202

ANNUAL FLOOD REPORT 1991

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ANNUAL FLOOD REPORT 1991

IRRIGATION & WATERWAYS DIRECTORATE

GOVERNMENT OF WEST BENGAL

CALCUTTA NOVEMBER 1991.

ANNUAL FLOOD REPORT OF WEST BENGAL FOR THE YEAR - 1991.

CONTENTS

1. INTRODUCTION

1.1. RIVER BASINS

1.2. RIVER SYSTEMS

1.2.1. BRAHMAPUTRA BASIN

1.2.2. GANGA BASIN

1.2.3. SURBARNAREKHA BASIN

2. RAINFALL

2.1. RAINFALL PATTERN

3. FLOOD DURING 1991

3.1. PREAMBLE

3.2. FLOOD SITUATION IN THE DISTRICTS

4. ASSEMENT OF FLOOD DAMAGES AND COST OF REPAIRS

LIST OF MAPS

1. MAPS OF WEST BENGAL SHOWING FLOODED AREA DURING 1991.
2. MAP OF WEST BENGAL SHOWING HYDROLOGICAL STATIONS.

LIST OF DRAWINGS

1. RESERVOIR LEVELS DURING 1991
2. GAUGE LEVELS DURING 1991

LIST OF ANNEXURES

Annexure - I - Raingall data in the districts of West Bengal during 1991.

Annexure - II - Flood Levels of West Bengal rivers during 1991 (North Bengal rivers)

Annexure - III - -Do- (South Bengal rivers)

Annexure - IV - Flooded area in different district of West Bengal during 1991.

Annexure - V - D.V.C. discharge down Durgapur Barrage.

Annexure -VI - General Abstract of estimated cost of Flood damage Repairs and Restoration works.

Annexure -VIA - -Do- Darjeeling district

Annexure -VIB - -Do- Jalpaiguri district.

Annexure - VIC - -Do- Cooch - Behar district.

Annexure - VID - -Do- West Dinajpur District.

Annexure - VIE - -Do- Maldah District.

Annexure - VIF - -Do- Murshidabad District.

Annexure - VIG - -Do- Nadia District.

Annexure -VIH . -Do- 24-Parganas District (North & South)

Annexure -VI I - Do- Howrah District.

Annexure -VI J - -Do- Hooghly District.

Annexure - VI K - -Do- Midnapore District.

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Annexure - I - Raingall data in the districts of West Bengal during 1991.

Annexure - II - Flood Levels of West Bengal rivers during 1991 (North Bengal rivers)

Annexure - III - -Do- (South Bengal rivers)

Annexure - IV - Flooded area in different district of West Bengal during 1991.

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Annexure -VI J - -Do- Hooghly District.

Annexure - VI K - -Do- Midnapore District.

INTRODUCTION

The State of West Bengal consists of a combination of land varying from the high hills on the north to the Seas on the South. With the Tropic of Cancer running across it, the State is located between $21^0 31'$ and $27^0 13' 15"$ North latitudes and $85^0 45' 20"$ and $98^0 53'$ East longitudes. The geographical area of the State is about 87,853 Sq.Km. Flood season in State starts from 15th June and extends upto 15th October.

CLASSIFICATION OF AREAS.

1. Geographical area	=	87,853 Sq.Km.
2. Area under forest	=	11,880 "
3. Total flood prone area	=	37,660 "
4. Area already protected	=	26,500 "

1.1. RIVER BASINS

The State can be demarcated into three district drainage basins, coming under the Ganga, Brahmaputra and Subarnarekha river systems respectively. The aforestated main basins in turn can be divided into Sub-basins having individual catchments of their own. The area wise distribution of the above main basins in the State is as under :-

1) Brahmaputra Basin - 14,208 Km^2
2) Ganga basin including Sundarbans area. - 71,485 Km^2.
3) Subarnarekha Basin - 2,160 Km^2

1.2 RIVER SYSTEMS.

1.2.1. Brahmaputra Basin- Drainage- the northern regions of the State, the rivers within the Brahmaputra system comprise a total area of 14,208 Km^2 the main rivers being Sankosh, Raidak, Torsa, Kaljani, Jaldhaka, Teesta.

The different tributaries of these rivers are listed below :

A.	Sankosh	-	Chiklajhore
B.	Torsa	-	Raidak-I,Raidak-II,Turturi.
C.	Torsa.	-	Kaljani,Sil-Torsa,Char,Torsa, Sanjai, Holong, Ghargharia, Goram,Dina,Pana,Jainti,Gabur-Basra.
D.	Jaldhaka	-	Mujnai, Murti,Diana,Sutanga, Dolong,Dharala, Ghatia,Kumlai Gilandi, Buduya.
E.	Teesta	-	Great Rangeet,Rammam, Rangpo, Relli, Lish,Ghish, Chel, Mal, Neora, Karali,

Brief description of the above rivers.

A. Sankosh It is the eastern most river under Brahmaputra system in this State and serves as the natural boundary between West Bengal and Assam. After being joined by Raidak-II, it outfalls into Brahmaputra in Bangladesh by the name Gangadhar. The river has its origin in Bhutan.

B. Raidak. Originate in Mt.Akungphu at an altitude 6400 M in Bhutan. The river bifurcate into two channels at Bhutanghat, close to Indo-Bhutan border. One of the branches, namely Raidak-I joins the united stream of Torsa and Kaljani, while the Raidak-II is joined by Sankosh and Outfalls into Brahmaputra in Bangladesh by the name Gangadhar.

C. Torsa The river Torsa rises in Chumbi Valley of Southern Tibet at an altitude of 7065 M. It flows through Tibet, Bhutan, West Bengal and Bangladesh. Below Hashimara Bridge (on NH 34), it bifurcates into two channels, viz.Sil-Torsa and Char-Torsa.They reunite at Patlakhowa Forest. The river passes by the Coochbehar town and is joined by Kaljani river and Raidak I. The combined flow outfalls into Brahmaputra near Nageswari at Rangpur in Bangladesh.

Contd.....2a.

D. Jaldhaka. The river has its origin from Bitang lake in Sikkim at an altitude of 4400 M. It flows through Sikkim, Bhutan, West Bengal and Bangladesh. After the river is joined by a number of streams and tributaries both in the mountaneous and Sub-mountaneous regions, if finally flows into Dharals river and the combined stream, getting the name Dharala ultimately outfalls into Brahmaputra in Bangladesh.

E. Teesta. Teesta originates in the glaciers of North Sikkim at an altitude of 6400 M. and is formed by the union of two streams, viz. Lachen and Lachung at Chungthung in Sikkim. It enters West Bengal at Rangpo and upto Melli, it forms the boundary between West Bengal and Sikkim. Two of its tributaries, viz. Great Rangit and Ramman, also serve as the natural boundary between the two states. It outfalls into Brahmaputra in Rangpur district of Bangladesh.

1.2.2 GANGA BASIN

The Central, Southern and the South-Western parts of the State of West Bengal constitute the Ganga Basin. The Ganga, only a stretch of which is now flowing through the narrow central waist-line of the present shape of this State had been an active delta builder.

The Ganga system comprise a total area of 71,485 Km^2 within the State of West Bengal. The catchment areas different rivers within this system in the State of West Bengal are as under :-

Sl.No.	Name of river Sub-Basins.	Catchment area in Km^2
A.	Mahananda	9460
B.	Punarbhaba	730
C.	Atrai	910
D.	Pagla-Bansloi	730
E.	Dwarka-Brahmani	2500
F.	Bhagirathi-Hooghly	1170
G.	Jalangi	5344
H.	Mayurakshi	2720
I.	Ajoy	2490
J.	Khari-Gangur-Ghea	1202 ~~1202~~
K.	Churni	800
L.	Damodar	5250
M.	Dwarakeswar	4430
N.	24(South &North)Parganas and Calcutta Port Drainage Basin.	4330
O.	Kangsabati	8369
P.	Silabati	3952
Q.	Rupnarayan	2548
R.	Pichban	820
S.	Rasulpur	1130
T.	Haldi	980
U.	Tidal Zone(Sundarbans areas)	11320

The different tributaries of these rivers are listed below :-

1) Mahananda-Mechi, Balasan, Dauk, Nagar, Kulik, Gamari, Chinmati, Tangon.
2) Punarbhaba- Punarbhaba.
3) Atrai -- Atrai.

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4)	Pagla-Baslloi	-- Pagla, Bansloi, Bagmari.
5)	Brahmani - Dwarka	-- Brahmani, Dwarka.
6)	Bhagirathi-Hooghly	-- Bhagirathi, Hooghly.
7)	Jalangi -	-- Jalangi,Silamari,Bhairab,Suti.
8)	Mayurakshi	-- Mayurakshi,Babla, Noon Beel, Siddheswari, Kuiya, Bakreswar, Kopai, Sal, Monikarnia, Daoki, Kana Mor, Gambhira.
9)	Ajoy	-- Ajoy, Hinglow, Kunoor.
10)	Khari-Gangur-Ghea	-- Khari, Brahmani, Banka, Bangur, Ghea, Behula, Kana.
11)	Churni	-- Churni.
12)	Damodar	-- Damodar, Barakar, Sali.
13)	Dwarkaswar	-- Gandheswari, Arksha, Berai, Dwarakeswar.
14)	Rupnarayan	-- Mundeswari,Dwarkeswar,Gandheswar Berai, Damodar, Tarjuli,Sankari, Silabati, Joypanda, Kubai,Parang Kanki.
15)	Haldi	-- Haldi,Kangsabati,Kumari,Bhairab, Banki, Tarafeni, Kaliaghai, Bagchai, Chandia, Kapaleswari.
16)	Rasulpur	-- Rasulpur, Pichaban.
17)	Tidal Rivers.	-- Tolly's Nullah, Keorapukur, Ichamati, Raimangal, Kultigong, Jamuna, Kalindi, Haria Bhanga, & Gosaba, Metia, Piali,Thakurani Raidighi, Saptamukhi,Muri Ganga.

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A brief note on the above Sub-basins.

1) Mahananda - The river Mahananda originates from Paglajhora near Kurseong town. It bifurcates into two channels, viz. Fulahar branch which flows through Bihar and Barsoi Branch which flows through West Bengal. At places, it forms the Indo-Bangladesh border. Mahananda carrying the flow of four tributaries, namely Nagar, Kalandri, Tangon and Punarbhaba, drains into Ganga from the north-Western side at Godogarighat just downstream of the point where Ganga leaves the boundary of West Bengal.

2) Atrai - Punarbhava- Some rivers like Sahu, Nim, Talma, Chani, Panga originate from the highlands in the district of Jalpaiguri. They gradually meet together afterwards, the combined stream assumes the name Karatowa. It then enters Bangladesh where it assumes the name Atrai and bifurcates into ~~the~~ two channels viz. Dhepa and Atrai.

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The eastern channel i.e.Atrai reenters West Bengal in Kumarganj P.S. of West Dinajpur district. Covering some 40 Kms length in the State it reenters into Bangladesh and ultimately outfalls into Brahmaputra.

The Dhepa on the other hand taking a south-Westernly course enters Gangarampur P.S. in West Dinajpur district, assumin the name Punarbhaba. Covering some 40 Kms. in length in West Dinajpur district, it touches the eastern boundary of Malda District and enters Bangladesh. Further down, it meets Mahananda in Banaladesh.

3) Nagar- Kulik- Gamari Chiramati Tangon Kalindri.

