Table 7.2.1 Detailed Information on Proposed Telemetric Gauging Sites

Sl. No.	Station Name	River Name	Coordinate		District	Upazilla	Union	Village	Existence of Suitable Structure	Proposed Location of Facilities			Accessibility to the Site*
			Longitude	Latitude						Water Level Gauge	Rainfall Gauge	House	
1	Panchagarh	Karatoa	88°33' E	26°19' N	Panchagarh	Panchagarh	Dhakkamara	Puraton Panchagarh	Road Br.	Bridge Pier (Right Bank Side)	Right Bank Side	Right Bank Side	A
2	Dalia	Teesta	89°03' E	26°09' N	Nilphamari	Dimla	Khalisa Chapani	Dalia	Barrage, Revetment	Right Bank Side	Right Bank Side	Right Bank Side	A
3	Noonkhawa	Brahmaputra (Du Kumar)	89°46' E	25°54' N	Kurigram	Nageswari	Noonkhawa	Pattala	-	Right Bank Side	Right Bank Side	Right Bank Side	C
4	Kurigram	Dharla	89°40' E	25°50' N	Kurigram	Kurigram	Kurigram	Jurigram	Road Br. (under construction)	Bridge Pier (Right Bank Side)	Right Bank Side	Right Bank Side	A
5	Sirajganj	Jamuna	89°43' E	24°27' N	Sirajganj	Sirajganj	Sirajganj	Ghurka	Revetment	Right Bank Side	Right Bank Side	Right Bank Side	A
6	Pankha	Upper Padma	88°07' E	24°39' N	Nawabganj	Sibganj	Pankha	Sahupur	Spur	Spur (Left Bank Side)	Left Bank Side	Left Bank Side	C
7	Nakuagaon	Bhugai	90°13' E	25°10' N	Sherpur	Nalitabari	Nayabil	Nakuagaon	-	Right Bank Side	Right Bank Side	Right Bank Side	A
8	Durgapur	Someswari	90°40' E	24°07' N	Netrakona	Durgapur	Birisiri	Dakshin Bhananipur	-	Right Bank Side of New Mainstream	Left Bank Side of New Mainstream	Left Bank Side of New Mainstream	C
9	Laurergarh	Jadukata	91°15' E	25°12' N	Sunamganj	Tahirpur	Baddal	Rajat	-	Right Bank Side	Right Bank Side	Right Bank Side	C
10	Sarighat	Sarigowain	92°07' E	25°06' N	Sylhet	Jaintapur	Nizpat	Dhupi	Road Br.	Bridge Pier (Right Bank Side)	Right Bank Side	Right Bank Side	A
11	Kanaighat	Surma	92°16' E	25°00' N	Sylhet	Kanaighat	Kanaighat	Nandirai	-	Left Bank Side	Left Bank Side	Left Bank Side	B
12	Amalshid	Kushiyara	92°28' E	24°52' N	Sylhet	Zakiganj	Baratakuri	Amalshid	-	Right Bank Side	Right Bank Side	Right Bank Side	B
13	Chatlaghat	Monu	91°57' E	24°22' N	Moulvi Bazar	Kulaura	Sharifpur	Chatlapur	Road Br. (under construction)	Bridge Pier (Left Bank Side)	Left Bank Side	Left Bank Side	B
14	Bhairab Bazar	Upper Meghna	91°00' E	24°02' N	Kishoreganj	Bhairab	Bhairab	Bhairab	Road Br., Railway Br	Rly. Bridge Pier (Right Bank Side)	Right Bank Side	Right Bank Side	A
15	Comilla	Gumti	91°13' E	23°28' N	Comilla	Comilla	Commila	Sangrais	-	Left Bank Side	Left Bank Side	Left Bank Side	A
16	Dhaka (Mill Barak)	Buriganga	90°30' E	23°43' N	(Dhaka City)				Revetment	Left Bank Side	Left Bank Side	Left Bank Side	A
17	Mongla	Pasur	89°36' E	22°28' N	Bagerhat	Mongla	Mongla	Galachipa Digraj	Wharf (Mongla Port)	Left Bank Side	Left Bank Side	Left Bank Side	A
18	Rayenda	Baleswar	89°51' E	22°19' N	Bagerhat	Sarankhola	Rayenda	Rayenda	Road Br. (under constuction)	Bridge Pier	Right Bank Side	Right Bank Side	B
19	Patharghata	Bishkhali	89°59' E	22°03' N	Barguna	Patharghata	Patharghata	Patharghata	-	Right Bank Side	Right Bank Side	Right Bank Side	C
20	Dasmina	Tetulia	90°34' E	22°14' N	Patuakhali	Dasmina	Dasmina	Sayed Jafar	Foot Br.	Right Bank Side	Right Bank Side	Right Bank Side	C
21	Daulatkhan	Shahbazpur	90°45' E	22°36' N	Bhola	Daulatkhan	Bhabanipur	Bhabanipur	Intake Gate	Right Bank Side of Intake Canal	Right Bank Side of Intake Canal	Right Bank Side of Intake Canal	C
22	Panchapukuria	Halda	91°47' E	22°40' N	Chittagong	Fatikchhari	Sundarpur	Panchapukuria	-	Left Bank Side	Left Bank Side	Left Bank Side	B
23	Chittagong	Karnafuli	91°46' E	22°10' N	(Chittagong City)				Wharf (Chittagong Port)	Right Bank Side	Right Bank Side	Right Bank Side	A

Note*

A : Accessible to the site by truck with load of 10t.

B : Accessible to the neighboring point (within 500m) to the site by truck with load of 10t.

C : Accessible only to the remote point (more than 500 m) to the site by truck with load of 10t.

Table 7.2.2 Proposed Gauge Types and Data Transmission Method by Observatories

Sl. No.	Station Name	Rainfall Gauge		Water Level Gauge	
		Gauge Type	Data Transmission Method*	Gauge Type	Data Transmission Method*
1	Panchagarh	Tipping Bucket	Cable	Sonar	Cable
2	Dalia			Sensing Pole	Wireless
3	Noonkhawa			Sensing Pole	Wireless
4	Kurigram			Sonar	Cable
5	Sirajganj			Sensing Pole	Wireless
6	Pankha			Sonar	Cable
7	Nakuagaon			Sensing Pole	Wireless
8	Durgapur			Sensing Pole	Wireless
9	Laurergarh			Sensing Pole	Wireless
10	Sarighat			Sonar	Cable
11	Kanaighat			Sensing Pole	Wireless
12	Amalshid			Sensing Pole	Wireless
13	Chatlaghat			Sonar	Cable
14	Bhairab Bazar			Sonar	Cable
15	Comilla			Sensing Pole	Wireless
16	Dhaka (Mill Barak)			Sensing Pole	Wireless
17	Mongla			Sensing Pole	Wireless
18	Rayenda			Sensing Pole	Wireless
19	Pathargata			Sensing Pole	Wireless
20	Dasmina			Sensing Pole	Wireless
21	Daulatkhan			Sensing Pole	Wireless
22	Panchapukuria			Sensing Pole	Wireless
23	Chittagong			Sonar	Cable

Note: Data transmission method shown above is that from gauging equipment to gauge (telemeter) house located nearby.

Table 7.3.1 Summary of Test Result for HF Data Transmission Test

Data	Time	Transmitter	Receiver	Frequency [MHz]															Note
				3.305			4.442			5.089			8.188			8.157 (tested for reference)			
				Successful Trial	Number of Trial	Ratio of Success	Successful Trial	Number of Trial	Ratio of Success	Successful Trial	Number of Trial	Ratio of Success	Successful Trial	Number of Trial	Ratio of Success	Successful Trial	Number of Trial	Ratio of Success	
July 22, 2003	12:24-13:59	Dhaka	Sylhet										12	12	100%	12	12	100%	*1
	11:27-12:19	Sylhet	Dhaka										9	12	75%	12	12	100%	*1
	15:12-15:48	Dhaka	Sylhet										11	12	92%	11	12	92%	*1
	14:24-15:03	Sylhet	Dhaka										6	12	50%	5	12	42%	*1
	20:47-21:57	Dhaka	Sylhet	0	7	0%	5	12	42%	8	12	67%	10	12	83%				*2
July 26, 2003	5:26-6:04	Dhaka	Sylhet	0	7	0%	0	12	0%	0	12	0%	0	12	0%				*2
	6:37-7:22	Sylhet	Dhaka				0	12	0%	2	12	17%	7	12	58%				*2
	8:32-9:04	Dhaka	Sylhet				0	12	0%	0	12	0%	4	12	33%				*2
	7:47-8:29	Sylhet	Dhaka				0	12	0%	0	12	0%	6	12	50%				*2
	9:59-10:31	Dhaka	Sylhet				0	12	0%	0	12	0%	11	12	92%				*2
	10:34-11:08	Sylhet	Dhaka				0	12	0%	0	12	0%	0	12	0%				*2
	20:12-21:02	Sylhet	Dhaka				0	12	0%	0	12	0%	0	12	0%				*2
Total				0	14	0%	5	96	5%	10	96	10%	76	144	53%	40	48	83%	

*1: Voice was not communicated at 3.305, 4.442, 5.089MHz so that data was not considered to be transmitted.
Therefore, data transmission test at these 3 frequencies was omitted.

*2: Due to trouble of test equipment, data transmission test at 3.305MHz was not carried out.
However, voice was not communicated at 3.305MHz so that data was not considered to be transmitted.

**:The successful trial in the above table is summed up at every frequency by the reason
that the success and failure of data transmission does not depend on baud rate and data size.

Table 7.3.2 Summary of Test Result for VHF Interference Measurement

No.	Place	Latitude (N) / Longitude (E	Frequency 149.250 [MHz]					Frequency 166.075 [MHz]				
			Date	Time	The presence or absence of interference radio	Number of presence of interference radio	Average signal level [dBμV]	Date	Time	The presence or absence of interference radio	Number of presence of interference radio	Average signal level [dBμV]
1	Amalshid	24°52'370"/092°22'002"	23-Jul-2003	12:15-15:15	presence / absence			23-Jul-2003	15:16-18:16	presence / absence		
2	Kanaighat	24°59'842"/092°15'699"	24-Jul-2003	10:38-13:38	presence / absence			24-Jul-2003	13:39-16:39	presence / absence		
3	Sarighat	25°05'767"/092°07'253"	25-Jul-2003	10:17-13:17	presence / absence			25-Jul-2203	13:20-16:20	presence / absence		
4	Nakuagaon	25°11'393"/090°10'115"	30-Jul-2003	12:53-14:23	presence / absence			30-Jul-2003	14:24-15:54	presence / absence		
5	Durgapur	25°07'108"/090°40'787"	31-Jul-2003	10:40-13:10	presence / absence			31-Jul-2003	13:12-15:42	presence / absence		
6	Noonkhawa	25°50'716"/089°43'632"	4-Aug-2003	07:25-10:25	presence / absence			4-Aug-2003	11:40-14:40	presence / absence		
7	Kurigram	25°48'519"/089°38'011"	5-Aug-2003	08:58-11:58	presence / absence			5-Aug-2003	12:00-15:00	presence / absence		
8	Dalia	26°09'451"/089°02'211"	6-Aug-2003	09:17-12:17	presence / absence			6-Aug-2003	12:19-15:19	presence / absence		
9	Panchagarh	26°20'293"/088°33'442"	7-Aug-2003	10:04-13:04	presence / absence			7-Aug-2003	13:06-16:06	presence / absence		
10	Pankha	24°38'376"/088°09'836"	9-Aug-2003	09:49-12:49	presence / absence			9-Aug-2003	12:50-15:50	presence / absence		
11	Comilla	23°27'839"/091°11'710"	12-Aug-2003	10:55-13:55	presence / absence			12-Aug-2003	13:56-16:56	presence / absence		
12	Laurergarh	25°11'492"/091°15'224"	15-Aug-2003	11:20-14:20	presence / absence			15-Aug-2003	14:21-17:21	presence / absence		
13	Bhairab Bazar	25°11'486"/091°15'219"	17-Aug-2003	12:18-15:18	presence / absence			17-Aug-2003	15:20-18:20	presence / absence		

Table 7.4.1 Summary of Flood Forecasting Errors Obtained from Trial Simulation

Location	Case	Error (cm) Exceeded For Given Percentage of Time					MAE (cm)	Max. Error (cm)
		50%	40%	30%	20%	10%		
Flash Flood Areas (Averages Based on 6 Stations)								
24hr	27 Update Stn, Obs. Bound.	0.13	0.17	0.22	0.28	0.40	0.20	1.25
	No Updating, Obs. Bound.	0.15	0.19	0.23	0.34	0.45	0.22	1.13
	27 Update Stn, FFWC Bound.	0.14	0.19	0.26	0.38	0.54	0.24	1.16
48hr	27 Update Stn, Obs. Bound.	0.21	0.27	0.33	0.42	0.60	0.31	1.55
	No Updating, Obs. Bound.	0.23	0.28	0.34	0.47	0.62	0.32	1.39
	27 Update Stn, FFWC Bound.	0.28	0.36	0.46	0.64	0.92	0.41	1.73
72hr	27 Update Stn, Obs. Bound.	0.26	0.35	0.41	0.51	0.69	0.37	1.71
	No Updating, Obs. Bound.	0.28	0.35	0.42	0.58	0.72	0.38	1.55
	27 Update Stn, FFWC Bound.	0.36	0.46	0.63	0.91	1.15	0.54	2.19
Monsoonal Flood Areas (Averages Based on 26 Stations)								
24hr	27 Update Stn, Obs. Bound.	0.05	0.06	0.07	0.09	0.12	0.06	0.28
	No Updating, Obs. Bound.	0.04	0.06	0.07	0.09	0.12	0.06	0.25
	27 Update Stn, FFWC Bound.	0.05	0.06	0.07	0.10	0.13	0.07	0.41
48hr	27 Update Stn, Obs. Bound.	0.08	0.10	0.13	0.16	0.21	0.11	0.46
	No Updating, Obs. Bound.	0.08	0.09	0.11	0.14	0.19	0.10	0.36
	27 Update Stn, FFWC Bound.	0.09	0.12	0.15	0.18	0.26	0.14	0.65
72hr	27 Update Stn, Obs. Bound.	0.12	0.14	0.18	0.22	0.28	0.15	0.58
	No Updating, Obs. Bound.	0.10	0.13	0.16	0.19	0.24	0.13	0.45
	27 Update Stn, FFWC Bound.	0.14	0.18	0.22	0.28	0.40	0.20	0.79

Table 7.6.1 Flood Shelter (Up to June 1999)

	Presented by Private Organization KARITAS	
Sl.	**District Name**	**Number of Shelter**
1.	Gopal Gonj	4
2.	Barishal	2
3.	Madaripur	2
4.	Sherpur	1
5.	Netrokona	3
6.	Mymenshingh	2
7.	Sunamgonj	1
8.	Naogaon	3
9.	Natore	4
10.	Pabna	4
11.	Rajshahi	3
12.	Chapi Nababganj	1
13.	Norail	2
14.	Faridpur	2
15.	Rajbari	2
16.	Kurigram	1
17.	Lalmonirhat	1
18.	Dinajpur	1
19.	Narayangonj	1
20.	Monshigonj	3
21.	Gazipur	6
22.	Sunamgonj	1
23.	Sylhet	1
24.	Dhaka	7
A.	**Total**	**58**

	Constructed By District Administration	
Sl.	**District Name**	**Number of Shelter**
1.	Shirajgonj	4
2.	Gaibandha	5
3.	Brahmman Baria	3
4.	Comilla	25
B.	**Total**	**37**
	Total (A+B)	**95**

Source: DMB.

Table 8.4.1 Staffing of Present FFWS

Division	Operation Task	Maintenance Task	SE	XEN	SDE	AE	Technical Staff	Support Staff	
Field Office	(Surface Water Division)	(Surface Water Division)	1	4	13	22	31	179	108
	Gauge Reading	Maintenance of hydrological survey station	*1 x0.2	x0.2	x0.2	x0.2	x0.2	x0.2	(GaugeReader)
	Set Stuff gauge and measure the level		0.2	0.8	2.6	4.4	6.2	35.8	
Central Office	(PFFC)		1	1	1	2	1	15	
	- SE Office		*2 x0.2	x0.2	x0.2	x0.2	x0.2	x0.2	
	Supervision of C&I and FFWC		0.2	0.2	0.2	0.4	0.2	3	
	-Management & service branch								
	Operation and management of the computer network among the branches of PFFC	Maintenance of the computer network among the branches of PFFC							
	(C&I Division)			1		1	1	15	
	Supervision of C&I Green Road			*3 x0.33		x0.33	x0.33	x0.33	
				0.3		0.3	0.3	5	
	(C&I Green Road)	(C&I Green Road)			1.2	1.2	3.2	11.2	85
	Receiving Data by HF Transceiver	HF Transceiver Maintenance							(HF Operator)
		Automatic gauge Maintenance							
		Telemeter Maintenance							
		Restoration of gauging structure							
	(FFWC)	(FFWC)		1	8			15	
	Receiving Data by HF Transceiver	Validation of analyzing model							
	Set boundary condition	Modification of Hazard map							
	Run the Super Model	Computer System Maintenance							
	(Making Country BULLETIN	FFWS Software Maintenance							
	and Hazard Map)								
	Edit the BULLETIN								
	Dissemination of Fax, E-mail,								
	and WebSite-Upload								
Total		Sub Total	0.4	2.3	12	6.3	9.9	70	193
		Grand Total							293.9

Remark *1 Part Time (Rate for FFWS=0.2)
*2 Part Time (Rate for FFWS=0.2)
*3 Part Time (Rate for FFWS=0.33)

Table 8.4.2 Staffing of Present Hydrology

Division	Circle	Division	Function	Manager					Staff		Field		Others
				CE	SE	XEN	SDE	AE	TS	SS	GR	TCO	
Regional	River Morphology & Research Circle	Mymensingh Division	To carry out the X-section and the Bathymetric survey			1	3	8	14	31			
		Kushitia Division				1	2	6	9	25			
	Surface Water Hydrology Circle	South Eastern Division	To carry out surface water hydrological survey			1	3	5	7	40	38		
		South Western Division				1	4	6	8	48	54		
		North Eastern Division				1	3	5	8	47	52		
		Northern Division				1	3	6	8	44	56		
	Ground Water Hydrology Circle	Div-1	To collect field hydro-geological data			1	8	5	11	40			
		Div-2				1	7	4	11	29			
Regional Total					0	8	33	45	76	304	200	0	
Central	CE Hydrology	CE Office	To provide supervision and technical guidance for the Circles under Hydrology	1		1	1	2	3	12			
	PFFC	SE Office	To supervise the quality control of hydrological &hydro-meteorological data processing		1	1	1	2	1	15			
		River Morphology Processing	To process river morphological data (river section, sounding)			1		3		3			
		Surface Water Processing Branch	To process surface water level data (water level, discharge, rainfall, evaporation)			1		10		6			
		Grand Water Processing Branch	To process ground water data			1		4		3			
		Management & Service Branch	To manage all hardware and software systems including computer network					2		1			
		Index and Publication Branch	To publish annual report etc.					1	1	3			
		FFWC	To collect real time data and prepare warning bulletin			1	8			15			
		C&I(Dhaka)	To supervise C&I(shimarail), C&I(Div-1) and C&I(Div-2)			1		1	1	15			
		C&I(Shimrail))	To repair, maintain and operate watercrafts, vessels, survey instruments for hydrological data collection.				1	2	2	60			
		C&I(Div-1)					1	1	1	6			
		C&I(Div-2)	To construct, operate and maintain wireless stations, wireless receivers and other related equipment.				1	1	3	10		85	
	River Morphology & Research Circle	SE Office	To manage the collection and preservation of raw data		1			3	3	12			
		Mapping Cell	To supervise preparation of maps using PHOCUS software			1		5	13	7			
	Surface Water Hydrology (Dhaka)		To supervise the quality control of hydrological &climatological data collection		1			3	5	10			
	Grand Water Hydrology (Dhaka)		To supervise technical guidance of all field ground data collection network		1	2		1	4	11			
Central Total				1	4	10	13	41	37	189	0	85	
Grand Total				1	4	18	46	86	113	493	200	85	
Total Stuff												1046	

CE:Chief Engineer, SE:Superintending Engineer, XEN:Executive Engineer, SDE:SubDivisional Engineer, AE:Assistant Engineer,
TS:Technical Stuff, SS:Support Stuff, GR:Gauge Reader, TCO:Telecom Operator

Table 8.4.3 Staffing of Improved Hydrology

Division	Circle	Division	Function	Manager					Staff		Field		Others
				CE	SE	XEN	SDE	AE	TS	SS	GR	TCO	
Regional	Regional FHC	(Data Collection)	To maintain gauging station		1	1	1	1	3	8	17 1		17:Mannual 1:Telemeter
		(Data Transmission)	To operate and maintain data transmission equipment in regional FHC and gauging station				1	1	3				
		(Forecasting)	To forecast water level and prepare regional warning bulletin				1	1	3				
	River Morphology & Research Circle		To carry out the X-section and the Bathymetric survey			1	1	3	5	10			
	Surface Water Hydrology Circle		To carry out surface water hydrological survey			1	3	8	12	15	19		
	Ground Water Hydrology Circle		To collect field hydro-geological data			1	3	2	5	15			
	(Sub Total)				1	4	10	16	31	48	37	0	
Regional Total(Sub Total x 5)					5	20	50	80	155	240	185	0	
Central	CE Hydrology		To provide supervision and technical guidance for the Circles under Hydrology	1		1		2	3	10			
	FHC	(Data Collection)	To supervise regional data collection div.		1	1				7			
		(Data Transmission)	To operate and maintain data transmission equipment in central FHC			1	1	1	3				
		(Forecasting)	To prepare nationwide warning bulletin			1	1	1	3				
	River Morphology & Research Circle		To supervise regional river morphology & research circle and collect river morphology data		1	1		8	15	20			
	Surface Water Hydrology Circle		To supervise regional surface water & hydrology circle and collect surface water data		1	1		3	5	10			
	Ground Water Hydrology Circle		To supervise regional ground water & hydrology circle and collect ground water data		1	1		2	5	10			
	Processing Division		To process all the data (river morphological data, surface water level data and ground water data)			1	5	15	5	15			
	Instrumentation Division		To repair, maintain and operate watercrafts, vessels, survey instruments for hydrological data collection.			1	2	4	5	75			
Central Total				1	4	9	9	36	44	147	0	0	
Grand Total				1	9	29	59	116	199	387	185	0	
Total Stuff												985	

CE:Chief Engineer, SE:Superintending Engineer, XEN:Executive Engineer, SDE:SubDivisional Engineer, AE:Assistant Engineer,
TS:Technical Stuff, SS:Support Stuff, GR:Gauge Reader, TCO:Telecom Operator

