सत्यमेव जयते

Report of the Comptroller and Auditor General of India on Performance Audit of Implementation of Flood Control Measures in West Bengal (Economic Sector)

लोकहितार्थ सत्यनिष्ठा

Dedicated to Truth in Public Interest

Government of West Bengal

Report No. 2 of the year 2019

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Comptroller and Auditor General of India
on
Performance Audit of
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PREFACE

Floods have been a recurrent phenomenon, causing loss of lives, public property and bringing untold misery to the people, especially those in rural areas. There is also a larger economic impact, as they derail economic activities, thus affecting growth. Indian sub-continent has peculiar climatic conditions, which cause floods in some parts whereas drought in other parts. West Bengal is one of the prime flood prone States in the country with 42 per cent (37660 sq. km.) of its total geographical area (88752 sq. km.) being susceptible to floods.

During the period from 2013 to 2017, there was loss of 1012 human lives and properties worth ₹ 43997.27 crore (that included cost of crops, houses, cattle and public utilities lost) due to floods, as reported by the West Bengal Government to Central Water Commission.

The Performance Audit on "Implementation of Flood Control Measures in West Bengal" was conducted to assess the implementation and effectiveness of the flood control measures. The Performance Audit covers the period from 2013-14 to 2017-18 and examines various aspects of the Programme such as Planning, Implementation, Financial Management, Quality Control and Monitoring.

This Report for the year ended March 2018 has been prepared for submission to the Governor of West Bengal under Article 151 of the Constitution of India for being laid before the Legislature of the State.

The audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Executive Summary

Flood damages - how bad is the situation?

A national perspective

The Indian sub-continent has peculiar climatic conditions, which cause floods in some parts whereas drought in other parts. Based upon the statistics provided by the States and compiled by Central Water Commission for the period 1953-2017, it has been reported that damages by floods in the country are more than ₹ 5800 crore per annum besides the loss of precious human lives and cattle.

In West Bengal

West Bengal is one of the prime flood prone States in the country with 42 per cent of its total geographical area (88752 sq. km.) being susceptible to floods. The State has three distinct drainage basins namely Brahmaputra, Ganga and Subarnarekha having 37660 sq. km. flood prone area.

During the period 2013-17, value of the flood damages to crops, houses and public utilities was ₹43997.27 crore. As such the average annual damages during these five years was ₹8799.45 crore, which was much higher than the all India average of last 60 years.

Who is responsible to take action?

Flood control programme/schemes are planned, funded and implemented by the West Bengal Government through the Irrigation and Waterways Department (I&WD). Besides, Government of India (GoI) also renders technical, advisory and financial assistance to the State Government. Central Assistance is provided to flood prone States to take up flood control and river management works in critical areas under Flood Management Programme (FMP). GoI set up Central Water Commission (CWC), Ganga Flood Control Commission (GFCC), Brahmaputra Board (BB) and National Disaster Management Authority (NDMA) to enable State Governments to address flood problems in a comprehensive manner. Apart from these, the Working Group for 12th Five Year Plan of the Planning Commission (PC) of India made (October 2011) various recommendations and suggestions for the management of flood. CWC plays a direct role in collection of flood data, flood forecasting and dissemination of flood forecasts to the local administration for planning suitable administrative measures.

What did we expect from this Performance Audit?

The Performance Audit was undertaken to get a reasonable assurance that:

- *The Department had prepared a comprehensive long-term plan, prioritising flood control measures necessary to combat recurrent floods in the State.*
- *Schemes/projects related to flood control measures were implemented as planned and were effective in minimising damage of life and property.*
- *Necessary funds were made available and were utilised judiciously.*
- *An effective system for ensuring quality control in construction and monitoring was in place.*

- *Flood Forecasting was used as a tool to predict, warn and minimise damage from floods.*

How did we do it?

Selection for detailed examination was done as follows: Out of 45 Divisions engaged in flood control measures during the years 2013-18, six Divisions executing two ongoing projects under Flood Management Programme (FMP)[1], and eight other Divisions on the basis of volume of expenditure and ensuring that these were located in different flood prone zones of the State.

The methodology adopted for achieving audit objectives with reference to audit criteria consisted of scrutiny of records, analysis of data, issue of audit queries, joint site visits etc.

How is this Performance Audit Report organised?

The report consists of six chapters, starting with introduction to the flood conditions in India and in West Bengal, extent of damages caused due to floods, statutory provisions to deal with the floods etc. Other chapters cover the planning, implementation, financial management and quality control and monitoring.

What did we observe in Audit?

As per the Annual Flood Report - 2017 of Irrigation and Waterways Department, all the blocks under KMP and KKB were inundated by flood waters in July 2017. The flood damage reports of the Department of Disaster Management and Civil Defence, GoWB reflected loss of life, devastating damage to property and its adverse economic and environmental impacts.

Flood damage data of 2017

Population affected (Million)	Cropped area affected (M ha)	Damage to crops (₹ in cr.)	Houses damaged (No.)	Damage to houses (₹ in cr.)	Human lives lost (No.)	Cattle lost (No.)	Damage to public utilities (₹ in cr.)	Total damages (₹ in cr.)
8.723	1.033	6914.50	8,26,982	9158.28	217	2,857	1655.16	17727.94

Chapter 2: Planning

In the absence of holistic basin-wise/river-wise Master Plan, flood management projects were taken up at different locations depending on priority and availability of funds without being linked to a comprehensive plan.

(Paragraph 2.1)

Irrigation and Waterways Department (I&WD) failed to adopt appropriate combination of structural and non-structural measures for effective management of floods. I&WD adopted only some of the structural measures. Non-structural /administrative measures like Flood Plain Zoning and Flood Proofing were not adopted.

(Paragraph 2.2)

[1] *Kandi Master Plan and Kaliaghai-Kapaleswari-Baghai Basin Drainage Project.*

Chapter 3: Implementation

Kandi Master Plan[2] was taken up in June 2012 to ameliorate the critical and perpetual flood situation in an area of about 510 sq. km. in Murshidabad district. Against the approved project cost of ₹ 438.94 crore, an amount of ₹ 209.32 crore was released and spent during the years 2013-18. Out of the total amount spent on this project so far, GoI has contributed only ₹ 24.98 crore (12 per cent) instead of ₹ 157 crore (75 per cent), mainly due to delay in submission of UCs by the State Government.

The project was still ongoing as only six out of 12 phases were completed as on March 2018 against the stipulated date of completion by March 2017.

Defects in Detailed Project Reports and various deviations from the Detailed Project Report like non-execution of embankment protection work in vulnerable stretches, less country side slope, less height of the embankment than the actual requirement, non-creation of additional waterway, less thickness of boulder pitching work etc. were noticed in execution of embankment protection work. Due to these deviations, risk of the infirmities of embankments cannot be ruled out, which could adversely impact the flood control arrangements.

Cases of non-compliance to the relevant Indian Standards Codes and recommendations of GFCC on providing sand cushion layer and sausage crate[3] were also noticed which impacted stability of the embankments.

Further, Annual Flood Report of 2017 of I&WD reflected that all the blocks under KMP were inundated by flood water in July 2017, a clear indication of lack of effectiveness of flood protection measures taken by I&WD until now. The inundation maps from ISRO Bhuvan portal also clearly demonstrated the lack of efficacy of the flood control plan of the KMP project.

(Paragraph 3.2.1)

With a view to provide relief to the flood prone low lying terrain of seven blocks in Paschim and Purba Midnapore districts, which historically suffer from flood and tidal inundation, the KKB Drainage Scheme was initiated in March 2010. Investment clearance of ₹ 650.38 crore for KKB project was accorded by the Planning Commission, GoI in March 2010 with target date of completion by March 2015.

The project was commenced in March 2011 and ₹ 347.78 crore was released against which expenditure of ₹ 340.24 crore was incurred upto March 2018. The project was still (December 2018) ongoing. The project could not be completed within stipulated period mainly due to delay in land acquisition. Only 35 per cent of the estimated land was acquired up to March 2018.

Commencement of the project without ensuring acquisition of land grossly hampered execution of works leading to delay in completion of the project. Rivers/khals were not widened/excavated up to design bed width, which implied that with the limited carrying capacity, they would not be able to control frequent flooding in the areas. Inclusion of non-feasible items, non-construction of regulator at the confluence of river Kapaleswari and Kaliaghai and non-maintenance of already resuscitated rivers/khals caused heavy siltation

[2] *Consisting of entire Bharatpur-I, parts of Khargram, Burwan and Kandi blocks.*

[3] *Wire net filled with boulders, used for embankment protection.*

affecting the overall drainage system of the project. It was observed in the Annual Flood Report of I&WD for 2017 that all the seven blocks[4] included under KKB were inundated in 2017, which was indicative of the lack of effectiveness of flood protection measures taken by I&WD.

(Paragraph 3.2.2)

Apart from the two FMP projects, I&WD executed embankment protection as well as anti-erosion of river bank works under State Plan, Rural Infrastructure Development Fund (RIDF), Common Border Rivers Fund, One Time Additional Central Assistance (OTACA) etc. A sample of 145 such works having estimated cost more than ₹ one crore each were selected for detailed examination. It was seen that in flood protection measures taken up by the Divisions, the standards prescribed in CWC guidelines, Indian Standard Code and I&WD Code (Vol.I) were not complied with. Further, few financial deficiencies in implementation of the flood protection works were also noticed.

Required thickness of graded filter layer as per the Indian Standards Code was not provided in total 28 cases valuing ₹ 61.83 crore resulting in exposure of those embankments to force of water making them vulnerable to erosion.

In nine embankment protection and anti-erosion works valuing ₹ 58.36 crore, laying of sand cushion was not envisaged in the estimates and works were executed without providing any cushion of sand layer.

Extra expenditure of ₹ 10.44 crore was incurred in 10 embankment protection/ anti-river erosion works where the thickness of stone boulder in launching apron was provided 33 to 56 per cent more than the actual requirement.

It was also observed that, in 2017, the area under flood inundation of the State was more than that in the last four years.

(Paragraph 3.2.3)

Chapter 4: Financial Management

During 2013-14 to 2017-18, Budget Estimates of ₹ 7309.59 crore were provided for Flood Control, which was subsequently reduced to ₹ 4520.53 crore in Revised Estimates. The actual expenditure was even less than the Revised Estimates of each year. Savings with respect to Budget Estimates as well as Revised Estimates ranged from 26 to 68 per cent and 14 to 34 per cent, respectively.

Yearly budgets were prepared by I&WD without taking any inputs from the Divisional level, which resulted in such savings. As per the Budget Publications, I&WD could not spend ₹ 1099.45 crore during 2013-14 to 2017-18, though provision of the fund was made through REs by the State Government.

Despite availability of funds, 2162 sq. km. of the total flood prone area of the State remained unprotected as per the Annual Flood Report 2017 of I&WD.

(Paragraph 4.1)

Some financial irregularities like executing maintenance work from FMP fund, non-deduction of Royalty and early refund of Security Deposit of contractors were also noticed and have been commented upon.

(Paragraph 4.2)

[4] *Narayangar, Datan-I, Sabong, Pingla, Bhagabanpur-I, Patashpur-I and Moyna.*

Chapter 5: Quality Control and Monitoring

Three test checked Divisions[5] did not ensure the quality of cement used in works valuing ₹ 13.52 crore, putting the strength of embankment protection works at stake.

I&WD failed to check the quality of materials used in the construction of the flood control works. This could impact the structural design causing defects leading to failure of the works impacting flood control measures.

(Paragraph 5.1)

Progress of the work was not monitored effectively. It was observed that both the projects (KMP and KKB) were delayed and vulnerable areas remained prone to floods.

Monitoring mechanism through remote sensing techniques was not adopted for any schemes of Flood Control.

None of the test checked Divisions maintained any inventory of assets. Land register was maintained only by KKB project division. As a result, I&WD had no database containing details of the assets created under FMP.

Inadequate monitoring system impacted field performance, also leading to failure to take corrective action while work was in progress.

(Paragraph 5.2)

There is no system of real time compilation and dissemination of flood data in I&WD. Though the river water level is collected on hourly basis in monsoon period by the river gauge stations, the data is uploaded only once during the day on the web-site of I&WD. As such, if there is a sudden surge of flood waters, it remains unreported.

There are only two river gauge station over River Bhagirathi-Hooghly though it passes through seven districts[6] in the State. Further, there is only one gauge station for the entire 129 km length of the Mahananda river within Malda district. There is also no river gauge station for Tangon, Kalindri, Punarbhaba and Pagla river in Malda district. Thus, water level recording mechanism in these sub-basins is weak which would affect rescue measures, leaving people at the mercy of the flood waters.

(Paragraph 5.3)

What do we recommend?

Department may consider to :

i. *Prepare state-centric comprehensive plan taking into account all existing developments with latest updated data, including the strategies recommended by various technical bodies such as scientific assessment of flood prone areas, integrated basin management approach etc.*

ii. *Adopt Engineering/Structural measures like detention basins, diversion of flood water, etc. which will not only reduce spilling but also bring relief to the flood prone areas by reducing flood flows and thereby the flood levels.*

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5 *Malda Irrigation Division, Mahananda Embankment Division and Howrah Irrigation Division.*

6 *Murshidabad, Burdwan, Nadia, Hooghly, Howrah, Kolkata and South 24 Parganas.*

iii. *Adopt Administrative/Non-structural measures like enactment of Model Flood Plain Zoning Bill which aim at demarcating zones or areas likely to be affected by floods of different magnitudes, frequencies, probability levels and specify the types of permissible developments in these zones, so that whenever floods actually occur, the damage can be minimized.*

iv. *Prepare defect-free DPRs and adhere strictly to the approved DPR and recommendations of GFCC while implementing the flood control measures without delay and avoiding wasteful expenditure.*

v. *Take inputs from individual Divisions with respect to annual requirement of funds for flood control measures to ensure optimum utilisation of funds.*

vi. *Introduction of Remote Sensing techniques for monitoring of physical progress of the schemes in Flood Management Works.*

vii. *To ensure real time compilation and dissemination of flood data, provide more river gauge stations to measure the level of water at different locations and warning mechanism which will provide timely flood warnings with adequate lead time for the public to minimise the flood damages.*

Chapter 1

Introduction

Chapter 1: Introduction

1.1 Floods - A national perspective

Floods[7] have been a recurrent phenomenon in many parts of India, causing loss of lives, public property and bringing untold misery to the people, especially those in rural areas. There is also a larger economic impact, as they derail economic activities, thus affecting growth. Indian sub-continent has peculiar climatic conditions, which cause floods in some parts whereas drought in other parts. The main causes of floods are as under:

(i) High intensity rainfall in short duration,

(ii) Poor or inadequate drainage/channel capacity,

(iii) Unplanned reservoir regulation,

(iv) Failure of flood management structures.

The flood damage data is collected by the State Governments in terms of affected area, crops, cattle, properties, population *etc*. Based upon the statistics provided by the States and compiled by Central Water Commission for the period 1953-2017, it has been reported that damages by floods in the country are more than ₹5800 crore per annum besides the loss of precious human lives and cattle.

The flood damages in India during the aforesaid period are given in **Table 1.1**.

Table 1.1 : Flood Damages in India during 1953-2017

Sl No	Item	Average Annual Damage	Maximum Damage	
			Extent	Year
1	**Area affected**	7.17 M ha	17.50	1978
2	**Population affected**	32.12 Million	70.45	1978
3	**Human lives lost**	1654	11316	1977
4	**Cattle lost**	93067	618248	1979
5	**Cropped area affected**	3.46 M ha	10.15	1988
6	**Damage to crops**	₹1711.16 Cr.*	17043.95	2015
7	**Houses damaged**	1241815	3959191	2015
8	**Damage to houses**	₹827.30 Cr.*	10809.80	2009
9	**Damage to public utilities**	₹3262.46 Cr.*	38937.84	2013
Total		**₹5800.92 Cr.***		

(Source : Information disseminated by CWC vide No.3/38/2012-FFM/1067-1164 Dt 17 May 2019)

For the study of flood problem, the rivers in India can be broadly divided into the following four regions.