These rivers flow through Malda and West Dinajpur district. Somewhere they form the boundary either between West Bengal and Bihar or between West Bengal and Bangladesh. The ultimately outfa into Mahananda.

Nagar originating in Bangladesh flows along the boundary with West Bengal. Taking a southernly course, it receives a spill channel of Mahananda and is joined by Kulik which has also its origin in Bangladesh.The Gamari and Chiramati are two other small rivers that blow through West Dinajpur district before meeting th combined stream which ultimately outfalls into Mahananda.

Tangon is a tributory to Mahananda.It rises in Bangladesh. After flowing through the districts of West Dinajpur and Malda, it meets Mahananda on the boundary of Malda and Bangladesh.

River Kalindri has its origin in the North Bihar, Flowing across the plains of Purnea district, it enters Malda and outfall into Mahananda.

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4) Pagla-Bansloi-Brahmani. These rivers rise in Rajmahal hills of Bihar. Flowing eastard across Birbhum district, they enter Murshidabad district as the tributaries of Bhagirathi.

5) Jalangi-Bhairab-Jalangi takes off from the right bank of rive Padma in Murshidabad district, 165 Kms.downstream of Farakka. It is dead for all purposes, except during the rains when it receiv water from Padma. The river ends its journey by finally out falling into Hooghly near Nabadwip town. In its lower stage of journey, it is also known as Kharia.

Bhairab takes off from Ganga in P.S.Lalbagh of Murshidabad district. It is now almost a dead channel but during rainy seaso for a few days, it receives water from Padma.

6) Ichamati-Churni- River Mathabhanga rises near to the mouth of the Jalangi on the Padma, It is not an important river in thi State as it flows mainly in Bangladesh.It flows only a few Kms. within Nadia district.At this stage,the river bifuracates into tv channels,the Western branch, i.e. Churni runs a few Kms in the district in a south-west direction to meet Bhagirathi. The other branch is known as Ichamati which gets little supply from Maha- nanda and thrives on wash-outs and tidal flows.

7) Bhagirathi Hooghly. Bhagirathi or Hooghly is the main river in the State. It is in fact the main artery of flow. Before the 12th century,the Ganga had its main course down Bhagirathi- Hooghly .Subsequently, the main flow was pushed to the east through the present course of Padma. The flow of Bhagirathi incr eases down stream due to the run off and outflow from a number of eastern and western tributaries.

After its confluence with Jalangi, Bhagirathi is known as Hooghly and forms the boundary between 24-Parganas(North) and Hooghly districts.

8) Mayurakshi-Babla.

Mayurakshi originates from the high lands of ~~Sabthal~~ Santhal Parganas. It is the main river in Birbhum district. Carrying flows of differe tributaries, its outfalls into Hijol Beel of Murshidabad district. Babla takes off from the Beel and drains into Bhagirathi.

9) Ajoy - It rises in the hills near Deoghar in Bihar.The principa tributaries of this river are Patro, Janiti, Darua, Kunoor and Hinglow.

10) Damodar- It rises in the Palaman hills in Bihar. The river bifurcates into two channels at Beguahana. The main flow passes through Mundeswari channel and discharges into Rupnarayan.The other one, Amta channel carries discharge during high floods and outfalls into Hooghly.

11) Dwarakeswar-Silabati-Rupnarayan

The lower tidal reach below the confluence of Dwarkeswar and Silabati is known as Rupnarayan. After receiving the main flow of Damodar through Mundeswari and a branch of Kangsabati i.e. Old Cossye or Palaspai Khal, it ultimately outfalls into Hooghly, The river is tidal throughout its entire course.

Dwarakeswar rises from the highlands of Purulia district.River Gandheswari rising from Bankura district meets Dwarkeswar near Bankura town Receiving waters of other streams like Arkasha,Berai, it enters Hooghly district and meets Silabati to form Rupnarayan.

Silabati originating in Purulia district, receiving water of Joypanda and after traversing through Midnapore district, it meets Dwarakeswar.

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12) Kangsabati-Kaliaghai-Haldi

River Kangsabati rising in Purulia district is joined by Kumari in Bankura district. Further down, it is joined by the combined stream of Bhairab Banki and Tarafeni rivers and thereafter flows on through the Midnapore district. After a tortuous course, it bifurcates, the upper branch known as Old Cossye or Palaspai Khal outfalls into Rupnarayan.

River Kalaighai trickles out from Jhargram P.S. in Midnapore district. Along its journey, it is fed by the flow of tributaries Kapaleswari, Baghai and Chandia. The combined flow meets the another arm of Kangsabati, i.e. New Cossye to form Haldi which o falls into Hooghly.

13) Rasulpur - It is a river of Contai Sub-Division of Midnapore district formed by the three streams Bagda, Sarpai and Madhakhati and ultimately meets Hooghly.

14) Tidal rivers of Southern West Bengal.

Apart from the rivers described earlier within Ganga and Brahmaputra system, there is a group of rivers in southern part of the state which fall in the tidal zone. These rivers mostly lie in the deltaic zone to the east of Hooghly river pupularly known as Sundarbans and form an intricate network with a number of criss-cross into connecting Channels, thus dividing the land into a number of islands. Most of these rivers were originally spill channels of Ganga, then upland supply running dry during winter months. But gradually their offtakes from Ganga have deteriorated and in some cases being cut-off from the parent river. Now these rivers drain off whatever fresh discharge comes

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Country side, thus ultimately draining into Bay of Bengal through one or other of the principal estuaries in the area which are, starting from Hooghly river successively the Barata or Muriganga or Channel Creck, Saptamukhi, Thakuran,Matla,Gosa Hariabhanga,Raimangal etc.

The tolly's Nullah or the Adi Ganga,as it is sometime called is a small but important tidal creck draining into the Hooghly from the left in the vicinity of the city of Calcutta.

1.2.3. SUBARNAREKHA BASIN

The river Subarnarekha,though it has avery small catchment within this State has got separate entity as it direc falls into the Bay of Bengal. It has its origin in the hills of Chatonagpur range at an elevation of 609 m.It erains a total areas of 18,951 Km^2 (13,950 Km^2 in Bihar, 2160 Km^2 in West Beng and 3201 Km^2 in Orissa). The main tributaries of the river are Kanchi and Kharkai above Chandil in Bihar, Khakhai in Bihar an Orissa and Dolong in West Bengal.

2. RAINFALL

The main rainfall season in this State is the southwest monsoon season during which the entire land(excepting the extre north,the extreme northeast and extreme south) gets 75% of the annual rainfall. The Gangetic plains of West Bengal gets 78% of its annual rainfall during the four months period,June to September. During the last seventy five years the dates of onset of monsoon over West Bengal was spread between last week of May to last week of June and these of its withdrawal between last week of September to second week of October.

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2.1. RAINFALL PATTERN.

The main channel of Ganga divides West Bengal in two parts which are by and large homogeneous from the meteorological point of view. The northern half is designated as Sub-Himalayan West Bengal and the Southern half Gangetic West Bengal. Sub-Himalayan West Bengal is more susceptible to heavy rains both in respect of amount as well as in frequency of occurence. Very heavy rain is more frequent in first two monsoon months (June and July) than in subsequent months in Sub-Himalayan West Bengal. In Gangetic West Bengal the frequency is maximum in August followed by June, September and July in that order.

On the basis of rainfall distribution, the state can be Sub-divided into two broad Zones.

1) The Himalayan and Sub-Himalayan Region.

2) The Gangetic Plains.

The Himalayan and Sub-Himalayan regions comprising districts of Darjeeling, Jalpaiguri, Cooch-Behar and northe part of Islampur Sub-Division of West Dinajpur district rec high incidence of rainfall from 200 cm. to over 400 cm, about 80% of which is found to occur during the monsoon season June to September. On the average Darjeeling, Cooch-Behar an Jalpaiguri get 114, 112 and 110 rainy days respectively in a The monsoon generally follow a northernly track to ultimate break up against Eastern Himalayas causing very heavy rain and thereafter through of low pressure under break monsoon c ditions, it shifts northwards to the Himalayan foot hills. I has been found that a precipitation to the tune of 200 to 3 m.m. in 2 hours is not unusual while in more than forty occas ons of rainfall of 250 m.m. and above have been registered durin 1891-1965.

The Gangetic plain which constitute the major portion the State can be further Sub-divided into the following sec rs on the basis of average rainfall :

SECTOR -I. Comprising the districts of Bankura, Birbhum Murshidabad and Burdwan which receive an average rainfall between 1140 m.m. and 1400 m.m.

SECTOR -II Consisting of the districts of Nadia, Hooghly, Western portion of West Dinajpur, Midnapur and North 24-Parganas having an average annual rainfall between 1400 m.m. and 1650 m.m.

SECTOR -III Comprising Howrah, Eastern portion of West Dinajpur, South 24-Parganas and Midnapur Districts which register an average annual rainfall between 1650 m.m. and 1900 m.m.

Such wide regional variations in the precipitation pattern causes flood conditions from time to time.

The rainfall data as collected from Indian Meteorologi l Department for the districts is shown in ANNEXURE-I.

3. FLOOD DURING 1991

3.1. PREAMBLE

The 1991 Monsoon forecast furnished by the Director General of Meteorology, India Meteorological Department on Apr 1991 made the following forecast.

"The total monsoon rainfall for the Country as a whole during the ensuing monsoon (June to September), 1991) is likel be on the negative side of the Normal, the term "normal" being defined as 'within plus or minus 10% of the long period averag value". The entire scenario, being still in an emerging mode the time was kept under review till a firm forecast was made i later Press Release dated May 27, 1991 which confirmed the ear forecast.

In West Bengal, like the previous years, the South West Monsoon set in well in time. It advanced into major parts the state on 6th June, had been active in the Gangetic West Ben since its onset and moderate to heavy downpour occured in diffe parts of the state. Monsoon had also been active in the norther districts where heavy precipitation continued for a number of d Rainfall had been more than normal during the month of June in of the places. Some dry spell previled during the second fortnig of July, yet the total rainfallrecorded upto the end of the mon was almost normal. Fairly well distributed rainfall occured dur August.

Complexion Since the first week of September, the meteorological ~~complexion~~ of the State was fully changed. Heavy spell of rainf in the Northern districts started from the very first week of th month. The rain gauge station at Jalpaiguri alone recorded a to of 870.90 mm of rainfall during a spell from 7th to 11th Septe This constitutes about 22% of the normal annual rainfall. Moreov a single day rainfall record was 260mm which is about 6.6% of normal annual rainfall. Synchoronised with the rainfalls in the Upper Catchments of the rivers situated in the States of Bihar, U.P., Hariana, Sikkim, the levels of the rivers began to rise dily and somewhere in alarming rate. The worst affected distric were Maldah, West Dinajpur and a part of Murshidabad where seve bank erosion, damage towards embankments, spurs and other Engin ing structures were caused. Widespread damage to public utiliti took place in these districts. High ruling of the level of Gang above extreme danger level for a sustained period added further the worsening of flood situation.

3.2 FLOOD LEVEL OF WEST BENGAL RIVERS DURING 1991.

Vide Annexures II & III

3.3. FLOOD SITUATIONS

A. Districts Darjeeling (Silituri Sub-Division) Jalpaiguri & Cooch-Behar.

Heavy concentrated precipitation both in the upper and local catchments of most of the rivers of these districts resul ted in flash floods of North Bengal rivers viz. Mahananda, Teesta Jaldhaka, Torsa, Raidak, Kaljani, Sankosh. etc. As the rivers w ruling high. Yellow and red signals were flashed on a number

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of accasions and this situation continued even for a number of days for flood plains of some of the rivers. Existing flood protective works inc ding spurs, studs were frequently under threat and in some of the vulne ble points, they were severely damaged. Work on some palliative measure on emergency basis had to be carried out to protect life and property i these areas.