Table 11.5.1 Implementation Schedule

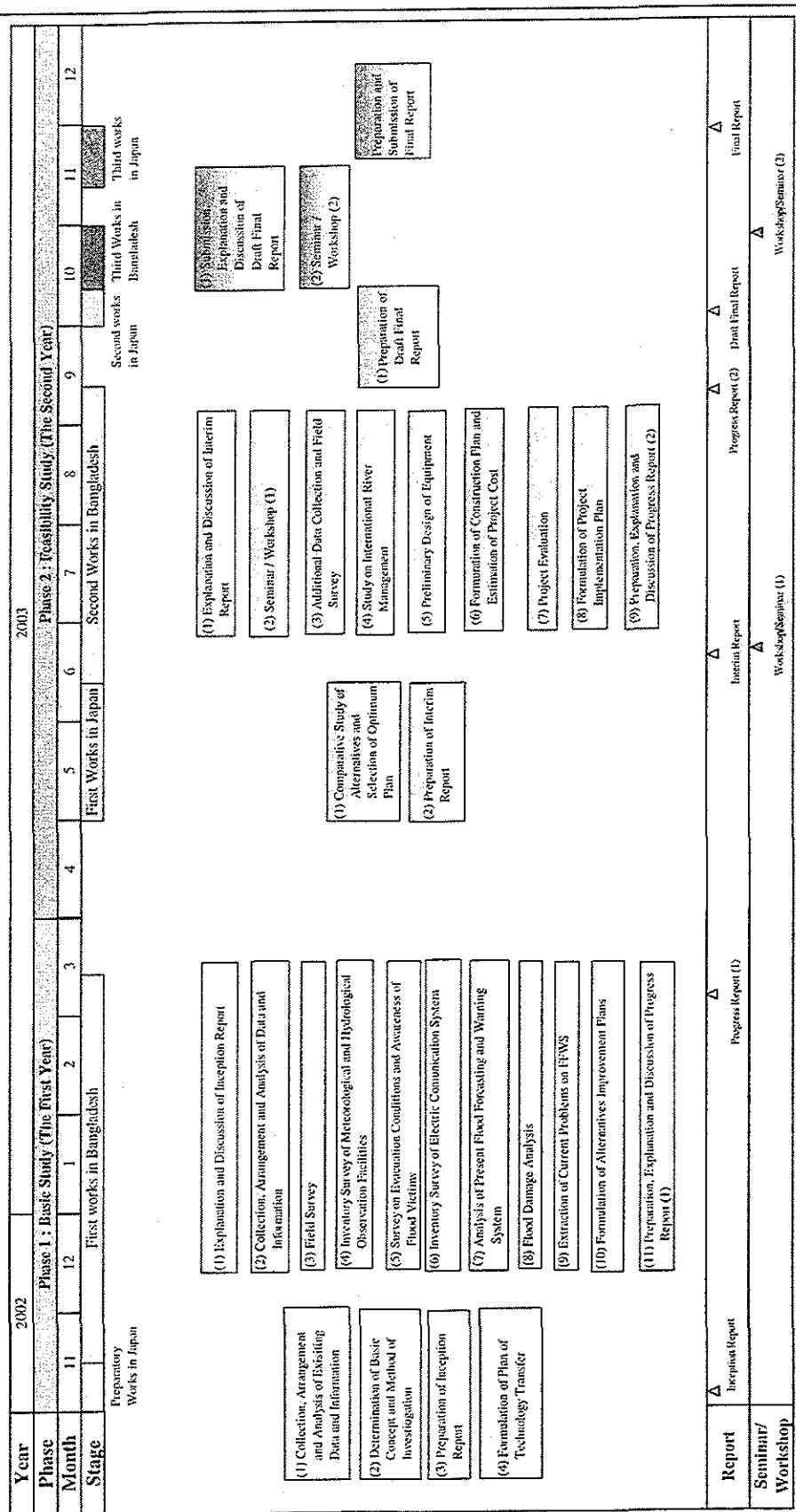
Pilot Project

Work Item	2003	2004	2005	2006	2007	2008	Local	Foreign
Completion of F/S							BWDB	
Financial Arrangement								
Design							BWDB	Foreign Assistance
Implementation and supervising of Pilot Project							BWDB	Foreign Assistance
Guidance Period							BWDB	Foreign Assistance

Priority Study

Work Item	2003	2004	2005	2006	2007	2008	Local	Foreign
1) Formulation of O&M Plan							BWDB	
2)Clarification of River management								
National Water Code							MOWR	
3) Strengthen of dissemination and evacuation (Response)								
FFWS is to be included in NWMP							MOWR and MDMR	UNDP
FFWS is to be included in CDMP							MOWR and MDMR	UNDP
4) Institutional study								
Institutional study							BWDB	Foreign Assistance
Regional organization plan for pilot project							BWDB	Foreign Assistance
Operating and Monitoring of Pilot project							BWDB	Foreign Assistance
5)Collecting the information on river management and review of danger level								
Collecting the information of river structures							BWDB	Foreign Assistance
Preparation of Operation manual							BWDB	Foreign Assistance
Preparation of DEM							BWDB, Survey of Bangladesh, and LGED	
Preparation of Flood Hazard map							BWDB	
Review / identification of danger level							BWDB	Foreign Assistance
Survey the river cross-sections							BWDB	

FIGURES



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.4.1

Overall Workflow

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.5.1

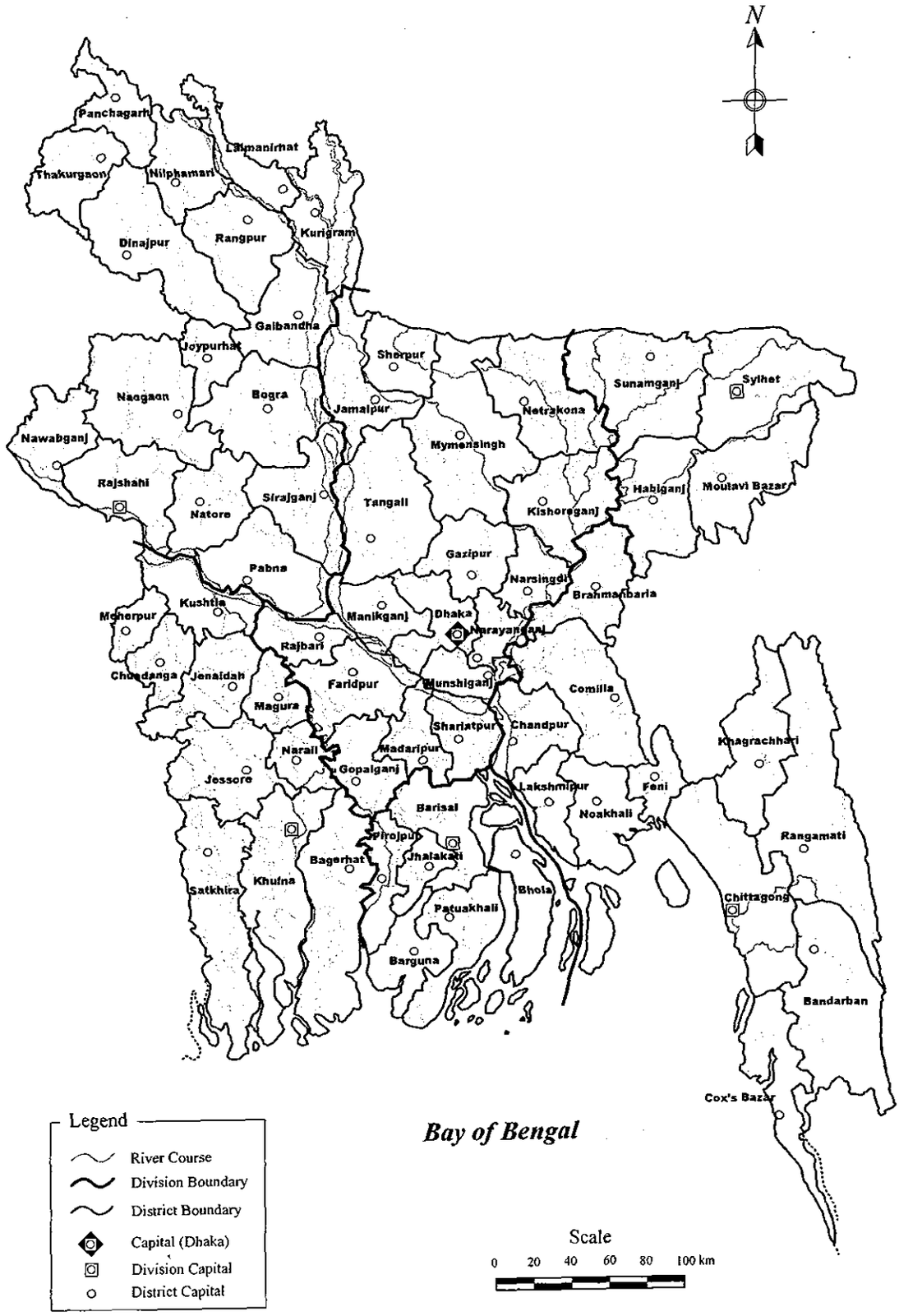
Staffing Schedule

Position	Name	FY2002						FY2003							
		10	11	12	1	2	3	4	5	6	7	8	9	10	11
Team Leader / River and Flood Control Expert	Hideki SATO														
Deputy Team Leader / Telecommunication System Expert	Masato OKUDA														
Flood Forecasting and Warning System Expert	Gregory HOOKEY														
Radio Transmission Expert	Masahiro SAKAGAMI														
Hydrologist	Kensuke SAKAI														
Economist / Finantial Analyst	Kiminari TACHIYAMA														
Institutional Expert	Nurul ISLAM														
Expert of International Cooperation	Naoko ANZAI														
Administrative Coordinator	Hiroto NAKAGAWA / Tadahiro FUKUDA														
Report			△ IC/R				△ P/R(1)			△ IT/R			△ P/R(2)	△ DF/R	△ F/R
Workshop / Seminar										△				△	
Stage		Phase I : Basic Study						Phase II : Feasibility Study on Selected Option(s)							

LEGEND ■ : Works in Bangladesh □ : Works in Japan

IC/R : Inception Report P/R(1) : Progress Report (1) IT/R : Interim Report

P/R(2) : Progress Report (2) DF/R : Draft Final Report F/R : Final Report

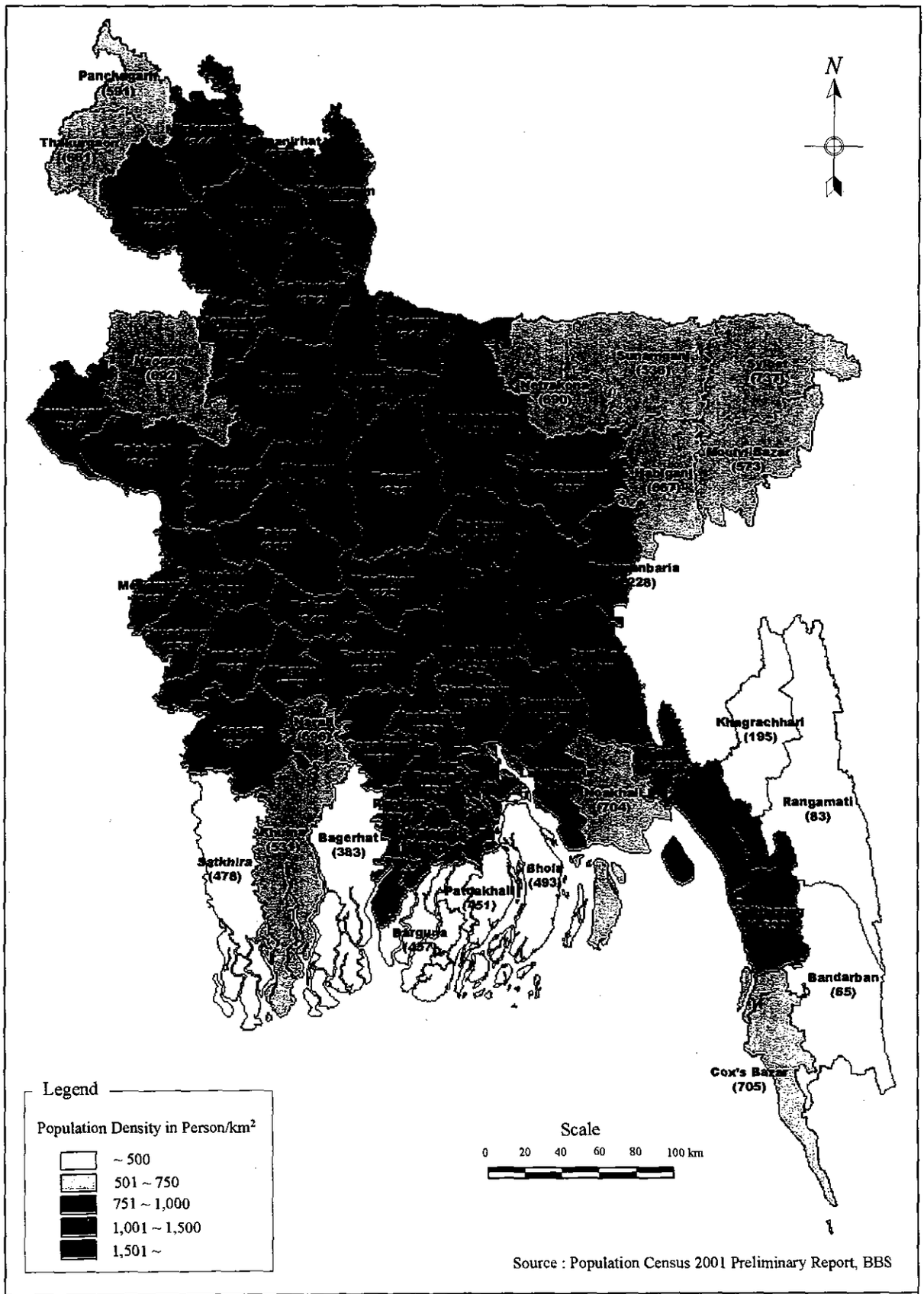


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

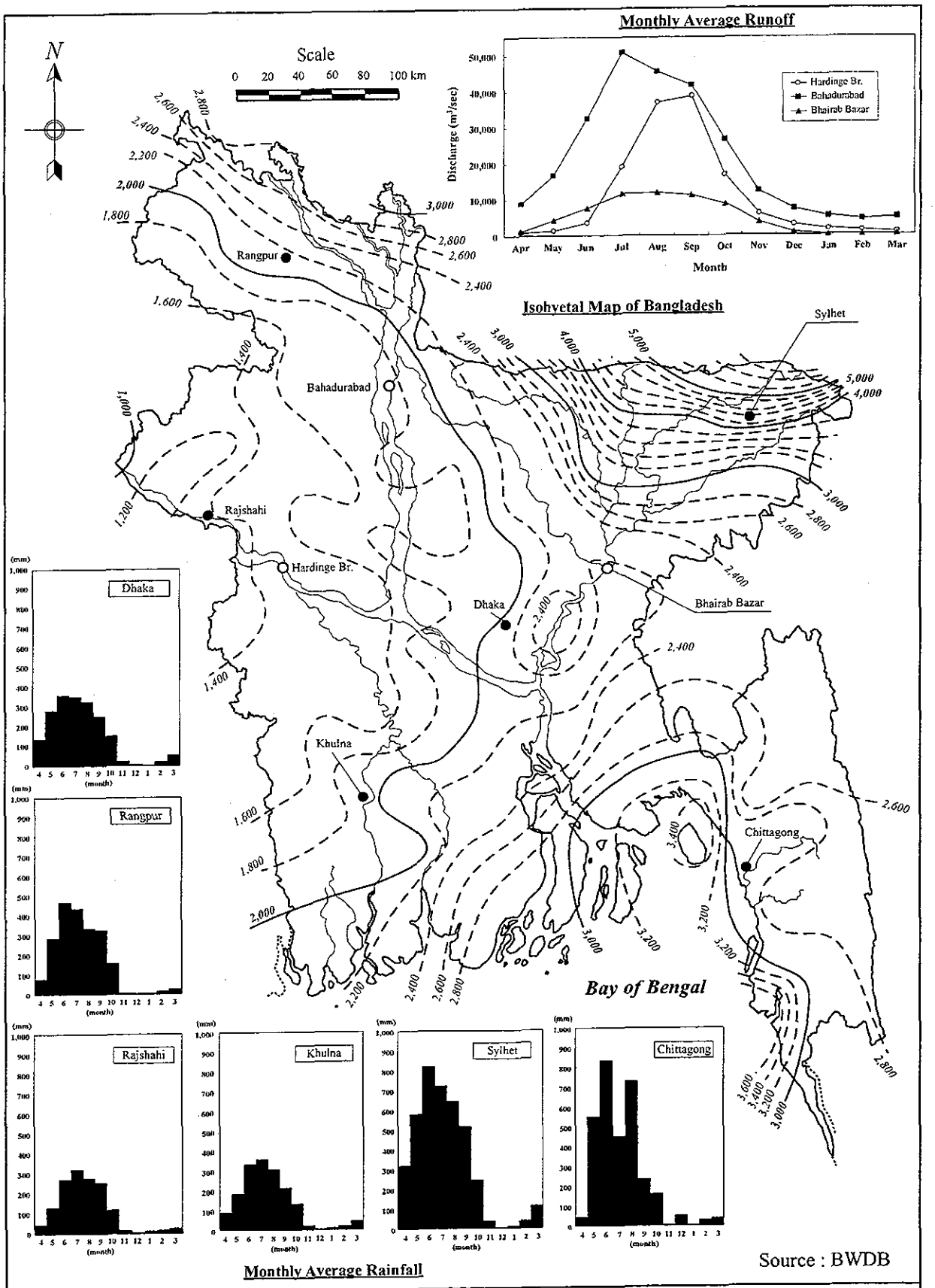
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.2.1

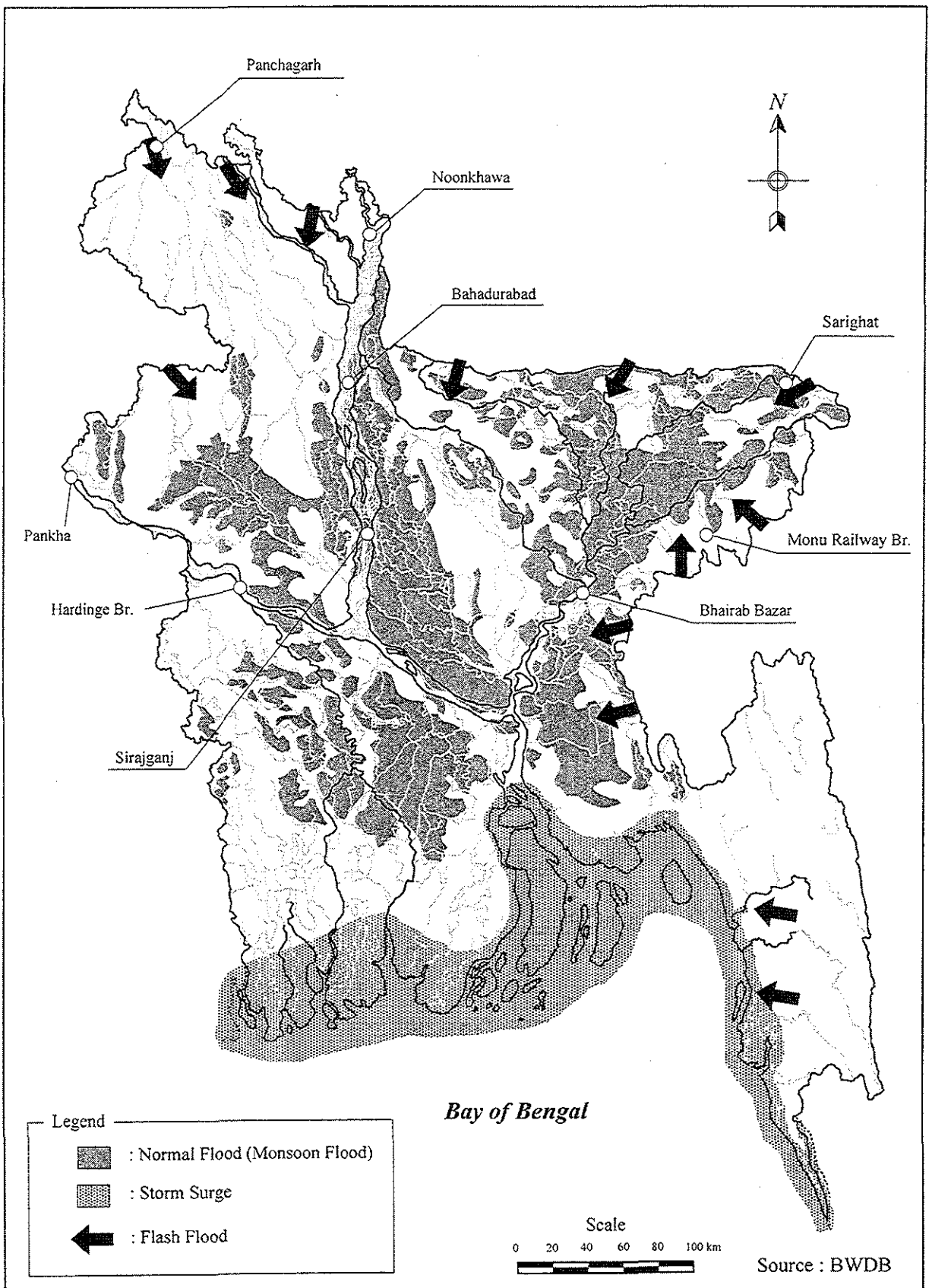
Administrative Boundary of Bangladesh



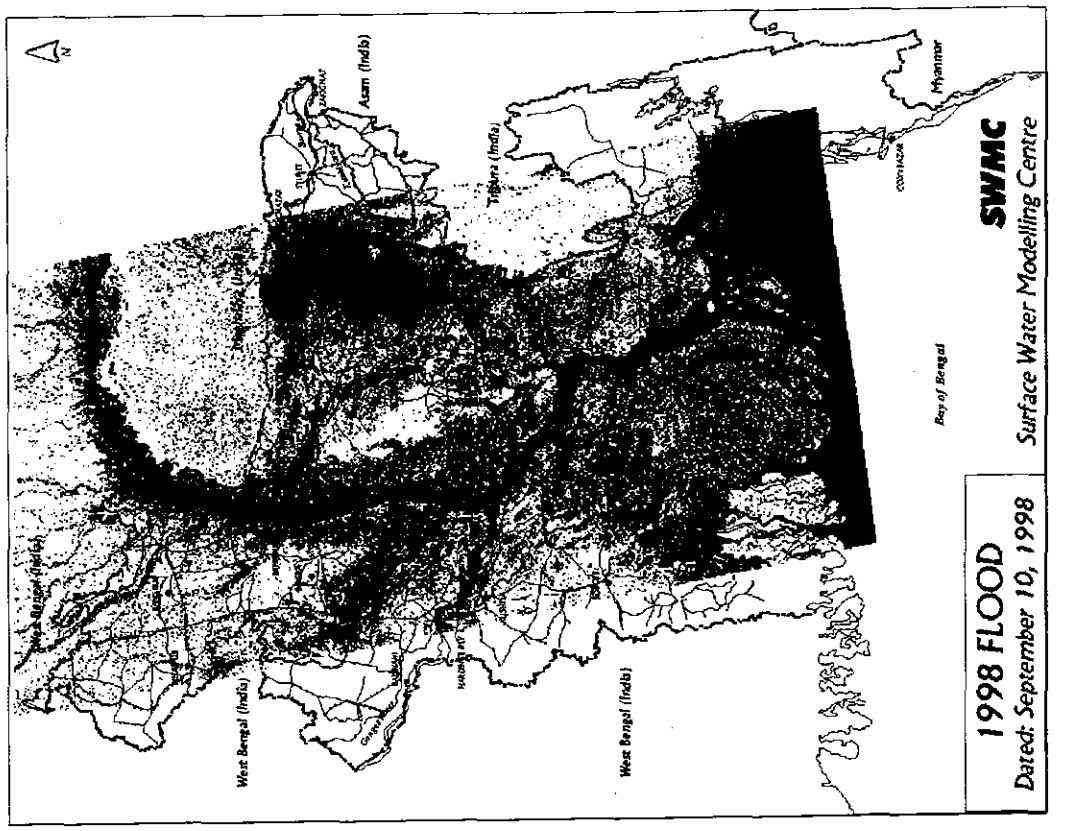
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.2.2
JAPAN INTERNATIONAL COOPERATION AGENCY	Population Density by District (2001)



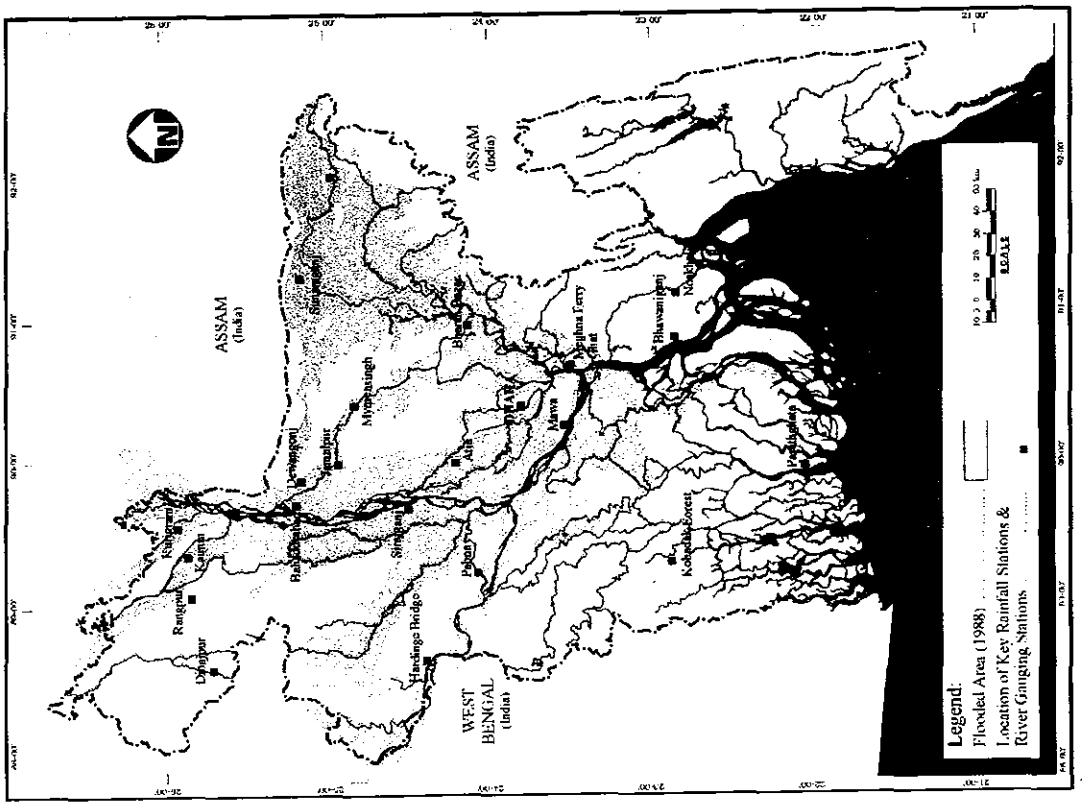
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydrometeorological Condition in Bangladesh



