PLANNING UNIT 4

TEESTA LEFT BANK

4.1 Basic Data

The planning unit is located just north west of the Kurigram South area. It is bounded by the railway line in the eastern and northern direction and the whole southern area is bounded by the Teesta river. This includes the drainage basins of the Bateswari river and the Dorasalu drainage khal and the downstream basin of the Sati river. The planning unit is located under Lalmonirhat district, which consists of all or part of thanas such as Kaliganj, Aditmari, Hatibandha, Patgram and Lalmonirhat Sadar.

Basic data of the planning unit is presented in Table 4.1. The gross are is 94000 ha.

The population in 1981 was 0.55 million. Population densities were below the regional average, but high population densities are found in Gangachara and Lalmonirhat thanas.

4.2 Present Agriculture, Cropping Pattern and Crop Damage

4.2.1 Soils

Agro-ecologically, the area of this unit falls under the north-western, central and eastern part of the Teesta meander flood plain (agro-ecological sub-regions 3a, 3b and 3d). The soils are developed in recent and sub-recent alluvial flood plain sediments deposited by the river Teesta. The topography of the area is gently undulating with broad ridges and shallow basin. The soils are mostly sandy loams to silt loams on ridges and silty clays on basins.

4.2.2 Cropping Patterns

Almost all the land in the planning unit is highland or medium-highland, therefore cropping patterns are generally not constrained by floods.

Overall cropping intensity in the area is 163% (based on 1989 BBS statistics) and irrigation coverage is only 9%. Due to low irrigation coverage, the HYV boro cropped area is relatively small, and the main dry season crop is b. aus. In the aman season, HYV t. aman is far more important than local t. aman.

Cropping patterns by flood phase are shown in Table 4.2.

4.2.3 Crop Damage

Since most land is highland or medium-highland, flooding is not a problem in normal years. Most flooding which occurs is the result of spillage through the Teesta Left Embankment, and possibly localised drainage congestion.

Table 4.1 Planning Unit 4 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
LALMONIRHAT	10	37
KALIGANJ	21	81
GANGACHARA	tr	2
DIMLA	tr	0
HATIBANDHA	21	68
PATGRAM	26	99
KAUNIA	tr	0
ADITMARI	21	100

Gross Area (ha) : 94036
Nca Area (ha) : 82154

Total population (1981) : 552732 Population Density : 5.88
(per ha Gross area)

Flood Phase :

F0 (ha) :	28333	F0 % of NCA (ha) :	34
F1 (ha) :	52338	F1 % of NCA (ha) :	64
F2 (ha) :	1479	F2 % of NCA (ha) :	2
F3 (ha) :	0	F3 % of NCA (ha) :	0
F4 (ha) :	0	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	17	STW 89	1212
DTW 81	25	DTW 89	79
LLP 81	44	LLP 89	79
Irrigation Coverage (%) Yr 81	1	Irrigation Coverage (%) Yr 89	9

TABLE 4.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	28333
F1	52338
TOTAL	80671
F2	1479
F3	0
TOTAL	
F4	0
GTOYAL	82154

IRRIGATION BALANCE	
HYV BORO	9243
WHEAT	0
HYV AUS	
TOTAL	9243

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRIG AREA	TOTAL AREA	% IRRIG
F0	2678	25655	28333	3
F1	5234	47104	52338	10
TOTAL	7912	72759	80671	10
F2	1331	148	1479	90
F3	0	0	0	80
F4			0	
TOTAL	9243	72911	82154	

CROPS ON F0+F1							
RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	7912	B. AUS	34978	HYV TAMA	44804	SUGARCA	297
WHEAT	4978	HYV AUS	2892	L.T. AMAN	25488	ORCHARD	30
POTATO	373	JUTE	7392	VEGETABL	15		
TOBACCO	261	OILSEEED	278	SPICES	190		
PULSES	1632	SPICES	288				
OILSEED	0	VEGETABL	51				
SPICES	288						
VEGETABLES	35						
Sub-Total	15156	Sub-Total	45878	Sub-Total	70307	Sub-Total	327
Total	131668						
CROPPING INTENSITY	163						

CROPS ON F2 LANDS	
HYV BORO	1331
DW AMAN	191
OILSEEDS	563
PULSES	19
L.BORO	73
Total	2104
CROPPING INTENSITY	142

Grand Total	133772
CROPPING INTENSITY	163

In the 1987 flood approximately 30% of the t. aman planted area was fully damaged, while in 1991 the corresponding figure was 4%. Damage tends to be mere severe in Lalmonirhat than in the upstream thanas.

4.3 Fisheries

There are about 13000 ha of water areas in the planning unit producing about 700 tonnes annually. Fisheries is at a critical point - river production is declining and likely to fall further since completion of Teesta Barrage. The World Food Programme is supporting re-excavation of Namuria beel through Food for Works.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	34	450	15
Rivers	10,900	34	370
Flood Plains	1,500	70	105
Total Capture Fish:	12434		490
Fish Ponds:			
- Cultured	195	850	166
- Culturable	206	120	25
- Derelict			
Total Culture Fish:	401		191
Overall Total:	12,835		681

4.4 Infrastructure

4.4.1 Major Infrastructure and Industries

This planning unit has a good road and railway communication net work. Lalmonirhat district town located in this planning area is connected with railway network of western zone. Most of the thanas are connected by roads and railways.

There is a 33 KV sub-station at Lalmonirhat and 33 KV transmission line passes over Kaunia, Lalmonirhat, Aditmari, Kaliganj, Hatibandha and Patgram Thanas.

There are no major industries but a few cigarette factories are situated in this area. Lalmonirhat, the district headquarter and the important commercial centre of northern zone lies within the project area. Important market and business places are Kaunia, Kaliganj, Aditmari and Hatibandha where main commodities marketed are jute, tobacco, paddy, onion etc.

Major infrastructures in the planning unit are highway, railway and feeder roads. Rangpur - Lalmonirhat is the main road which passes along the eastern boundary of the project area.

There is a disused airport at Lalmonirhat.

The Teesta river is not navigable for big country crafts throughout the year as during dry season there is not enough draught and during monsoon the velocity is very high. Small boats ply through the year with difficulty. The existing navigation facilities of the project area around Kaunia will not be affected by the implementation of the Teesta left embankment, since there is no practiced navigation to connect the Teesta and the internal river.

4.4.2 Infrastructure Damage

Damage in 1987 was Tk. 84 lakh and Tk. 71 lakh to BWDB and LGEB infrastructure respectively. For BWDB this was mainly along the Teesta Left Bank.

Damage to R&H roads and bridges during the 1988 flood was estimated at about Tk. 10.5 lac. In the same year it was respectively Tk. 95 lac. In the same year it was respectively Tk. 95 lakh and Tk. 479 lakh for BWDB and LGEB. For BWDB damage occurred both along the Teesta itself, and also inland on the Bateswari river. In the case of LGEB damage occurred in the north of the planning unit, towards the Indian border.

4.5 Special Issues

The Teesta is an important river for both fish and bird species. Environmental monitoring is required.

4.6 Hydrology

The planning unit is bounded on the west by Teesta river which dominates the hydrology of the area. Two minor rivers Shaniajan and Sati drain the planning unit into Teesta near Gaddimari and Kaunia respectively.

At present Teesta river is gauged at Dalia, Doani, Kaliganj and Kaunia for water level and Kaunia Dalia-Doani for discharge. However long time data is available for Kaliganj and Kaunia only. The mean daily maximum WL of Teesta at Kaliganj and Kaunia and discharge at Kaunia are given in Table 3.3 and 3.4, Planning Unit 3.

The rainfall data of Kaliganj for three high rainfall months are given in Table 3.5 as a representative station.

The morphology of the Teesta is discussed under planning unit 3.

4.7 Existing FCD Infrastructure

The planning unit lies within MPO planning areas 2 and 3.

The main FCD infrastructure in the unit is the Teesta left embankment which was built in the mid-1970s, together with the infrastructure for the Sati-Nadi Scheme behind it.

The Sati Nadi project area located behind the Teesta Left Embankment has been suffering from flooding by the Teesta River. The flood embankment about 6.5 km long in the downstream portion has already disappeared due to river bank erosion and hence the downstream part of the area is

affected by the flood of the Teesta river. Six cross bars located in the downstream part along the Teesta Left Embankment were washed away due to the intensive bank erosion of the Teesta river in the 1989-90 & 1990-91 flood. One drainage regulator at Harinchura was completely damaged due to the same reason. Now silt deposition in the channels has also created problems such as shortage of surface water for irrigation as well as decreases of flow capacity of the internal river.

4.8 Flooding and Drainage Problems

Cropping intensities are about average for the region, and there is little broadcast or deepwater aman grown. F2 and F4 land forms about 2% of the total. Therefore there is not a serious and prolonged flooding and drainage problem generally in the unit.

Crop and infrastructure damage occurs as a result of flash flooding from the Teesta, when the embankment is subject to erosion and breaching. There is also some problems due to overland flow from India.

Some flood occurs in the catchment of Sati when Teesta is in high stage and consequently Sati cannot drain out the catchment resulting in stagnation of water in the area.

Main countermeasures in this planning unit would be strengthening the left embankment and improving.

4.9 Options for Development

The main proposals for this unit involve sealing of Teesta Left Bank and rehabilitation of the Sati Nadi Scheme. This was considered as an SRP project but has been dropped. It does not appear that there are feasible solutions within Bangladesh to reducing damage due to overland flow from India.

Flood embankment along the Teesta left bank needs to be constructed, heightened or strengthened, and river training works against the bank erosion are also needed.

To minimize silt deposition in the Sati river which is caused by intrusion of the Teesta flood water therein through the breaches of the Teesta left embankment, it is suggested to construct a retired embankment from Chandimari to Kaunia. Since the bank erosion is severe in this location provision of bank protection works by the concrete blocks placement on the embankment is recommended. There are two options for rehabilitation of the Sati Nadi Scheme and treatment of the outfall of the Sati stream to the Teesta. The one is to keep it open and construct backwater embankment along the Sati stream. The other is to close the outfall of the Sati stream and construct a drainage regulator there.

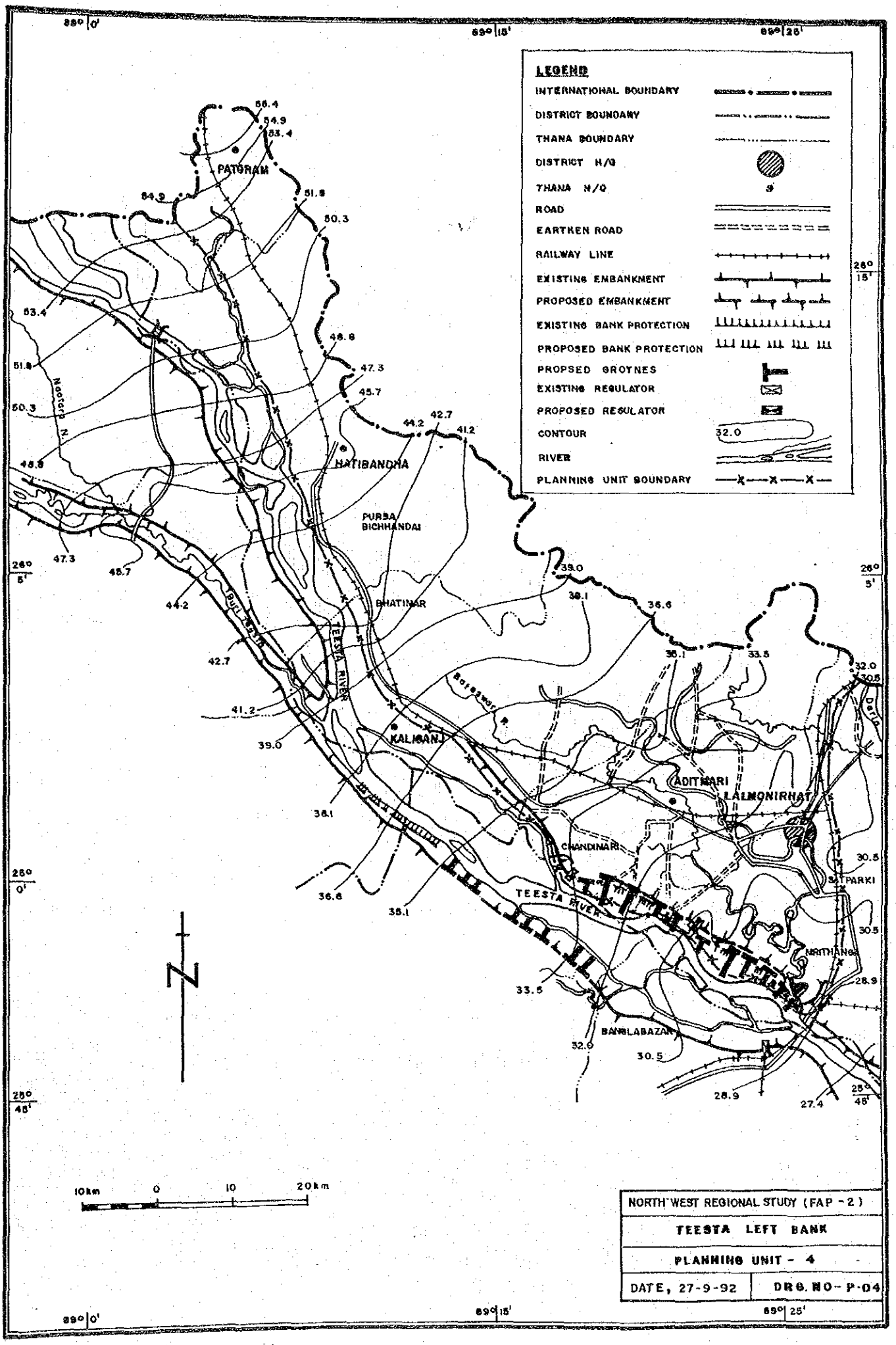
Option 1 : Full CFD with the backwater embankment of the Sati

Main feature of this option is to provide strengthening of Teesta left embankment and backwater embankment along the Sati against the Teesta flood water. Drainage regulators are also proposed for each sub-basin for inland drainage areas of the Sati left and right backwater embankments.

Option 2 : Fill CFD with Sati outfall regulator

Main feature of this option is to provide strengthening of Teesta left embankment and Sati outfall regulator against the Teesta flood water.

Drainage of some areas of the basin comprising the Sati Nadi project area needs improvement. Also the Sati river needs to be re-excavated in order to enable swift drainage and retention of water for surface irrigation purposes.


LEGEND
INTERNATIONAL BOUNDARY
DISTRICT BOUNDARY
THANA BOUNDARY
DISTRICT H/Q
THANA H/Q
ROAD
EARTHEN ROAD
RAILWAY LINE
EXISTING EMBANKMENT
PROPOSED EMBANKMENT
EXISTING BANK PROTECTION
PROPOSED BANK PROTECTION
PROPSED GROYNES
EXISTING REGULATOR
PROPOSED REGULATOR
CONTOUR
RIVER
PLANNING UNIT BOUNDARY
88° 0'
89° 15'
89° 25'
26° 15'
26° 5'
26° 0'
25° 45'
PATGRAM
HATIBANDHA
PURBA BICHHANDAI
BHATINAR
KALIGANJ
ADITMARI
LALMONIRHAT
CHANDMARI
SAPTPARKI
NRITHANGA
BANSLABAZAR
TEESTA RIVER
Nagdara N.
Bulbulia
Boraibari R.
Dorla
10km 0 10 20km
N
NORTH WEST REGIONAL STUDY (FAP - 2)
TEESTA LEFT BANK
PLANNING UNIT - 4
DATE, 27-9-92
DRG. NO - P-04

PLANNING UNIT 5

KURIGRAM

5.1 Basic Data

The planning unit consists of the Kurigram district and Lalmonirhat thana from the Lalmonirhat district. On north of the unit is India, on south the Teesta, on east the Jamuna river and on west the Kaunia-Lalmonirhat railway.

Basic data of the planning unit is presented in Table 5.1. The gross area is 16700 ha.

The population in 1981 was 1.10 million. Population densities in the area are higher than for the region as a whole (except in Razibpur) and are very high along the Teesta (Kaunia) and at the Teesta/Brahmaputra confluence (Chilmari).

5.2 Agriculture

5.2.1 *Soils*

The planning unit lies within MPO planning areas 1, 2 and 3. It is covered by the Teesta Floodplain physiographic unit.

5.2.2 Cropping Patterns

Most of the land in the planning unit is highland or medium land, although 8% of NCA is lowland. Most of the land area is therefore not normally subject to prolonged flooding and cropping patterns are not greatly constrained by floods in normal years.

Overall cropping intensity is 166% (based on BBS 1989 statistics) and irrigation coverage is 18% (1989 AST) data). HYV boro is grown on most of the irrigated land, but non-irrigated b. aus is still important. In the aman season, HYV T. Aman is more important than Local T. Aman.

