gauging facilities will be administered by the Communications Section of the Center.

7.8 Project Evaluation

The establishment of the proposed flood forecasting system which is essential to any comprehensive flood control project is expected to have appreciable mitigation effects on flood damage, together with other economic and social impacts. The beneficial effects will be realized ultimately when the flood control project is completed.

(1) Mitigation of Flood Damage

As mentioned in Chapter 6, the most direct effect of establishing the Step 1 Flood Forecasting System is the mitigation of flood damage to (a) immovable properties such as buildings, roads, railways, river structures and facilities, and agricultural crops; (b) movable properties such as livestock and household effects; (c) business activities of people and business firms; and, (d) traffic on highways and railways.

In the Step 2 system with updated facilities, flood predictions are transmitted to agencies concerned more rapidly than in the case of the Step 1 system. Therefore, the reduction effects on damage are expected to be more than those of the Step 1 system.

(2) Other Impacts

Besides the above direct effects, the system is expected to produce the following favorable effects:

(a) The proposed telecommunication system can be utilized for common administration and communication among the RID Head Office, its regional offices, and other related agencies during non-flood time. This will greatly facilitate execution of normal work activites.

(b) Eradication of people's apprehension on the occurrence of surprise floods, since it is possible to save inhabitants by the prompt transmission of information.

(c) Stimulative effect to the economic development of regions concerned due to the investment on facilities.

(d) Increase in employment opportunity for people through the implementation of construction works.

In addition, the following system and organization will be achieved through the operation of the Step 2 system:

(a) Establishment of the long-term flood forecasting system through the accumulation of hydrological and hydraulic data which cover a wide range and a long period; and

(b) Realization of a substantial organization with experts for flood forecasting.

Table 7-1(1/3). ANNUAL PEAK DISCHARGE AND ANNUAL DISCHARGE VOLUME SIMULATED THROUGH VARIED POINT RAINFALL GAUGING NETWORK (STEP 2)

Case of Observation and Simulation				Objective Basin: Upper Reaches from Bhumibol Dam (C.A. = 20,031 km^2) /1			
Year		Case No.	Density of Rainfall Gauging Network (km^2/station)	Number of Rainfall Stations	Annual Peak Discharge (m^3/s)	(Date)	Annual Discharge Volume ($10^6 m^3$)
1978	(1)	Observation	-	-	1,267	Oct. 06	6,829
	(2)	Simulation 1	1000	20	1,327	Oct. 05	6,771
	(3)	simulation 2	1200	17	1,337	Oct. 05	6,797
	(4)	Simulation 3	1400	13	1,431	Oct. 05	6,967
	(5)	Simulation 4	1600	13	1,431	Oct. 05	6,967
	(6)	Simulation 5	more than 1800	11	1,368	Oct. 05	6,167
1980	(1)	Observation	-	-	1,662	Oct. 08	6,156
	(2)	Simulation 1	1000	19	1,547	Oct. 08	6,214
	(3)	Simulation 2	1200	17	1,587	Oct. 08	6,185
	(4)	Simulation 3	1400	13	1,627	Oct. 08	5,939
	(5)	Simulation 4	1600	12	1,635	Oct. 08	5,930
	(6)	Simulation 5	more than 1800	10	1,805	Oct. 08	5,499
1983	(1)	Observation	-	-	1,574	Oct. 19	4,939
	(2)	Simulation 1	1000	20	1,593	Oct. 19	5,041
	(3)	Simulation 2	1200	16	1,577	Oct. 20	5,013
	(4)	Simulation 3	1400	14	1,670	Oct. 20	5,551
	(5)	Simulation 4	1600	13	1,652	Oct. 20	5,547
	(6)	Simulation 5	more than 1800	11	1,709	Oct. 20	5,285

Note: /1 Covering the sub-basin of Code No. BS-1.

Table 7-1(2/3). ANNUAL PEAK DISCHARGE AND ANNUAL DISCHARGE VOLUME SIMULATED THROUGH VARIED POINT RAINFALL GAUGING NETWORK (STEP 2)

Year	Case of Observation and Simulation		Objective Basin: Upper Reaches from Nakhon Sawan (C.A. = 58,721 km^2) /1			
	Case No.	Density of Rainfall Gauging Network (km^2/station)	Number of Rainfall Stations	Annual Peak Discharge (m^3/s)	(Date)	Annual Discharge Volume ($10^6 m^3$)
1978	(1) Observation	-	-	3,540	Oct. 07	31,215
	(2) Simulation 1	1000	59	3,579	Oct. 07	30,892
	(3) simulation 2	1200	49	3,514	Oct. 08	30,139
	(4) Simulation 3	1400	42	3,378	Oct. 08	28,477
	(5) Simulation 4	1600	37	3,390	Oct. 08	29,453
	(6) Simulation 5	more than 1800	33	3,268	Oct. 08	29,780
1980	(1) Observation	-	-	4,320	Oct. 09	29,085
	(2) Simulation 1	1000	57	4,360	Oct. 09	30,753
	(3) Simulation 2	1200	49	4,373	Oct. 09	30,959
	(4) Simulation 3	1400	40	4,434	Oct. 09	30,501
	(5) Simulation 4	1600	38	4,514	Oct. 09	31,081
	(6) Simulation 5	more than 1800	34	4,580	Oct. 09	31,663
1983	(1) Observation	-	-	2,290	Oct. 23	23,945
	(2) Simulation 1	1000	58	2,324	Oct. 24	24,831
	(3) Simulation 2	1200	48	2,332	Oct. 24	25,081
	(4) Simulation 3	1400	42	2,229	Oct. 24	24,962
	(5) Simulation 4	1600	37	2,304	Oct. 24	25,612
	(6) Simulation 5	more than 1800	32	2,372	Oct. 24	26,319

Note: /1 Covering the sub-basins of Code Nos. BS-2, 3, 4, 5 6, 7, 8, 9 and 10.

Table 7-1(3/3). ANNUAL PEAK DISCHARGE AND ANNUAL DISCHARGE VOLUME SIMULATED THROUGH VARIED POINT RAINFALL GAUGING NETWORK (STEP 2)

Case of Observation and Simulation				Objective Basin: Pasak River Upper Reaches from Saraburi (S.9) (C.A. = 8,124 km^2) /1			
Year		Case No.	Density of Rainfall Gauging Network (km^2/station)	Number of Rainfall Stations	Annual Peak Discharge (m^3/s)	(Date)	Annual Discharge Volume ($10^6 m^3$)
1978	(1)	Observation	-	-	3,206	Oct. 03	5,186
	(2)	Simulation 1	1000	-	-	-	-
	(3)	simulation 2	1200	7	3,272	Oct. 03	5,318
	(4)	Simulation 3	1400	-	-	-	-
	(5)	Simulation 4	1600	5	3,305	Oct. 03	6,023
	(6)	Simulation 5	more than 1800	3	3,309	Oct. 03	6,239
1980	(1)	Observation	-		No Notable Flood		
	(2)	Simulation 1	1000				
	(3)	Simulation 2	1200				
	(4)	Simulation 3	1400				
	(5)	Simulation 4	1600				
	(6)	Simulation 5	more than 1800				
1983	(1)	Observation	-		No Notable Flood		
	(2)	Simulation 1	1000				
	(3)	Simulation 2	1200				
	(4)	Simulation 3	1400				
	(5)	Simulation 4	1600				
	(6)	Simulation 5	more than 1800				

Note: /1 Covering the sub-basin of Code No. BS-14.

Table 7-2(1/2). INVENTORY OF POINT RAINFALL GAUGING STATIONS (STEP 2)

Installation Priority	Code No.	River Basin	Location	
			Latitude	Longitude
1	R-1.1	Sakae Krang	15°54'	99°28'
1	R-1.2	"	15°47'	99°41'
1	R-1.3	"	15°38'	99°32'
1	R-1.4	"	15°28'	99°34'
1	R-1.5	Chao Phraya	15°20'	100°32'
1	R-1.6	Pasak	15°28'	101°04'
1	R-1.7	"	15°13'	101°16'
1	R-1.8	"	15°04'	101°04'
1	R-1.9	"	14°51'	100°59'
1	R-1.10	"	14°37'	101°11'
2	R-2.1	Ping	16°52'	99°07'
2	R-2.2	"	16°46'	98°55'
2	R-2.3	"	16°20'	99°16'
2	R-2.4	"	16°12'	99°43'
2	R-2.5	"	16°03'	99°51'
2	R-2.6	"	15°56'	99°59'
2	R-2.7	Yom	16°49'	99°48'
2	R-2.8	"	16°39'	99°35'
2	R-2.9	"	16°27'	99°53'
2	R-2.10	Nan	16°52'	100°45'
2	R-2.11	"	16°50'	100°31'
2	R-2.12	"	16°42'	100°36'
2	R-2.13	"	16°25'	100°33'
2	R-2.14	"	16°12'	100°25'
2	R-2.15	Nan	16°10'	100°33'
2	R-2.16	"	16°11'	100°51'
2	R-2.17	"	15°51'	100°35'
2	R-2.18	"	15°38'	100°29'
2	R-2.19	"	15°35'	100°39'
2	R-2.20	Pasak	16°25'	101°09'
2	R-2.21	"	15°59'	101°03'
2	R-2.22	"	15°59'	101°14'

Table 7-2(2/2). INVENTORY OF POINT RAINFALL GAUGING STATIONS (STEP 2)

Installation Priority	Code No.	River Basin	Location	
			Latitude	Longitude
3	R-3.1	Wang	18°17'	99°30'
3	R-3.2	"	18°07'	99°31'
3	R-3.3	"	17°52'	99°20'
3	R-3.4	Yam	18°23'	100°22'
3	R-3.5	"	18°08'	100°08'
3	R-3.6	"	18°04'	99°50'
3	R-3.7	"	17°53'	99°36'
3	R-3.8	"	17°19'	99°33'
3	R-3.9	"	17°00'	99°34'
3	R-3.10	Nan	17°37'	100°05'
3	R-3.11	"	17°28'	100°07'
3	R-3.12	"	17°13'	100°21'
3	R-3.13	"	17°17'	100°33'
3	R-3.14	"	17°05'	100°50'
4	R-4.1	Ping	18°50'	98°58'
4	R-4.2	"	18°51'	99°17'
4	R-4.3	"	18°50'	98°44'
4	R-4.4	"	18°42'	99°02'
4	R-4.5	"	18°29'	98°21'
4	R-4.6	"	18°24'	98°40'
4	R-4.7	"	18°27'	99°08'
4	R-4.8	"	18°17'	98°19'
4	R-4.9	"	18°18'	98°49'
4	R-4.10	"	18°03'	98°38'
4	R-4.11	"	17°47'	98°21'
4	R-4.12	"	17°48'	98°57'
4	R-4.13	"	17°39'	98°46'
4	R-4.14	"	17°22'	98°29'
4	R-4.15	Nan	18°44'	101°01'
4	R-4.16	"	18°34'	100°45'
4	R-4.17	"	18°23'	100°51'
4	R-4.18	"	18°19'	100°43'
4	R-4.19	"	18°02'	101°01'

Table 7-3. INVENTRY OF POINT RAINFALL AND WATER LEVEL GAUGING STATIONS (STEP 2)

Installation Priority	Station Code No.	River System	Location		Existing /1 Gauging Station Located Nearby	Existing River Structure Located Nearby
			Latitude	Longitude		
1	W/R-1.1	Chao Phraya	15°40'	100°06'	C2 (RID)	-
1	W/R-1.2	Sakae Krang	15°29'	99°56'	-	-
1	W/R-1.3	Pasak	16°46'	101°14'	Wichian Buri (MD)	-
1	W/R-1.4	"	14°33'	100°45'	-	Upper Rama VI Dam Site
2	W/R-2.1	Ping	17°12'	99°06'	W4A (RID)	-
2	W/R-2.2	"	16°28'	99°31'	P7A (RID)	-
2	W/R-2.3	Yom	16°30'	100°12'	Y17 (RID)	-
2	W/R-2.4	Nan	16°49'	100°15'	N5A (RID)	-
2	W/R-2.5	"	16°12'	100°25'	N10A (RID)	-
2	W/R-2.6	Pasak	16°46'	101°14'	Lom Sak (MD)	-
3	W/R-3.1	Wang	18°31'	99°37'	W10A (RID)	Lower Kiu Lom Dam Site
3	W/R-3.2	"	17°38'	99°14'	W3A (RID)	-
3	W/R-3.3	Yom	18°35'	100°09'	Y20 (RID)	-
3	W/R-3.4	"	17°35'	99°43'	Y14 (RID)	-
3	W/R-3.5	"	17°00'	99°49'	Y4 (RID)	-
3	W/R-3.6	Nan	17°44'	100°32'	N12A (RID)	Lower Sirikit Dam Site
3	W/R-3.7	"	17°01'	100°11'	N27A (RID)	Upper Naresuan Dam Site
4	W/R-4.1	Ping	18°47'	99°00'	P1 (RID)	-
4	W/R-4.2	Nan	18°46'	100°46'	N1	-

Note: /1 The name in parenthesis means the office controlling the existing water level gauging station.