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.2
JAPAN INTERNATIONAL COOPERATION AGENCY	Flood Types in Bangladesh



1998 Flood (Source : SWMC)

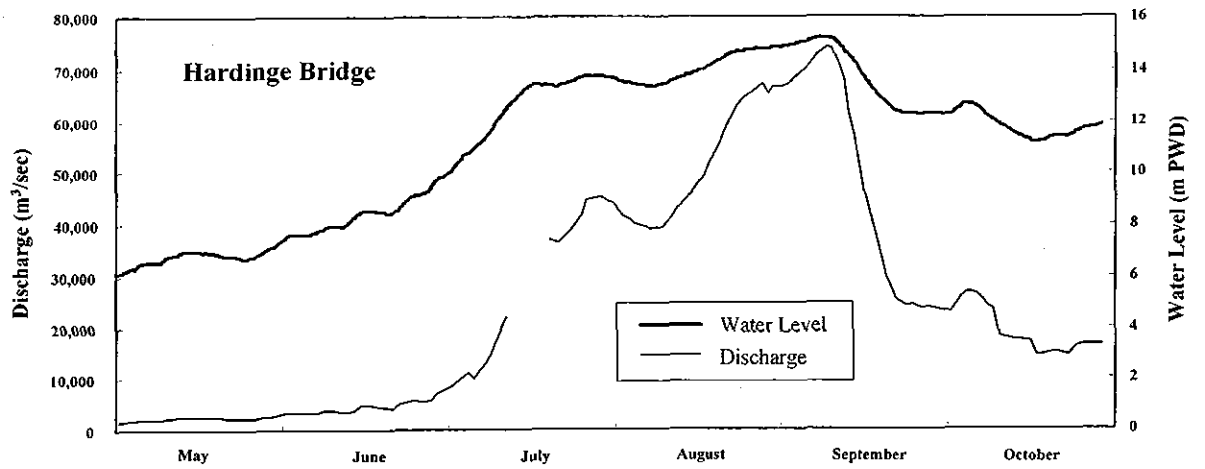


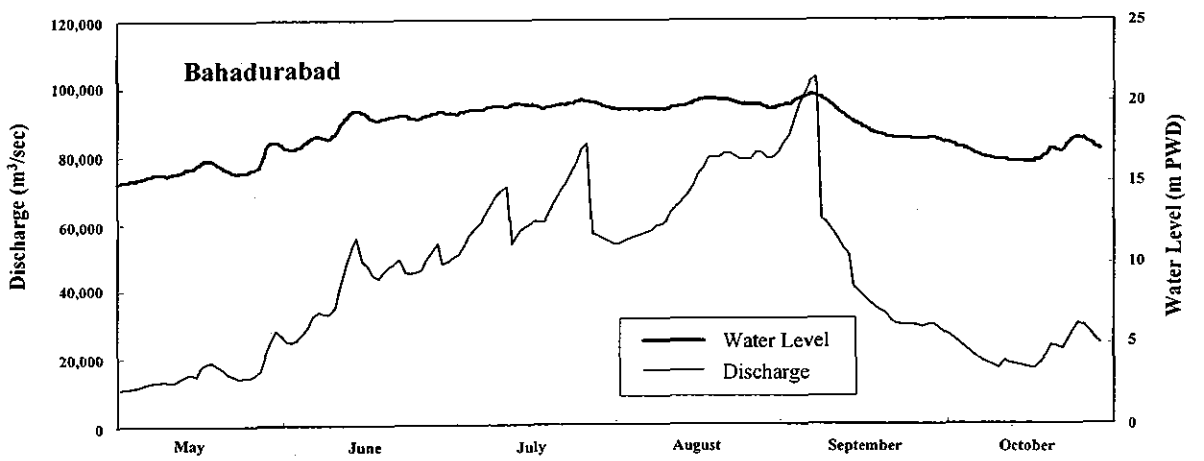
1988 Flood (Source : BWDB)

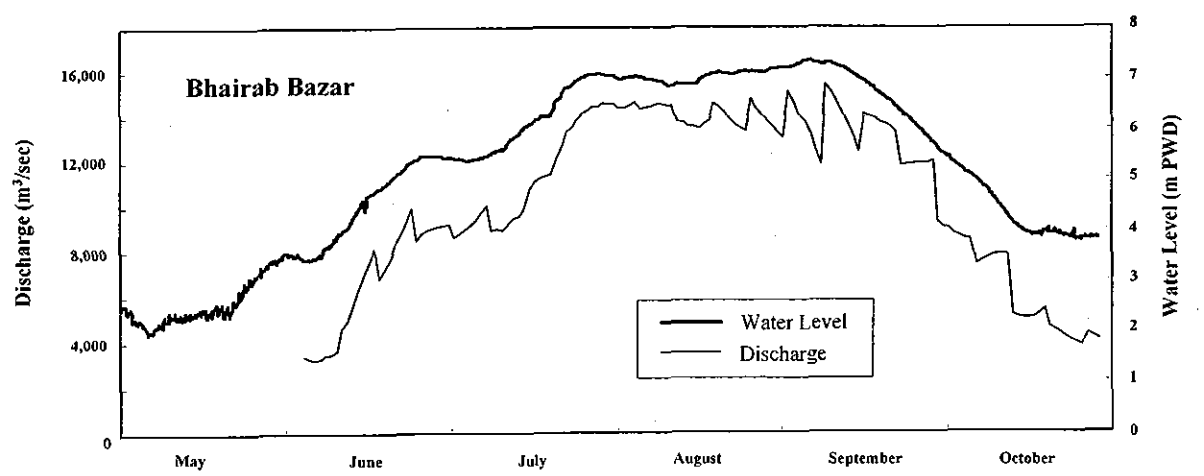
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.4.3
Flood Affected Area for Past Large-scale Events



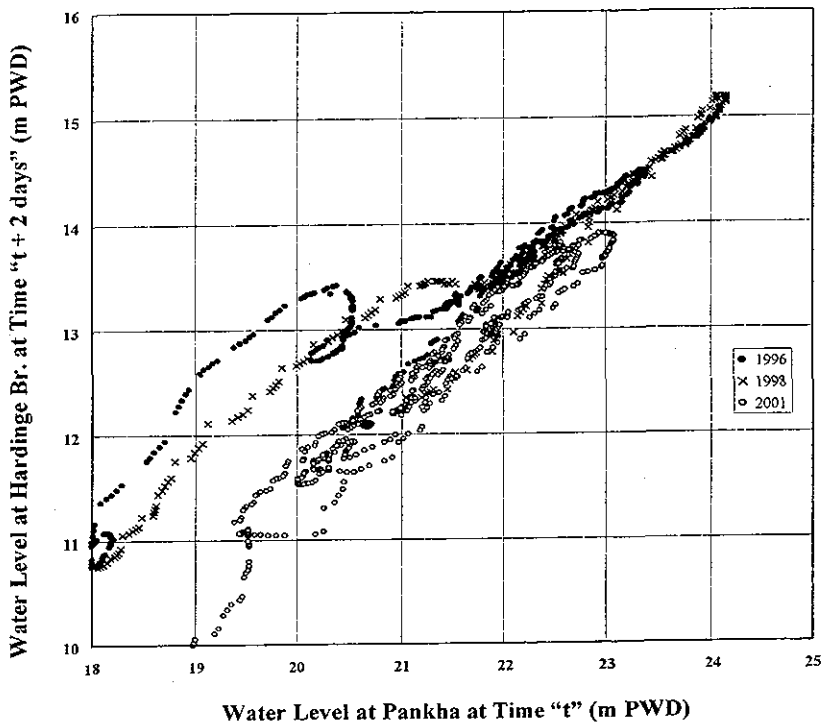




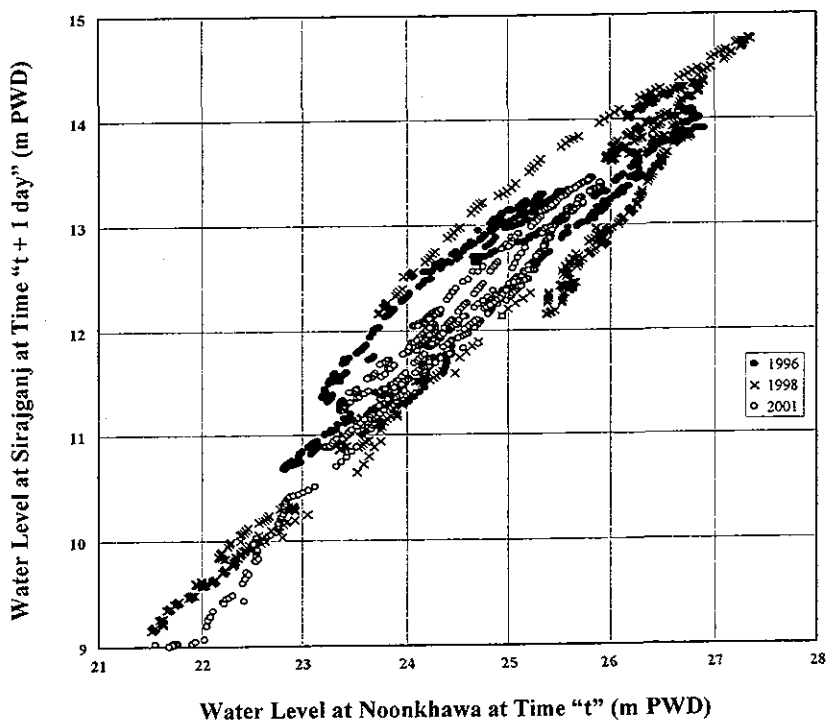
Note: The fluctuations of discharge record seem to be unnaturally large compared to those of water level. It is recommended for BWDB to review the discharge record as well as the method of conversion from water level to discharge.

Data Source : BWDB

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.4
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydrographs of 1998 Flood



(1) Water Level Correlation between Pankha and Hardinge Br.

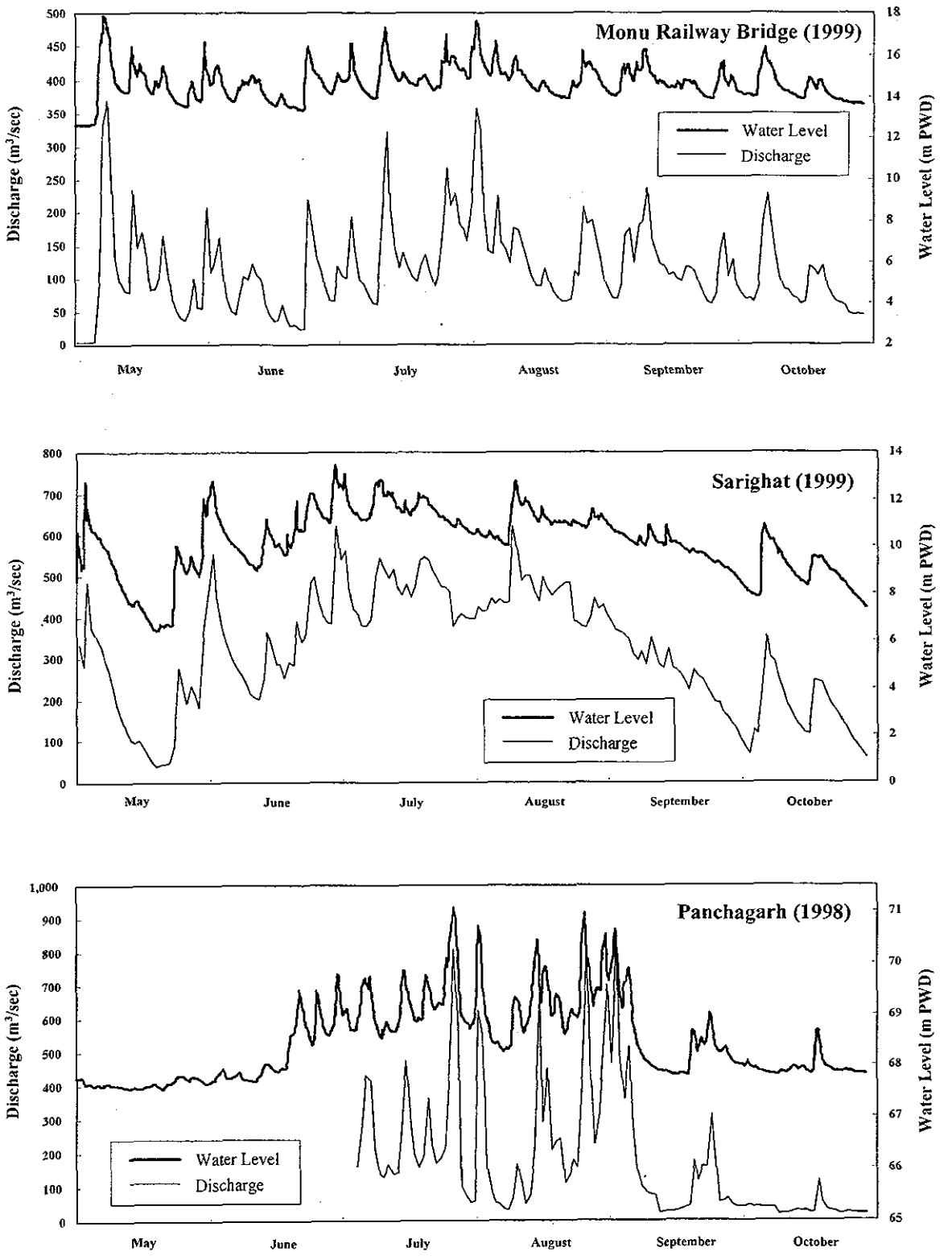


(2) Water Level Correlation between Noonkhawa and Sirajganj

Note: Lag time is set to compress the loop around the highest water level built up due to the difference of the water level situation (rising or lowering).

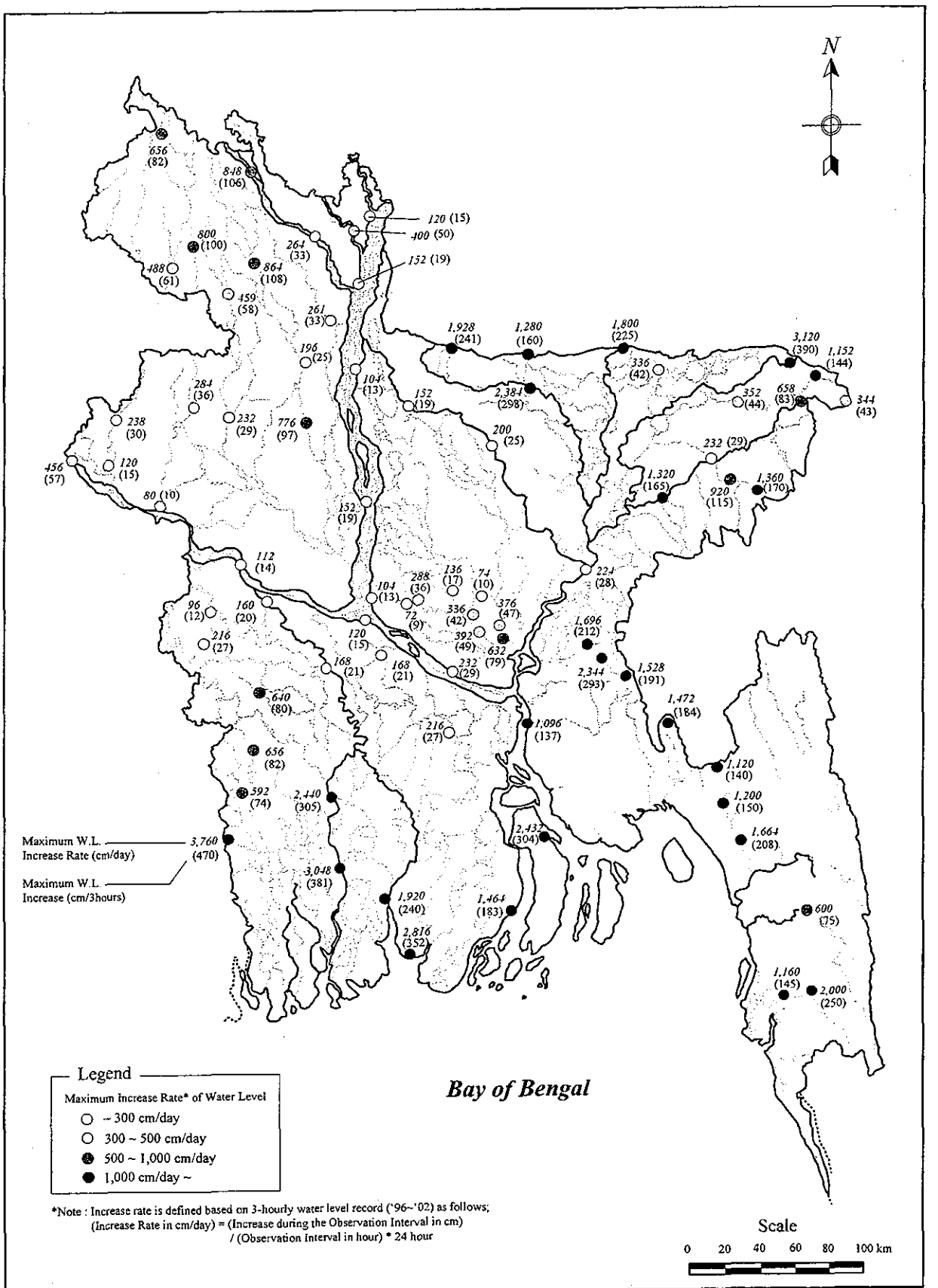
Data Source: BWDB

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.5
JAPAN INTERNATIONAL COOPERATION AGENCY	Water Level Correlations along Major Rivers

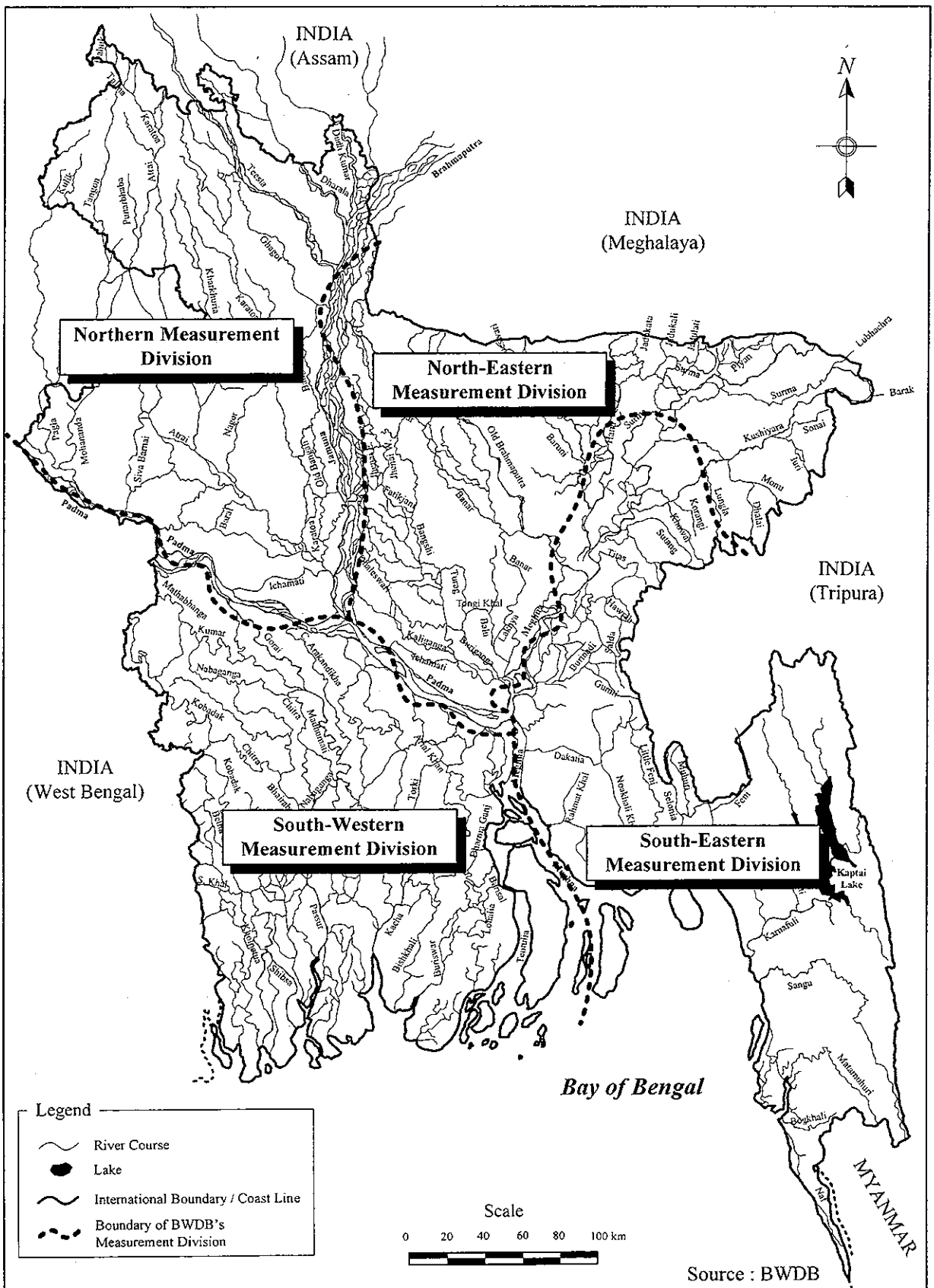


Data Source : BWDB

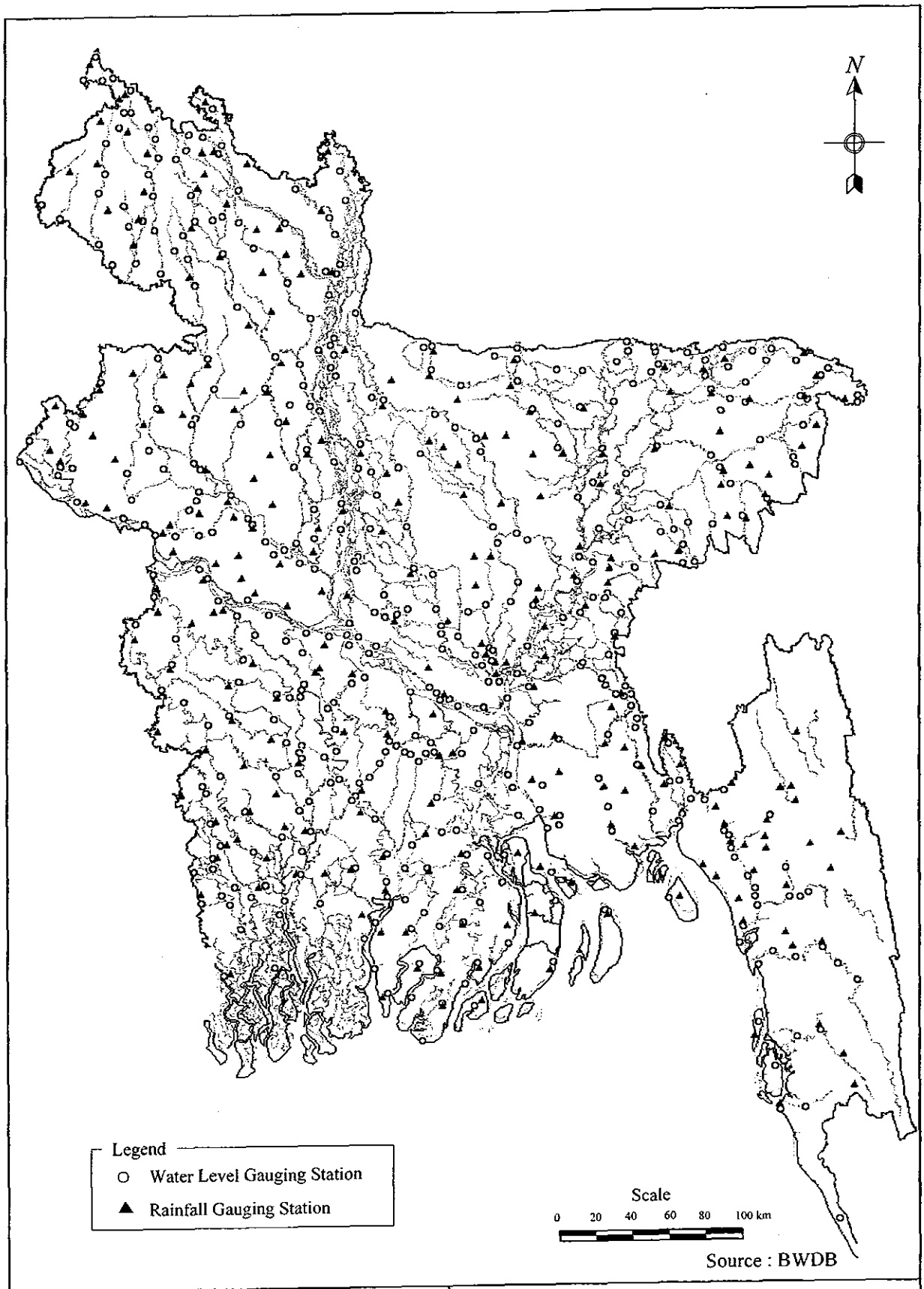
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.6
JAPAN INTERNATIONAL COOPERATION AGENCY	Hydrographs of Flashy Rivers