Cropping patterns for the planning unit are shown in Table 5.1

5.2.3 Crop Damage

Since most land is highland or medium-highland, flooding is not a major problem in normal years. However, since the planning unit is bounded by the Brahmaputra and Teesta, and is in addition cut across by the Dharla and Dudhkumar River, flooding can be serious at high river stages. In the 1987 flood approximately 33% of the t.aman planted area was fully damaged. In 1991 the corresponding figure was 8%.

Most of the damage naturally tends to occur along the Brahmaputra but in 1987 50% of the b.aman in Kurigram thana was damaged.

Table 5.1 Planning Unit 5 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
PIRGACHA	1	4
RAJARHAT	10	100
SUNDARGANJ	2	9
ULIPUR	16	57
NAGESWARI	19	77
KURIGRAM	12	74
FULBARI	10	100
BHURUNGAMARI	14	100
KAUNIA	1	11
CHILMARI	5	85
RAZIBPUR	tr	4
LALMONIRHAT	9	60

Gross Area (ha) : 166612
Nca Area (ha) : 130900

Total population (1981) : 1099125 Population Density : 6.60
(per ha Gross area)

Flood Phase :

F0 (ha) :	38423	F0 % of NCA (ha) :	29
F1 (ha) :	81319	F1 % of NCA (ha) :	62
F2 (ha) :	9597	F2 % of NCA (ha) :	7
F3 (ha) :	1039	F3 % of NCA (ha) :	1
F4 (ha) :	0	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	210	STW 89	4444
DTW 81	88	DTW 89	251
LLP 81	81	LLP 89	127
Irrigation Coverage (%) Yr 81	3	Irrigation Coverage (%) Yr 89	18

TABLE 5.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	38423
F1	81319
TOTAL	119742
F2	9597
F3	1039
TOTAL	
F4	0
GTOYAL	130900

IRRIGATION BALANCE	
HYV BORO	22981
WHEAT	0
HYV AUS	581
TOTAL	23562

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRIG AREA	TOTAL AREA	% IRRIG
F0	2574	35849	38423	7
F1	13011	68308	81319	16
TOTAL	15585	104157	119742	13
F2	7198	2399	9597	75
F3	779	260	1039	75
F4			0	
TOTAL	23562	107338	130900	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	15052	B.AUS	36101	HYV TAMA	66463	SUGARCA	760
WHEAT	11707	HYV AUS	4242	L.T. AMAN	42042	ORCHARD	54
POTATO	1433	JUTE	20454	VEGETABL	23		
TOBACCO	602	OILSEEED	417	SPICES	382		
PULSES	1737	SPICES	579				
OILSEED	848	VEGETABL	76				
SPICES	579						
VEGETABLES	53						
Sub-total	32010	Sub-Total	61869	Sub-Total	108528	Sub-Total	814
Total	203220						
CROPPING INTENSITY	170						

CROPS ON F2 LANDS

HYV BORO	7198
DW AMAN	1947
PULSES	1168
JUTE	2273
Total	12586
CROPPING INTENSITY	131

CROPS ON F3 LAND

HYV BORO	731
LOCAL BORO	308
D.W.AMAN	183
Total	1222
CROPPING INTENSITY	118

Grand Total	217028
CROPPING INTENSITY	166

5.3 Fisheries

There are about 18500 ha of water area in the unit, producing about 2000 tonnes of fish annually. RDRS, BARC, PEP/IDP,Terre des Hemmes and CARE are active in the unit mainly working on fish pond and some beel developments, in association with DOF under the Fisheries Management Policy arrangements.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	2950	450	530
Rivers	5400	34	430
Flood Plains	9500	70	650
Total Capture Fish:	17850		1610
Fish Ponds:	244	950	232
- Cultured	179	450	80
- Culturable	367	160	60
- Derelict			
Total Culture Fish:	790		372
Overall Total:	18640		1982

5.4 Infrastructure

5.4.1 Major Infrastructure and Industry

The main infrastructure in the planning unit are the Kaunia-Kurigram road and railway. There are also district roads from Kurigram to Bhurungamari, and from Kurigram to Ulipur and Chilmari.

There are no major industries in the planning unit.

5.4.2 Infrastructure Damage

In 1987 there was damage to BWDB infrastructure of Tk. 436 lakh, and to LGEB infrastructure of Tk. 86 lakh. For BWDB this was mainly along the Brahmaputra embankment, particularly between the Dharla and Dudhkumar rivers, and also to the Dharla embankments.

In 1988 BWDB recorded damage was Tk. 1423 lakh, while for LGEB it was Tk. 157 lakh. The high cost for BWDB was again due to extensive damage to the main river embankments, particularly along the Dharla near Kurigram. The LGEB damage in 1988 was spread throughout the planning unit.

Damage to R&H roads and bridges during the 1988 flood was estimated at Tk. 125 lakh.

5.5 Special Issues

A feasibility study for FCD works for the whole area was completed in 1969 and implementation of the main river embankment and other works were commenced in 1973. The main works are substantially complete but follow-up studies in both the north and south units have been funded by JICA. A feasibility study for the south unit is on-going in late 1992.

5.6 Hydrology and Morphology

The planning unit is bounded by the Brahmaputra in the east and Teesta river in the west. Dharla and Dudhkumar are two important rivers which drain the rainfall of the planning unit. The catchment of these rivers however extend into Indian territory in the upstream.

Discharge and water level data for representative stations in the planning unit are given in Table 5.3 and 5.4

Rainfall data for Kurigram within the planning unit are given in Table 5.5

Table 5.3 Max Mean Daily Discharges (m^3/s)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Pateswari (Dudhkumar)	2125	6257	NA	NA	1986	6740	NA	NA	1827	4662	NA	NA
Kurigram (Dharla)	2046	4275	2360	2620	1178	6448	7600	4960	1719	3034	1730	2990

Table 5.4 Max Mean Daily Water Levels (m PWD)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Pateswari (Dudhkumar)	29.64	30.20	29.50	29.94	29.50	30.48	30.31	30.68	29.23	30.59	29.40	30.50
Kurigram (Dharla)	26.39	26.92	NA	26.68	26.06	27.04	NA	27.35	25.89	26.89	NA	26.64

Table 5.5 Rainfall (mm/month)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Kurigram	533	911	870	686	252	628	607	702	350	644	312	333

5.7 Existing FCD Development

Existing FCD development in the planning unit consists of Kurigram Town protection and Kurigram North and South units. All these are covered by on-going projects and are discussed below in Section 5.9, options for development.

5.8 Flooding and Drainage Problems

Cropping intensities are about average for the region. During the kharif season the main crop grown is transplanted rather than deepwater or broadcast aman, so that prolonged and deep flooding is not generally a serious problem throughout the planning unit. However, statistics shows that 8% of the unit is F2-F4 land, which is higher than for other units within the upper reaches. The area is also suffering from drainage congestion due to long-lasting high river-stages and insufficient carrying capacities of drainage channel. Problems from erosion, breaches and spills from the major rivers are also a major problem. Erosion is a particular problem round Kurigram town itself.

This unit is included in the eastward basins of the Teesta. Basic flooding characteristics are the same with the others in the eastward basins of the Teesta. But the difference of this unit from other unit in the basins eastward of the Teesta is that this unit is influenced by the long-lasting high flow of the Brahmaputra, and hence the backwater in the Dudhkumar, Dharla and Teesta. In addition this unit is suffering from serious erosion on the right bank of the Dharla and Brahmaputra, and the left bank of Teesta. Erosion is the main reason of breaches of flood embankment.

5.9 Development Options

The north unit is located just upstream of the confluence of the Brahmaputra and Dharla. The south unit is located just upstream of the confluence of the Brahmaputra and Teesta. Accordingly flood protection schemes in this planning unit will not cause any adverse effect to other areas in terms of flood discharge or river stage. Therefore full controlled flooding and drainage development can be applied to this planning unit.

Kurigram North Unit

A feasibility study for the North Unit was commissioned by JICA and the report was completed in October 1990. This report is awaiting implementation. The proposed development covers a gross area of 42,800 ha and a cultivable area of 35,100 ha. The project aims to increase productivity by improving drainage but, in particular, increasing irrigation. It also includes road network improvement and agricultural storage and support services strengthening. Approximately 80 % of the main river embankment in the north unit area is already completed. The 1990 report proposed completion of the remainder, together with necessary repairs to the existing embankment, and drainage pumping at the tail section. Irrigation water is to be supplied mainly from the Dudhkumar (the Dharla being committed for Kurigram South Unit). Two pump stations are proposed, of capacity 42 and 5 m3/s, the downstream one being reversible. Forecast cropping patterns are based largely on boro, and t.aus/aman. Increased rice production is forecast at 45,360 t.

Kurigram South Unit

In 1991, a feasibility study for the South Unit was started by JICA independently and is scheduled to be completed in 1993. Most of the basic FCD facilities were completed during 1973-1984 based on the study conducted in 1969/71, and the existing flood embankment is functioning, though some rehabilitation works are required. proposes some alternatives on flood control component, drainage improvement component and irrigation development component.

The basic concepts on which flood planning is based are

- only rehabilitation works of the existing FCD facilities are mainly considered, because the large scale river protection works are not economically feasible;

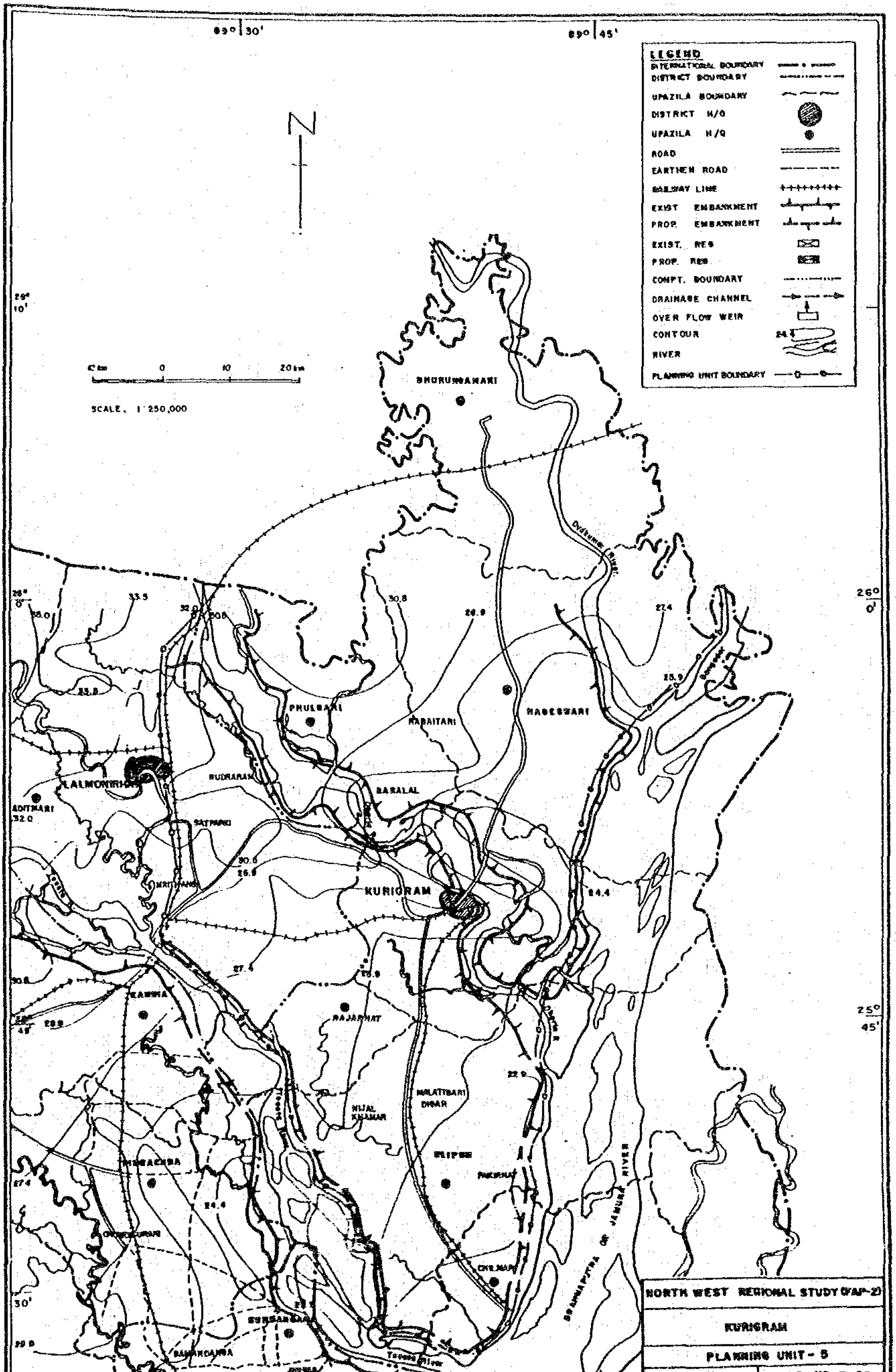
- drainage congestion should be improved as much as possible to the extent that the investment can be justifiable.

The study has been making extensive use of the findings of FAP12 and other FAP supporting studies and its conclusions are expected to be broadly in line with FAP philosophy.

Kurigram Town Protection

Other than the above, Kurigram town is covered by the Secondary Towns Integrated Flood Protection by FAP-9A. Draft Final Report of FAP-9A was issued in February 1992. According to the report, the following works are proposed as FCD components:

- construction of some 1,000 m of bank revetment works;
- construction of two new groynes;
- extension and rehabilitation of the existing groyne;
- localised repairs to the flood embankment;
- rehabilitation, enlargement and extension of the surface water drainage system .



LEGEND
INTERNATIONAL BOUNDARY
DISTRICT BOUNDARY
UPAZILA BOUNDARY
DISTRICT H/Q
UPAZILA H/Q
ROAD
EARTHEN ROAD
RAILWAY LINE
EXIST EMBANKMENT
PROP. EMBANKMENT
EXIST. RES
PROP. RES
COMPT. BOUNDARY
DRAINAGE CHANNEL
OVER FLOW WEIR
CONTOUR
RIVER
PLANNING UNIT BOUNDARY
SCALE, 1:250,000
BHURUNGAMARI
PHULBARI
NAGESWARI
LALMONIRHAT
KURIGRAM
RAJARHAT
ULIPUR
CHILMARI
KAUNIA
SUNDARGANJ
Brahmaputra or Jamuna River
NORTH WEST REGIONAL STUDY (FAP-2)
KURIGRAM
PLANNING UNIT - 5
DATE, 9-8-92
DRG. NO, P-03

PLANNING UNIT 6

UPPER KARATOYA BASIN

6.1 Basic Data

The planning unit consists of most of Nilphamari and Rangpur districts and a part of the Gaibandha district. On the north of the unit is India; on east, the Alai, the Ghaghot and the Buri Teesta river; on south the Katakhali river and the Gobindganj-Deogaon-Hilli road; on west the Parbatipur-Saidpur railway.

Basic data of the planning unit is presented in Table 6.1. The gross area is 380000 ha.

The population in 1981 was 2.58 million. Population densities are slightly above the average for the region as a whole. They are highest in the partly urbanized thanas of Rangpur and Saidpur, and lowest in the more isolated thanas in the middle of the unit.

6.2 Agriculture

6.2.1 Soils

The planning unit is covered by the Teesta flood plain physiographic unit with a small part of the Barind tract in the south-east.

6.2.2 Cropping Patterns

Almost all the land in the planning unit is highland or medium-highland, and therefore cropping patterns are generally not constrained by floods.

Overall cropping intensity is 155% (based on 1989 BBS statistics) and irrigation coverage is 19% HYV boro is grown on most of the irrigated land. The other main dry season foodgrain crops are b. aus and wheat. Jute is quite widespread and locally important crops are tobacco, potato and sugarcane. In the aman season HYV t. aman is more important than local t.aman.

Cropping patterns for the planning unit are shown in Table 6.2.

6.2.3 Crop Damage

Since most land is highland or medium-highland, major flood damage is not expected in normal years. In the 1987 floods 28% of the planted area of aman crops was fully damaged, and in 1991 the corresponding figure was 12%. Most of this flooding resulted from spillage from the Karatoya River and some drainage congestion. Spillage from the Karatoya is partly due to spillage from the Teesta entering the Karatoya River upstream.

The thanas which are most seriously affected are those at the downstream end, such as Gobindaganj and Palashbari.