Table 7-4(1/2). POINT RAINFALL GAUGING STATIONS APPLIED TO BASIN RUNOFF PREDICTION MODEL (STEP 2)

Objective Basin		Applied Gauging Station		
Basin Code No.	River System	Station Code No. /Location	Station Code No. /Location	Station Code No. /Location
BS-1	Ping	W/R-4.1/Chiang Mai R-4.3/Mae Rim R-4.6/Chom Thong R-4.9/Hot R-4.12/Li	R-4.1/Samoeng R-4.4/Sarapi R-4.7/Mae Tha R-4.10/Ban Aen R-4.13/Ban Ko	R-4.2/Sam Kamphaeng R-4.5/Mae Chaem R-4.8/Huai Mae Ka R-4.11/Omkoi R-4.14/Ban San Mamuang
BS-2	Wang	W/R-3.1/Kiu Lom Dam R-3.3/Sop Prap	R-3.1/Lampang W/R-3.2/Thoen	R-3.2/Mae Tha
BS-3	Ping	W/R-2.1/Wang Khrai R-2.3/Khlong Lan	R-2.1/Tak W/R-2.2/Kamphaeng Phet	R-2.2/Doi Musae
BS-4	Ping	W/R-2.2/Kamphaeng Phet R-2.6/Banphot Phisai	R-2.4/Khlong Khlung W/R-1.1/Nakhon Sawan	R-2.5/Ban Pang Wai
BS-5	Yom	W/R-3.3/Ngao Sak R-3.6/Long	R-3.4/Rong Kwang R-3.7/Wang Chin	R-3.5/Phrae W/R-3.4/Si Satchanalai
BS-6	Yom	W/R-3.4/Si Satchanalai W/R-3.5/Sukhotai	R-3.8/Thung Saliam	R-3.9/Ban Dan Lan Hoi
BS-7	Nan	W/R-4.2/Nan R-4.17/Na Noi W-R-3.6/Tha Pla	R-4.15/Mae Charim R-4.18/Yan Sarang	R-4.16/Sa R-4.19/Nam Pat
BS-8	Nan	W/R-3.6/Tha Pla R-3.12/Ban Nong Bon W/R-3.7/Naresuan Dam	R-3.10/Uttaradit R-3.13/Chattrakan W/R-2.4/Phitsanulok	R-3.11/Thron R-3.14 Nakhon Thai
BS-9	Nan	W/R-2.4/Phitsanulok R-2.12/Nan Khek	R-2.10/Khao Krayang R-2.13/Wang Saiphum	R-2.11/Wang Nok Aen

Table 7-4(2/2). POINT RAINFALL GAUGING STATIONS APPLIED TO BASIN RUNOFF PREDICTION MODEL (STEP 2)

Objective Basin		Applied Gauging Station		
Basin Code No.	River System	Station Code No. /Location	Station Code No. /Location	Station Code No. /Location
BS-10	Nan/ Yom	R-2.7/Khirimat R-2.13/Wang Saiphum R-2.16/Chon Daen R-2.19/Phaisali	R-2.8/Phran Kratai R-2.14/Bang Mun Nak R-2.17/Nong Bua W/R-2.3/Sam Ngam	R-2.9/Sai Ngam R-2.15/Thap Khlo R-2.18/Thatako W/R-2.5/Taphan Hin
BS-11	Sakae Krang	R-1.1/Ban Pang Makha R-1.4/Lan Sak	R-1.2/Ban San Chao W/R-1.2/Uthai Thani	R-1.3/Khlong Pho
BS-12	Tha Pla Pi	R-1.5/Ban Mi		
BS-13	Pasak	W/R-2.6/Lom Sak R-2.22/Ban Wang Thadi	R-2.20/Phetchabun W/R-1.2/Wichian Buri	R-2.21/Nong Phai
BS-14	Pasak	W/R-1.3/Wichian Buri R-1.8/Chai Badam W/R-1.4/Rama VI Dam	R-1.6/Kok Saat R-1.9/Phatthana Nikhom	R-1.7/Ban Tha Ruak R-1.10/Kham Takhian

Table 7-5(1/2). INVENTORY OF WATER LEVEL GAUGING STATIONS (STEP 2)

Installation Priority	Station Code No.	River System	Location		Existing /1 Gauging Station Located Nearby	Existing River Structure Located Nearby
			Latitude	Longitude		
1	W-1.1	Chao Phraya	15°09'	100°11'	C13 (RID)	Chao Phraya Dam
1	W-1.2	"	14°53'	100°24'	C3 (RID)	-
1	W-1.3	Lop Buri	14°47'	100°36'	L2A (RID)	-
1	W-1.4	Chao Phraya	14°35'	100°27'	C7A (RID)	-
1	W-1.5	"	14°21'	100°35'	S5 (RID)	-
1	W-1.6	"	14°11'	100°30'	C29 (RID)	-
1	W-1.7	"	13°53'	100°29'	C22 (RID)	-
1	W-1.8	"	13°47'	100°30'	C12 (RID)	-
1	W-1.9	"	13°44'	100°29'	C4 (RID)	-
1	W-1.10	"	13°32'	100°34'	Phra Chul (PAT)	-
1	W-1.11	C-P Canal /2	15°20'	100°06'	-	Manorom Regulator
1	W-1.12	"	15°09'	100°25'	-	Chongkae Regulator
1	W-1.13	"	14°54'	100°36'	-	Kake Kathien Regulator
1	W-1.14	"	14°38'	100°45'	-	Reong Rang Regulator
1	W-1.15	C-A Canal /3	15°10'	100°10'	-	Maharaj Regulator
1	W-1.16	Noi	15°10'	100°09'	-	Borommathat Regulator
1	W-1.17	"	14°56'	100°17'	-	Chanasatr Regulator

Note: /1 The name in parenthesis means the office controlling the existing water level gauging station.

/2 Chai Nat - Pasak Canal.

/3 Chai Nat - Ayutthaya Canal.

Table 7-5(2/2). INVENTORY OF WATER LEVEL GAUGING STATIONS (STEP 2)

Installation Priority	Station Code No.	River System	Location		Existing /1 Gauging Station Located Nearby	Existing River Structure Located Nearby
			Latitude	Longitude		
1	W-1.18	Noi	14°45'	100°25'	-	Yang Manee Regulator
1	W-1.19	"	14°26'	100°23'	-	Pakhar Regulator
1	W-1.20	Suphan	15°13'	100°04'	-	Phonlathep Regulator
1	W-1.21	"	15°03'	100°01'	-	Thabote Regulator
1	W-1.22	"	14°46'	100°06'	-	Samchook Regulator
1	W-1.23	"	14°32'	100°08'	-	Phophya Regulator
2	W-2.1	Ping	17°14'	99°00'	P12 (RID)	Lower Bhumibol Dam Site
4	W-4.1	"	17°15'	98°50'	-	Upper Bhumibol Dam Site
4	W-4.2	Nan	17°46'	100°33'	-	Upper Sirikit Dam Site

Note: /1 The name in parenthesis means the office controlling the existing water level gauging station.

Table 7-6. WATER LEVEL GAUGING STATIONS TO MONITOR AND CALIBRATE THE RIVER STREAM FLOW DISCHARGE (STEP 2)

River System	Monitor and Calibration Items	Station Code No.	Location
Ping	Discharge	W-4.1	Upper Bhumibol Dam
Ping	Discharge	W/R-2.2	Kamphaeng Phet (P7A)
Wang	Discharge	W/R-3.2	Thoen (W3A)
Wang	Discharge	W/R-2.1	Wang Khrai (W4A)
Yom	Discharge	W/R-3.4	Si Satchanalai (Y14)
Yom	Discharge	W/R-3.5	Sukhotai (Y4)
Yom	Discharge	W/R-2.3	Sam Ngan (Y17)
Nan	Discharge	W-4.2	Upper Sirikit Dam
Nan	Discharge	W/R-3.7	Lower Naresuan Dam (N27A)
Nan	Discharge	W/R-2.4	Phitsanulok (N5A)
Nan	Discharge	W/R-2.5	Thaphan Hin (N10A)
Sakae Krang	Discharge	W/R-1.2	Thap Than (Ct8)
Pasak	Discharge	W/R-1.3	Wichian Buri
Pasak	Discharge	W/R-1.4	Upper Rama VI Dam
Chao Phraya	Discharge/Water Level	W/R-1.1	Nakhon Sawan (C2)
Chao Phraya	Discharge/Water Level	W-1.1	Lower Chao Phraya Dam (C13)
Chao Phraya	Discharge/Water Level	W-1.2	Sing Buri (C3)
Lop Buri	Discharge/Water Level	W-1.3	Lop Buri (L2A)
Chao Phraya	Discharge/Water Level	W-1.4	Angthong (C7A)
Chao Phraya	Discharge/Water Level	W-1.5	Ayutthaya
Chao Phraya	Discharge/Water Level	W-1.6	Bang Sai (C29)
Chao Phraya	Water Level	W-1.7	Pakred (C22)
Chao Phraya	Water Level	W-1.8	RID Bangkok Office (C12)
Chao Phraya	Water Level	W-1.9	Memorial Bridge
Chao Phraya	Water Level	W-1.10 /1	Fort Phra Chul (Gulf)

Note: /1 The observed water level is also used to predict the tidal level in the Gulf of Thailand.

Table 7-7. WATER LEVEL GAUGING STATIONS TO MONITOR THE CHANNEL FLOW DISCHARGE AT EXISTING REGULATOR (STEP 2)

Name of Channel	Name of Regulator	Station Code No.
Chai Nat-Pasak Canal	Manorom	W-1.11
Chai Nat-Pasak Canal	Chongkae	W-1.12
Chai Nat-Pasak Canal	Kake Kathiom	W-1.13
Chai Nat-Pasak Canal	Reong Rang	W-1.14
Chai Nat-Ayutthaya Canal	Maharaj	W-1.15
Noi River	Borommathat	W-1.16
Noi River	Chanasatr	W-1.17
Noi River	Yang Manee	W-1.18
Noi River	Pakhai	W-1.19
Suphan River	Phonlathep	W-1.20
Suphan River	Thabote	W-1.21
Suphan River	Samchook	W-1.22
Suphan River	Phophya	W-1.23

Table 7-8. WATER LEVEL GAUGING STATIONS TO INPUT THE OBSERVED DISCHARGE AS BOUNDARY CONDITION (STEP 2)

Item of Prediction		Applied Gauging Station		
Prediction Time	Target Point	River System	Station Code No.	Location
Short	Bangkok Metropolis	(1) Chao Phraya	W-1.6	Bang Sai (C29)
Short	Ayutthaya	(1) Chao Phraya	W-1.1	Lower Chao Phraya Dam (C13)
		(2) Pasak	W/R-1.3	Wichian Buri
Short	Chai Nat, Sing Buri, Lop Buri and Angthong	(1) Chao Phraya	W/R-1.1	Nakhon Sawan (C2)
Short	Nakhon Sawan	(1) Ping	W/R-2.2	Kamphaeng Phet (P7A)
		(2) Yom	W/R-2.3	Sam Ngam (Y17)
		(3) Nan	W/R-2.4	Phitsanulok (N5A)
Long	All Target Points	(1) Ping	W-2.1	Lower Bhumibol Dam (P12)
		(2) Wang	W/R-3.1	Lower Kiu Lom Dam (W10A)
		(3) Yom	W/R-3.3	Ngao Sak (Y20)
		(4) Nan	W/R-3.6	Lower Sirikit Dam (N12A)
		(5) Pasak	W/R-2.6	Lom Sak
		(6) Ping	W/R-4.1	Chiang Mai (P1) /1
		(7) Nan	W/R-4.2	Nan (N.1) /1

Note: /1 Subject to flood prediction for upper reaches from Bhumibol and Sirikit dams.

