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OFFICE OF THE SUPERINTENDING ENGINEER
CENTRAL TENDER UNIT
IRRIGATION AND WATERWAYS DIRECTORATE
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Memo No-CTU/E/441 **Date- 15.09.2025**

Reference No: **WBIW/SE/CTU /e-EOI-01/2025-26** **Date: 15.09.2025**

Loan reference No:

REQUEST FOR EXPRESSION OF INTEREST (EOI)

Assignment Title: Engagement of a Consultant for preparation of Feasibility Study Report & Detailed Project Report (DPR) including detailed design, cost estimate and bidding documents for 30 % of the total investment under ADB funded "*Sundarban Upper Delta Climate Resilient Development Project*" in the State of West Bengal, India

Request for Expression of Interest

1 Rationale

The Government of West Bengal intends to apply for financing from the Asian Development Bank (ADB) towards the cost of the "*Sundarban Upper Delta Climate Resilient Development Project*" (Project) in the State of West Bengal, India and aims to apply part of the proceeds for the following consulting services.

The consulting services (Service) includes preparation of a Feasibility study, including design of structural and non-structural measures, Nature-based Solutions (NbS), collection of baseline data (including data necessary to conduct the environmental and social impact, climate risk assessment and gender action plan), hydrological, hydro-dynamic and morpho-dynamic modelling, topography, physiography, geology of the project area, selection of optimal set of agriculture and drainage interventions with due consideration of Management Operation and Maintenance (MOM) related issues under alternative options, analysis of the economic and financial costs and benefits, preparation of detailed designs, cost estimates and 30% Bidding Documents of the project, preparation of a Procurement and Project Operational Manual, Preparation of Detailed Project Report (DPR) and assessment of Institutional Capacity Strengthening system having a duration of 24 calendar months.

The Terms of Reference (TOR) for the assignment is elaborated on in Sections 1 to 10 of this Request for Expression of Interest (REOI). It is to be noted that the TOR may be subject to changes when the Request for Proposal (RFP) is issued.

2. Call for Expressions of Interest

The Superintending Engineer, Central Tender Unit, Irrigation & Waterways Directorate on behalf of the Governor of West Bengal invites eligible consulting firms ("Consultants" or "Firm") to indicate their interest in providing the Services. Interested Consulting firms should provide information demonstrating that they have the required qualifications and relevant experience to perform the services.

Encrypted electronic Expression of Interest (e-EOI) is hereby invited through electronic EOI under single stage one part e-EOI System using the Govt. of West Bengal e-Tender platform for the above-mentioned consultancy job from eligible consultants/bidders having desired pre-qualification eligibility credential for conducting the Services of similar nature and requisite financial capability. **The e-EOI would require the consultants to only qualify for the next stage for issuance of e-RFP document**.

Intending consultants desirous of participating in the e-EOI are required to login to the Government of West Bengal e-Procurement website having URL https://wbtenders.gov.in and locate this tender by typing **WBIW/SE** in the search engine provided therein, or by logging-in using their assigned user ID and password. They may also visit the official website of Irrigation & Waterways Department (I&WD), Government of West Bengal www.wbiwd.gov.in and locate the same e-EOI by clicking the "e-Procurement" link.

Consultants/bidders willing to take part in this e-EOI are required to obtain a valid Digital Signature- Certificate (DSC) from any of the authorized 'Certifying Authorities' (CA) under Controller of Certifying Authorities (CCA), Department of Electronics & Information Technology (DEIT), Govt. of India. (viz. NIC, n-Code Solution, Safes crypt, e-Mudhra Consumer Services Ltd, TCS, MTNL, IDRBT) or as notified by the CA /Finance Department, GoWB from time to time. DSC is given as a USB e-Token. After obtaining the Class 2 or Class 3 Digital Signature Certificate (DSC) from any of the above CA, they are required to register the fact of possessing the DSC through a registration system available in the above-mentioned websites. A list of such licensed CAs' is also available in the CCA website cca.gov.in. The prospective consultants / bidders may contact the Departmental e-Tendering Help desk located at the 7th Floor of Jalasampad Bhavan at Bidhannagar, Sector-II, Kolkata, or through designated e-mail addresses of ID:irrigationhelpdesk@gmail.com and no-egov@wbiwd.gov.in with Telephone No. 033-23346098 and the State Level e-Procurement Help Desk located at the Ground Floor of Jalasampad Bhavan, through wbehelpdesk@gmail.com on any working day between 10AM-5PM for any query on e-tendering procedure, obtaining DSC and free of cost training on e-tendering usage.
Intending consultants/bidders are required to download the e-EOI documents directly from either of the websites stated above. EOI is required to be submitted on-line with the help of the e-Tokens provided. **This is the only mode of submission of the e-EOI**. **No Earnest Money deposit is required at this stage.**

Last date & time of submission of e-EOI, is on 9th October, 2025 up to 17.00 Hours IST.

No Financial proposal is required now. On the basis of information provided by the interested consulting Firms the **Authority will prepare a short list of Firms who will be invited to submit detailed proposals in the next stage e-RFP.**

A pre-bid meeting will be held in the office of the undersigned on XXXXX at 2 pm.

Further information can be obtained at the former address below from 10:30 hrs. upto 17:30 hrs. (IST) except on State Government declared holidays.

3 Pre-qualification criteria for this EOI

The short listing of consultants or Firms will be done based on their ranking determined on the basis of the documents furnished in this e-EOI, following the below mentioned criteria:

a. The Firms should have at least ten (10) years' experience in the business of providing consultancy services of similar nature at National/International level preferably in preparation of feasibility study and mathematical hydro-morpho dynamic modelling, detailed engineering design, cost estimate, bidding documents and Design Project Report (DPR) for erosion control, drainage & flood management in any Country/State/Central/Multi-Lateral Financial Institution funded projects anywhere in India or abroad. Otherwise bid will not be considered. It is requested to provide a brief description of the Firm including ownership details, date and place of incorporation of the Firm, objectives of the Firm and details of assignments undertaken during last five (05) English financial years excluding the current financial year. It is desirable at least one of the assignments during last five years should be in West Bengal.

b. For EOI evaluation purpose, Marks will be distributed as per the following criteria.

Serial no.	Criteria	Weightage
1.	**Past experience of the Consultant firm** • Number of years' experience • Past experience of studies/job of similar nature • Past experience in carrying out studies/job in related sectors • Studies/job carried out in West Bengal	**60%** 20% 50% 20% 10%
2.	**Experience of Key personnel** • Qualifications • Relevant experience	**25%** 30% 70%
3.	**Financial strength of the consultant firm**. • Turnover figure for last three years. • Net profit figure for last three years	**15%** 50% 50%

Total marks will be 100. The Bid Evaluation Committee shall short list all the consultants who secure the minimum required marks of 50.

c. The Firm should have completed at least one (01) similar nature project in the last five financial years excluding the current financial year for projects having minimum awarded project cost of Rs. 6.00 (Six) crore. (Provide letter of Award of Contract from the employer and documentary evidence of completion in last five English financial years).

d. The **Team Leader and Deputy Team Leader & Water Resources Expert** having proven experience as stated in Para 10.1. The Firm is also required to engage hydraulic and structural design engineers, hydraulic modellers, Ground Water Modeler, procurement specialist, environment specialist, social specialist and Agriculture Economist. (The Firm shall provide a list of personnel having experience and expertise in the relevant field stated above to be deployed out of its pool of man power resources. Bio- data/CV of individual experts need not be provided at this stage). Requisite qualification and experience are the minimum criteria, otherwise bid will not be considered. Each Key Expert satisfying all the requisite qualifications and experience having highest qualification and experience will get full marks, while marks to other Key Experts will be assigned marks on pro-data basis.

The Firm must have achieved a minimum average annual turnover of INR 12.00 crore in the last three completed financial year (Provide Audited Profit & Loss statements/ Financial Reports of last three (03) completed financial years).

g. The Firm should provide its self-certified organizational Structure.

h. The Firm may associate to enhance their qualification, but should mention whether the association is in the form of a "**Joint Venture" or "Consortium"**. The documents regarding formation of JV or Consortium are to be provided. In case of Joint Venture, all members of the Joint Venture shall sign the contract and shall be jointly and severally liable for the entire assignment. In case of Consortium, one of the members of the Consortium must become the lead member of the Consortium and I&WD shall only deal with the lead member for all purposes. It is to limit the total number of Firms including the associates to a maximum of four (04). This should be clearly stated in the submission.

The minimum score required to be eligible for short listing of Firms is 50. All the criteria vide sl.no. a, c, d, e, f, g and h above should simultaneously fulfil as minimum eligibility for qualifying in the e-EOI, however the final selection of the winning consultant will be done on the basis of subsequent e-RFP documents among the qualified Firms.

0.4 Procurement of shortlisted Firms during bidding process

Details of e-tender submission, procedure for participating in tenders of the State Government are explained more elaborately in the 'Bidders Manual', which is available in the Departmental website www.wbiwd.gov.in. Minimum period given to the consultants/bidders for submission of e-bids is counted from the date on which the notice inviting bid including e-EoI is actually published in newspaper(s). More specific details will be provided when issuing the RFP to the shortlisted firms.

A Winning Consultant will be finally selected in accordance with the combined Quality-cum-Cost -Based-System (QCBS) score. The Consultant with most advantageous proposal in the RFP, which is the proposal that achieves the highest combined technical and financial scores, will be selected. A contract which will eventually be signed, which will be on a lump sum basis.

Section 1. Background and introduction

1.1 Background

The Northeast of India is a delta built by the Ganga, Brahmaputra, Meghna rivers and their tributaries. The Indian Sundarbans is spread over approximately 9,630 square kilometres, of which 5,363 square kilometres is reclaimed area and 4,267 square kilometres is protected mangrove forest. The Sundarbans suffers from freshwater shortage threatening agriculture and pisciculture in the reclaimed area and environmental degradation through erosion, monsoon flooding and cyclonic events in the protected area. Moreover, the area landward of the Sundarbans is suffering from fresh sweet water shortages; the loss of discharge through the Bidyadhari, Raimangal, Matla and other connecting rivers has rendered large number of fishermen and farmers jobless. These areas are also threatened by erosion, tidal and storm surges, monsoon flooding and super cyclonic events. On the other side, the urban area in and around Kolkata perpetually suffers from poor storm water drainage, flooding, salinity intrusion, and water shortage amongst others. As the human population continues to increase, environmental degradation continues and resultant climate change has led to high salinity in the dry season due to a reduction in dry weather flow, sea level rise and tidal amplification; flooding problems due to more rainfall in the monsoon season and sea level rise.

1.2 Project area and focus

The project area is bounded by the Hooghly River on the west, the Ichhamati River on the east, the Jamuna River on the North and the Piyali, Matla, Raimongal rivers on the south. This area is representative of a much larger area which is characterized by waterbodies (beels), oxbow lakes, channels poorly connected to adjacent rivers and generally poor drainage systems. The Project will focus on the Upper Delta to alleviate flood, erosion, and drainage congestion in selected priority rivers/canals, combined with climate resilient livelihoods activities related to improving agriculture and fisheries.

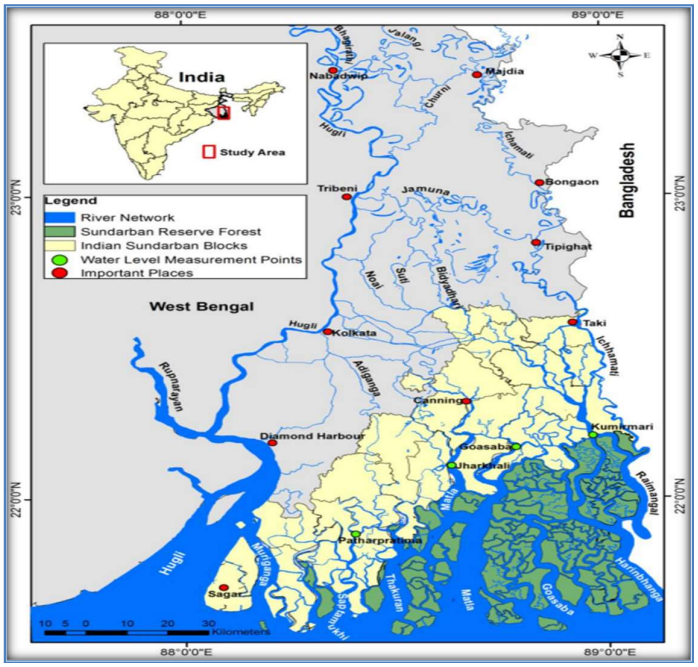

Figure 1: Disconnected River network in upper Delta region

1.3 General proposition

The perennial problem of drainage congestion in the urban areas of Kolkata rural areas like Gaighata, Swarupnagar etc in North 24 Parganas, alarmingly increasing salinity in the Sundarbans area which can be addressed by improving the riverine connections between the upper delta derelict rivers and the Sundarbans. Exploring the potential benefits of such river restoration is an effective proposition coupled with widening of inadequate waterways by modification of the bridges, induction of sluice structures to control and regulate the water flow and also restoration of the large water bodies.

It is expected that experience developed through the implementation of the project will facilitate water management and development in this large area of the proposed project. Technologies that need piloting include run-of-the–river sediment collectors, temporary compartmentalized sediment collection depots to facilitate sediment sorting for appropriate end use, the efficacy of increasing beels and oxbow lake storages through dredging, the sustainability of dredging distributary channel off-takes, Sustainable Regional Soil Bank Concept and so on.

1.4 General system understanding

The present-day river/channel network connecting the branches of the Ganga/Hooghly to the Sundarbans is degraded. Restoring such degraded river courses requires an understanding of the original state of these rivers/channels and the system (basin) dynamics. An important factor for degeneration of the river network is the loss of wetlands. In the past centuries, many of these smaller river mouths have been closed or marginalized through human interventions. The distributaries of the Ganga/Padma/Bhagirathi/Hooghly, such as Jamuna, Ichhamati, Nowi, Suti, AdiGanga, Bidyadhari, and KultiGong, along with the beheaded portion of the river Padma, the Bhairav-Jalangi and the Mathabhanga, requires restoration and de-siltation to enable water flow from the Padma River to the Mathabhanga River and subsequently to the Ichhamati River. Additionally, the silted-up water bodies like Mathura Beel, Barti Beel, Beel Balli, and Kheebli Beel, as well as the allied drainage channels of Kolkata and the Raimangal & the Matla, which once nourished the Sundarban ecosystem, have been disconnected from upland freshwater supply. Restriction of freshwater flow and de-forestation have resulted in loss of freshwater mangroves, change in species composition towards a more salinity tolerant ones and concomitant loss to the ecosystem like shoreline stabilization, storm protection, recycling of organic nutrients, carbon sequestration, food, wood and other resources supply etc. The rivers Ganga, Hooghly and Ichhamati etc. have a salinity gradient of freshwater to high salinity from north to south. Although data of water quality deterioration is not readily available but some bio indicators corroborate the phenomenon. Depletion of some plant species like Sundari trees or rejection of the region by the populace of the well-known Hilsa fish (through annual migration) and the extinction of the Gangetic dolphins may be attributed to the increase in salinity.