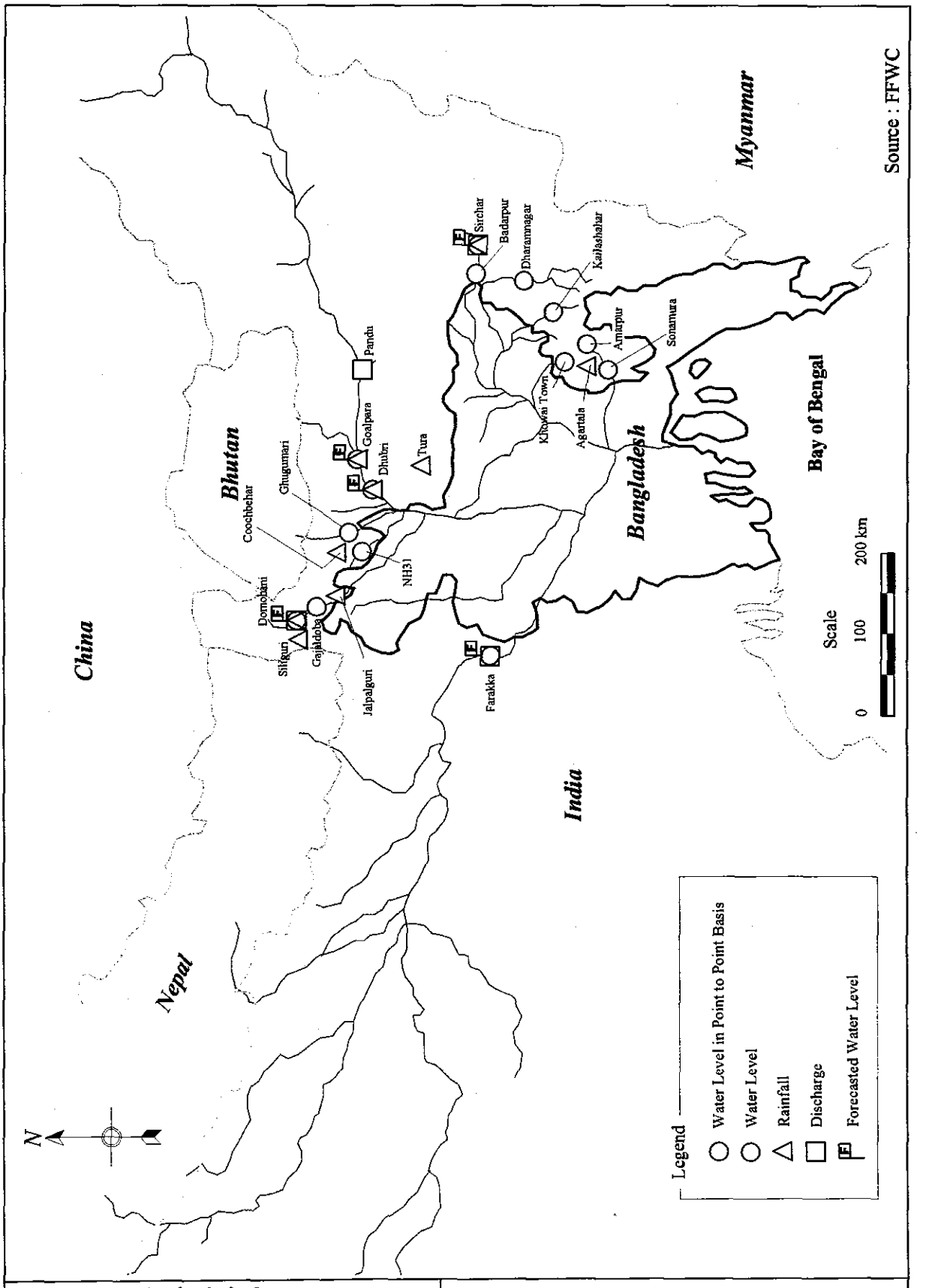
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.7
JAPAN INTERNATIONAL COOPERATION AGENCY	Maximum Water Level Increase in 3 Hours



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.8
JAPAN INTERNATIONAL COOPERATION AGENCY	Measurement Division of BWDB (SW)



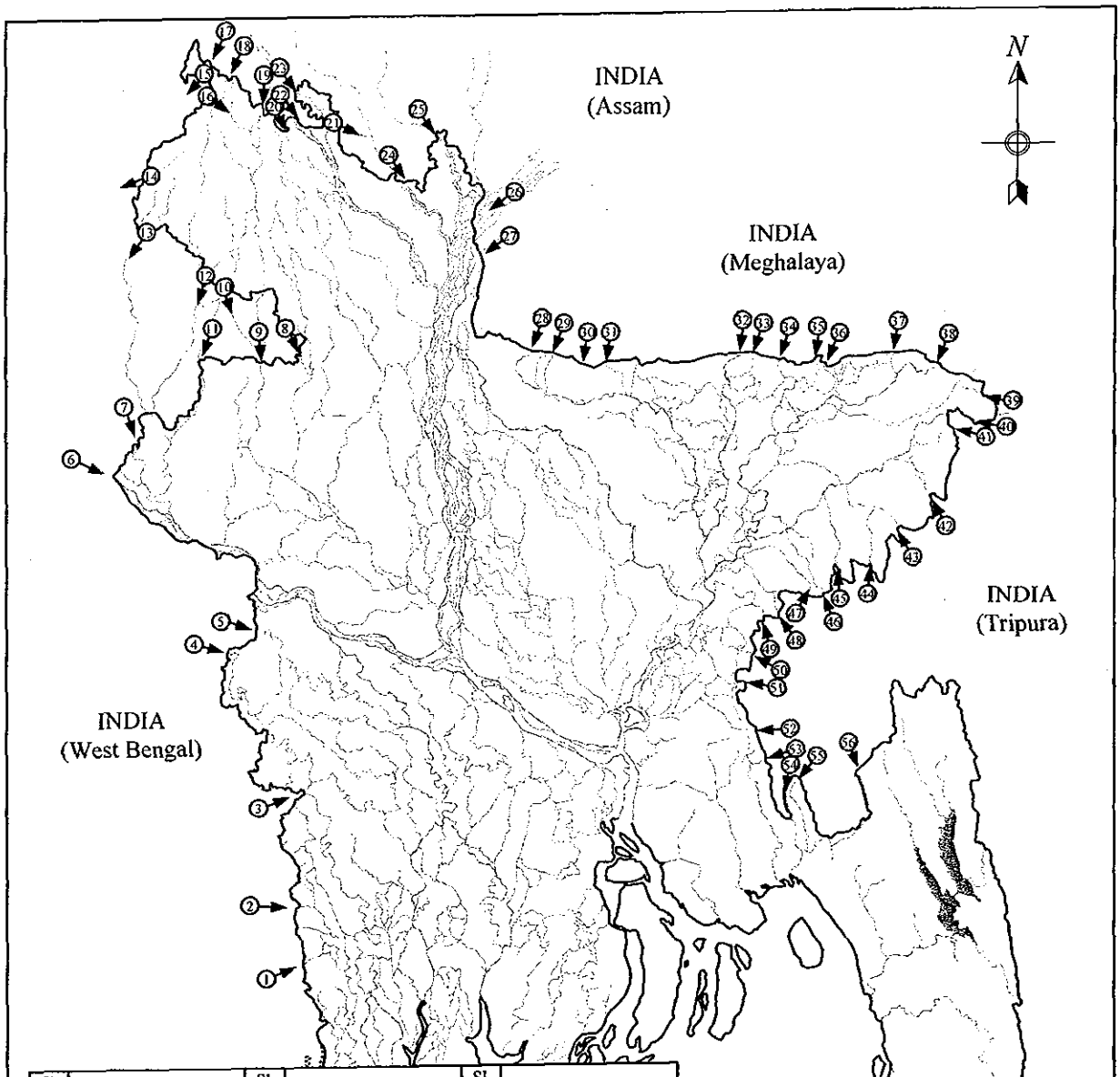
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.4.9 Water Level and Rainfall Gauging Stations of BWDB
JAPAN INTERNATIONAL COOPERATION AGENCY	



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.4.10
Flood Related Data Sharing Agreed in 1972 and Subsequent JRC Meetings



Sl. No.	River Name	Sl. No.	River Name	Sl. No.	River Name
1	Ray Mangal	21	Buri Teesta	41	Sonai Bardal
2	Icharmati-Kalindi	22	Teesta	42	Juri
3	Benta-Kodalia	23	Sangil	43	Monu
4	Bhairab-Kabodak	24	Dharla	44	Dhalai
5	Mathabhanga	25	Dudhkumar	45	Langola
6	Ganges (Padma)	26	Brahmaputra	46	Khowai
7	Pagla	27	Jinjiran	47	Sutang
8	Khukshi	28	Chilakhali	48	Sonai
9	Atrai	29	Bhogai	49	Howra
10	Punarbhaba	30	Nitai	50	Bijni
11	Tentulia	31	Semeswari	51	Salda
12	Tangon	32	Jadukata	52	Gomti
13	Kulic	33	Dhamalia	53	Feni-Dakatia
14	Nagar	34	Nawagang	54	Selonia
15	Mahananda	35	Eusium	55	Muhuri
16	Dahuk	36	Dhala	56	Feni
17	Karatoa	37	Piyan	57	Sangu
18	Talma	38	Sarigowain	58	Matamuhuri
19	Ghoramara	39	Surma	59	Naf
20	Deonai-Jamuneshwari	40	Kushiyara		

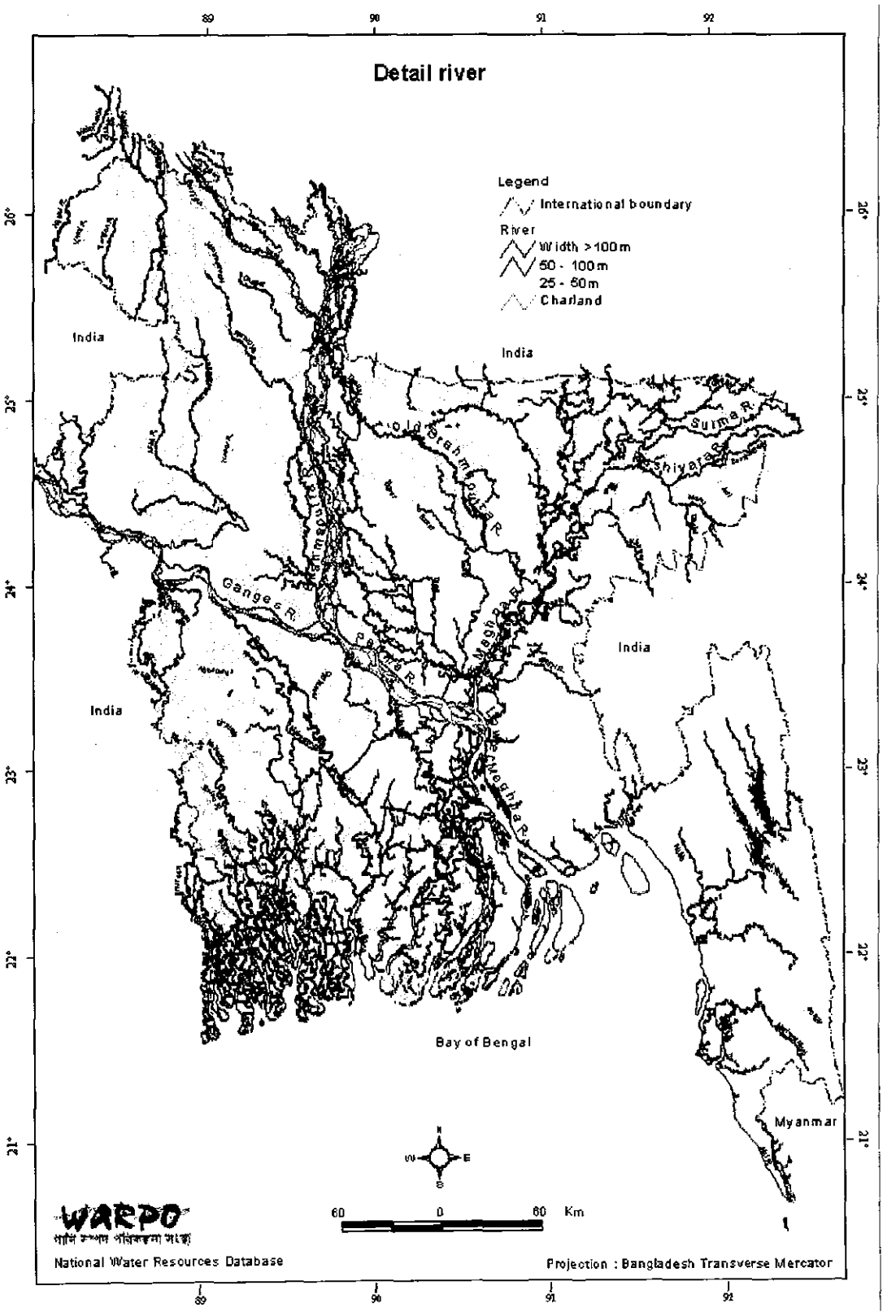
Source : JRC

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

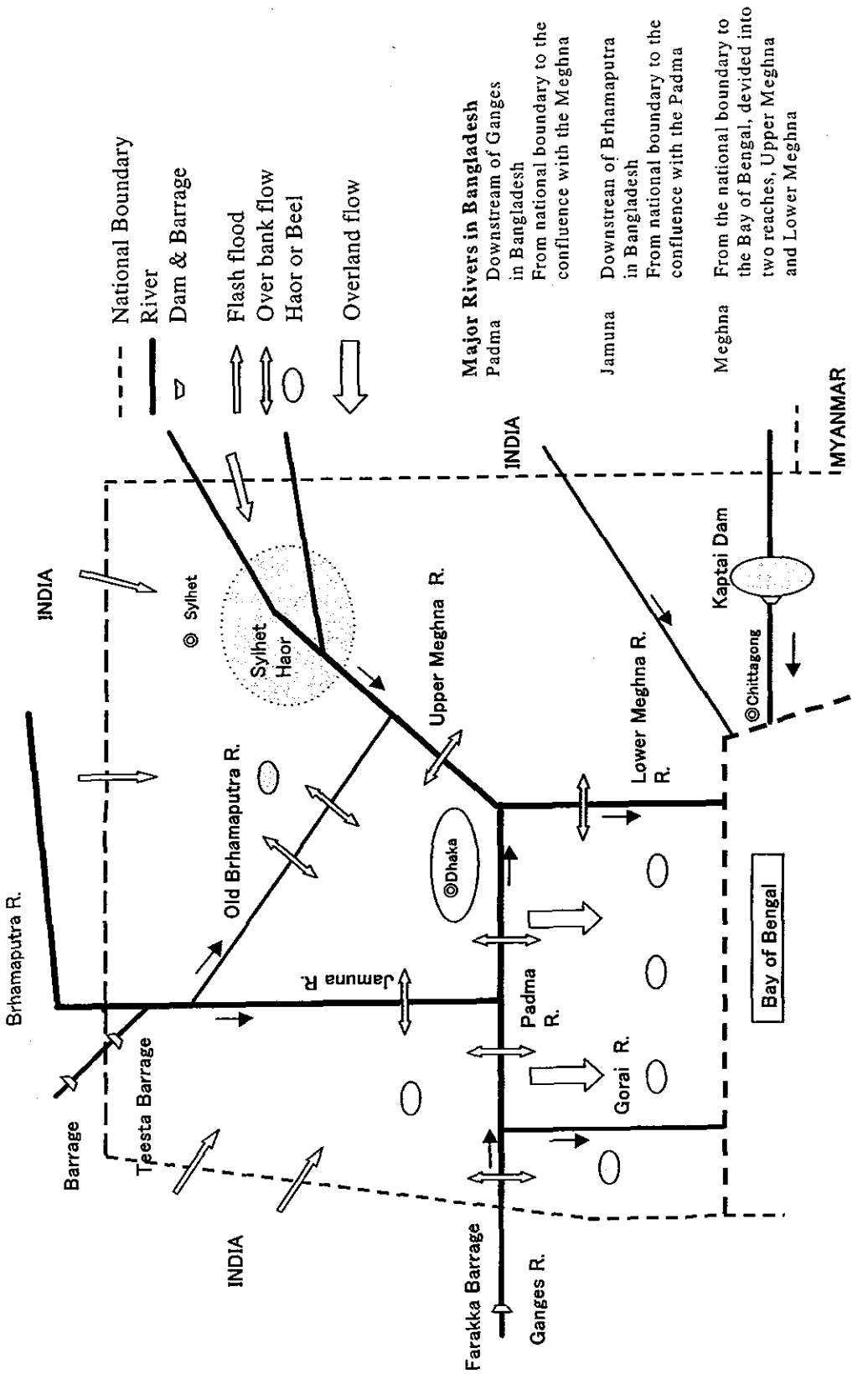
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.4.11

International Rivers Related to Bangladesh



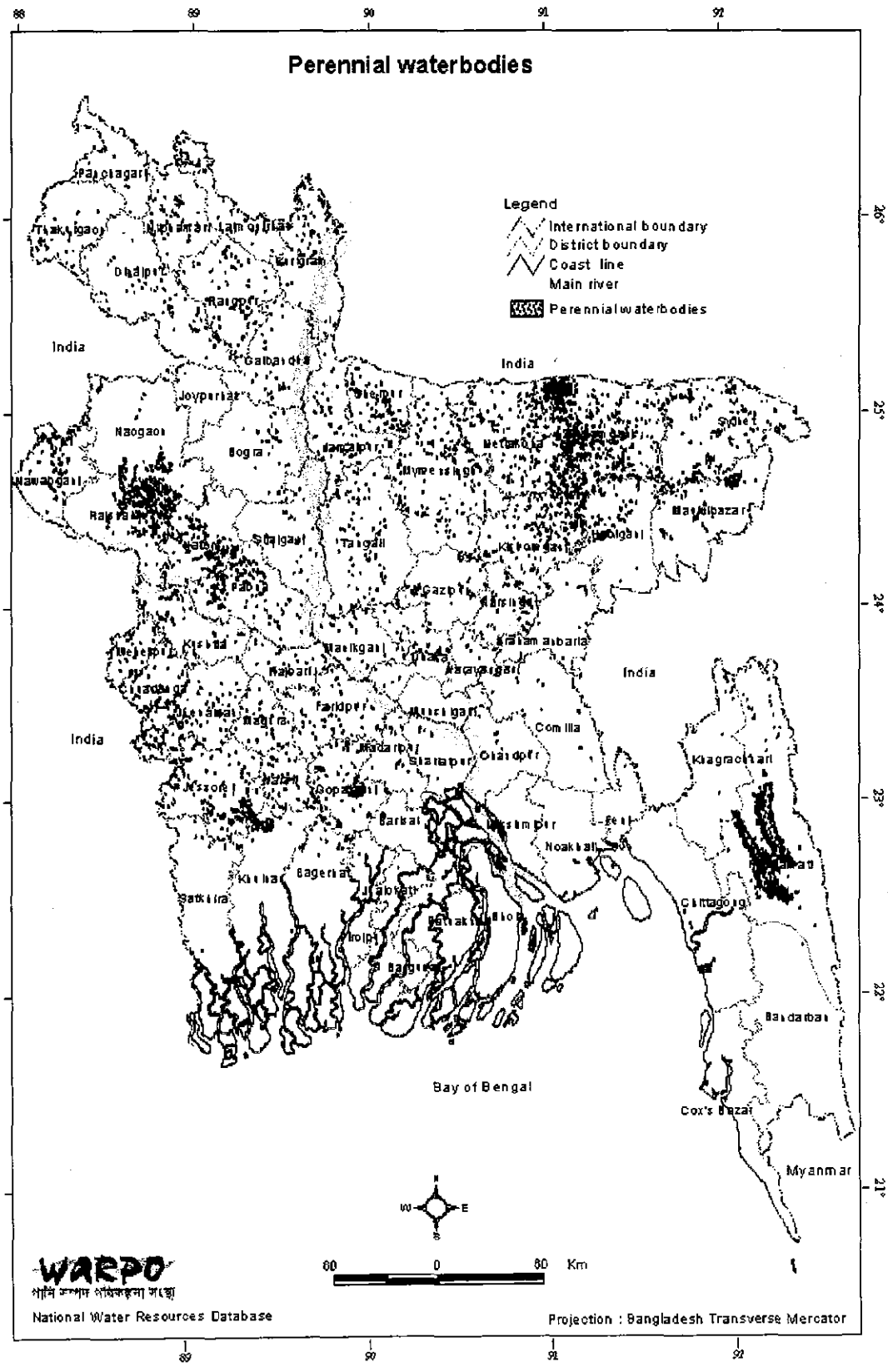
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.5.1
JAPAN INTERNATIONAL COOPERATION AGENCY	River System in Bangladesh