(1) Brahmaputra Region;

(2) Ganga Region;

(3) North West Region; and

(4) Central India and Deccan region.

[7] *Flooding occurs when the capacity of the river channel to carry the discharge is exceeded.*

1.1.1 Statutory Provisions for Flood Management

The subject of flood control, unlike irrigation, does not figure as such in any of the three legislative lists included in the Constitution (State list, Union list and Concurrent list) of India. Drainage and Embankments, however, are two of the flood control measures specifically mentioned in entry 17 of List II (State List), reproduced below:

"Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provision of entry 56 of List I (Union List)."

Entry 56 of List I (Union List) reads as follows:-

"Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest."

For implementation of any flood control programme, it is necessary to acquire private land for execution of engineering measures such as Reservoirs, Detention basins, Embankments, Channelization of rivers, Channel improvement, Drainage improvement, Diversion of flood waters and Watershed Management. Since there is provision for "acquisition and requisitioning of property" in the Concurrent List under entry 42, both Centre and the States can enact laws for this purpose. The Land Acquisition Act of 1894 under which land could be acquired both by the Centre and the States is the basic Act in this regard. Further, if legislation for reducing flood damages is to be resorted to by Flood Plain Zoning, it involves restriction of land use and this power though not included under entry 17 of List II (State List) mentioned above, is covered under entry 18 of List II (State List) which provides "land that is to say, rights in and over land". Besides, Flood Plain Zoning being essentially a local problem and since local conditions differ from area to area, it needs, therefore, to be dealt with by the State Government. The subject of "Flood Management" including erosion control therefore falls within the purview of the States.

The schemes for flood control are planned, investigated and implemented by the States as per priorities within the State with their own resources and the role of Central Government is technical, advisory, catalytic and promotional in nature. A number of States have already enacted laws with provisions to deal with matters connected with flood control works. West Bengal has not enacted any law in this regard, so far.

1.1.2 Existing Flood Management Mechanisms in India

In India, a two tier system of flood management exists, as described below:

State Level Mechanism - The State Level Mechanism includes the Water Resources Departments, State Technical Advisory Committee and Flood Control Board. In some States, the Irrigation Departments and Public Works Departments look after flood matters.

Central Government Level Mechanism – The Union Government has set up following organizations and various expert committees to provide guidance and assist the State Governments in addressing flood problems in a comprehensive manner:

Central Water Commission (CWC) – The Government of India set up Central Water Commission, as presently named, in 1945 for achieving the goal of furthering and promoting measures of flood control, conservation and utilization of water resources throughout the country in the areas of beneficial uses, irrigation and hydropower generation, flood management and river conservation.

Ganga Flood Control Commission (GFCC) – The Ganga Flood Control Commission (GFCC) was set up by Government of India in 1972 for preparation of comprehensive plan of flood control for Ganga Basin and to draw out a phased coordinated programme for implementation of works and monitoring & appraisal of flood management schemes of Ganga Basin States. The GFCC has prepared comprehensive plans of flood management of the 23 sub-basins in the Ganga Basin besides drawing up a phased programme for implementation of these works to proper standards as well as examination and monitoring of various flood management schemes implemented in the Ganga Basin States.

Brahmaputra Board (BB) – The Government of India set up Brahmaputra Board under Brahmaputra Board Act, 1980 (46 of 1980) under the then Ministry of Irrigation (now Ministry of Water Resources). The jurisdiction of Brahmaputra Board includes all NE States (including Sikkim) and North Bengal in Brahmaputra and Barak Basin.

National Disaster Management Authority (NDMA) – For prevention and mitigation effects of disasters including flood disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation, the Government of India has set up a National Disaster Management Authority (NDMA) in 2005, an Apex body under the Chairmanship of the Prime Minister of India as per the provision contained in the NDM Act, 2005.

As per the Act, NDMA was to lay down guidelines to be followed by the State Authorities in drawing up the State Plan (Clause No 6(2) (d)). Accordingly, NDMA has issued guidelines in January 2008 for management of floods and the roles of various Central and State agencies have been specified for preparation of flood mitigation plans and taking relief measures during flood disasters.

1.2 Flood Scenario of the State

West Bengal falls mainly in the Ganga Region as the southern and central parts of the State are covered by the river Ganga and its tributaries. Some of the northern parts are covered under the Brahmaputra Region through its tributaries like Teesta, Raidak, Torsa *etc*. The State has three distinct drainage basins namely Brahmaputra, Ganga and Subarnarekha.

West Bengal is one of the prime flood prone States in the country with 42 *per cent* (37660 sq. km.) of its total geographical area (88752 sq. km.) being susceptible to floods. West Bengal, being located at the tail-end of the Ganga Basin, is a hydrologically subsidised State, which receives huge volume of transboundary water. However, the supply of this water is so skewed that West Bengal bears the brunt of flood during monsoon and faces shortage of water during the lean months. The floods of West Bengal have special characteristics. Heavy rainfall at origin or catchment areas of main flooding rivers of this State cause flood, but

these catchment areas are mainly lying outside the State. West Bengal is flooded by water from adjoining states or countries.

Table 1.2 : Flood damages in West Bengal

Sl No.	Kinds of damage	Flood damages occurred in West Bengal							All India
		During the years					Maximum during (1953-2017)		Average Damage
		2013	2014	2015	2016	2017	*Year*	*Damage*	(1953-2017)
1	**Area affected (M ha)**	0.182	0.051	1.300	Not reported	1.033	1978	3.080	7.17
2	**Population affected (Million)**	3.112	0.448	10.840	1.94	8.723	2000	21.800	32.12
3	**Human lives lost (nos.)**	41	169	338	247	217	1968	2730	1654
4	**Cattle lost (nos.)**	28311	145	22774	2020	2857	1978	221826	93067
5	**Cropped area affected (M ha.)**	0.182	0.051	1.300	0.11	1.033	2007	2.490	3.46
6	**Damage to crops (₹ crore)**	533.95	6.13	11433.68	83.92	6914.50	2015	11433.68	1711.16
7	**Houses damaged (nos.)**	233336	33621	830245	87704	826982	2000	2194858	1241815
8	**Damage to houses (₹ crore)**	178.97	17.275	7895.63	47.00	9158.28	2017	9158.28	827.30
9	**Damage to public utilities (₹ crore)**	13.58	2.67	6023.96	32.56	1655.16	2015	6023.96	3262.46
	Total value of Damages (6+8+9) (₹ crore)	**726.50**	**26.075**	**25353.27**	**163.48**	**17727.94**			**₹ 5800.92 crore**
		Average Damages : ₹ 8799.45 crore							

(Source : Information as disseminated by CWC vide No.3/38/2012-FFM/1067-1164 Dated 17 May 2019 and as provided by WB Disaster Management and Civil Defence Department)

From the **Table 1.2,** it is observed that during the period 2013-17, flood damages to crops, houses and public utilities in West Bengal was ₹ 43997.27 crore. As such the average annual damages during these five years was ₹ 8799.45 crore, which was much higher than the all India average of last 60 years (₹ 5800.92 crore).

Along with flooding, various allied problems like bank erosion, drainage congestion and cyclonic disaster exacerbate the flood situation. Major contributing factors to floods in North Bengal region are heavy local rainfall, discharge from upper basin areas and also outfall condition[8] in the neighbouring countries. In South Bengal, floods become voluminous because of the shape of the catchment area[9], its steep slope starting from a high plateau area and sloping sharply down to a flood terrain[10] near the outfall of limited capacity.

Flood in deltaic region is a disaster, which can destroy the total environmental set up of the area. It causes river bank erosion, depression of land, shifting of river course, river channel widening *etc*., due to its high discharge, elevation,

[8] *Narrowed and silted end of river where it falls into the sea.*

[9] *Surrounding area of a river from where accumulated rain water falls into the river.*

[10] *Flood affected area.*

volume and duration. When flood water recedes, affected areas are often blanketed in silt and mud. The water and landscape can be contaminated with hazardous materials, such as sharp debris, pesticides, fuel and untreated sewage. Residents of flooded areas can be left without power and clean drinking water, leading to outbreaks of deadly waterborne diseases like typhoid, hepatitis A and cholera.

Flood	North Bengal	South Bengal
Districts Affected by Flood	Cooch Behar, Jalpaiguri, Uttar Dinajpur, Dakshin Dinajpur, Malda	Nadia, Howrah, Murshidabad, North 24 Parganas, South 24 Parganas, Hooghly, Burdwan, Birbhum, Paschim Midnapore, Purba Midnapore
Relatively scarce Districts affected by Flood	Darjeeling	Purulia & Bankura

Figure 1.1: Blue area depicts the flood prone districts of West Bengal

Flood damage reports for the years 2015 and 2017 prepared by the Disaster Management and Civil Defence Department, GoWB, as included in the CWC data, reflect loss of human lives of 338 and 217 along with damages of crops, houses and public utilities valuing ₹ 25353.27 crore and ₹ 17727.94 crore, respectively.

The major river basins and sub-basins of West Bengal are depicted in **Figure 1.2** below:

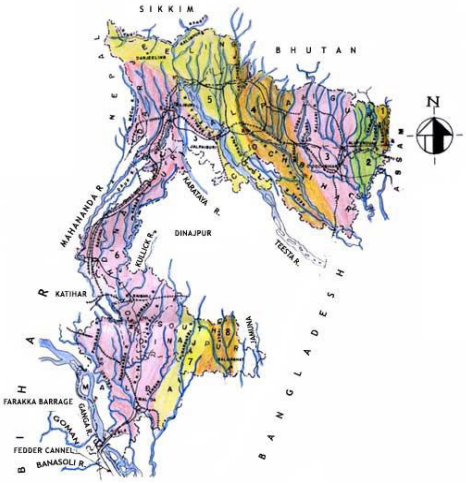
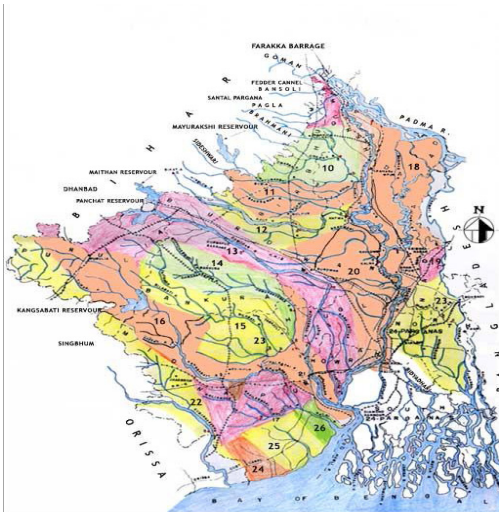
River Basins of North Bengal	River Basins of South Bengal
	

Figure 1.2: River Basins in West Bengal

River Basins and Sub-Basins		
BRAHMAPUTRA		
1. Sankosh 2. Raidak	3. Torsa 4. Jaldhaka	5. Teesta
GANGA-PADMA		
6. Mahananda	7. Punarbhaba	8. Atrai
GANGA-BHAGIRATHI		
9. Pagla-Bansloi 10. Dwarka-Brahamani 11. Mayurakshi 12. Ajay	13. Damodar 14. Darakeswar 15. Shilabati 16. Kangsabati	17. Kaliaghai 18. Jalangi 19. Churni 20. Bhagirathi-Hooghly 21. Rupnarayan
SUBARNAREKHA DRAINAGE		
22. Subarnarekha 23. 24-Parganas & Calcutta Port Area	24. Pichabani 25. Rasulpur	26. Haldi

Flood control programme/schemes are planned, funded and implemented by the West Bengal Government through the Irrigation and Waterways Department (I&WD).

Besides, Government of India (GoI) also renders technical, advisory and financial assistance to the State Government. Central Assistance is provided to flood prone States to take up flood control and river management works in critical areas under Flood Management Programme (FMP).

The Government of India had decided to provide financial assistance through various Plan schemes because flood damages had increased due to non-completion of flood control works and their poor maintenance on account of funds constraints. A plan scheme "Flood Management Programme" for providing Central Assistance to the State Governments was taken up at an estimated cost of ₹ 8000.00 crore during 11th Five Year Plan for river management, flood control, anti-erosion, drainage development, flood proofing, restoration of damaged flood management works and anti-sea erosion works; which were considered critical in nature. This programme was continued in the 12th Five Year Plan period also. Some of the salient features of FMP include:

- To avail the Central Assistance, the States have been advised to prepare the schemes of flood management works in an integrated manner covering the entire river/tributary or a major segment. However, in case of emergent situation arising due to high floods, the works in critical reaches are taken up immediately after flood season.
- While submitting a proposal, the State Governments have to ensure acquisition of land required under the scheme and submit a certificate to this effect.
- The State Governments have to ensure inclusion of the scheme in the State Plan and make requisite budget provision towards Central as well as State share on annual basis.

GoI set up Central Water Commission (CWC), Ganga Flood Control Commission (GFCC), Brahmaputra Board (BB) and National Disaster Management Authority (NDMA) to enable State Governments to address flood problems in a comprehensive manner. Apart from these, the Working Group for 12th Five Year Plan of the Planning Commission (PC) of India made (October 2011) various recommendations and suggestions for the management of flood.

These included following strategies to be effectively implemented:

- Scientific assessment of flood prone area.
- Integrated basin management approach.
- Construction of dams and reservoirs with adequate flood cushion.
- Development of detention basins.
- Drainage improvement.
- Strengthening of organizations.
- Public-Private Partnership concept.
- Inventory of works completed by State.
- Provision for adequate funds for maintenance of existing works.
- Procedural reforms.
- Application of new technologies.
- Emergency action plans.

CWC plays a direct role in collection of flood data, flood forecasting and dissemination of flood forecasts to the local administration for planning suitable administrative measures. Apart from approving the projects (particularly those receiving Central Assistance) forwarded by the Departmental Screening Committee[11] of the State, GFCC monitors the progress of the schemes/projects, prepares comprehensive plans for the river system for management of flood in a focussed manner. As part of its mandate, the GFCC has prepared a number of guidelines from time to time on various flood related subjects in consultation with the States for formulation and execution of flood management schemes for ensuring quality in construction and meeting material specifications as per standards. These guidelines were also approved in meetings of the GFCC in which representatives of Ganga river basin States are members.

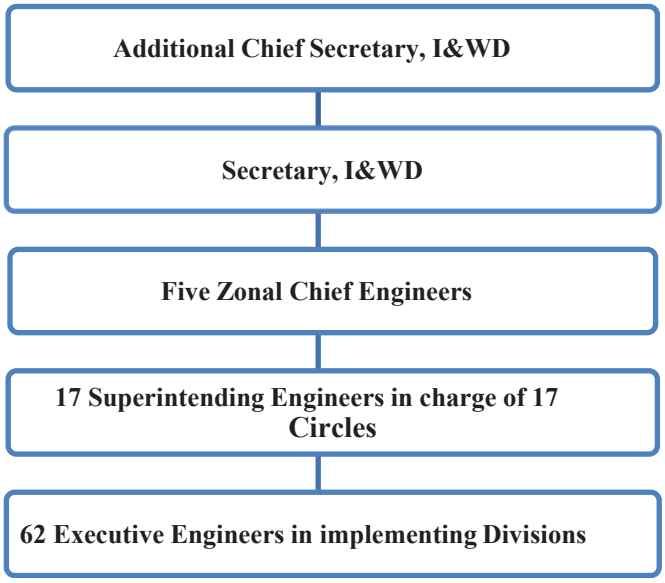
In order to assess the implementation and effectiveness of flood control measures a **"Performance Audit of Implementation of Flood Control Measures in West Bengal"** was conducted during February to December 2018 covering the period from 2013-14 to 2017-18.

1.3 Organisational structure

Additional Chief Secretary (ACS), I&WD has the overall responsibility for implementation of flood control projects. The organisational set up is depicted in **Chart 1.1**.