While Jalpaiguri recorded a total rainfall of 264 mm from 1.8 to 4.8.Alipurduar recorded 284m and Siliguri recorded 211mm during this period. The situation however took its worst turn during the firs fortnight of September when heavy precipitation in the local as well a in the upper catchmentsof the rivers of this area caused swelling of th rivers. Drainage congestion and inundation were caused in many areas in ding parts of Siliguri, Jalpaiguri Coochbehar and Mathabhanga towns. Jo paiguri recorded a rainfall of 871mm while Siliguri recorded ~~634mm.~~ 734 mm rainfall spread over a period of only 5 days from 7.9.91 to 11. 9. 91 Almost all the rivers of North Bengal were in spate resulting in wide- spread bank spilling, inundation, damage of embankments, spurs, etc. and d ruption of communication in a number of places. Jalpaiguri Town Protecti Embankment, Makhliganj town protective, Bibiganj-Jharsingeswar Embankme on Teesta, Atharakota Embankment on Torsa, Lalchandpur Embankment on Raidak-II, Chikmati Embankment on river Chel were worst hit. Severe ero also resulted to Kalabari Embankment on river Diana in mouza Dhampara i the district ot Jalpaiguri.

B. WEST DINAJPUR DISTRICT.

A number of rivers of this district-originate in Bangladesh after flowing through the district for certain stretches of length reen Bangladesh. Rivers like Kulik, Nagar, Chiramati, Tangon, Punarbhaba, ha their outfalls in river Mahananda either in West Dinajpur or in Maldah District or in Bangladesh where Mahananda ultimately outfalls into Padma Atrai however outfalls into Brahmaputra. The uncontrolled high flood di charge from Catchments areas synchronising with concentrated local rain fall caused all the rivers in spate inundating major part of the distri by overflowing and breaching the embankments in anumber of places. More than 2rd of the area of the district was flooded and was under water 3 more than a fortnight causing damage to life, property, public utilitie amd Engineering structures and snapping communication lines including N.H-34.

The inundation and flooding of P.S.Hilli in this district w due to spillway of river Cheri, Ghagra and Yamuna and ingress of flood water from Bangladesh, probably due to some surreptitious cut in the area just on the other side of the district. The worst affected areas were P.S.Itahar, Gangarampur, Balurghat. The district heqdquarters Balur and towns like Raiganj, Itahar were under 1.5 m to 2 m of water for a n ofdays. Such drainage congestion remained for more than a fortnight cau miseries to the inhabitants of the area.

Raiganj town area was flooded due to spillway of river Kul over the Raiganj town protective embankment. Rivers Punarbhaba abd Atrai have been specially affected due to intenserainfall in their catchments lying in Bangladesh. A number of embankments in the districthad been damaged including the one breached at Pajol. The quantum of rainfall recorded at Islampur and Raiganj from 7. 9. 91 to 10.9.91 was 457 mm. a 576 mm respectively.

C. DISTRICT MALDAH

The district has mainly four river plains viz, Ganga, Fulaha Mahananda and Punarbhaba. There is a bank line of 72 Kms of river Gang in the district. The district is bounded by Ganga in the South, Fulahar and Mahananda on the North-West and Punarbhaba on the east. There are number of other rivers like Tangon, Srimati, Kalindri, Pagla etc. There

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been incessant and heavy precipitation in the district and this was synchronised by the flood of Ganga, Mahananda(Fulahar and BarsoiBranch) and Punarbhava. The problem was further compounded due to persistent hi level maintained by Ganga above extreme danger level which serves as an arterial outfall of most of the rivers passing through the district. Du to such heavy local rainfall and major rivers flowing above extreme dan level, a vast area of the district was flooded.The total rainfall recor ded at Maldah from 1st June to 21st September of this year was 1654 mm. against 1010mm of normal rainfall i.e. a departure of + 644 mm. The problem was further accentuated due to severe erosion which took place the left bank of Ganga upstream of Farakka Barrage in P.S.Kaliachak and Manickchak.

A number of spurs and protective works were badly damaged. Fulahar embankments had been damaged at several places. There was sever erosion at Bhaluka Point on the left bank of river Fulahar, a breach however could be averted only a after persistent palliative measures.The Bhutnidiara island of an area of about 35 Sq.km. was inundated due to surreptitious cut of embankment at Uttar Chandipur during the high spate in Ganga on 5.9.91. Due to high ruling level of the Ganga, the island which is inhabited by about 50,000 people remained under water f about a fortnight. The 9th marginal embankment on the left bank of rive Ganga at Simultala was breached due to erosion on 30.8.91 for a length about 500 metres. The 10th marginal embankment at Simultala in P.S.Mani chak was breached on 11. 9. 11 resulting in inundation to an area of abou 80 Sq.Km in P.S.Kaliachak, Manickchak and Englishbazaar . The spur nos. 10, 24 and 25 were heavily damaged.

The river Ganga was flowing 1.24 metres above Extreme Danger Level and river Mahananda,too was flowing above Extreme Danger Level. This resulted in inundation of 1.2 and 2.4 metres depth of water in some part of the district and this continued for a period of more than three weeks.

D. DISTRICT MURSHIDABAD.

The principal rivers of this district are Ganga and its tributar Viz. Bhagirathi,Bhairab, Jalangi,Bansloi, Dwarka,Brahmani, Bele,Mayurak etc. Besides there a good number of hill areas in this district. The ban length of Ganga/Padma in this district is 94 Kms.

Due to high ruling of Ganga, vast tracts of land in this district under P.S.Farakka, Samserganj, Suti, Raghunathganj, Bhagwangola,Raninagar Lalgola and Jalangi were inundated causing serious hardship to the peopl of the locality.

The entire right bank of river Ganga downstream of Farakka Barra except for some protected reaches had been experiencing bank erosion of varying magnitudes during the flood. The zone where most active erosion was noticed was near Sekhalipur and upstream of Akheriganj Protective Embankment in P.S.Lalgola, Bhagawangola, the width of erosion varied from 10m to 400m in different reaches.

Flood and erosion brought about extensive damages to anti-erosion works,bank protective works and engineering structures through out the entire right bank of river Ganga downstream of Farakka Barrage in Murshi-dabad district.

E. DISTRICT- NADIA

The district has a topography having scattered low areas with dense population and intensive cultivation. Slight excess rain over average may cause flood here.Spilling from rivers flowing in this distri results in tremendous hazards accompanied with drainage congestion.

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The rivers of this district viz. Bhagirathi, Jalangi and Churni were ruling high due to spilling from river Ganga/Padma. This resulted in rise of levels of the rivers and bank erosion, scour overtopping of embankment were caused in many places. Some low lying areas were flooded due to drainage congestion and some protective works were damaged.

F. DISTRICT MIDNAPORE

Due to heavy rainfall during the last week of July, the rivers of Midnapore district particularly Kaliaghai and its tributaries Kapaleswari and Chandia were rising. This resulted in slips in Kapaleswari Embankment in P.S. Sabang and also to Kaliaghai Left Embankment. Midnapore recorded a rainfall of 130 mm on 22. 7. 91.

G. HOOGHLY AND HOWRAH DISTRICTS.

Due to substantial release from Maithon and Panchet dams, Durgapur Barrage had to release a maximum of 83,000 cusecs (2360 cumecs) on 7. 9. 91. As a result, some drainage congestion occured in the Lower Damodar area of Hooghly district.

Severe erosion was observed on the left bank of river Rupnarayan at Charkatapuria in P.S. Bagnan and other places in Howrah District.

H. NORTH & SOUTH 24 PARGANAS DISTRICTS.

Due to local rainfall and prevailing high tides during the Kotal period, there was some drainage congestion in different parts of the districts and some damages were caused to some flood protective embankments.

The flood levels of different rivers of West Bengal during 1991 have been shown in Annexure II(North Bengal Rivers) and Annexure-III (South Bengal Rivers) while flooded areas during 1991 as collected from Relief and Welfare Department have been shown in ANNEXURE IV.

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ANNEXURE

RAINFALL DATA IN THE DISTRICTS OF WEST BENGAL DURING 1992

Name of the District.	From 1.1.91 to 31.5.91 Normal	Actual	From 1.6.91 to 10.10.91 Normal	Actual	from 1.1.91 to 10.10.91 Normal	Actual	RAINFALL IN MM. Total Annual Normal.	Percentage departure on 10.10.91.
Coochbehar	649	331.0	2848	2810.2	3497	3141.2	3608	-10.17
Jalpaiguri	473	322.3	2739	3414.6	3212	3736.9	3339	+16.34
Darjeeling	358	178.4	2368	3873.7	2726	4052.1	2832	+48.65
Malda	200	121.8	1146	1531.5	1346	1653.3	1453	+22.83
West Dinajpur	298	229.2	1140	1485.3	1438	1714.5	1972	+19.23
Murshidabad	231	176.8	1101	2461.7	1332	2638.5	1417	+98.06
Birbhum	140	120.5	959	1127.9	1099	1248.4	1289	+13.59
Nadia	306	96.0	1087	860.3	1393	956.3	1474	-31.35
Burdwan	228	104.8	1165	1145.5	1393	1250.3	1496	-10.24
Bankura	203	257.0	1126	1276.2	1329	1533.2	1422	+15.36
Purulia	107	170.8	1105	967.5	1212	1138.3	1249	- 6.08
Midnapore	241	230.4	1271	1206.9	1512	1437.3	1593	- 4.94
Hooghly	215	59.7	1250	1227.7	1465	1287.4	1523	-12.12
Howrah	259	139.9	1277	1419.7	1535	1559.6	1525	+ 1.60
24-Parganas (S)	236	177.9	1347	1457.4	1583	1635.3	1544	+ 3.30
24-Parganas (N)	215	136.1	1250	1450.8	1465	1586.9	1693	+ 8.32

Source : India Meteorological Department,
Alipur, Calcutta - 27.