On the other hand, the shallow ground water is highly saline except for a few meter-thick water tables (aquifers). Fresh groundwater is only available at depths of >300 meter. The salt water intrusion into shallow level ground water often takes place due to influent discharge of the rivers. This situation may further worsen with current climate change and rising sea level. Salinization of soil and aquifer makes agriculture difficult and contaminates sources of drinking water. Scarcity of fresh surface and groundwater during dry season, increased siltation, high soil and water salinity, drainage congestion and vulnerability of the flood protective embankments etc. thus having posed hardship to secure livelihood of the people of the Sundarbans.

1.5 Project formulation

With this background the Project is proposed to be designed to establish a holistic plan for development of integrated structural and non-structural methodologies to boost flow in upper delta rivers & channels. This includes not only ensuring fresh water security by restoring connectivity of derelict/beheaded rivers and channels to enhance water flow in the upper deltaic region but also establishing a hydrological connection or water management system connecting rivers in upper and lower delta which in turn will mitigate flood risk in upper delta and reduce overall salinity in the Sundarbans by increasing flow of fresh water from the parent Ganga-Padma River system. These measures is likely to promote climate-resilient practices in agriculture, horticulture, and fisheries, while generating freshwater to conserve bio-diversity and derive socio-economic development.

Section 2. Overall objectives of the proposed Project

2.1 The overall objective of the proposed Project is to enhance climate resilience and improve water resource management in the upper delta and Sundarbans region by addressing key challenges such as salinity intrusion, flooding, navigation, stormwater drainage, and the degradation of river and waterbody ecosystems. This will be achieved through a combination of nature-based solutions, infrastructure improvements, and institutional strengthening to ensure sustainable water management and socio-economic development.

2.2 **The more specific objectives of the proposed Project are to**:

2.2.1 *Augment freshwater and salinity management***:**

Restore and reconnect derelict rivers, channels, and wetlands to increase the flow of freshwater from the Ganga-Padma system into the delta via means of smart re-excavation/ dredging, thereby mitigating salinity intrusion in the Sundarbans and improving water quality, implement innovative solutions, such as nature-based sand-silt trap flap gates, to reduce sedimentation and improve freshwater availability during the rainy season, incorporate the concept of room for rivers by creating additional space for rivers to expand during high flow periods, reducing flood risks and supporting natural sediment deposition processes. The envisaged target is to enhance fresh water flowing into the lower part of the Sundarbans to around 500 m^3/s on an average throughout the year.

2.2.2 **Improve storm water drainage and flood management:**

Enhance the stormwater drainage capacity by rehabilitating key rivers and channels, including Mathabhanga-Ichhamati, Hooghly-Jamuna-Ichhamati, Hooghly-Nowi-Bidyadhari, Suti, Adi-Ganga and Piyali, optimize waterway infrastructure, such as bridges and culverts, to facilitate unimpeded water flow, provide room for the rivers by restoring floodplains and creating buffer zones to accommodate excess water during monsoon seasons thus minimizing urban and rural flood risks.

2.2.3 Rejuvenate wetlands and water bodies (beels): Restore the ecological and hydrological functions of wetlands and large waterbodies (Beels) in North 24 Parganas to support water retention, biodiversity, and seasonal freshwater storage. Strengthen the role of wetlands, as retention basins for rainwater, storage reservoirs for dry-season freshwater, and tidal wetlands to sustain tidal river systems and saltwater ecology.

2.2.4 Improve navigation and optimise water flow: Improve navigability and carrying capacity of derelict rivers and channels to facilitate water transport and support the fresh

water distribution system in the delta. Redesign and upgrade natural water courses, such as Adi-Ganga, Piyali etc., to function as freshwater conduits from the parent Hooghly River to the Sundarbans.

2.2.5 Support for climate-resilient livelihoods: Promote sustainable water resource management practices to support climate-resilient agriculture, horticulture, aquaculture, and biodiversity conservation. Rejuvenation of the derelict/degenerated/beheaded rivers/channels/Beels (large water bodies) considered to keep the river channels navigable and capable of carrying more discharge and would augment freshwater flows in the system as shown in Figure 1.

2.3 The restoration concept will help in the following way; however, it should be stressed that the solutions should derive from a thorough system including basin and sub-basins understanding and should focus on nature-based solutions and low-regret solutions primarily which are sustainable:

- Augment the discharge of fluvial rivers in the upper part of Ichhamati river and the Hooghly.
- Generate silt free freshwater flow (at least for rainy season) through tidal rivers having low salinity by using say, a nature-based sand silt trap flap gate concept.
- Redesigning and upgrading of the Rivers/Canals: The canals like the natural water courses could potentially be used to function as a freshwater conduit from the Ganga & the Hooghly River to the Sundarbans, like the Jamuna, the Matla, the Raimangal and the Piyali.
- For other Beels or large water bodies in the district of North 24 Parganas: Wetlands have an important role in functioning of the water distribution ecosystem in the delta of the Hooghly/Sundarbans because of their capacity to retain water and their influence on the tidal rivers. The large Beels in North 24-Parganas have gradually lost their original functions owing to a range of human interventions executed from the last 20th century.
- Re-excavation of rivers and canals is generally considered a low-regret measure, as it restores lost river and canal connections while increasing the waterway's discharge capacity. However, before initiating such a re-excavation campaign, it is crucial to assess both historical sedimentation rates and the predicted rates following re-excavation. High sedimentation rates can undermine the benefits of re-excavation and render it a solution of limited sustainability. This particularly in cases siltation is caused by tidal effects, encroachments through settlements or presence of fishponds, and in general, insufficient openings of the waterways of road culverts and/or bridges across the rivers.
- Furthermore, special attention should be given to cases of blind tidal channels which gradually fill with sediment or when intertidal areas of parallel river delta distributaries are reclaimed unevenly. In such scenarios, the tidal propagation accelerates in the partially reclaimed distributary, affecting the non-reclaimed distributary through connecting channels. These channels expand progressively, causing the pristine channel to shoal and potentially degenerate. This highlights the importance of obtaining a good understanding of the system's behaviour for identifying the most suitable and climate resilient solutions.

Section 3. Basic framework of an integrated river basin approach of the Project

3.1 The basic framework of an integrated river basin approach of the Project is outlined in the following paras:

- The project's technical objective aligns with the necessity to enhance freshwater flow within the hydrologic system of the Jamuna River (linking the Hooghly River with the Ichhamati River), the Ichhamati River (linking the Padma River with the Raimangal River) and Nowi Khal (linking the Hooghly River with the Ichhamati River). It aims to meet the

freshwater requirements in the Project area, curbing the upward spread of salinity from the lower delta, mitigating siltation caused by tidal effects, and alleviate drainage congestion.

- Beel (wetland) areas are flooded during the monsoon, allowing local communities to practice fishing. During the lean season, they transform into agricultural land, enabling farmers to cultivate up to three seasonal crops, including paddy and vegetables. A comprehensive livelihood action plan will have to be developed, incorporating capacity building for diversification towards high value cropping practices. This could involve innovative utilization of local environmental conditions, such as floating farms, as well as the promotion of climate-resilient aquaculture. Additionally, the Project could focus on (i) creating value chains for both agriculture and aquaculture products, (ii) fostering responsible ecotourism, and (iii) prioritizing biodiversity conservation.
- To prepare this comprehensive livelihood action plan, a detailed socio-economic baseline survey is required which will help understanding the social and economic context of the Project area, provide information on existing livelihood strategies, income sources, and economic activities, which is crucial for designing interventions that align with local needs and capacities. Other priorities for upstream preparatory work are the recruitment of environmental and social safeguard consultant and the climate change consultant for the upstream climate risks assessment.
- In order to provide feasible interventions which, have the appropriate functionality with the regard to the Project objectives and the above basic framework, a deep understanding of the hydro-morpho dynamics of the Sundarbans system is essential.

3.2 The key challenges and constraints in the morphological dynamics of the Sundarbans delta are:

- Very vast flat deltaic area with many areas prone to flooding exacerbated by increasing climate impact and hydraulic constriction at narrow waterway of bridges and under capacity culverts along the natural water courses or rivers and canals transformed over the centuries.
- Lack of hydraulic conveyance of the fresh water fluvial flow due to siltation of upper or lower ends of a large number of distributaries of the Ganga/Hooghly River impeding navigation and urban and rural drainage congestion during monsoon rainfall and attenuation of the flood peaks during high flood events.
- Recurrent silt deposition even after some works have been undertaken in a few water courses (cycle of about 5 to 7 years).
- Lack of flood protection measures.
- High salinity in rivers, water bodies and soil exacerbated by increasing sea level rise linked to climate change and limited capacity and number of sluice gates or locks.
- Changes of tide dynamics in the Sundarbans; such as the range of the incoming tides therefore used to remain constant in the Matla River at around 4 metres at its mouth at Canning, but is now amplifying from 4 metre to 6.5 metre. This amplification towards Canning is probably caused by drying up of the water bodies or Beels and encroachment of 'room for river' by the fishery ponds, which used to provide a large storage area for saline waters brought in by the tides. The loss of storage capacity has resulted in tidal amplification following their reclamation.
- Increase in frequency of severe to very severe cyclonic storms due to the proximity of the Bay of Bengal, like Aila-2009, Phailin-2013, Hudhud-2014, Bulbul-2019, Amphan-2020 and Yaas-2021.
- High population density reliant mainly on agriculture and fisheries for their livelihood in the rural areas and large urbanized areas (such as Murshidabad-Nadia, Kolkata-Barrackpur, Kalyani-Haringhata and Basirhat-Taki belts) without adequate drainage infrastructure.

- Many encroachments of the population in the immediate vicinity of the rivers/canals/ or Beels or large water bodies (Mathura, Barti, Beel Balli and Kheebli beels in North 24 Parganas district).
- Limited available data (hydrological, topographical, hydrographical and sediment load) to develop a holistic catchment understanding leading to the design of sustainable non-structural and structural mitigation measures.
- Disposal of dredged spoil of de-siltation/re-excavation works will need to be carefully assessed based on environmental guidelines.

3.3 More specifically**,** climate change impacts include:

- Rainfall intensity increase. It is estimated that the annual maximum daily rainfall in the project area will increase by about 30% for both (Shared Socioeconomic Pathways) SSP2-4.5 and SSP5-8.5 scenarios. It will increase the peak flood runoff, increasing frequency of overflowing or overtopping from river channels and fluvial flooding, leading to severer and longer flooding and inundation. Increased flood discharge in river channels can cause erosion and scouring of riverbanks, flood protection structures and infrastructure crossing the rivers such as bridges. Inadequate capacity within agricultural drainage systems may lead to flooding as well as increase in flood duration in the agricultural land. Under the high emission scenario, the multi-model mean ensemble shows that the maximum change in the project area is likely to be in Bhagirathi-Hooghly sub-basin and the maximum water discharge is projected to increase by 27% (50th percentile) for this sub-basin for the period 2041-2070 relative to the baseline levels of 1981-2010.
- Increased intensity of tropical cyclones. The number of tropical cyclones that have made landfalls in the West Bengal have not shown increasing trends, however, number of very strong tropical cyclones have shown an upwards trend. Strong tropical cyclones cause very heavy rainfall as well as higher storm surges, which could lead to overtopping of coastal structures and inundation of lowland areas. Combination of the above will further increase flood risks in the project areas by increasing the magnitude, frequency and duration of flood related inundation.
- Sea level rise**.** The mean sea level is estimated to increase by 0.24 m to 0.27 m by 2050. It will lead to increased vulnerability of low-lying areas to flood inundation by increasing flooding frequency and severity, hindering flood water drainage, and increasing the extent and duration of flood inundation. This will also increase the extent of intrusion of saline water in the area during high tides.

3.4 In the above context following priority activities have been considered in the Project:

- Need for increased freshwater flow during lean season, and proper drainage of excess water during monsoon.
- Re-connection of derelict rivers and channels Beels, lakes and wetlands.
- Integrated water management in the channels/rivers and Beels for proper storage of water during monsoon for fresh water supplies during lean period and supporting livelihoods for the communities.
- Livelihood action plan: capacity building, diversification towards climate resilient livelihood and transformation, value chain creation for fisheries, climate smart agriculture, responsible ecotourism, biodiversity conservation.
- Groundwater quality is probably impacted due to short supplies of fresh water into the commands during lean season.
- Set up a Climate Resilient Adaptation Master Plan (AMP) for upper delta region.

Section 4. Impact and output of the Project

4.1 Tentative impact of the Project

The tentative impact of the Project is enhanced climate resilience in the upper Sundarbans region through improved flood management during the monsoon and increased freshwater availability during the lean season, supporting sustainable ecosystems and livelihoods.

4.2 Tentative outputs of the Project

The tentative outputs of the Project are summarised as follows:

Output 1: Strengthening institutional capacity for mainstreaming climate resilience and participatory approaches in water resources management. This output will institutionalize the mainstreaming of climate change adaptation strategies in public agencies responsible for the development and management of rural water resources. The output will support digital innovations for integrated water resources management, including strengthening the capacities of Government institutions for flood prevention and protection, sedimentation monitoring, riverbank protection using innovative approaches such as predictive artificial intelligence (AI), and state-of-the-art modelling tools.

Output 2: Climate resilient river flow and water resources management infrastructures enhanced. This output will include green infrastructure assets specifically designed using cost-effective, near-nature-based, and nature-based solutions to build community resilience to climate change.