[11] *A committee comprising the Secretary, I&WD as Chairman, Financial Adviser, Joint Secretary (Works), all Chief Engineers and Deputy Secretary – II (Works).*

Chart 1.1: Organisational set up



1.4 Audit Objectives

The Performance Audit was undertaken to get a reasonable assurance that:

(i) The Department had prepared a comprehensive long-term plan, prioritising flood control measures necessary to combat recurrent floods in the State.

(ii) Schemes/projects related to flood control measures were implemented as planned and were effective in minimising damage of life and property.

(iii) Necessary funds were made available and were utilised judiciously.

(iv) An effective system for ensuring quality control in construction and monitoring was in place.

(v) Flood forecasting was used as a tool to predict, warn and minimise damage from floods.

1.5 Audit Criteria

Performance was assessed against the following criteria:

(i) National Disaster Management Guidelines (January 2008),

(ii) Handbook for Flood Protection, Anti Erosion and River Training Works of Central Water Commission (CWC Guidelines 2012),

(iii) Report of Working Group on Flood Management and Region Specific Issues for 12th Five Year Plan of Planning Commission, Government of India,

(iv) Revised guidelines for providing Central Assistance to State Governments for the schemes/proposals of flood control and river management works under Flood Management Programme (2007-12), Ministry of Water Resources, Government of India,

(v) Technical Memoranda on General Flood Management Structures, Ganga Flood Control Commission, Government of India,

(vi) Indian Standards Codes,

(vii) West Bengal Financial Rules (Volume-I & II),

(viii) Irrigation & Waterways Department Code, GoWB (Volume-I),

(ix) Schedule of Rates of I &WD, GoWB,

(x) GoWB orders, including departmental policies.

1.6 Scope and Methodology

The Performance Audit covered the period from 2013-14 to 2017-18 and commenced with an Entry Conference on 23 February 2018 where the audit objectives of this Performance Audit were discussed in detail with the Department.

The methodology adopted for achieving audit objectives with reference to audit criteria consisted of scrutiny of records, analysis of data, issue of audit queries, joint site visits *etc.*

Selection for detailed examination was done as follows: Out of 45 Divisions ***(Appendix 1.1)*** engaged in flood control measures during the years 2013-18, six Divisions[12] executing two ongoing projects under Flood Management Programme (FMP)[13] and eight other Divisions[14] were selected on the basis of volume of expenditure and ensuring that these were located in different flood prone zones of the State. The Exit Conference was held on 13 December 2018 to discuss the audit observations. Department's replies have been considered, while finalising the report and suitably incorporated.

1.7 Acknowledgement

The co-operation extended by the Department of Irrigation and Waterways, Government of West Bengal in providing the necessary records and information in connection with the conduct of this Performance Audit is acknowledged.

[12] *Berhampore Irrigation Division, Mayurakshi North Canal Division, Mayurakshi South Canal Division, East Midnapore Division, KKB Project Division and Contai Irrigation Division.*

[13] *Kandi Master Plan and Kaliaghai-Kapaleswari-Baghai Drainage Basin Project (in which 124 out of 142 tenders were test checked).*

[14] *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division (in which 145 out of 357 tenders were test checked).*

Chapter 2

Planning

Chapter 2: Planning

The effectiveness of measures taken to address flood risk and mitigation is dependent on coherent planning. In particular, long term strategic planning is required to ensure maximum benefit from limited resources. Flood management in a State calls for a long term and comprehensive approach. Preparation of an integrated plan to address flooding, erosion and drainage problems in flood prone basins and its implementation in a phased and coordinated manner is essential. The deficiencies noted in planning are detailed below:

2.1 Non-preparation of Comprehensive Plan

While the State Governments are responsible for flood control as per priorities within the State with their own resources, Government of India has been rendering technical, advisory and financial assistance to the State Governments through the various Plan schemes. Government of India decided to provide financial assistance because it found flood damages had increased due to non-completion of flood control works and their poor maintenance on account of funds constraints. A plan scheme "Flood Management Programme" (FMP) for providing Central Assistance to the State Governments was taken up at an estimated cost of ₹ 8000.00 crore during 11th Five Year Plan for river management, flood control, anti-erosion, drainage development, flood proofing, restoration of damaged flood management works and anti-sea erosion works; which were considered critical in nature. This programme was appreciated by all the States and 12th Five Year Plan Working Group on "Flood Management and Region Specific Issues" recommended to continue with it in the 12th Five Year Plan period also.

Salient features of FMP

- To avail the Central Assistance, the States have been advised to prepare the schemes of flood management works in an integrated manner covering the entire river/tributary or a major segment. However, in case of emergent situation arising due to high floods, the works in critical reaches are taken up immediately after flood season.
- While submitting a proposal, the State Governments have to ensure acquisition of land required under the scheme and submit a certificate to this effect.
- The State Governments have to ensure inclusion of the scheme in the State Plan and make requisite budget provision towards Central as well as State share on annual basis.
- Subsequent installments of Central Assistance are released on receipt of the Utilization Certificate in FORM GFR-19A submitted by the concerned Chief Engineer and the financial authority; and countersigned by the concerned Secretary of the implementing Department/Finance Secretary of the State Government.
- Actual expenditure incurred by the State Governments from their own resources in the financial year (in which the scheme is approved by the Empowered Committee under FMP) would be reimbursed in the same financial year or, if the Central Assistance is not released in that financial

year, in the next financial year, in which case requirement of budget provision may not be necessary.

Further, Para 1.2 of National Disaster Management Guidelines (January 2008) of National Disaster Management Authority (NDMA), GoI provide for preparation of basin-wise and region-wise comprehensive plans, taking into account all existing developments. This was to also indicate areas prone to floods, which could be provided reasonable protection, broad feasibility study of different methods of flood control and priorities identified *etc*. The Report of the Working Group on Flood Management and Region Specific Issues for 12th Five Year Plan also emphasised the need for an "integrated basin management approach" (Section 7.0).

I&WD stated that GoWB did not prepare any basin-wise/river-wise Master Plan. In the absence of a holistic plan, the Divisions proposed schemes as and when required, considering the vulnerability of specific areas. The Departmental Screening Committee[15] prioritised the works proposed by the Divisions. Further, schemes/projects planned for execution in a particular year mainly depended upon the availability of funds.

As such, flood management projects were taken up at different locations depending on priority and availability of funds without being linked to a comprehensive plan for the management of floods. The impact of the flood protection measures may, thus, have been limited to that extent.

In their reply, I&WD stated that considering the wide variation in hydro-meteorological conditions in different parts of the State, preparation of any long-term flood management plan applicable to the whole State may not be an appropriate solution. Basin-wise comprehensive flood management schemes had, however, been prepared for some critically flood prone areas such as Kaliaghai-Kapaleswari-Baghai (KKB) Basin Project, Sundarban Embankment Re-construction Project, Kandi Master Plan (KMP), Lower Damodar Scheme and Ghatal Master Plan.

While I&WD, West Bengal, has prepared plans for the critically flood prone areas it requires to prepare the schemes of flood management works in an integrated manner covering the entire river/tributary or major segment, which it has not prepared as per the salient feature of the FMP.

2.2 Non-adoption of various structural and non-structural measures

Para 2.2 of the Report of Working Group stipulates that providing absolute protection to all flood prone areas against all magnitude of floods is neither practically possible nor economically viable. It further provides that such an attempt would involve high cost of construction as well as expenditure for maintenance. Hence, a pragmatic approach in flood management is required to provide a reasonable degree of protection against flood damages at economic cost through a combination of structural and non-structural measures. GFCC[16],

[15] *Is a committee comprising the Secretary, I&WD as Chairman, Financial Adviser, Joint Secretary (Works), all Chief Engineers and Deputy Secretary – II (Works).*

[16] *Para 5.4.1 of Guidelines on Flood Management (January 2004) of Ganga Flood Control Commission.*

CWC[17] and Planning Commission recommended for adoption of a combination of structural and non-structural measures for effective management of floods.

Depending upon the manner in which the work is required for flood protection, flood management measures are broadly classified as under:

(a) Engineering/Structural Measures,

(b) Administrative/Non-Structural Measures.

Engineering/Structural Measures:

The engineering measures for flood control which bring relief to the flood prone areas by reducing flood flows and thereby the flood levels are :

(i) Reservoirs: An artificially created reservoir behind a dam across a river.

(ii) Detention basins: A natural depression suitably improved and regulated, if necessary.

(iii) Diversion of flood waters by diversion of a part of the peak flow to another river or basin, where such diversion would not cause appreciable damage.

(iv) Channelization of rivers by constructing a parallel channel by-passing a particular town/reach of the river prone to flooding.

(v) Watershed Management: The watershed management measures include developing and conserving the vegetative and soil covers and also to undertake structural works like check-dams, detention basins, diversion channels, *etc*.

The engineering methods of flood protection, which do not reduce the flood flow but reduce spilling, are:

(vi) Embankments: Embankments which artificially raise the effective river bank and thereby prevent spilling.

(vii) Channel and Drainage improvement: Channel and drainage improvement works, which artificially reduce the flood water level so as to keep the same, confined within the river banks and thus prevent spilling.

Administrative/Non-Structural Measures:

The administrative methods endeavour to mitigate the flood damages by:

(i) Flood Forecasting: Facilitating timely evacuation of the people and shifting of their movable property to safer grounds by having advance warning of incoming flood *i.e.* flood warning in case of threatened inundation

(ii) Flood Plain Zoning: Discouraging creation of valuable assets/settlement of the people in the areas subject to frequent flooding *i.e.* enforcing flood plain zoning regulation.

(iii) Flood Proofing: Consisted in raising a few villages above pre-determined flood levels and connecting them to nearby roads or high lands.

It was, however, observed that I&WD adopted only some of the structural measures related to raising and strengthening of embankments, construction of structures to protect the river banks/embankments from erosion, re-excavation

[17] *Para 1.6.1 and 1.6.2 of CWC Hand book for Flood Protection Anti-erosion and River Training Works.*

of drainage channels and maintenance of existing embankments *etc*. as discussed in subsequent observations. Other structural/engineering measures for flood control which bring relief to the flood prone areas by reducing flood flows and thereby the flood levels were not implemented. Non-structural/administrative measures like Flood Plain Zoning, Flood Proofing were also not adopted. Thus, in the absence of any comprehensive long-term plan, execution of flood control measures with combination of various structural and non-structural measures as recommended by GFCC, CWC as well as Planning Commission were not taken up by I&WD.

In their reply, I&WD stated that the adopted structural methods included construction of new embankment, raising and strengthening of existing embankments, construction of sluices and other regulating structures, construction of dams, barrages *etc.* and non-structural measures like Flood Forecasting was also adopted. I&WD, however, accepted that other structural measures like detention basins, diversion of flood water and non-structural measures like Flood Plain Zoning and Flood Proofing were not adopted.

Chapter 3

Implementation

Chapter 3: Implementation

3.1 Formulation of Project Proposals/Detailed Estimates

Rule 164 of West Bengal Financial Rules (Volume-I & II) stipulates that before execution of any work, a Detailed Estimate is prepared and approved by the competent authority. Technical viability as well as cost of the work is assessed through the Estimates. Test check of 105 estimates of works (comprising of 145 selected tenders) other than FMP works relating to eight divisions revealed the following deficiencies:

3.1.1 Source of data not mentioned in the estimates

As per Indian Standard No. 14262:1995 of Planning and Design of Revetment, silt factor and river velocity data were required to be considered for designing the embankment protection and anti-bank erosion works. This also required to assess the weight and size of stone boulders to be used in the work as well as to calculate the required thickness of the protection work.

It was observed that source and age of data on silt factor and river velocity were not mentioned in 52 estimates prepared by seven test checked Divisions[18]. Further, in 39 estimates of five test-checked Divisions[19] prepared during the years 2013-18 where the source of the silt factor data was mentioned as River Research Institute under I&WD, the data taken into consideration was even upto 30 years old.

Strength and design of protection work is to be based on the silt factor and river velocity data, which vary from time to time. Therefore, updated data should have been considered instead of historical data. Thus, consideration of old data may undermine design of the embankment.

3.1.2 Inconsistency in approval process of Estimates

I&WD did not prescribe any criteria regarding timelines for approval of estimates. Audit observed that time taken for completion of the approval process of estimates from Sub-division level to Chief Engineer level ranged from 103 to 863 days in case of 21 estimates prepared in five test checked Divisions[20]. On the other hand, however, in case of 26 estimates prepared by five Divisions[21], the entire approval process was completed within one month and, in case of three estimates prepared by two Divisions[22], approvals from three different levels (from Division to CE office) were obtained in a single day. The exemplary promptness shown in these three estimates did not, however,

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[18] *Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[19] *Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[20] *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[21] *Mahananda Embankment Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[22] *Howrah Irrigation Division and Jalpaiguri Irrigation Division.*

help in quick execution. Only one work was completed within the scheduled date of completion, another work was completed with a delay of 54 days and the remaining work was on-going as of May 2018 even after the scheduled date of completion in April 2018.

Thus, irrespective of the time taken in approval process, there were delays in execution of works under Flood Control Programme.

3.2 Execution of Projects

I&WD executed (1) embankment protection, (2) anti-river erosion, (3) drainage improvement works for flood control during the years 2013-18. It also included two major projects namely Kandi Master Plan (KMP) and Kaliaghai-Kapaleswari-Baghai (KKB) under Flood Management Programme (FMP) with shared funding by the Centre and the State. As per Para 4.2 of the "Revised guidelines for providing Central Assistance to State Governments for the Schemes/Proposals of Flood Control and River Management Works under FMP (2007-12)", Central and State share was to be in the ratio of 75:25. The DPRs of both KMP[23] and KKB[24] were stated to have been prepared as per the guidelines of GFCC/CWC and relevant IS codes.

3.2.1 Kandi Master Plan

An area of about 510 sq. km.[25] in Murshidabad district is critically prone to perpetual flooding and drainage congestion and remains totally cut-off for several days at a time during floods. Most of the embankments, constructed decades ago, are in dilapidated condition. I&WD prepared (June 2012) the Detailed Project Report (DPR) for the Kandi Master Plan to ameliorate the flood situation. The project primarily comprised of structural measures like :

(i) raising/strengthening of a total of 223 km embankments of five different rivers[26],

(ii) protection work of different river embankments of a total length of 38.72 km,

(iii) resuscitation of four khals[27],

(iv) renovation of 57 existing sluices,

(v) creation of additional capacity of waterways by renovating 12 existing rail/road bridges and culverts and

(vi) construction of three double lane River Bridges.

Investment clearance of ₹ 438.94 crore was accorded by the erstwhile Planning Commission, GoI in June 2012 under Flood Management Programme (FMP) with target date of completion by March 2017.

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[23] *Page 7 of Chapter 7 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[24] *Page IV-16, X-2, X-10, XI-8 and XIII-1 of Final Report Volume-I and Page 2 of Supplementary Volume-II (Revised) of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin.*

[25] *Consisting of entire Bharatpur-I, parts of Khargram, Burwan and Kandi blocks.*

[26] *Mayurakshi, Bele, Dwarka, Kuye-Babla and Kana Mayurakshi.*

[27] *Small drainage channels namely Jibanti Khal, Jhumjhum Khali Khal, Banki Khal and Swarup Khali Khal.*

First instalment of the Central Fund was released in March 2014. Approval of State Planning Board was accorded in May 2014. Administrative Approval was given by I&WD to Chief Engineer (North) in December 2014 and the project work commenced in January 2015. As per the approved DPR, the project was to be completed by March 2017, but it was executed in different phases and only six out of 12 phases were completed as on March 2018. I&WD proposed (October 2017) to complete the project by March 2019, which was yet to be approved by GoI (December 2018).