ANNEXURE - II

FLOOD LEVELS OF WEST BENGAL RIVERS DURING 1991

(NORTH BENGAL RIVERS)

Name of River	Gauge at	District	Yellow Signal		Red Signal		Date	Time	Water level above Y.S.& R.S. in m.	Remarks
			Unprotected area	Protected area	Unprotected area	Protected area				
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Teesta	Coronation bridge	Darjeeling	149.40 M	~~150.80~~ M 150.00	151.80 M	153.60 M	3.7.91	10.00	149.25	Y.S. for P.A.
							11.7.91	10.00	149.60	Y.S. for U.A.
							17.8.91	10.00	151.10	
							10.9.91	10.00	150.00	
-Do-	Damohani	Jalpaiguri	85.30 M	85.60 M	85.60 M	86.30 M	12.6.91	10.00	85.78	Y.S. for P.A.
							15.6.91	10.00	85.55	Y.S. for P.A.
							16.6.91	10.00	85.74	R.S. for P.A.
							17.6.91	10.00	~~85.74~~ 85.58	R.S. for U.A.
							18.6.91	10.00	85.42	R.S. withdrawn
							24.6.91	10.00	85.56	Y.S. for U.A.
							30.6.91	10.00	85.69	
							1.7.91	10.00	85.72	
							2.7.91	10.00	85.57	
							3.7.91	10.00	85.85	
							4.7.91	10.00	85.85	
							5.7.91	10.00	85.59	
-Do-							6.7.91	10.00	85.42	
							9.7.91	10.00	85.32	
							29.7.91	10.00	85.21	
							1.8.91	10.00	85.32	
							2.8.91	10.00	85.39	
							3.8.91	10.00	85.51	
							4.8.91	10.00	85.30	
							11.8.91	10.00	85.38	
							12.8.91	10.00	85.38	
							15.8.91	10.00	85.39	
							16.8.91	10.00	85.82	
							17.8.91	10.00	85.90	
							18.8.91	10.00	85.53	
							19.8.91	10.00	85.34	
							20.8.91	10.00	85.66	
							21.8.91	10.00	85.36	
							22.8.91	10.00	85.36	
							25.8.91	10.00	85.42	
							26.8.91	10.00	85.37	
							27.8.91	10.00	85.45	

contd..p/2

							28.8.91	10.00	85.54
							29.8.91	10.00	85.33
							3.9.91	10.00	85.57
							4.9.91	10.00	85.48
							8.9.91	10.00	85.42
							9.9.91	10.00	85.65
							10.9.91	10.00	85.68
							11.9.91	10.00	85.60
							12.9.91	10.00	85.46
							13.9.91	10.00	85.50
							14.9.91	10.00	85.62
							15.9.91	10.00	85.46
							16.9.91	10.00	85.51
							19.9.91	10.00	85.43
							22.9.91	10.00	85.33
							23.9.91	10.00	85.36
							24.9.91	10.00	85.36
							25.9.91	10.00	85.45
							26.9.91	10.00	85.46
							27.9.91	10.00	~~85.36~~ 85.3
Jaldhaka	NH31 Xing	-do-	80.00	80.10	80.50	80.90	3.7.91	10.00	79.98
Raidak-I	LRP Xing	Cooch-behar	46.70	47.00	47.60	47.90	14.9.91	10.00	46.55
Raidak-II	LRP xing	-do-	48.10	48.40	49.00	49.30	9.7.91	06.00	47.10
Sankosh	LRP X'ing	-do-	48.20	48.50	49.10	49.40	9.7.91	06.00	48.35
Mansai	Matha-bhanga	-do-	48.20	48.40	48.70	48.90	15.6.91	10.00	48.27
							3.7.91	10.00	48.51
							4.7.91	10.00	48.22
							10.7.91	10.00	48.40
							12.7.91	10.00	48.60
							3.8.91	10.00	48.27
							4.8.91	10.00	48.32
							9.9.91	10.00	48.70
							10.9.91	10.00	48.28
							11.9.91	10.00	48.56
Kaljani	Alipur-duar	Jalpai-guri	48.10	48.20	45.70	48.70	31.7.91	10.00	45.05
Diana	Chengmari	-do	200.50	200.50	201.40	201.40	5.8.91	09.00	199.85

(1)	(2)	(3)	(4) D.L.	(5) E.D.L.	(6)	(7)	(8)	(9)
Mahananda	Siliguri	Darjeeling	115.275	116.59	10.9.91	09.45	116.60	
Ganga	Farakka	Murshi-dabad	22.25	23.77	10.8.91	~~06.00~~ 06.00	22.30	
					11.8.91	06.00	22.46	
					12.8.91	06.00	22.55	
					13.8.91	06.00	22.56	
					14.8.91	06.00	22.50	
					15.8.91	06.00	22.46	
					16.8.91	06.00	22.43	
					17.8.91	06.00	22.38	
					18.8.91	06.00	22.39	
					19.8.91	06.00	22.32	
					20.8.91	06.00	22.26	
					21.8.91	06.00	22.28	
					22.8.91	06.00	22.40	
					23.8.91	06.00	22.45	
					24.8.91	06.00	22.52	

					25.8.91	06.00	22.61
					26.8.91	06.00	22.66
					27.8.91	06.00	22.77
					28.8.91	06.00	22.97
					29.8.91	06.00	23.12
					30.8.91	06.00	23.22
					31.8.91	06.00	23.32
					1.9.91	06.00	23.50
					2.9.91	06.00	23.15
					3.9.91	06.00	23.98 Cr E.D
					4.9.91	N.A.	
					5.9.91	06.00	24.05
					6.9.91	06.00	24.23
					7.9.91	06.00	24.24
					8.9.91	06.00	24.25
					9.9.91	06.00	24.34
					10.9.91	06.00	24.46
					11.9.91	06.00	24.58
					12.9.91	06.00	24.70New
					13.9.91	06.00	24.70
					14.9.91	06.00	24.58
					15.9.91	06.00	24.38
					16.9.91	06.00	24.16
					17.9.91	06.00	23.98
					18.9.91	06.00	23.67 Bel E.D
					19.9.91	06.00	23.40
					20.9.91	06.00	23.15
					21.9.91	06.00	22.94
					22.9.91	06.00	22.68
					23.9.91	06.00	22.41
Punar-bhava	Gangaram-pur	West Dinaj-pur	25.82 M	26.42 M	10.9.91	06.00	26.25
					11.9.91	06.00	26.40
					12.9.91	06.00	26.50
					13.9.91	06.00	26.45
Atrai	Balurghat	-do-	23.15 M	23.76 M	11.9.91	06.00	23.66
					12.9.91	06.00	23.71
					13.9.91	06.00	23.95 Cr E.D
					14.9.91	06.00	24.20
					15.9.91	06.00	24.17
					16.9.91	06.00	23.89
					17.9.91	06.00	23.50 Be E.D
					18.9.91	06.00	23.39
					19.9.91	06.00	23.32
					20.9.91	06.00	~~22.36~~ Bel 22.38 D.L.
Tangon	Bansihari	-do-	25.60M	26.21 M	9. 9. 91	06.00	25.65 Crossed D.L.
					10.9.91	06.00	26.15
					11.9.91	06.00	26.46 Cros E
					12.9.91	06.00	27.04
					13.9.91	06.00	26.90
					14.9.91		N.A.
					15.9.91		N.A.
					16.9.91	06.00	26.50
					17.9.91	06.00	26.89
					18.9.91		N.A.
					19.9.91		N.A.
					20.9.91		N.A.
					21.9.91	06.00	~~25.06~~ Bel 26.06 E.D

contd...p

					22.9.91	06.00	25.80	
					23.9.91	06.00	25.50	Belo
					24.9.91	06.00	24.80	
Kulik	Raiganj	West Dinajpur ~~-do-~~	31.20	32.69	10.9.91	06.00	31.25	Cros
					11.9.91	06.00	31.60	
					12.9.91	06.00	31.60	
					13.9.91	06.00	31.40	
					14.9.91	06.00	31.20	
					15.9.91	06.00	30.70	Belo
Nagar	Mukdampur	-do-	31.54	31.86	10. 9.91	12.00	31.54	Cros D.1
					11.9.91	12.00	31.65	
					12.9.91	12.00	31.65	
					13.9.91	12.00	31.50	Belo
Fulahar	Teljana	Malda	90.00ft.	93.00	5.9.91	06.00	92.30	Cross
					6.9.91	06.00	93.80	Cros E
					7.9.91	06.00	93.50	
					8.9.91	06.00	92.80	
					9.9.91	06.00	93.75	
					10.9.91	06.00	96.00	
					11.9.91	06.00	97.90	
					12.9.91	06.00	97.90	
					13.9.91	06.00	96.70	
					14.9.91	06.00	95.10	
					15.9.91	06.00	93.80	
					16.9.91	06.00	93.00	
					17.9.91	06.00	92.90	Belo
					18.9.91	06.00	92.90	
					19.9.91	06.00	92.10	
					20.9.91	06.00	90.00	
Ganga	Manickchak	Malda	25.30M	25.30M	1.7.91	06.00	27.74	Cros E.1
					5.9.91	06.00	25.95	
					6.9.91	06.00	26.04	
					7.9.91	06.00	26.05	
					8.9.91	06.00	26.04	
					9.9.91	06.00	26.14	
					10.9.91	06.00	26.23	
					11.9.91	06.00	26.31	
					12.9.91	06.00	26.36	
					13.9.91	06.00	26.31	
					14.9.91	06.00	26.18	
					15.9.91	06.00	25.95	
					16.9.91	06.00	25.68	
					17.9.91	06.00	25.37	

ANNEXURE - III

FLOOD LEVELS OF THE RIVER OF WEST BENGAL DURING 1991

(South Bengal Rivers)

Name of river	Gauge at	District	Danger Level	Extreme Danger Level	Date	Time	Flood Level above D.L. & E.D.L.	Remark
1.	2.	3.	4.	5.	6.	7.	8.	9.
Ganga	Noorpur	Murshi-dabad.	21.03M	21.64M	12.8.91	06-00	21.04	Above D.
					13.8.91	06-00	21.07	-Do-
					18.8.91	06-00	21.03	
					24.8.91	06-00	21.04	
					25.8.91	06-00	21.12	
					26.8.91	06-00	21.20	
					27.8.91	06-00	21.29	
					28.8.91	06-00	21.49	
					29.8.91	06-00	21.65	
					30.8.91	06-00	21.75	
					31.8.91	06-00	21.83	
					1.9.91	06-00	21.97	
					2.9.91	06-00	22.12	
					3.9.91	06-00	22.26	
					4.9.91	06-00	22.41	5.9.91 to 9.9. record: are not availat
					10.9.91	06-00	22.94	
					11.9.91	06.00	23.07	
					12.9.91	06.00	23.14	
					13.9.91	06-00	23.13	
					14.9.91	06-00	23.06	
					15.9.91	06-00	22.91	
					16.9.91	06-00	22.75	
					17.9.91	06-00	22.55	
					18.9.91	06.00	22.27	

Contd..2..

1.	2.	3.	4.	5.	6.	7.	8.	9.
					19.9.91	06.00	21.96	
					20.9.91	06.00	21.66	
					21.9.91	06.00	21.39	
Ganga	Chakghat	~~-Do-~~ Murshidabad	20.88M	21.49M	2.9.91	06.00	20.95	
					3.9.91	06.00	21.10	
					4.9.91	06.00	21.25	5.9.91 to 6.9.91 records are not available.
					7.9.91	06.00	21.54	
					8.9.91	06.00	21.58	
					9.9.91	06.00	21.68	
					10.9.91	06-00	21.83	
					11.9.91	06.00	21.94	
					12.9.91	06.00	22.01	
					13.9.91	06.00	22.00	
					14.9.91	06.00	21.93	
					15.9.91	06.00	21.79	
					16.9.91	06.00	21.63	
					17.9.91	06.00	21.40	
					18.9.91	06.00	21.12	
Ganga	Jalangi bazar	-Do-	16.76M	17.37M	12.9.91	06.00	16.76	For other dates, records N.A.
					13.9.91	06.00	16.80	
Ganga	Giriya	-Do-	20.57M	21.18M	27.8.91	06.00	20.63	Crossed D.L.
					28.8.91	06.00	20.82	
					29.8.91	06.00	20.97	
					30.8.91	06.00	21.06	-Do-
					31.8.91	06.00	21.18	Crossed E.D.L.
					1.9.91	06.00	21.32	
					2.9.91	06.00	21.46	
					3.9.91	06.00	21.60	

Contd...3..