Output 3: Promotion of Water Users' Associations (WUA) for sustainable management of water resources and livelihood development. Support the formation of WUAs and the training of their members in (i) scientific planning, management, and financially sustainable operations of water resources infrastructure and community assets, (ii) productivity enhancement of agricultural, horticultural, and fisheries activities through value chain development, and (iii) the development of innovative and resilient livelihoods using technologies such as AI, the Internet of Things (IoT), and other digital tools. These technologies will be used for disseminating area-specific information on disaster risk prevention, water resources status, precision agriculture, fisheries, and other livelihoods undertaken by WUA members.
Community and women led organizations will be engaged at all stages of the project and a comprehensive stakeholder communication strategy will have to be developed.

Output 4: Increased freshwater flow within the river system through the rejuvenation and reconnection of upper delta water bodies, supporting climate-resilient livelihoods, reducing salinity intrusion, and improving water availability in the lower delta.

Output 5: Integrated Water Resources Management (IWRM): State and basin-level institutions, including I&WD and the River Research Institute (RRI), West Bengal equipped with enhanced technical, operational, and policy capacities to implement IWRM effectively in selected river basins of West Bengal.

Output:6 Rehabilitation of river and channel infrastructure in the upper delta including restoration and desilting of derelict rivers and channels to increase their carrying capacity

and improve freshwater delivery systems. Infrastructure improvements to regulate water flow and manage salinity levels in tidal channels and creeks throughout the year.

Section 5. Tentatively assessed interventions proposed

5.1 Locations of the Project considered

Strategic re-excavation in these derelict river channels might be helpful to keep the river channels capable of carrying more discharge throughout the year and to generate freshwater flow in the system. The now considered locations of the Project interventions are elaborated upon in the following sections.

(a) Major Off-taking rivers/channels on the left bank of the river Hooghly.

(i) Ichhamati
(ii) Jamuna, partly disconnected from river Hooghly
(iii) Bidyadhari, indirectly connected.
(iv) Adi-Ganga-Piyali, indirectly connected.
(v) Nowi
(vi) Suti.

(b) River stabilization works:

In addition to the existing vulnerable banks, dredging and excavation of rivers and canals (khals), along with the opening of beheaded portions may lead to higher discharge levels potentially requiring additional bank protection works. It is important to adopt a sustainable and holistic approach towards stabilisation of river banks which should include Nature-based Solutions (NbS) for instance at the inlet structure points of the river Hooghly and the Padma along with the vulnerable stretches at different locations along both the banks of the various rivers and channels in the upper delta region.

(c) Rejuvenation of the water bodies or Beels in the district of North 24 Parganas:

- Mathura Beel.
- Bortir Beel.
- Beel balli
- Kheblee beel

5.2 Project interventions tentatively proposed

The following Project interventions are now proposed to be taken at this stage subject to actual assessment:

Project component	Description of Project Component	Quantity	Unit	Cost in M USD	Updated intervention list during June 2025 Mission	
					River/Khal /Beel	Proposed intervention by I&WD
1	Restoration of connection by excavating beheaded portion of Jamuna river with Hooghly river.	18	km	24.63	Hooghly River	2 intakes Hooghly and Jamuna to allow for dynamics of char
					Jamuna River	Re-excavation & bank protection of Jamuna River and widening by 15 m Left Bank and Right Bank
						Temporary wooden bridge at starting of Jamuna River replaced by concrete bridge

Project component	Description of Project Component	Quantity	Unit	Cost in M USD	Updated intervention list during June 2025 Mission	
					River/Khal /Beel	Proposed intervention by I&WD
						Construction of 10 nos. R.C.C. bridges in Jamuna River in place of existing old small R.C.C culverts and wooden bridges
2	Rejuvenation of Mathura Beel including restoration of its connection with Hooghly River through Bager Khal / New Bager Khal and restoration of escape channel of Mathura Beel to Jamuna River.	7	km	1.71	Bager khal	1 intake structure over Bager Khal at Rathala Ghat together with drainage of Bager Khal & 1 controlling structure at the junction of Bager khal & Mathura Beel
						Re-excavation/dredging and bank protection of Bager khal by widening of 10 m to 15 m for a length of 6.6 km up to Mathura Beel
						4 RCC bridges on Bager khal and widening
					Mathura Beel	Dredging of 300 m between Jamuna River at Mathura Beel including necessary protection work
						Existing culvert to be upgraded with sluice structure
					Midpoint Mathura Beel	Rejuvenation (boating, eco-tourism)
						Culverts in road embankment
3	Re-excavation of Jamuna River from its confluence with Ichamati at Tipi up to Charghat.	9	km	2.74	Jamuna River	Re-excavation of 9 km of Jamuna River at Jamuna outfall at Tipi Ghat
4	Rejuvenation of Borti Beel including restoration of its connection with Hooghly	32.5	km	13.49	Bortir Beel	Tourism development at Bortir Beel and fisheries
						Re-excavation of Bortir Beel
					Khoirapur Khal	De-siltation of Koirapur Khal for a length of 3.87 km including construction of 3 nos. sluices along with protection work

Project component	Description of Project Component	Quantity	Unit	Cost in M USD	Updated intervention list during June 2025 Mission	
					River/Khal /Beel	Proposed intervention by I&WD
	River through Ichapur Khal and restoration of flow in Nowi Khal as its escape channel.				Ichapur Khal	De-siltation of Ichapur Khal for a length of 4.50 km including renovation of sluice at outfall point of Ichapur khal including protection work
					Nowi khal	De-siltation for a length of 15 km including construction of 3 nos. R.C.C bridges in place of existing dilapidated bridges
						Cleaning of polluted discharge water and protection work of bank of Nowi khal at different stretches
5	Re-excavation of Nona Gong	29	km	9.63	Nona Gong	Re-excavation over 29 km
						1 no. sluice structure at the off taking point of Nona Gung with Jamuna river & 3 nos. R.C.C. bridges in place of existing wooden bridges
6	Re-excavation of Adiganga and Piyali rivers with connecting Khals and Inner Channels	204 .64	km	31.57	Adiganga and Piyali rivers system	Se-siltation of 204.64 Km of Adiganga-Suryapur-Piyali river system including bank protection, renovation/re-construction of existing sluices and replacement of 33 nos. existing wooden bridges with RCC bridges and construction of 23 Nos. New RCC Bridges
7	De-siltation of Ichamati River; from Tentulia bridge to Sangrampur Bridge (Basirhat-I Block).	39	km	14.39	Ichamati River	Re-excavation of Ichamati River for a length of 34 km Tentulia bridge to Sangrampur Bridge (Basirhat-I Block) and re-excavation of Tentulia Khal for a length of 5Km
						Bank protection of Ichamati river for a length of 5 km. and construction of Soil bank for de-siltation of tidal silt by hydraulic dredging system
8	Anti-erosion work	5.1	km	6.5	River Hooghly (Right Bank)	Anti-erosion work: Chengail to Uluberia Bibir Char; Uluberia Kalimadir to Jagadishpur

Project component	Description of Project Component	Quantity	Unit	Cost in M USD	Updated intervention list during June 2025 Mission	
					River/Khal /Beel	Proposed intervention by I&WD
						(Chapa Khal); Barkalia Kalimadir to Ramchandrapur and Shibganj to Gadiara; (Lower Damodar Construction Division _EE-II) District-Howrah
		3.6	km	5.68	River Hooghly (Right Bank)	Anti-erosion work: Bally bridge to Howrah Bridge; B.Garden Ferry Ghat to Nazirgang Ferry Ghat; Rajganj to Sankrail Police Station; near Deltajute Mill area; near Manikpur Ferry Ghat area; near Nayaband Area; near Bhabatarini Mandir Area; Near Sarenga sluice Area and Gloster Jute mill to Bouria area (LDCD; EE-I)- District-Howrah
		5.4	km	4.19	River Hooghly (Left Bank)	Anti-erosion work: Near Naldari Sluice; Taraganj Colony(Char Land), Gayenpara, Dariratneswarpur; Budge Budge Police Station to Pujali Ferryghat and Birlapur 3 phatak to Raipur Swadeshi mela ground (CD_EE-II); District-South 24 Parganas
		10.8	km	10.29	River Hooghly (Left Bank)	Anti-erosion work: Near Sadhu Ghat and Panchanantala Ghat; Near Rupdas Ghat; Near Panchanantala Ghat to Balak Brohmachari Dham; Near Debitala Ferighat; Near Chinikuthi Ghat; Near Kashipore Burning Ghat; Near Nimtala Burning Ghat and other locations: (EE-I, Canals Division); Districts- North 24 Parganas and Kolkata
	Total Amount in M USD	**124.82**				

It is noted that design for above proposed interventions have not been prepared as yet and Consultant will have to verify if they fulfil the objectives and requirements of the Project by

means of a thorough assessment by field survey, investigations of the entire system and modelling exercises. Consultants are encouraged to come up with innovative alternatives.

Note: As per agreement between India and Bangladesh, within a distance of 8 km from the border, no interventions can be implemented without prior agreement between the two countries. The interventions proposed in the project design do not involve inter-state matters. No issues will be triggered related to interstate water sharing, cost or benefit distribution, submergence impacts from upstream states, or associated costs such as compensation for submerged land or resettlement of displaced population. However, any compliance related to Inter-State/ International issues, if at all identified, will be included at the time of preparation and submission of DPR for approval of the competent authorities of Govt. of India.

Section 6. Objectives of the Consultancy Services

6.1 The objectives of the Consultancy Services for this Project under this assignment are to:

6.1.1 Demarcation of project area, study of topography, physiography, geology, river-morphology, land use pattern, socio-economics, determination of population benefited/affected, hydrology and hydrodynamic modelling using field data and engineering surveys, remote sensing & GIS, creation of salinity mapping & design of structures using state of the art proven technology.

6.1.2 Prepare a basin-wise Master Plan as a part of the Feasibility Study Report comprising water resources planning, their merits & demerits and justifications for final choice of the project, ancillary irrigation planning with cost investments if any (short, medium and long structural and non-structural measures), including design of infrastructure using green or hybrid innovation technologies; community-based disaster risks management for flood (CB-DRM-flood) with the development of framework for Flood Forecasting Emergency Warning Systems (FFEWS).

6.1.3 "Feasibility Study Report" and detailed designs for structural and non-structural measures including social and environmental impact assessment, cost estimates, economic analysis, preparation of 30% of bidding documents.

6.1.4 Detailed topographical surveys in respect of rivers, command area for On-Farm Development (OFD), ancillary irrigation planning and drainage improvement, soil conservation etc. relating to rejuvenation of the rivers and channels for generation of continuous flow in upper delta region of derelict rivers (like the Jamuna, the Ichhamati, the Nowai, the Bidyadhari, the Adi-Ganga etc.) and establish continuity, restoration of wetlands (the Bortir Beel Beel Balli, Khebli beel and the Mathura Beel). Furthermore, undertake geo-technical investigations, foundation investigations & construction material surveys.

6.1.5 Improvement of fresh water flow with the assessment of water requirement to reduce the salinity up to 10-14 PPT, define & design structural interventions at the constricted waterways by widening of narrow bridges, design construction and/or remodelling of old sluices to arrest tidal salinity ingress, bank protection and river training works of identified rivers and channels adopting Nature Based Solutions (NbS).

6.1.6 Address non-structural measures and activities such as creation of local water user's association, capacity building, development of value-chains for climatic smart agriculture and aquaculture, and linkages with Farmers Producer Organization (FPOs) (markets) for economic development.

6.1.7 Outlining additional data collection through surveys, hydrological and hydraulic studies including 1D coupled with 2D Mathematical Modelling, model calibration and validation, community and stakeholder consultations, and coordination with NITI Aayog, GFCC, CWC, MOJS & other key GoI agencies for obtaining mandatory clearances of the FSR & DPR.

Section 7. Scope of Services and Tasks

7.1 Main tasks

The Consulting Services is for the preparation of Feasibility Study Report(FSR) and the Detailed Project Report (DPR) including detailed design, cost estimate and preparation of 30% of bidding documents confirming to Asian Development Bank's(ADB) guidelines and norms for the "*Sundarban Upper Delta Climate Resilient Development Project*" in the State of West Bengal, India; also complying to the "Standard operating procedure for Examining and processing of Project proposal posed for External Assistance" published by the Central Water Commission(CWC), GoI.

The following main tasks are envisaged:

1. Task 1 Data collection and surveys
2. Task 2 Modelling studies
3. Task 3 Feasibility Study Report and selection of the preferred option
4. Task 4 Social and Environmental impact studies and Climate Change
5. Task 5 Preparation of DPR with detailed Designs, cost estimates, comprehensive cost-benefit analysis as per GoI format and Bidding Documents for 30% of the total investment.
6. Task 6 Institutional Strengthening

These are distinct activities with separate deliverables but in practice there will be overlap in data and knowledge to perform these tasks. It is important however to hold on to the sequence of these activities, to reach an effective result in an efficient way, taking into account all physical technical social and environmental considerations, criteria and requirements of all stakeholders. This includes, but not limited to the Environmental and Social Framework of the ADB which will be applicable for the Feasibility Study and Detailed Design activities including the DPR.

It should be noted that this Section 7 outlines the scope of work and provides a narrative description of tasks, while Section 8 presents the required information to be included in each deliverable. Each deliverable may contain elements from multiple tasks.

The main focus of the assignment is to undertake feasibility level studies, if feasible, then prepare Detailed Project Report containing detailed designs, cost estimates and 30% bidding documents of the proposed investment as per ADB procurement guidelines. In addition, the Consultant will assess the existing institutional capacity strengthening system and will propose options for its improvement, and will also design a real-time agricultural monitoring system for the Project area.

The Consultant will develop alternative options for modernizing and improving water management including agriculture, drainage and flood management in the Project area over a 5 years period for a total projected estimated project budget of US$ 165 million. It is crucial that the Consultant does not merely propose the rehabilitation of existing infrastructure, but instead analyse alternative investment options for each case that are better suited to a

changing environment based on a thorough understanding of the system. While doing so, issues associated with management, operation and maintenance for various options should also be taken into consideration following consultations and on the basis of the investigations and the outcomes of an environmental and social impact assessment, the Consultant shall prepare a preferred investment package that would most adequately respond to the Project objectives and that would yield the highest value-for-money (VfM), taking into account all alternative ways of achieving the desired objectives. For this preferred investment package, the Consultant will prepare detailed designs, cost estimates and 30% of bidding documents that meet the requirements of ADB procurement guidelines in vogue as well as the DPR guidelines of Central Water Commission (CWC) for project proposal posed for External Assistance.

7.2 Detailed Scope of Work

The activities and scope of work for the assignment will include, but not limited to the tasks and sub-tasks stated in the following sub-paras.