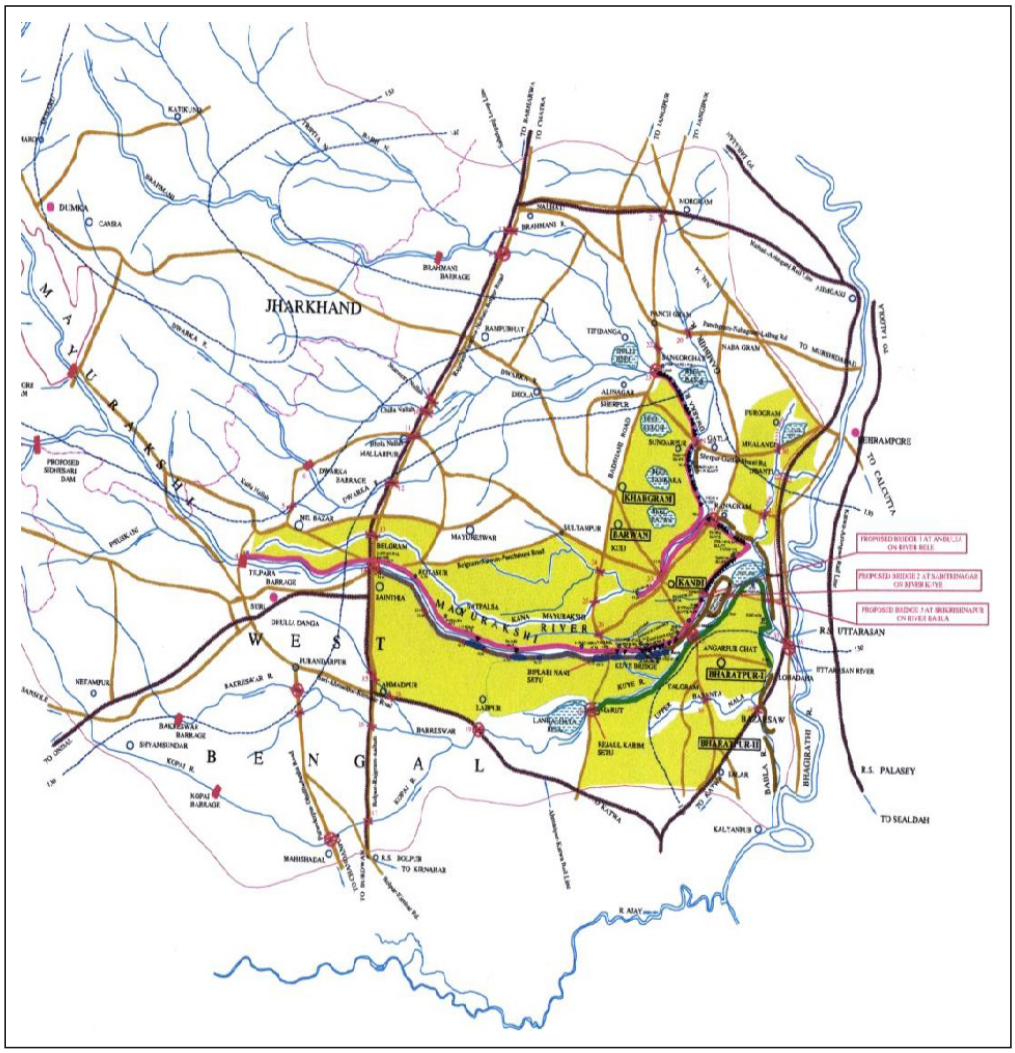

Figure 3.1 : Index Map of Kandi Basin Project

3.2.1.1 Financial arrangements

Against the approved project cost of ₹ 438.94 crore, an amount of ₹ 209.32 crore (Central Share ₹ 24.98 crore and State Share ₹ 184.34 crore) was released and spent during the years 2013-18.

Out of the total amount spent on this project so far, GoI has contributed only ₹ 24.98 crore (12 *per cent*) instead of ₹ 157 crore (75 *per cent*), mainly due to delay in submission of UCs by the State Government.

3.2.1.2 Physical progress

As on 31 March 2018, physical progress of the project was as depicted in the **Table 3.1**.

Table 3.1: Physical progress of the Kandi Master Plan (KMP)

Sl. No.	Components	Provision as per DPR	Executed as on March 2018	Progress in percentage
1	**Raising and Strengthening of embankment**	223 km	Completed: 130 km Ongoing: 64 km	58
2	**Embankment protection work**	38.72 km	32.71 km completed	84
3	**Resuscitation of drainage channels (four khals)**	40.50 km	Completed: 24.90 km Ongoing: 6 km	61
4	**Renovation of existing sluices**	57 nos.	47 nos.	82
5	**Creation of additional waterway by renovating 12 existing rail/road bridges and culverts**	635 m	Nil	Nil
6	**Construction of double lane river bridge**	3 nos.	Ongoing: 3 nos	80

(Source: Divisional records)

3.2.1.3 Defective Detailed Project Report

Scrutiny of execution of the project works under 12 different phases revealed following defects in the approved Detailed Project Report (DPR), as discussed below:

Schematic diagram of embankment protection work is shown in figure below:

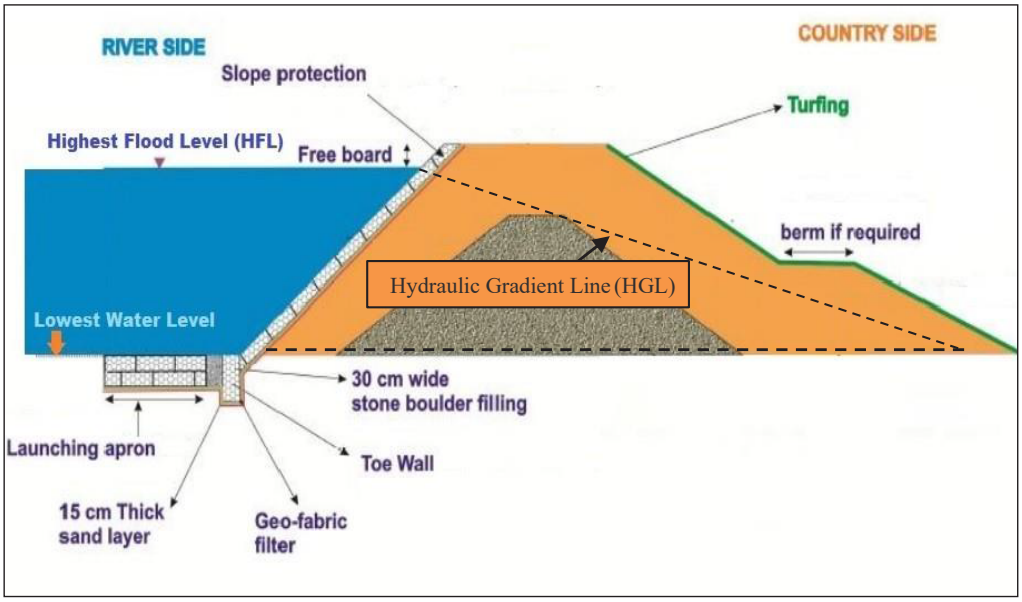

Figure 3.2: Cross section of river embankment

Non-execution of embankment protection work[28] in vulnerable stretches

DPR[29] of the KMP stipulated that protection work should be provided only in those reaches where the embankment is within 50 m of the existing bank line. Accordingly, provision for embankment protection work for a length of 38.72 km. was provided in the DPR for the entire KMP. During preparation of

[28] *Boulder pitching with launching apron (Figure-3.2).*

[29] *Page 3 and 4, Chapter 8 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

estimates in 2015-16, I&WD noticed that rivers Mayurakshi and Kuye-Babla under KMP came very close (within 50 m) of their embankments in several reaches where protection work was urgently required. Protection work was, however, not undertaken for those reaches as the same was not included in the DPR though actually required. Thus, the embankment protection work was not executed as per the present condition of the rivers, leaving those portions vulnerable to erosion.

In reply, I&WD stated (October 2018) that all the vulnerable reaches under KMP had been covered/protected as on date.

It was, however, noted in the estimates of Left Bank of river Mayurakshi (23.59 km to 39.30 km) and Right Bank of river Kuye-Babla (14.00 km to 29.00 km) under KMP that provision of protection for such vulnerable reaches was not incorporated though required as the same was not included in the original DPR of KMP. Thus, estimates were incomplete and did not account for the dynamic ground realities.

3.2.1.4 Deviations from approved DPR

Scrutiny of execution of the project works under 12 different phases revealed following deviations from the approved Detailed Project Report (DPR), as detailed below:

(a) Required Country Side Slope as per DPR not provided

In the DPR[30] of KMP, the country side slope was considered 3H:1V or as required to cover the Hydraulic Gradient Line (HGL)[31] for which 277.38 ha land was to be acquired at a cost of ₹ 96.47 crore. The Embankment Manual, CW&PC, 1960 also stipulates that the slope of the embankment should not be steeper than 3H:1V, for embankment higher than 4.5 m.

It was noticed that the country side slope of embankment of entire KMP was restricted to 2H:1V without any berm[32], though height of embankment was more than 4.5 m. Additional land acquisition was required in country side to make the slope 3H: 1V with execution of required berm. The slope was restricted due to non-acquisition of land.

Thus, by constructing embankments with countryside slope of 2H:1V, it was not possible to cover the HGL for the entire reach, making embankments vulnerable to seepage in those reaches.

In reply I&WD stated that by constructing the embankment slope 2H:1V sufficient cover of HGL was provided.

[30] *Page 48, Chapter 5 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[31] *A line of 4H:1V (for clayey soil) from High Flood Level (HFL) to the country side indicates the line of seepage through the embankments.*

[32] *A horizontal shelf built into the embankment to strengthen its stability or to catch and arrest slide material.*

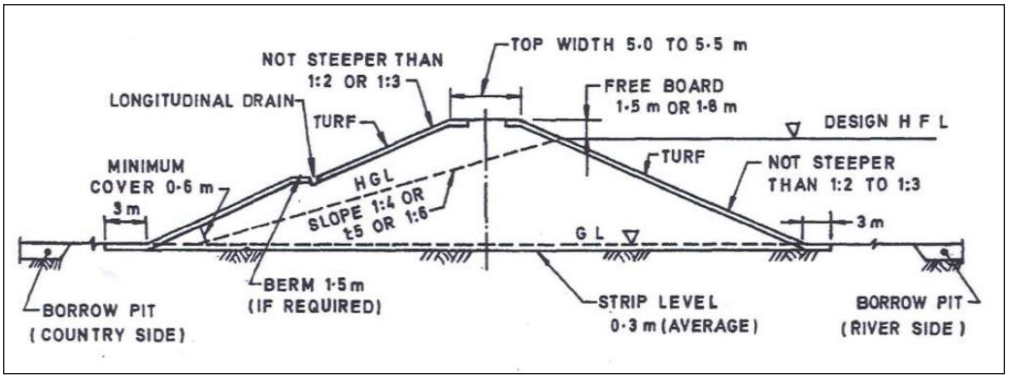

Figure 3.3: Schematic design of a river embankment

The cross sectional drawing of the embankment attached with the DPR of Phase II of KMP, however, reflected that it was not possible to cover the HGL for the entire length of the embankment with the actually executed slope of 2H:1V. Also, the reply was in contradiction to the guidelines for preparation of DPR for flood management projects, 2018.

(b) Height of embankment constructed less than the actual requirement

In the DPR[33] of KMP, minimum free board[34] of 1.80 m on river Mayurakshi having design discharge more than 3000 cumecs and 1.50 m on rivers Dwarka, Kuye and Babla having design discharge less than 3000 cumecs was provided. Accordingly, height of embankments proposed to be constructed was to cover the free boards.

It was observed that as against the free board of 1.50 m on the Kuye and Babla rivers, the height of embankment was short by 0.91m to 1.41 m in the stretches between 3.60 kmp and 6.00 kmp under Phase-IV and 20.30 kmp and 20.60 kmp under Phase-IX.

Thus, construction of embankments under Phase-IV and IX at a cost of ₹ 21.76 crore (upto March 2018) was still vulnerable to overflow during floods as the embankments constructed were below the height of the proposed free boards at different locations.

In reply, I&WD stated that during test check of audit the work was in progress and as on date the construction of embankment has been completed with the required free board.

The reply is not based on facts as the audit observation was made as per the level books[35] submitted with the final bills of the works. Thus, constructed embankment was neither as per approved DPR nor according to the GFCC guidelines relating to Design of Embankments.

(c) Non-creation of additional waterway

The existing bridges and culverts over the canals were hindering the smooth flow of canal water and creating upstream impounding of water specially during rainy season. As such, the work was taken up for reconstruction/renovation of bridges to clear the hindrances to the flow of water. Hence, a provision for

[33] *Page 48, Chapter 5 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[34] *Additional height of embankment provided over HFL to protect overtopping even with the intense wave wash or any other unexpected rise in water level (Figure-3.3).*

[35] *Book containing cross section-wise graphical representation of pre and post level of earth work.*

creation of additional waterway width of 635.58 m by renovating 12 existing bridges and culverts at a cost of ₹ 25.42 crore was made in the DPR for proper drainage of the basin water. National Commission on Floods had recommended (1976) that closer coordination amongst concerned agencies like the Railways, National Highways *etc*., was needed to ensure that structures like bridges, roads and railways do not cause flood problems.

Although the work of KMP commenced in January 2015, such linear waterways could not be provided by re-construction/renovation of the existing bridges as I&WD failed to co-ordinate with the concerned Departments (Railway and PWD) for necessary approvals to commence such works. Without providing the linear waterway, the draining of the entire basin water would not be possible. This would lead to water logging and stagnation of flood water. In reply, I&WD stated that it had already persuaded concerned Railway and PWD authorities several times. The fact, however, remains that the matter is yet to be resolved even after a lapse of more than three years.

(d) Non-execution of embankment

Provision was made in the DPR[36] of KMP for raising and strengthening of embankments from 0.00 km to 14.00 km of right bank of river Kuye. The raising and strengthening of embankment from 3.00 km to 14.00 km was, however, only considered. There was no existing right bank embankment from 0.00 km to 3.00 km and construction of embankment was not taken up due to non-acquisition of required land. Owing to non-construction of embankment from 0.00 to 3.00 km, safety of the three km stretch was compromised and protection of agricultural land of that area could not be ensured.

In reply, I&WD stated that raising and strengthening work for the initial reach of 0.00 km to 3.00 km was not considered as it flows through high land. It was noted, however, that the DPR of KMP had made the provision considering the actual site condition.

(e) Execution of less thickness of boulder pitching work

As per DPR[37], Dwarka right embankment from Indradangapara to Barpari sluice for a length of about 17 km was to be protected with 60 cm thick boulder pitching over Geo-synthetic filter. As against the planned length of 17 km and thickness of 60 cm, provision for 45 cm thick boulder pitching over Geo-synthetic filter for a length of only 13.27 km between Indradangapara and Barpari sluice was made at a total estimated cost of ₹ 28.89 crore under Phase-II and III.

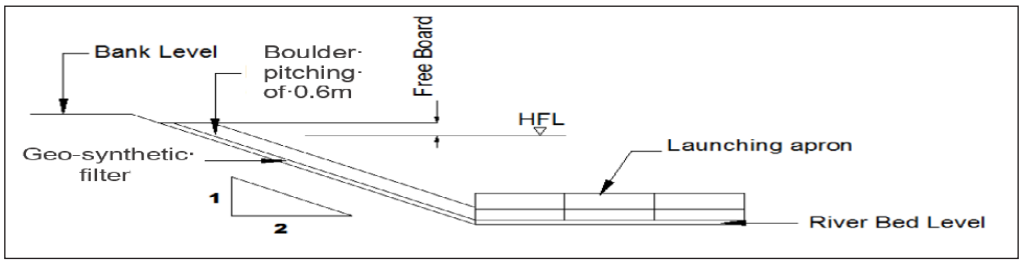

Figure 3.4: Diagram of location of Boulder pitching and Geo-synthetic filter

[36] *Page 21, Chapter 9 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

[37] *Page 26, Chapter 7 of DPR for Improvement of embankment and ancillary works in Kandi and other adjoining areas of district of Murshidabad.*

Thus, due to execution of inadequate thickness of the boulder pitching, the length of 13.27 km of embankment remained vulnerable to erosion even after incurring expenditure of ₹20.84 crore (upto March 2018). Further, boulder pitching for the remaining length of 3.73 km was yet to be initiated for execution.