1.	2.	3.	4.	5.	6.	7.	8.	9.
					4.9.91	06.00	21.75	Crossed E.D.L
								No records available for 5.9.91 & & 6.9.91.
					7.9.91	06.00	22.03	Above EDL
					8.9.91	06.00	22.06	
					9.9.91	06.00	22.16	
					10.9.91	06.00	22.29	
					11.9.91	06.00	22.41	
					12.9.91	06.00	22.49	
					13.9.91	06.00	22.46	
					14.9.91	06.00	22.39	
					15.9.91	06.00	22.25	
					16.9.91	06.00	22.09	
					17.9.91	06.00	21.90	
					18.9.91	06.00	21.62	
					19.9.91	06.00	21.30	-Do-
					20.9.91	06.00	21.00	Below EDL
					21.9.91	06.00	20.72	
Ganga	Jangipur	Murshidabad -Do-	20.27M	20.88M	11.9.91	06.00	20.27	Data not available.
Bhairab	Akheriganj	-Do-	18.44M	19.05M	1.9.91	06.00	18.52	Crossed D.L.
					2.9.91	06.00	18.66	
					3.9.91	06.00	18.77	
					4.9.91	06.00	18.86	
					5.9.91	06.00	19.00	-Do-
					6.9.91	06.00	19.12	Crossed E.D.L.
					7.9.91	06.00	19.18	
					8.9.91	06.00	19.26	
					9.9.91	06.00	19.32	
					10.9.91	06.00	19.40	
					11.9.91	06.00	19.40	

Contd...4..

1.	2.	3.	4.	5.	6.	7.	8.	9.
					12.9.91	06.00	19.57	Crossed EDL
					13.9.91	06.00	19.63	
					14.9.91	06.00	19.54	
					15.9.91	06.00	19.46	
					16.9.91	06.00	19.26	
					17.9.91	06.00	19.08	-Do-
					18.9.91	Not available		
					19.9.91	06.00	18.62	below E.D.L.
	Jalangi	Swarupganj	Nadia	8.44 9.05	7.9.91	21.00	8.44	Crossed D.L.
					8.9.91	06.00	8.50	
					9.9.91	06.00	8.66	
					10.9.91	06.00	8.77	
					11.9.91	06.00	8.87	
					12.9.91	06.00	8.97	
					13.9.91	06.00	9.00	
					14.9.91	06.00	9.01	
					15.9.91	06.00	8.98	
					16.9.91	06.00	8.95	
					17.9.91	06.00	8.93	
					18.9.91	06.00	8.93	
					19.9.91	06.00	8.97	
					20.9.91	06.00	9.00	
					21.9.91	06.00	8.99	
					22.9.91	06.00	8.99	
					23.9.91	06.00	8.96	
					24.9.91	06.00	8.91	
					25.9.91	06.00	8.85	
					26.9.91	06.00	8.74	
					27.9.91	06.00	8.60	
					28.9.91	06.00	8.45	
	Churni	Hanskhali	-Do-	7.53M 8.14M	17.9.91	06.00	7.65	

Contd....5...

1.	2.	3.	4.	5.	6.	7.	8.	9.
					18.9.91	06.00	7.70	
					19.9.91	06.00	7.72	
					20.9.91	06.00	7.76	
					21.9.91	06.00	7.66	
					22.9.91	06.00	7.74	
					23.9.91	06.00	7.70	
					24.9.91	06.00	7.65	
					25.9.91	06.00	7.52	
					26.9.91	06.00	7.60	
					27.9.91	06.00	7.56	
Dwarka	Sankoghat	Birbhum	20.40M	21.30M	6.9.91	09.00	21.39	
					7.9.91	09.00	21.50	
					8.9.91	09.00	21.50	
					9.9.91	09.00	21.46	
					10.9.91	09.00	21.35	
Mundeswari	Harinkhola	Hooghly	40.00ft	42.00ft	31.8.91	16.00	40.02	
					6.9.91	10.00	41.33	
					7.9.91	10.00	40.57	
					8.9.91	10.00	40.62	
					9.9.91	10.00	40.70	
Kaliaghaye	Amgachia	Midnapore	5.79M	6.40M	23.7.91	06.00	6.58	
					24.7.91	14.00	6.70	
					25.7.91	06.00	6.61	
					26.7.91	22.99	6.18	
					27.7.91	Not available		
					28.7.91	06.00	5.82	
-Do-	Dehati	-Do-	7.00M	-	20.7.91	15.00	7.00	
					22.7.91	19.30	7.20	
					23.7.91	17.30	8.31	
					24.7.91	22.30	8.02	
					25.7.91	09.00	7.66	
					26.7.91	06.00	7.31	

Contd....6...

1.	2.	3.	4.	5.	6.	7.	8.	9.
Rupnarayan	Buxi	Midnapore	4.11M	5.54M	26.7.91	13.10	4.26	
					29.7.91	14.40	4.59	
					30.7.91	14.45	4.41	
					31.7.91	15.00	4.14	
					9.8.91	12.20	4.29	
					10.8.91	13.00	4.53	
					11.8.91	13.35	4.69	
					12.8.91	14.10	4.44	
					14.8.91	15.15	4.38	
					25.8.91	13.15	4.47	
					26.8.91	13.25	4.59	
					27.8.91	13.40	4.44	
					28.8.91	14.25	4.41	
					29.8.91	15.00	4.32	
					7.9.91	12.05	4.47	
					9.9.91	13.20	4.84	
					10.9.91	13.55	4.87	
					11.9.91	14.15	4.72	
					12.9.91	14.55	4.38 ~~4.48~~	
					22.9.91	12.10	4.20 ~~4.30~~	
					23.9.91	12.35	4.20	
Kapaleswari	Narayanbar	-Do-	5.33M	5.94M	23.7.91	15.00	6.52	
					24.7.91		Not available	
					25.7.91	06.00	6.55	
					26.7.91	06.00	6.28	
					27.7.91	-	N.A.	
					28.7.91	06.00	5.70	
					29.7.91	06.00	5.49	
					16.8.91	20.00	5.36	
					31.8.91	06.00	5.33	
Chandia	Barisa	-Do-	4.57	5.03	21.7.91	06.00	5.40	
					23.7.91	19.00	5.34	
					24.7.91	12.00	5.33	
					25.7.91	07.30	5.12	
					26.7.91	07.30	5.03	y

A N N E X U R E - IV

Area flooded in different districts of West Bengal during 1991.

Name of districts	Geographical area in Sq.Km.	Area flooded in Sq.Km
Coochbehar	3386	400
Jalpaiguri	6245	675
Darjeeling	3075	48
West Dinajpur	5206	3458
Malda	3713	1453
Murshidabad	5341	503
Nadia	3926	110
Burdwan	7028	Nothing appreciable
Birbhum	4545	-do-
Howrah	1467	-do-
24 Parganas(North)	13 96	-do-
24 Parganas(South)		
Purulia	6259	-do-
Bankura	6881	N I L.
Hooghly	3145	140
Midnapore	13724	20
Calcutta	116	--
	Total : 87,853	Total : 6807

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ANNEXURE - V.

D.V.C. discharge down Durgapur Barrage

Date	Time	Discharge in Cumecs	Discharge in Cusecs.
5.9.91	06.00	2098	74,000
6.9.91	11.00	2438	86,000
7.9.91	06.00	2379	83,925
8.9.91	06.00	2027	71,525
9.9.91	15.00	1954	68,925
10.9.91	06.00	1435	50,625
10.9.91	09.00	1040	36,675

ANNEXURE - VI .

General abstruct of entimated cost of Flood Damage Repairs and Restoration Works.

*****

Sl. No.	Name of the District.	Estimated Cost Repairs/restoration Works. (Rs. in lacs)	Nature of repairs/restoration Works.
1.	2.	3.	4.
1.	Darjeeling	228.00	
2.	Jalpaiguri	601.00	Closing breaches and cuts in
3.	Coochbehar	432.00	flood protective embankments
4.	West Dinajpur	229.00	and Irrigation canals/drainage
5.	Malda	980.00	channels banks, repairs to
6.	Murshidabad	1109.00	damaged flood embankments &
7.	Nadia	156.00	canal/channels banks repairs
8.	24-Parganas (North & South)	480.00	to sluices and various structures,
9.	Howrah	111.00	restoration works of various bank
10.	Hooghly	100.00	protective works repairs to departmen-
11.	Midnapore	169.00	tal buildings and roads / approach roads etc.
Total : : :		4595.00	

ANNEXURE - VIA.

Abstract Report of Damages and estimated cost of Repairs and Restoration there of : Caused during August and September '91, in Darjeeling District.

1.	Closing breaches	Nil			
2. (a)	Damage to Embktt.	12 Km.	Rs.	12.00	lakhs
(b)	Cost of repair	@ 1,00,000/-			
3. (a)	Damage to Bridges, Sluices and Structures	14 Nos.			
(b)	Cost of repair	@ 1,00,000/-	Rs.	14.00	Lakhs
4. (i)	Damages to Bank protection works.	12.26 Km.			
(ii)	Damages to Spurs, etc.				
	(a) Streens & Studs	211 Nos.			
	(b) Bed bar	135 Nos.			
	(i) Cost of repair	@ 1,000/-	Rs.	122.70	Lakhs
	(ii) -do- (a)	@ 5,000/-	Rs.	17.30	Lakhs
	(b)	@ 5,000/-			
5.	Repairs to Buildings and Colony approach Road etc.	L.S.	Rs.	2.00	Lakhs
6.	Damage to Irrigation Works				
	Taipur Irrigation Scheme	2.00			
	Siavita Irrigation Scheme	2.00			
	Jamaitulla Irrigation Scheme	10.00	Rs.	14.00	Lakhs
7.	Works already executed as Palliative Works	-	Rs.	55.00	Lakhs
			Rs.	228.00	Lakhs.

ANNEXURE - VI B.

Estimate for repair and restoration to embankments and structures caused during August & September '91 in the District of Jalpaiguri, West Bengal.

Sl. No.	Desctiption of items	Quantity	Unit	Rate Rs.	Amount (Rs. in Lac)
1.	Closing of breaches				
i)	Jorai Irrigation Scheme.	30 mt.	Per mt.	6,000	1.80
ii)	Bargrakota and Kumlai	400 "	"	10,000	4.00
2.	Repairs of embankment by earth work and turfing including repairs to inspection path.	54 KM	Per K.M.	21,500	11.60
3(A)	Repairs to existing armoured embankments etc.	15.50	Per K.M.	2.25	34.90
(B)	Repairs to apron	15.50	"	6.00	93.00
4(A)	Repairs to existing bank protection works and anti-erosion measures:-	8 Nos.	Each	20,000/-	1.60
(B)	Bank protection works:-	11 K.M.	Per K.M.	4.00	44.00
5.	Repairs to existing Spurs:				
	Type A	6 Nos.	Each	3.00	18.00
	Type B	23 "	Each	5.00	115.00
6.	Repairs to existing Irrigation Schemes including closing of breaches of Canals and repairs of head regulators:-	7 "	Each	1.50 lacs.	10.50
7.	Repairs to existing drainage Sluice in embkts: Extn. of Alipurduar embkt.	20 "	Each	60000	12.00
8.	Repairs to boulder sausage embankments:	5 "	Each	4.00 lacs	20.00
9.	Repairs to Buildings, Godowns, Rest-Shed Office Buildings etc.	L.S.	-	-	10.00
10.	Works already executed for Palliative measures.	-	-	-	225.00
				Rs.	601.40

ANNEXURE VI C.