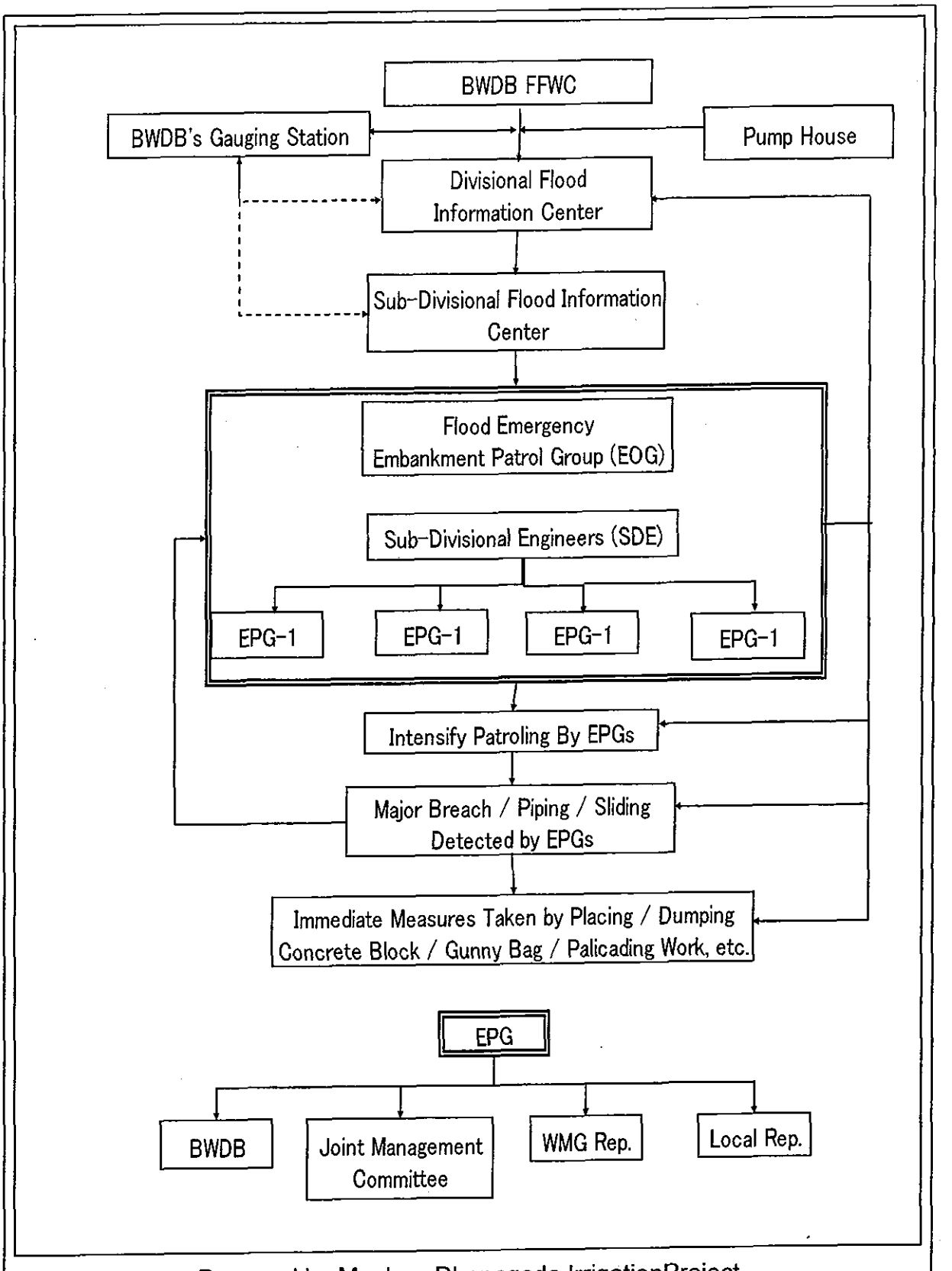
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.5.2
Schematic Diagram of River System in Bangladesh

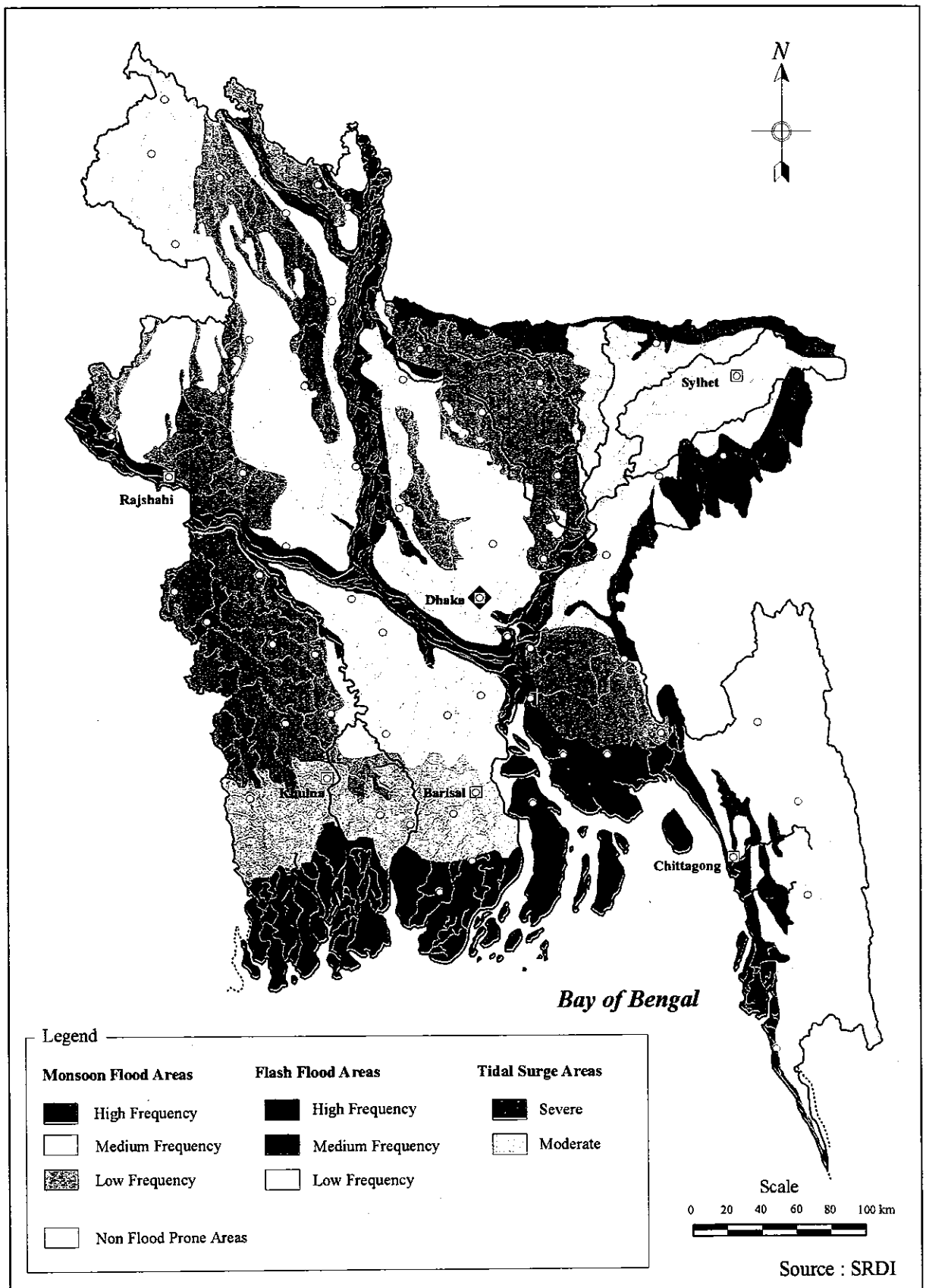


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.5.3
JAPAN INTERNATIONAL COOPERATION AGENCY	Water Bodies in Bangladesh



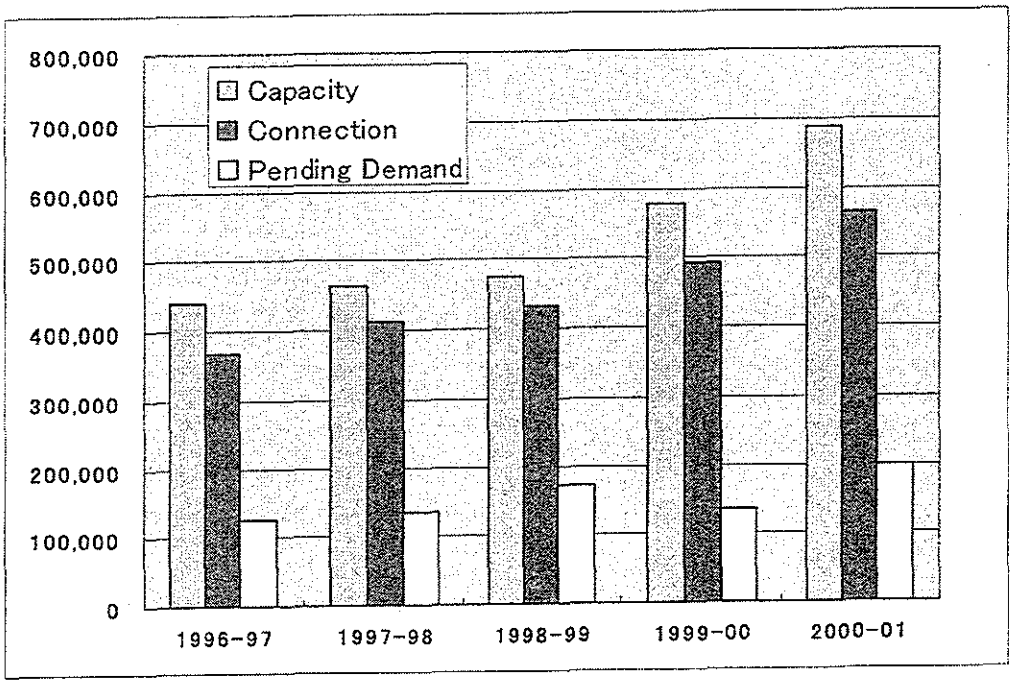
Prepared by Meghna-Dhonagoda IrrigationProject

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.5.4
JAPAN INTERNATIONAL COOPERATION AGENCY	Operation of River Structures in Emergency

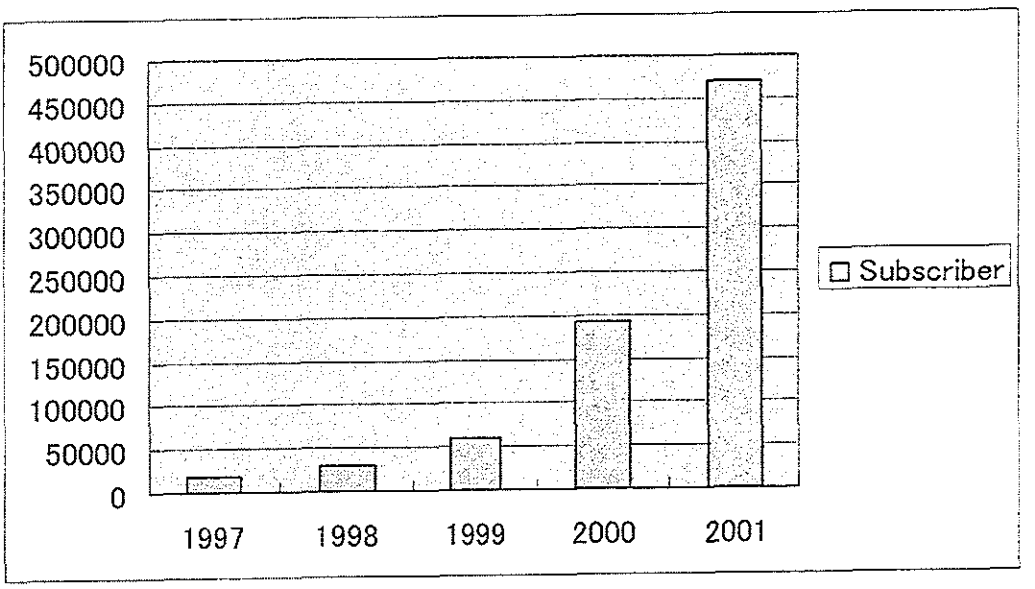


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.6.1 Delineation of Flood Prone Areas Based on Long Term Flood Information
JAPAN INTERNATIONAL COOPERATION AGENCY	

Growth of Telephone line

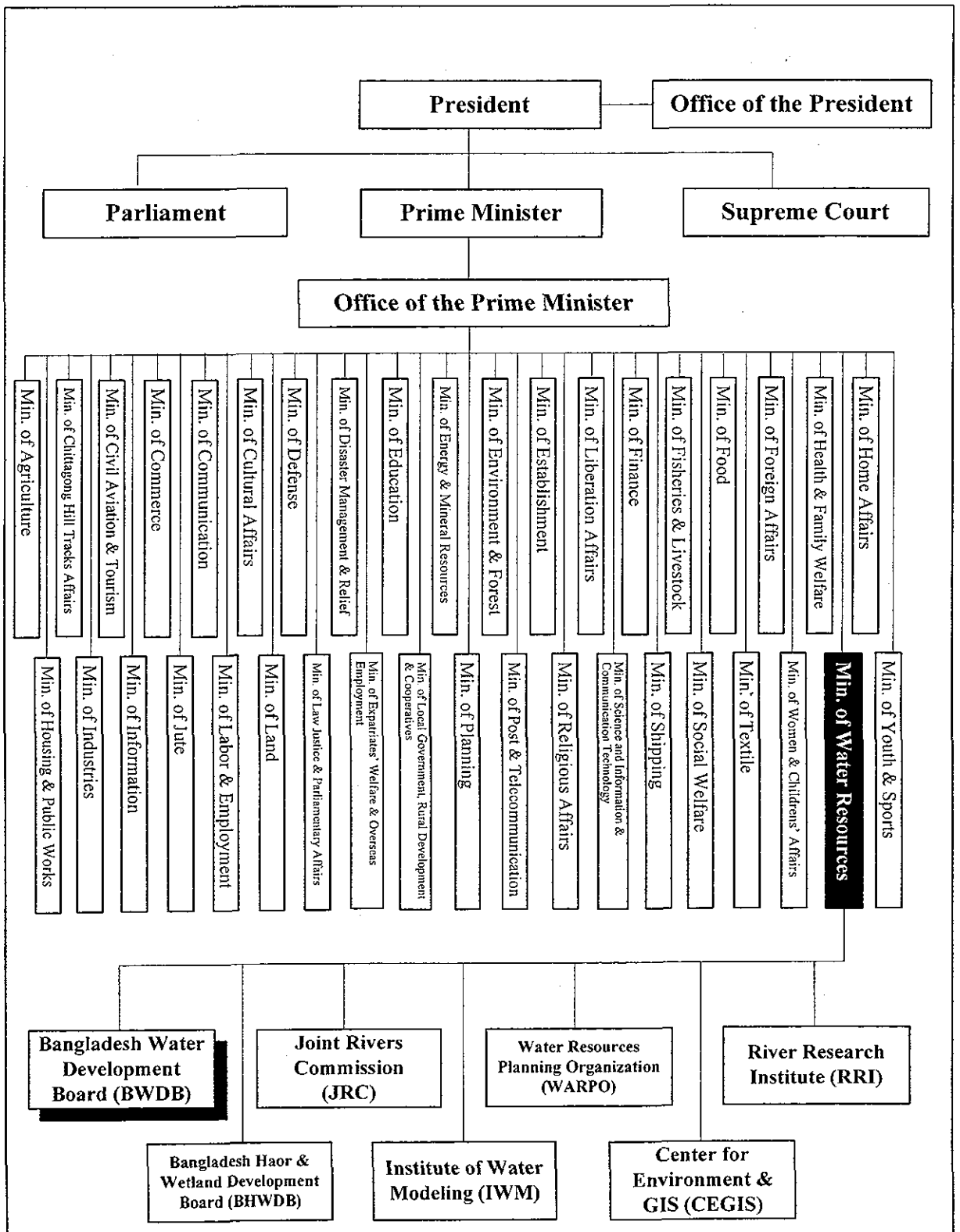


Growth of Mobile phone(Subscriber)



Source : BTTB

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 2.7.1 Growth of Telecommunications
JAPAN INTERNATIONAL COOPERATION AGENCY	

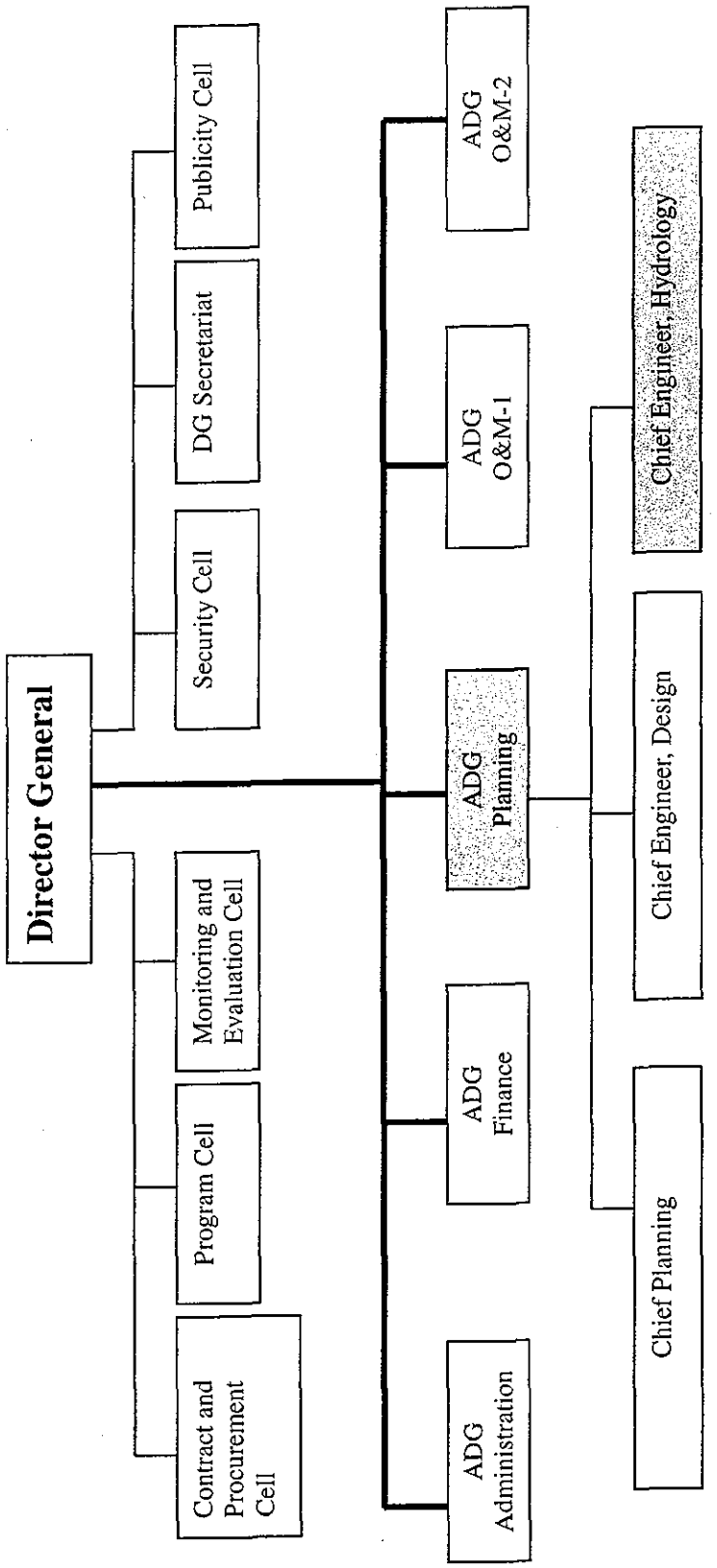


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.8.1

Organogram of GOB and MOWR



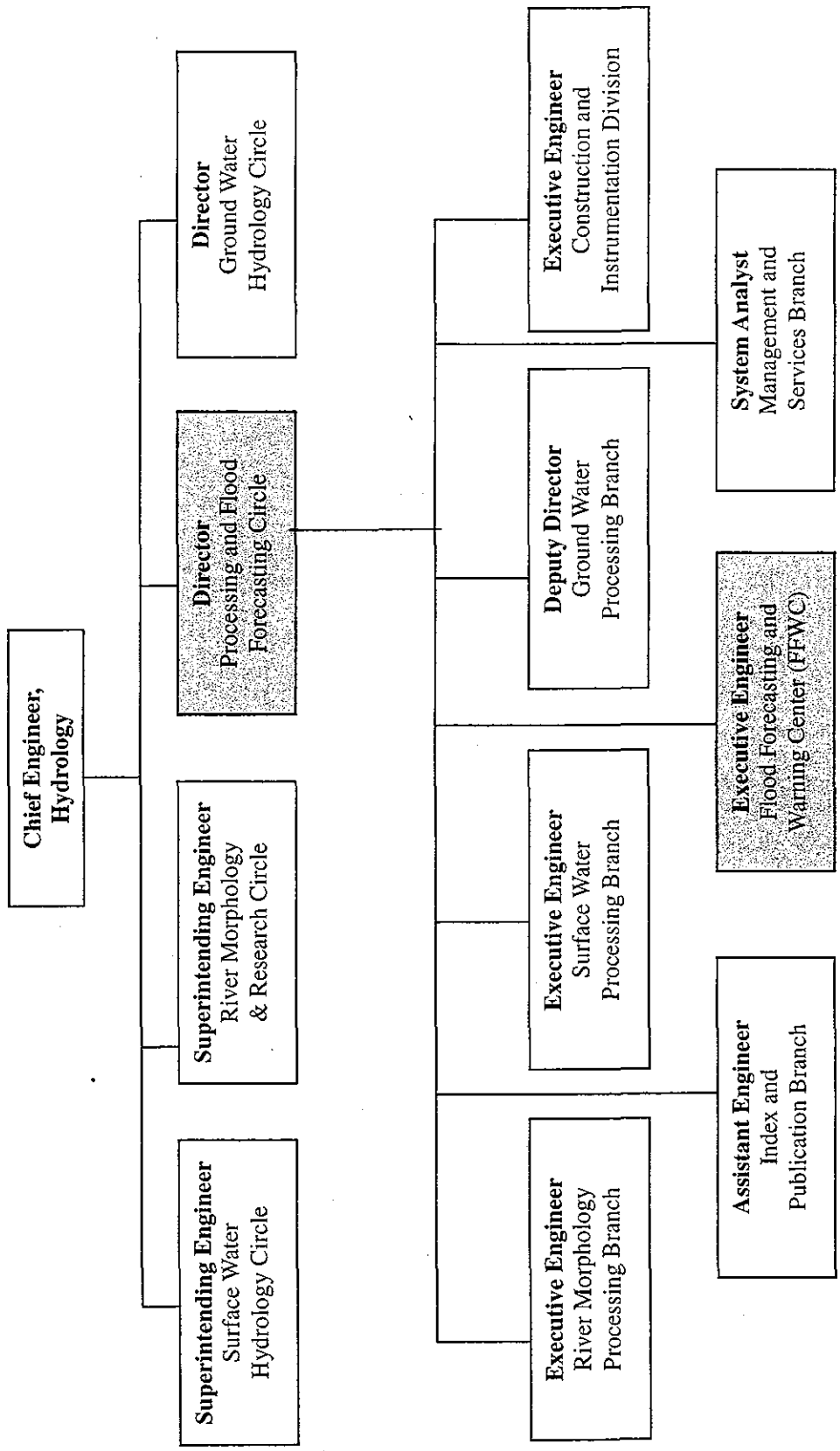
Note: ADG stands for Additional Director General
There are 6 small units directly under DG
FFWC is under CE, Hydrology.