Table 7-9. INSTALLATION PRIORITY OF GAUGING STATIONS (STEP 2)

Priority	Gauging Purpose	Coverage of Gauging Network to be Expanded	Number of Gauging Station			
			Water Level Gauging Station	Water Level/ Rainfall Gauging Station	Rainfall Gauging Station	Radar Gauging Station
1.	(1) Short Term Prediction for target areas except Nakhon Sawan	(1) Chao Phraya River Basin upto Nakhon Sawan (Sta. C2) including Sake Krang River Basin (2) Pasak River Basin upto Wichian Buri	23	4	10	0
2.	(1) Long Term Prediction for target areas except Nakhon Sawan (2) Short Term Prediction for Nakhon Sawan	(1) Ping River Basin upto Bhumibol Dam (Stas. P12 and W4A) (2) Yom River Basin upto Sam Ngam (Sta. Y17) (3) Nan River Basin upto Phitsanulok (Sta. N5A) (4) Pasak River Basin upto Lop Buri	1	6	22	0
3.	(1) Long Term Prediction for all target areas	(1) Wang River Basin upto Chae Hom (Sta. W10A) (2) Yom River Basin upto Ngao Sak (Sta. Y20) (3) Nan River Basin upto Sirikit Dam (Sta. N12A)	0	7	14	0
4.	(1) Long Term Prediction for all target areas (2) Flood mitigation effect for respective target areas through effective use of potential flood control functions attached to Bhumibol and Sirikit Dam.	(1) Catchment area of Bhumibol Dam upto Chiang Mai (Sta. P1) (2) Catchment area of Sirikit Dam upto Nan (Sta. N1)	2	2	19	0
5.	(1) Facilitating the rainfall prediction measures (2) Improving the accuracy of areal average rainfall estimated from the point rainfall gauging data	(1) Most of Pasak and Sakae Krang River (2) Lower reaches of Ping, Yom and Nan River Basin	0	0	0	2

Note: "Short Term Prediction" is proposed to be done 3 days in advance, while "Long Term Prediction" is to be done 6 to 10 days in advance.

Table 7-10. NUMBER OF CHANNELS FOR THE TRUNK LINE (STEP 2)

Section	No. of Channels				
	Data /1 Transmission	Tel/FAX	Telephone	Radar	Total
FFC - R1	1	1	-	-	2
FFC - R2	1	1	-	-	2
FFC - R3	1	1	-	2	4
FFC - R7	1	1	1	-	3
FFC - R8	1	1	1	2	5

Note: /1 Sections R1, R2 and R3 are used for telemetering transmission to FFC only. Sections R7 and R8 are used for telemetering transmission to FFC and mutual data communication.

Table 7-11. COST COMPARISON OF TELECOMMUNICATION NETWORK (STEP 2)

Cost Item	Amount (US$ 10^3)			
	TOT	RID	CAT	PTD
Construction Cost				
1. Trunk Line	1,645	10,980	1,781	3,013
- Sub-station	678	1,115	678	2,723
- Terminal Station (TOT, CAT, PTD)	813	-	949	136
- Repeater Station (UHF)	-	9,407	-	-
- Flood Forecasting Center	154	458	154	154
2. Branch Line	1,524	1,524	1,524	1,524
- Radar Ganging Station	171	171	171	171
- Repeater Station	1,182	1,182	1,182	1,182
- Sub-station	171	171	171	171
Sub Total	3,169	12,504	3,305	4,537
O&M Cost for 10 years				
1. Rental Fee for Line	309	-	5,619	818
2. Personnel for O&M	682	853	682	768
3. Maintenance Cost for Materials	540	2,133	564	774
Sub-Total	1,531	2,986	6,865	2,360
Grand Total	4,700	15,490	10,170	6,897

Table 7-12(1/2). SPECIFICATIONS OF DATA MANAGEMENT FACILITIES (STEP 2)

(1) Engineering Work Station

(1.1) CPU

1. Quantity : 3
2. Technical Specifications : To be refered to Table 6-8.

(1.2) CRT color graphic display/keyboard

1. Quantity : 3
2. Technical Specifications : To be refered to Table 6-8.

(2) Data Storage Equipment

(2.1) Hard Disk Drive

1. Quantity : 3
2. Technical Specifications : To be refered to Table 6-8.

(2.2) Magnetic Tape Unit

1. Quantity : 1
2. Technical Specifications : To be refered to Table 6-8.

(3) Printer

1. Quantity : 1
2. Technical Specifications : To be refered to Table 6-8.

(4) Color Hard Copy

1. Quantity : 1
2. Technical Specifications : To be refered to Table 6-8.

(5) Video Projector

1. Quantity : 1
2. Technical Specifications : To be refered to Table 6-8.

Note: Above specifications should be modified in detailed design.

Table 7-12(2/2). SPECIFICATIONS OF DATA MANAGEMENT FACILITIES (STEP 2)

(6) Mimic Board		
1. Quantity	:	1
- Type	:	Self-standing with basin map and display panel
- Display	:	Present date and time, observation time, rainfall data, water level data
(7) Electronic Filing System		
1. Quantity	:	1 set
2. Technical Specifications		
- Type	:	16 bit CPU, 17" display keyboard, mouse, image scanner, optical disk, laser printer
- Disk Capacity	:	800 MB
- Resolution	:	Scanner: 400 picture element/inch, Printer: 400 picture element/inch
- Print Speed	:	8 page/min
(8) Video Tape Recorder		
(8.1) Portable Video Cassette Recorder		
1. Quantity	:	1
2. Technical Specifications	:	Remote control, editing, picture search
(8.2) Portable Video Camera		
1. Quantity	:	1
2. Technical Specifications	:	Zoom, 525 lines 50 fields 2:1 interlaced scanning, 500(H)x582(V) picture elements.

Note: Above specifications should be modified in detailed design.

Table 7-13. ANNUAL PEAK DISCHARGE PREDICTED AT TARGET POINT (STEP 2)

Target Point	Year	Observed		Predicted 3 Days Before		Predicted 6 Days Before	
		m^3/s	Date	m^3/s	Date	m^3/s	Date
Nakhon Sawan	1978	3,540	Oct. 07	3,527	Oct. 07	3,514	Oct. 08
Chai Nat	1978	3,741	Oct. 11	3,689	Oct. 11	3,709	Oct. 11
Angthong	1978	2,550	Oct. 10	2,966	Oct. 12	2,938	Oct. 12
Nakhon Sawan	1980	4,320	Oct. 09	4,356	Oct. 09	4,373	Oct. 09
Chai Nat	1980	3,795	Oct. 10	3,796	Oct. 10	3,796	Oct. 10
Angthong	1980	3,115	Oct. 15	3,024	Oct. 13	3,011	Oct. 11
Nakhon Sawan	1983	2,290	Oct. 23	- /1	- /1	2,332	Oct. 24
Chai Nat	1983	3,290	Oct. 25	3,097	Oct. 27	3,114	Oct. 27
Angthong	1983	2,482	Oct. 24	2,604	Oct. 26	2,425	Oct. 28

Note: /1 Prediction was not made because of the missing upstream observed discharge data at Y17.

Table 7-14. DIFFERENCES BETWEEN OBSERVED AND PREDICTED DAILY MAXIMUM TIDAL LEVEL (STEP 2: PREDICTED 6 DAYS IN ADVANCE)

Subject Year	Season	Maximum Difference (m)	Average Difference (m)	Occurrence of Difference in Daily Maximum Tidal Leve in One Year					
				Less than 0.1 m (day)	Less than 0.2 m (day)	Less than 0.3 m (day)	Less than 0.4 m (day)	Less than 0.5 m (day)	More than 0.5 m (day)
1978	Rainy Season	0.45	0.11	105	157	175	182	184	
	Dry Season	0.38	0.10	115	168	177	181		
	Annual	0.45	0.11	120	325	352	363	365	
1980	Rainy Season	0.33	0.08	125	173	181	184		
	Dry Season	0.34	0.09	112	166	179	182		
	Annual	0.34	0.09	237	339	360	366		
1983	Rainy Season	0.62	0.11	95	162	180	182	182	184
	Dry Season	0.28	0.09	117	167	181			
	Annual	0.62	0.10	212	329	361	363	363	365

Table 7-15. ONE-DAY MAXIMUM WATER LEVEL PREDICTED FOR TIDAL COMPARTMENT (STEP 2)

Observation/ Prediction Date /1	Objective Point		Observed		Predicted 3 Days Before		Predicted 6 Days Before	
	Location Name	Distance from River Mouth (km)	Water Level (m. MSL)	Time	Water Level (m. MSL)	Time	Water Level (m. MSL)	Time
Oct. 21 1978	Bangkok Port	27	1.73	10:00	1.70	11:00	1.67	11:00
	Satha Pradit	40	1.77	10:00	1.66	11:00	1.60	11:00
	Memorial Bridge	48	1.89	10:00	2.07	11:00	2.01	10:00
	RID Samsen	54	2.03	12:00	2.00	11:00	1.94	11:00
	Pakred	70	2.15	12:00	2.09	12:00	1.98	12:00
Oct. 27 1980	Bangkok Port	27	1.77	09:00	1.86	10:00	1.86	10:00
	Satha Pradit	40	Data Missing		1.76	10:00	1.75	10:00
	Memorial Bridge	48	1.92	10:00	2.04	10:00	2.02	10:00
	RID Samsen	54	2.01	10:00	2.05	10:00	2.07	10:00
	Pakred	70	2.21	11:00	2.24	12:00	2.27	11:00
Oct. 31 1983	Bangkok Port	27	1.97	15:00	1.93	17:00	1.89	17:00
	Satha Pradit	40	1.87	16:00	1.85	18:00	1.74	18:00
	Memorial Bridge	48	1.82	16:00	1.97	16:00	2.13	16:00
	RID Samsen	54	1.94	17:00	1.97	18:00	1.85	18:00
	Pakred	70	2.05	18:00	1.99	20:00	2.00	19:00

Note: /1 Date of observation of annual maximum discharge at Bang Sai.

Table 7-16. STAGEWISE CONSTRUCTION OF TELECOMMUNICATION NETWORK (STEP 2)

Phase	Trunk Line	Branch Line Data Collection	Data Dissemination
Phase 1	FFC - R/O 8 (3 ch)	R/O 8 - 11 Gauging Stations (1 ch)	FFC - BMA (2 ch)
	FFC - R/O 7 (3 ch)	R/O 7 - 21 Gauging Stations (1 ch)	FFC - LAD (2 ch)
		FFC - 5 Gauging Stations (1 ch)	FFC - EGAT (2 ch)
Phase 2	FFC - R/O 3 (2 ch)	R/O 7 - 2 Gauging Stations	-
		R/O 3 - 27 Gauging Stations (1 ch)	-
Phase 3	FFC - R/O 2 (2 ch)	R/O 3 - 10 Gauging Stations	-
		R/O 2 - 11 Gauging Stations (1 ch)	-
Phase 4	FFC - R/O 1 (2 ch)	R/O 3 - 2 Gauging Stations	-
		R/O 2 - 6 Gauging Stations	-
		R/O 1 - 15 Gauging Stations (1 ch)	-
Phase 5	FFC - R/O 8 (2 ch)	R/O 8 - 1 Radar Gauge (2 ch)	-
	FFC - R/O 3 (2 ch)	R/O 3 - 1 Radar Gauge (2 ch)	-

Table 7-17. TOTAL COST OF THE PROPOSED SYSTEM (STEP 2)

Cost Item	Amount (US$)
1. Telecommunication Facilities	
Gauging Station	16,954,700
Substation	4,544,600
TOT Terminal Station	813,000
Flood Forecasting Center	5,291,700
Related Agencies	330,000
Sub-Total	27,934,000
2. Data Management and Dissemination Facilities	
Substation	101,000
Flood Forecasting Center	1,034,800
Related Agencies	123,900
Sub-Total	1,259,700
3. Engineering Services	
Detailed Design	3,134,800
Construction Supervision	5,634,500
Development of the System	1,422,000
Sub-Total	10,191,300
4. Training	600,000
Total of 1 to 4	39,985,000
5. Physical Contingency	3,998,500
Total of 1 to 5	43,983,500
6. Price Contingency	11,964,000
Grand Total	55,947,500

Table 7-18. COST BREAKDOWN FOR EACH PHASE

(Unit: US$)

Work Item	Total	Detailed Design	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
1. Telecommunication Facilities							
Gauging Station	16,954,700	-	2,495,600	1,693,400	1,553,500	1,451,600	9,760,600
Substation	4,544,600	-	1,136,700	511,700	511,700	511,700	1,872,800
TOT Terminal Station	813,000	-	406,500	135,500	135,500	135,500	-
Flood Forecasting Center	5,291,700	-	1,682,700	-	-	-	3,609,000
Related Agencies	330,000	-	330,000	-	-	-	-
Sub-Total	27,934,000	-	6,051,500	2,340,600	2,200,700	2,098,800	15,242,400
2. Data Management and Dissemination Facilities							
Substation	101,000	-	77,000	8,000	8,000	8,000	-
Flood Forecasting Center	1,034,800	-	1,034,800	-	-	-	-
Related Agencies	123,900	-	123,900	-	-	-	-
Sub-Total	1,259,700	-	1,235,700	8,000	8,000	8,000	-
3. Engineering Services							
Detailed Design	3,134,800	3,134,800	-	-	-	-	-
Construction Supervision	5,634,500	-	1,126,900	1,126,900	1,126,900	1,126,900	1,126,900
Development of the System	1,422,000	-	284,400	284,400	284,400	284,400	284,400
Sub-Total	10,191,300	3,134,800	1,411,300	1,411,300	1,411,300	1,411,300	1,411,300
4. Training	600,000	-	120,000	120,000	120,000	120,000	120,000
Total of 1 to 4	39,985,000	3,134,800	8,818,500	3,879,900	3,740,000	3,638,100	16,773,700
5. Physical Contingency	3,998,500	313,500	881,800	388,000	374,000	363,800	1,677,400
Total of 1 to 5	43,983,500	3,448,300	9,700,300	4,267,900	4,114,000	4,001,900	18,451,100
6. Price Contingency	11,964,000	434,500	1,881,700	981,600	1,098,400	1,220,600	6,347,200
Grand Total	55,947,500	3,882,800	11,582,000	5,249,500	5,212,400	5,222,500	24,798,300