Estimate for restoration to embankments and structures caused during the flood period of 1990-91 in the Dist. of Coochbehar, West Bengal.

Sl. No.	Description of items.	Quantity	Unit	Rate Rs. in lacs.	Amount Rs. in lacs.
1.	Closing of breaches.	-	-	-	-
2.	Repairs to embankment by earchwork and turfing (as Annexure-4)	66 K.M	K.m.	0.20	13.20
3.	Repair to existing armoured embankments etc. (as per Annexure-A)				
	A) Sippe pitching	66 K.M	K.M.	0.70	46.20
	B) Repairs to apron.	66 K.M.	K.m.	1.50	99.00
					45.20
4.	Repairs to existing bank protection works and anti-erosion measures (as per Annexure-A)	9.30 K.M.	K.m.	4.00	33.00
					78.20
	A) Repairs to screen including strengthening.	52 nos.	Each.	0.50	26.00
5.	Repairs to existing spurs & bed bars.	100 nos.	Each.	2.00	200.00
6.	Repairs to existing Irrigation Schemes.	-	-	-	-
7.	Repairs to existing drainage sluice in different embankments.	11 nos.	each.	1.20	13.20
8.	Repairs to boulder sausage embankments.	-	-	-	-
9.	Repairs to buildings, Go-downs, Rest shed, approach roads etc.		L.S.		3.00
10.	Works already executed for palliative measured.		-		99.00
				Rs.	431.80 Laks.

ANNEXURE VI D.

ANSTRACT OF COST FOR RESTORATION OF FLOOD DAMAGE DURING SEPTEMBER, 1991 DISTRICT WEST DINAJPUR.

Sl. No.	Items.	Quantity.	Unit.	Rate.	Amount.
1.	Breaches cuts.	41 nos.	Each.	40,000/-	16,40,000.000
2.	Damages to embankments.	12 K.m.	K.m.	6,40,000/-	73,68,000.00
3.	Damages to sluices.	60 nos.	Each.	20,000/-	12,00,000.00
4.	(a) Damages to bank protective works.	1600 Metre.	Metre.	4,705/-	75,28,000.00
	(b) Damages to spurs and bed bars.	40 nos.	Each.	37,744/-	15,09,760.00
5.	Repairs to buildings.	30 nos.	Each	25,000/-	7,50,000.00
6.	Damages to Department roads and inspection path.	15 K.m.	K.m.	25,000/-	3,75,000.000
				Total:	Rs.2,03,70,760.00
7.	Works already executed for palliative works and continuing palliative works during and after flood	.....	.....	.....	25,00,000.00
				Grand Total	Rs. 2,28,70,760.00
					Rs. 228.70 lakhs.

ANNEXURE - VI E.

Estimates for repairs and restoration works to embankments and structures caused during August and September 1991 in the district of Malda, W.B.

Sl.No.	Description of items	Quantity	Unit	Rate(Rs. in lac)	Amount (Rs.in lacs)
1.	2.	3.	4.	5.	6.
1.	Breaches and cuts of Bhutni Circuit Embkt.and 10th retired embankment of Ganga.	1985M	M	0.0064	12.73
2.	Damages to embankments of left Fulahar,Mahananda, marginal Ganga Embankments.	145.11 KM	K.M.	1.891	274.47
3.	Damage to culverts, sluices and other structures under Malda Irrigation & Mahananda Embankment Divisioh.	50 (sluices)	Each	0.732	42.50
4. (a)	Damage to bank protective works of left Fulahar,Mahananda & marginal Ganga Embankments.	125.62 K.M.	K.M.	1.9435	244.15
(b)	Damage to spurs and bed bars of left Fulahar & Ganga Marginal embankments.	22 Nos.	Each.	9.822	216.10
5.	Damage to buildings and R.T.sheds of both Division.	± 51	Each	0.40	20.40
6.	Protection to slips in hills.	--	--	--	--
7.	Damages to departmental and Inspection roads.	56.50	K.M.	1.25	± 70.62
8.	Works already executed and under execution as palliative measures at several places for protection to Fulahar embkt.(near Valuka & Khopakati), Mahananda embkt., Ganga Marginal Embankment.	—	—	—	99.41
					980.38
					Say Rs.980.00 lacs.

A N N E X U R E - VI F.

Abstract of cost for repairs and restoration of damages to embankments and structures caused by flood during August and September, 1991 in the district of Murshidabad, West Bengal.

Sl.No.	Description of items	Quantity	Unit	Rate (Rs.in lacs)	Amount (Rs.in lacs)
1.	2.	3.	4.	5.	6.
1.	Breaches and cuts				
	Type -- A	8 Nos.	Each	0.41	3.30
	Type --- B	10 Nos.	Each	0.20	2.00
	Type --- C	10 Nos.	Each	0.50	5.00
2.	Repairs and restorations to different embankments.	46.20 K.M.	K.M.	1.62	74.52
3.	Repairs & restoration to sluices, bridges and irrigation structures.	19 nos.	Each	1.20	22.80
4.	Damages to Bank protective works :-				
	a) Bank protection works :	27.96 K.M.	K.M.	18.90	528.44
	b) Bed bars	39 Nos.	Each	8.53	332.67
5.	Repairs to buildings etc.	L.S.	--	---	6.00
6.	Repairs and restoration to roads and inspection paths.	12.75	K.M.	1.92	24.48
7.	Works already executed as palliative works.	--	--	--	110.00
				Total :	Rs. 1109.21 lacs
				Say	Rs. 1109.00 lacs

A N N E X U R E - VI G.

Abstract of cost of "Reports & Restoration of damages caused by flood during August & September, 1991 in the District of Nadia.

Sl.No.	Description of items	Quantity	Unit	Rate (Rs.in lacs)	Amount Rs.in lacs.
1.	2.	3.	4.	5.	6.
1.	Repairs and restoration of embankment.	29 K.M.	K.M.	039	11.31
2.	Damages to sluices, bridges and irrigation structures.	41 Nos.	Each	0.35	14.35
3.	Damages to existing bank protection works. Type--- A.	5.40 K.M.	K.M.	19.58	105.75
	Type - B.	4.61 K.M.	K.M.	2.47	11.38
4.	Repairs to buildings, Godown, Rest shed, Office buildings etc.	10 Nos.	Each	L.S.	3.40
5.	Works already executed for palliative measures.	--	--	--	10.00
					Rs.156.19
					Say Rs. 156.00 lacs.

A N N E X U R E - VI H

Abstract Report of damages and estimated cost of Repairs and Restoration thereof caused during August and September, 1991 in 24 Parganas(North & South)

Sl.No.	Description	Extent of damage	Unit/ Rate	Amount in lacs.	District-wise break up (Rs.in lacs) South	North
1.	2.	3.	4.	5.	6.	6. 7.
1.	Damages to Embankment & Revetment work.	240.00 K.M.	1.60 lacs.	384.00	344.00	40.00
2.	Damages to sluice	140 Nos.	0.17 lacs	25.00	16.00	9.00
3.	Breaches	2.75 K.M.	4.00 lacs.	11.00	11000	---
4.	Repairs to bank protection work.	9.00 K.M.	4.65 lacs	42.00	14.00	28.00
5.	Repairs and Restoration of Departmental road&Inspection path & approach road.	7.00	2.50	17.50	4.00	13.50
				479.50	389.00	90.00
			Say Rs.	480.00	390.00	90.0
6.	Out of total Rs.480.00 lacs works already taken up as palliative measures		Rs.	40.00	30.00	10.00

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A N N E X U R E - VI I

EStimate for Flood Damage repairs and restoration to Embankment and Structures in September,1991 under Howrah Listrict.

Sl.No.	Description of items	Quantity	Unit	Rate..	Amount in lacs.
1.	2.	3.	4.	5.	6.
1.	Closing of breaches	--	--	--	--
2.	Damages to earthen embankment repair.	15000 Meter	Per Meter	50/-	7.50
3.	Repairs to armourud bank protection works(Hooghly right)	4200 Meter	Per Meter	2100/-	88.20
4.	Repairs to damaged sluices and bridges	25 Nos.	Each	20000/-	5.00
5.	Repairs to Buildings, Inspection Path, etc.	--	---	---	--
6.	Works already executed for palliative measures.	--	---	---	-10.00
				Total :	Rs.110.70
				Say	Rs.111.00 lacs.

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A N N E X U R E - VI J

ESTIMATE FOR FLOOD DAMAGES REPAIRS AND RESTORATION TO EMBANKMENT AND STRUCTURES DURING SEPTEMBER, 1991 UNDER THE DISTRICT OF HOOGHLY.

Sl.No.	Description of item.	Quantity.	Unit.	Rate.	Amount in lacs.
1.	2.	3.	4.	5.	6.
1.	Repairs to breaches/Cuts.	Nil.	---	---	Nil-
2.	Repairs to earthen embankment.	32,000 Metre	Metre	Rs.50/-	Rs.16.00 lacs.
3.	Repairs to bank protection works(pucca)	3,000 metre	Metre	Rs.2100/-	Rs.63/lakhs
4.	Repairs to damaged sluices, Bridges or other Irrigation structures.	25 Nos.	Each	Rs.20,000/-	Rs.5.00 lakhs.
5.	Repairs to Building, staff quarter, Coloney, approach Road etc.	---	---	---	---
6.	Works already executed for palliative measure	---	---	---	Rs.16.00 Lakhs.
					Rs.100.00 lakhs.

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A N N E X U R E - V I K

Estimate for Flood Damage Repairs & Restoration during August and September 1991 for the District of Midnapore.

Sl No	Description of Items.	Quantity	Unit	Rate.	Amount (in lacs)
1.	2.	3.	4.	5.	6.
1.	Repairs to Breaches/Cuts.	---	---	---	---
2.	Repairs to Earthen Embankment	37,000 metre	Per metre	Rs.50/-	Rs.[illegible]
3.	Repairs to Bank Protection work (Pucca)	4500metre	Per Metre	Rs.2,100/-	Rs.[illegible]
4.	Repairs to damages sluices/ bridges or Other Irrigation Structures.	100 Nos.	Each.	Rs.20,000	Rs.20[illegible]
5.	Repairs to Buildings, Staff Qr.Colony apprach Road etc.	---	---	---	---
6.	Work already executed for palliative measures	---	---	---	---
					Rs.168.73

Say :- Rs. 169 lacs.