Reference:

The following publications is to be referred but not limited to by the consultant during preparation of the FSR & DPR:

(i) Standard operating procedure for Examining and processing of Project proposal posed for External Assistance published by the Central Water Commission, GoI.

(ii) "Guidelines for submission appraisal and acceptance of Irrigation and Multipurpose Projects, 2017" of the Central Water Commission, GoI.

(iii) "National frame work for sediment Management" published by CWC.

(iv) Sustainable operation and Maintenance (SOM) for sediment management.

(v) Study of the River Network, Water Quantity and Quality for Assessment of Environmental Flow requirement for the Sustenance of the Sundarbans Ecosystem prepared by RRI, West Bengal in 2024.

(vi) Any other relevant publications of Govt. of India/State Govt.

7.2.1 Task 1: Data collection and surveys

(i) Data collection and consultations

The Consultant will use available data and studies, additional data collected from surveys, hydrological and hydraulic studies working in close consultation with I&WD and other associated institutions and authorities. Furthermore, the Consultant will review earlier programs performed in the Project area and wider surroundings and derive lessons learnt. The Consultant shall pay specific attention to (i) achievements in increasing protection, changes in employment and incomes, and technologies used, (ii) effectiveness of institutional arrangements and role of project beneficiaries; (iii) accomplishments in improving water management; (iv) performance of implementing agencies, design and supervision arrangements, and contractors; and (v) O&M and project sustainability.

Collection of baseline data necessary to conduct the environmental and social impact, climate risk assessment and gender action plan for inclusion in the DPR as per guidelines of ADB as well as CWC (more details under Task 4).

(ii)Engineering Surveys

Extensive engineering field surveys will have to be conducted in the whole Project area, some of the survey details will have to be provided during preparation of FSR as inputs to the numerical models (either as boundary conditions or for calibration/ validation), to get a good understanding of the area and to prepare designs, data collection through engineering and hydromet surveys. The following surveys and measurements should be conducted where needed, amongst others: discharge, sediment sampling and load analysis, water level, suspended sediment, cross-section bathymetry of rivers, cross-section of canals, bed sampling, salinity observations, aquifer characteristics, topographic surveys, physiography and geotechnical investigations. The additional survey work shall have to be undertaken by the Consultant all along the Project area in terms of accuracy, level of detail and grid in remote sensing and GIS platform.

More details of the required surveys are presented as below along with their links to associated Project activities:

- Demarcation of project area, physiography and detailed topographical surveys in project area, determination of Command area for OFD for irrigation planning and drainage improvement, soil conservation etc. relating to rejuvenation of the rivers and channels for generation of continuous flow in upper delta region of derelict rivers, foundation investigations & construction material survey.

- As mentioned earlier, the Feasibility Study will be conducted for smooth flow of fresh water from Upper Delta to Lower Delta region through the river Ichhamati, Jamuna , Bager Khal, New Bager khal, Ichapur khal, Nowi Khal, Nonagong (Bidyadhari khal), Adi-Ganga-Piyali river, Bidyadhari river etc. For the Project area rivers and channels, bathymetric and topographic surveys will be conducted for a total length of 415 km (approx.). Survey of entire length (except Client's input) including cross section @100 metre interval for straight portion and @50 metre interval for the concave portion of existing and as per proposed design section has to be done by DGPS-RTK for topographic survey and ADCP/Echosounder with DGPS-RTK system for bathymetric and hydrographic surveys. Lidar survey also to be considered and would save time as many surveys will have to be conducted. Apart from the cross-sectional survey, correction with SOI Bench Marks will also have to be done with an accuracy upto (+/-) 20 mm.
- Furthermore, bathymetric surveys as well as hydrometric surveys should be conducted on rivers and channels, where cross sectional surveys may not be required as those being beyond the zone of interventions, as inputs to the numerical models. The spacing of these surveys could be between @500 meter and @ 1000 meter interval depending on the need of the model.
- Undertake topographic and hydrographic surveys of the defunct water bodies (beels) like Mathura Beel, Bortir Beel etc. including its rejuvenation proposal will have to be done. Collection of available data in respect of the Padma-Jalangi-Bhairab-Mathabhanga basin, and undertake topographic and hydrographic surveys of the Upper Delta system comprising Ichhamati river, Hooghly River, like water levels and discharges near off-take of the Jamuna River, the Bager khal, the New Bager khal, salinity and sediment concentration (Bed & suspended) near Ichapur Khal have to be done by the Consultant. The quantity of water required from the river Padma and Hooghly for successfully implementation of the Sundarbans Upper Delta Climate Resilient Development Project also has to be assessed and technically substantiated.
- Identification of outfall drains/canals, their length, longitudinal slope, size at various locations, discharge, catchment area as exists within the proposed flow path of the

Project canals have to be considered. The contour maps of the Project area as per requirement also have to be prepared by the Consultant.

- An inventory with infrastructure and hydraulic data of all existing bridges, sluices & other important structures within the entire flow path of different channels i.e. from the Padma and the Hooghly River to the Lower Delta region through the rivers/channels under the Project proposal including modification of the proposal, if any, have to be submitted.
- Land detail for excavation of new channel through railway land, widening of different rivers/channels/sluices including preparation of land plan, land schedule over mouza map, collection of R.O.R. etc. by LiDAR / DGPS or any suitable method as required for land acquisition/ land transfer from Railway Authority, Fishery Department, P.W.D. and local land owners etc. Rehabilitation & Resettlement plan has also to be submitted by the Consultant. All level related data should be in same platform of reference. The reference will be provided by the I&WD.
- **Salinity measurements** will facilitate a salinity study of the Hooghly River and the rivers of Sundarbans Upper Delta region. Sampling should be made in every alternate day at the locations through engaging a sample collector. In addition, salinity profiles should be measured simultaneously by using the Salinometer or Conductivity Temperature and Depth (CTD) Sensors during the discharge observation.

(iii) Environmental and social surveys:

While more details will be provided in the environmental and social section (Task 4), it is important to highlight the need for soil quality and properties testing in rivers, canals (khals), and water bodies (beels) planned for excavation or dredging. This is essential to develop an appropriate sediment management plan and assess the potential for reusing spoil material for construction, land reclamation, and other purposes. Land use, socio-economics and population benefited/ affected are to be determined. In addition, water quality assessments and ecosystem mapping are needed to support environmentally inclusive design and inform mitigation measures.

Equally important are social and land surveys, especially since interventions such as canal widening could lead to land acquisition and resettlement impacts. Ensuring that designs are done within available Govt land and is socially acceptable is key. For long-term sustainability, community participation in the operation and maintenance of project infrastructure is vital, which requires establishing a sense of ownership—best achieved by involving communities early in the project design process.

(iv) **Stack holder and Public representative consultation with the project area.**

Consultant will survey the stack holder and public representative opinion with in the project area with proper formulation methods.

7.2.2 **Task 2: Modelling studies**

A comprehensive hydrological, hydro morpho-dynamic model (1D coupled with 2D, with sediment transport module) of the whole Project area will have to be developed. The Consultant will use a hydro morpho dynamic model based on for instance those similar like Mike 11, 21C software. Inputs will come from the survey data for the Project area and the model will be instrumental in assessing the technical viability of various options, or as suggested by the I&WD. Conducting the hydrological studies should be as per relevant BIS publications (IS:12094:2000) as required by the MoWR, RD&GR, Government of India (GoI).

Comprehensive hydrodynamic modelling is required taking into account groundwater and evaporation. Since the system is morphologically dynamic, it is suggested that a morphological module be attached to the hydrodynamic model. The latter would allow to access the impact of the (many) dredging interventions and see how quickly sedimentation will occur again after a number of years. The model to be developed will need lower boundary

water levels. Climate change scenarios should also be included in the modelling (see Task 4.2).

Study of the Hooghly River and the rivers of the Sundarbans Lower Delta region is crucial. For instance, the quantum of sweet water required to check the increased salinity of Sundarbans rivers, the effect of sweet water in reducing groundwater salinity through storage in rejuvenated water bodies, and the maximum volume of sweet water that can be conveyed from the Upper Delta to the Lower Delta through the canal/river network under this project need to be assessed. This study can be supported by salinity modelling. The salinity model uses catchment data, rainfall, evaporation, river geometry, and flow/salinity data. A rainfall-runoff model feeds freshwater input into a 1D hydrodynamic model, coupled with a 2D model to account for tidal influences from the Bay of Bengal. These hydrodynamic models which are described above can supply flow information to the salinity model which will produce seasonal salinity variations and salinity mapping within the river. Based on the field visits and consultations with both international and national experts, it is anticipated that inclusion of Jalangi Sub-basin will further enhance the water availability in the Upper Sundarban delta. Therefore, the impact assessment of water flow from the Jalangi-Bhairab-Mathabhanga system into the Upper Delta system is covered in the scope of analytical modelling in the consultancy services in addition to the project area for preparation of the DPR.

Hydrological analysis including the model for assessment of carrying capacity of various channels/ rivers is to be got vetted by National Hydrological Institute, Roorkee/ other GoI institutes.

7.2.3 Task: 3 Feasibility Studies

The Consultant will prepare a comprehensive and holistic systematic approach to enhance climate resilience and improve water resource management in the upper delta and Sundarbans, including improvement of freshwater flow and flood management.

On the basis of a good system understanding gained throughout the previous tasks, Consultant will determine river basin management strategies and identify alternative sets of structural and non-structural measures that are consistent with the Project objectives. For each of these options, Consultant will determine the amount of funds that needs to be mobilized and an investment plan will be prepared accordingly. In order to determine the alternatives, the Consultant will conduct all necessary analysis to adequately justify the proposed investments (including technical, social, environmental, economic, etc.), and will specify this in the methodology statement as part of the feasibility report. A preferred investment package with all associated details will be a result which will be also based on thorough stakeholder consultations.

Community will be engaged at all stages of the Project and a comprehensive stakeholder communication strategy will have to be developed. It will develop community-based disaster risk management capacities in nearby areas along with the establishment of comprehensive grievance redressal mechanism.

The following tasks will be taken into account while conducting the feasibility studies.

Task 3.1: Assess feasibility of intervention alternatives

This sub-task is overarching for all the sub-tasks mentioned below will include the assessment of the feasibility of the whole project with Basin-wise Master Planning (including initial delineation of intervention alternatives for the areas of concern) to a certain whether the Project is feasible or not, and submission of feasibility study report supported by hydrodynamic and morphological modelling (outputs of Task 2) with actual under survey data (outputs of Task 1). For instance, it will be accessed whether required silt free/laden

fresh water is available from river Hooghly and Padma to reduce the salinity up to 10-14 PPT, or whether the Project is feasible to execute through land acquisition and rehabilitation resettlement programme.

The sub-basin wise Master Planning should also include long-term road maps for future adaptation or transformation strategies.

The alternatives may include all structural and non-structural measures and investments (e.g., dredging, "making space for water", priority areas for flooding, improve embankments, and any other method for management of floods and harnessing a part of post monsoon and tidal flow that would help to achieve the Project objectives, including those measures suggested by I&WD. For each of the options, the Consultant will prepare an indicative economic and financial analysis and consider Management Operation Maintenance (MOM) related issues. Once the final option has been selected, the Consultant will prepare a full-fledged economic and financial analysis in accordance with ADB requirements.

Task 3.2: Design of a comprehensive set of structural (prioritizing nature-based solutions where ever feasible) and non-structural measures

This sub-task will include initial design of a comprehensive set of intervention alternatives, including structural (prioritizing nature-based solutions whenever feasible) and non-structural measures to improve the flow in the designated derelict channels including management of floods in the Project area. Furthermore, it will include preparation of an asset management system and O&M planning and implementation of pilots created for climate smart agriculture and aquaculture as per value chains. In addition, and based on the results of soil/ sediment properties and estimated re-excavation/ dredging volumes, a sediment management plan should be prepared. Planning for disposal of excavated earth needs to be under taken in details.

The design process should incorporate the hydrodynamic and morpho-dynamic context as addressed in Tasks 1 and 2, along with relevant social and environmental considerations (Task 4). To address the uncertainties associated with climate change, an adaptive design approach should be applied. This approach should account for functional requirements, land use zoning, and safety levels, and be aligned with long-term road maps for future adaptation or transformation strategies (Task 3.1).

All designs should be based on a clear Basis of Design (BoD), which outlines the specific design criteria and standards—including design return periods, safety factors, hydrological and hydraulic data, assumptions and methodologies, design parameters, and key system components. Designs incorporating Nature-based Solutions (NbS) should follow a similar BoD structure and include post-project monitoring strategies to evaluate performance and guide future improvements. Based on these criteria and standards, initial designs will be prepared, which will be further detailed under Task 5, following the same principles.

Some relevant considerations:

- New channels to establish connection between the Bager khal & the Mathura Beel through the railway land has to be explored. Assessment of dredged silt properties and quantities as per design section as well as selection of disposal sites is to be required. Also, the optimum number of bridges/culverts/sluices required due to widening of the channel including its design has to be taken up.
- For anti-erosion and appropriate bank protection works on the river Hooghly, Ichhamati, Jamuna etc., identification/suggesting new structural interventions in the form of construction of new embankment lines, construction of new sluices/other hydraulic structures, new river training or bank protection works etc. as well as various non-

structural measures are required for minimizing the impact of erosion and flood. The proposed remedial measures may be in the form of short term and long-term protection works. While doing so, prevailing the ground realities and difficulties associated with acquisition of land in large scales need to be duly considered. Suggested new interventions should be implementable on the ground for all practical purposes with due importance of the environmental aspect.

Task 3.3: Initial analysis of the economic and financial costs and benefits of the proposed investments

Consultants will perform an initial analysis of the economic and financial costs and benefits of the proposed investments in accordance with ADB and CWC guidelines, which will be further detailed under Task 5.