Table 6.1 Planning Unit 6 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
PIRGACHA	tr	0
PALASHBARI	5	100
NILPHAMARI	6	57
PIRGANJ	11	100
SADULLAPUR	4	72
FULCHHARI	tr	5
BADARGANJ	8	100
DIMLA	tr	1
MITHAPUKUR	13	100
GANGACHARA	tr	8
TARAGANJ	4	100
GOBINDHAGANJ	4	31
DOMAR	4	62
HAKIMPUR	1	46
KISHOREGANJ	3	51
PARBATIPUR	5	42
SUNDARGANJ	tr	0
NOWABGANJ	9	100
SAGHATTA	1	20
FULBARI	tr	4
RANGPUR	4	46
GAIBANDHA	4	41
JALDHAKA	5	64
GHORAGHAT	3	86
SAIDPUR	3	81
BIRAMPUR	2	38

Gross Area (ha) : 379803
Nca Area (ha) : 345452

Total population (1981) : 2578777 Population Density : 6.79
(per ha Gross area)

Flood Phase :

F0 (ha) :	132718	F0 % of NCA (ha) :	38
F1 (ha) :	199774	F1 % of NCA (ha) :	58
F2 (ha) :	8943	F2 % of NCA (ha) :	3
F3 (ha) :	3744	F3 % of NCA (ha) :	1
F4 (ha) :	277	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	423	STW 89	9176
DTW 81	559	DTW 89	1280
LLP 81	419	LLP 89	402
Irrigation Coverage (%) Yr 81	5	Irrigation Coverage (%) Yr 89	19

TABLE 6.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	132718
F1	199774
TOTAL	332492
F2	8943
F3	3744
TOTAL	
F4	277
GTOYAL	345452

IRRIGATION BALANCE	
HYV BORO	68236
WHEAT	0
HYV AUS	0
TOTAL	68236

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRIG AREA	TOTAL AREA	% IRRIG
F0	19630	113088	132718	15
F1	39955	159819	199774	25
TOTAL	59585	272907	332492	18
F2	5813	3130	8943	60
F3	2838	906	3744	75
F4			277	
TOTAL	68236	277216	345452	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	59585	B. AUS	64402	HYV TAMA	144337	SUGARCA	9310
WHEAT	36176	HYV AUS	12338	L.T. AMAN	119780	ORCHARD	259
POTATO	9391	JUTE	32645	VEGETABL	396		
TOBACCO	8788	OILSEEED	109	SPICES	2441		
PULSES	12092	SPICES	3698				
OILSEED	2204	VEGETABL	566				
SPICES	3698						
VEGETABLES	396						
Sub-Total	132331	Sub-Total	113757	Sub-Total	264513	Sub-Total	9569
Total	520169						
CROPPING INTENSITY	156						

CROPS ON F2 LANDS

HYV BORO	5813
DW AMAN	1212
PULSES	1344
JUTE	3265
L.BORO	0
Total	11633
CROPPING INTENSITY	130

CROPS ON F3 LAND

HYV BORO	2838
LOCAL BORO	559
D.W.AMAN	1057
PULSES	0
Total	4454
CROPPING INTENSITY	119

Grand Total	536257
CROPPING INTENSITY	155

6.3 Fisheries

There are about 16500 ha of water area in the planning unit, yielding 4000 tonnes annually. There is said to be an acute shortage of fingerlings in the area, which can absorb up to 300 million. The large ODA funded Parbatipur Fisheries Project is located in this planning unit and will greatly ease the shortfall. BRAC is supporting a paddy/fish culture pilot project. Several other NGOs support fishing groups

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	2200	450	990
Rivers	2050	70	143
Flood Plains	8900	65	578
Total Capture Fish:	13150	-	1711
Fish Ponds:			
- Cultured	2007	950	1907
- Culturable	598	450	269
- Derelict	679	120	81
Total Culture Fish:	3284	-	2257
Overall Total:	16434	-	3968

6.4 Infrastructure

6.4.1 Major Infrastructure and Industries

The main roads in the unit are the Bogra - Rangpur highway, the Palashbari-Gaibandha road, the Gobindaganj - Dinajpur road and the Rangpur - Dinajpur road.

The area has two railway links i.e. Iswardi - Parbatipur and Dinajpur - Rangpur line.

Tobacco is an important crop in the planning unit, and there are many tobacco factories.

6.4.2 Flood Damage to Infrastructure

In 1987 damage was estimated at Tk. 99 lakh and Tk. 168 lakh to BWDB and LGEB infrastructure respectively. For BWDB this was mainly located round Badarganj and also in the area between Palashbari and Gaibandha.

In 1988 BWDB infrastructure was damaged to the tune of Tk. 148 lakh. This was again round Badarganj, along the Ghagot and as the downstream end of the Karatoya near Gobindaganj. Damage to LGEB infrastructure was estimated at Tk. 616 lakh, mainly located round Nilphamari, Badarganj and Gobindaganj.

The 1988 floods caused an estimated Tk. 1976 lakh damage to R&H roads and bridges.

6.5 Special Issues

The planning unit is mostly within the area of the Teesta barrage project. Proposals therefore for flooding and drainage within the planning unit must be integrated with these for the Teesta Irrigation Project. This is discussed further in Section 6.7.

The area between the Bogra-Rangpur road and the Ghaghot includes an extensive area of beels which are an important location for minor fish species. Any proposed interventions must take this into account.

6.6 Hydrology and Morphology

Karatoya, Jamuneswari, Chikli, Ghagot are the major rivers in the planning unit.

Hydrological and rainfall data are given in Table 6.3 to 6.5.

Table 6.3 Max Mean Daily Discharges (m^3/s)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Barahata (Jamuneswari)	256	930	NA	NA	144	579	NA	NA	152	613	NA	NA
Nijbari (Chikli)	120	263	NA	NA	108	186	NA	NA	110	548	NA	NA

Table 6.4 Max Mean Daily Water Levels (m PWD)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Badaiganj (Karatoya)	31.52	33.04	32.56	30.52	31.02	32.67	32.75	32.88	30.70	31.90	30.65	31.39
Nijbari (Chikli)	36.71	37.54	-	35.75	36.20	37.60	-	37.65	36.13	37.07	-	36.54

Table 6.5 Rainfall (mm/month)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Mithapukur	499	1119	1290	540	285	767	524	697	306	896	453	287
Badarganj	461	869	997	359	280	600	760	537	351	602	638	389
Bagdogra	477	671	612	367	278	647	627	705	281	595	238	218

The river Karatoya originates in Dinajpur, the Jamuneswari and Chikli river are the tributaries. The catchment of these rivers are mostly within Bangladesh. The Karatoya river was originally flowing close to Bogra town. In 1940 a closure was built to protect Bogra town from flooding and subsequently a man made canal was excavated to connect Karatoya river with Alai river near Mohimagonj, the man made canal is known as Katakhali river. From Mohimagonj the river is known as Bangali river which ultimately falls in Hurasagar river. The Karatoya is a meander river but with a very steep slope at the upstream section. The average bed slope at the upstream is about 0.0003. The bed width of the Karatoya at Badarganj is about 100 m and depth of flow at this reach is about 7.0 m. The river Karatoya has comparatively mild slope from Nawabgonj to Mohimagonj which is about 0.000134. The average bed width of Karatoya is about 200 m to 300 m and the flow depth is about 5.0 m to 6.0 m. However near Katakhali bridge (man made Khal) the river attains a depth of 14 m, it may be mentioned that at the bridge site two spur dykes were built for controlling the river. It is also reported that the Upper Karatoya river is eroding its bank at Badarganj. However, there is no other important town or structure which are presently under threat. The river receives flood flows through spillage from the river Teesta during high flood; sediment movement also takes place causing some changes in morphologic characteristics.

6.7 Existing FCD Infrastructure

The planning unit is mainly within MPO planning areas 4 and 5.

Teesta Project

The Teesta Project was originally identified in 1940 and was the subject of detailed feasibility studies during the 1960s. Construction of the Teesta Right Embankment then took place, followed by the construction of the barrage on the Teesta, which was completed in 1990. Construction of the main and distribution system for the upper part of the project area is now under way and is scheduled for completion by 1995.

It is currently estimated that the irrigable area of the project is about 315000 ha with a first phase of about 182000 ha. It is primarily intended to increase agricultural production through the supply of supplementary irrigation water during the monsoon. However, it will also have a beneficial effect on flooding and drainage in the region, through the protection provided by the distribution and drainage disposal network. The drainage system is currently being modelled at SWMC. 7 existing river systems are proposed for drainage of the Teesta project, as follows:

- Buri-Teesta system
- Ghagot system
- Karatoya-Bangali system
- Kharkharia system
- Tulshiganga system
- Nagor system
- Old Karatoya system

The most important link between the project and the Regional Water Plan would be through the Interceptor Drain, if it were to be constructed. The proposed Interceptor alignments cut the Teesta main canals and distribution system. This not only requires that crossing structures be provided, but also raises the possibility that the drain could be used as a source of additional supplementary water

during the dry season. However, this could only be done by abstracting water from rivers such as the Atrai which are already short of water at this time, and thus depriving downstream users of customary rights to the water. It is thus unlikely that this could be seen as a major benefit for the Interceptor.

An additional linkage between the Teesta project and the NWRS is through the proposals for strengthening and rehabilitating the Teesta embankment upstream of Kaunia under planning unit 3. This will provide protection for part of the Teesta project area.

Karatoya FCD Project

Karatoya Flood Control Project is an on-going project of EIP situated on the left bank of the Karatoya river. The gross area of the project is about 10,400 ha.

Embankments are planned along Karatoya from Katakhali bridge on Bogra road to Ghoraghat and along Akhira river left bank of Akhira river from Ghoraghat to Ekbarpur. For drainage improvement a number of sluices are planned. The scheme also provide irrigation inlet for agriculture. The Akhira river will be re-excavated under desilting program.

6.8 Flooding and Drainage Problems

The GIS statistics presented in Table 6.1 shows that there is effectively no F2-F4 land within the planning unit. This would indicate that there are few areas where prolonged and deep flooding regularly occurs.

Cropping intensities are around 150%, so that some increase may be possible, but the proportions of transplanted aman grown are also high, so that flooding may not be an important constraint to production.

Infrastructure damage in 1987 and 1988 appears to be fairly widely distributed throughout the planning unit. Significant damage was found near Badarganj, reportedly caused by flows in the Chikli river. Serious flooding occurred during September 1991 when a cut was made on the right bank of the Upper Karatoya at its downstream end to relieve problems upstream. In general infrastructure and crop damage has been relatively severe in the downstream reaches of the Upper Karatoya.

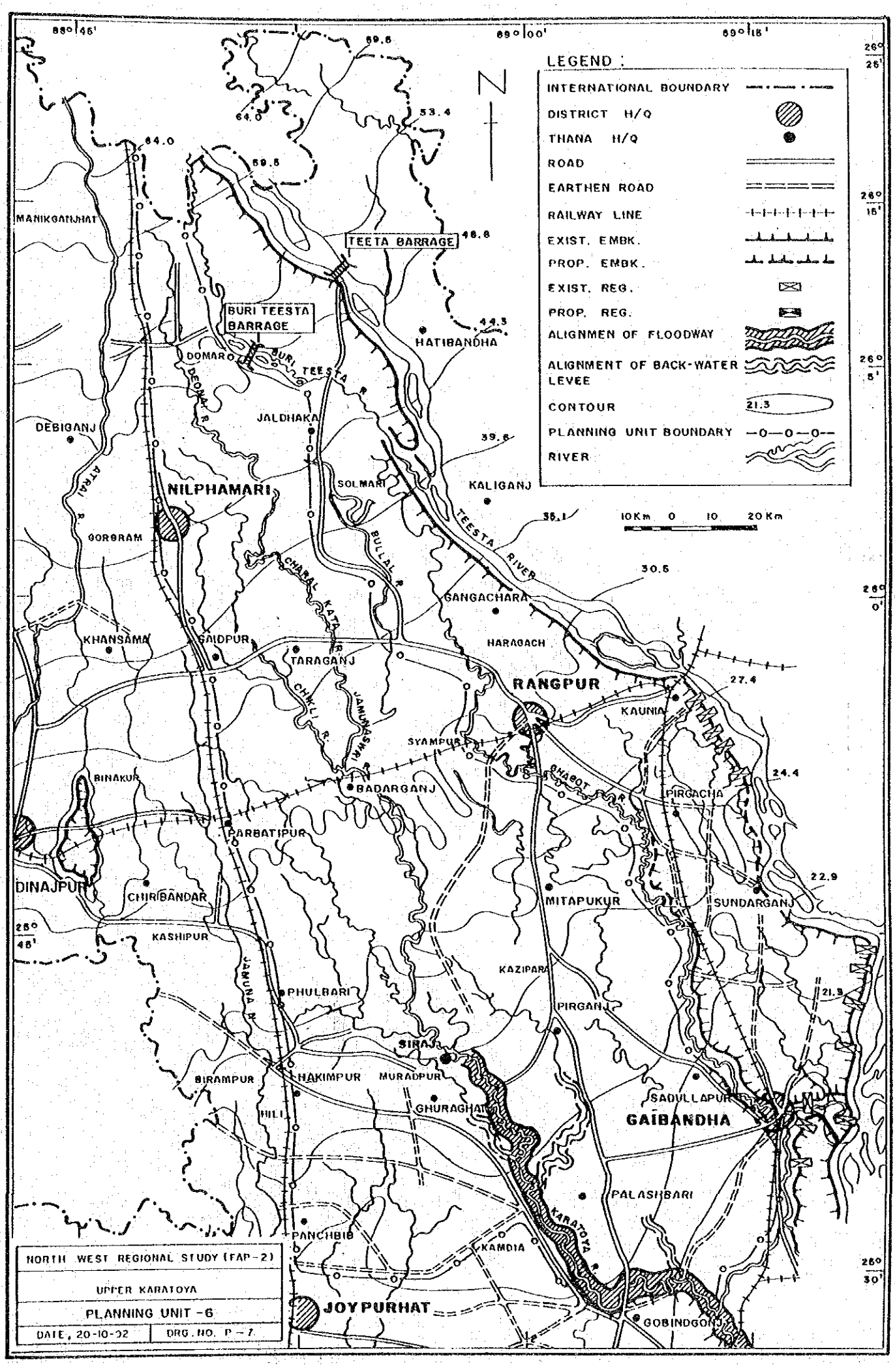
A comparison of NAM-generated discharges and conveyance capacity for the Upper Karatoya confirms that upstream of Siraj, conveyance capacities are generally sufficient. Downstream this is not the case and some flooding may occur, particularly just upstream of the Katakhali.

6.9 Options for Development

The main rivers in this planning unit are the Karatoya, Jamuneswari, and Chikli. The Jamuneswari, and Chikli are tributaries of the Karatoya. The catchment of the rivers in the planning unit lies mostly within Bangladesh. However, spillages from the Teesta river in India flow overland and augment the river discharges. It is assumed that this augmentation will continue as at present.

The flooding in this planning unit is quite extensive in terms of crop damage and human discomfort, especially when augmented by Teesta flows. However, CFD responses would increase downstream discharges. Consideration was given to providing off-stream flood retention in the upstream reaches but this was found to be impractical and not considered further. Increased downstream discharges should be drained directly to the Jamuna through the shortened interceptor known as the "Bangali Floodway" if the principle of avoiding increased downstream disbenefits is to be adhered to. Thus the main option under consideration for this unit is full CFD of Upper Karatoya and Alai, with the Bangali floodway. CFD developments along the Upper Karatoya would also reduce flood damage due to overland flow on its right bank.

Some developments along the Karatoya are under implementation by EIP through the Upper Karatoya project.


LEGEND :
INTERNATIONAL BOUNDARY
DISTRICT H/Q
THANA H/Q
ROAD
EARTHEN ROAD
RAILWAY LINE
EXIST. EMBK.
PROP. EMBK.
EXIST. REG.
PROP. REG.
ALIGNMEN OF FLOODWAY
ALIGNMENT OF BACK-WATER LEVEE
CONTOUR
PLANNING UNIT BOUNDARY
RIVER
10Km 0 10 20 Km
TEETA BARRAGE
BURI TEESTA BARRAGE
MANIKGANJHAT
DEBIGANJ
NILPHAMARI
KHANSAMA
SAIDPUR
DINAJPUR
BIRAMPUR
PARBATIPUR
BINAKUR
CHIRIBANDAR
KASHIPUR
PHULBARI
HILI
PANCHBIB
JOYPURHAT
HAKIMPUR
MURADPUR
SIRAJ
GHURAGHAT
KAMDIA
DOMARO
JALDHAKA
SOLMARI
GORGRAM
TARAGANJ
BADARGANJ
SYAMPUR
HATIBANDHA
KALIGANJ
GANGACHARA
HARAGACH
RANGPUR
KAUNIA
PIRGACHA
MITAPUKUR
SUNDARGANJ
KAZIPARA
PIRGANJ
SADULLAPUR
GAIBANDHA
PALASHBARI
GOBINDGONJ
DEORAI R.
ATRAI R.
BURI TEESTA R.
BULLAI R.
CHARAL KATA R.
CHIKLI R.
JAMUNASHRI
JAMUNA R.
TEESTA RIVER
GHAGOT R.
KARATOYA
88°46'
89°00'
89°18'
26°26'
26°18'
26°8'
26°0'
25°48'
26°30'
59.6
64.0
53.4
64.0
59.6
46.6
44.5
39.6
35.1
30.5
27.4
24.4
22.9
21.3
NORTH WEST REGIONAL STUDY (FAP-21)
UPPER KARATOYA
PLANNING UNIT -6
DATE, 20-10-92
DRG. NO. P-7

PLANNING UNIT 7

GAIBANDHA

Planning Unit 7 is fully described in the Gaibandha Improvement Project main report, Volume 5 .