In all these cases, deviations from the approved DPRs were noticed because of which risk of the infirmities adversely impacting the arrangements of flood management cannot be ruled out.

3.2.1.5 Non-compliance to Indian Standards Code and GFCC/ Technical Expert Committee recommendations

(a) Non-execution of sand cushion layer[38]

Para 3.7 of the IS Code 14262:1995 provided 150 mm thick sand layer over the filter fabric to prevent mechanical rupture of the fabric by revetment stones. Therefore, a cushion of 100-150 mm of locally available river bed materials/ sand was to be provided over Geo-textile filter.[39]

Boulder revetment work with Geo-textile filter for 25.11 km embankments of rivers Mayurakshi, Bele and Dwarka were taken up under Phase-II and III of KMP after May 2016. Sand layer over Geo-textile filter as recommended in IS code was, however, not included in the DPR and hence not executed. While conducting monitoring visit in May 2016, GFCC also observed that during boulder revetment works[40] on slope of embankment non-laying of sand cushion layer, may lead to puncture of the filter.

Therefore, non-execution of sand cushion layer compromised the quality of works executed at a cost of ₹ 21.81 crore upto March 2018 and may also lead to failure of the protection work on the embankments.

Accepting the audit observation, I&WD stated that there were some difficulties in bearing the extra expenditure within the tender provision. Extra care had, however, been taken during execution of works to minimise the possibility of puncture of Geo-textile filter.

(b) Non-execution of sausage crate[41] **in step**

As per 5th Technical Expert Committee meeting of I&WD, GoWB on implementation of river bank erosion in February 2015, in the reaches where there is no scope to set back the bank line, the required slope is to be generated by dumping boulder in crates over sand filled bags. GFCC also recommended (May 2016) that in case of steeper slope towards river side, where there was land constraint, sausage crate had to be provided *i.e.* at Sundarpur, Bhatkhanda or places where necessary over the right bank of Dwarka and left bank of river Bele.

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38 *A sand layer over Geo-textile filter.*

39 *A filter layer made with Geo-jute laid over the earthen embankment in protection work with boulder pitching to protect the erosion of earthen embankment by river water.*

40 *Sloping structures with boulders placed on embankment.*

41 *Wire net filled with boulders, used for embankment protection.*

Figure 3.5 : Image of Boulder Pitching in sausage crate

Figure 3.6 : Image of Loose Boulder Pitching

It was observed from the estimates and contractor's bills that the protection work of right bank of river Dwarka and left bank of river Bele were taken up under Phase-II and III of KMP respectively with the provision of loose boulder pitching in the estimates. Provision for boulder pitching in sausage crate was not made in DPR and the work was being executed with loose boulder pitching as on March 2018. As a result, stability of the steeper river side slopes over the right bank of Dwarka and left bank of river Bele was not ensured, endangering the stability of the embankments.

In reply, I&WD stated that boulder pitching in sausage crate was provided in those locations after approving the excess-savings statements. No such document in support of execution of such item was, however, produced to Audit.

(c) Avoidable extra expenditure in embankment protection work

IS code 14262:1995 on Planning and Design of Revetment and Handbook of Central Water Commission (CWC), GoI, on Flood Protection, Anti-Erosion and River Training Works-2012 stipulates that the width of the launching apron[42]

[42] *A launching apron is a flexible stone cover placed on the bed of the river which settles into the scouring area as scouring takes place and covers the base and side of the scour hole, preventing it from developing further scouring.*

depends upon the scour[43] depth below High Flood Level (HFL). Average thickness of launching apron should be 1.5 times of the thickness of boulder pitching.

It was observed that the average thickness of launching apron was provided 1.88 times of the thickness of boulder pitching (0.45 m) in the estimates instead of 1.5 times and executed subsequently for 18.14 km embankment protection works on the rivers of Dwarka and Bele under Phase-II and Phase-III of KMP. Thus, due to execution of excess thickness of launching apron, extra expenditure of ₹ 3.53 crore was incurred by I&WD which could have been avoided.

In reply, I&WD stated that considering the criteria laid down in clause 5.6.2 of Indian Standard 10751:1994 (design of Guide banks), such thickness was provided for launching apron. The fact, however, is that this code is applicable for designing Guide banks[44] and not for embankment protection.

Thus, the intended benefits of the KMP project could not be assured only by the raising and strengthening of embankments of different rivers, without creating additional waterways by renovating the existing bridges and culverts. The already executed improvement works of different embankments were also not in conformity with the approved DPR or guidelines of GFCC.

The inundation maps below show the comparison between the water available in the catchment area of KMP and the floods that had taken place in the catchment area in the years 2011 (before the commencement of the project), 2015 and 2017.

Flood Report of 2017 reflects that all the four blocks (Bharatpur-I, Khargram, Burwan and Kandi) included under KMP were inundated by flood water in July 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.

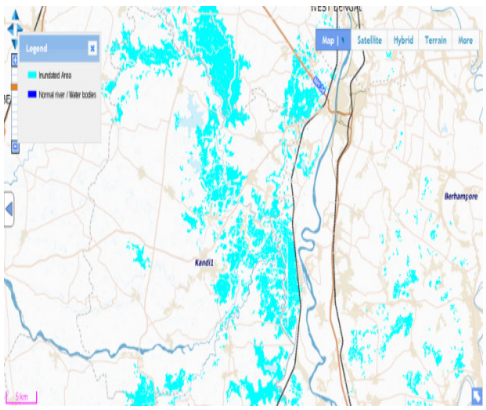

Figure 3.7: Inundation map of Kandi Basin on 16.08.2011

Figure 3.8: Inundation map of Kandi Basin in dry season

[43] *'Scouring' is the name given to the removal of the bed or bank of a water course by the action of flowing.*

[44] *Guide Bank is defined as the site of a barrage to guide the river flow through the confined waterway without causing damage to the structure and its approaches.*

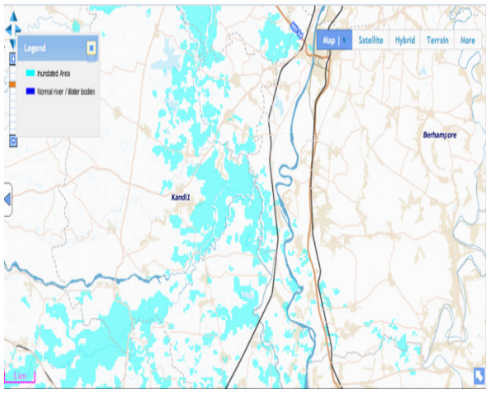

Figure 3.9: Inundation map of Kandi Basin on 07.08.2015

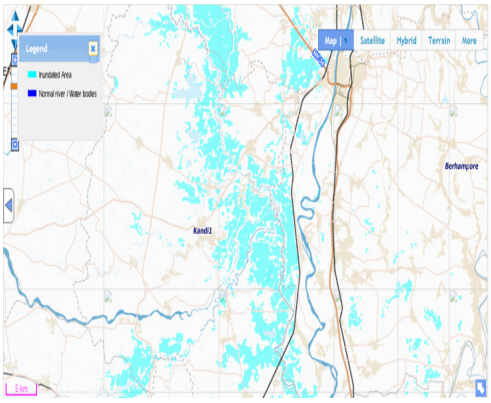

Figure 3.10: Inundation map of Kandi Basin during 23-25.08.2016

I&WD stated that though the blocks were inundated, the extent of inundation was less compared to previous years.

3.2.2 Kaliaghai-Kapaleswari-Baghai Project

The entire KKB (Kaliaghai-Kapaleswari-Baghai) basin covers an area of 2145 sq. km. spread over the districts of Paschim and Purba Midnapore. The southern portion of the basin, having low lying terrain, historically suffers from flood and tidal inundation.

The project primarily comprised of structural measures like:

(i) Excavation/re-sectioning of a total of 186 km embankments of five rivers/ tributaries[45],

(ii) Realignment of the flood protective embankments of Kaliaghai, Kapaleswari and Baghai and construction of embankments as per standard specification,

(iii) Construction of Rubber dam type regulator on river Kaliaghai at Chabukia downstream of outfall of Kapaleswari,

(iv) Construction of three bridges across river Chandia at Sridharpur, Ejmali Chak and Chandipur *etc*.

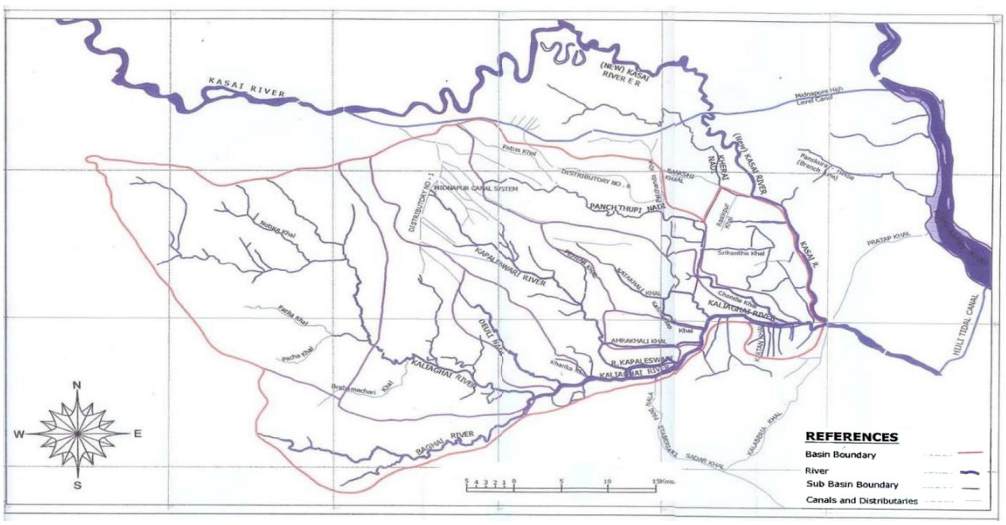

Figure 3.11 : Index Map of KKB Drainage Basin Project

[45] *Kaliaghai, Kapaleswari, Baghai, Deuli, Chandia and Kalimandap, Amrakhali.*

The KKB Drainage Scheme was initiated to provide relief to seven flood prone blocks in Paschim and Purba Medinipur districts. The scheme was envisaged to benefit a total area of 621 sq. km. with population of four lakh.

Investment clearance of ₹ 650.38 crore for KKB project was accorded by the Planning Commission, GoI in March 2010 with target date of completion by March 2015. The project was included under FMP with a funding ratio of 75:25 (Central:State) in July 2010. The project was commenced in March 2011 and ₹ 347.78 crore (Central Share ₹165.73 crore and State Share ₹182.05 crore) was released against which expenditure of ₹340.24 crore was incurred up to March 2018. Release of Central Share was 36.46 *per cent*[46] less as the project could not be completed within the stipulated time. Meanwhile, the State Government released funds in anticipation of receipt of Central fund. I&WD proposed (August 2017) to complete the project by March 2019 which was yet to be approved by GoI. The project was still (December 2018) ongoing.

The project could not be completed within stipulated period mainly due to delay in land acquisition. Only 35 *per cent* of the estimated land was acquired up to March 2018. The main rivers were excavated with reduced design bed width due to non-availability of required land. The length of the rivers/channels were resuscitated only on the available Government land (*i.e.* river course) and to the extent of land acquired for the purpose. Besides, resuscitation works were executed in khals not in the original scope of the DPR.

Physical progress under different components of KKB is shown in **Table 3.2**.

Table 3.2: Physical progress of different components of the KKB project

Sl. No.	Name of the Component	Unit	Estimated quantity	Completed upto March 2018	Progress in Percentage
1.	**Land Acquisition**	Ha	500.00	173	35
2.	**Resuscitation of main rivers**	Km	141.00	128.85	91
3.	**Resuscitation of small drainage channels**	Km	170.00	170.46	100
4.	**Earth work**	Lakh Cum	484.47	414.12	85
5.	**Concrete work**	Cum	6000.37	5490.00	91

(Source: Divisional records)

3.2.2.1 Land acquisition

Clause-4.6 of the FMP Guidelines (2009) stipulates that while submitting a new proposal, the State Government should ensure acquisition of land required under the scheme and submit a certificate to this effect. Failing this, no fund would be released to the State Government.

Approximately 500 ha of land was targeted for acquisition by I&WD involving 223 mouzas in seven blocks for the project. While obtaining techno-economical clearance, I&WD replied to MoWR (GoI) that only small stretch of land would need to be acquired for this project which would not be a problem as the local affected people were urging for the project.

[46] *₹165.73 crore against ₹260.84 crore (75 percent of ₹347.78 crore).*

I&WD published (December 2010) a notification for acquisition of land on emergency basis so that the land acquisition could be made before the monsoon period of 2011 for timely completion of the project. It was, however, observed that I&WD did not initiate any land acquisition proposal prior to May 2011. Against the target of 500 ha, only 173 ha of land (35 *per cent*) was acquired till March 2018. It was observed that the resuscitation of rivers through excavation and/or widening of bed width were made only within available land. As a result, design bed width[47] as per DPR had to be compromised.

As I&WD failed to acquire requisite land the bed width of rivers stipulated in the DPRs for smooth drainage of flood waters could not be achieved.

3.2.2.2 Execution of the project

(a) Non-completion of works due to defective DPR

Para-195 of Irrigation Code of I&WD stipulates that preliminary investigations should be conducted and feasibility assessed before undertaking a project. In the DPR[48] of the project, entire stretch of 63 km[49] of the Kaliaghai river was included for re-excavation work[50], *i.e.*, construction of cross bund (required for dry excavation) for de-siltation. Accordingly, NITs were invited (during March 2012 to December 2015) for the entire stretch at an estimated cost of ₹ 236.37 crore. During execution, however, it was reported by the implementing agency that dry excavation was not feasible in a 500 m stretch as it was at the confluence point of river Kaliaghai with river Haldi, which ultimately discharges water to the Bay of Bengal.

It was observed that the river was excavated for a length of 62.50 km at a cost of ₹ 206.04 crore leaving 500 m from 62.50 km to 63 km un-excavated.

Non-excavation of silt at the confluence point at downstream would hinder smooth drainage of water from the excavated upstream portion of the river and would lead to siltation at upstream again. GFCC in its monitoring visit (September 2017) also witnessed siltation at upstream reaches and confluence point. In reply, the concerned Division stated (March 2018) that the siltation was due to non-completion of the remaining 500 m.

Thus, expenditure of ₹ 206.04 crore incurred on resuscitation of the river in the upstream remained ineffective due to defective DPR as no feasibility study was conducted before taking up of the work.

(b) Selective implementation of DPR

- **Existence of Fishing Barriers in rivers**

As per DPR[51] of the project, about 150 families of the KKB basin used to catch fish using fishing barriers[52] with nylon net across the rivers. Such structures

[47] *Horizontal width of river bed.*

[48] *Page 3, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[49] *From Poktapol (46 km) to Dheubhanga (109 km) i.e. 63 km was included for re-sectioning work in the DPR.*

[50] *Excavation for de-siltation.*

[51] *Page 2, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[52] *Barriers with polythene sheets in flowing rivers for fishing.*

reduce the velocity of river flow as well as augment silt deposition. Therefore, the DPR proposed for removal of fishing barriers across main rivers.

Figure 3.12: Fishing nets across river Kaliaghai at ch 39.00 km

During joint inspection (April 2018), however, existence of numerous fishing barriers were noticed in all the major rivers, *i.e.*, Kaliaghai, Kapaleswari and Baghai.