The analysis will involve the following activities, which will be further detailed under Task 5:

- In consultation with the Client, local authorities, and other relevant agencies and stakeholders, the project area to be determined and defined which refers to the zone impacted by the project interventions.
- Identify and assess the physical assets in both financial and economic terms, including roads, bridges, utilities, agricultural facilities (such as markets, storage, and processing), schools, and healthcare facilities, as well as land use and vegetative features. The analysis will also cover rural and urban areas that will benefit from the interventions.
- Evaluate the potential impacts of drought, salinity, floods, and erosion on the project area, considering various return periods, types, and extents of damage. This includes losses to sectors such as agriculture, industry, health, education, power, telecommunications, and public and private infrastructure, as well as the potential loss of life and production during storm surges and floods.
- Estimate the benefits of the project, including its impact on agricultural production, reduction in damage and losses across sectors like housing (including contents), industry, health, education, transportation, communication, and infrastructure. This will include comparing alternative scenarios (current situation, future without the project, and future with the project) and preparing rate of returns on investment, as well as assessing impacts on income and employment in both financial and economic terms.
- Estimate the total project cost, benefits, and the financial and economic returns for the entire project. Identify potential risks and perform sensitivity analysis, including switching values and their effect on the economic rate of return.
- Propose an optimal project design by considering the economic return of varying levels of intervention and prioritizing areas based on their economic return and risk reduction potential.
- Under take excavated earth & other materials disposal plan considering environmental impact assessment and social requirements.

Task 3.4: Selection of preferred option

Based on the initial designs, cost-benefit estimates, and environmental and social considerations, a set of preferred measures will be identified that align with the Basin-wise Master Planning. To support decision-making, a Multi-Criteria Analysis (MCA) can be developed, taking into account technical, social, environmental, and climate aspects, as well as the measures' contribution to achieving the project objectives. With such MCA tool, stakeholder and community engagement in decision-making can also be facilitated.

7.2.4 Task: 4 Social and Environmental impact studies and Climate Change

Task 4.1: Social and Environmental impact studies

The Consultant will consider environmental and social impacts, climate risk assessment and gender action plan of the proposed investments, including (but not limited to) an analysis of the impact of the Project on groundwater as well as surface water. Once the Consultant has developed alternative options, an environmental and social impact assessment will be conducted by the Consultant. Side by side, the consultant will also require to formulate an Environmental and Social Management Framework (ESMF) and also Environmental and Social Management Plan (ESMP) suggesting mitigation of the likely adverse impacts of the interventions, if any. Preparation of detailed design and bidding documents will take place once the recommendations from the environmental and social impact assessment have been incorporated into the Project planning & design. Consultant will identify socio-economic risks and vulnerabilities and potential adaptation options and practices as inputs for assessment of Environmental Impacts on relevant aspects of the project.

The Consultant will collect all baseline data necessary to conduct the environmental and social impact assessment. The following social information is required from the part of the consultant:

1. Identification:
   - Projects Blocks and villages
   - Socio-economic baseline of the project area in terms of demographic;
   - cultural; social and economic (based on secondary sources of information)
   - General skill set with the community in the Project area (needs to be covered under economic characteristics of the area) based on secondary sources of information
   - Data should be gender segregated
2. Land:
   - Estimated extent of private land to be acquired
   - Estimated extent of government land to be transferred
3. Resettlement/land acquisition/transfer will lead to any:
   - Estimated number of displaced people (provide number)
   - Estimated number of people with loss of livelihood (provide number)
   - Source of livelihood of people with loss of livelihood (explanatory note)
   - Estimated number of people with loss of access to common property resources or loss of common property resources (explanatory note)

The social and environmental studies will be prepared in accordance with ADB rules and guidelines of Govt. of India.

Task 4.2: Climate Change impact

Climate change impact will be assessed and this Task will include, but not be limited, to the following:

- Consultants should collect socio-economic, climate change and disaster related data from local/national/international agencies working in climate change domain. They should furthermore collate, organize and review available baseline biophysical, environmental, demographic, socioeconomic and policy data and information relevant to socio-economic and climate risk management within the context of the Project. Lastly, review existing studies, data and information on current and projected environmental impact, climate change risks and vulnerability for the proposed specific geographic areas and sectors covered by the Project.

- Consultant should also develop detailed scenarios of climate change variables as required for future time horizons pertinent to the Project, including documentation of scenario method, data sources, uncertainties and caveats. Such variables include temperature, precipitation, upstream discharge, cyclones and storm surges, monsoons flooding, increased salinity, sediment flux, extreme heat/ drought. These will be used as inputs to the hydrodynamic models (Task 2), amongst others.
- This task should run in parallel with Tasks 2 and 3. Consultant should process social and environmental safeguards, gender mainstreaming, climate finance and guidelines with the core team of I&WD as per guidelines of Govt. of India relevant to the Project. Furthermore, within the context of the project, assess existing policies, laws and regulations, and/or institutional framework for adaptation and identify ways to enhance the enabling environment. As a result, Consultant will assist in accounting climate change adaptation and mitigation financing for the project as well as preparation of environmental safeguards, social safeguards and gender quality and social inclusion documents relevant to the Project area.
- A climate risk assessment approach should be followed to identify vulnerable hotspots in the Project area, which should be also aligned with preparation of the integrated basin river management plan and investment plan. Based on that, Consultant should identify climate risks and vulnerabilities and potential adaptation options and practices, following adaptive design principles, as inputs to assessment of climate change impacts on relevant aspects of the project.
- Consultant should identify and address the implications of projected climate change impacts and associated uncertainties for the design and operations of the project (Task 3). Furthermore, should perform the preparation of detailed designs with a comprehensive report on the potential risks of climate change to the Project and possible adaptation interventions (Task 5).
- Overall, climate change should be well integrated in the Project to ensure that climate resilient measures are embedded in project design.

7.2.5 Task5: Preparation of DPR with detailed designs, cost estimates, comprehensive cost-benefit analysis as per CWC,GoI format and Bidding Documents for 30% of the total investment

Task 5.1: Preparation of Detailed Designs, cost estimates and Bidding Documents
This Task will deliver detail design, cost estimates and bidding documents for 30% of total investment cost of the selection interventions of Task 3 and Task 4. These works would be implemented mostly under NCB contract packages clustering a series of interventions. The consultants would prepare detailed designs, cost estimates and ADB's Standard bidding documents for covering works of each package. Environmental and Social impact assessments and associated required safeguards documents are to be developed for all work packages. Planning for the physical work in various phases in different years with various sub-components of the project needs to be incorporated.

For preparing detailed designs and bidding documents for work components, the consultant would carry out, but not limited to, the following activities:

a. Prepare detailed designs and for that purpose, carry out surveys, site investigations, analysis, and prepare detailed designs reports for function and use design covering the contracting agency's requirements with respect to the procurement, in particular requirements related to the following:
   - Site conditions and circumstances.
   - Technical standards and use;
   - Technological innovations to meet the requirements with least cost

solutions including technology and construction methods.
- Architectural and aesthetic considerations.
- Functionality, durability and sustainability.
- Services according to the acceptable standards.

b. Carry out a comprehensive site examination and collect all information required for the evaluation of the present field conditions.

c. Carry out topographical surveys, addition to the ones performed within Task 2, to an extent sufficient to select the optimum alignments, grade and level of the embankment/dykes/number and dimensions of the hydraulic structures, to select the optimum location, and to facilitate the adequate determination of required quantities for the construction of the works.

d. Carry out geo-technical field investigations, which may be additionally required to determine the basic design parameter for the construction of embankment/structures and sluices, and to locate appropriate borrow areas (and/or disposal areas as needed) for material and concrete aggregates. In particular, the consultant will carry out technical, environmental and social impact analysis of dredged material that may be generated during dredging and construction activities and prepare detailed design for safe disposal of such materials.

e. Prepare criteria for the detailed designs including supporting computations for the proposed dredging operations, embankment structures, sluices, intakes, coffer dikes, bank protection works and other related works, according to approved Government standards. Drawings will be prepared to the extent that detailed cost estimates will be possible, and to facilitate contractors to prepare their bids and construction drawings.

f. Choose appropriate materials, optimize the designs and select least cost options that meet technical requirements and estimate quantities of construction, materials and finally Engineer's Estimate for preparation of bidding documents.

g. Prepare technical specifications, engineering drawings needed, tender documents, Bill of Quantities (BOQs) and bidding documents. For National Competitive Bidding, the bidding documents would be prepared in accordance with ADB procurement regulations & guidelines.

h. Identify requirements for construction supervision, including facilities, materials testing labs, on or off site as needed, equipment and staffing or any other special requirements.

i. Prepare detailed designs for all the interventions considering availability of local materials for construction, multi-functionality, ease in O&M, suitable for local O&M institution etc. Determine optimal criteria to reach to a best solution preventing from direct surge i.e. least cost solution that will be sustainable in long run with minimum O&M requirements. Develop a sediment management plan for the dredged material.

j. Estimate materials, equipment, costs: Prepare estimates of quantities of construction, materials, equipment, and prepare cost estimates with appropriate physical and price contingencies, and breakdown by major works items. Also, prepare bill of quantities and detailed engineering drawings showing the rehabilitation works that need to be carried out in each sub-project.

Task 5.2: Preparation of DPR

Preparation of DPR is required following the guidelines and SOP for examining and processing of project proposal for external assistance of Central Water Commission, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India. **The assignment of the Consultant will not be completed unless the DPR is approved by**

the Competent Authorities (Appraisal wings of Govt. of India and the ADB). DPR should be prepared as per the format of CWC, GoI also acceptable to ADB.

In the DPR, the Consultant will prepare a package of feasibility level outputs, documenting the viability of the proposed project investments, while adequately addressing hazards and risks, and mitigating environmental and social issues that have been identified in a separate environmental and social impact assessment. After getting the clearance of feasibility study report, the Consultant will prepare the detailed design, cost estimates and bidding documents. The Consultant will consider the views of I&WD during identification of zone and type of works and size of contract packages, for the purpose of preparation of design, cost estimates and bidding documents.

The DPR will include cost estimates and economic and financial cost benefit analysis as per GoI format, including an identification of the costs and benefits that have been incorporated into the design. Separate chapters to be included for land requirement and rehabilitation programme and cost thereof and planning for disposal of excavated earth.

7.2.6 Task 6 Institutional Strengthening

Task 6.1 Capacity Strengthening of the River Research Institute (RRI)

Consultant will conduct Capacity Strengthening of the River Research Institute (RRI), Mohanpur, Nadia under Irrigation and Waterways Department, Government of West Bengal which is an Institute dealing with river hydrology & hydraulics, geotechnical engineering, exploration and statistical analysis of hydrological data. River Research Institute (RRI) is equipped with modern instruments and technical experts for studying river behaviour, sedimentation and preparing models (Physical & Mathematical) etc and was established in the year of 1943. I&WD proposes to use this institute for the purpose of quality assurance and quality control during implementation of the Sundarbans Upper Delta Climate Resilient Development Project and also to use its infrastructure for assessment of the performance of the project, by systematic collection of data, remote sensing and GIS application, physical and mathematical modelling and developing as well as maintaining database on river behaviour and irrigation development within the Project area during post implementation period.

The Consultant will assess the existing infrastructure, review the plan of I&WD regarding its modernization and suggest a comprehensive proposal along with cost estimates for improvement of laboratories and other components to the extent required to meet up the objectives in regard, for implementation of "*Sundarbans Upper Delta Climate Resilient Development Project*" as well as its subsequent evaluation. The task would also include assessment of the skill of human resources presently available and preparing suitable training modules / manuals for upgrading their skills, if required, or any up-to-date upgradation proposed.

Task 6.2 Preparation of Institutional Capacity Strengthening System

The Consultant has to undertake the tasks summarised below:

Non–structural Measure and activities such as Basin-wise Master Plan with cost investment plans (short, medium and long-term structural and non-structural measures with land acquisition and rehabilitation programme); FFEWS; CB-DRM (flood), surveys and investigations, Capacity building plan; Creation of local water-users groups /associations; development of value chains of climate smart agriculture and aquaculture and linkages with FPOs (markets) for economic development. It can be summarised as follows:

- Comprehensive hydrodynamic modelling taking into account groundwater and evaporation. Since the system is morphologically dynamic, it is suggested that also a morphological module be attached to the hydrodynamic model. The later would also allow to access the impact of the (many) dredging interventions and see how quickly sedimentation will occur again after a number of years. The model to be developed will need lower boundary water levels.
- Basin-wise Master Plan with cost investment plans (short, medium and long-term structural and non-structural measures with land acquisition and rehabilitation programme).
- Community-based flood risk management / DRM activities.
- Asset management system – operation and maintenance plan.
- Water and sediment quality monitoring.
- Biannual bathymetry surveys.
- Capacity building plan.
- Creation of local water-users groups / associations.

Section 8. Time lines and expected deliverables

8.1 The Consultant will prepare the feasibility study report (FSR) and detailed project report (DPR) containing survey and hydro-morpho dynamic modelling, detailed design (including structural design wherever necessary), cost estimates, bidding documents including BoQ, Procurement Plan and other relevant documents as stated earlier, and Project Operational Manual to meet the requirements. The detailed designs and bidding documents need to be approved by the Design Wing of I&WD, State Project Management Unit (SPMU) as well as by the ADB in accordance with agreed framework. The Consultant is encouraged to discuss and agree design parameters with the Design Wing of I&WD prior to undertaking the actual design work by following appropriate procedures.

The schedule for various reports to be issued by the consultants is given below. All deliverables must be written in English. The Consultant shall allow sufficient time (at least 2 weeks) in the proposed time schedule for I&WD to review draft deliverables and incorporate the comments in the final deliverables.

Draft and Final deliverables (reports, maps) shall be submitted to I&WD. The report/deliverables shall be submitted in MS Office, MS Excel, MS Project and Adobe PDF (with copying provision). Deliverables should also be submitted in hard-copy (numbers indicated below). All reports should have an easy-to-read layout, should be well-structured and well written, should include a summary and helpful illustrations, graphics, charts and maps.

The total duration of the assignment is 24 months. Conducting workshop and preparation of report to complete the Environment and Social Impact Analysis (ESIA) as well as climate change and gender action plan report will go simultaneously at the time for preparation of feasibility report.

A detailed Work Plan shall be submitted by the Consult within 7 (Seven) working days from the date of contract signing.

8.2 The deliverables as listed below shall be submitted by the Consultant in electronic / soft copy and ten (10) hard copies (both draft & final feasibility report, draft & final DPR, draft & final procurement plan & bidding documents).