PLANNING UNIT 8

MIDDLE BANGALI BASIN

8.1 Basic Data

The planning unit is bordered by the Katakhali - Alai Nadi to the north whilst the west is identified by the Rangpur Bogra - Nagarbari highway from Gobindaganj to Kumajpur via Shibganj including the catchment area of the old Karatoya river basin. The unit is bounded by the BRE along the eastern side from Gaibandha to Sirajganj including Sonail embankment scheme and also by the road from Serajgonj to Bogra Nagarbari highway along the southern direction that includes Ichamoti river basin.

Basic data of the planning unit is presented in Table 1.1. The gross area is 225,000 ha.

In 1981 the population was 1.74 million. Population densities are significantly above the regional average and tend to be higher adjacent to the Brahmaputra river than elsewhere.

8.2 Agriculture

8.2.1 Soils

The planning unit lies in the Teesta and Karatoya/Bangali floodplains.

These are meander floodplains which when in flood deposit materials to such a height that the banks break spilling water onto adjacent land. Because of the meander they erode the outside banks of bends resulting in curved ridges, saucer-shaped basins and abandoned channels.

The Teesta Floodplain is composed of mixed silt and clay deposit and floods deeply in severe conditions.

The Karatoya/Bangali on the other hand is a complex geomorphological structure of silts on the ridges and clays in the basins. In severe conditions these basins hold large amounts of floodwater.

8.2.2 Cropping Patterns

Over 80% of the land area is highland or medium-highland, and 18% lowland. The cropping pattern, particularly in the southern part of the planning unit is therefore constrained by floods.

Overall cropping intensity is 158%, based on 1989 BBS statistics, and irrigation coverage is relatively high at 38% of NCA. Most of this irrigated area is used to grow HYV boro, which is by far the main dry season crop. In the aman season, HYV t. aman is far more important than local t. aman.

Cropping patterns for the area are shown in Table 8.1

Table 8.1 Planning Unit 8 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
FULCHHARI	3	19
KAZIPUR	13	78
SHIBGANJ	4	32
RAIGANJ	4	38
KAMARKANDA	1	14
GOBINDHAGANJ	8	37
SARIAKANDI	9	50
SIRAJGANJ	8	60
SONATALA	6	95
SAGHATTA	7	65
ULLAPARA	tr	0
SHERPUR	5	40
BOGRA	10	56
DHUNAT	11	100
GAIBANDHA	tr	1
GABTALI	11	100

Gross Area (ha) : 225431
Nca Area (ha) : 191642

Total population (1981) : 1736323 Population Density : 7.70
(per ha Gross area)

Flood Phase :

F0 (ha) :	66798	F0 % of NCA (ha) :	35
F1 (ha) :	89116	F1 % of NCA (ha) :	47
F2 (ha) :	27376	F2 % of NCA (ha) :	14
F3 (ha) :	8341	F3 % of NCA (ha) :	4
F4 (ha) :	9	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	2134	STW 89	14095
DTW 81	243	DTW 89	656
LLP 81	419	LLP 89	351
Irrigation Coverage (%) Yr 81	9	Irrigation Coverage (%) Yr 89	38

TABLE 8.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	66798
F1	89116
TOTAL	155914
F2	27376
F3	8341
TOTAL	
F4	9
GTOYAL	191642

IRRIGATION BALANCE	
HYV BORO	80920
WHEAT	0
HYV AUS	0
TOTAL	80920

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRIG AREA	TOTAL AREA	% IRRIG
F0	14982	51816	66798	22
F1	40102	49014	89116	45
TOTAL	55084	100830	155914	35
F2	19163	8213	27376	70
F3	6673	1668	8341	80
F4			9	
TOTAL	80920	110722	191642	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	55084	B. AUS	27562	HYV TAMA	80224	SUGARCA	2992
WHEAT	18972	HYV AUS	2294	L.T. AMAN	38421	ORCHARD	140
POTATO	3192	JUTE	13529	VEGETABL	67		
TOBACCO	3192	OILSEEED	1508	SPICES	2899		
PULSES	3644	SPICES	4392				
OILSEED	0	VEGETABL	224				
SPICES	4392						
VEGETABLES	157						
Sub-Total	88633	Sub-Total	49509	Sub-Total	118712	Sub-Total	3132
Total	259986						
CROPPING INTENSITY	167						

CROPS ON F2 LANDS

HYV BORO	19163
DW AMAN	2936
OILSEED	3061
PULSES	3644
JUTE	5798
L.BORO	0
Total	34602
CROPPING INTENSITY	126

CROPS ON F3 LAND

HYV BORO	6673
LOCAL BORO	1083
D.W.AMAN	1252
PULSES	0
Total	9008
CROPPING INTENSITY	108

Gand-Total	303596
CROPPING INTENSITY	158

8.2.3 Crop Damage

Since the majority of land is highland or medium-highland, crop damage would be expected to be relatively low in normal years. However, the impact of flood waters through breaches in the BRE is serious in this area. Crop damage is therefore serious in high flood years and is about evenly distributed through the planning unit, depending on where breaches occur in a particular year.

In the 1987 flood 47% of the planted area of aman crops was fully damaged, and in 1991 the corresponding figure was 26%.

8.3 Fisheries

There are about 27000 ha of water bodies in the planning unit, yield about 2000 tonnes annually However, this was a difficult area in which to obtain reliable data and FAP2 estimates based on field inquiries have had to be used in cases. The Grameen Bank is supporting nearly 100 fishing groups in fish culture activities.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	1180	450	530
Rivers	13250	40	530
Flood Plains	10000	70	700
Total Capture Fish:	24430		1760
Fish Ponds:	1105	850	939
- Cultured	1565	180	282
- Culturable			
- Derelict			
Total Culture Fish:	2670		1221
Overall Total:	27100		2981

8.4 Infrastructure

8.4.1 Major Infrastructure and Industries

There are a number of important roads situated in the area. The main one is the national highway, Nagarbari-Bogra-Rangpur. There are also important national roads, including the Sirajganj and the Bogra-Sariakandi road.

Apart from above roads Fulchari - Bogra railway line is situated in this area.

The area has large number of handloom cottage industries which creates employment opportunity to the poor people of the area.

There is a sugar mill at Mohimaganj, in the north of the planning unit.

8.4.2 Infrastructure Damage

In 1987 damage to LGEB infrastructure was estimated at Tk. 56 lakh, while there was no record of damage to BWDB infrastructure.

In 1988 damage to BWDB infrastructure was Tk. 8426 lakh. In the case of BWDB this damage was located along the BRE, particularly in the north between Manos and Shaghata and in the south between Kazipur and Sirajganj. Damage also occurred along the Nuruller Beel embankment, on the right bank of the Katakhali. The damaged LGEB infrastructure tended to be in the north of the planning unit, including Gobindaganj, Shaghata, Bogra and Gabtola.

Infrastructure damage in this planning unit during the 1988 flood was greater than in any other part of the region. Most of this damage was to the Bogra-Rangpur highway: a total of Tk. 1613.3 lakh of damage was due to R&H roads and bridges, of which over Tk. 1,000 lakh was damage to bridges.

8.5 Special Issues

Within this planning unit there are important remnants of Jamuna flood plain wet lands and associated flora and fauna. There are also major sites of char and embankment dwellers.

8.6 Hydrology

Karatoya-Bangali is the principal river in the planning unit. The unit bears the scars of a large number of abandoned courses of the principal river system. Karatoya river (main course) originally used to flow past Bogra town, but its course was diverted through a manmade canal, Katakhali from char Rahimpur to Alai Nadi in the upstream of Mohimaganj RB. The combined flow is known as Bangali river.

The lower part of the river is completely separated from the original river and flows as a small channel past Bogra town. This channel joins Bangali river at Char Shodi. Gazaria, Ichamoti river is an important channel which drain rainfall runoff of eastern Bogra and overspill of lower Karatoya into Bangali. The rivers in the eastern side of Bangali eg. old Bangali, Old Karatoya convey rainfall runoff as well as Jamuna overspill to it . But since the construction of BRE they convey the overspill of the Jamuna through the breaches only.

The gaugings of the streams in the planning unit are thus influenced by the condition of BRE. Thus 1:20 yr flow is found to be 3 to 4 times more than 1:2 yr flow in the lower reaches while it is about 2 times in the upper reach.

Discharge and water level data for representative stations on the Bangali in the planning unit for the high rainfall months are given in Tables 8.3 and 8.4

Rainfall data for Bogra within the planning unit is given in Table 8.5

Table 8.3 Max Mean Daily Discharges - Bangali (m^3/s)

Station	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Mohimaganj	443	978	645	525	450	958	662	1150	420	940	438	1100
Khanpur	621	880	715	795	587	1335	1020	1160	570	1487	803	1250
Ullapara	516	1625	729	1250	607	2483	1180	1520	705	2078	1080	1620

Table 8.4 Max Mean Daily Water Levels (m PWD)

Station	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Mohimaganj	18.33	19.28	19.34	19.73	18.08	19.29	19.34	19.74	17.90	18.98	18.15	19.66
Khanpur	13.65	15.50	14.87	15.94	13.32	15.34	14.87	15.63	12.89	15.39	13.93	15.94
Ullapara	11.09	12.72	12.18	13.17	11.07	12.58	12.18	12.89	10.69	12.46	11.44	13.17

Table 8.5 Bogra Rainfall (mm/month)

	July	August	September
1:2	296	232	180
1:20	583	570	538
1987	582	734	215
1988	578	273	279

8.7 Existing FCD Infrastructure

The planning unit lies within MPO planning areas 5 & 6.

The major FCD infrastructure in the planning unit is the Brahmaputra Right Embankment (BRE).

Two other existing FCD schemes in the unit are the Sonail Embankment Scheme (SES) and the Nuruller Beel Scheme (NBS).

Sonail Embankment Scheme

The project area is situated south east of Gaibandha Town and is located within the Gaibandha and Fulchari thanas of Gaibandha district. It is bordered to the north by the river Ghagot and to the east by the BRE. The southern border is bounded by the metal road connected between Alai bridge and

BRE. The western border is formed by the Alai river which was originally called the Mara Ghagot river. The project area which covers a total area of 5,700 hectares was designed by EIP and is the responsibility of Gaibandha O & M Division, BWDB.

During last year is flood (1991), the Sonail embankment was cut by the people living outside the project for quick drainage of accumulated runoff water from upstream and from spill from the Alai river. Hence, the embankment is now completely ineffective in the southern part of the project area.

Nuruller Beel Scheme

The project area which covers a total of 16,600 hectares is located south of Gaibandha Town and north of Bogra Town and comprises two thanas, Gobindaganj and Shibganj under Gaibandha and Bogra districts respectively. The main part of the project is an embankment of length 30.7 km along the Katakhali river from Sahebganj to Mohimaganj. About 3.7 km is new embankment and the remaining part resectioning of an existing road/embankment system. To provide adequate drainage facilities, four regulators and flushing sluice and five outlet were proposed and scheduled to be completed by 1992-93.

Compartmentalization Pilot Project (FAP-20)

A pilot area for the Compartmentalization Pilot Project (FAP-20) is to be located in the south-east of the project area, west of Sirajganj.

8.8 Flooding and Drainage Problems

Analysis of available statistics indicates that cropping intensities are reasonably high at 158% and that transplanted aman is widely grown. Only 18% of the land is F2-F4, so that the problem of deep and prolonged flooding is not widespread. In the upper part of the unit there are problems are caused by the Bogra-Gaibandha railway line which in effect forms a compartment preventing good drainage to the south through the Gazaria/Ichamoti river.

In the middle and lower parts of the planning unit the flooding problems become more acute. Not only is there spillage from the rivers Bangali and Karatoya but large breaches occurred in the River Brahmaputra. One breach at Mathurapara in 1991 was four miles long, bringing large discharges into the area. This also potentially alters the morphological conditions in the smaller rivers in the unit with large deposits of silt and sediment, thus exacerbating the problem further.

8.9 Planning Concepts

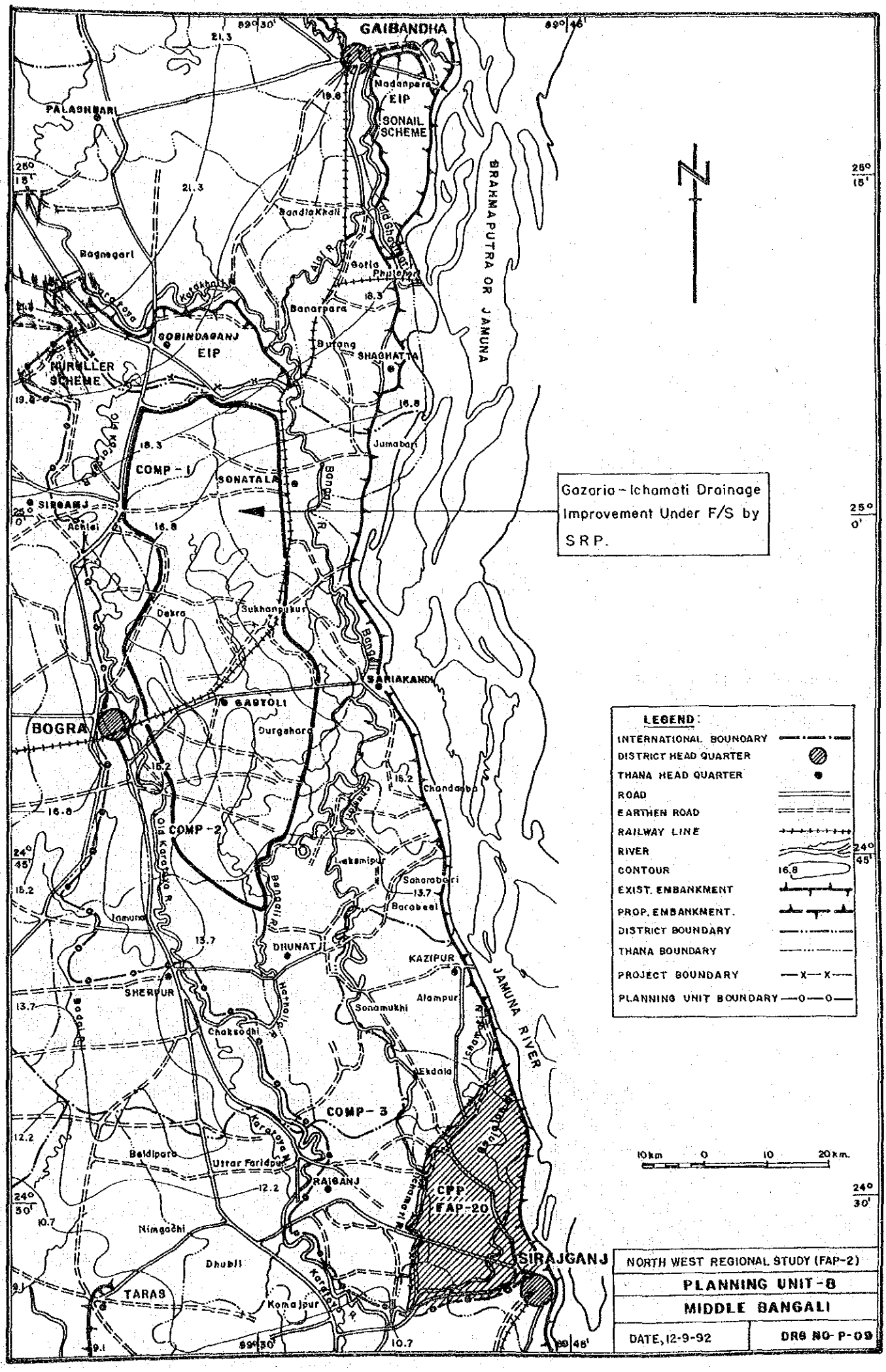
The major flooding problems in this planning unit are the result of breaches in the BRE. Sealing of the BRE would considerably reduce flooding problems. Rehabilitation and strengthening of the BRE is being studied under FAP1. Regional planning for FAP2 assumes that the BRE will be effectively sealed.

In the northern part of the planning unit provision of better drainage in this area is the main requirement. Desilting of the old Karatoya and Bangali and also the re-excavation of the drainage

system between them would improve movement of water through the unit and reduce over-spillage onto the surrounding land. This is being considered as part of an SRP project, which is also looking at dry season supplies.

Spillage from the Alai has been considered under potential EIP projects.This will be considerably reduced by proposals made under NRWS for the Gaibandha Project.

The most important measure to reduce flooding conditions in the southern part of the region is the sealing of the BRE, as described above. Consideration has also been given to providing a second line of defence against breaches in the BRE. An appropriate measure would be an embankment along the right bank of the Ichamoti, which would contain any breach flows from the Brahmaputra between the Ichamoti and Brahmaputra, allowing them to drain through the Ichamoti. However it is unlikely that such relatively major works could be justified if investment is made in sealing the BRE itself. The pilot compartmentalisation project (FAP 20) at Sirajganj will provide useful information on the use of compartments as flood cells for floodwater retention, which is a possible alternative for a second line of defence.