In reply, test checked Divisions related with the project stated (April 2018) that they had no data regarding the numbers and ownership of such fishing barriers and there was also no plan for eviction of such structures. It was also observed that there was no monitoring mechanism to control placing of fishing nets across the rivers.

This indicated that the actual implementation of the project by I&WD was in variance with that of DPR. Continued existence of such structures may lead to reduced discharge of rivers and augmentation of silt deposition, thereby exacerbating floods.

- **Removal of Brick Manufacturing Units**

In the DPR[53] of KKB Project, removal of brick or tile manufacturing units from river embankments was identified as one of the absolutely unavoidable measures for meaningful flood management. Indiscriminate cutting of land and lifting of sand from the river bed leads to several hydro morphological changes in the river channel. Provision of ₹ 50 lakh was made in the DPR for rehabilitation of these units. It was observed (March to May 2018) that no rehabilitation programme was carried out by I&WD. During joint inspection (March to May 2018) of seven spots, six brick manufacturing units were noticed on the embankments[54] of Kaliaghai river.

[53] *Page 2, 3 and 6, Chapter XI of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[54] *Haorar Khea (at Ch. 55.00 km of River Kaliaghai), at Ch.42.70 km of River Kaliaghai, Chabukia (at Ch.49.20 km of River Kaliaghai).*

Figure 3.13: Brick Kilns alongside river Kaliaghai at ch. 42.70 km

Thus, I&WD failed to achieve the targets set in the DPR for removal of brick units. Existence of such manufacturing units hampered effective flood management.

(c) Non-compliance with approved DPR

- **Design Bed Width not achieved**

The resuscitation work of rivers and khals[55] under KKB was taken up to increase their carrying capacity by widening and removing silted soil up to the depth as specified in the DPR[56] to deal with the problem of frequent floods. It was observed that the design bed width as envisaged in the approved DPR could not be achieved as requisite land was not acquired. I&WD could acquire only 35 *per cent* of the estimated land up to March 2018. Design bed width was compromised in several cases due to non-availability of adequate land as shown in **Table 3.3**.

Table 3.3: River stretches where design bed width was compromised

Name of the River with chainage (km)	Effected stretch (km)	Bed width as per DPR (m)	Executed Bed width (m)
Kaliaghai (0.00 to 15.00)	15	50 to 70	35
Kaliaghai (15.00 to 34.00)	19	80 to 140	50
Kapaleswari (2.00 to 6.50)	4.50	40 to 45	30 to 44
Deuli (0.00 to 9.487)	9.487	40	15
Kaliaghai (34.00 to 49.20)	15.20	135 to 160	50 to 110
Baghai (15.60 to 7.50)	8.10	45 to 50	18 to 22

(Source: Divisional records)

[55] *Khal means a narrow water channel.*

[56] *Page 14 and 15, Table 10.4B, 10.4C, 10.4D of Kaliaghai-Kapaleswari-Baghai Drainage Basin Scheme – Gradient Statement.*

The executing Divisions replied that resuscitation of rivers was carried out only on available Government land (river course) as the required land was not acquired. Due to non-resuscitation of rivers up to the design bed width specified in the DPR, the problem of frequent flooding and drainage congestion in the basin remained unresolved.

- **Construction of Rubber Dam yet to be taken up**

In the DPR[57] of KKB Project, non-monsoon tidal ingress was identified as one of the major causes of faster siltation of the river beds. Accordingly, it was planned to construct a regulator structure[58] having one-way flow system at the confluence of river Kapaleswari with river Kaliaghai. Provision for construction of the regulating structure on river Kaliaghai was also made to store upstream water for irrigation purposes during non-monsoon period. In order to construct the regulating structure over river Kaliaghai, a cost effective **Rubber Dam** was incorporated (2010) in the DPR[59] with a stipulation to complete the work within three years of commencement, *i.e.*, by 2012-13.

I&WD, however, failed to construct the regulator at the designated site. Scrutiny of related records revealed that revised target was set by I&WD to complete the same by March 2019. I&WD was still (December 2018) in the process of preparation of modified Expression of Interest (EoI) for this work. On the issue of revised expected date of completion, the Department stated (January 2019) that due to complexity of technical know-how, no positive response was received from bidders in the past.

Figure 3.14: Image of a typical Rubber Dam

It was also observed from the report prepared by the concerned Divisional office that even after resuscitation of river Kaliaghai at a cost of ₹ 201.79 crore, huge amount of silt was carried and deposited in the upstream of the river during high-tide. The existence of heavy siltation in the portion already re-excavated in upstream of Kaliaghai river was also witnessed during the joint inspection of site (April 2018). As a result, due to non-construction of the regulator, siltation due to tidal ingress could not be prevented in the re-excavated areas and the carrying capacity of the river was reduced. The aim

[57] *Page 3, Chapter VIII of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin (Final Report-Volume I).*

[58] *Structure which regulates water flow.*

[59] *Page 2, Supplementary Volume II (Revised) of Master Plan and DPR for Kaliaghai-Kapaleswari-Baghai Drainage Basin.*

of storing upstream water for irrigation purposes during non-monsoon period was also not achieved.

(d) Violation of conditions of DPRs/agreement/WBFR

The Planning Commission in the investment clearance of the scheme imposed conditions (March 2010)[60] that various components under the project shall be designed and executed as per various relevant Indian Standards and designs vetted by GFCC. Para 5.13 of the FMP guidelines also stipulates that the State Governments should ensure that the works are executed in a well-planned manner and completed within the scheduled period. The project was, however, still in progress and deviations of following conditions/guidelines was also noticed.

- **Execution beyond the scope of the DPR**

While giving Investment Clearance, Planning Commission recommended that the State Government should restrict the expenditure within approved cost and no additional expenditure would be permitted unless revised estimates were approved. Besides, designs of all works were to be vetted by the GFCC.

Audit, however, observed that total 40 works[61] were executed on public demand beyond the scope of the DPR at an expenditure of ₹ 41.94 crore. Designs of these new works were also not vetted by GFCC. Execution of works not included in the DPR without vetting by the competent authority was not permissible. Thus, execution of these works led to unauthorised expenditure from project outlay.

In reply, I&WD admitted that some works had been executed beyond the scope of the DPR due to demand of the local public. I&WD, however, remained silent about non-vetting of the design by the GFCC.

- **Extension of time on grounds other than those mentioned in the tender clause**

As per conditions of contract, time extension beyond stipulated period could be allowed only on grounds of unavoidable hindrance[62] as specified in the tender.

It was seen that in three test checked Divisions[63] under KKB, out of 87 test checked works, 79 works (90.8 *per cent*) valuing ₹ 268.67 crore got delayed for periods ranging from nine to 2113 days (nearly six years). Records relating to extension of time were not made available in 51 works. In remaining 28 works, it was observed that time-extension was allowed in eight works on the grounds[64] other than those mentioned in the tender.

Thus, granting of extension beyond stipulated time and for reasons not specified in the tender conditions resulted in delay in completion of project works.

- **Execution of work without Technical Sanction**

Rule-164 of West Bengal Financial Rules provides that technical sanction from the competent authority must be obtained before commencement of any work.

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60 *No. 12(1)/25/2010-WR dated 9 March 2010.*

61 *Resuscitation of 31 Khals, construction of five bridges and improvement of four roads works.*

62 *Non receipt of departmental materials, land, injunction, public interference.*

63 *East Medinipur Division, Kaliaghai-Kapaleswari-Baghai Basin Project Division, Contai Irrigation Division.*

64 *Labour problem, Boro cultivation, crisis of machinery, monsoon.*

It was observed that during 2012-13 to 2016-17, four works[65] were executed at a cost of ₹ 8.68 crore without obtaining technical sanction from the competent authority and was also not vetted by the GFCC as per stipulation. Violation of provisions of WBFR not only rendered the execution of works unauthorised but also led to a risk that the works did not adhere to the prescribed technical standards.

In reply, I&WD stated that all works were duly sanctioned by the competent authority as per departmental norms. Reply of I&WD was, however, not specific to the four cases pointed out by Audit.

(e) Non-compliance of recommendation of the Independent Agency engaged by I&WD

Clause 5.8 of FMP Guidelines (2009) required performance evaluation of the project by independent professional agencies having expertise in related field. Accordingly, Indian Institute of Technology (IIT), Kharagpur was nominated by I&WD for performance evaluation of the project. IIT Kharagpur in its report recommended (April 2014) that proper maintenance of the channels be undertaken once in a year to maintain its geometry, otherwise problem may reappear due to siltation. GFCC in the Monitoring Report of January 2018 also recommended for periodical maintenance of the channels to assure the safety of the excavated channels.

Figure 3.15: Heavy siltation observed at Ch.55.00 km (approx) of River Kaliaghai

It was observed that 266.03 km of excavation works were completed in different rivers/khals during March 2011 to May 2018. The concerned Divisions, however, stated that no maintenance work was ever carried out on any of those channels. In its reply, the Department stated the project was still ongoing and for cleaning the bed siltation periodically, the Department needs to observe the situation for at least four to five years as it involves huge amount of funds. The fact remains that the excavation of canals commenced from 2011 and eight years has already elapsed without any maintenance works. Thus, non-compliance

[65] *(1) Resuscitation by excavation of Debi Khal from ch.0.00 km to ch.3.30 km, (2) Improvement of riding quality of Narghat - Gokhuri Road from 0.00 km to 11.00 km, (3) Urgent maintenance and repair of Tyaparpara More to Singlai More Sluice for a length of 6100 m, (4) Urgent maintenance and repair of Bhagabanpur More to Goalapukur for a length of 6000 m.*

of recommendations of Independent Agency/GFCC made the previous efforts in respect of excavation of rivers/ channels ineffective. During joint site visits (March to May 2018), heavy siltation in different rivers/khals[66] was also noticed.

Encroachment of embankments hampered essential maintenance and repair work. The IIT Kharagpur recommended (in its report of 2012-13 and 2015-16) that unauthorised encroachment should be strictly avoided. From the records of the Division it was noticed that there were encroachments on 955 structures[67] at different locations[68] on the embankments hampering the maintenance and repair works. The Divisional Officer requested (September 2017) the District Magistrate, Paschim Medinipur for removal of those encroachments, but without any positive result. During 31 joint site visits (March to May 2018), seven number encroachments were noticed at different locations of rivers/khals.

Figure 3.16: Encroachment over Abhoy Giri Khal

Thus, commencement of the project without ensuring land, grossly hampered execution of works leading to delay in completion of the project. Rivers/khals were not widened/excavated upto design bed width, which implied that with the limited carrying capacity, they would not be able to control frequent flooding in the areas. Inclusion of non-feasible items, non-construction of regulator at the confluence of river Kapaleswari and Kaliaghai and non-maintenance of already resuscitated rivers/khals caused heavy siltation affecting the overall drainage system of the project.

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66 *Chabukia (at Ch.49.35 km of River Kaliaghai), Haorar Khea (at Ch.55.00 km of River Kaliaghai), Dheubhanga (at Ch.62.50 km of River Kaliaghai), Chandibenia (at Ch.22.00 km of River Chandia), Asnan Ghat (at Ch.24.00 km of River Chandia), Dheubhanga (at Ch.6.80 km of Moyna New Cut Channel), at Ch.42.70 km of River Kaliaghai and outfall of river Kapaleswari, Chabukia at Ch.49.20 km of River Kaliaghai, Birjiban (at Ch.2.00 km of Kapaleswari).*

67 *House, shops, cattle sheds, clubs, primary school, machine sheds, party offices, etc.*

68 *River Kapaleswari left embankment (2.00 kmp to 14.70 kmp), Kalimondop Khal left embankment (0.142 kmp to 0.950 kmp, 2.00 kmp to 2.50 kmp, 5.40 kmp to 6.60 kmp), Kalimondop Khal right embankment (4.60 kmp to 6.80 kmp), Kalimondop Khal both left and right at Mohanbazar, River Kaliaghai (13 kmp to 34 kmp), Ganapatkhal, Banskona khal and Amrakhali khal.*

The Annual Flood Report of 2017 of I&WD reflected that all the seven blocks[69] included under KKB were inundated in 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.

3.2.3 Implementation of other Embankment protection and anti-river erosion works

Apart from the two FMP projects as discussed above, I&WD executed embankment protection as well as anti-erosion of river bank works under State Plan, Rural Infrastructure Development Fund (RIDF), Common Border Rivers Fund, One Time Additional Central Assistance (OTACA) *etc*. In eight test checked Divisions[70] (other than project Divisions of KKB and KMP), 145 out of 357 tenders having estimated cost more than ₹ one crore each, which were executed during 2013-14 to 2017-18 under flood control measures, were selected for detailed examination.

Scrutiny of selected embankment protection and anti-erosion works revealed the following deviations which would have an adverse impact on the flood control measures:

3.2.3.1 Work done without obtaining clearance from the Forest Department

As per Forest Conservation Act, 1980, clearance from Forest Department is required for construction of embankment on forest land. Alipurduar Irrigation Division took up (December 2016) the work of 'Extension of Subhasini embankment along the left bank of river Torsa' at a cost of ₹ 5.78 crore without obtaining forest clearance. Subsequently, the work was proposed for termination by the Chief Engineer, I&WD in April 2018 due to objection raised by the Forest Department for not obtaining clearance; no reply was received from the Department in this regard.

Thus, commencement of work without obtaining forest clearance made the partially executed work worth ₹ 0.70 crore (only earth work without protection) wasteful.

3.2.3.2 Required thickness of graded filter not provided in the revetment

Para 3.7 of IS code-14262:1995 as well as Para 4.5.4 of CWC Guidelines-2012 stipulate that graded filter of size 150 mm to 300 mm thickness should be provided below the revetment[71] to prevent water from removing the underlying soil of embankments through voids in the boulder pitching.

It was noticed that in 28 estimates prepared by three test checked Divisions[72] valuing ₹ 61.83 crore, provision for only 100 mm thick filter layer of shingles under the slope pitching was made and executed in violation of the existing norms. Thus, construction of embankments with less thickness of filter layer made them vulnerable to erosion.

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69 *Narayangar, Datan-I, Sabong, Pingla, Bhagabanpur-I, Patashpur-I and Moyna.*

70 *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Canals Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

71 *Embankment protection work with boulders placed along the slope of the embankments.*

72 *Coochbehar Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

In reply, I&WD stated that 100 mm thickness shingles filter is normally provided where discharge is less than 4500 cumec[73].

The reply was, however, not in consonance with the fact that neither the IS code nor the CWC guidelines recommend graded filter layer of 100 mm thickness.

3.2.3.3 Non-execution of sand cushion layer in embankment

Para 3.7 of Indian Standards code-14262:1995 stipulates that a 150 mm thick sand cushion layer should be provided over the filter fabric to prevent mechanical rupture of the fabric by revetment stones.

Mahananda Embankment Division executed nine embankment protection and anti-erosion works valuing ₹ 58.36 crore where boulder pitching on top and slope was executed over Geo-textile filter. It was, however, observed that laying of sand cushion was not envisaged in the estimates and works were executed without providing such layer.

As a result, possibility of rupture of filter layer and failure of the protection works could not be ruled out. In reply, the concerned Division stated (June 2018) that in future sand cushion layer will be included in this type of work.

3.2.3.4 Delay in execution of works

Clause-2 of standard tender agreement stipulates that time is the essence of the contract. NIT clause further stipulates that time extension may be granted only on the ground of non-receipt of departmental materials, land injunction or public interference, *etc*.

It was observed that completion of 42 works taken up by the six test checked Divisions[74] were delayed by nearly four months to four years. Further, scrutiny revealed that time extension was granted by the competent authority on grounds other than those specified in the contract agreements in all cases. This resulted in delay in achievement of the intended benefits from the projects. Moreover, delay in execution of works kept the river embankments in vulnerable condition.