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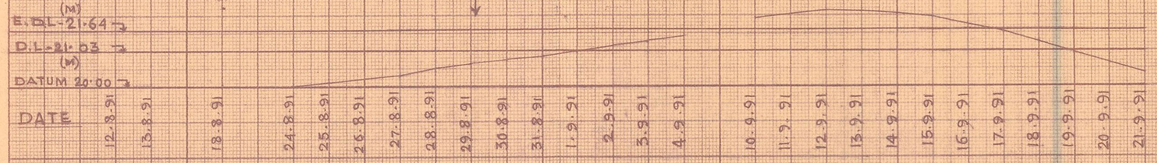
RIVER- GANGA, GAUGE STN- NOORPUR, DIST. MURSHIDABAD



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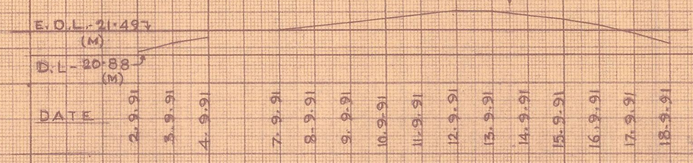

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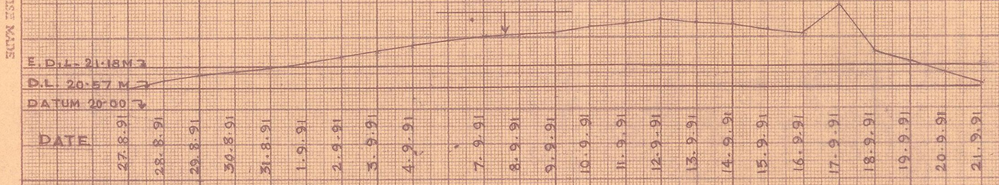

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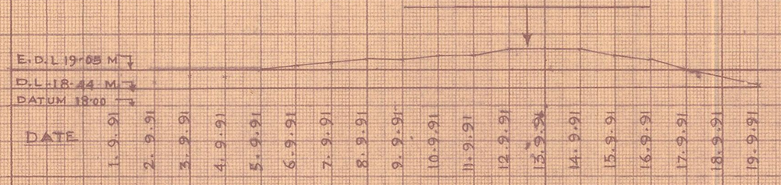
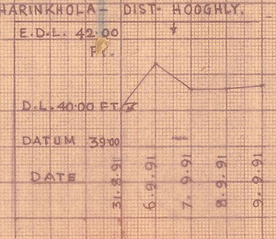
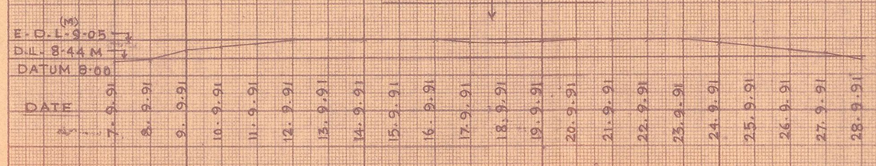


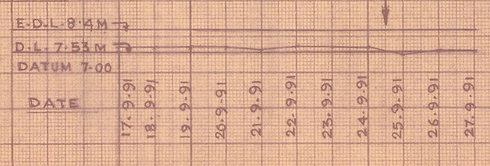
RIVER- MUNDESWARI- GAUGE STN- HARINKHOLA- DIST. HOOGHLY.



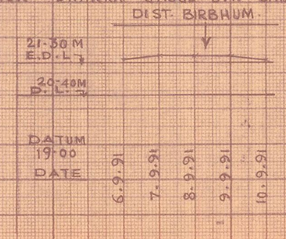
RIVER- JALANGI- GAUGE STN- SWARUPGANJ- DIST- NADIA



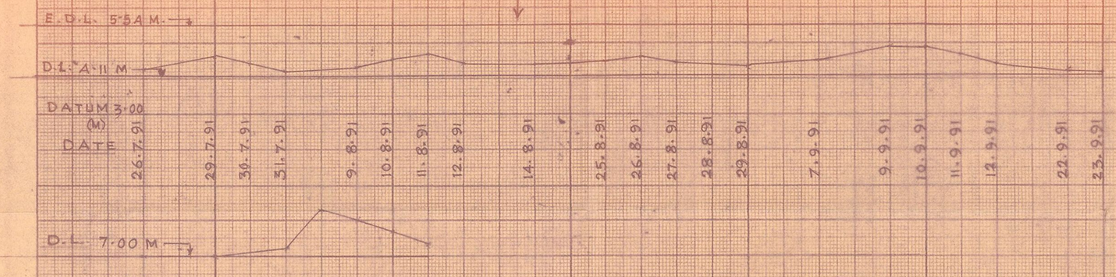
RIVER- CHURNI - GAUGE STN - HANSKHALI - DIST- NADIA



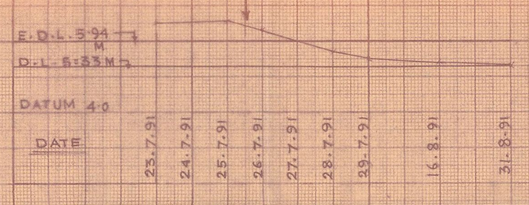
RIVER- DWARKA - GAUGE STN- SANKOGHAT DIST BIRBHUM



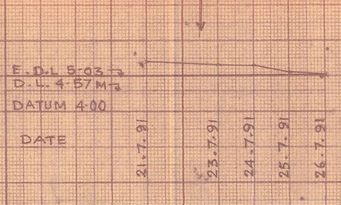
RIVER- RUPNARAYAN - GAUGE STN- BUXI - DIST-MIDNAPORE

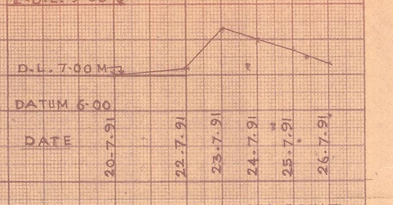


RIVER- KAPALESWARI- GAUGE STN- NARAYAN BAR- DIST.- MIDNAPORE

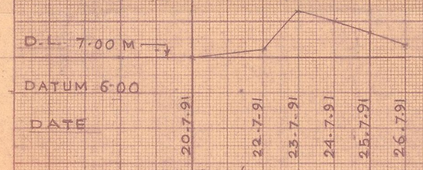


RIVER- CHANDIA - GAUGE STN- BARISA DIST- MIDNAPUR



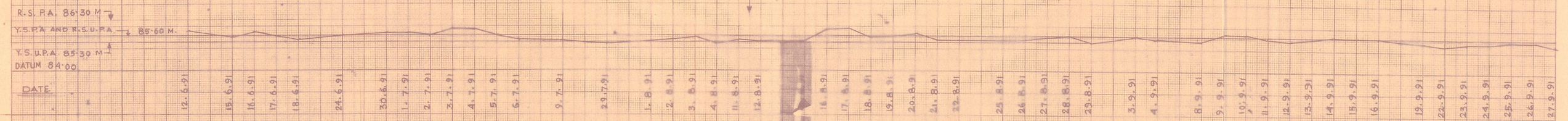


RIVER- KALIAGHAYE - GAUGE STN- DEHATI DIST- MIDNAPUR.

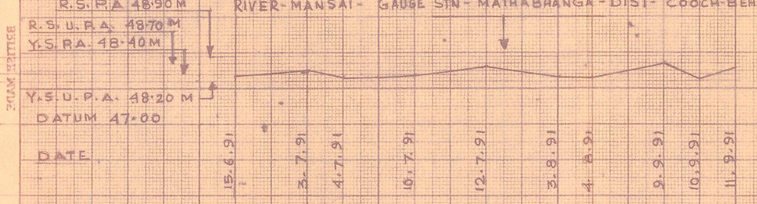


GAUGE STN- DEHATI - /RIVER- KALIAGHAYE/ DIST. MIDNAPUR

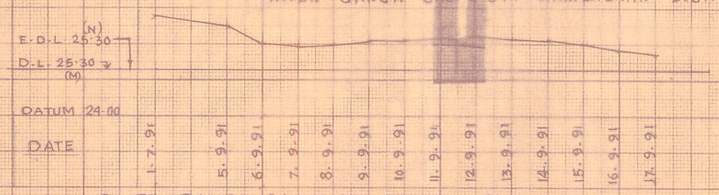
RIVER- TEESTA - GAUGE STATION - DOMOHANI
DIST. - JALPAIGURI



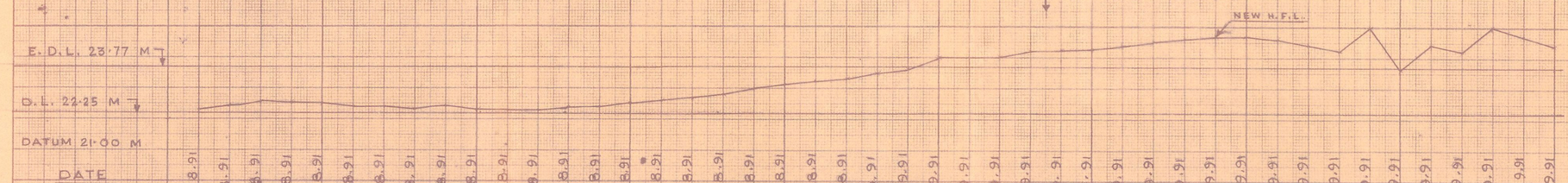
RIVER- MANSAI - GAUGE STN - MATHABHANGA - DIST - COOCH BEHAR



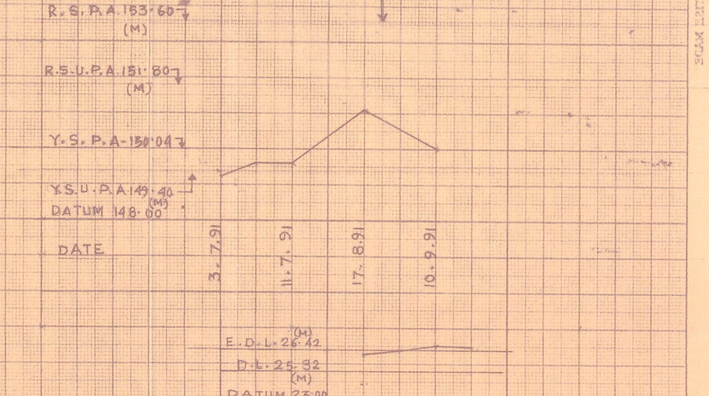
RIVER- GANGA - GAUGE STN - MANICKCHAK - DIST. - MALDA



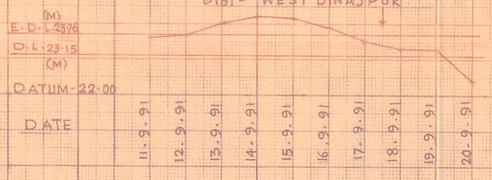
RIVER- GANGA - GAUGE STN - FARAKKA - DIST - MURSHIDABAD



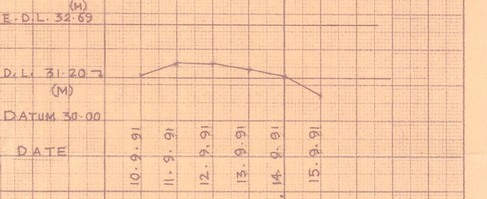
RIVER- TEESTA - GAUGE STN - CORONATION BRIDGE - DIST - DARJEELING



RIVER - ATRAI - GAUGE STN - BALURGHAT
DIST - WEST DINAJPUR

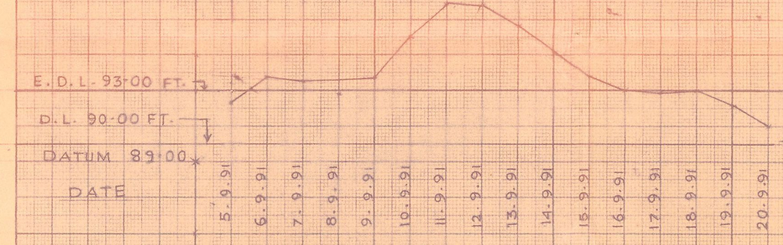


RIVER - PUNARBHABA - GAUGE STN -
GANGARAMPUR - DIST - WEST DINAJPUR

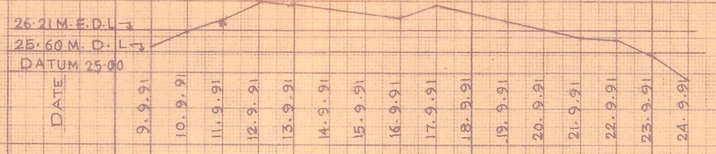


RIVER - KULIK - GAUGE STN - RAIGANJ -
DIST - WEST DINAJPUR

RIVER - FULAHAR - GAUGE STN - TELJANA -
DIST - MALDA



RIVER - TANGON - GAUGE STN - BANSIHARI -
DIST - WEST DINAJPUR



DATE

MAITHON RESERVOIR
RESERVOIR LEVELS IN M
SCALE 2M=1CM.