GAIBANDHA
Madanpara EIP
SONAIL SCHEME
PALASHBARI
BRAHMAPUTRA OR JAMUNA
Bandlakhali
Ragnagari
Sotia
Panchpir
Banarpara
GOBINDAGANJ EIP
Burang
SHAGHATTA
HURILLER SCHEME
Jumabari
COMP - 1
SONATALA
SIRGANJ
Achial
Gazaria - Ichamati Drainage Improvement Under F/S by SRP.
Dekra
Sukhanpukur
SARIAKANDI
BOGRA
GABTOLI
Durgahara
Chandaiba
COMP - 2
Lakshmipur
Saherabari
Barabeel
Jamuna
DHUNAT
KAZIPUR
SHERPUR
Alampur
Sonamukhi
Chaksodhi
Ekdala
JAMUNA RIVER
COMP - 3
Beldipara
Uttar Faridpur
RAIGANJ
CPP FAP-20
Nimgachi
Dhubil
SIRAJGANJ
TARAS
Komarpur
LEGEND:
INTERNATIONAL BOUNDARY
DISTRICT HEAD QUARTER
THANA HEAD QUARTER
ROAD
EARTHEN ROAD
RAILWAY LINE
RIVER
CONTOUR
EXIST. EMBANKMENT
PROP. EMBANKMENT.
DISTRICT BOUNDARY
THANA BOUNDARY
PROJECT BOUNDARY
PLANNING UNIT BOUNDARY
10km 0 10 20km.
NORTH WEST REGIONAL STUDY (FAP-2)
PLANNING UNIT-8
MIDDLE BANGALI
DATE, 12-9-92
DRG NO- P-09

PLANNING UNIT 9

JOYPURHAT

9.1 Basic Data

The planning unit is situated in the district of Joypurhat, Naogaon and Bogra. The Gobindaganj Hilli road has formed the northern boundary of the planning unit, whilst the old Karatoya and Bogra road lies in the east, Bogra-Naogaon-Mohadevpur road in the south and Atrai river in the west.

Basic data of the planning unit is presented in Table 9.1. The gross area is 251,000 ha.

The population in 1981 was 1.63 million. Population densities are about average for the region, lower densities in the more isolated thanas to the west of the planning unit.

9.2 Agriculture

9.2.1 Soils

The planning unit lies within MPO planning areas 8 and 9. It is covered by the Barind Tract and Teesta Floodplain physiographic units.

The Barind Tract is an elevated landscape, thought to be of a marine deposits of Mio-pliocene age, which was later uplifted and broken into different fault lines, associated with denudation and human activities resulting in the present day topographic sequence. The landscape comprises level, to undulating and locally rolling topography. In the undulating and rolling areas the summits are usually almost level while the slopes are terraced. The area is slightly tilted from north - west to south - east direction which is reflected and confirmed by the drainage pattern of the area. The sediments are usually loamy locally clayey, underlain by clayey sediments. The weathering of sediment usually effects a depth within a range of 1-2 metre, locally even less from the surface. In the valleys diluvial loamy sediments were observed over clayey substratum. All the sediments are acidic in reaction.

The major constraint of crop production is the severe drought during the dry season in the Barind Tract.

The Teesta Flood Plain is an area of slightly irregular, low relief with a complex pattern of low, narrow ridges, small basins and infilled channels. The ridges are mainly covered by olive grey to grey, friable, and loamy soils. They are acidic in reaction. The basin margins and low ridges are occupied by grey to dark grey, clayey friable soils.

9.2.2 Cropping Patterns

Almost all the land in this area is highland or medium-highland, and therefore there are few constraints on cropping patterns due to floods.

Overall cropping intensity is 169%, based on 1989 BBS statistics, and irrigation coverage is 34% of the NCA. HYV boro is grown on most of the irrigated area and is easily the main dry season crop. In the aman season HYV t. aman is far more important than local t. aman.

Cropping patterns for the area are shown in Table 9.2.

Table 9.1 Planning Unit 9 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
PANCHBIBI	11	99
MOHADEVPUR	6	42
KAHALOO	3	32
JOYPURHAT	10	100
NAOGAON	3	30
GOBINDHAGANJ	6	31
KHETLAL	6	100
KALAI	6	100
AKKELPUR	6	100
HAKIMPUR	1	30
SHIBGANJ	8	68
BADALGACHI	9	100
BOGRA	3	17
GHORAGHAT	1	14
DHAMOIRHAT	9	75
PATNITOLA	5	32
ADAMDIGHI	2	29
DUBCHACHIA	5	71

Gross Area (ha) : 250955
Nca Area (ha) : 229062

Total population (1981) : 1626644 Population Density : 6.48
(per ha Gross area)

Flood Phase :

F0 (ha) :	130365	F0 % of NCA (ha) :	57
F1 (ha) :	84807	F1 % of NCA (ha) :	37
F2 (ha) :	11111	F2 % of NCA (ha) :	5
F3 (ha) :	2779	F3 % of NCA (ha) :	1
F4 (ha) :	0	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	1333	STW 89	11113
DTW 81	622	DTW 89	1602
LLP 81	243	LLP 89	176
Irrigation Coverage (%) Yr 81	9	Irrigation Coverage (%) Yr 89	34

TABLE 9.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	130365
F1	84807
TOTAL	215172
F2	11111
F3	2779
TOTAL	
F4	0
GTOYAL	229062

IRRIGATION BALANCE	
HYV BORO	83429
WHEAT	0
HYV AUS	0
TOTAL	83429

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRIG AREA	TOTAL AREA	% IRRIG
F0	35265	95100	130365	27
F1	38163	46644	84807	45
TOTAL	73428	141744	215172	34
F2	7778	3333	11111	70
F3	2223	556	2779	80
F4			0	
TOTAL	83429	145633	229062	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	73428	B. AUS	29775	HYV TAMA	133509	SUGARCA	7146
WHEAT	16334	HYV AUS	9926	L.T. AMAN	56104	ORCHARD	87
POTATO	8983	JUTE	8837	VEGETABL	340		
TOBACCO	7074	OILSEEED	1669	SPICES	2152		
PULSES	5033	SPICES	3261				
OILSEED	3390	VEGETABL	1133				
SPICES	0						
VEGETABLES	793						
Sub-Total	115035	Sub-Total	54601	Sub-Total	189953	Sub-Total	7233
Total	366821						
CROPPING INTENSITY	170						

CROPS ON F2 LANDS

HYV BORO	7778
DW AMAN	514
PULSES	3356
OILSEED	3389
JUTE	2209
L.BORO	0
Total	17246
CROPPING INTENSITY	155

CROPS ON F3 LAND

HYV BORO	2223
LOCAL BORO	95
D.W.AMAN	795
PULSES	0
Total	3113
CROPPING INTENSITY	112

Grand-Total	387180
CROPPING INTENSITY	169

9.2.3 Crop Damage

Since most land is highland or medium-high land, little crop damage from floods would be expected during normal years.

In the 1987 floods however an estimated 40% of the aman planted area was fully damaged, while in 1991 the corresponding figure was 12%.

Crop damage tends to be more severe in the thanas of Badalgachi, Mohadevpur and Naogaon, indicating that there may be local problems of spillage from the Atrai and Little Jamuna rivers.

9.3 Fisheries

The planning unit has 16000 ha of water bodies yielding 3000 tonnes annually.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	930	220	205
Rivers	1360	78	106
Flood Plains	10000	69	690
Total Capture Fish:	12290	-	1001
Fish Ponds:			
- Cultured	1546	950	1469
- Culturable	1308	450	589
- Derelict	654	120	78
Total Culture Fish:	3508	-	2136
Overall Total:	15798	-	3137

This is an area where fish farming is growing rapidly in importance. Adamdighi on the southern boundary is already a major hatchery and nursery centre. However, DOFs extension service needs more resources to enable it to keep pace will developments. CARITAS, PROSHIKA, BRAC CARE support fishing group activities

9.4 Infrastructure

9.4.1 Major Infrastructure and Industries

The main roads in the district are the Joypurhat-Shibganj road, and the Naogaon-Badalgachi-Patnitola road.

The Santahar-Parbatipur railway line passes through Joypurhat.

9.4.2 Damage to Infrastructure and Industries

In 1987 damage to BWDB and LGEB infrastructure was Tk. 49 lakh and Tk. 83 lakh, respectively. This mainly occurred round Joypurhat, both on the Little Jamuna and on the Tulshiganga.

In 1988, BWDB infrastructure was damaged to an amount of Tk. 44 lakh, in the same locations as in 1987. Damage to LGEB infrastructure was much more severe in 1988, amounting to Tk. 502 lakh. Again, it was centred on the Little Jamuna around Joypurhat but there was also damage round Mohadevpur, Akkelpur and Dhubchanchia.

In the 1988 flood an estimated Tk. 500 lakh of damage was caused to R&H roads and bridges.

9.5 Special Issues

There are deposits of limestone near Joypurhat. Consideration has been given to extracting this limestone and transporting it by boats using the Little Jamuna.

9.6 Hydrology and Morphology

The main rivers are the Atrai, Little Jamuna, Tulshiganga and Nagor. Basic hydrological data for the unit are given in Tables 9.3 to 9.5.

Table 9.3 Max Mean Daily Discharges (m^3/s)

Gauge Station	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Mohadevpur (Atrai)	907	1155	1080	937	881	1232	1160	1170	858	1095	866	1060
Naogaon (L. Jamuna)	424	566	482	393	371	555	476	419	257	563	324	458

Table 9.4 Max Mean Daily Water Levels (m PWD)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Mohadevpur	17.86	18.75	18.24	16.51	17.50	18.90	19.10	18.05	16.93	18.32	17.91	18.15
Naogaon	14.65	15.24	14.96	14.75	14.51	15.21	15.32	14.58	14.25	15.27	14.54	15.41

Table 9.5 Rainfall (mm/month)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Badalgachi	362	691	852	350	223	697	527	543	261	594	508	217
Bogra	444	702	581	578	242	598	734	273	222	550	214	279

9.7 Existing FCD Infrastructure

Tulshiganga Project

The present Tulshiganga Project was constructed between 1975 to 1982 and was funded by EIP. The gross area of the project is 25,092 ha of which 20,356 ha is provided with flood control and drainage facilities. Originally the project was initiated as a drainage improvement scheme but actually the project was implemented as flood control and drainage project.

The project was completed in 1975, but a major component of works was not executed as per PP (Project Proforma). Drainage congestion and flooding persist in the low-lying area of the project area. Hence rehabilitation work was taken up to stop flood water entering through the northern side. Rehabilitation works involves an embankment along river Chiri and 3 nos of regulators, which have already been constructed.

The hydrological situation in the project area was determined by the flows from the three rivers on the periphery. Before project, the Little Jamuna and Tulshiganga could spill freely a large part of their flood water into the project area. The Tulshiganga River used to overflow the low lands of its both banks causing damage to the crops to the southern part of the project particularly. Thus, flood protection needed the construction of embankment along the river Little Jamuna where its banks were too low, and two embankment along the Tulshiganga River to Tajnagar where the rivers meet.

Tulshiganga Left Embankment Project

Tulshiganga Left Embankment project is an on-going project financed by EIP. After construction of Tulshiganga River Project embankment along right bank, the Tulshiganga left embankment project was initiated under FFW. The Tulshiganga river carries considerable discharge during monsoon and spills over bank causing flooding to this area but during dry months the river flow is negligible. The flood flow of the Tulshiganga overtopped the FFW embankment and flood water entered into the project area through khals particularly the old Tulshiganga channel. The gross area of the project is 12,000 ha and cultivated land is 9,600 ha.

Badalgachi Flood Control Project

This is a project consisting of 37 km of embankment on the right bank of the Little Jamuna downstream of Badalgachi.

Patnitola Sub-project

Chhilimpur Chhaligram Sub-project

Sowra Beel Drainage Scheme

Protappur Irrigation Project

These are mainly small schemes. On the whole, they are reported to be functioning effectively.

9.8 Flooding and Drainage Problems

Flood phase data indicates that most of the land in this planning unit is F0 and F1, so that serious and prolonged flooding does not occur. Overall cropping intensities are high, at around 170%.

The comparison of NAM-generated discharges and conveyance capacities confirms that, in this planning unit, conveyance capacities are generally sufficient for the 20-yr probable discharge, and that flooding problems are relatively minor.

Crop and infrastructure damage, however, occurs on the Little Jamuna west of Badalgachi, indicating that spills from the Little Jamuna downstream of Joypurhat may be significant. Overland flow from the Atrai in India may also be a contributory factor.

9.9 Planning Options

Flood control and drainage options in this planning unit are presented below:

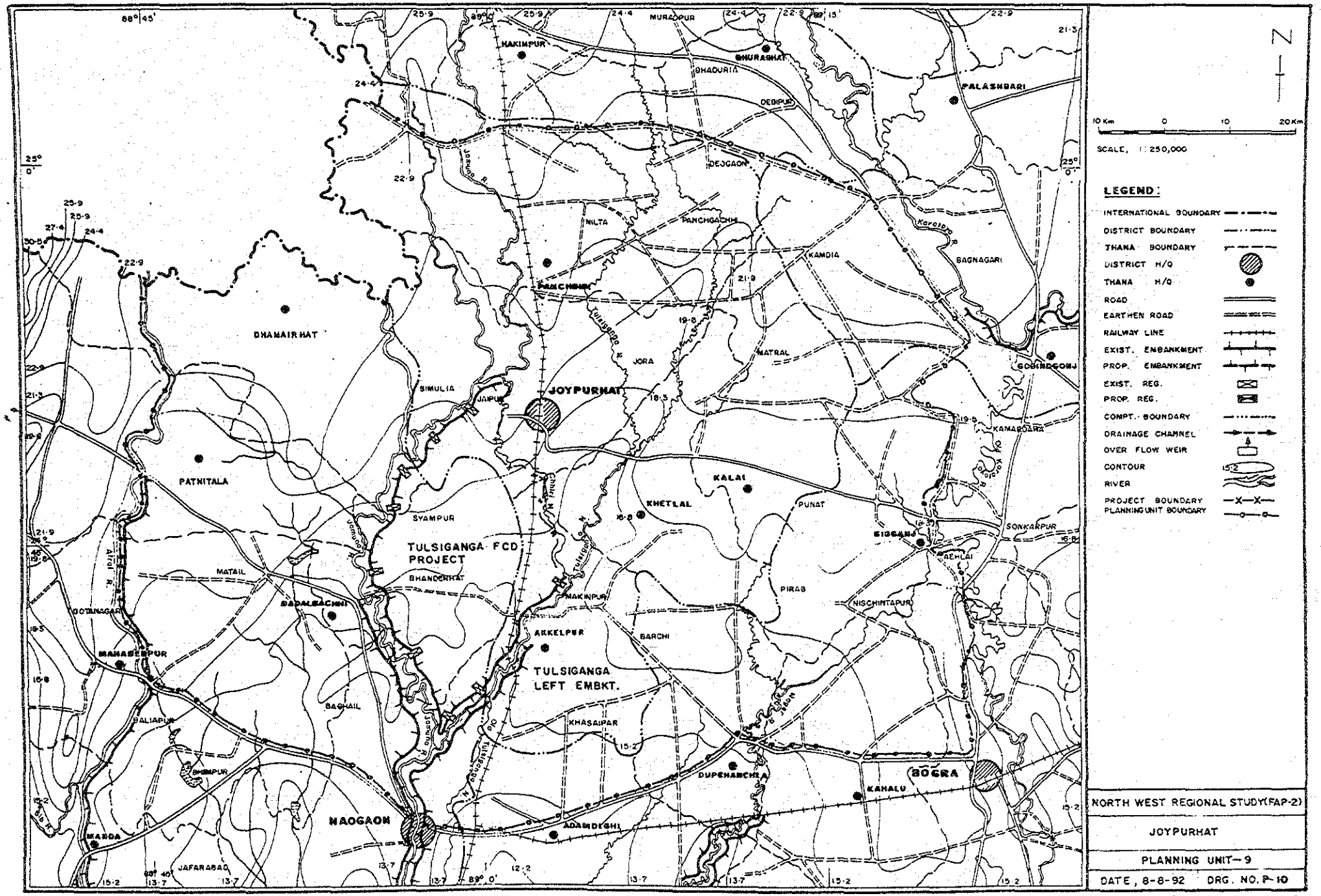
Upper Badalgachi Project

According to the information of EIP, some area near Badalgachi in the basin of the Little Jamuna of this area is suffering from flooding. The river cross-sections in this reach used for the estimate of present conveyance capacities of the river are limited in numbers. Accordingly even though the results based on the cross-sections show the sufficiency of the present capacities, some reaches may be lacking in the capacities.

Accordingly the extension of the right embankment of the Little Jamuna to the upstream reaches of Bangladesh may improve the flooding situation of the area and may even improve the situation of the Naogaon Polder to some degree since some part of this area is forming a drainage basin of the Naogaon Polder Project.