No.	Deliverable description	Timeline of submission	Percentage of payment of Contract Price
1	Inception Report	One (01) month from Contract signing	5
2	Workshop and Workshop Report on selection of options	Within three (03) months after Contract signing	5
3	Draft Feasibility Study Report including Primary Model Study and ESIA report	Eight (08) months from Contract signing	10
4	Final Feasibility Study Report	15 calendar days after receipt of comments, to be communicated within 15 calendar days from receipt of the Draft Feasibility Report	10
If the Project seems to be not feasible, the contract will be terminated at this stage			
5	Draft DPR	Within twelve (12) months after Contract signing including the report of ESIA alongwith ESMF & ESMP.	15
6	Final DPR	35 calendar days after receipt of comments, to be communicated within 25 calendar days from receipt of the Draft DPR	20
7	Draft Procurement Plan and Bidding Documents for 30% of the total investment	Within one (01) months after submission of Final DPR.	10
8	Final Procurement Plan and Bidding Documents for 30% of the total investment	Within one (01) months after submission of Draft Procurement Plan and Bidding Documents.	15
9	Response to queries of the appraisal authorities for a period of one year after actual completion of the contract period or till obtaining clearances of the appraisal wings of GoI whichever is later.	Within one month after raising the query	10

Notes:

1) The Consultant shall review and modify the Final DPR even after clearance by the I&WD, beyond the pendency of the contract period, without charging any extra cost, if such modification and review are required / suggested by the ADB & MoWR, RD & GR, GoI to achieve the objective of the Project and to accord final approval to the project.
2) It will be obligatory on the part of the consultant to respond to the queries raised by GoI entities up till one year of the completion of the contract.
3) The above deliverables are indicative which may be subjected to suitable modifications if required in the RFP.

The total duration of the assignment is 24 months. Conducting workshop and preparation of report to complete the Environment and Social Impact Analysis (ESIA) as well as climate change and gender action plan report will go simultaneously at the time for preparation of DPR.

8.3 Workshop Report, including but not limited to:

- Power Point presentations summarizing the findings.
- Comprehensive details of all identified options.
- Potential environmental and social impacts of each of the options, including indication on management, operation and maintenance related issues.
- Comparative preliminary costs analysis.
- Minutes of meetings (MoM) with local authorities.
- Detailed justification of the selection of the preferred option, keeping into consideration inter alia, issues related to management, operation and maintenance related issues.
- Proceedings of the workshop and list of participants

8.4 The draft and final Feasibility Study Report will contain inter alia the following information:

- Comprehensive details of the preferred option, including a detailed justification.
- Narrative of the challenges after site visits and detail survey works, including Site visit and survey report
- Detailed hydro morpho dynamic modelling, to assess the feasibility of the project.
- Sub-basin wise availability of water to reduce the salinity.
- Confirmation of the approach / methodology.
- Broad suggestions of the likely options that I&WD will consider.
- Economic viability of the project. The preliminary cost-based analysis.
- Confirmation of the data, reports and other information received from the Client, and collected from other sources by the Consultant.
- Update on office establishment in Kolkata.
- List of experts that have been recruited and are being deployed.
- Probable land requirement and rehabilitation proposal.
- Planning for Disposal of excavated earth in details.
- Assessment of private land purchase along with preliminary R & R.

8.5 The Draft and Final DPR shall contain inter alia the following information:

- Detailed designs (including structural design wherever necessary), design calculation/hydro morpho dynamic modelling report, drawings, survey maps, geotechnical and sediment load analysis reports.
- Detailed cost estimate and economic with financial benefit analysis, including identification of the costs and benefits that have been incorporated into the design. A separate chapter to be included for land requirement and rehabilitation programme and cost thereof.
- Cost of disposal of excess excavated earth with methodology.
- Compliances of the observations of the appraisal wings of the Govt. of India.
- Environmental and social impacts of the preferred option and how these have been reflected into the design of the investments. Various mitigation measures for minimizing adverse environment and social impacts are to be incorporated in the Draft DPR.
- Capacity strengthening of the RRI, Mohanpur, Nadia.

- Project Operational Manual including suggestions for specific quality control measures for proper implementation of the project.

8.6 Procurement Plan and Bidding Documents shall contain, inter alia, the following information:

- Procurement Manual and Procurement Plan for initial bidding purposes, of the 30% of the total project investment envelope, as per norms/regulations of the ADB and suggestions of I&WD.
- Invitation to Bid, technical specifications, tender drawings, GCC, SCC, timeline, and all relevant annexes all in form acceptable to the I&WD under GoWB and the ADB.
- BoQ.

Section 9. Institutional arrangements and classification

9.1 Institutional arrangements

The Consultant shall work under the direct supervision of the I&WD and it is required to establish a dedicated Project Management Unit (PMU) assisting the Consultancy Team as required, particularly to the hydrological, morphological and institutional aspect of the services. In case of any unforeseen events, be it in terms of physical or social obstacles at field levels, the I&WD concerned field offices will take initiatives to solve them and ensure good working environment. Technical and project management issues shall be discussed in meetings among I&WD and the Consultant. Any unresolved issue, technical or otherwise, would be taken up with MoWR GoI through the I&WD The Consultant will establish their office in Kolkata and the field at a convenient location from I&WD field offices to whom they will be reporting on a day-to-day basis.

The Consultant will conduct regular meetings with I&WD to:

- Discuss the progress of the work and preliminary outputs;
- Give the I&WD an opportunity to make comments and suggestions on a timely basis; and.
- Resolve problems and issues that may be encountered.

The I&WD may assign counterpart personnel to the study for purposes of transfer of knowledge and capacity building. The Consultant shall provide for the required office space for the I&WD counterparts.

The following data sets and studies are to be provided to the Consultant by I&WD:

- List of stretches of Channels for which survey data are available as per Annexure-I (pdf) with available cross sectional data in MS Excel format.
- List of stretches of Ichhamati river with length and Latitude & Longitude for which Bank protection and Anti-erosion work is required as per Annexure-II (pdf).
- Index Map showing drainage infrastructure primarily identified for 1st Phase execution (pdf files) in Plate No. 1
- Historically observed gauge level and discharge data of different Channels / Rivers System.
- Other available data (on request).

Section 10. Key experts and other specialists

10.1 List of Key (K) Experts and their minimum qualification and experience (to be evaluated for arriving at the Technical Score of the Proposals) are listed in next page:

Sl. No.	Position	Minimum Qualification	Experience	Assigned Tasks and estimated Man Month
K-1	Team Leader	Graduation in Civil Engineering and Post-Graduation in Hydrology / Water Resources or equivalent	At least 20 years of experience at National & International level out of which at least 8 years in Asia in design, implementation and management of major Flood & Drainage projects having dredging experience; and team leadership in these types of projects, preferably funded by ADB, World Bank or other MFIs.	Overall supervision and monitoring, providing technical guidance, compliance of observations of ADB and other State/Central Govt appraisal Organizations. He will keep close liaison with the client. He will monitor the output of other experts and/or other category of staff. **Man Months - 24**
K-2	Deputy Team Leader & Water Resource Expert	Graduation in Civil Engineering and Post-Graduation in Hydrology / Water Resources / Hydraulic Engineering.	At least 15 years of experience at National/State level in India, in design, implementation and management of major Flood & Drainage projects; and team leadership/deputy leadership in these types of projects, preferably funded by ADB/World Bank / other MFIs.	Sub basin wise design of water resource management, selection of options, providing guidance on modelling, interacting with various stakeholders, dealing with land related issues, supervision & monitor the quality of survey works (hydrographic/topographic and other type of survey works) and assistance to the Team Leader. **Man Months – 24**
K-3	Structural Engineer	Post Graduation in Structural Engineering	At least 15 years of experience, in detailed design of hydraulic structures for major Irrigation / Flood Management/ Drainage / Water Resources projects.	Planning & supervision of all types of survey works, expertise in Detailed structural designs, preparation of working/ tender drawings & estimates and interaction with the Modeller, as necessary, and report to the Deputy Team Leader.

Sl. No.	Position	Minimum Qualification	Experience	Assigned Tasks and estimated Man Month
				Man Months - 16
K-4	Hydrologist cum Mathematical Modeller	Graduation in Civil Engineering and Post-Graduation in Hydrology / Water Resources/Modelling.	At least 10 years of experience, in the field of hydrological studies /hydro morphologic/ Modelling (Knowledge of framing & running of softwares like MIKE-1D & 2D model/ or HEC HMSC 1D & 2D) / mapping / designing for major Water Resources Projects, preferably in Flood Management / Drainage Sector with peripheral Domain knowledge.	• Collection of available hydrological & hydraulic data and analyse these data • Day to day checking of field survey data • Development of hydro morpho-dynamic model (1D coupled with 2D, with sediment transport module) with calibration and validation • Assess the technical viability of various options for drainage and flood management • Analyse the sustainability of dredging/ desiltation interventions **Man Months - 16**
K-5	Ground water cum Mathematical Modeller	Graduation in Civil Engineering and Post-Graduation in Hydrology / Water Resources/Modelling.	At least 10 years of experience, in the field of hydrological studies /hydro morphologic/ Modelling (Knowledge of framing & running of softwares like MIKE-1D & 2D model/ or HEC HMSC 1D & 2D) / mapping / designing for major Ground Water Resources Projects, preferably in Flood Management / Salinity intrusion with peripheral Domain knowledge.	• Collection of available hydrological & Ground water/ aquifer data and analyse these data • Day to day checking of field survey data • Development of hydro morpho-dynamic model (1D coupled with 2D, with sediment transport module) with calibration and validation • Assess the technical viability of various options for ground water mapping and reduction of salinity using different techniques. **Man Months - 12**

Sl. No.	Position	Minimum Qualification	Experience	Assigned Tasks and estimated Man Month
K-6	Procurement Specialist	Graduation in Civil Engineering or equivalent	At least 15 years of experience, in procurement of works, goods and services, preparation of bid and contract documents, evaluation of bids and expertise in contract management of projects funded by ADB/World Bank or other MFIs.	Preparation of bidding documents, bill of quantities, specification, tender drawings, modes of measurement, quality control measures and terms & conditions etc. He will draft all documents related to the EOI, RFP, RFB, RFQ, etc., as applicable, for each of the packages as per ADB norms for the execution of the project. **Man Months – 6**
K-7	Environment Specialist	Master degree in Environmental Engineering or equivalent	At least 10 years of experience in Environmental-Social Impact Analysis and Climate Change Assessment for projects in water resource sector preferably having experience with ADB, World Bank or other MFIs.	Working closely with the Team Leader/ Deputy Team Leader and the stake holders for incorporating the environmental management requirements for the feasibility study and preparation of DPR including the bidding documents. Preparation of the Information Education & Communication (IEC) materials, the Environment Assessment Report (EAR) and other necessary documents on environment issues. **Man Months – 10**
K-8	Social Specialist	Master degree in Social Sciences	At least 15 years of relevant experience in flood and water resources and drainage sector preferably having experience with ADB, World Bank or other MFIs	Identification and analysing potential social impacts of water resource projects including effects on local communities, livelihoods and vulnerable groups. Ensuring compliance with ADB's social safeguard policies including those related to involuntary resettlement and rehabilitation of indigenous people and human rights. Addressing gender & social issues in

Sl. No.	Position	Minimum Qualification	Experience	Assigned Tasks and estimated Man Month
				project design, implementation and mitigation measures. **Man Months – 14**
K-9	Agriculture Economist	Post-Graduation in Economics /Agri-Economics or equivalent	At least 15 years of relevant work experience in financial management and accounting in agricultural and major flood and irrigation projects preferably having experience with ADB, World Bank or other MFIs	Assessment of project feasibility, costs and benefits to ensure efficient allocation of resources. Designing the policies to promote water conservation and evaluating the economic value of water resources and ensuring project alignment with equity and environmental sustainability goals. **Man Months – 08**

10.2 Other Non-Key (NK) specialists listed below (will not be evaluated for arriving at the Technical Score of the Proposals. However, the Consultant shall submit CVs of the proposed staff for each of these positions for I&WD's review:

Sl. No.	Position	Man Month
NK-1	Dredging Engineer with experience in O&M – 1 No.	12
NK-2	AutoCAD – 2 Nos.	48
NK-3	GIS/RS Expert – 1 No.	24
NK-4	Electrical/ Mechanical Engineer – 1 No.	12
NK-5	Support Engineer (Civil) – 5 Nos.	100
NK-6	Surveyors – 10 Nos.	140
NK-7	Land Management Expert (Amin) – 7 Nos.	105
NK-8	Geotechnical Specialist – 1 No.	12
NK-9	Capacity Strengthening Specialist – 1 No.	12
NK-10	MIS Specialist with experience in the design of IT-based monitoring – 1 No.	12
NK-11	Climate Change Expert with experience in flood and water resources & drainage sector having experience with ADB/World Bank/other MFIs – 1 No.	6
NK-12	Data Entry Operators – 3 Nos.	72

List of Rivers and Channels to be surveyed under the "Sundarbans Upper Delta Climate Resilient Development Project".