Table 7-19. BREAKDOWN OF ANNUAL OPERATION AND MAINTENANCE COST

Cost Item	Amount (US$)
1. Rental Fee for TOT Line /1	
Line Charge	42,500
Power Charge	3,800
Sub-Total	46,300
2. Operation /2	
Personnel	180,000
Consumables /3	25,300
Power Charge	500,000
Miscellaneous	200,000
Sub-Total	905,300
3. Maintenance	
Materials, Spare Parts and Unit /4	
- Telecommunication	558,700
- Data Management	25,300
Vehicles	153,000
Sub-Total	737,000
Grand-Total	1,688,600

/1 Refer to Supporting Report

/2 Refer to Supporting Report

/3 Cost for consumable is assumed to be 2% of data management facility cost

/4 Cost for maintenance is assumed to be 2% of equipment cost

Table 7-20. MEMBERS OF THE ADVISORY COMMITTEE FOR THE FLOOD FORECASTING CENTER IN RID (STEP 2)

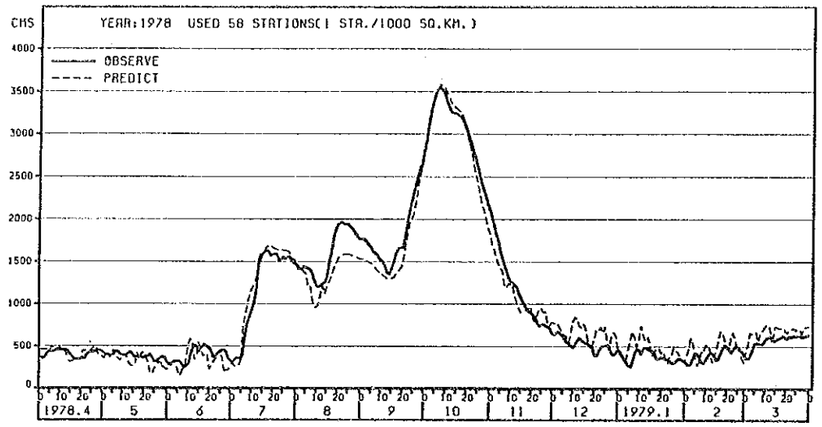
	Posision in RID	Position in Committee	Existing Related Activity
1.	Chairman of Flood Forecasting Center	Chairman	-
2.	Director of Hydrology Division	Member	Hydrological analysis
3.	Director of O&M Division	- do -	Management of water flow control
4.	Director of Communications Division	- do -	Telecommunication service
5.	Director of Data Processing Division	- do -	Data compilation by computer
6.	Director of Project Planning Division	- do -	Monitoring and evaluation of RID's projects for the purpose of adequate future planning
7.	Director of Design Division	- do -	Design of riparian structures for flood protection
8.	Director of Regional Office (Nos. 7 & 8) /1	- do -	Flood fighting for agricultural areas
9.	Chief of Flood Prediction Section	Secretary	-

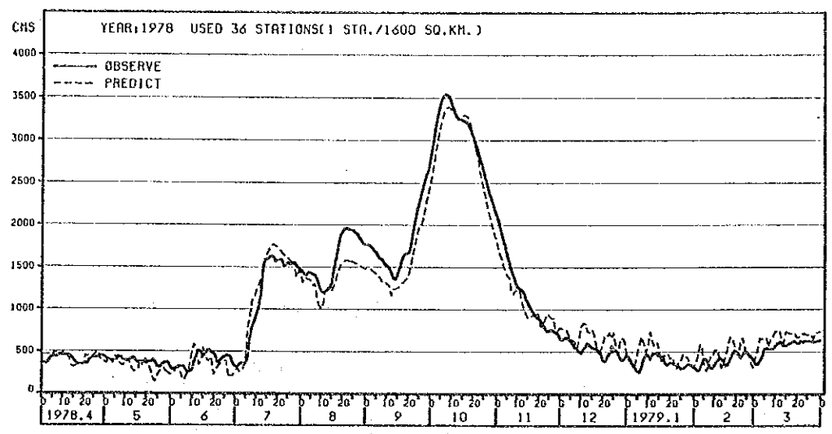
Note: /1 Directors of Regional Office shall serve as members upon instructions of the Chairman, in accordance with predicted flood area and scale.

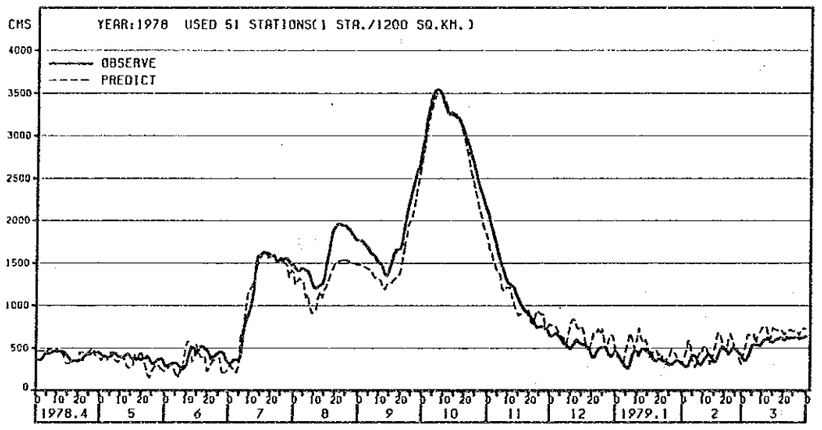
Table 7-21. ASSIGNMENT OF REQUIRED ACTIVITIES FOR EXECUTING OFFICES UNDER THE FLOOD FORECASTING CENTER IN RID (STEP 2)

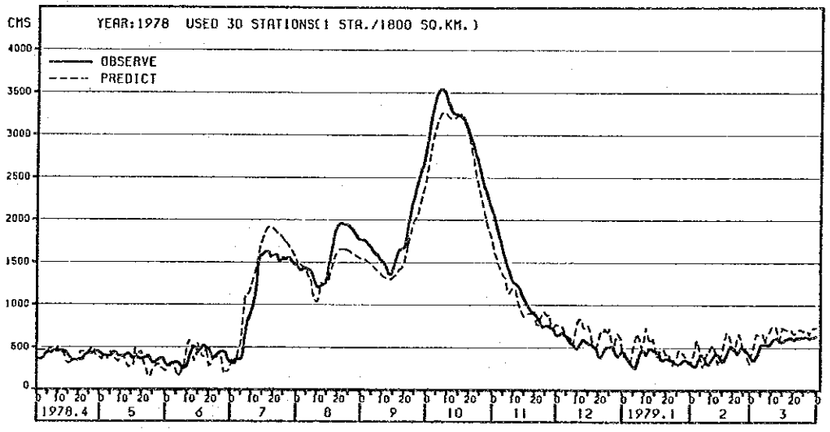
Office	Required Activity
Administrative Section	Administrative affairs
Flood Prediction Section	Collection of hydro-meteorological information; flood prediction; dissemination and public response.
Communications Section /1	Maintenance and study of telecommunication system and facilities such as telemetering, radar and gauging facilities in head office and substations.
Data Processing Section	Basic data collection, compilation and storage for formulation of flood control includig flood forecasting; maintenance of computers acilities and study of computer system.

Note: /1 Substations of the Communications Section will be installed in Regional Offices (Nos. 1, 2, 3, 7 and 8) for the inspection of related facilities in the region.









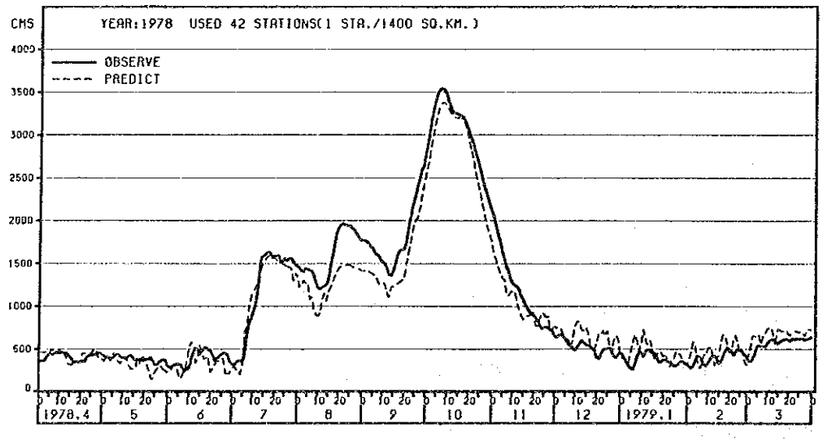
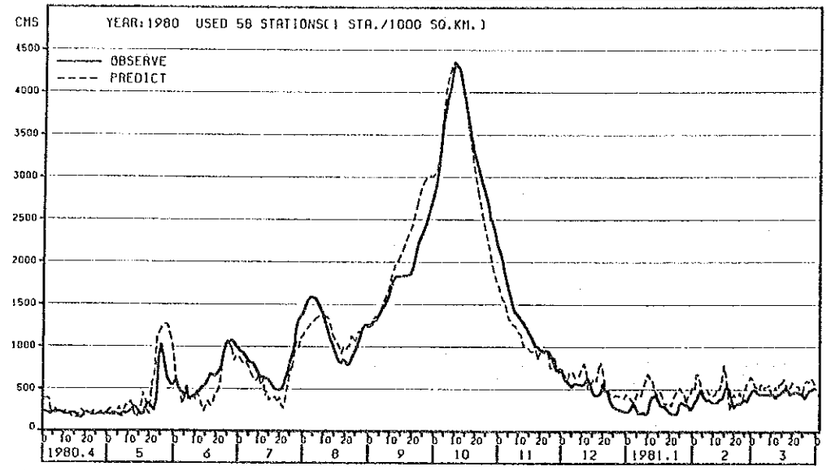
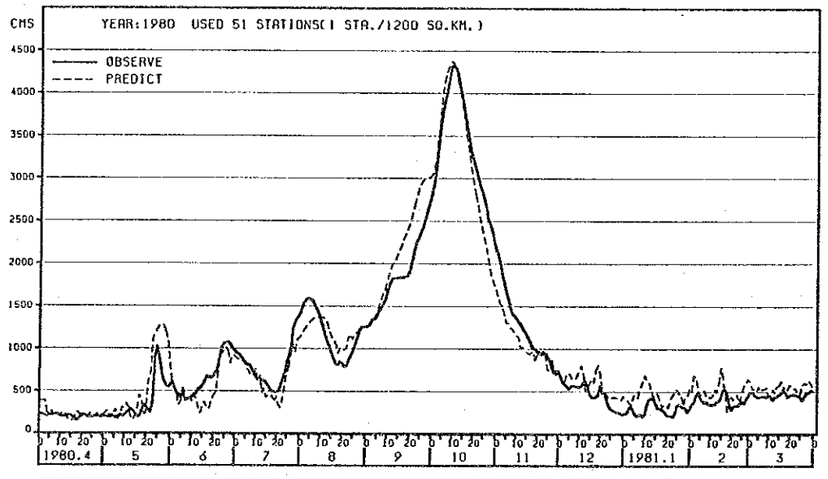
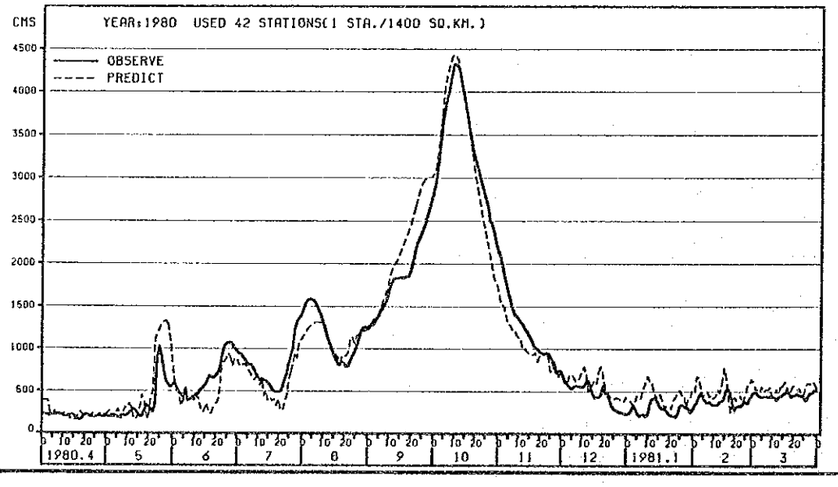