Northern Area of the Road from Naogaon to Bogra

Northern area of the road from Naogaon to Dubchanchia is the same situation as north area of Naogaon Polder. The difference is that the down stream area is the Bogra Polder 2 area. Thus the same idea, but taking account of the condition of Bogra Polder 2, will be adopted for this area. Other than this, for relieving the Bogra Polder 2 from much rainfall-runoff load, some diversion drainage channels connecting to the Tulshiganga or the Nagor river will be conceived. Proposals for works here are included within planning unit 12, Atrai Left Bank.



NORTH WEST REGIONAL STUDY(FAP-2)

JOYPURHAT

PLANNING UNIT-9

DATE, 8-8-92 DRG. NO. P-10

PLANNING UNIT 10

WESTERN BARIND TRACT

10.1 Basic Data

The planning unit is situated in the districts of Chapai Nawabganj, Rajshahi and Naogaon. International boundary lies in the north, the river Atrai and Shib and Nowhata-Rajshahi form the eastern boundary, the Ganges is situated in the southern side and Godagari-Rohanpur railway line form the western boundary.

Basic data of the planning unit is presented in Table 10.1. The gross area is 269,000 ha.

The population in 1981 was 1.18 million, at a population density of 4.41 persons per ha, much below the regional average. Only near Rajshahi are high population densities found.

10.2 Agriculture

10.2.1 Soils

The planning unit is covered by the Barind Tract physiographic unit.

It is an elevated landscape, thought to be of marine deposits of Mio-pliocene age, which was later on uplifted and broken into different fault lines, associated with denudation and human activities resulted in the present day topographic sequence. The landscape comprises level land mainly in the eastern part, to undulating and locally rolling topography to the west. In the undulating and rolling areas the summits are usually almost level while the slopes are terraced. The area is slightly tilted from north-west to south-east direction which is reflected and confirmed by the drainage pattern of the area. The sediments are usually loamy; locally clayey, underlain by clayey sediments. The weathering of sediment is usually reflected within a range of 1-2 metre, locally even less from the surface. In the valleys diluvial loamy sediments were observed over clayey substratum. All the sediments are acidic in reaction.

10.2.2 Cropping Patterns

About 85% of the planning unit is classified as highland, the remainder being almost equally divided between medium-highland, medium, and lowland. The lower areas are mostly in the eastern part of the unit. Only in these areas are cropping patterns constrained by floods.

Overall cropping intensity is only 130% based on 1989 BBS statistics, and irrigation coverage is 19%. A relatively high proportion of irrigated area is irrigated by DTWs (about 50000 ha by STW and 30000 ha by DTWs).

HYV boro is the main dry season crop but b. aus is still important, whilst pulses, wheat and HYV aus are quite widespread. In the aman season the area under HYV t. aman and local t. aman is about the same; there is also a small amount of b. aman.

Cropping patterns are shown in Table 10.2.

Table 10.1 Planning Unit 10 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
PATNITOLA	10	68
PORSHA	10	100
PABA	4	49
SAPAHAR	9	100
NACHOLE	6	52
MOHADEVPUR	5	32
NIAMATPUR	17	100
TANORE	11	98
GOMOSTAPUR	8	67
MOHONPUR	tr	1
BOALIA	tr	11
NAWABGANJ(RAJ)	2	12
MANDA	2	13
DHAMOIRHAT	3	25
GODAGARI	13	78

Gross Area (ha) : 268532
Nca Area (ha) : 242176

Total population (1981) : 1184965 Population Density : 4.41
(per ha Gross area)

Flood Phase :

F0 (ha) :	207031	F0 % of NCA (ha) :	85
F1 (ha) :	12692	F1 % of NCA (ha) :	5
F2 (ha) :	11333	F2 % of NCA (ha) :	5
F3 (ha) :	11116	F3 % of NCA (ha) :	5
F4 (ha) :	0	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	549	STW 89	3864
DTW 81	77	DTW 89	1068
LLP 81	356	LLP 89	818
Irrigation Coverage (%) Yr 81	3	Irrigation Coverage (%) Yr 89	19

TABLE 10.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	207031
F1	12692
TOTAL	219723
F2	11333
F3	11116
TOTAL	
F4	0
GTOYAL	242176

IRRIGATION BALANCE		
HYV BOR	30419	
WHEAT	8908	8908
HYV AUS	6686	
TOTAL	46013	

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRI AREA	TOTAL AREA	% IRRIG
F0	26014	181017	207031	13
F1	3173	9519	12692	25
TOTAL	29187	190536	219723	13
F2	7933	3400	11333	70
F3	8893	2223	11116	80
F4			0	
TOTAL	46013	196163	242176	

CROPS ON F0+F1							
RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	13593	B. AUS	25651	HYV TAM	92169	SUGARCA	3569
WHEAT	9509	HYV AUS	6686	L.T. AMA	96559	ORCHAR	2752
POTATO	8280	JUTE	2015	VEGETAB	205		
TOBACCO	3286	OILSEEE	1293	SPICES	1135		
PULSES	12084	SPICES	1720				
OILSEED	2625	VEGETAB	683				
SPICES	1720						
VEGETABLES	478						
Sub-Total	51575	Sub-Total	38048	Sub-Total	188933	Sub-Total	6321
Total	284877						
CROPPING INTENSITY	130						

CROPS ON F2 LANDS	
HYV BORO	7933
DW AMAN	2938
PULSES	1343
JUTE	504
L.BORO	0
Total	12718
CROPPING INTENSITY	112

CROPS ON F3 LAND	
HYV BORO	8893
LOCAL BORO	525
D.W.AMAN	3032
PULSES	0
Total	12450
CROPPING INTENSITY	112

Grand Total	310044
CROPPING INTENSITY	128

10.2.3 Crop Damage

Since most of the area is highland, and there is a distinct north west-south east slope facilitating good drainage, crop damage should be insignificant in normal years. Any damage that occurs would mostly in the east around the Shib river.

Even in 1987 flood damage was not too serious: an estimated 13% of the planted area of aman crops was fully damaged, while in 1991 the corresponding figure was 7%.

10.3 Fisheries

According to available statistics there are 29000 ha of water bodies in the planning unit, with a total annual production of 5500 tonnes.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	10650	220	2343
Rivers	3220	78	251
Flood Plains	11300	69	780
Total Capture Fish:	25170	-	3374
Fish Ponds:			
- Cultured	1295	950	1230
- Culturable	1890	450	851
- Derelict	1038	120	125
Total Culture Fish:	4223	-	2206
Overall Total:	29393	-	5580

Planning Unit 10 covers the Barind Tract which is high ground and relatively flood free. Fish farming benefits from such conditions, provided that the ponds can be filled each year. The high level of capture fish production is a little surprising and may be overstated. However, there are large areas of beels along the Punarbhaba where it borders India. CARITAS has been the principal supporter of fishing groups so far in this area.

10.4 Infrastructure

10.4.1 Major Infrastructure and Industries

The main road is the Rajshahi-Chapai Nawabganj in the south of the planning unit. There is also a railway line between these two towns.

10.4.2 Infrastructure Damage

The 1987 flood caused damage estimated at Tk. 36 lakh to BWDB infrastructure and Tk. 42 lakh to LGEB infrastructure. For BWDB the damage occurred along the left bank of the river Ganges.

In 1988 the damage to BWDB infrastructure was valued at Tk. 446 lakh. Besides the Ganges left bank this also occurred along the river Shib. LGEB infrastructure damage was valued at Tk. 108 lakh.

During the 1988 floods an estimated Tk. 168 lakh of damage was caused to R&H roads and bridges.

10.5 Special Issues

A feasibility study for the North Rajshahi Irrigation Project, funded by JICA, was completed in August 1988. An appraisal team visited in early 1990 and recommended deferring implementation until the results of NWRS became known. This is discussed further in Section 10.7.

10.6 Hydrology and Morphology

Major Rivers

There are four major rivers in and near the planning unit. The Ganges river flows along the southern boundary, and the Mahananda river flows along the western boundary of the project area.

Along the eastern boundary of the project area, the Sib river flows from north to south and joins the Barnai river at Naohata.

The dry season resources of the Sib river are exploited both by LLPs and STWs (adjacent to the channel). Cross bunds are built on the channel to improve the dry season retention capacity, however this cross bunding induces more repeat siltation which in subsequent seasons further limits both the drainage capacity of the channel and the retention potential.

The Atrai river flows in the northern part of the project area from north to south and joins the Sib river at Mohadevpur. The confluence point has been closed by an embankment by the local people.

The discharge and water levels of Mohadevpur, Naohata and Rohanpur on Atrai, Shib and Punarbhaba rivers respectively are given in Table 10.3 and 10.4 respectively.

Table 10.3 Max Mean Daily Discharges (m^3/s)

Gauge Station	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Naohata (Sib)	54	149	88	96	73	175	174	144	79	124	120	120
Rohanpur (Punarbhaba)	205	1034	372	205	354	1360	1740	547	461	1035	1280	794
Mohadevpur (Atrai)	907	1155	1080	937	881	1232	1160	1170	858	1095	8660	1060

Table 10.4 Max Mean Daily Water Levels (m PWD)

Gauge Station	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Naohata (Sib)	13.59	14.56	14.35	14.57	13.87	14.79	15.34	15.14	14.03	14.95	15.07	15.02
Rohanpur (Punarbhaba)	20.56	21.63	20.67	20.02	21.52	23.28	23.74	23.27	21.59	23.31	22.91	23.38
Mohadevpur (Atrai)	17.86	18.75	18.24	16.51	17.50	18.90	19.10	18.04	16.93	18.32	17.91	18.15

Rainfall Data

The average annual rainfall, calculated from data from 1962 to 1990 observed from 5 BWDB rainfall stations in the unit is 1438 mm. The rainfall is almost uniform throughout the planning unit.

Station Code	Name of Station	Avg. Annual Rainfall (mm)
R211	Sapahar	1443
R190	Nachol	1411
R194	Nithpur	1454
R208	Rohanpur	1406
R219	Tanore	1473

Rainfall of Nachol is given in Table 10.5 as a representative station.

Table 10.5 *Rainfall (mm/month)*

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Nachol	311	498	352	283	284	562	553	422	259	434	296	122

10.7 Existing FCD Infrastructures

The planning unit lies within MPO planning area 9.

Existing development includes:

- Barnai River System;
- Karnahar Bara Bila and adjoining Beel System;
- Rajshahi Town Protection Scheme;
- Ganges Left Bank Flood Embankment;

Proposed development includes the North Rajshahi Irrigation Project.

Barnai River System

The project lies on the right side of the Barnai river starting from upstream of Naohata to Natore. It is an on-going FCDI project. It started in 1986-87. It has 5 regulators, 57.00 km of road and 12.25 km of embankment.

Karnahar Barabila and Adjoining Beel System

The project is located a few km north-west of Rajshahi town. The area is under Paba thana of the Rajshahi district. This FCD project protects two low beel areas against annual flooding by the Joakhali Nadi which flows towards the Barnai river. The project was started in 1964 and was finished in 1977. The project area is 5811 ha. There are 8 regulators and 26.00 km of embankment in the project.

Rajshahi Town Protection Scheme

The project is along the left side of the river Ganges. This FCD project has an benefitted area of 6860 ha. There are 21 regulators, 10 groynes, 5.70 km of embankment and 2.13 km of revetment in the project.

Ganges Left Bank Flood Embankment

The project lies on the left side of the Ganges river, both upstream and downstream of the Rajshahi Town Protection Scheme. This is an on-going FCD project with 9 regulators, 92.00 km of embankment with 159,611 ha of project area.

North Rajshahi Irrigation Project.

A feasibility study for this project, funded by JICA, was completed in August 1988. An appraisal team visited in early 1990 and recommended deferring implementation until the results of NWRS became known.

The proposed development of the project covers irrigation, drainage, rural road network, inland fisheries on a gross area of 61,630 ha, net irrigable area of 51,200 ha. Of the irrigable area 42,200 ha lie in the Barind area with a further 9,000 ha on the Paba Flood Plain.

The project also includes the establishment and improvement of a systematic drainage network in the Paba floodplain. The drainage plan proposes to connect the Joakhali river at Kasba to the river Ganges with a regulator, near to the proposed pumping station. The possibility of utilising the irrigation pumps reversibly was also noted. (The report notes that it would be possible to connect the Shib to the Ganges via Damkura Khal and Joakhali river).

In the Barind area only farm drainage improvement is planned, together with Shib river improvements in reaches where the cross section is considered insufficient.

10.8 Flooding and Drainage Problem

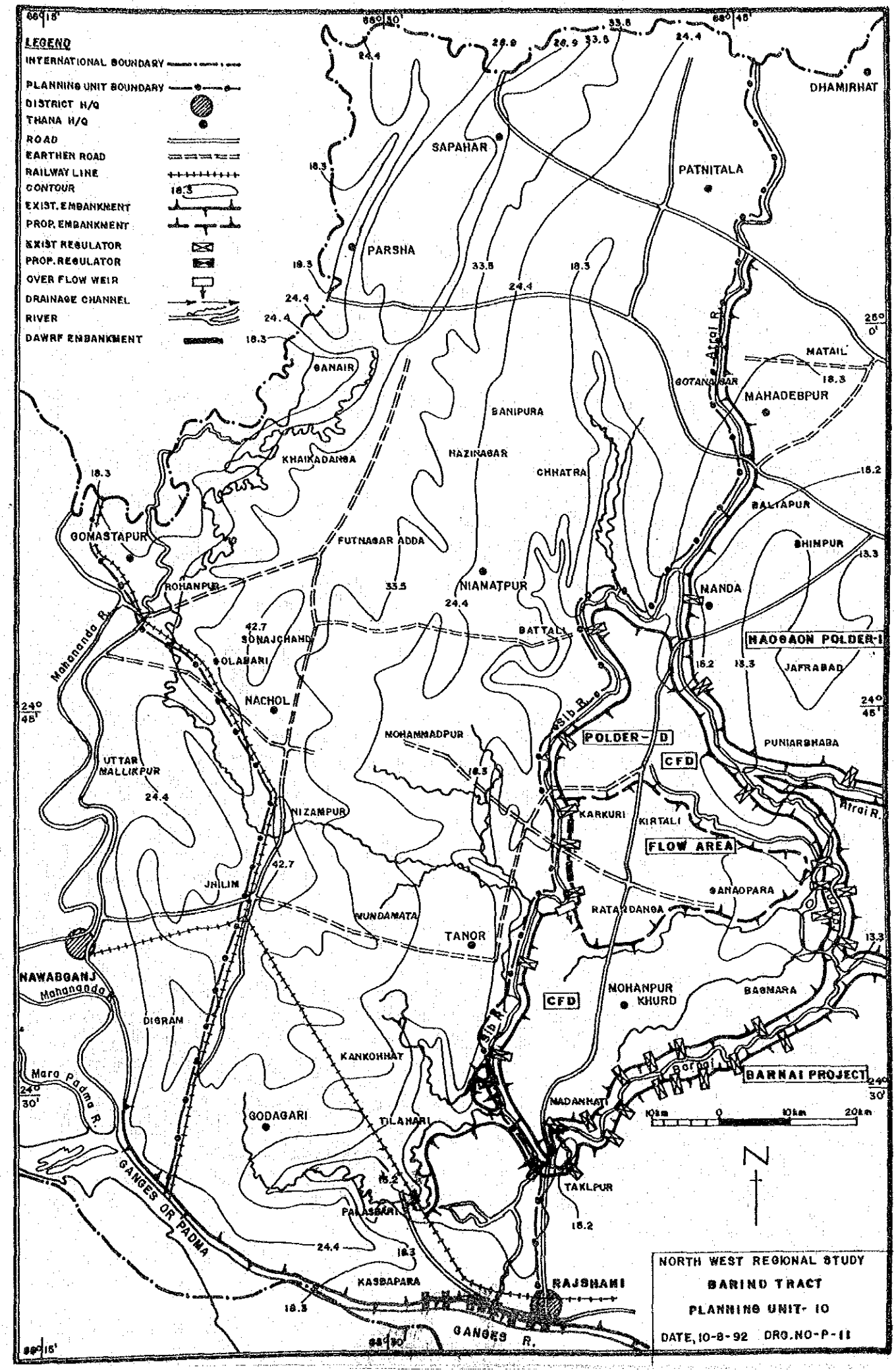
Published statistics indicate that cropping intensities are low, but this is primarily the result of lack of water in the dry season, rather than flooding and drainage problems. About 10% of the area is F2-F4 land, mainly situated along the margins of the planning unit, on the Punarbhaba to the west, or the Shib to the east. Crop damage is also more serious along the river Shib than elsewhere.

The Barind Tract is basically an elevated area. Accordingly the area has no flooding problem as a whole. The problems are flooding of a strip along the Shib river and drainage congestion on the north side of Polder D. These are located in the eastern area of the unit.

10.9 Planning Options

The drainage problem on the north side of Polder D is caused because drainage channels were interrupted by the flood embankment of Polder D. These drainage channels should be diverted to the upstream reaches of the Shib. This is a localised problem and not of sufficient scale to include within the regional plan.