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.8.2

Organogram of BWDB Head Quaters

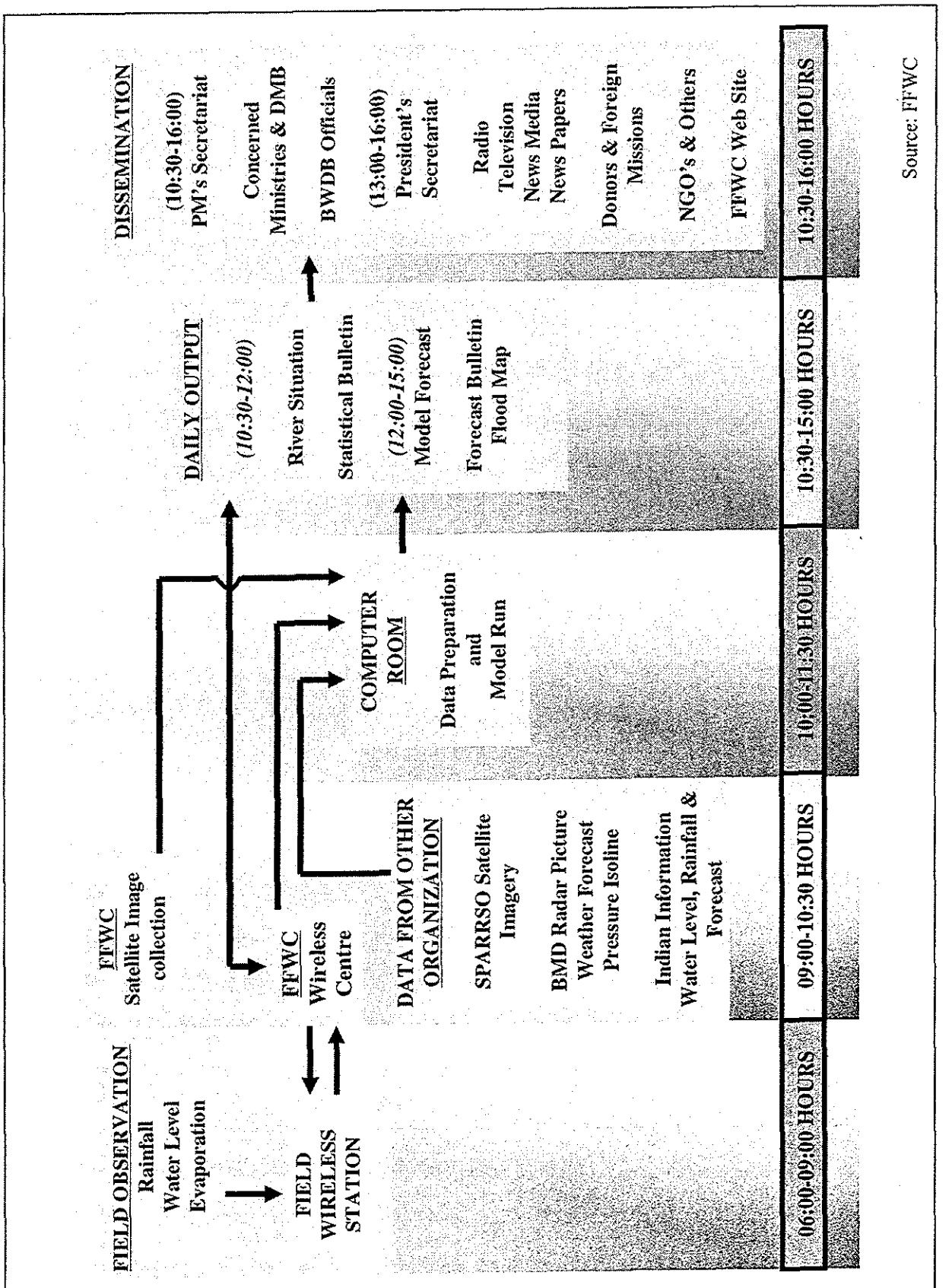


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

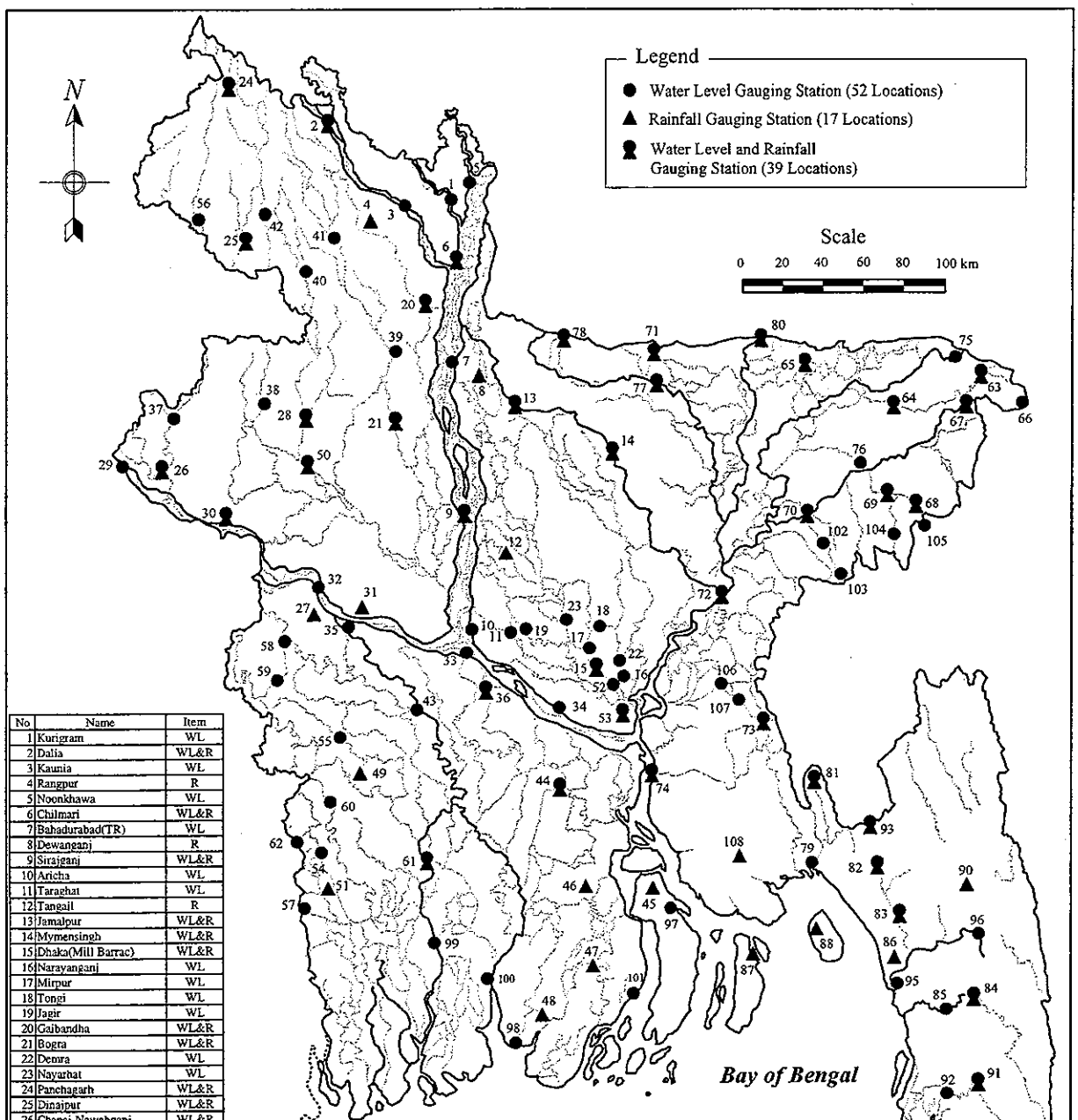
Figure 2.8.3

Organogram of Chief Engineer, Hydrology



Source: FFWC

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.2.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Daily Activity Flowchart of FFWC



No	Name	Item
1	Kurigram	WL
2	Dalia	WL&R
3	Kaunia	WL
4	Rangpur	R
5	Noonkhawa	WL
6	Chilmari	WL&R
7	Bahadurabad(TR)	WL
8	Dewanganj	R
9	Sirajganj	WL&R
10	Aricha	WL
11	Taraghat	WL
12	Tangail	R
13	Jamalpur	WL&R
14	Mymensingh	WL&R
15	Dhaka(Mill Barrac)	WL&R
16	Narayanganj	WL
17	Mirpur	WL
18	Tongi	WL
19	Jagir	WL
20	Gaibandha	WL&R
21	Bogra	WL&R
22	Demra	WL
23	Nayarhat	WL
24	Panchagarh	WL&R
25	Dinajpur	WL&R
26	Chapai-Nawabganj	WL&R
27	Kushitia	R
28	Naogaon	WL&R
29	Pankha	WL
30	Rajshahi(R-Boalia)	WL&R
31	Pabna	R
32	Hardinge Br.	WL
33	Goalunda Transit	WL
34	Bhagyakul	WL
35	Gorai Rly Br	WL
36	Faridpur	WL&R
37	Rohanpur	WL
38	Mohadevpur	WL
39	Chak Rahimpur	WL
40	Phulbari	WL
41	Badarganj	WL
42	Bhushirbandar	WL
43	Kamarkhali	WL
44	Madaripur	WL&R
45	Bhola	R
46	Barisal	R
47	Patuakhali	R
48	Borguna	R
49	Jessor	R
50	Atrai	WL&R
51	Satkhila	R
52	Hatiharpara	WL
53	Rekabi Bazar	WL&R
54	Kalaroa	WL
55	Kaliganj(Jessor)	WL
56	Kodalkatiga/Takulgaon	WL
57	Shakra	WL
58	Hatboalia	WL
59	Chuadanga	WL
60	Jhikargacha	WL
61	Khulna	WL&R
62	Giba	WL
63	Kanaighat	WL&R
64	Sylhet	WL&R
65	Sunamganj	WL&R
66	Amalshid/Zakiganj	WL
67	Sheola	WL&R
68	Monu Rly.	WL&R
69	Moulvi Bazar	WL&R
70	Habiganj	WL&R
71	Durgapur	WL&R
72	Bhairab Bazar	WL&R
73	Comilla	WL&R
74	Chandpur	WL&R
75	Sarighat	WL
76	Sherpur	WL
77	Jaria Jhanjail	WL&R
78	Nakugaon	WL&R
79	Jibonpur/Companiganj	WL
80	Laurergarh Sakt	WL&R
81	Parshuram	WL&R
82	Narayanhat	WL&R
83	Panchapukuria	WL&R
84	Bandarban	WL&R
85	Dohazari	WL
86	Chittagong	R
87	Hatia	R
88	Sandwip	R
89	Cox's Bazar	R
90	Rangamati	R
91	Lama	WL&R
92	Chiringa	WL
93	Ramgarh	WL&R
94	Teknaf	WL&R
95	Sadarghat	WL
96	Kaptai	WL
97	Daulatkhan	WL
98	Patharghata	WL
99	Mongla	WL
100	Rayenda	WL
101	Dasmunia	WL
102	Shaistaganj	WL
103	Ballah	WL
104	Kamalganj	WL
105	Chatraghat	WL
106	Jibanpur(Gumti B)	WL
107	Kangsanagar	WL
108	Noakhali	R

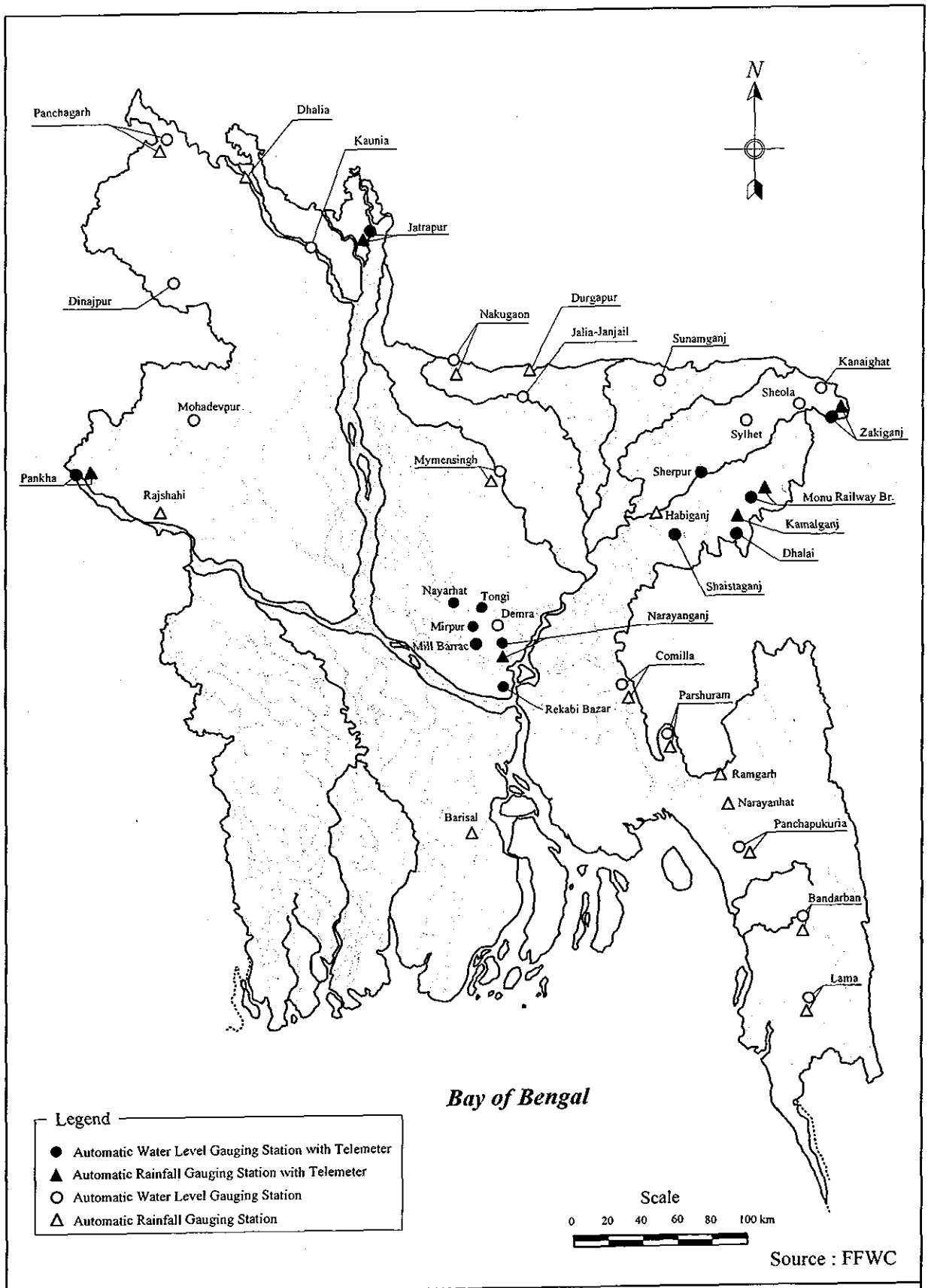
Source : FFWC

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

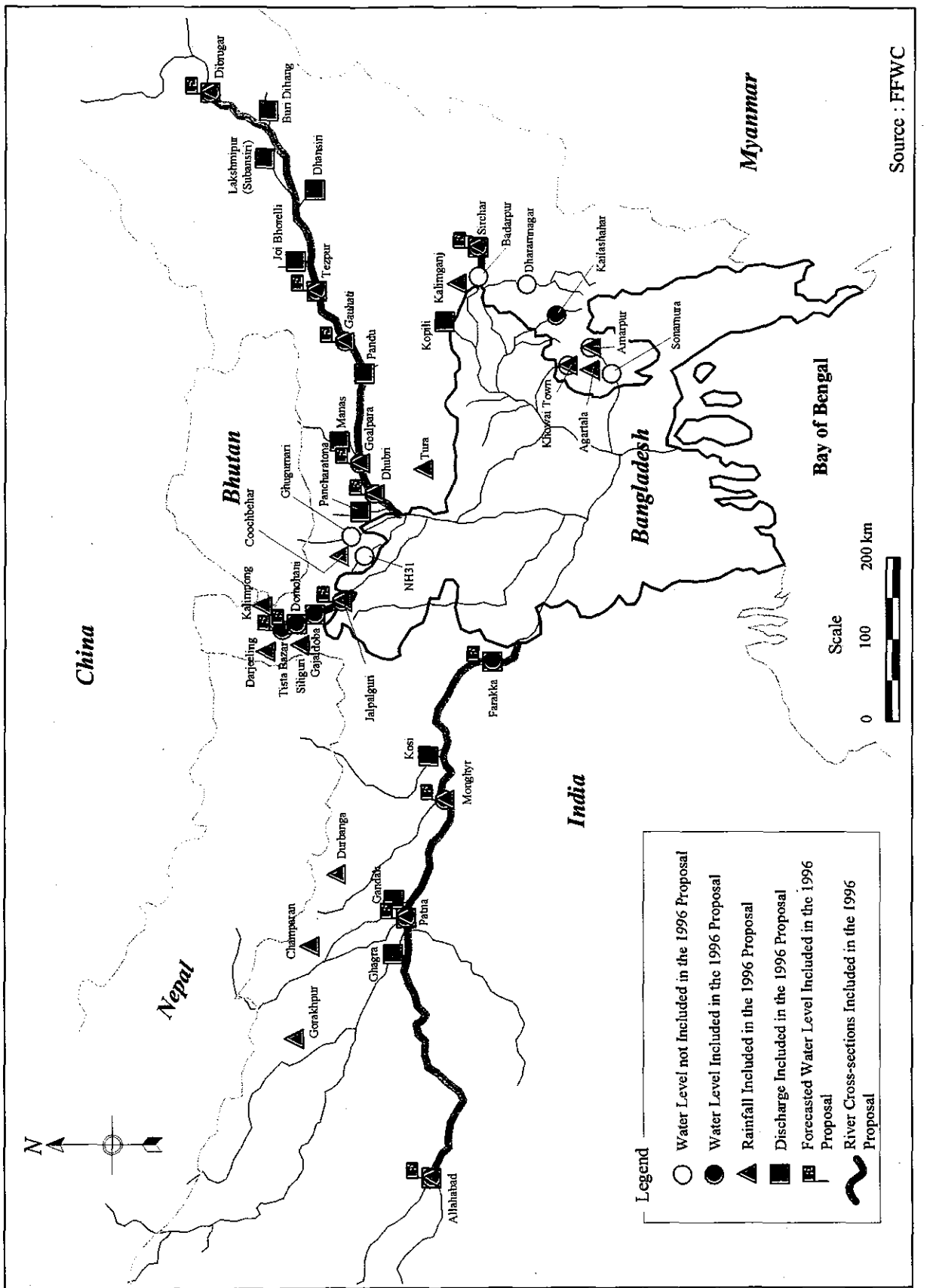
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3.3.1

Present Observatories of FFWC



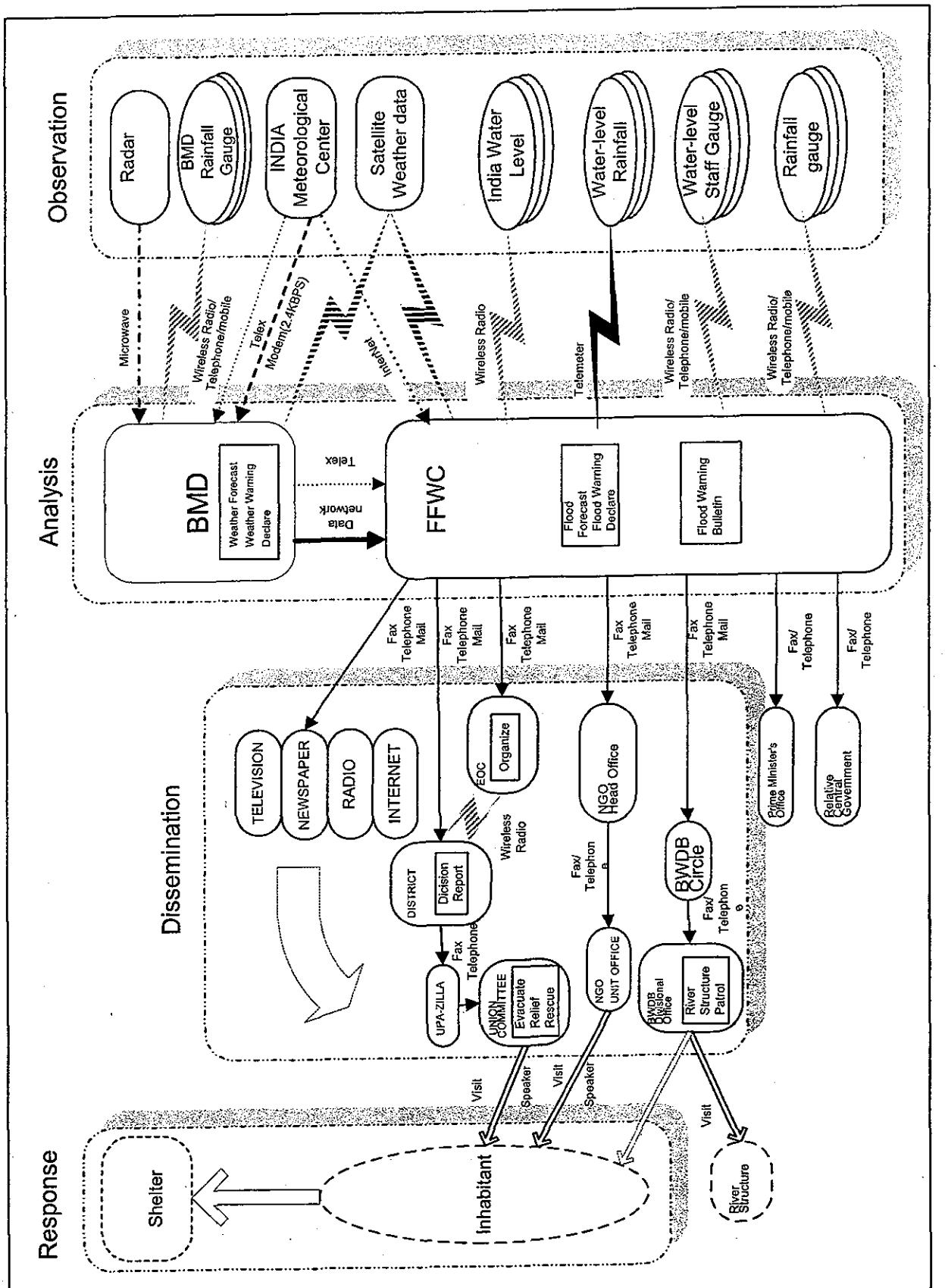
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.3.2 Existing Automatic Water Level / Rainfall Gauges
JAPAN INTERNATIONAL COOPERATION AGENCY	



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3.3.3
The 1996 Proposal by Bangladesh Side for the Data Exchange Improvement

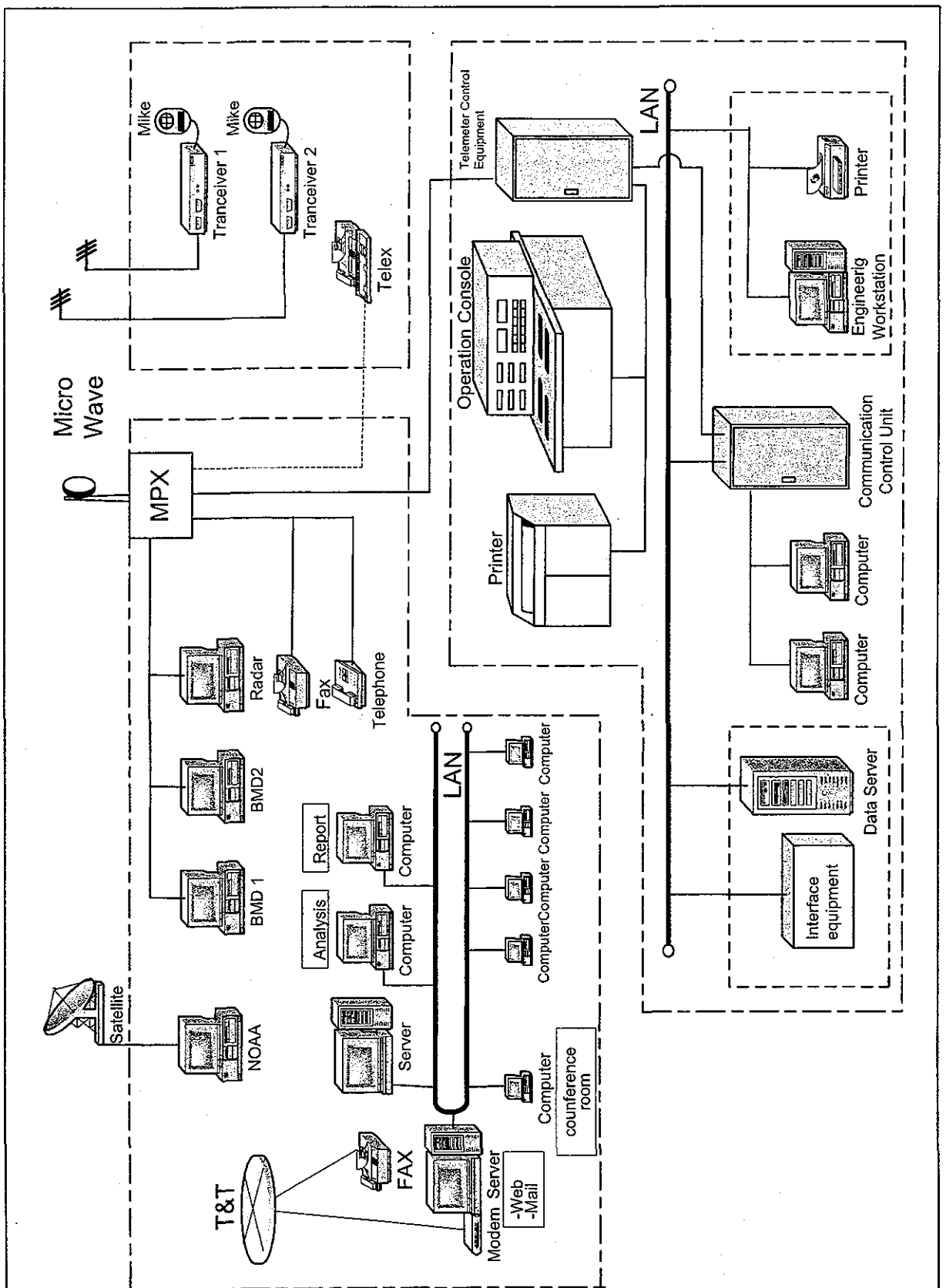


Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

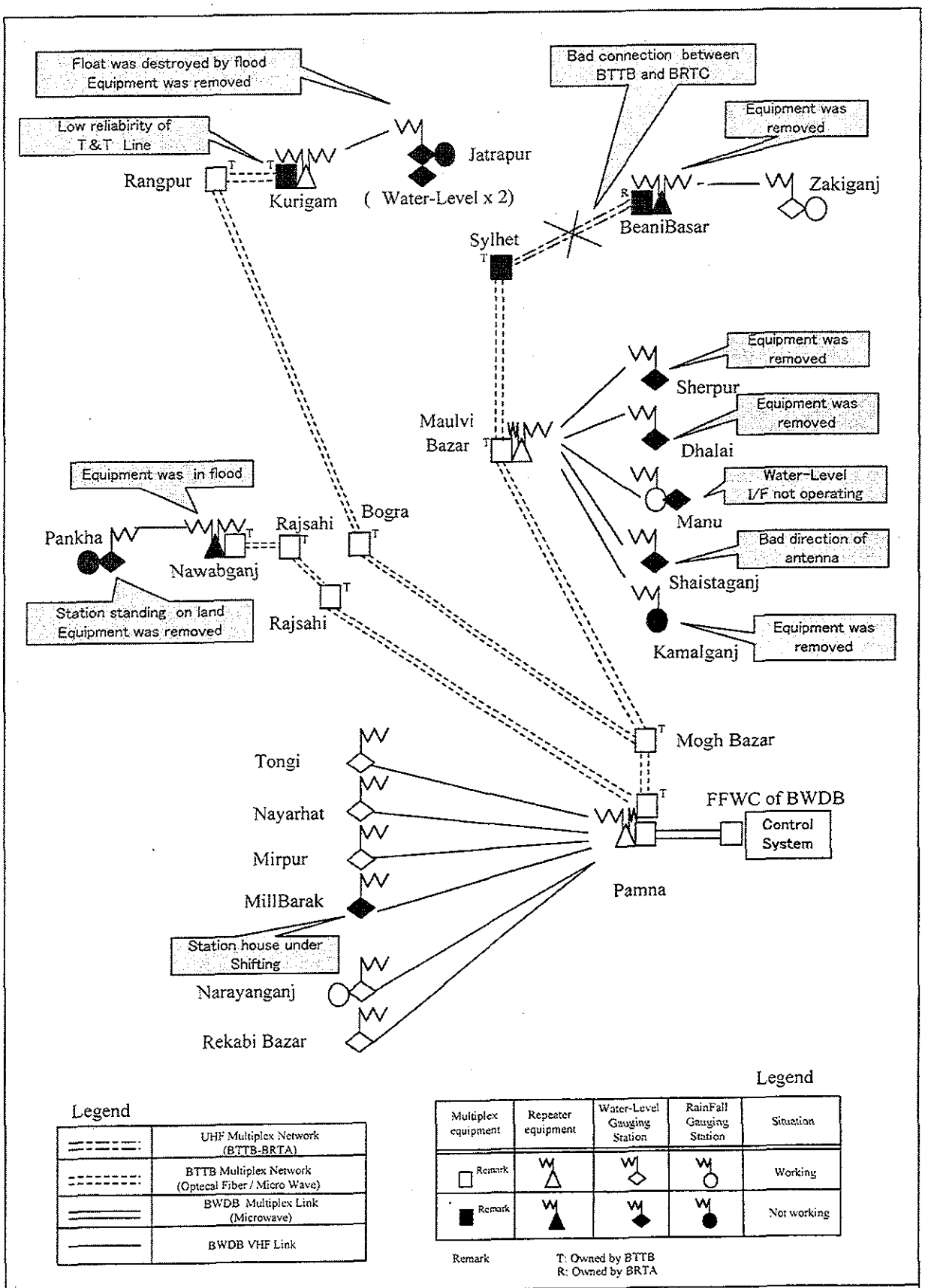
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3.4.1