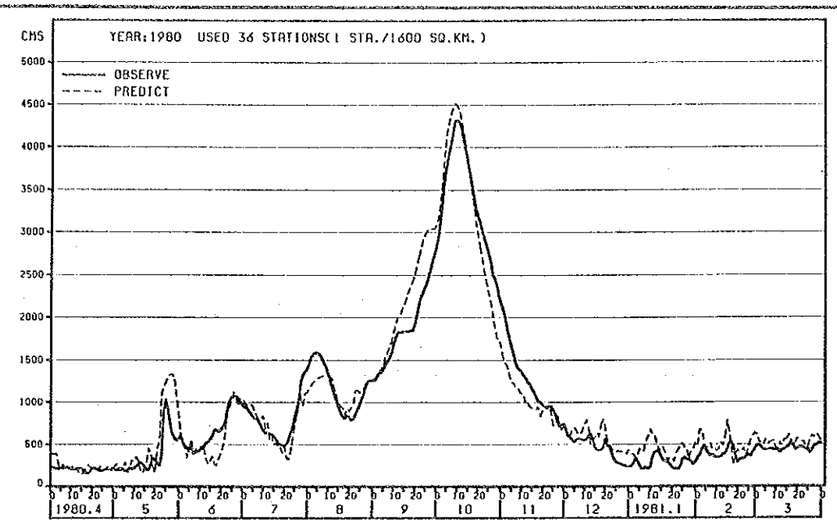
Fig. 7-1(1/3). DISCHARGE HYDROGRAPHS SIMULATED THROUGH VARIED RAIN-FALL GAUGING STATIONS

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY









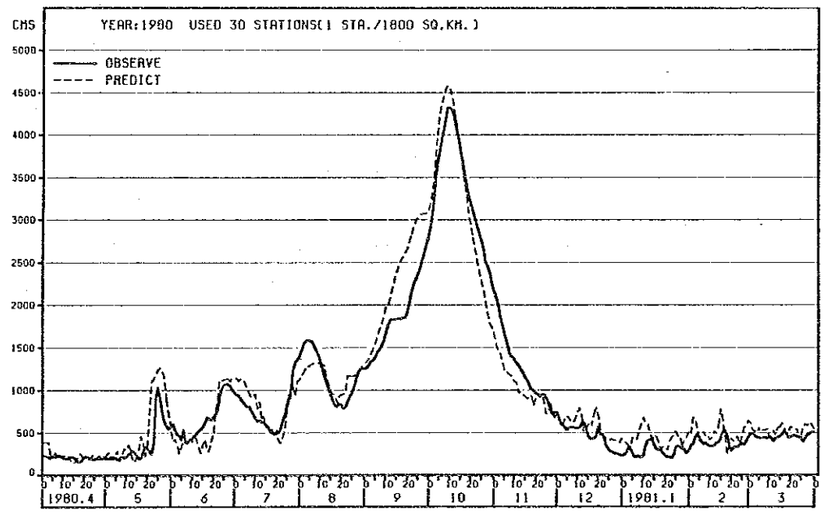
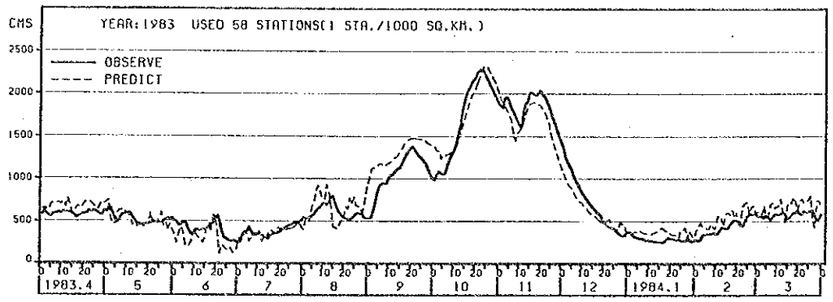
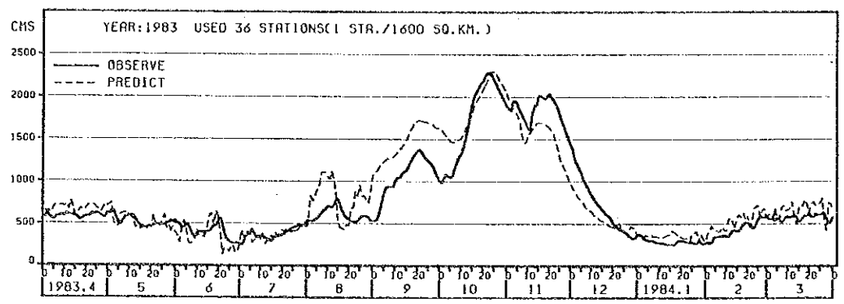
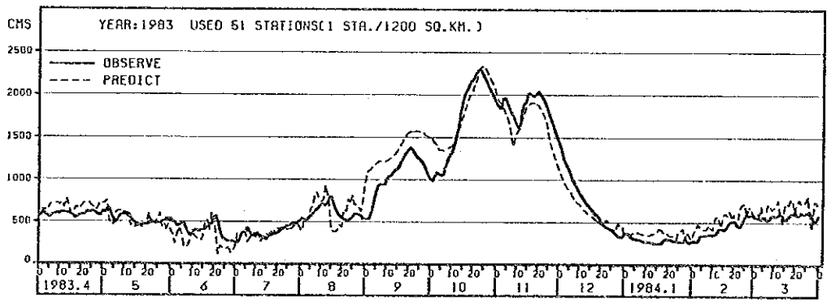


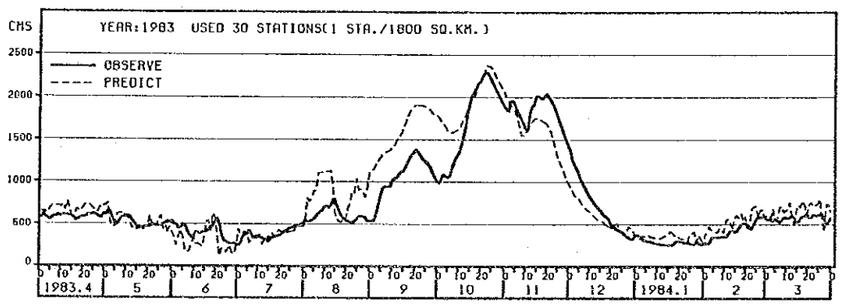
Fig. 7-1(2/3). DISCHARGE HYDROGRAPHS SIMULATED THROUGH VARIED RAINFALL GAUGING STATIONS

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY









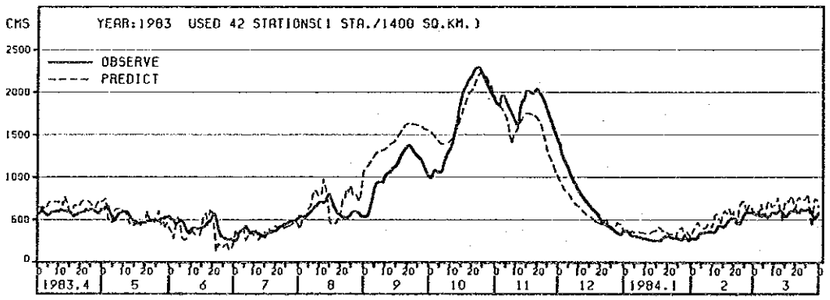


Fig. 7-1(3/3). DISCHARGE HYDROGRAPHS SIMULATED THROUGH VARIED RAIN-FALL GAUGING STATIONS

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

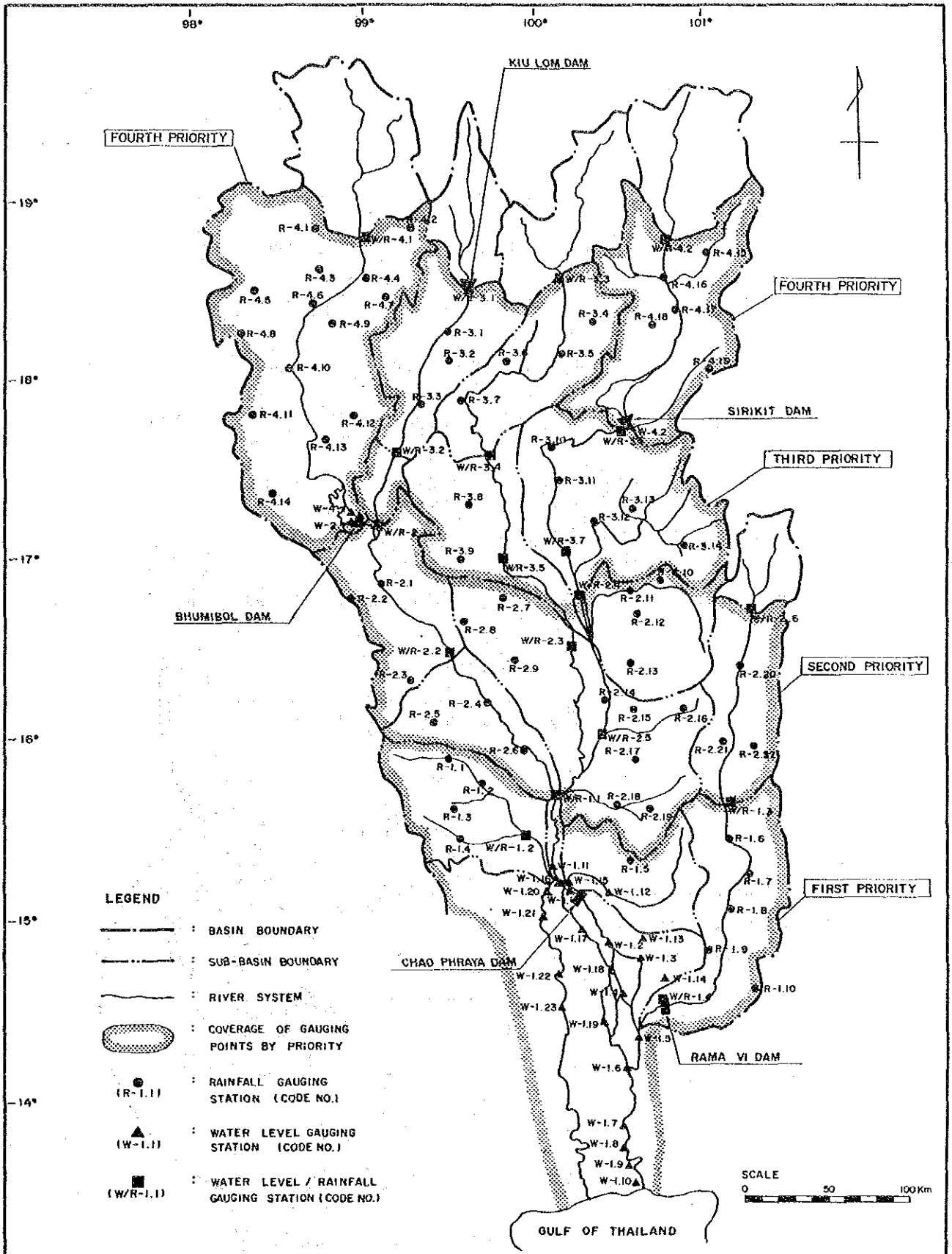


Fig. 7-2. HYDROLOGICAL GAUGING STATIONS (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