Relief of flooding problems along the Shib is considered in Planning Unit 13 (Atrai Right Bank).


LEGEND
INTERNATIONAL BOUNDARY
PLANNING UNIT BOUNDARY
DISTRICT H/Q
THANA H/Q
ROAD
EARTHEN ROAD
RAILWAY LINE
CONTOUR
EXIST. EMBANKMENT
PROP. EMBANKMENT
EXIST REGULATOR
PROP. REGULATOR
OVER FLOW WEIR
DRAINAGE CHANNEL
RIVER
DAWRF EMBANKMENT
DHAMIRHAT
SAPAHAR
PATNITALA
PARSHA
MATAIL
MAHADEBPUR
BANIPURA
NAZINAGAR
CHHATRA
BALIAPUR
GOMASTAPUR
FUTNAGAR ADDA
BHIMPUR
NIAMATPUR
NANDA
ROHANPUR
BATTALI
HAOGAON POLDER-I
JAFRABAD
SOLABARI
NACHOL
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UTTAR MALLIKPUR
NIZAMPUR
KARKURI
KIRTALI
FLOW AREA
JHILIM
SANAOPARA
RATARDANGA
NUNDAMATA
TANOR
NAWABGANJ
MOHANPUR
KHURD
BAGNARA
DIGRAM
KANKOHHAT
BARNAI PROJECT
GODAGARI
TILAHARI
NADANHATI
TAKLPUR
PALASBARI
KASBAPARA
RAJSHAHI
GANGES R.
Atrai R.
Mahananda R.
Mara Padma R.
GANGES OR PADMA
NORTH WEST REGIONAL STUDY
BARIND TRACT
PLANNING UNIT- 10
DATE, 10-8-92 DRG.NO-P-11

PLANNING UNIT 11

MOHANANDA BASIN

11.1 Basic Data

The planning unit is situated in the district of Chapai Nowabganj and also parts of the districts of Rajshahi, Natore and Pabna. The International border forms the north-western boundary, Godagari-Rohanpur railway lines lies to the east and the River Ganges provides the southern limit of the planning unit.

Basic data of the planning unit is presented in Table 1.1. The gross area is 139000 ha.

The population in 1981 was 0.76 million, and the population density was 5.5 person per ha gross, significantly below the regional average. This is due to the isolated nature of the region and its poor communications.

11.2 Agriculture

11.2.1 Soils

The planning unit is covered by the physiographic units Lower Punarbhaba Flood Plain, Barind Tract and Ganges Flood Plain.

Lower Punarbhaba Floodplain is a small (13,000 ha) narrow strip of land at the extreme west of Naogaon district. It is a low-lying flood prone area differing from the areas nearby in that it has been derived from non-calcareous Teesta and Brahmaputra alluvium and not from the calcareous Gangetic deposits. Most of the soils are cracking acid clays.

Although the cool rabi period is quite long, the nature of the soil in most places preclude the growing of un-irrigated wheat and other rabi crops because of difficulties with timely land preparation. The likely major crop is late boro/early aus.

The Barind Tract is an elevated landscape thought to be of marine deposits of Mio-pliocene age, which was later on uplifted and broken into different fault lines, associated with denudation and human activities resulting in the present topographic features. The landscape comprises level to undulating and locally rolling topography. In the undulating and rolling areas the summits are usually almost level while the slopes are terraced. The sediments are usually loamy locally clayey, underlain by clayey sediments. In the valleys diluvial loamy sediments were observed over clayey substratum. All the sediments are acidic in reaction.

The major constraint of crop production is the severe drought during the dry season.

Three sub-units can be identified in the Ganges Flood Plain: the active, the high and the low Gangetic Floodplain. Less than a quarter of the area lowlands. Soils are mostly of medium or medium heavy texture and are typical of Gangetic alluvium, calcareous, making them eminently suitable for sugarcane.

Table 11.1 Planning Unit 11 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
BHOLAHAT	9	100
GODAGARI	7	21
SHIBGANJ	38	97
GOMOSTAPUR	8	33
NACHOLE	10	48
NAWABGANJ(RAJ)	28	83

Gross Area (ha) : 138834
Nca Area (ha) : 123134

Total population (1981) : 764322 Population Density : 5.51
(per ha Gross area)

Flood Phase :

F0 (ha) :	70087	F0 % of NCA (ha) :	57
F1 (ha) :	34537	F1 % of NCA (ha) :	28
F2 (ha) :	14732	F2 % of NCA (ha) :	12
F3 (ha) :	3778	F3 % of NCA (ha) :	3
F4 (ha) :	0	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	300	STW 89	1817
DTW 81	16	DTW 89	586
LLP 81	166	LLP 89	285
Irrigation Coverage (%) Yr 81	3	Irrigation Coverage (%) Yr 89	18

TABLE 11.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	70087
F1	34537
TOTAL	104624
F2	14732
F3	3778
TOTAL	
F4	0
GTOYAL	123134

IRRIGATION BALANCE	
HYV BOR	7815
WHEAT	5003
HYV AUS	2346
TOTAL	15164

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATE AREA	NONIRRI AREA	TOTAL AREA	% IRRIG
F0	1824	68263	70087	3
F1	5181	29356	34537	15
TOTAL	7004	97620	104624	7
F2	5893	8839	14732	50
F3	2267	1511	3778	60
F4			0	
TOTAL	15164	107970	123134	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	828	B. AUS	37442	HYV TAM	25514	SUGARCA	194
WHEAT	5003	HYV AUS	1173	L.T. AMA	26696	ORCHAR	5861
POTATO	24034	JUTE	666	VEGETAB	29		
TOBACCO	158	OILSEEE	1080	SPICES	242		
PULSES	9532	SPICES	367				
OILSEED	0	VEGETAB	95				
SPICES	367						
VEGETABLES	67						
Sub-Total	39988	Sub-Total	40823	Sub-Total	52239	Sub-Total	6055
Total	139104						
CROPPING INTENSITY	133						

CROPS ON F2 LANDS

HYV BORO	4720
HYVAUS	1173
DW AMAN	5637
PULSES	5132
OILSEED	1097
JUTE	285
L.BORO	0
Total	18045
CROPPING INTENSITY	122

CROPS ON F3 LAND

HYV BORO	2267
LOCAL BORO	621
D.W.AMAN	588
OILSEED	1096
PULSES	0
Total	4572
CROPPING INTENSITY	121

Grand Total	161721
CROPPING INTENSITY	131

11.2.2 Cropping Patterns

About 85% of land area is highland or medium-highland, the remainder being mostly medium-lowland (F2). Cropping patterns in most areas are therefore not greatly constrained by floods.

Overall cropping intensity is only 131%, based on 1989 BBS statistics, and irrigation coverage is 18%. A relatively high proportion of irrigation comes from DTWs, DTW irrigation covering a slightly higher area than STW units.

Rabi crops are important in this planning unit, particularly potato and pulses. The HYV boro area is limited by the extent of irrigation, b. aus is therefore significantly more important than HYV boro at present. In the aman season HYV t. aman and local t. aman are of equal importance: only a very small area of b. aman is grown.

Sugarcane yields have increased quite spectacularly during the last several years. Further considerable improvements could be made if irrigation at times of acute water stress could be introduced and prove economically feasible.

The range of rabi crops is wider in this unit than anywhere in the region. This is not only a reflection of farming standards, but also indicates the superior quality of Gangetic alluviums compared to those deposited by the northern rivers.

Cropping patterns are shown in Table 11.2

11.2.3 Crop Damage

Crop damage in normal years would be unlikely to be serious, since most of the land is highland or medium-highland. In the 1987 flood, an estimated 32% of the planted area of aman crops was fully damaged, while the corresponding figure for 1991 was 16%.

Crop damage tends to be more serious in the west of the planning unit, particularly in Shibganj thana.

11.3 Fisheries

The planning unit has about 23000 ha of water bodies, yielding about 3500 tonnes annually.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	4430	270	1115
Rivers	2980	79	235
Flood Plains	14000	69	966
Total Capture Fish:	21110		2316
Fish Ponds:			
- Cultured	630	950	598
- Culturable	930	450	418
- Derelict	555	160	89
Total Culture Fish:	2115		1105
Overall Total:	23225		3421

The area has a number of beels which could be made more productive than at present. Unfortunately several have already been drained in the course of drainage and irrigation works.

11.4 Infrastructure

11.4.1 Major Infrastructure and Industries

Road

The planning unit is transversed by two highways running from the district head quarter Nawabganj. One runs north to Rohanpur via Gomastapur, the other north-west to Shibganj with a ferry crossing at Nawabganj and then to Sonamasjid, a place of historical importance.

Rail

The railway line runs from Amnura through Nachole to Rohanpur and an old railway track runs from the eastern boundary of the planning unit. Nawabganj is also connected by railway line to Amnura.

Navigation

The river Mohananda is navigable throughout the year. Large cargo boats are plying regularly.

11.4.2 Infrastructure Damage

The 1987 flood caused damage to BWDB infrastructure valued at Tk. 81 lakh, and to LGEB infrastructure valued at Tk. 40 lakh. The BWDB infrastructure damage was mainly along the Mohananda, both left and right banks.

In 1988 damage to BWDB infrastructure was Tk. 236 lakh, LGEB infrastructure damage was estimated at Tk. 118 lakh in the same year, particularly along the left bank of the Mohananda between Nawabganj and Gomastapur.

In the 1988 flood an estimated Tk. 625 lakh of damage was caused to R&H roads and bridges, out of which Tk. 583 lakh was damage to roads.

11.5 Special Issue

Mango, an important and delicious fruit of Bangladesh is produced in abundance in the planning unit. It gives the people substantial economic support next to paddy. The Mango Research Centre of Bangladesh is at Nawabganj.

11.6 Hydrology and Morphology

The Ganges (Padma) forms the southern boundary of this planning unit and the Mahananda is the principal river which virtually bisects the planning unit in the north-west direction. The other important river is the Pagla which meets the Mahananda river near Mohanpur. The Punarbhaba river enters the planning unit in the north-eastern corner and joins Mahananda river.

Nawabganj is a discharge and water level gauging station on Mahananda river. The gauge was installed in the year 1980 by shifting Godagari gauge, which is very close to the confluence with the Ganges. This latter gauge was established in 1945. The data length at Nawabganj is too short for reliable frequency analysis. Water level and flow data for 1987 and 1988, two extreme event years are given in Table 11.3 and 11.4 respectively.

The rainfall in this planning unit is the lowest in the country the mean rainfall in the area is between 1200 mm to 1400 mm. Rainfall data of Shibganj, a representative station, is given in Table 11.5

Table 11.3 Max Mean Daily Discharges (Mohananda) (m^3/s)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Chapai Nawabganj	-	-	1780	1030	-	-	3270	2580	-	-	2700	3290

Table 11.4 Max Mean Daily Water Levels (m PWD)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Chapai Nawabganj	-	-	19.50	19.26	-	-	21.91	21.95	-	-	22.24	21.98

Table 11.5 Rainfall (mm/month)

	July				August				September			
	1:2	1:20	1987	1988	1:2	1:20	1987	1988	1:2	1:20	1987	1988
Shibganj	313	642	456	337	290	559	518	548	237	402	185	190

11.7 Existing Flood Control and Drainage Infrastructure

The planning unit lies within MPO planning area 11.

In this area, a number of small FCD/drainage schemes have been executed so far, mostly by EIP. These are located on both sides of the Mohananda river and in the Pagla river basin. Each scheme consists of regulator at the outfall of drainage channel, flood embankment and improvement of drainage system. These are listed below:

(a) Left bank of Mohananda

Samespur Beel Drainage Scheme

In this drainage scheme of 5000 ha there are two regulators, one at Samespur (Avova) and other at Bahadurpur which are draining rainwater coming from upstream areas. Local opinion is that the cill level of Bahadurpur regulator is too high and ventage is insufficient for draining rain water in pre-monsoon, this inadequate drainage capacity causes damage to aus paddy.

Singri Beel Drainage Scheme

This is a FCD scheme with a gross area of 9655 ha, out of 3 drainage regulators constructed for the project, 2 are on the R&H road towards Rohanpur. This road is functioning as flood protection embankment on the western boundary of the project.

Bhitabari Damos Scheme

This is a small FCD project. The peripheral catchment areas of the project are high lands and above flood level but the middle portion is low. Provision for retention of water had been created at the time

of construction of the regulator by raising the invert level 1m above the design level. This provision creates some irrigation facilities to the middle part of the project. It is also a good source of fishing for the people. The construction of the project was completed in the year 1981-82.

(b) Right bank of Mohananda

Marichar Danra Scheme

This is a FCD scheme of 5570 ha gross completed in the year 1976-77. The area is bounded in the north by Gomastapur-Kansat road, and in the east by Mohananda river, Pagla river is the south and in the west.

The basin topography is low and flat with a general slope from north to south. The area consists of many beels and these are inter connected by drains. All beels combined drain through Marichar Danra regulator. Another regulator at Trimohini interconnects the upper and lower basin. The lower basin area is subject to flooding from the bank spill from the river Mohananda and as well as from the river Pagla. Water also enters the area through existing flushing channels.

Bhatia Beel Drainage Scheme

The drainage cum irrigation scheme was completed in the year 1962-63. The benefited area of 2332 ha is bounded by the Mohananda river in the north and east, Chaudala-Kansat road in the south and south-east, Kansat-Sonamasjid road in the south-west and the international border in the west. The Pagla river also flows by the south-western side of the area. The basin topography consists of nearly level to very gently undulating ridges and beels. The river bank in the north, is high and normally not flooded but within the basin, the lands are below the highest flood level during monsoon. The Bhatia beel drains through the existing regulator at Karnakhali and Kolonugara and ultimately through Kansat regulator to the Pagla river.

Karnakhali and Kolmugara regulator are constructed in series to provide water retention in the Bhatia beel during post monsoon season for irrigation.

(c) Pagla river basin

Toker Danra sub-project

This is a drainage project of gross area 1650 ha. The area is bounded on the west side by raised homestead, on the east and north sides by the Kansat-Sonamasjid road and on the south by the Pagla river. Drainage from the area is via the Toker Danra which flows directly into the Pagla river.

Kumisdah Scheme

It is a small drainage project of 640 ha gross on the right bank of Pagla river.

All these regulators were constructed on the periphery of the schemes to prevent flood waters from the rivers entering the schemes whilst also controlling drainage flow.

Among the above mentioned FCD schemes, six schemes are now under study for improved O&M by the System Rehabilitation Programme.

In the recent years BWDB constructed a flood embankment along the right bank of Mohananda from Chaudala to Gonalabari for a length of about 18.50 km. under FDR and FFW.

In the upstream reaches of the Mohananda (in Bangladesh), two drainage regulators are proposed to be constructed. They are: Haldigachi regulator, Jhanjhani regulator.

11.8 Flooding and Drainage

Flooding problems occur mainly on the right bank of the Mohananda. The left bank is adequately protected by the Chapai Nawabganj-Rohanpur road, and supplied with sufficient regulators.

Though this is one of the driest areas of the country a certain area composed by some beels on the right bank of Mahananda suffers from flooding. Spillage Water from Pagla and Mahananda river are mainly responsible for the flooding in this planning unit although restricted drainage is also a problem.

Flooding problem in the basin is mainly rainfall run-off from high land and high stage of the Mohananda at the outfall to the Ganges. The area of the basin is subject to some flooding with F2-F4 land forming about 15% of the NCA.

11.9 Development Options

In the Mohananda basin, the conceivable options for flood control and drainage are as follows:

Left bank no other additional development
Right bank CFD development.