3.2.3.5 Use of lower specification Galvanised Iron wires in boulder crates for construction of embankment

Para 3.6 of Indian Standard 14262:1995 on Planning and Design of Revetment stipulates that Galvanised Iron (GI) wire of minimum four mm diameter should be used for crates in revetment in the area where velocity of river is high. It was observed that in five test checked Divisions[75] crated boulder with GI wire of less than four mm diameter (ø) was used in all 48 test checked embankment protection/anti-erosion works valuing ₹ 219.79 crore during 2013-18 in violation of the norms. The works remained vulnerable due to use of below specification GI wire for boulder crates in embankment and anti-erosion works. During joint site visit (April 2018) of left bank of river Mahananda in Adampur Block of Malda District it was also noticed that the crates used in protection works were in broken condition.

[73] *Cubic metre per second.*

[74] *Howrah Irrigation Division, Malda Irrigation Division, Mahananda Embankment Division, Hooghly Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

[75] *Malda Irrigation Division, Mahananda Embankment Division, Coochbehar Irrigation Division, Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

Figure 3.17: Damaged revetment constructed with below specification GI wire

3.2.3.6 Avoidable extra expenditure

(a) Para 5.6 of IS Code 14262:1995 on Planning and Design of Revetment and Para- 4.9.4 of Guidelines of Central Water Commission (CWC), GoI, on Flood Protection, Anti Erosion and River Training Works-2012 stipulate that the thickness of launching apron be 1.5 times the thickness of pitching. Test checked Malda Irrigation Division, however, executed 10 embankment protection/anti-river erosion works where the thickness of stone boulder in launching apron was provided 33 to 56 *per cent* more than the actual requirement. Thus, execution of excess thickness of apron resulted in extra expenditure of ₹ 10.44 crore which could have been avoided.

In reply, I&WD stated that as the works were executed in restricted zone of border area having rare scope of maintenance, such excess thickness was provided.

No such justification was, however, provided in the DPR. Besides, the reply appears to be an afterthought.

(b) IRC-SP-72-2007, the guidelines for the design of Flexible Pavements for low volume rural roads do not recommend laying of any bituminous base course for rural road/village road of low traffic intensity. It was observed that 50 to 75 mm Bituminous Macadam (BM) was provided on three roads[76] over earthen embankment by three test checked Divisions[77] where the roads were either of village road category or the traffic intensity was very low. Execution of unnecessary BM layer resulted in extra expenditure of ₹ 2.10 crore, which could have been avoided.

Flood protection measures taken up by the Divisions were not as per prescribed standards. It was also observed from the Annual Flood Reports of I&WD that, in 2017, the area under flood inundation of the State was more than that in the last four years, despite the flood control measures.

[76] *Malior embankment 0.00 to 10.00 kmp, Improvement of inspection road of distributary 5 of DBMC, bituminous inspection path at Bibigunj and Jhar Singhersar embankment.*

[77] *Mahananda Embankment Division, Mayurakshi North Canal Division and Jalpaiguri Irrigation Division.*

Chapter 4

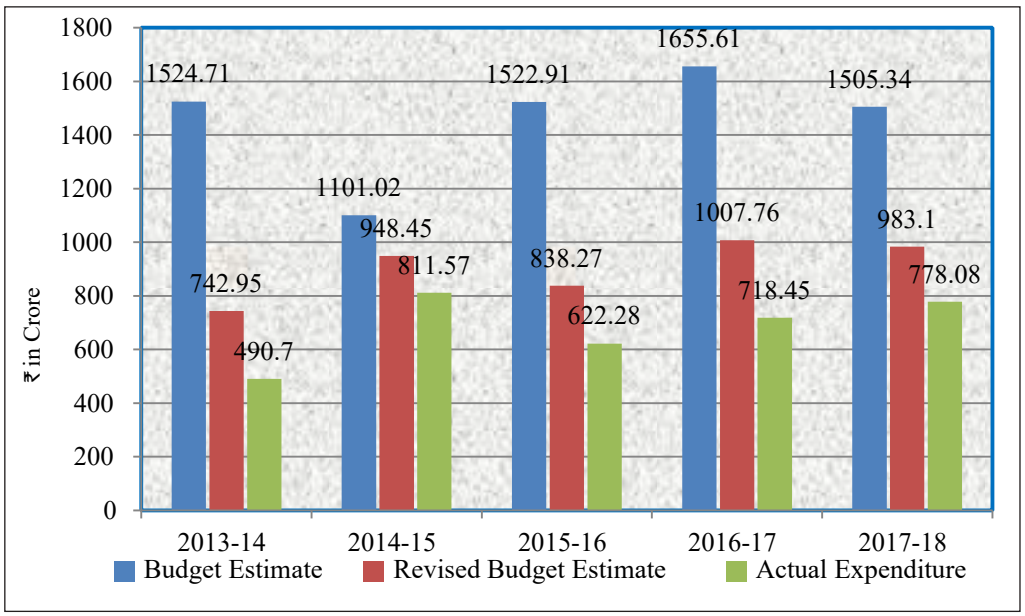
Financial Management

Chapter 4: Financial Management

4.1 Allotment and expenditure

During 2013-14 to 2017-18, I&WD received funds from State Plan, RIDF, and funds from GoI requiring corresponding State share for Flood Control. Details of fund allocation and expenditure incurred under Flood Control during this period are shown in the **Chart No. 4.1**.

Chart 4.1: Expenditure vis-à-vis Budget Estimates on Flood Control



(Source: Departmental data and Budget Publication)

During 2013-14 to 2017-18, total Budget Estimates of ₹ 7309.59 crore was made under Flood Control. This was subsequently reduced to ₹ 4520.53 crore in the Revised Estimates, which was 62 *per cent* of Budget Estimates. The actual expenditure each year during 2013-14 to 2017-18 was, however, less than the Revised Estimates of the respective year. Savings with respect to Budget Estimates as well as Revised Estimates ranged from 26 to 68 *per cent* and 14 to 34 *per cent,* respectively.

Rule 333 along with Appendix-20 of West Bengal Financial Rules (WBFR) stipulates that Executive Engineers are responsible for preparation of Budget Estimates (BE for the next year and RE for the current year), which are required to be sent to their Superintending Engineers (SE) by 15th September of each year. In the test checked Divisions, Audit noticed that the provision of sending yearly budget proposals was not complied with during 2013-14 to 2017-18 as the selected Divisions could not furnish any document of budget proposals made by them. As a result, yearly budgets were prepared by I&WD without taking any inputs from the divisional level, which resulted in savings. As per the Budget Publications, I&WD could not spend ₹ 1099.45 crore during 2013-14 to 2017-18, though provision of the fund was made through REs by the State Government.

It was observed that despite availability of funds, 2162 sq. km. of the total flood prone area of the State remained unprotected as per the Annual Flood Report 2017 of I&WD.

4.2 Financial Irregularities

4.2.1 Maintenance work with FMP fund

Para 4.3 of FMP Guidelines (2009) stipulates that Central Assistance will not be provided for regular maintenance of flood management works but only for restoration of damaged works for their completion before next monsoon season, provided such works were earlier constructed with Central Assistance and not covered under Calamity Relief Fund (CRF)/National Calamity Contingency Fund (NCCF).

While submitting fund release proposal to the MoWR in August 2017, I&WD stated that KKB project could not be completed within stipulated time due to lack of Central funding. It was, however, observed that urgent maintenance and repair works of three roads were executed by test checked Contai Irrigation Division under KKB project at a cost of ₹ 6.87 crore with the fund of FMP during the years 2013-17. Confirming the fact, the Division stated (June 2018) that the works were executed due to extreme demand and in public interest. Execution of maintenance works with Central fund was in deviation of the scheme guidelines and would reduce the availability of funds for completion of the project.

4.2.2 Non-deduction of Royalty

As per standard tender clause and work orders, royalty payment certificates in original from the concerned authority were to be submitted along with the bills by the contractors for the stone boulders/earth used. In the absence of the certificates, royalty amount should be deducted from the bills submitted by the contractors.

It was observed that royalty amounting to ₹ 69.05 lakh for 19314 m^3 of boulder and 487794 m^3 of carried earth was not deducted from the bills in respect of three contractors by Mayurakshi North Canal Division up to March 2018, though the contractors did not submit the requisite royalty certificates. Non-deduction of royalty resulted in loss to the exchequer and undue favour of ₹ 69.05 lakh to the agencies.

In reply, the Divisional Officer stated (July 2018) that the royalty would be deducted from the pending bills of the contractors.

4.2.3 Early refund of Security Deposit

Tender Clause 17 of the agreement stipulates that Security Deposit (SD) deducted from contractor's bill shall be refundable after expiry of three months from the actual date of completion of the work. It further stipulates that the contractor shall be responsible for rectifying defects in asphaltic work within a year from completion of work and the portion of the SD relating to asphaltic work shall be refundable after the expiry of that period.

It was, however, observed that Security Deposit amounting to ₹ 53.72 lakh was refunded in three works[78] in two test checked Divisions[79] even before completion of the works; Mahananda Embankment Division released the entire amount of Security Deposit of ₹ 54.90 lakh in respect of five tenders of two road works[80] having asphaltic works within six to eight months instead of one year of completion of the works in violation of the tender agreements, thereby extending undue favour to the contractors.

[78] *(i) Protection to the eroding left bank of the River Hooghly from Babughat to Nathupal Ghat, (ii) Protection to the eroding left bank of the River Hooghly from Mangal Pandey Ghat to Latbagan, (iii) Protection to the eroding right bank of the River Mundeswari in Arambagh.*

[79] *Canals Division and Hooghly Irrigation Division.*

[80] *(i) Improvement of inspection path over Mahananda embankment from 0.00 to 36.00 kmp. (ii) Improvement of inspection path over Fulhara embankment 0.00 kmp to 18.00 kmp.*

Chapter 5

Quality Control and Monitoring

Chapter 5: Quality Control and Monitoring

5.1 Quality Control

The ultimate health of a project during the life span of its operational phase will depend largely on the quality achieved during its construction. It is also necessary that the materials and standard of execution fully satisfy the specifications to have a safe and durable structure. For this purpose, a strong quality control mechanism is required in flood control sector. It was, however, noticed in Audit that works were executed without ensuring the quality of materials as discussed below:

5.1.1 Testing of Cement not conducted

IS Code 4031:1988 (reaffirmed 2005) stipulates that the quality of cement is ensured with tests like Fineness Modulus test, Soundness test, Initial and Final setting time, Compressive Strength test *etc.*

It was noticed that three test checked Divisions[81] used 8398.34 MT cement in 10 embankment protection works during the years 2014-17. Out of this quantity, samples of 6217.11 MT cement were tested from Malda Polytechnic and remaining 2181.23 MT (26 *per cent*) cement was used without conducting any tests. The agencies purchased the cement from the local markets. Quality of material purchased from local market was to be ensured before use in flood protective works. The Divisions, however, did not ensure the quality of cement used in works valuing ₹ 13.52 crore, putting the strength of embankment protection works at stake.

5.1.2 Testing of Geo-textile not conducted

Clause 20 of additional terms and conditions attached to NIT stipulated that for special type of materials like Geo Synthetic Bags, High Density Polyethylene (HDPE) Bags, Geo-textile Filter, Geo Jute Filter *etc*., test reports had to be submitted by the supplying agency along with bills. Engineer-in-Charge (EIC) might conduct independent test on the samples drawn randomly before according approval for using the materials at site.

Test reports of Geo-textile valuing ₹ 1.61 crore used by two Divisions[82] in 16 works as filter layer during 2013-14 and 2014-15 were neither attached to the bills nor could be produced to Audit by the concerned Divisions.

In the absence of such records, it could not be ascertained if the necessary tests had been done and the quality of materials used ensured by the executing Divisions before their use in the flood protection works.

5.1.3 Soil test not conducted for earthen embankment in KMP

As per IS code 1498:1970 and SP 36 (Part 1) 1987, construction of earthen embankment for flood control requires quality tests to assess permeability, compressibility as well as compaction of soil. Provision for raising of earthen embankment of 223 km was made in the DPR of KMP at a cost of ₹ 166.29 crore,

[81] *Malda Irrigation Division, Mahananda Embankment Division and Howrah Irrigation Division.*

[82] *Mahananda Embankment Division and Hooghly Irrigation Division.*

out of which 130 km has already been completed (March 2018) and the work for 64 km was in progress. No test report of soil used in the embankments under KMP was, however, available in any of the executing Divisions.

I&WD appeared to have not taken the onus to ensure the quality of the earthen embankments constructed.

5.1.4 Specific Gravity of stone boulder not determined

As per Para 3.2 of IS code 14262:1995, Specific Gravity of stone is required to be determined for calculating the weight, size of boulder/stone to be used as well as thickness of protection layer while designing and preparing estimates of revetment used for embankments and bank protection works. The thickness of the boulders to be used in the revetment works depends on the Specific Gravity of the boulders.

It was observed that in violation of the above provision, two Divisions[83], while preparing design of 22 bank protection works, did not conduct any tests for determining Specific Gravity of the boulders used as detailed in **Table 5.1**:

Table 5.1: Details of boulders used in works where Specific Gravity not assessed while preparing estimates

Name of the Division	Source of quarry	Specific Gravity considered	No. of estimates	Estimated quantity of boulders (in cum)	Estimated amount involved (₹ in crore)
Jalpaiguri Irrigation	Jaldhaka	2.40, 2.65, 2.70	03	32847	3.33
	Patharjhora	2.65	10	223393	23.35
Alipurduar Irrigation	Torsa	2.40, 2.60	05	216918	14.32
	Diana	2.65	01	71522	7.05
	Bhutan Ghat	2.40	02	32773	2.90
	Jayanti	2.40	01	11284	0.78
Total			**22**	**588737**	**51.73**

From the above, it is also evident that different values of Specific Gravity of boulders were considered even for boulders mined from the same quarry. Further, Specific Gravity of the boulders were not tested even during execution of works.

Thus, I&WD failed to check the quality of materials used in the construction of the flood control works. This could impact the structural design causing defects and leading to failure of the works impacting flood control measures.

5.2 Monitoring

5.2.1 Monitoring of FMP projects

5.2.1.1 Monitoring of progress through CPM/PERT Charts

Para 5.13 of FMP Guidelines (2013) stipulate that the State Governments shall ensure that the works are executed in a well-planned manner and completed within the scheduled period. The progress shall be monitored through Critical

[83] *Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.*

Path Method (CPM)/Programme Evaluation Review Technique (PERT) Charts which shall be submitted within three months of release of first instalment of Central Assistance.

None of the test checked Divisions executing either of the FMP projects prepared CPM/PERT Chart to monitor the progress of the projects. As a result, progress of the work was not monitored efficiently. It was observed that both the projects (KMP and KKB) were delayed as detailed in paragraphs 3.2.1 and 3.2.2 above, and vulnerable areas remained prone to floods.

Further, as specified in Annexure-III attached to the RIDF loan requirement format, a certificate for monitoring the physical progress as per CPM/PERT chart is required to be sent to NABARD. It was noted in Audit that no such CPM or PERT chart was maintained by two Divisions[84] in respect of any of the four selected RIDF works executed during the period 2013-18.

5.2.1.2 Monitoring through Remote Sensing

Para 5.7 of FMP guidelines (2009) stipulates that the Department of Space/ National Remote Sensing Agency (NRSA) may also be associated with the monitoring of physical progress of the schemes through Remote Sensing techniques. It was, however, observed that no such monitoring mechanism through Remote Sensing techniques was adopted for any schemes of Flood Control during the years 2013-18.

5.2.1.3 Monitoring visits of GFCC

Para 4.13 of FMP Guidelines (2009) stipulates that Monitoring Agency (GFCC) would inspect the works valuing more than ₹ 15 crore, at least once in every financial year, to monitor overall quality of works, technical specifications and progress at site before recommending further fund releases.

It was noticed that four monitoring visits (two each for KMP and KKB) were conducted by GFCC during the years 2013-18. Follow-up actions as per recommendations of GFCC were, however, not taken up for the KMP and KKB projects (paragraphs 3.2.1 and 3.2.2).