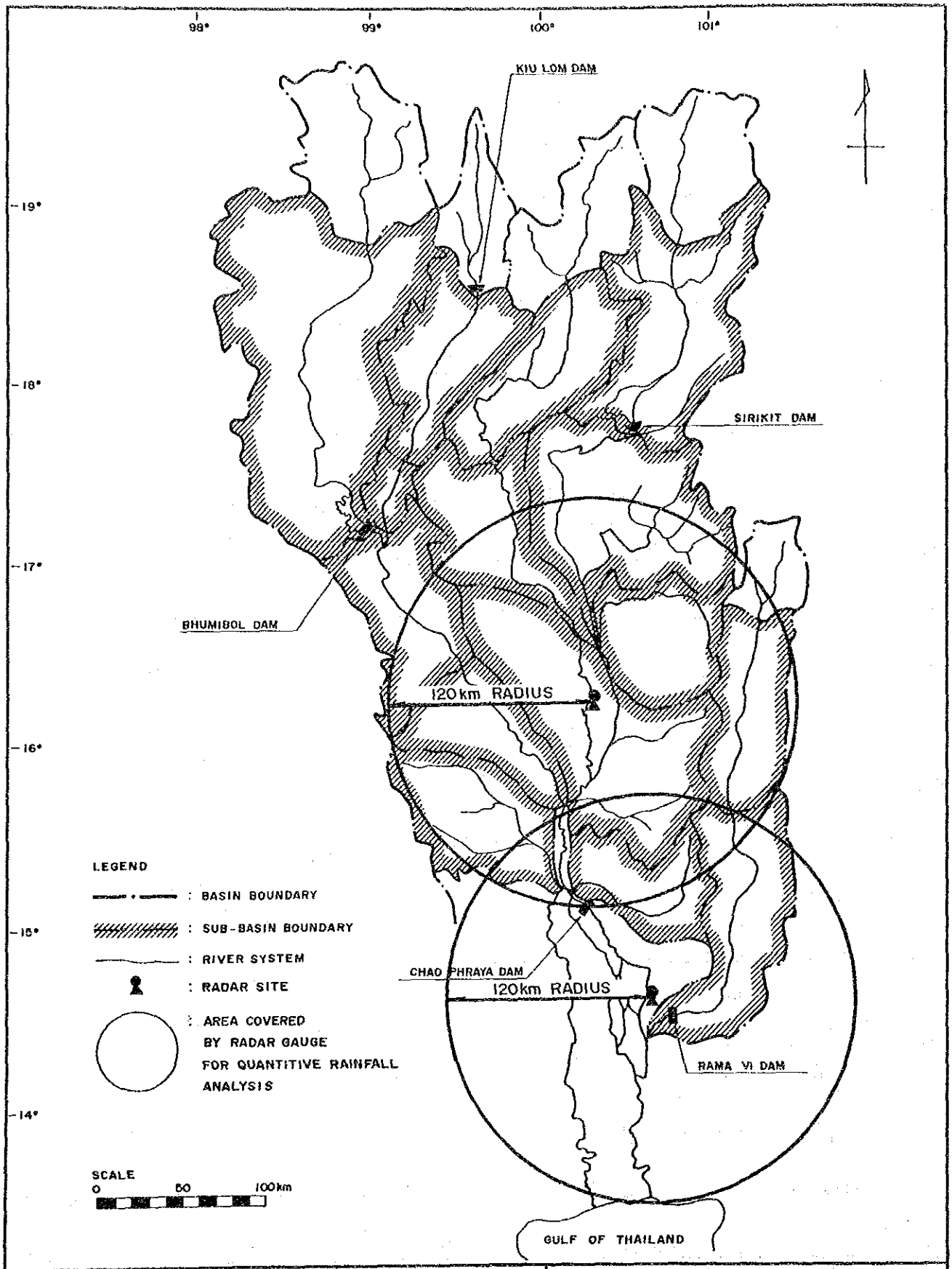


Fig. 7-3. PROPOSED RADAR SITE AND AVAILABLE COVERAGE OF RADAR SITE (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

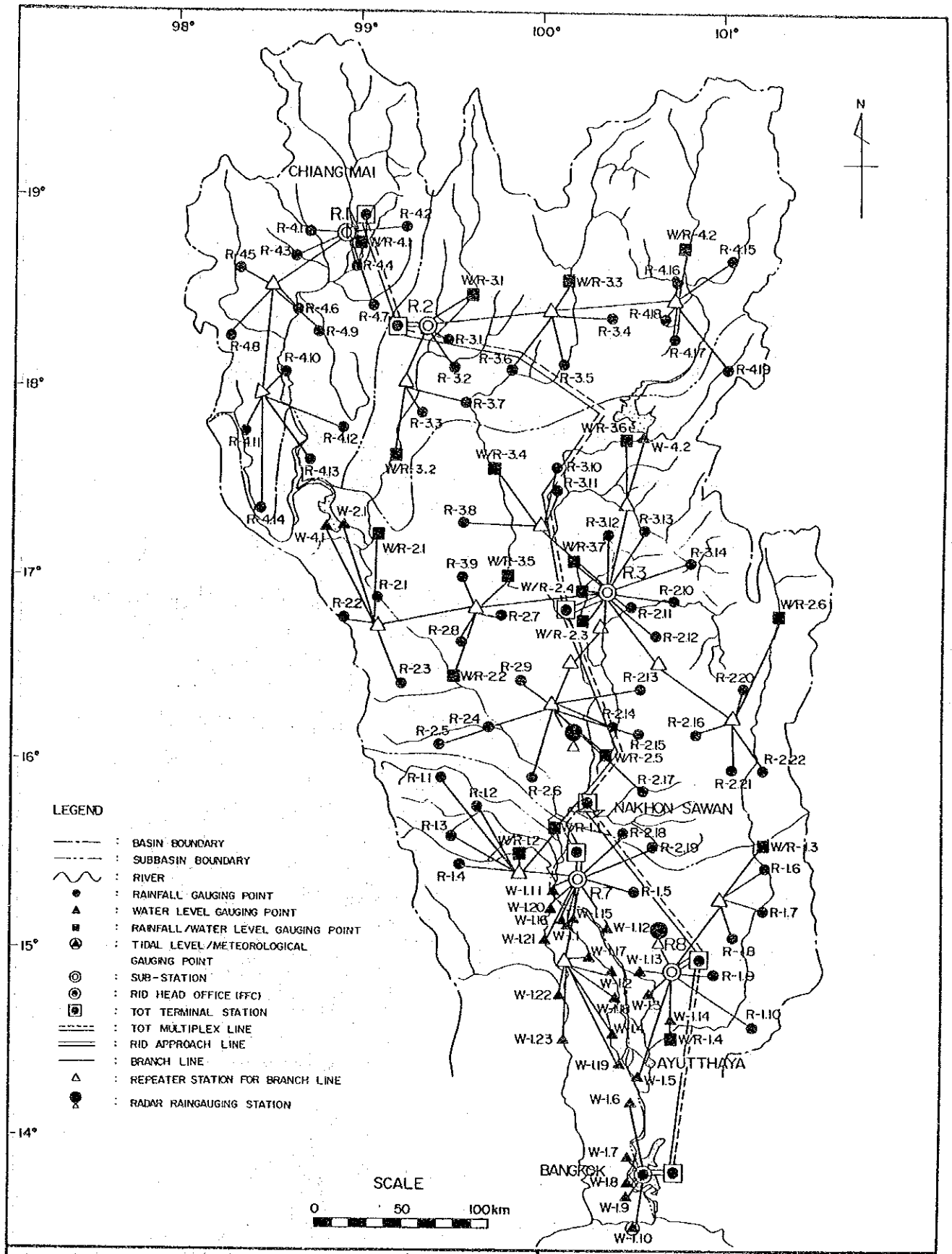


Fig. 7-4(1/4). TELECOMMUNICATION NETWORK (STEP 2: ALTERNATIVE CASE 1)

FLOOD FORECASTING SYSTEM IN THE CHAO PHRAYA RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

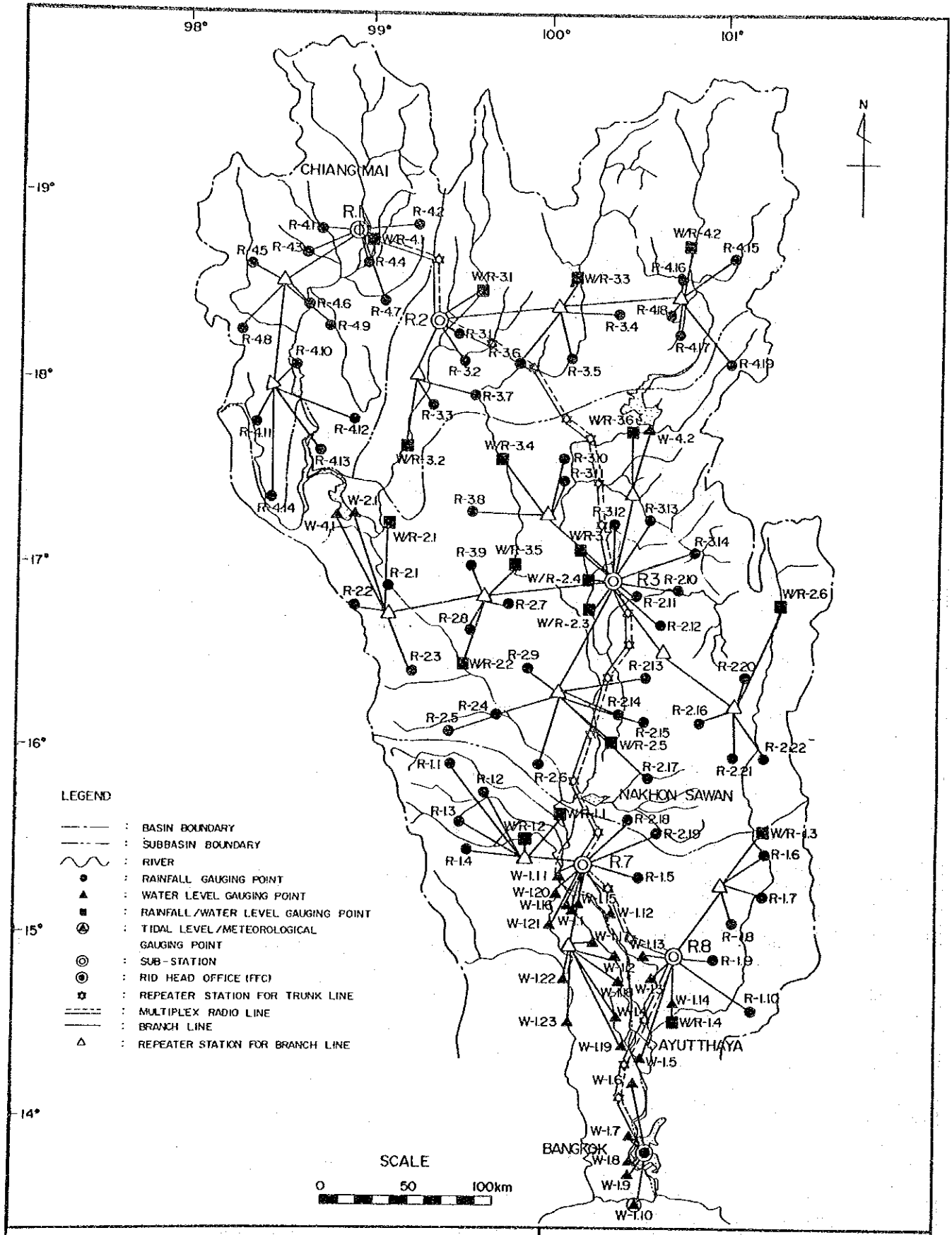


Fig. 7-4(2/4). TELECOMMUNICATION NETWORK (STEP 2: ALTERNATIVE CASE 2)

FLOOD FORECASTING SYSTEM IN THE CHAO PHRAYA RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

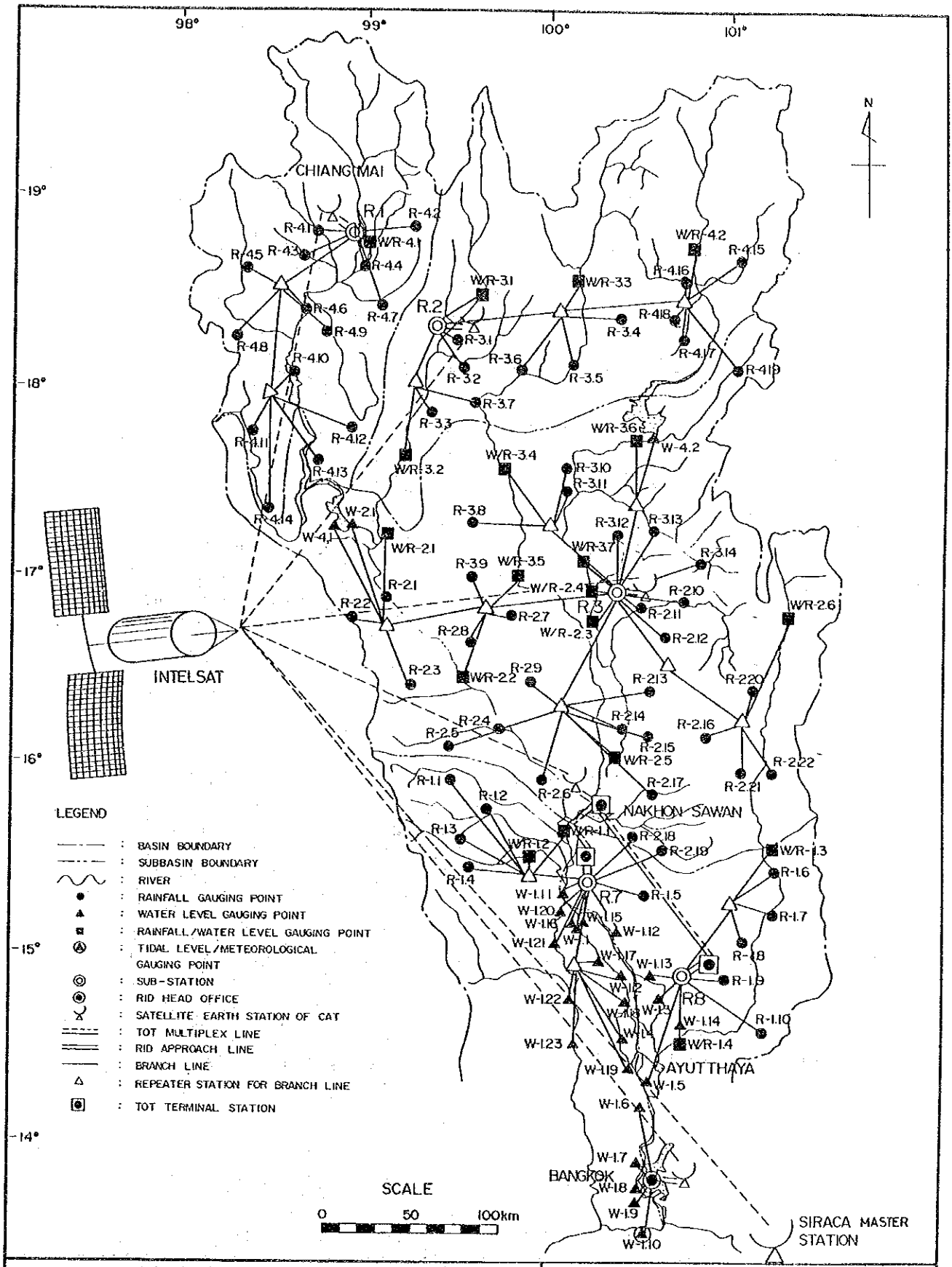


Fig. 7-4(3/4). TELECOMMUNICATION NETWORK (STEP 2: ALTERNATIVE CASE 3)