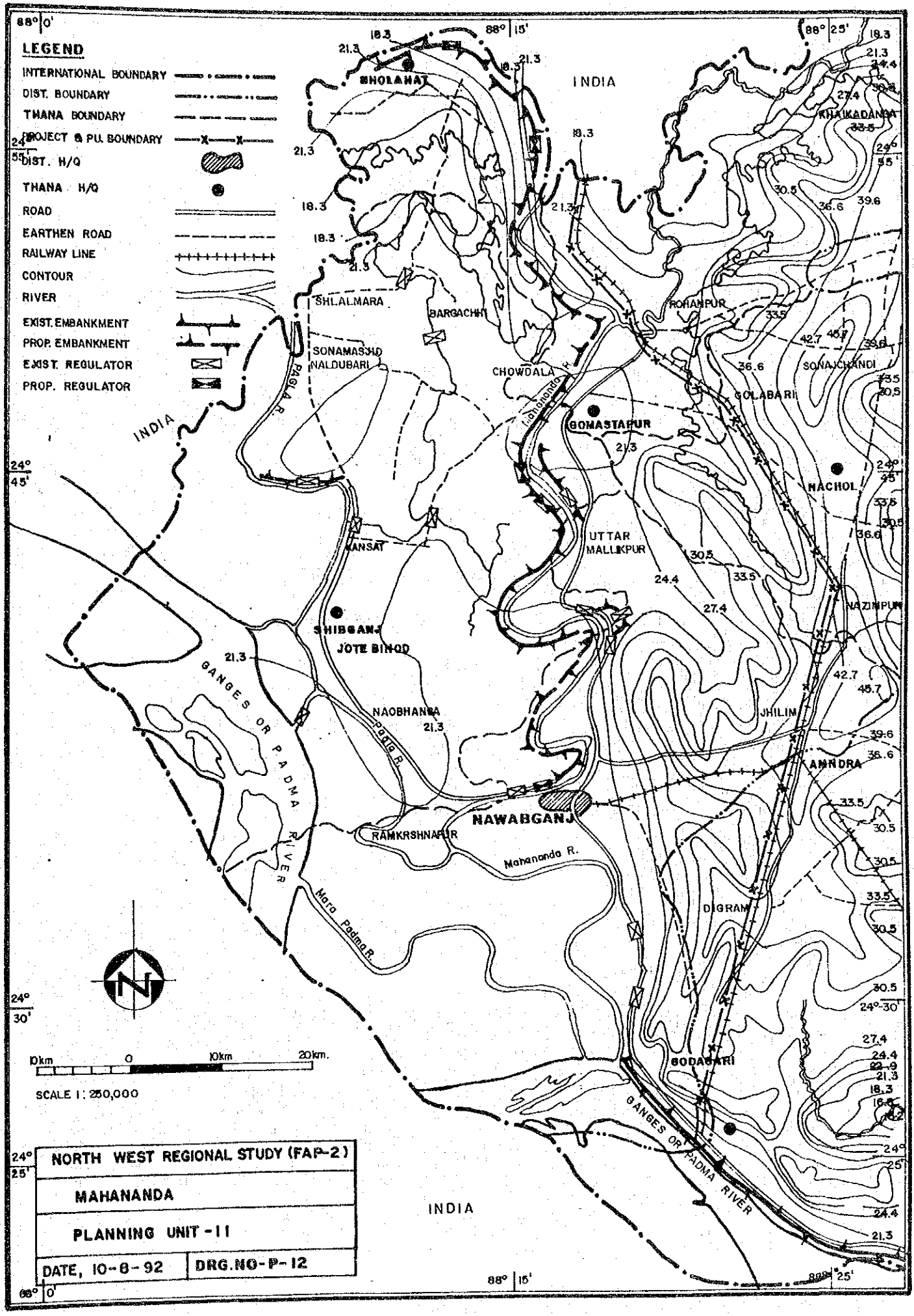
In the above, CFD requires construction of flood embankment along the right side of the Mohananda and the left side of the Pagla and some drainage regulators at present opening sites.

No additional provision of drainage regulators is proposed since the present drainage regulators have sufficient capacities to drain out the internal rainstorm water.

Flooding also occurs between the Pagla river and the Ganges due to the high stages of the Ganges. But the area is so small with a strip shape that no protective FCD works are proposed thereof.

Upstream Areas

The upstream area of the confluence of the Mohananda and the Punarbhaba is also composed of a very wide beel area along the international border, forming a natural retarding basin. Even in the dry season a large quantity of water remains in the beel area. Existing beel extends in the Indian territory across the border with Bangladesh. No works are proposed for this area since existing beel covers not only the area of Bangladesh but also the area of India and some countermeasure only in Bangladesh causes another problem to India.


LEGEND
INTERNATIONAL BOUNDARY
DIST. BOUNDARY
THANA BOUNDARY
PROJECT & P.U. BOUNDARY
DIST. H/Q
THANA H/Q
ROAD
EARTHEN ROAD
RAILWAY LINE
CONTOUR
RIVER
EXIST. EMBANKMENT
PROP. EMBANKMENT
EXIST. REGULATOR
PROP. REGULATOR
INDIA
BHOLAHAT
SHIBGANJ
JOTE BINOD
NAWABGANJ
GOMASTAPUR
NACHOL
SHIBALMARA
BARGACHHI
SONAMASJID
NALDUBARI
CHOWDALA
KANSAT
UTTAR MALLIKPUR
ROHANPUR
SONAICHANDI
GOLABARI
KHAKADANGA
NAZIMPUR
JHILIM
AMNDRA
DIGRAM
GODAGARI
NAOBHANGA
RAMKRSHNAPUR
Mahananda R.
Mara Padma R.
GANGES OR PADMA RIVER
Pagla R.
10km 0 10km 20km.
SCALE 1: 250,000
NORTH WEST REGIONAL STUDY (FAP-2)
MAHANANDA
PLANNING UNIT - II
DATE, 10-8-92
DRG.NO-P-12

PLANNING UNIT 12

LOWER ATRAI LEFT BANK

12.1 Basic Data

The planning unit is situated in the districts of Bogra, Naogaon, Natore and Rajshahi. The planning unit is bounded by rivers Bhadai in the east, Atrai in the south and west and Mohadevpur-Naogaon-Bogra road in the north.

Basic data of the planning unit is presented in Table 12.1. The gross area is 202000 ha.

The population in 1981 was 1.17 million, and the population density was 5.8 persons per ha, well below the regional average. The low density probably reflects the fact that part of the planning unit is low-lying deeply-flooded land, which is not as productive as, for example, the Karatoya floodplain nor as conducive to human settlement.

Data on landholding status by thana is available from the 1983-84 Agriculture Census. Using the definitions adopted in that Census, data are presented for two thanas in the planning unit, Singra and Nandigram.

% of Households Owning Land, by Land Size Category.

	Singra	Nandigram
Landless	14.4	14.9
Small Farmer	53.7	50.1
Medium Farmer	23.3	26.9
Large Farmer	8.6	8.1
Households owning <0.5 acre	36.1	31.8

Note: Landless - <0.05 acre
Small Farmer - 0.05-2.49 acre
Medium Farmer - 2.50-7.49 acre
Large Farmer - >7.49 acre.

The landholding data are similar for the two thanas and show that 65-70% of households are landless or small farmers. In Singra almost 50% of households own less than 1 acre. Due to land fragmentation and land sales, the proportion of households in these categories is likely to have increased since the census date.

Despite the large number of small or landless households, other sources (e.g. the FAO Land Resources Appraisal, 1988) indicate that large landowners are dominant in the area in terms of proportion of land they control. Share cropping is therefore likely to be important: the survey done by EIP on the Nagor Valley Project found 35% of households share cropped-in land.

Table 12.1 Planning Unit 12 Basic Data

Thana	Percentage in Planning Unit	Percentage in Thana
SINGRA	19	72
RANINAGAR	13	99
DUBCHACHIA	2	29
GURUDASPUR	2	15
BOGRA	5	26
KAHALOO	8	68
NAOGAON	10	70
SHERPUR	1	5
NANDIGRAM	13	100
ADAMDIGHI	6	71
MANDA	6	29
TARASH	3	21
MOHADEVPUR	5	26
ATRAI	7	57

Gross Area (ha) : 201866
Nca Area (ha) : 185920

Total population (1981) : 1174297 Population Density : 5.82
(per ha Gross area)

Flood Phase :

F0 (ha) :	93655	F0 % of NCA (ha) :	50
F1 (ha) :	22859	F1 % of NCA (ha) :	12
F2 (ha) :	31030	F2 % of NCA (ha) :	17
F3 (ha) :	38268	F3 % of NCA (ha) :	21
F4 (ha) :	107	F4 % of NCA (ha) :	0

Irrigation Equipment Operating :

STW 81	1730	STW 89	18503
DTW 81	299	DTW 89	695
LLP 81	488	LLP 89	658
Irrigation Coverage (%) Yr 81	10	Irrigation Coverage (%) Yr 89	51

TABLE 12.2 CROPPING PATTERN

LAND TYPE	AMOUNT(HA)
F0	93655
F1	22859
TOTAL	116514
F2	31030
F3	38268
TOTAL	
F4	107
GTOYAL	185920

IRRIGATION BALANCE	
HYV BORO	92522
WHEAT	0
HYV AUS	2297
TOTAL	94819

DISTRIBUTION OF LAND BY IRRIGATION STATUS BY FLOOD PHASE

LAND TYPE	IRRIGATED AREA	NONIRRIGA AREA	TOTAL AREA	% IRRIG
F0	31463	62192	93655	34
F1	12572	10287	22859	55
TOTAL	44035	72479	116514	38
F2	20170	10861	31030	65
F3	30614	7654	38268	80
F4			107	
TOTAL	94819	91101	185920	

CROPS ON F0+F1

RABI SEASON		AUS SEASON		AMAN SEASON		ANNUAL CROPS	
HYV BORO	41738	B. AUS	9083	HYV TAMA	62538	SUGARCA	450
WHEAT	4745	HYV AUS	4320	L.T. AMAN	37672	ORCHAR	128
POTATO	7594	JUTE	4151	VEGETABL	45		
TOBACCO	999	OILSEEED	660	SPICES	670		
PULSES	0	SPICES	1015				
OILSEED	740	VEGETABLE	150				
SPICES	1015						
VEGETABLES	105						
Sub-Total	56935	Sub-Total	19378	Sub-Total	100255	Sub-Total	578
Total	177146						
CROPPING INTENSITY	152						

CROPS ON F2 LANDS

HYV BORO	20170
HYVAUS	0
BAUS	0
DW AMAN	19753
WHEAT	2034
OILSEED	600
PULSES	1407
JUTE	0
L.BORO	0
Total	43963
CROPPING INTENSITY	142

CROPS ON F3 LAND

HYV BORO	30614
LOCAL BORO	38
D.W.AMAN	12246
PULSES	4320
Total	47218
CROPPING INTENSITY	123

Grand Total	268327
CROPPING INTENSITY	144

12.2 Present Agriculture

12.2.1 Soils

The Lower Atrai Basin as a whole mostly comprises smooth, low-lying basin land. Some ridges penetrate into the basin in the areas bordering the Lower Atrai and Little Jamuna Floodplains, and relief is locally irregular near the river channels.

The main physiographic units represented in the area are the Ganges Floodplain, Teesta Floodplain including Atrai and Little Jamuna Floodplains as sub-units, and the Barind Tract. The Ganges Floodplain occurs more on the Right Bank of the Atrai.

The main soil type in the area is non calcareous Dark Grey Floodplain Soils: these mainly comprise dark grey heavy clays which occupy moderately deep or deeply flooded basin sites which stay wet for all or part of the dry season.

12.2.2 Cropping Patterns

An approximate division of the planning unit into three zones can be made. The first zone would comprise high land, the second zone medium land, and the third low land.

The predominant cropping pattern in the first zone is HYV boro followed by t. aman (HYV and local). Some aus is grown where there is no irrigation, and some rabi crops are also grown following the aman harvest.

In the second, transitional zone, a similar cropping pattern as above is adopted on medium-high land, but t. aman is replaced by b. aman on medium-low land. This b. aman generally follows boro, indicating either a shorter growing variety or the transplanting of deepwater aman.

In the lowland zone boro (HYV and local) is followed by b. aman, and in some areas b. aman is single-cropped.

Cropping intensities vary across the planning unit but are generally higher in the high land zone. For example, the RRA conducted by FAP 12 on the Nagor River Project, an area mostly of low land, estimated a pre-project cropping intensity of 118%. The SAR of the 3rd FCD Project calculated a pre-project cropping intensity in Naogaon Polder, an area with a higher proportion of high and medium-high land, of 140%. The EIP Advisory Mission which appraised the proposed Nagor Valley project in 1983 estimated cropping intensities of 210% on high land, 200% on medium land, and 135% on low lands (in the latter project low land makes up about 50% of the whole project area).

Thana livestock data for Singra thana show a 35% decline in total bovine stocks over 1986/87-1990/91, but quite significant increases in numbers of small livestock. These trends are borne out by the similar findings in the FAP 12 RRA report on the Nagor River project.

While 50% of the land area is highland, there are significant amounts of medium and lowland, and therefore cropping patterns are quite significantly influenced by flooding conditions.

Overall cropping intensity in the planning unit is 144%, based on 1989 BBS statistics and irrigation coverage is high at 51%. Cropping patterns are therefore adjusted to irrigation and flooding conditions. HYV boro is by far the main dry season crop. Other crops of some importance include

wheat, potato, pulses and b. aus. In the aman season HYV t. aman is far more important than local t. aman, and the b. aman area is slightly less than local t. aman area.

Cropping patterns are shown in Table 12.2.

12.2.3 Crop Damage

The stated aim of most FCD projects which have been implemented in the planning unit has been to reduce crop damage: changes in cropping patterns have generally been regarded as a secondary objective.

In the RRA on Nagor River Project, it is stated that in the pre-project period HYV boro and b. aman grown on medium-low land were both susceptible to flash floods, and on low land, local boro was subject to damage from early flooding. The extent of damage is again not indicated.

In the Baseline Study on the EIP Nagor Valley Project, flood damage is said to occur at different times: early flooding affects b. aman and HYV and local boro; peak monsoon flooding affects b. aman, aus and t. aman; and drainage congestion affects HYV boro in the early monsoon and b. aman in the late monsoon. Estimates given of flood damage show very wide variability between years and it is not clear whether total or partial damage is being referred to.

More recently, crop damage resulting from breaches in the embankments has become a problem. In the Nagor River project area, for example, it has become virtually impossible for farmers to secure a b. aman crop due to breaching, whereas one of the main justifications of the project was to reduce crop damage to b. aman.

In the 1987 flood an estimated 50% of the planted area of aman crops was fully damaged, and in 1991 the corresponding figure was 17%. Crop damage in those years was particularly high in thanas Manda, Bagmara, Gurudaspur and Singra.

12.3 Fisheries

The Atrai bank comprises about 4100 ha of water bodies yielding about 5000 tonnes annually.

Fishing Sector	Area (ha)	Yield (KG/ha)	Production (mt)
Beels	2885	220	635
Rivers	3918	78	306
Flood Plains	31000	69	2140
Total Capture Fish:	37798	-	3081
Fish Ponds:			
- Cultured	1170	950	1111
- Culturable	1270	450	571
- Derelict	660	120	79
Total Culture Fish:	3100	-	1761
Overall Total:	40898	-	4842

The planning unit covers Naogaon and most of the Bogra polders, which despite the FCD failures have also impacted on fish stocks in the rivers especially. Future developments, along the lines of the "Green River" should result in a substantial recovery in river/beel fishery stocks and production.

12.4 Infrastructure

12.4.1 Major Infrastructure and Industry

Major infrastructure in the planning unit mostly comprises highways and feeder roads (apart from FCD structures). The Bogra-Rajshahi main road passes through the area, crossing the Atrai River at Singra bridge. The Ishwardi-Naogaon rail line passes north-south through the area, crossing the Atrai

River at Atrai railway bridge, downstream of the Atrai-Little Jamuna confluence. There are a large number of bridges on the rail route. There are important feeder roads connecting Naogaon, Raninagar and Atrai thanas. Much of this infrastructure is at risk during serious floods.

There are no major industries in the planning unit but a number of small agro-industrial units, particularly rice husking mills (many of these are situated around Singra which is on both the left and right banks of the Atrai), serving the significant rice trade out of the area.

12.4.2 Infrastructure Damage

In 1987 damage to BWDB infrastructure totalled Tk. 15 lakh while damage to LGEB infrastructure was Tk. 51.5 lakh. The BWDB damage was mainly to the Naogaon Polder embankment, which was under construction at that time.

In 1988 the BWDB damage was Tk. 213 lakh. Again, it appears to have been mainly to the Naogaon polder embankment. LGEB infrastructure was damaged to the tune of tk. 248 lakh in 1988. This was in the northern part of the Bogra polders, including round Naogaon, Raninagar, Talora and Nandigram.

No damage to R&H roads and bridges is recorded as a result of the 1988 flood.

12.5 Special Issues

Environment

The southern part of the Planning Unit is a low-lying, moderate-deep flooded area forming the easternmost part of the Chalan Beel depression, which therefore normally is likely to provide habitats for many aquatic species, including fish species. The impact of FCD embankments could therefore be significant. The RRA of the Nagor River Project notes that the project has had many negative environmental impacts (and few positive ones), including the following major negative impacts:

- increased flooding
- reduced land availability and land capability
- reduced crop cultivation
- increased disruption of human life, reduced safety and survival capacity
- reduced social cohesion.

The biological impacts have not been as great as might be expected for two main reasons:

- flora and fauna have already been severely reduced in numbers and variety by expanding human occupancy, and

- the project has not functioned properly, therefore areas of wetland have barely been reduced.

Gender

The limited information available suggests that women in the area have few income-earning opportunities, and are primarily involved in household and homestead-based work. Some additional work opportunities are available due to increased boro cultivation, although women are paid less than men. However, since b. aman production has declined, work opportunities and post-harvesting work have also declined.

Other limited work opportunities are available for road maintenance and tree plantation, but these involve only small numbers. BRDB organises Women's Societies and gives loans, generally on an individual basis, for activities such as livestock raising and fattening, and rice husking. Some NGOs and Grameen Bank engage in similar programmes, but information on the extent of their operations is not available.

Female literacy is very low in the area, particularly the poorer lowland areas, being around 6-7%.