MAXIMUM WATER LEVEL 150.576M

½ 2M=1CM.
D.S.L
132.588

PANCHET RESERVOIR
RESERVOIR LEVELS IN M.
SCALE 2M=1CM.

MAXIMUM WATER LEVEL 135.635

D.S.L
119.482

MASSENJORE RESERVOIR
RESERVOIR LEVELS IN M
SCALE 2M=1CM.

MAXIMUM WATER LEVEL 123.7M

D.S.L
106.40

KANGSABATI RESERVOIR
RESERVOIR LEVELS IN M
SCALE 2M=1CM

MAXIMUM WATER LEVEL 185.67M

D.S.L
10.42

RESERVOIR LEVELS DURING
FLOOD SEASON 1991

SHEET NO:-1/2

KANGSABATI RESERVOIR
RESERVOIR LEVELS IN M.
SCALE-2M = 1CM.

DSL-120.42

MAXIUM WATER LEVEL 135.67M

MASSENJORE RESERVOIR
RESERVOIR LEVELS IN M.
SCALE-2M=1CM

DSL-106.40

MAXIUM WATER LEVEL 123.17M

PANCHET RESERVOIR
RESERVOIR LEVELS IN M.
SCALE-2M=1 CM

DSL-119.492

MAXIMUM WATER LEVEL 135.635 M.

V=2M=1CM

DSL-132.980

MAITHON RESERVOIR
RESERVOIR LEVELS IN M.
SCALE 2M=1CM.

MAXIMUM WATER LEVEL 150.576 M.

DATE-28 28 27 28 28 29 30 31 1 9 29 89 49 59 69 79 89 99 109 119 129 139 149 159 169 179 189 199 209 219 229 239 249 259 269 279 289 299 309 310 210 510 410 510 610 710 810 910 1010 1110 1210 1310 1410 1510

RESERVOIR LEVELS DURING FLOOD SEASON
1991

SHEET NO-2/2

3GM EDITEX
BRITISH MADE

INDEX MAP OF
WEST BENGAL

SCALE: 1: 2,000,000

FLOODED AREA DURING 1990 -

HYDROLOGICAL STATIONS -

LEGENDS

INT. BOUNDARY

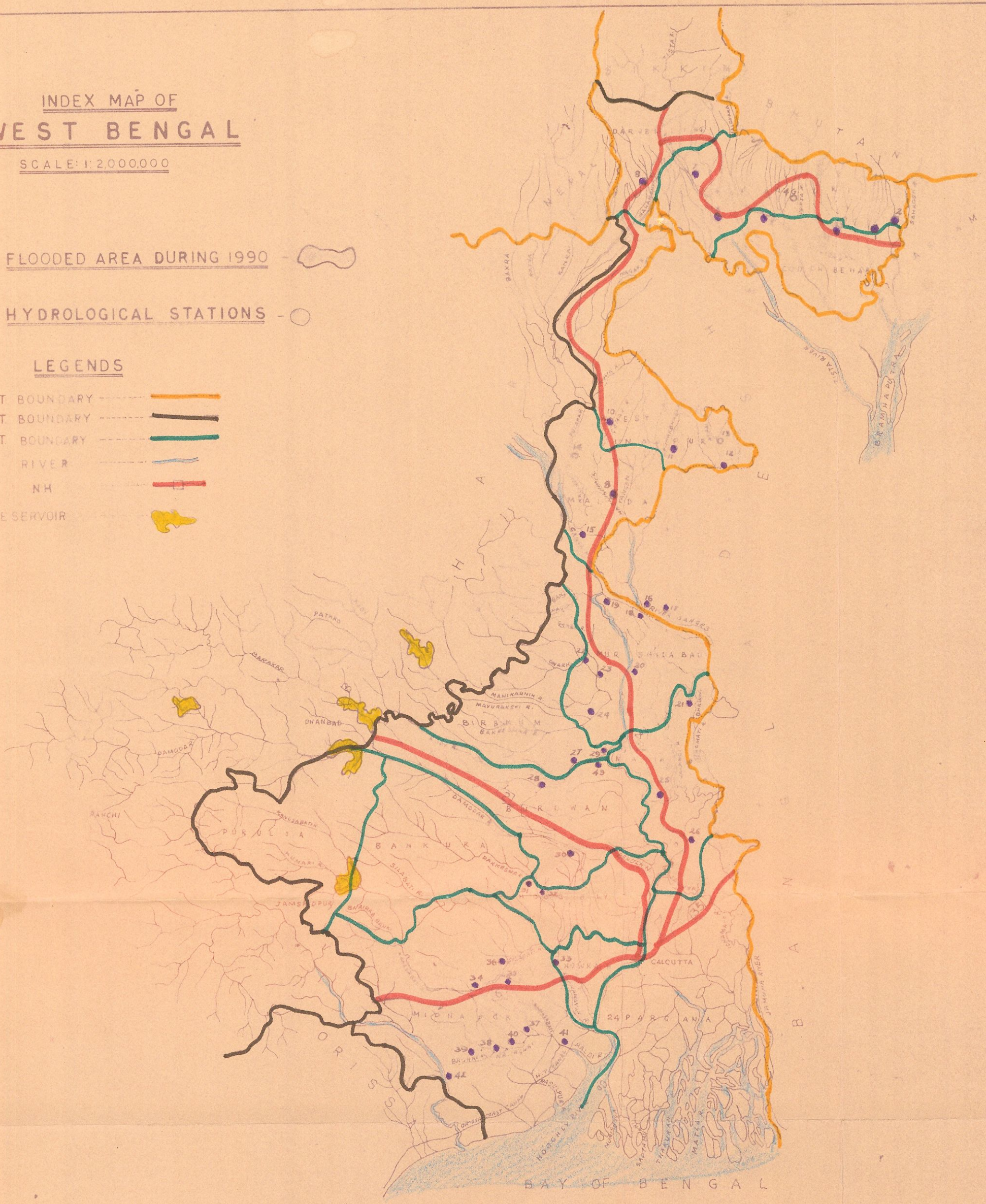
ST. BOUNDARY

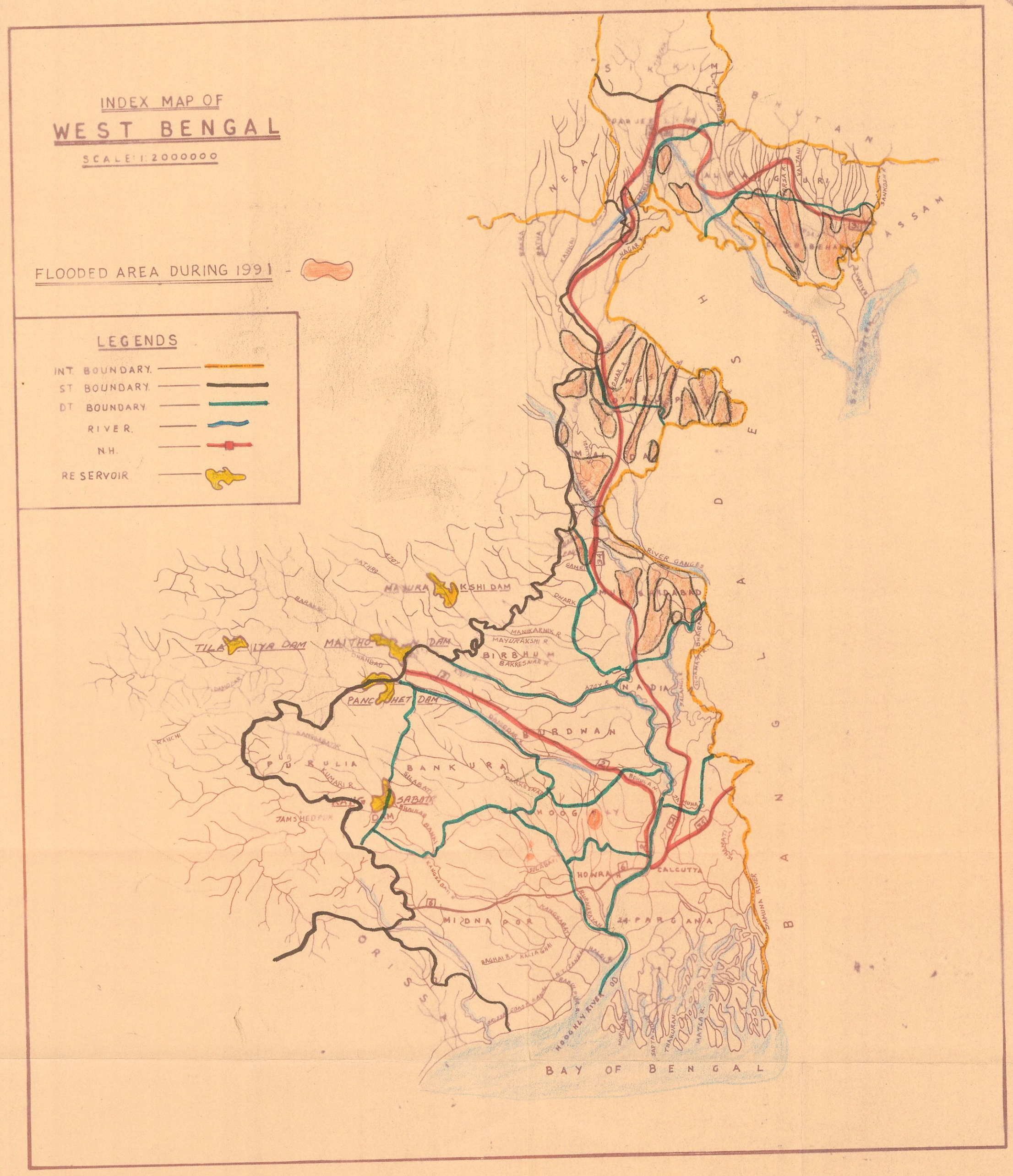
DT. BOUNDARY

RIVER

NH

RESERVOIR




INDEX MAP OF
WEST BENGAL
SCALE: 1:2000000
FLOODED AREA DURING 1991 -
LEGENDS
INT. BOUNDARY
ST BOUNDARY
DT BOUNDARY
RIVER
N.H.
RESERVOIR
SIKKIM
BHUTAN
NEPAL
ASSAM
BANGLADESH
ORISSA
BAY OF BENGAL
RIVER GANGES
MAYURAKSHI DAM
TILAIYA DAM
MAITHON DAM
PANCHET DAM
BIRBHUM
NADIA
BURDWAN
PURULIA
BANKURA
HOOGHLY
HOWRAH
CALCUTTA
MIDNAPOR
24 PARGANA
JAMSHEDPUR
RANCHI
HOOGHLY RIVER
JAMUNA RIVER