FLOOD FORECASTING SYSTEM IN THE CHAO PHRAYA RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

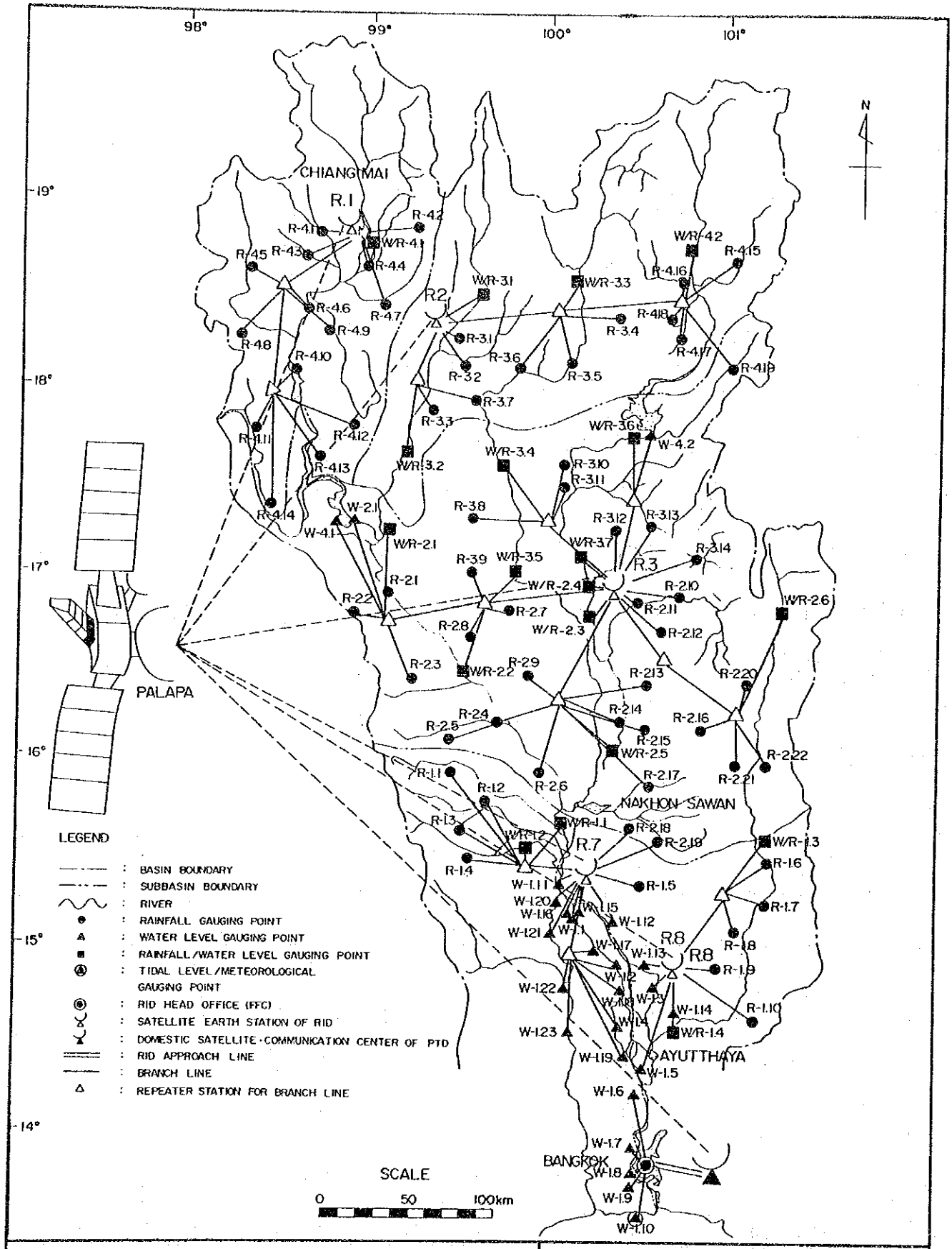


Fig. 7-4(4/4). TELECOMMUNICATION NETWORK (STEP 2: ALTERNATIVE CASE 4)

FLOOD FORECASTING SYSTEM IN THE CHAO PHRAYA RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

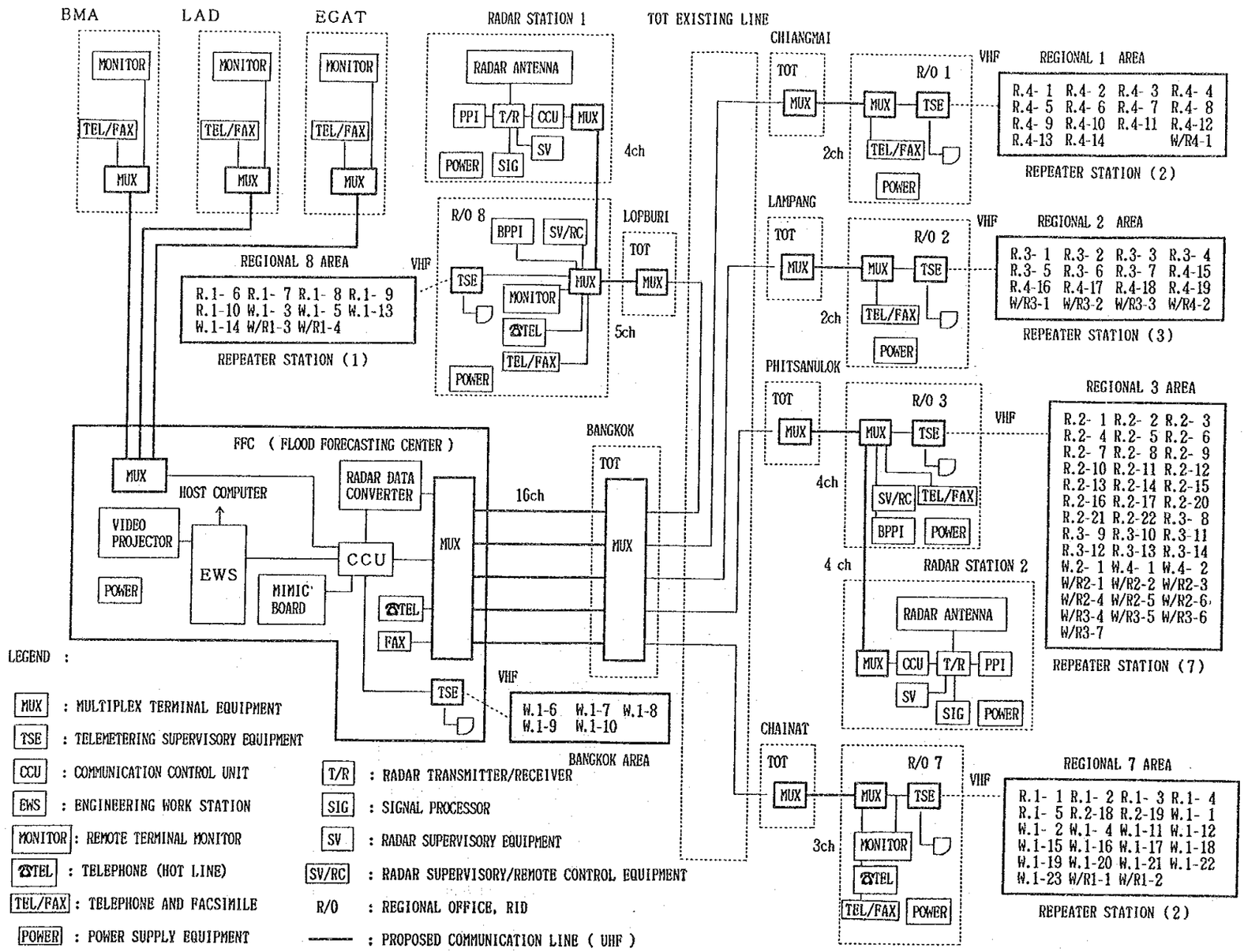


Fig. 7-5. PROPOSED TELECOMMUNICATION NETWORK (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

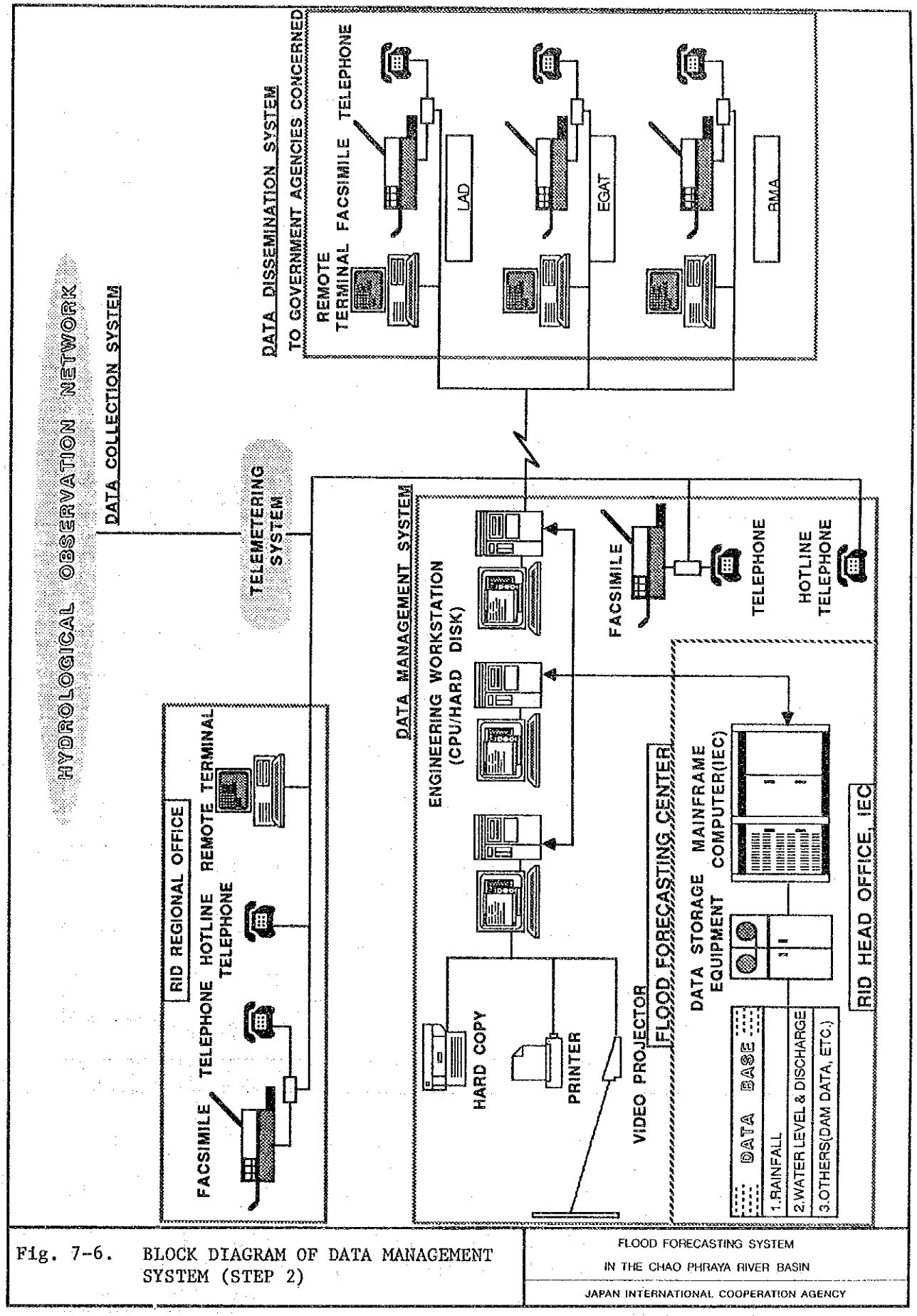
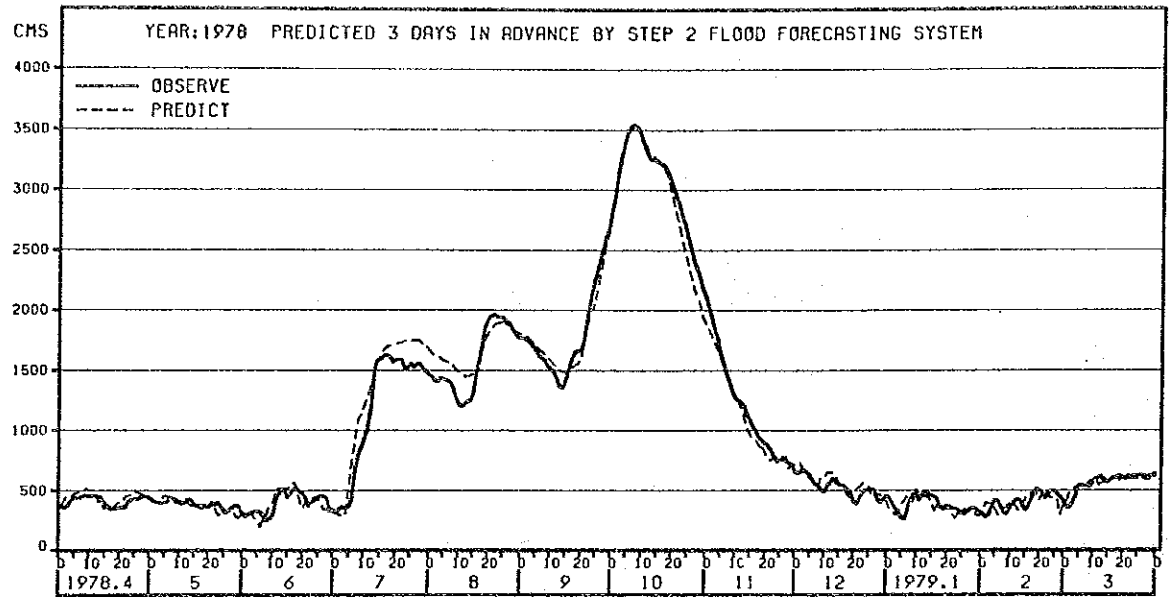