Communication Network during Flood



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.4.2
JAPAN INTERNATIONAL COOPERATION AGENCY	FFWC System Configuration



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

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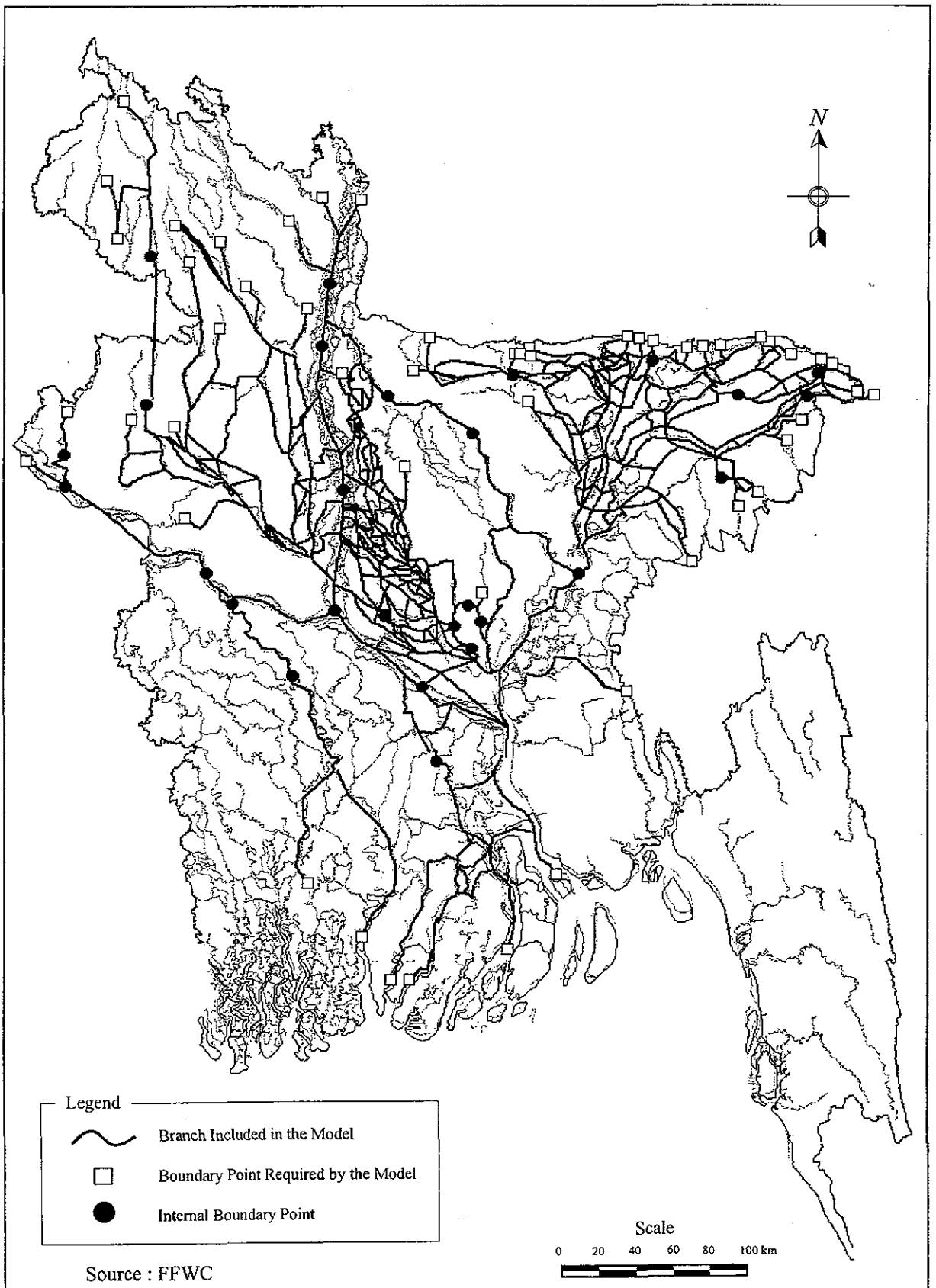
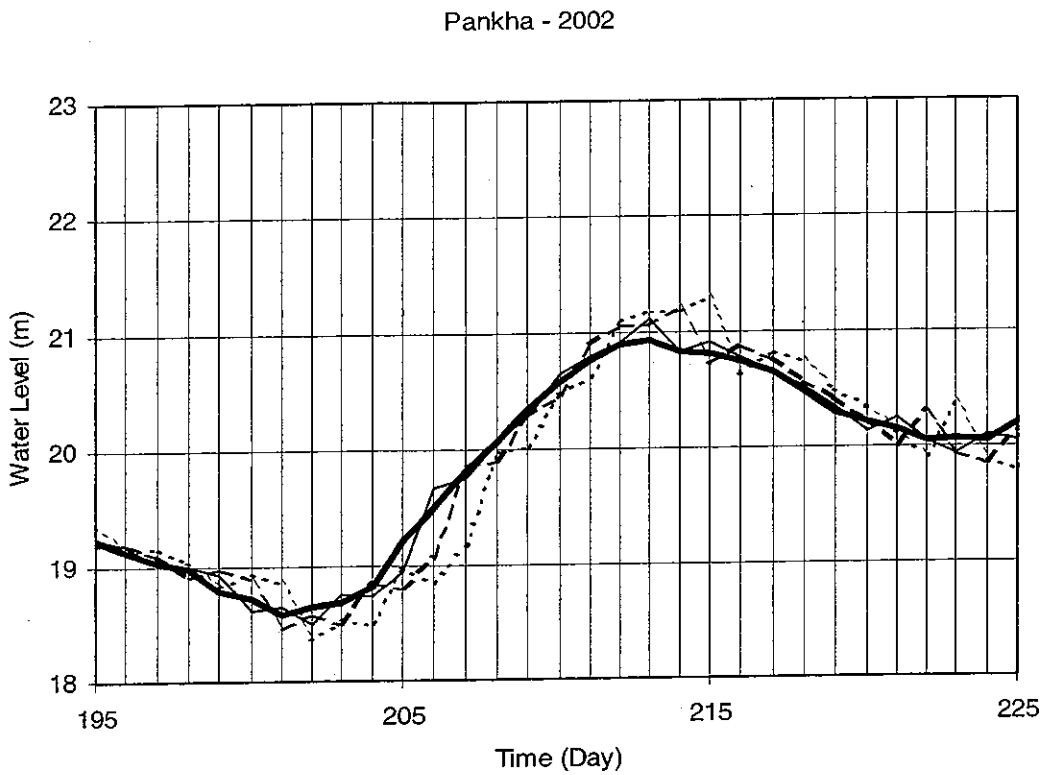
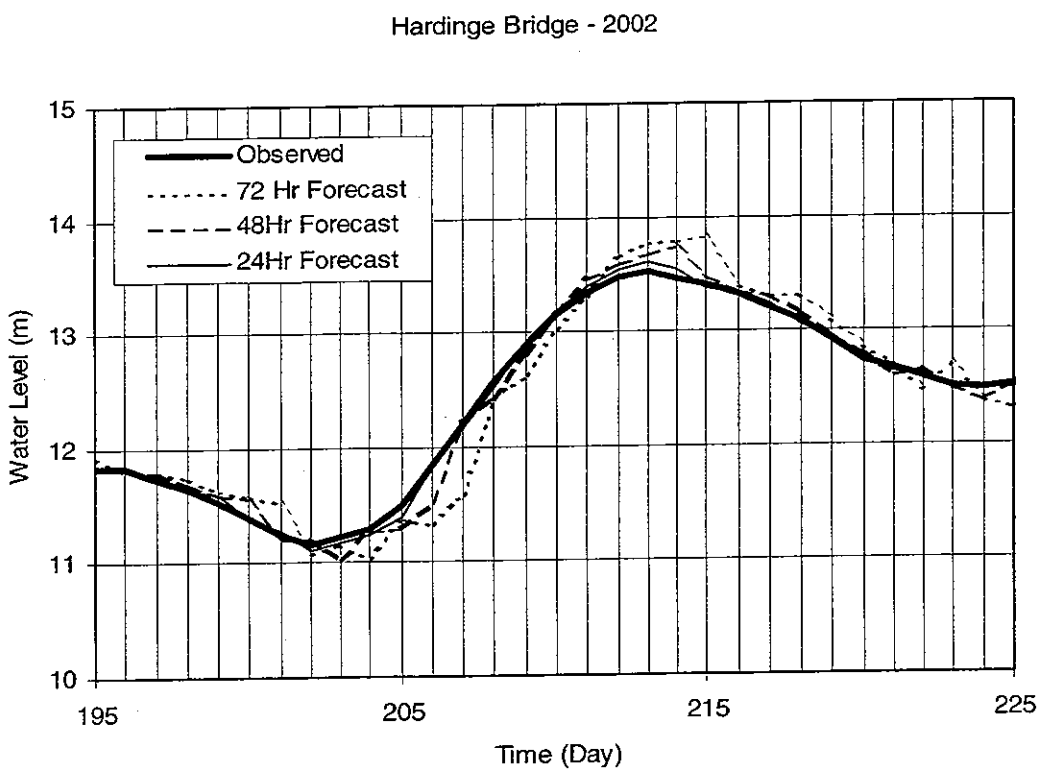
Figure 3.4.3
Telemeter System Network and Existing Problem



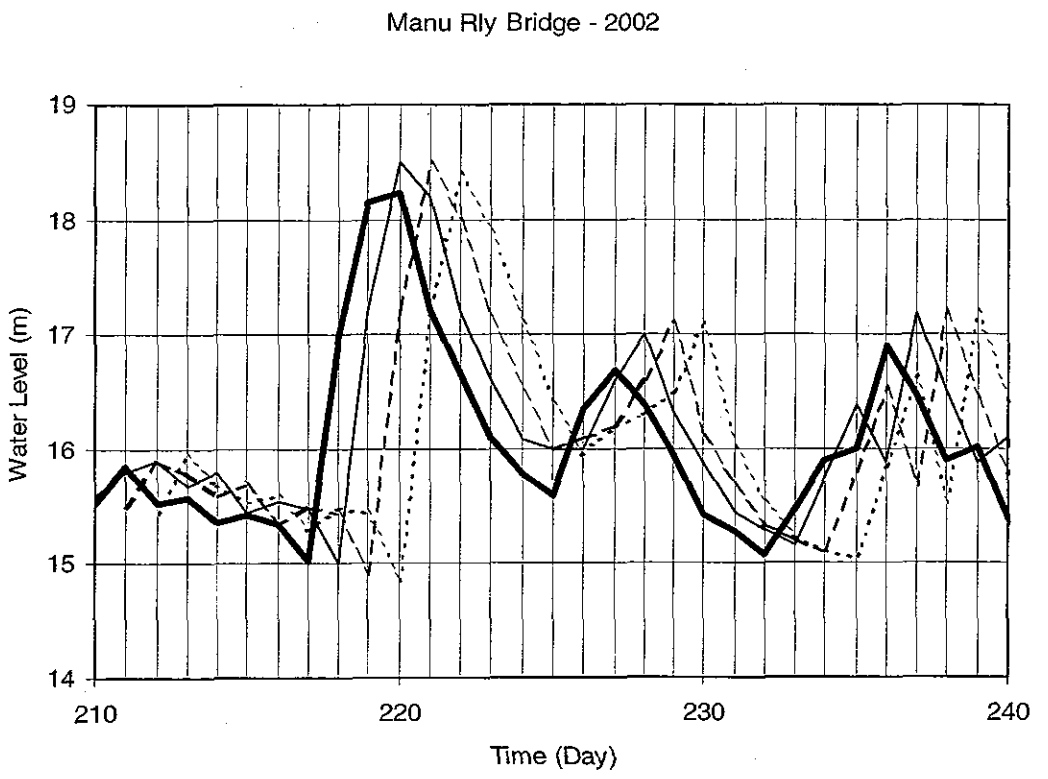
Source : FFWC

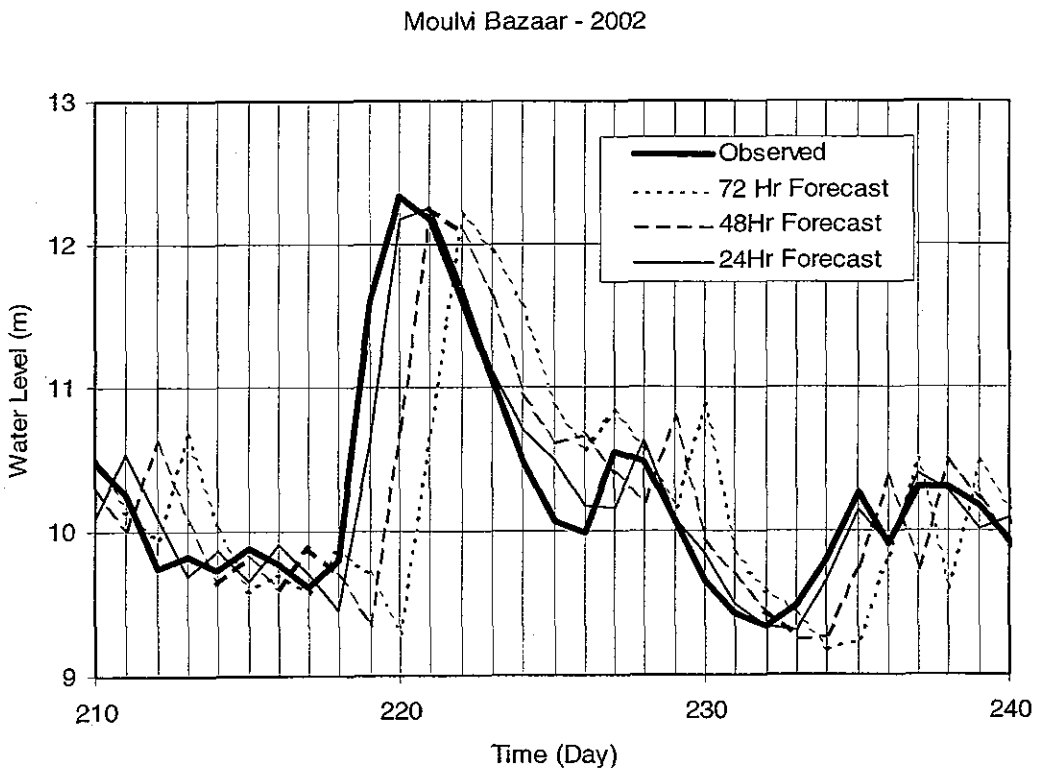
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.5.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Branch Network of Supermodel 2001





Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.5.2 Comparison of Observed and Forecast Water Levels in Monsoonal Flood Regions
JAPAN INTERNATIONAL COOPERATION AGENCY	





Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 3.5.3 Comparison of Observed and Forecast Water Levels in Flash Flood Regions
JAPAN INTERNATIONAL COOPERATION AGENCY	

