demand of land, ill maintained, Mathura Jheel ,





Map 35 - High Resolution Satellite Image 2003 , shows Waterbodies near Saraswati Pally , Barrackpur



Map 36 - High Resolution Satellite Image 2019 , shows shrinking of Waterbodies in the same area Saraswati Pally , Barrackpore.



**7.6. WATER POLLUTION :** The Ganges has a long cultural and religious heritage, as also a deep historical bondage with the citizens of India. The river supports livelihoods of millions in the basin and also caters to their drinking water needs. Despite its importance, extreme pollution pressures from increasing population and industrialization pose a great threat to the biodiversity and environmental sustainability of the Ganga, with detrimental effects on both the quantity and quality of its flows. Discharge of untreated sewage and industrial wastewater, nonpoint pollution sources from religious activities along the river, agricultural runoff as well as poor municipal solid waste management are the main causes of pollution in river Ganga. The river Hugli has been also used as a part of a traditional sewerage system where this system faces pressures related to increasing population growth: encroaching development in the wetlands, increasing pollution in and volume of the wastewater. Their success has been constrained by point source pollution from both the city and along the Ganges River, as well as population-growth related needs for land development and a sewage system. Within Kolkata's indigenous sewage system lies the answers to sustainable environmental, economic and social alternatives. The challenge is to curb pollution, encourage indigenous economic gains, and to develop a meaningful coastal and riverine management system that will address the real needs of her people.



Plate 136– Opening up of Sewer line in Ariadaha area





Plate 137– Dumping of waste near Bhatpara municipality



Plate 138– Naihati Khal full of waste opens up in Hugli River





Plate 139– Khardah Khal with Garbage opening in Hugli River



Plate 140– Thermacol plates are another very common source of pollution near Naihati

**7.7. RAPID URBANISATION** -Barrackpore subdivision has dense population. The industrialisation on the bank of river Hugli in the pre-independence period and inflow of refugees from East Pakistan (Now Bangladesh) in the post-independence period changed the social scenario of the district and the sub-division. Most of the areas of the of the sun - divisions are well connected with Kolkata. So, persons from neighbouring districts and states migrated to this subdivision and the district accelerating the urbanisation. The rapid growth rate creates pressure on the drainlines. The wastes generated are all dumped into the drainline making them choked and clogged. Less amount of addition of water in River Hugli further aggravates the problem of sedimentation of the river.



Plate 141– Chaath Puja celebration , Naihati showing number of Bihari Population in the township



**7.8. SEDIMENTATION** - Sedimentation is one of the major problem in the studied reach and have resulted in the elevation of thalweg which in turn hinders navigational activities during low tide. Sedimentation along the stretch may also gradually result in decaying and degeneration of the channel. To increase the carrying capacity of the lifeline of Bengal and one of the major navigational route, measures like dredging, change in land-use pattern should be adopted by concerned authorities.



Plate 142 – Exposed sedimentation in the mouth of Naihati Khal near Jubilee Bridge  
22°54'25.00"N 88°24'19.82"E

### 7.8. CLIMATE CHANGE AND VULNERABILITY:

**Impact on Gangetic Dolphins** - The charismatic Gangetic dolphin, *Platanista gangetica gangetica*, is distributed in the Ganges–Brahmaputra–Meghna and Karnaphuli–Sangu river systems of India, Bangladesh and Nepal.

However their habitat is severely stressed due increased pollution, decreased water flow and shrinking fish populations in the Ganga. The study area is also part of the **National Waterways 1** (Haldia – Varanasi) and therefore the two-way movement of large barges including intrusive methods of making the river navigable has the potential to wipe out the dolphin habitats in these water bodies. According to Ravi Kant Sinha, IFS , also known as India’s Dolphin Man, said several habitats of the Gangetic river dolphin have shrunk in the last few decades and many more will follow in coming years due to climate change. “Rising temperature and erratic rainfall are leading to fast decline in the river flow and that is bound to hit dolphins hard”. However, due to lockdown and pandemic situation ( Lesser amount of ferry service and watertransport movement ) visibility of Gangetic Dolphins have become more common.

On 5th October, 2020, World Dolphin Day was celebrated by Inland Fisheries Society of India & ICAR (Central Inland Fisheries Research Institute)-CIFRI, Manirampur , Barrackpore . A mass awareness program was organised at Daspara ghat and Nawabganj ghat of river Ganga where dolphins usually seen.



Plate 143 – Gangetic Dolphin , Source – Wikipedia.

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9. Pottery & Idol making of Bengal
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