5.2.1.4 Preparation and updation of inventories of Flood Management schemes

GFCC instructed (July 2012) all the State Governments to prepare and periodically update inventory of assets created in a proper format (detailing reach in which embankments were constructed, completion year, cost, embankment details, area protected, *etc*.) for flood management schemes executed by the State Government. It was observed that none of the test checked Divisions maintained any inventory of assets. Land register was maintained only by KKB project division. As a result, I&WD has no database containing details of the assets created under FMP. Absence of the database affects proper planning for maintenance of the assets.

5.2.1.5 Visit of Departmental Authorities

Para 68 of I&WD Code stipulates that it is the duty of the concerned Superintending Engineer to inspect the state of the various works within his

[84] *Alipurduar Irrigation Division and Jalpaiguri Irrigation Division.*

Circle and to satisfy himself that the system of management prevailing is efficient and economical. It was observed that the departmental higher authorities (Chief Engineer, Superintending Engineer) had visited sites of execution of KKB project, however, in the absence of Inspection Reports, the outcome of such visits could not be assessed.

5.2.2 Monitoring of other flood control projects

5.2.2.1 Work Programme and Site Order Book

As per conditions of contract, the agency was required to submit Work Programme (detailing the items of works to be completed within stipulated time) within seven days from the receipt of work order. The Divisional Officer was also required to issue machine-numbered Site Order Books before commencement of work for recording instructions at site to the agency by inspecting officers and for noting the action taken in that matter by the agency as quickly as possible.

Scrutiny revealed that in four[85] out of six Divisions neither the Work Programmes nor the Site Order Books were available. In two Divisions[86] where Site Order Books were maintained, it was noticed that the agency did not mention the rectification measures taken by them against the instructions issued by the officers at the time of site visit.

Lack of proper monitoring by the executing levels was pointed out by the CE, North East and SE, NEIC-I in May 2016 and July 2017, respectively. Information on follow-up action taken, if any, was, however, not available on record.

Thus, the monitoring system was inadequate. This may adversely impact implementation of works and also leads to failure of any corrective action being taken while work is in progress.

5.3 Flood Forecasting

Flood forecasting is a non-structural measure in flood management by providing advance warning to flood prone areas. I&WD is responsible for maintenance, collection, compilation and dissemination of hydrological and meteorological data for the purpose of monitoring of flood situation for almost all river sub-basins of the State during monsoon. For this purpose, network of river gauges and rain gauges have been established at important locations. During monsoon, flood control rooms are set up in each district along with Central Flood Control Room at Department level.

The present flood monitoring and management system in the State comprises of the preparation of Daily Flood Report by Central Flood Control Room of I&WD and transmission of the same to the State Disaster Management Department during June to October each year. This report is also shared with other organisations like Railways, Defence, Kolkata Port Trust (KoPT) *etc*., regularly. During emergency, separate Flood Bulletin is also issued and the same is disseminated to the District Disaster Management Cells via e-mail, fax or SMS. This Daily Flood Report generally contains rainfall, river gauge and discharge, reservoir level/inflow/outflow data of different Stations within and

[85] *Hooghly Irrigation Division, Jalpaiguri Irrigation Division, Alipurduar Irrigation Division and Coochbehar Irrigation Division.*

[86] *Malda Irrigation Division and Mahananda Embankment Division.*

outside the State. Sometimes the location and extent of major damages, the status of affected areas under inundation *etc*., are also included. These data are collected from different district control rooms under I&WD along with other agencies like Indian Meteorological Department (IMD), CWC and Damodar Valley Corporation (DVC) through telephone, e-mail or fax. Daily Flood Report is also uploaded in the departmental web site. Deficiencies observed in flood forecasting were as follows:

- There is no system of real time compilation and dissemination of flood data in I&WD. Though the information on river water level is collected on hourly basis in monsoon period by the river gauge stations, the data is uploaded only once during the day on the web-site of I&WD. As such, if there is a sudden surge of flood waters, it remains unreported.
- Warning levels of a river are different at different locations depending on the plinth level of residential and industrial areas. Hence, frequent river gauge stations are required to measure the level of water at different locations. River Bhagirathi-Hooghly passes through seven districts[87] in the State; however, only three river gauge stations are located in two districts[88]. There are no gauge stations in the remaining five districts at the down-stream of the river. Further, there is only one-gauge station (English Bazar) for the entire 129 km length of the Mahananda river within Malda district. There were no river gauge stations for 66 km length of Tangon river, 57.6 km length of Kalindri river, 24 km length of Punarbhaba river and 23 km length of Pagla river in Malda district. Thus, water level recording mechanism in these sub-basins is weak. In the absence of adequate water level recording and warning mechanism the State Government would be ill-prepared for rescue measures, leaving people at the mercy of flood waters. Although flood risks cannot be completely eliminated, real time flood data, as an important and integral part of a flood warning service, can help to provide timely flood warnings with an adequate lead time for the public and reduce flood damages.

[87] *Murshidabad, Burdwan, Nadia, Hooghly, Howrah, Kolkata and South 24 Parganas.*

[88] *Murshidabad and Burdwan.*

Chapter 6

Conclusion

Chapter 6: Conclusion

As per the Annual Flood Report - 2017 of Irrigation and Waterways Department, all the blocks under KMP and KKB were inundated by flood waters in July 2017. The flood damage reports of the Department of Disaster Management and Civil Defence, GoWB reflected loss of life, devastating damage to property and its adverse economic and environmental impacts.

Flood damage data of 2017

Population affected (Million)	Cropped area affected (M ha)	Damage to crops (₹ in crore)	Houses damaged (No.)	Damage to houses (₹ in crore)	Human lives lost (No.)	Cattle lost (No.)	Damage to public utilities (₹ in crore)	Total damages (₹ in crore)
8.723	1.033	6914.50	8,26,982	9158.28	217	2,857	1655.16	17727.94

(Source : *Information disseminated by CWC vide No.3/38/2012-FFM/1067-1164 Dt 17 May 2019)*

Planning

- In the absence of basin-wise/river-wise holistic Master Plan, flood management projects were taken up at different locations depending on priority and availability of funds without being linked to a comprehensive plan.
- I&WD failed to adopt appropriate combination of structural and non-structural measures for effective management of floods. It only adopted some structural measures, which may not have been adequate to mitigate the impact of floods.

In this context the Department may need to:

- ✓ ***Prepare comprehensive plan taking into account all existing developments with latest updated data, including the strategies recommended by various technical bodies, such as scientific assessment of flood prone areas, integrated basin management approach, etc.***
- ✓ ***Adopt Engineering/Structural measures like detention basins, diversion of flood water, etc. which will not only reduce spilling but also bring relief to the flood prone areas by reducing flood flows and thereby the flood levels.***
- ✓ ***Adopt Administrative/Non-structural measures like enactment of Model Flood Plain Zoning Bill which aim at demarcating zones or areas likely to be affected by floods of different magnitudes, frequencies, probability levels and specify the types of permissible developments in these zones, so that whenever floods actually occur, the damage can be minimized.***

Implementation

- The two Flood Management Programmes (FMP) :- Kandi Master Plan (KMP) and Kaliaghai-Kapaleswari-Baghai Plan (KKB) executed by I&WD during the years 2013-18 suffered from various deficiencies such as defective DPRs with incomplete estimates. There were also deviations from the approved DPR and non-compliance with Indian Standard Codes and GFCC recommendations.
- KMP, which as per the DPR was to be completed by March 2017 was delayed and is still ongoing (August 2019). Only raising and strengthening of embankments of different rivers was carried out by I&WD, while it failed to create the additional waterways by reconstructing/renovating bridges and culverts to ensure proper drainage of the basin water. As per the Flood Report of 2017, all the four blocks included under KMP were

inundated by flood waters in July 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.

- Commencement of the KKB project without ensuring acquisition of land, grossly hampered execution of works leading to delay in completion of the project, which is still ongoing (August 2019). Rivers/khals were not widened/excavated up to design bed width, which implied that with the limited carrying capacity, they would not be able to control frequent flooding in the areas. Inclusion of non-feasible items, non-construction of regulator at the confluence of river Kapaleswari and Kaliaghai and non-maintenance of already resuscitated rivers/khals caused heavy siltation affecting the overall drainage system of the project. According to the Flood Report of 2017 all the seven blocks included under KKB were inundated in 2017. The flood protection measures taken by I&WD may, therefore, not have been adequate.
- In addition to the above two projects, the various embankment protection and anti-erosion of river bank works undertaken during the period did not meet the prescribed standards. Failure to provide the required thickness of graded filter below the revetment, non-provision of the required sand cushion layer in the embankment and use of below specification GI wires in boulder crates for construction of embankment resulted in not providing the required relief from flood problem in the areas. Besides, there was wasteful, avoidable extra expenditure and delay in execution of works.

In view of these deficiencies in implementation the Department needs to:

✓ ***Prepare DPRs in accordance with prescribed standards and guidelines and adhere strictly to the approved DPR while implementing the flood control programmes.***

Financial Management

- Savings with respect to Budget Estimates as well as Revised Estimates ranged from 26 to 68 *per cent* and 14 to 34 *per cent,* respectively. Yearly budgets were prepared by I&WD without inputs from the divisional level, which resulted in such savings.
- As per the Budget Publications, I&WD could not spend ₹ 1099.45 crore during 2013-14 to 2017-18, though provision of funds were made through REs by the State Government. Despite availability of funds, 2162 sq. km. of the total flood prone area of the State remained unprotected as per the Annual Flood Report 2017 of I&WD.
- There were irregularities in the use of the FMP funds. Under KKB project, Central funds of Rs 6.87 crore were used for urgent maintenance and repair of three roads contrary to scheme, guidelines, royalty amount of Rs 69.05 lakh was not deducted from contractors bills for failure to submit royalty payment certificates and security deposits were refunded to contractors in violation of tender clauses.

In view of such deficient financial management, the Department may:

✓ ***Take inputs from all Divisions for preparation of budget and ensure optimum utilisation of allotted funds.***

Quality Control and Monitoring

- I&WD did not ensure the quality of cement used in works. The onus of I&WD in ensuring the quality of the earthen embankments constructed appeared to

be lacking. Tests for determining Specific Gravity of the boulders used were not done. These could impact the structural design causing defects leading to failure of the works impacting flood control measures.

- Progress of the work was not monitored effectively. Both the projects, KMP and KKB were delayed and vulnerable areas remained prone to floods. Monitoring physical progress of the schemes through remote sensing techniques stipulated by the FMP guidelines was not adopted for any schemes of Flood Control during the years 2013-18. Inadequate monitoring system also negated the scope to take corrective action while work was in progress.
- Due to inadequate number of gauge stations, the water level recording mechanism in the sub-basins of Tangon river, Kalindri river, Punarbhaba river and Pagla river was weak.

There is no system of real time compilation and dissemination of flood data by I&WD. This is an important and integral part of a flood warning service, which can help to provide adequate lead time for the public and reduce flood damages. In view of these the Department may consider:

- ✓ ***Introduction of Remote Sensing techniques for monitoring of physical progress of the schemes in Flood Management Works.***
- ✓ ***To ensure real time compilation and dissemination of flood data, provide more river gauge stations to measure the level of water at different locations and warning mechanism which will provide timely flood warnings with adequate lead time for the public to minimise the flood damages.***

(REENA SAHA)
Principal Accountant General
(Economic & Revenue Sector Audit)
West Bengal

KOLKATA
The 27 Jan 2020

Countersigned

(RAJIV MEHRISHI)
Comptroller and Auditor General of India

NEW DELHI
The 29 Jan 2020

Appendix

Appendix-1.1

(Refer paragraph No 1.6, page - 9)

Division-wise Expenditure Details

Sl. No.	Name of the Division	Total Expenditure (in ₹)
1.	Howrah Irrigation Division	1,28,72,65,441
2.	Contai Irrigation Division	1,21,47,99,534
3.	Mahananda Embankment Division	78,62,22,600
4.	Hooghly Irrigation Division	77,53,08,313
5.	Jalpaiguri Irrigation Division	75,20,99,255
6.	Cooch Behar Irrigation Division	66,06,93,431
7.	Alipurduar Irrigation Division	57,65,79,387
8.	Malda Irrigation Division	50,18,89,294
9.	East Midnapore Division	49,91,49,023
10.	Canals Division	48,51,49,869
11.	Berhampore Irrigation Division	47,98,32,676
12.	Ganga Anti-Erosion Division I	46,44,49,536
13.	West Midnapore Division	45,58,52,307
14.	South Dinajpur Irrigation Division	37,14,74,063
15.	Nadia Irrigation Division	35,67,09,334
16.	Bidyadhari Drainage Division	32,33,14,985
17.	Metropolitan Drainage Division I	30,90,96,336
18.	Ganga Anti-Erosion Division II	28,25,28,318
19.	Siliguri Irrigation Division	25,76,28,365
20.	Lower Damodar Construction Division	22,30,91,696
21.	Damodar Canal Division	21,85,03,094
22.	Kakdwip Irrigation Division	21,59,16,146
23.	North Dinajpur Irrigation Division	21,49,00,059
24.	Basirhat Irrigation Division	16,29,24,156
25.	Damodar Headworks Division	15,42,91,209
26.	Urban Drainage Division	15,18,41,309
27.	Lower Damodar Irrigation Division	13,33,83,785
28.	Mayurakshi South Canal Division	12,75,23,478
29.	Jaynagar Irrigation Division	12,50,59,973
30.	Burdwan Irrigation Division	12,45,49,654
31.	Bankura Irrigatioin Division	10,42,42,381
32.	Kangsabati Canals Division II	7,86,56,146
33.	Subarnarekha Head Quarters Division	6,55,37,195
34.	Right Bank Irrigation Division	6,45,16,809

Sl. No.	Name of the Division	Total Expenditure (in ₹)
35.	Kaliaghai-Kapaleswari-Baghai Project Division	5,66,19,296
36.	Kangsabati Canals Division III	5,32,52,544
37.	Metropolitan Drainage Division II	4,73,88,043
38.	Subarban Drainage Division	4,15,56,977
39.	Mayurakshi North Canal Division	3,99,16,664
40.	Mograhat Drainage Division	2,91,80,378
41.	Teesta Barrage Division	2,36,65,000
42.	Metropolitan Drainage Mechanical Division	1,11,38,855
43.	Mayurakshi Head Quarters Division	38,66,259
44.	Metropolitan Electrical Division	20,11,874
45.	Durgapur Mechanical and Electrical Division	14,40,349
	Total	**13,31,50,15,396**

Glossary

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Abbreviation	Full Form
ACS	Additional Chief Secretary
BB	Brahmaputra Board
BE	Budget Estimates
BM	Bituminous Macadam
CE	Chief Engineer
CPM	Critical Path Method
CRF	Calamity Relief Fund
CWC	Central Water Commission
DPR	Detailed Project Report
DVC	Damodar Valley Corporation
EE	Executive Engineer
EIC	Engineer-in-Charge
EoI	Expression of Interest
FMP	Flood Management Programme
GFCC	Ganga Flood Control Commission
GI	Galvanised Iron
GoI	Government of India
GoWB	Government of West Bengal
HDPE	High Density Polyethylene
HFL	High Flood Level
HGL	Hydraulic Gradient Line
I&WD	Irrigation and Waterways Department
IMD	Indian Meteorological Department
KKB	Kaliaghai-Kapaleswari-Baghai
KMP	Kandi Master Plan
KoPT	Kolkata Port Trust
MoWR	Ministry of Water Resources
NCCF	National Calamity Contingency Fund
NDMA	National Disaster Management Authority
NIT	Notice Inviting Tender
NRSA	National Remote Sensing Agency
OTACA	One Time Additional Central Assistance
PC	Planning Commission
PERT	Programme Evaluation Review Technique
PWD	Public Works Department
RIDF	Rural Infrastructure Development Fund
SD	Security Deposit
SE	Superintending Engineer
UC	Utilisation Certificate
WBFR	West Bengal Financial Rules

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