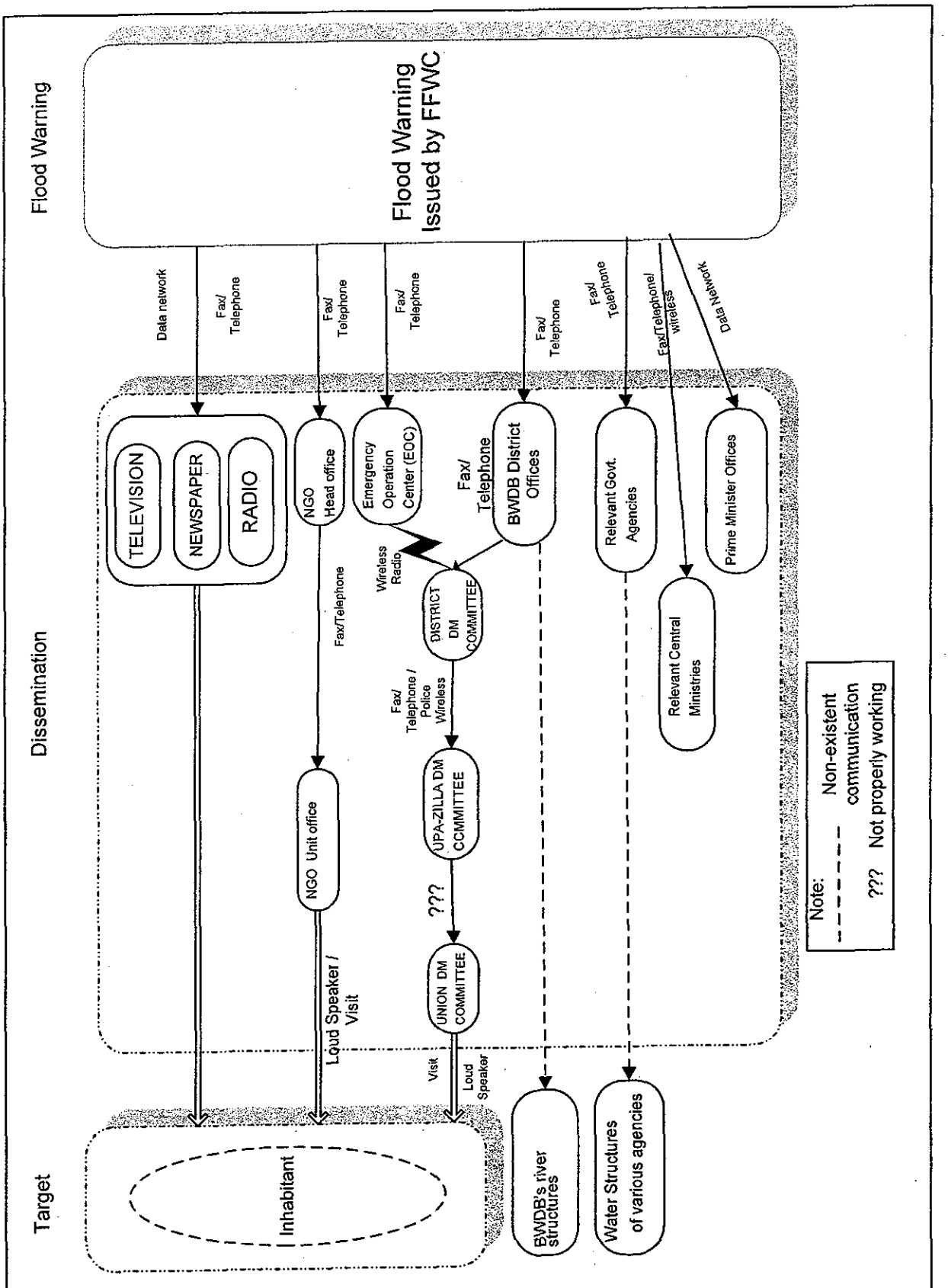


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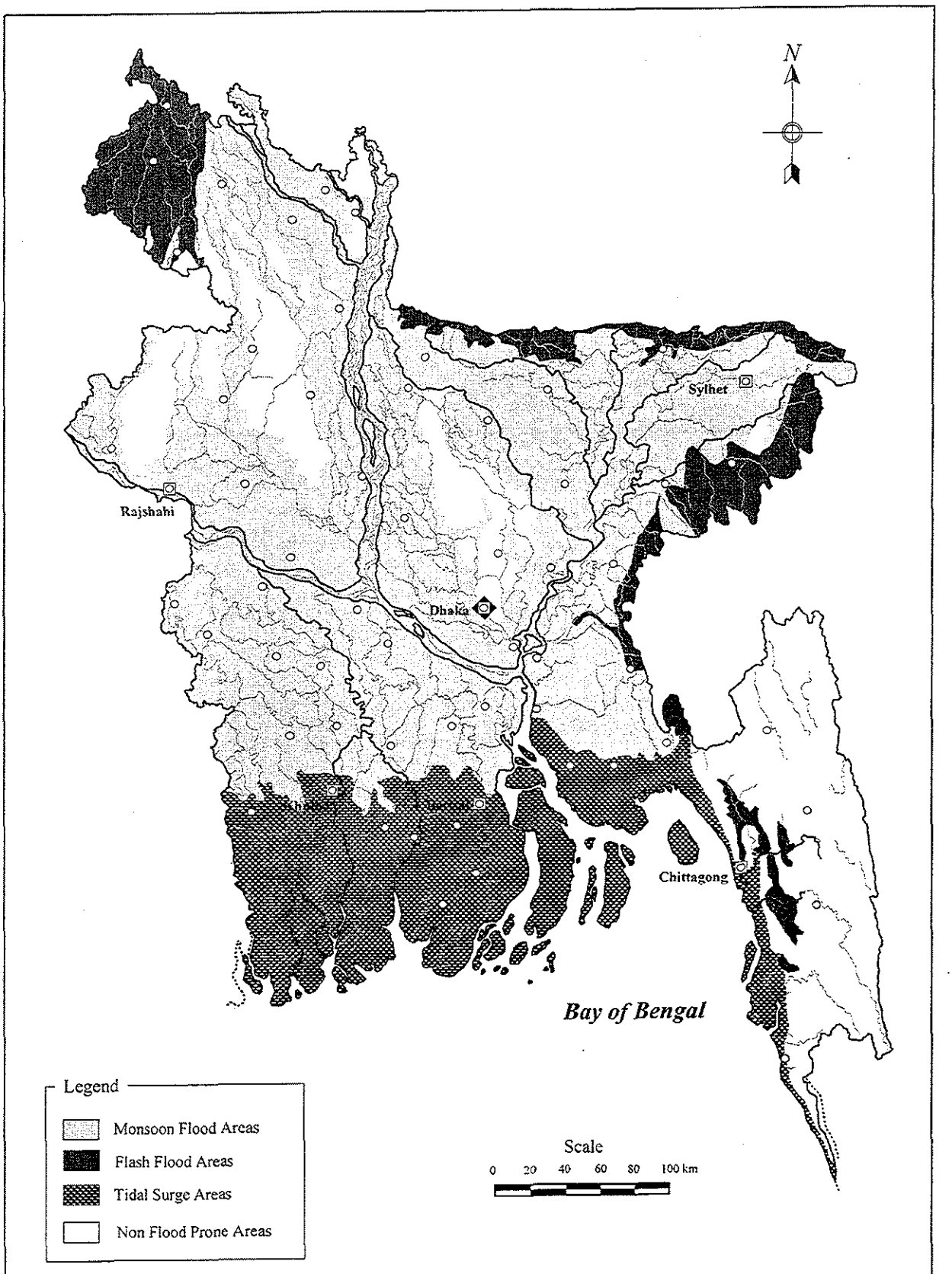
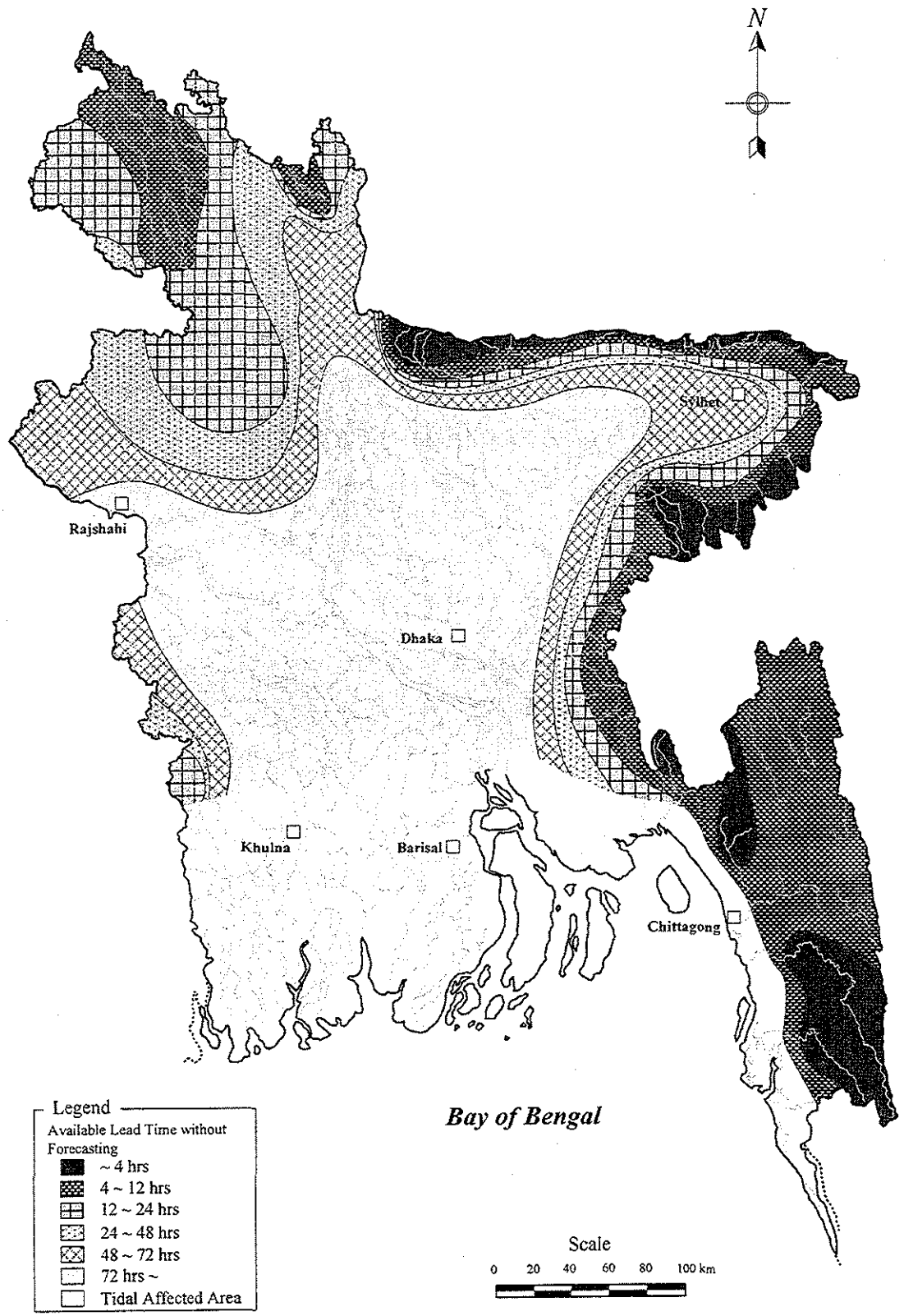
Figure 3.6.1

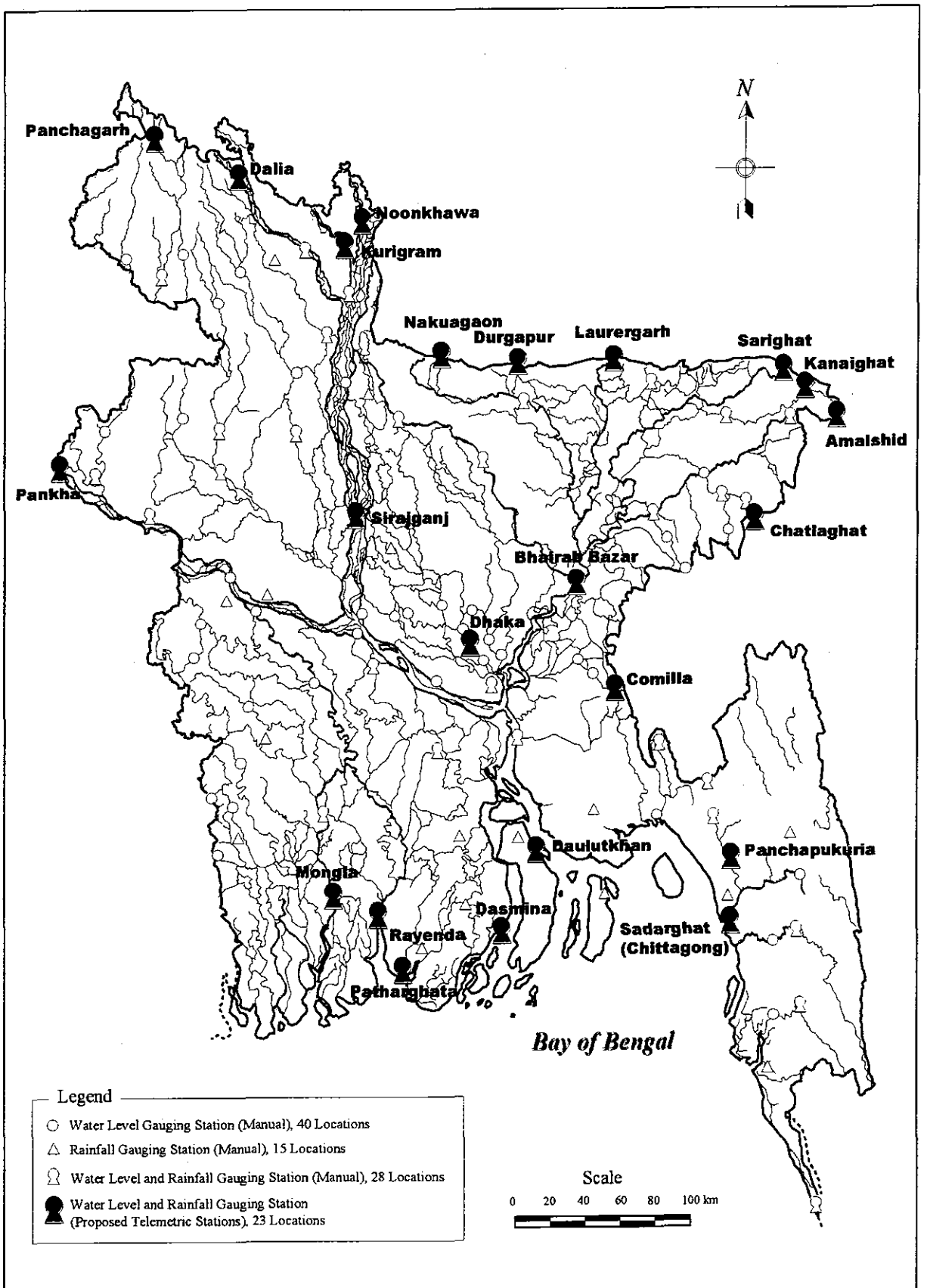
Existing Flood Warning Dissemination Flow



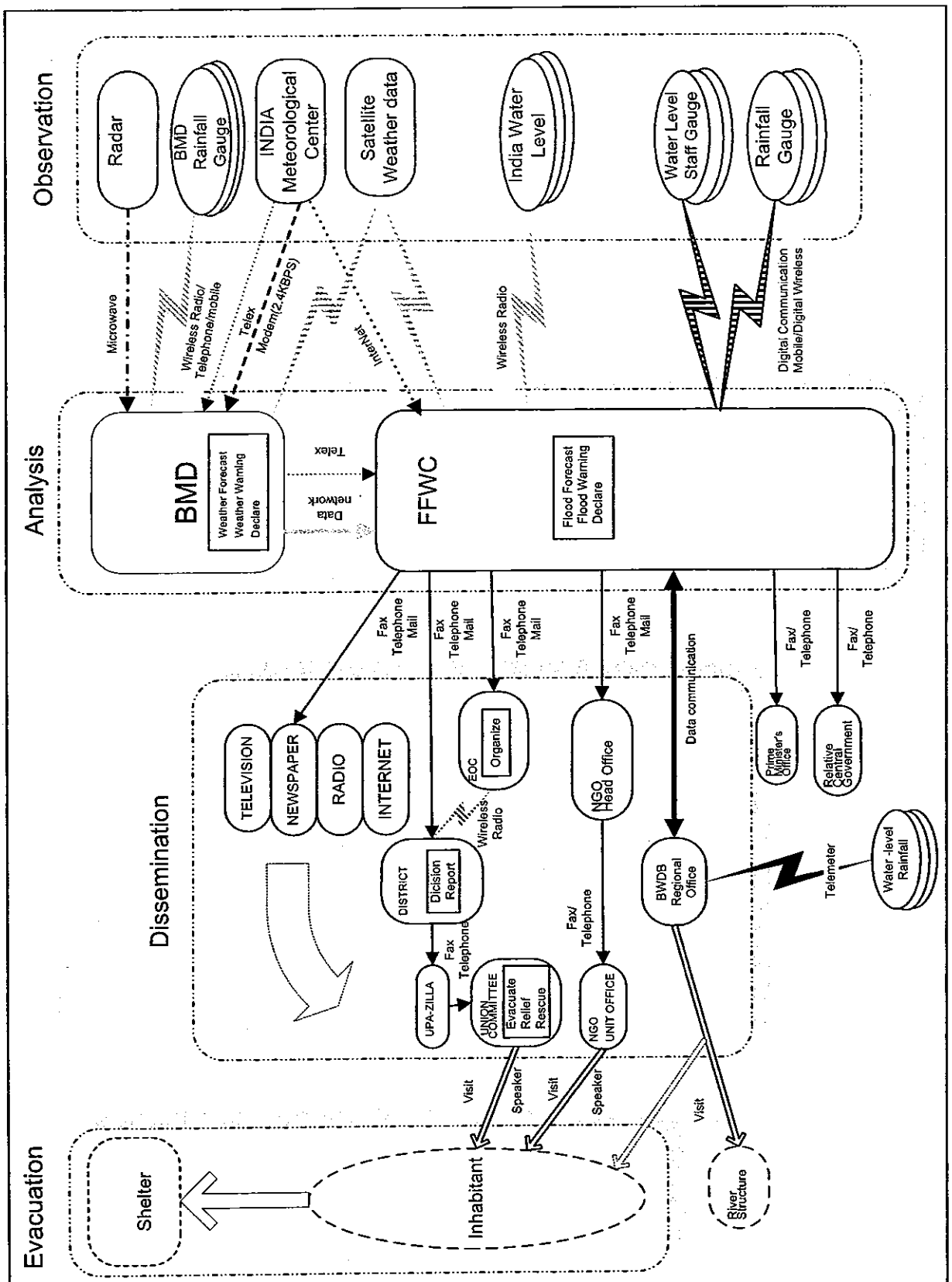
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 4.1.1 Delineation of Flood Types Based on Available Data/Information
JAPAN INTERNATIONAL COOPERATION AGENCY	



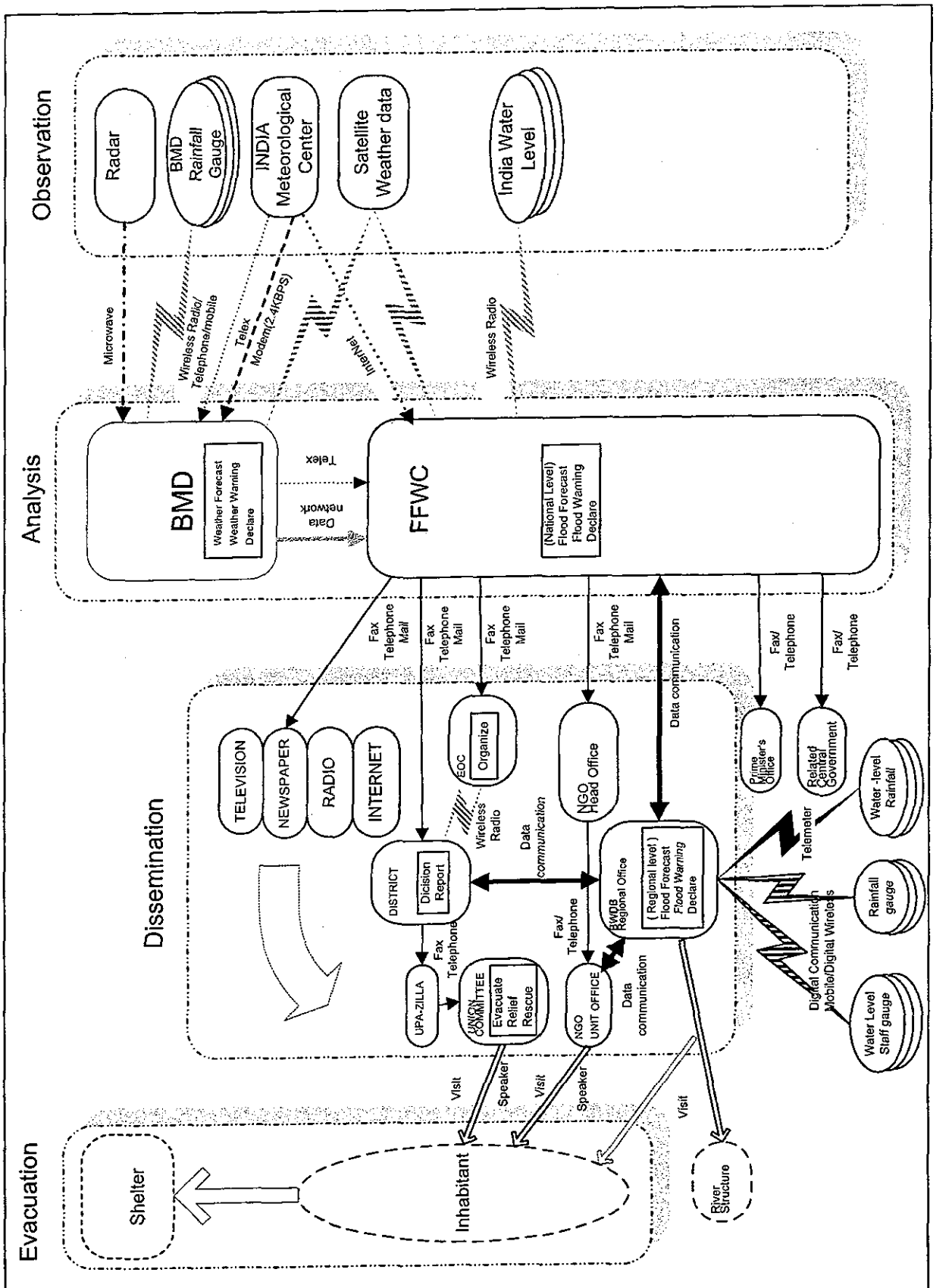
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 4.1.2
JAPAN INTERNATIONAL COOPERATION AGENCY	Minimum Available Time for Preparedness



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 4.2.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Proposed Network of FFWC Observatories



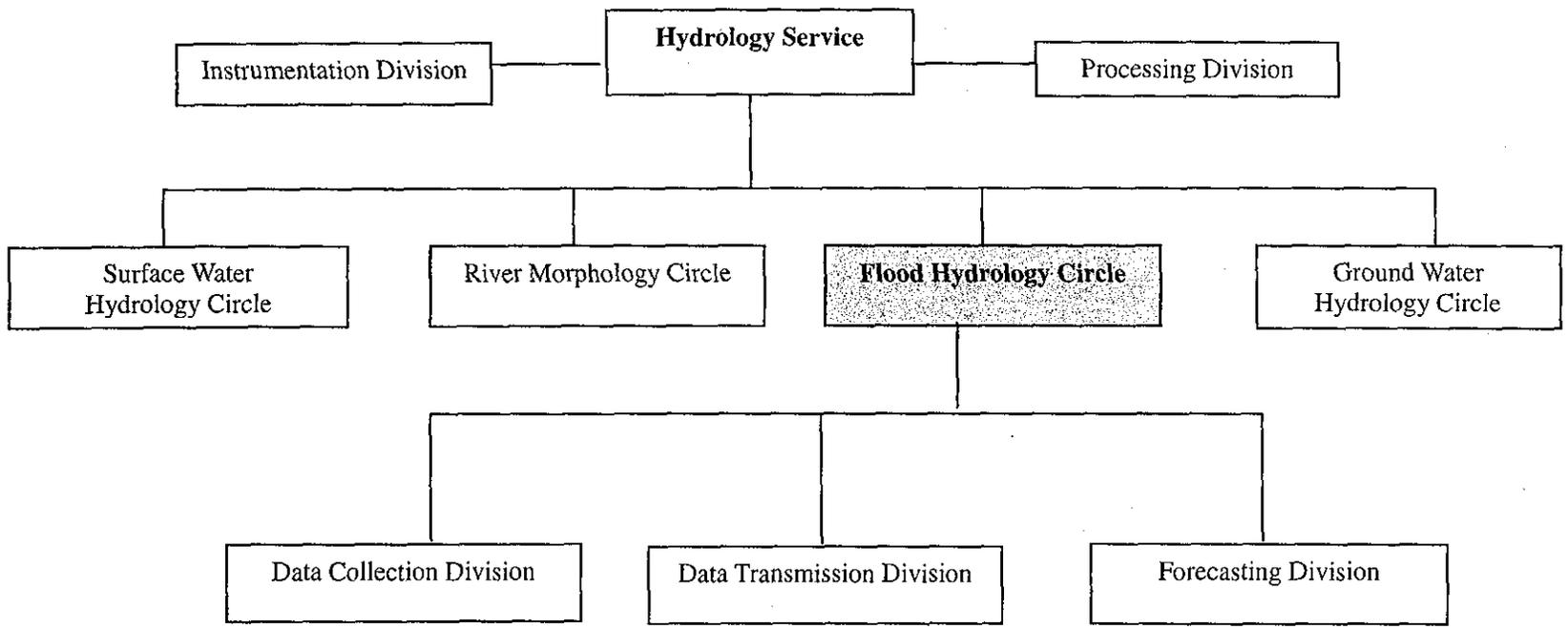
Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh	Figure 4.2.2 Alternative Communication Network (Central Control Plan)
JAPAN INTERNATIONAL COOPERATION AGENCY	



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 4.2.3
Alternative Communication Network
(Regional Control Plan)

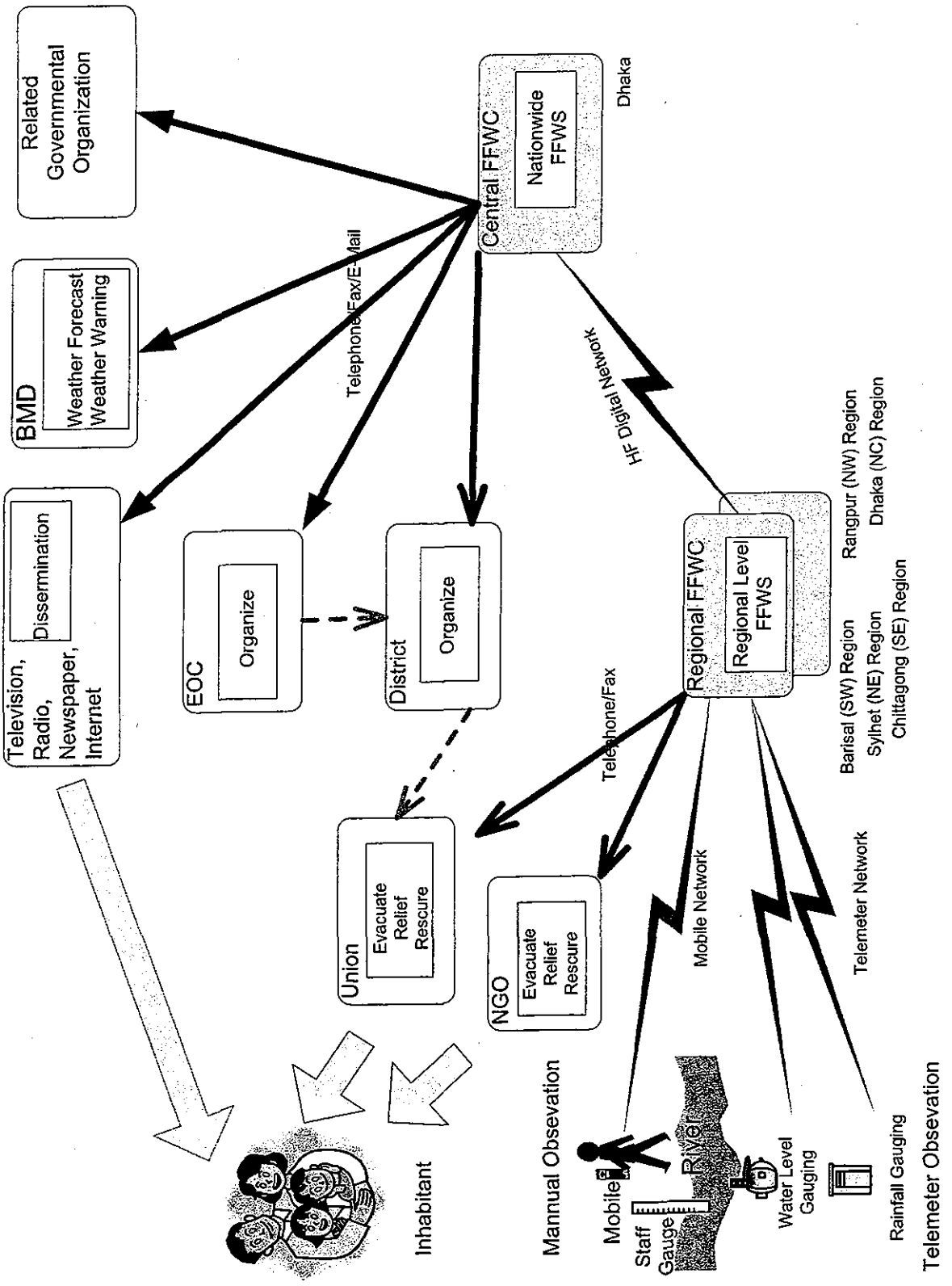


Note:
1. Present 3 processing branches of PFFC will be placed in Processing Division .
2. Part of the present C&I division will be placed in Data Transmission Division and the rest will become Instrumentation Division
3. Present FFWC will become Forecasting Division

Figure 4.3.1
Proposed Organogram of Hydrology Service

Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

JAPAN INTERNATIONAL COOPERATION AGENCY



Feasibility Study for Improvement of Flood Forecasting and Warning Services in the People's Republic of Bangladesh

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Figure 4.4.1

Outline of Optimum Plan