Annexure-I under Bidyadhari Drainage Division (for desiltation works)

Sl. No.	River/Khal	District	Block/ Municipality	Start (Latitude, Longitude)	End (Latitude, Longitude)	Approximate Length in Km
1	Jamuna River (From 60.0 Km to 78.0 Km)	Nadia	Kalyani, Chakdaha, Haringhata	22.992907 88.545196 (Birohi)	22.994278 88.411131 (Char Jadubati)	18.00
2	Jamuna River (From 0.0 Km to 9.0 Km)	North 24 Parganas	Swarupnagar	22.841881 88.842038 (Tipi)	22.854982 88.807677 (Charghat)	9.00
3	Nonagong (From 0.0 Km to 24.0 Km	North 24 Parganas	Habra-I Deganga, Barasat-I, Barasat-II	22.632892 88.626925 (Conflece at Haroa Gong)	22.773053 88.602736 (Dhabdhara /Rautara Bridge)	24.00
4	Nonagong (From 43.10 Km to 48.0 Km	Nadia	Haringhata	22.884878 88.626567 At Kakpole G.P.	22.945334 88.579968 (Doilar More/ Fatepur High School)	5.00
					Total =	**56.00**

Annexure-II under Urban Drainage Division (for desiltation works)

Sl. No.	River/ Khal	District	Block/ Municipality	Latitude	Longitude	Approximate Length in Km
1	Re-excavation/dredging Bager khal and widening by 10 m to 15 m over length of 6.6 km up to Mathura Beel including protection work	North 24 Parganas	Halisahar Kanchrapara	22.940012°	88.457631°	6.60
2	Dredging of 400 m between Jamuna khal and culvert at Mathura Beel	North 24 Parganas	Haringhata	22.961668°	88.512340°	0.40
3	Dredging of Khoirapur Khal over 3.87 km including protection work & construction of 3 nos sluices	North 24 Parganas	Barrackpore I	22.745148°	88.403826°	3.87
4	Dredging of Ichapur Khal over 4.50 km including protection work & rehabilitation of 2 nos sluices	North 24 Parganas	Barrackpore II & North Barrackpore	22.749976°	88.380527°	4.50
5	Dredging over 15 km of Nowi khal including protection work	North 24 Parganas	Rajarhat	22.687866°	88.421743°	15.00
6	Cleaning of polluted discharge water over length of dredging with a width of 250 m at Bartir Beel	North 24 Parganas	Barrackpore I, Barasat II	22.792270°	88.412440°	0.25
					Total =	**30.62**

Annexure-III under EE-I Canals Division (for anti-erosion works)

Sl. No.	Location Name	River	District	Block/ Municipality	Latitude	Longitude	Approximate Length of Damage in Km
1	Near Sadhu Ghat and Panchanantala Ghat	Hooghly	North 24 Parganas	Bhatpara	22.843077	88.376595	0.50
2	Near Kalibari Ferighat to Abinash Sarkar Ghat	Hooghly	North 24 Parganas	Bhatpara	22.829796	88.377315	0.50
3	Near Rupdas Ghat	Hooghly	North 24 Parganas	Bhatpara	22.873462	88.408081	0.25
4	Near Hara Ghosh Road Ghat	Hooghly	North 24 Parganas	Bhatpara	22.845585	88.376178	0.30
5	Near Jagaddal Ghat	Hooghly	North 24 Parganas	Bhatpara	22.858575	88.374247	0.20
6	Pal Ghat	Hooghly	North 24 Parganas	Bhatpara	22.863709	88.380819	0.20
7	Near Bichali Ghat	Hooghly	North 24 Parganas	Garulia	22.82391	88.3599	0.10
8	Near Girish Ghat	Hooghly	North 24 Parganas	Garulia	22.82111	88.3575	0.10
9	Near Pacha Khal	Hooghly	North 24 Parganas	Garulia	22.71232	88.36475	0.40
10	Near Ramkrishna Ashram	Hooghly	North 24 Parganas	Halisahar	22.62132	88.4162	1.20
11	Near Bagher Khal	Hooghly	North 24 Parganas	Halisahar	23.62162	88.4263	2.90
12	Near Panchanantala Ghat to Balak Brohmachari Dham	Hooghly	North 24 Parganas	Panihati	22.71232	88.36475	0.70
13	Near Tannath Babu Ghat	Hooghly	North 24 Parganas	Panihati	22.700555	88.365866	0.50
14	Near Sukhachar	Hooghly	North 24 Parganas	Panihati	22.701252	88.364365	0.40
15	Near Baro Mandir Ghat	Hooghly	North 24 Parganas	Panihati	22.702499	88.365721	0.50
16	Near Palta water Tank	Hooghly	North 24 Parganas	North Barrakpore	22.785882	88.34172	0.50
17	Near Deodwar Park	Hooghly	North 24 Parganas	North Barrakpore	22.7693	88.33842	0.50
18	Mangal Pandey Ghat to Annapurna Ghat	Hooghly	North 24 Parganas	Barrakpore	22.750277	88.36416	2.00
19	Near Debitala Ferighat	Hooghly	North 24 Parganas	Barrakpore	22.751257	88.36426	0.50
20	Near Camp Ghat	Hooghly	North 24 Parganas	Khardah	22.714739	88.364815	0.60
21	Near Rashkhola	Hooghly	North 24 Parganas	Khardah	22.70389	88.363611	0.60
22	Near BSF Ghat	Hooghly	North 24 Parganas	Baranagar	22.65105	88.35813	0.35
23	Rameswar Ghat to Pramanic Ghat	Hooghly	North 24 Parganas	Baranagar	22.631367	88.357132	1.10
24	Near Chinikuthi Ghat	Hooghly	North 24 Parganas	Baranagar	22.637618	88.312488	0.30

Sl. No.	Location Name	River	District	Block/ Municipality	Latitude	Longitude	Approximate Length of Damage in Km
25	Near Ratan Babur Ghat	Hooghly	Kolkata	Kolkata Municipal Corporation	22.63005	88.365214	0.20
26	Near Kashipore Burning Ghat	Hooghly	Kolkata	Kolkata Municipal Corporation	22.6309334	88.364619	0.30
27	Near Nimtala Burning Ghat	Hooghly	Kolkata	Kolkata Municipal Corporation	22.590426	88.350958	1.10
						Total=	**16.80**

Annexure-IV under EE-II Canals Division (for anti-erosion works)

Sl. No.	Location Name	River	District	Block/ Municipality	Latitude Longitude		Approximate Length of Damage in Km.
					Starting	Ending	
1	Near Naldari Sluice	Left Embankment of river Hooghly	South 24 Parganas	Budge Budge - II	22.384163 N 88.115272 E	22.383832 N 88.114400 E	0.250
2	Taraganj Colony(Char Land)	Left Embankment of river Hooghly	South 24 Parganas	Diamond Harbour - II	22.281936 N 88.100177 E	22.280374 N 88.098875 E	0.25
3	Gayenpara	Left Embankment of river Hooghly	South 24 Parganas	Kulpi	22.163807 N 88.205237 E	22.161663 N 88.205784 E	0.40
4	Dariratneswarpur	Left Embankment of river Hooghly	South 24 Parganas	Kulpi	22.132026 N 88.211646 E	22.130275 N 88.211556 E	0.60
5	Budge Budge Police Station to Pujali Ferryghat	Left Embankment of river Hooghly	South 24 Parganas	Budge Budge - I	22.478228 N 88.169360 E	22.474704 N 88.143703 E	1.40
6	Between Nungi Feeryghat to Budge Budge Ferryghat	Left Embankment of river Hooghly	South 24 Parganas	Thakurpukur Maheshtala & Budge Budge - I	22.514529 N, 88.212428 E	22.445705 N 88.129042 E	1.50
7	Birlapur 3 phatak to Raipur Swadeshi mela ground	Left Embankment of river Hooghly	South 24 Parganas	Budge Budge -II Block	22.420378 N, 88.147717 E	22.401986 N, 88.142864 E	0.60
						Total =	**5.00**

Annexure-V under EE-I Lower Damodar Construction Division (for anti-erosion works)

Sl. No.	Tentative Location	River	District	Block	Latitude	Longitude	Length (km)
1	Proposed Bank protection to Right Bank of river Hooghly in different places in between Bally bridge to Howrah Bridge.	Right Embankment of river Hooghly	Howrah	Bally Municipality & Howrah Municipal Corporation	22.649722	88.351111	0.60
2	Proposed Bank protection to Right Bank of river Hooghly from B.Garden Ferry Ghat to Nazirgang Ferry Ghat (Including Botanical Garden)	Right Embankment of river Hooghly	Howrah	Howrah Municipal Corporation	22.554444	88.299167	1.20
3	Proposed Bank protection to Right Bank of river Hooghly from Podra Kheya Ghat to Outfall of Mahisdhara Khal.	Right Embankment of river Hooghly	Howrah	Sankrail	22.55333	88.271111	0.50
4	Proposed Bank protection to Right Bank of river Hooghly from Rajganj to Sankrail Police Station .	Right Embankment of river Hooghly	Howrah	Sankrail	22.561667	88.236111	0.40
5	Proposed Bank protection to Right Bank of river Hooghly at Deltajute Mill area .	Right Embankment of river Hooghly	Howrah	Sankrail	22.534444	88.237222	0.50
6	Proposed Bank protection to Right Bank of river Hooghly at Manikpur Ferry ghat area .	Right Embankment of river Hooghly	Howrah	Sankrail	22.529221	88.227394	0.50
7	Proposed Bank protection to Right Bank of river Hooghly at Nayaband Area.	Right Embankment of river Hooghly	Howrah	Sankrail	22.52291	88.225944	0.40
8	Proposed Bank protection to Right Bank of river Hooghly at Bhabatarini Mandir Area.	Right Embankment of river Hooghly	Howrah	Sankrail	22.5221684	88.2188544	0.50
9	Proposed Bank protection to Right Bank of river Hooghly at Sarenga sluice Area.	Right Embankment of river Hooghly	Howrah	Sankrail	22.519554	88.207346	0.50
10	Proposed Bank protection to Right Bank of river Hooghly in different places in between Gloster Jute mill to Bouria area	Right Embankment of river Hooghly	Howrah	Uluberia Municipality	22.485356	88.165089	0.50
						Total =	**5.60**

Annexure-VI under EE-II Lower Damodar Construction Division (for anti-erosion works)

Sl. No.	Description	Block / Municipality	Lat & Long (Starting)	Lat & Long (Ending)	Length(Km) (Approx.)
1	Chengail(Chakkasi) Uluberia Bibir Chara	Uluberia Municipality	22° 29' 00" N 88° 28' 16" E	22° 28' 06" N 88° 06' 55" E	4.60
2	Uluberia Kalimandir to Jagadishpur (Chapa Khal)	Uluberia Municipality	22° 28' 03" N 88° 06' 53" E	22° 27' 14" N 88° 06' 54" E	2.00
3	Barkalia Kalimandir to Ramchandrapur	Shyampur-I	22° 18' 48" N 88° 05' 26" E	22° 18' 01" N 88° 05' 17" E	1.50
4	Shibganj to Gadiara	Shyampur-I	22° 15' 19" N 88° 04' 34" E	22° 14' 04" N 88° 03' 47" E	3.00
				Total =	**11.10 km**

Annexure-VII under Mograhat Drainage Division

Table A: Desiltation Works

Sl. No.	River/Khal	District	Block/ Municipality	Start (Latitude, Longitude)	End (Latitude, Longitude)	Approximate Length in Km
1	Adiganga Drainage Channel	South 24 Parganas	Rajpur Sonarpur Municipality, Sonarpur, Baruipur Municipality, Baruipur	22.4469°N 88.39049°E	22.365853°N 88.422838°E	21.30
2	Brindakhali Khal	South 24 Parganas	Baruipur	22.338828°N, 88.507702°E	22.318643°N 88.516495°E	6.40
3	Suryapur outer Khal &Suryapur link channel	South 24 Parganas	Baruipur, Jaynagar-I	22.29171°N 88.467157°E	22.257267°N 88.542023°E	13.20
4	Suryapur Defunct khal	South 24 Parganas	Baruipur	22.338828°N 88.507702°E	22.30301°N 88.50742°E	4.30
5	Nachangacha Khal	South 24 Parganas	Baruipur	22.318343°N 88.483525°E	22.29214°N 88.470078°E	3.80
6	Veragachi Khal	South 24 Parganas	Baruipur	22.318163°N 88.500646°E	22.318343°N 88.483525°E	5.50
7	Kumrakhali Khal	South 24 Parganas	Baruipur	22.28269°N, 88.47646°E	22.26514°N 88.53040°E	8.90
8	Himchi Khal	South 24 Parganas	Baruipur	22.304068°N 88.51975°E	22.303705°N 88.520421°E	3.90
9	Piali Canal	South 24 Parganas	Baruipur, Jaynagar-I	22°20'23.37"N, 88°30'57.93"E	22° 8'5.08"N, 88°35'54.05"E	33.85
10	Peyaratala Khal	South 24 Parganas	Jaynagar-I	22.25562°N 88.53879°E	22.25828°N 88.53675°E	1.80
11	Extension of Adiganga	South 24 Parganas	Rajpur Sonarpur Municipality	22.446969°N 88.390464°E	22.45147°N 88.387749°E	0.85
12	Inner Channel-I	South 24 Parganas	Joynagar-I	22.244139°N, 88.557435°E	22.24858°N, 88.54795°E	1.60
13	Inner Channel-II	South 24 Parganas	Joynagar-I	22.230706°N, 88.555351°E	22.238977°N, 88.569802°E	3.12
14	Inner Channel-III	South 24 Parganas	Joynagar-I	22.227035°N, 88.554126°E	22.225170°N, 88.573751°E	2.80
15	Inner Channel-IV	South 24 Parganas	Kultali	22.187045°N, 88.558646°E	22.185386°N, 88.573691°E	2.44
16	Inner Channel-V	South 24 Parganas	Kultali	22.162742°N, 88.562097°E	22.175376°N, 88.578734°E	3.40

Sl. No.	River/Khal	District	Block/ Municipality	Start (Latitude, Longitude)	End (Latitude, Longitude)	Approximate Length in Km
17	Inner Channel-VI	South 24 Parganas	Kultali	22.144452°N, 88.593447°E	22.152448°N, 88.598940°E	6.20
18	Suryapur Inner channel	South 24 Parganas	Mograhat-II	22°24'87" N 88°37'69" E	22°29'50" N 88°46'26" E	12.80
19	Mograhat connecting channel	South 24 Parganas	Mograhat-II	22.789442°N, 88.889585°E	22.789539°N, 88.854212°E	4.00
20	Kata Khal	South 24 Parganas	Mograhat-II	22.819484°N, 88.843741°E	22.819479°N, 88.848708°E	8.00
21	Barasat Kata Khal	South 24 Parganas	Mograhat-II	22°21'51" N 88°44'16" E	22.825059°N, 88.838377°E	8.80
22	Hobka khal Upper & lower	South 24 Parganas	Mograhat-II	22°19'79" N 88°49'32" E	22°26'07" N 88°54'06" E	15.00
23	Joynagar Khal	South 24 Parganas	Mograhat-II	22°20'85" N 88°38'83" E	22°18'34" N 88°41'29" E	5.80
24	Muldia Krishi Khal	South 24 Parganas	Mograhat-II	22°20'67" N 88°38'82" E	22°18'41" N 88°38'77" E	5.60
25	Borar Khal	South 24 Parganas	Mograhat-II	22°18'32" N 88°41'32" E	22°16'65" N 88°42'72" E	5.90
26	Hotor Khal	South 24 Parganas	Mograhat-II	22°30'60" N 88°39'84" E	22°31'78" N 88°44'09" E	5.80
27	Branch channel of Hotor Khal	South 24 Parganas	Mograhat-II	22°30'83" N 88°40'23" E	22°30'82" N 88°40'24" E	1.80
28	Suti Khal of Suryapur Inner Channel	South 24 Parganas	Mograhat-II	22°28'25" N 88°41'66" E	22°28'85" N 88°40'09" E	4.50
29	Shyamnagar Khal	South 24 Parganas	Mograhat-II	22°25'08" N 88°37'76" E	22°25'05" N 88°38'72" E	2.10
30	Radhanagar Khal	South 24 Parganas	Mograhat-II	22°26'12" N 88°38'37" E	22°26'35" N 88°36'78" E	2.80
31	Gotberia Khal	South 24 Parganas	Mograhat-II	22°25'53" N 88°38'02" E	22°25'83" N 88°40'06" E	1.95
32	Telepukur Khal	South 24 Parganas	Mograhat-II	22°16'63" N 88°46'97" E	22°16'58" N 88°47'75" E	3.00
33	Br.Channel of Suryapur Inner channel	South 24 Parganas	Mograhat-II	22°27'59" N 88°39'77" E	22°30'77" N 88°39'29" E	4.00
34	Mandirbazar Khal	South 24 Parganas	Mograhat-II	22°16'14" N 88°33'85" E	22°21'82" N 88°37'31" E	7.80
					Total =	**223.01**

Table B: Anti-erosion Works

Sl. No.	Location Name	River with bank	District	Block/ Municipality	Latitude, Longitude	Approximate Length in Km
1	Kharijtala RCC Bridge to 14 vent Regulator	Both Bank	South 24 Parganas	Baruipur	22°17'14.64"N, 88°31'0.10"E	7.5
2	Dabu 6-vent Sluice	Both Bank of SAMD Part-II	South 24 Parganas	Canning-I	22.249649°N, 88.647741°E	2.00
1	Jiban mondaler Hat to Udkhali Regulator	Hobka lower Reach(Left)	South 24 Parganas	Joynagar-I	22°11'38.13"N 88°29'30.04"E	0.75
2	Hobka Khal at Mouza-Khaiyamara	Hobka lower Reach(Left)	South 24 Parganas	Joynagar-II	22°22'73 N 88°51'60 E	1.10
3	Suryapur inner Channel from Hangsageria to Chandpur Bridge	Suryapur inner Channel (Right)	South 24 Parganas	Mograhat-II	22°16'29.43"N 88°24'28.44"E	1.20
					Total =	**12.55**

Annexure-VIII under Basirhat Irrigation Division

Table A: Desiltation Works

Sl. No.	River/Khal	District	Block/ Municipality	Start (Latitude, Longitude)	End (Latitude, Longitude)	Approximate Length in Km
1	Ichamati	North 24 Parganas	Swarupnagar, Baduria, Basirhat-I, Basirhat-II and Baduria & Basirhat Municipality	22.787151°N, 88.852592°E	22.665946°N, 88.873288°E	33.30
2	Tentulia Khal with sluice	North 24 Parganas	Swarupnagar	22.789442°N, 88.889585°E	22.789539°N, 88.854212°E	4.00
3	Paglar Baor with sluice	North 24 Parganas	Swarupnagar	22.819484°N, 88.843741°E	22.819479°N, 88.848708°E	8.00
4	Saheber khal with sluice	North 24 Parganas	Swarupnagar & Baduria	22.777012°N, 88.799787°E	22.825059°N, 88.838377°E	8.80
					Total =	**54.10**

Table B: Anti-erosion Works

Sl. No.	Location Name	River with bank	District	Block/ Municipality	Latitude, Longitude	Approximate Length of Damage in Km
1	Basirhat Shamshan ghat	Ichamati (Right bank)	North 24 Parganas	Basirhat Municipality	22.663056°N, 88.868056°E	1.1
2	Basirhat Taparchar Jelepara	Ichamati (Right bank)	North 24 Parganas	Basirhat Municipality	22.675938°N, 88.856853°E	0.8
3	Chowrah jame Masjid	Ichamati (Left bank)	North 24 Parganas	Basirhat-I	22.694860°N, 88.853990°E	1
4	Faridkati Jelepara	Ichamati (Left bank)	North 24 Parganas	Baduria Municipality	22.740614°N, 88.812535°E	0.2
5	Banglani Charpara	Ichamati (Left bank)	North 24 Parganas	Swarupnagar	22.803748° N, 88.840576° E	0.19
6	Tentulia Dolderpara	Ichamati (Left bank)	North 24 Parganas	Swarupnagar	22.793661°N, 88.855545°E	0.18
7	Ghola ghat	Ichamati (Left bank)	North 24 Parganas	Swarupnagar	22.847822°N, 88.847570°E	0.2
					Total =	**1.10**

Superintending Engineer
Central Tender Unit
Irrigation & Waterways Directorate
Government of West Bengal
Jalasampad Bhawan, Salt Lake,
Kolkata-700091

Memo .No. CTU/E/441(28) Dated the 15.09.2025

Copy Submitted for information and wide circulation through the Notice Board to the:-

1) Chief Engineer (South), Irrigation and Waterways Directorate, Govt. of W.B., Jalasampad Bhawan, Salt Lake, Kolkata-700091.
2) Chief Engineer (West), Irrigation and Waterways Directorate, Govt. of W.B., Kanainatshal, Sadhanpur, Purba Burdhaman-713013.
3) Chief Engineer (South West), Irrigation & Waterways Directorate, Govt. of W.B.
4) Chief Engineer (North), Irrigation & Waterways Directorate, Govt. of W.B.
5) Chief Engineer (North East), Irrigation & Waterways Directorate, Govt. of W.B.
6) Chief Engineer (TBP), Irrigation & Waterways Directorate, Govt. of W.B.
7) Director, River Research Institute, I & W Dte., Govt. of West Bengal, Mohanpur, Nadia.
8) Superintending Engineer, Eastern Circle, I & W. Directorate, Govt. of W.B., Jalasampad Bhawan, Salt Lake, Kolkata-700091.
9) Superintending Engineer, Western Circle-I, I & W. Directorate, Govt. of W.B., Jalasampad Bhawan, Salt Lake, Kolkata-700091.
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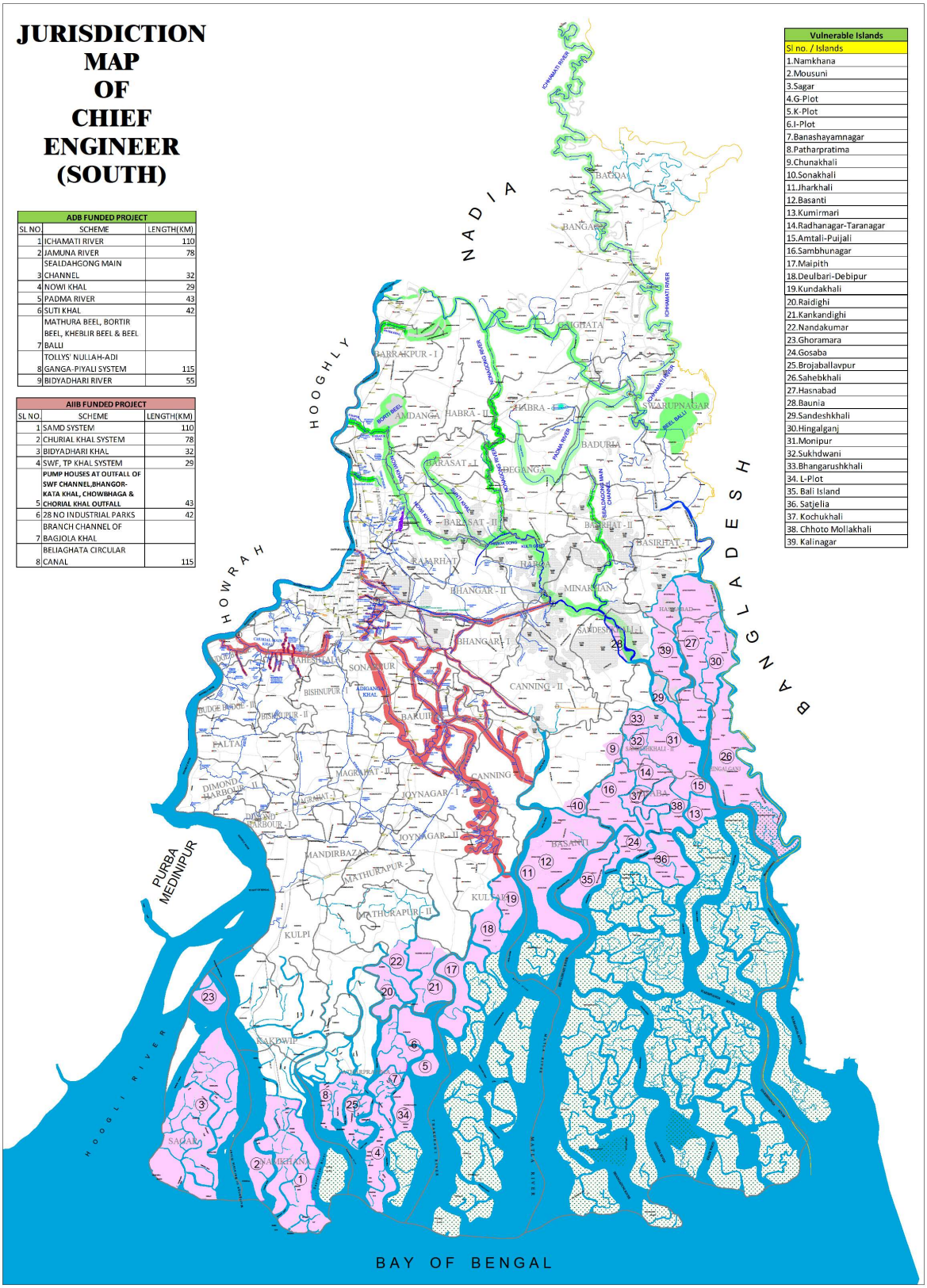
11) Superintending Engineer, Greater Calcutta Drainage Circle, Irrigation & Waterways Directorate, Government of West Bengal, Jalasampad Bhawan, Salt Lake, Kolkata-700091
12) District Magistrate, South 24-Parganas
13) District Magistrate, North 24-Parganas
14) District Magistrate, Nadia
15) District Magistrate, Howrah
16)District Magistrate, Hooghly
17) Commissioner of Kolkata Municipal Corporation
18)Executive Engineer, Bidyadhari Drainage Division, Barasat.
19) Executive Engineer, & TA to C.E. (South), I & W Dte., Govt. Of West Bengal
20) Executive Engineer-I, Canals Division, I & W Dte., Govt. Of West Bengal
21) Executive Engineer-II, Canals Division, I & W Dte., Govt. Of West Bengal
22) Executive Engineer, Basirhat Irrigation Division, I & W Dte., Govt. Of West Bengal
23) Executive Engineer-I, Lower Damodar Construction Division, I & W Dte., Govt. Of West Bengal
24) Executive Engineer-II, Lower Damodar Construction Division, I & W Dte., Govt. Of West Bengal
25) Executive Engineer-I, Mograhat Drainage Division, I & W Dte., Govt. Of West

Bengal

26) Executive Engineer, Sundarban Delta Project, Haringhata, Nadia
27) Executive Engineer, Urban Drainage Division, I & W Dte., Govt. Of West Bengal
28) Notice Board, Greater Calcutta Drainage Circle, I & W Dte., Govt. Of West Bengal

Superintending Engineer
Central Tender unit
Irrigation & Waterways Directorate
Government of West Bengal
Jalasampad Bhawan, Salt Lake,
Kolkata-700091

Plate No-01


JURISDICTION MAP OF CHIEF ENGINEER (SOUTH)
ADB FUNDED PROJECT
SL NO. | SCHEME | LENGTH(KM)
1 | ICHAMATI RIVER | 110
2 | JAMUNA RIVER | 78
3 | SEALDAHGONG MAIN CHANNEL | 32
4 | NOWI KHAL | 29
5 | PADMA RIVER | 43
6 | SUTI KHAL | 42
7 | MATHURA BEEL, BORTIR BEEL, KHEBLIR BEEL & BEEL BALLI |
8 | TOLLYS' NULLAH-ADI GANGA-PIYALI SYSTEM | 115
9 | BIDYADHARI RIVER | 55
AIIB FUNDED PROJECT
SL NO. | SCHEME | LENGTH(KM)
1 | SAMD SYSTEM | 110
2 | CHURIAL KHAL SYSTEM | 78
3 | BIDYADHARI KHAL | 32
4 | SWF, TP KHAL SYSTEM | 29
5 | PUMP HOUSES AT OUTFALL OF SWF CHANNEL,BHANGOR-KATA KHAL, CHOWBHAGA & CHORIAL KHAL OUTFALL | 43
6 | 28 NO INDUSTRIAL PARKS | 42
7 | BRANCH CHANNEL OF BAGJOLA KHAL |
8 | BELIAGHATA CIRCULAR CANAL | 115
Vulnerable Islands
Sl no. / Islands
1.Namkhana
2.Mousuni
3.Sagar
4.G-Plot
5.K-Plot
6.I-Plot
7.Banashayamnagar
8.Patharpratima
9.Chunakhali
10.Sonakhali
11.Jharkhali
12.Basanti
13.Kumirmari
14.Radhanagar-Taranagar
15.Amtali-Puijali
16.Sambhunagar
17.Maipith
18.Deulbari-Debipur
19.Kundakhali
20.Raidighi
21.Kankandighi
22.Nandakumar
23.Ghoramara
24.Gosaba
25.Brojaballavpur
26.Sahebkhali
27.Hasnabad
28.Baunia
29.Sandeshkhali
30.Hingalganj
31.Monipur
32.Sukhdwani
33.Bhangarushkhali
34. L-Plot
35. Bali Island
36. Satjelia
37. Kochukhali
38. Chhoto Mollakhali
39. Kalinagar
NADIA
HOOGHLY
HOWRAH
BANGLADESH
PURBA MEDINIPUR
HOOGLI RIVER
BAY OF BENGAL
ICHAMATI RIVER
BAGDA
BANGAON
BELGHATA
BARRACKPUR - I
AMDANGA
HABRA - II
HABRA - I
BARASAT - I
DEGANGA
BADURIA
BARASAT - II
BASIRHAT - II
BASIRHAT - I
HARINGHATA
HARORA
BHANGAR - II
MINAKHAN
SANDESHKHALI - I
BHANGAR - I
SONARPUR
CANNING - II
BISHNUPUR
BISHNUPUR - II
BAKULI
FALTA
MAGRAHAT - II
CANNING - I
DIAMOND HARBOUR - II
MAGRAHAT - I
JOYNAGAR - I
DIAMOND HARBOUR - I
JOYNAGAR - II
MANDIRBAZAR
BASANTI
MATHURAPUR
MATHURAPUR - II
KULPI
KULTALI
NAMKHANA
SAGAR
HASNABAD
SANDESHKHALI - II
GOSABA
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