Fig. 7-6. BLOCK DIAGRAM OF DATA MANAGEMENT SYSTEM (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY



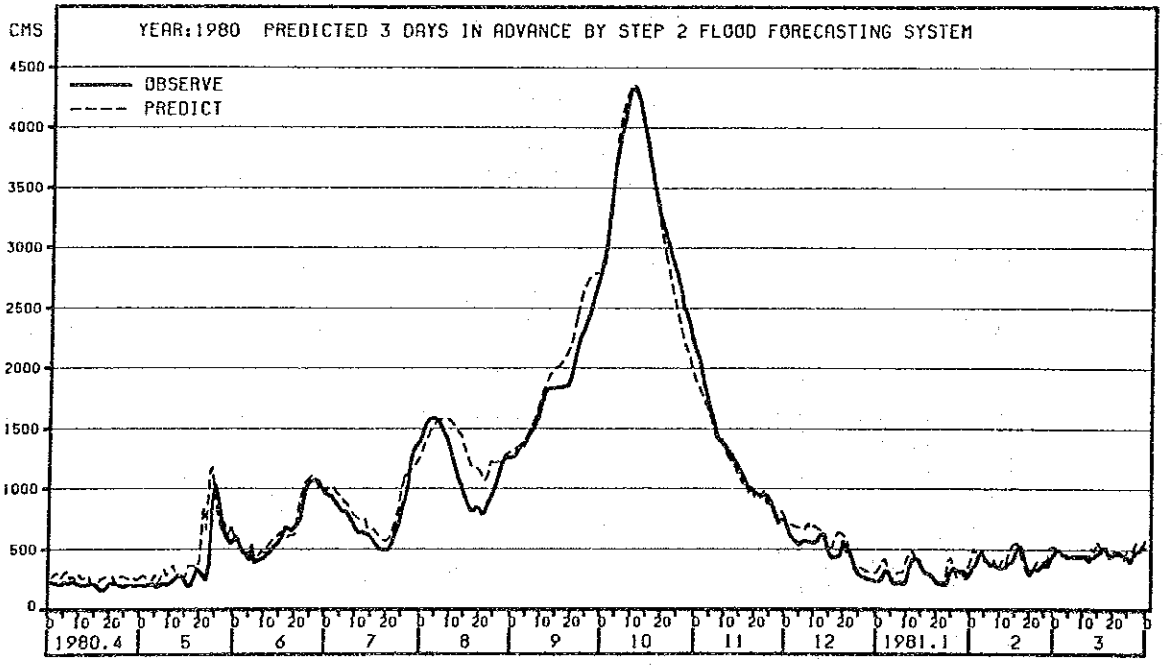
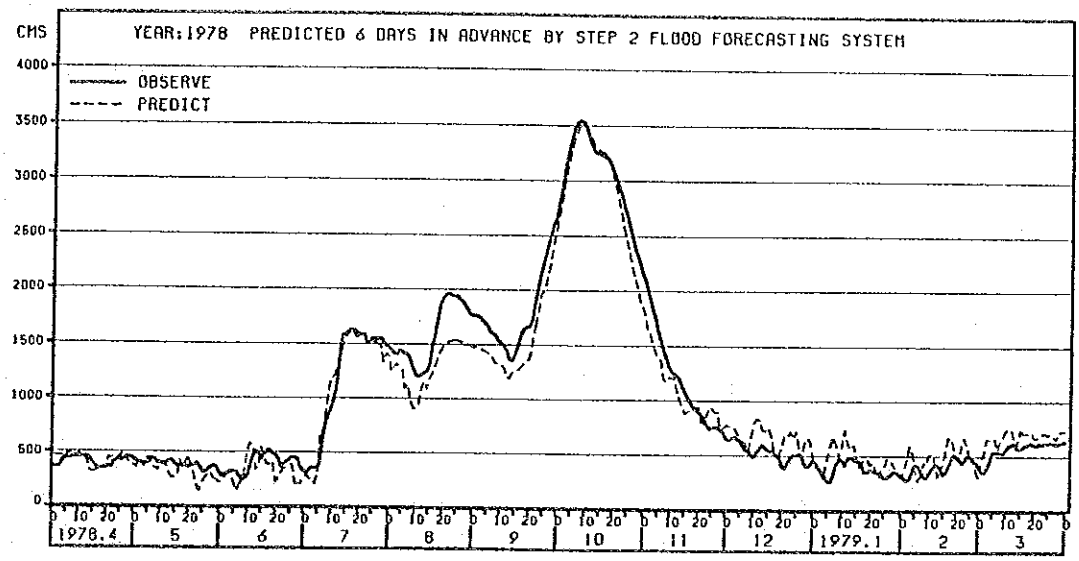
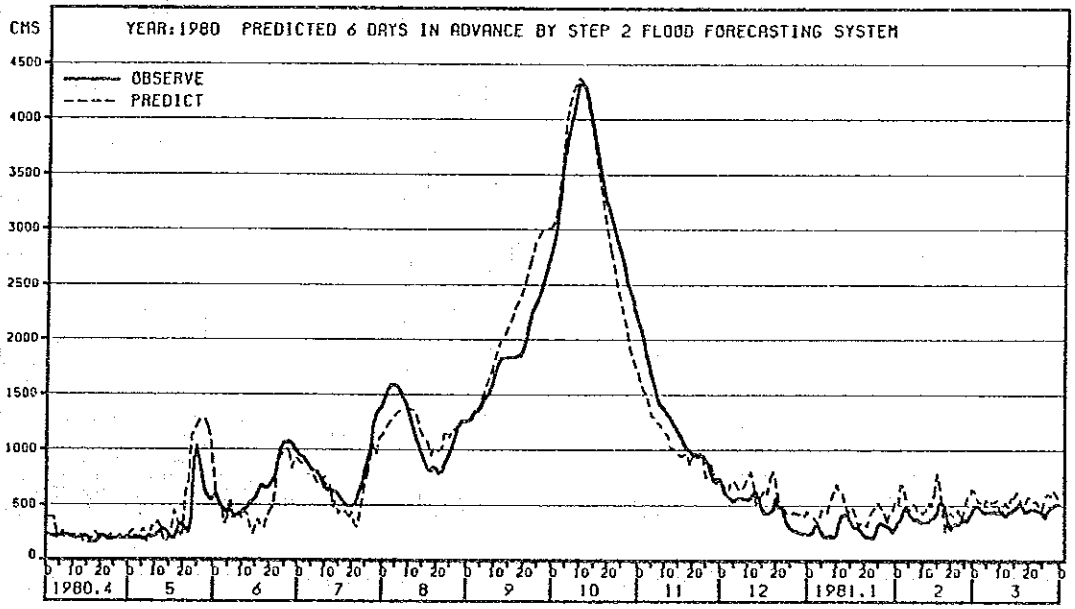


Fig. 7-7. DISCHARGE HYDROGRAPH PREDICTED 3 DAYS IN ADVANCE AT NAKHON SAWAN (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY





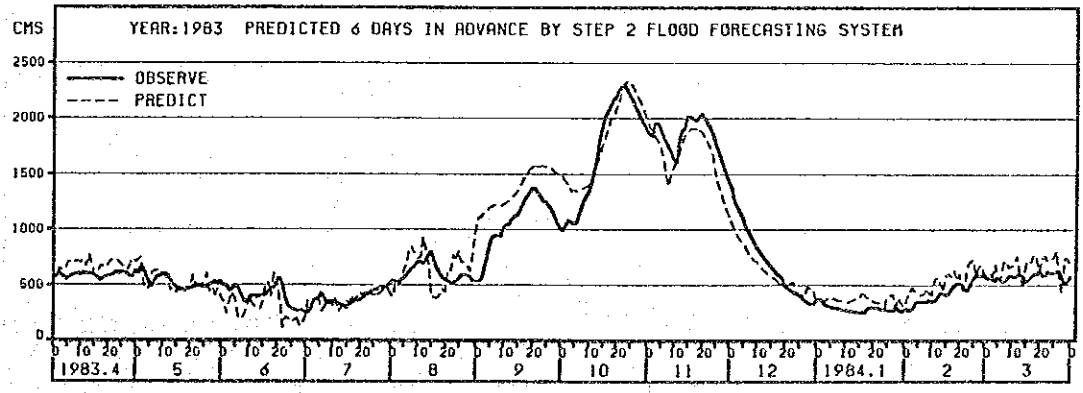
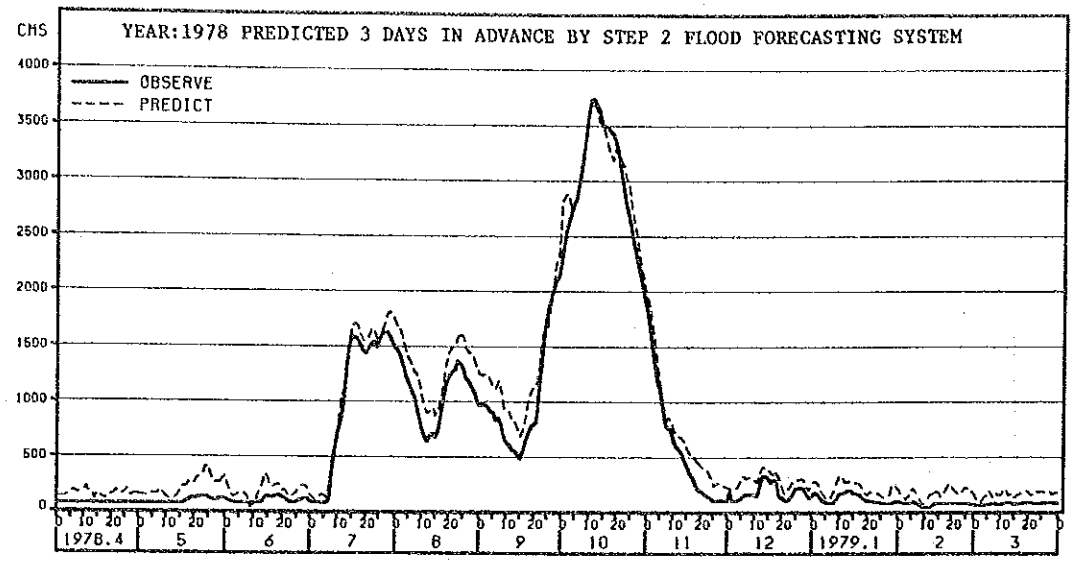
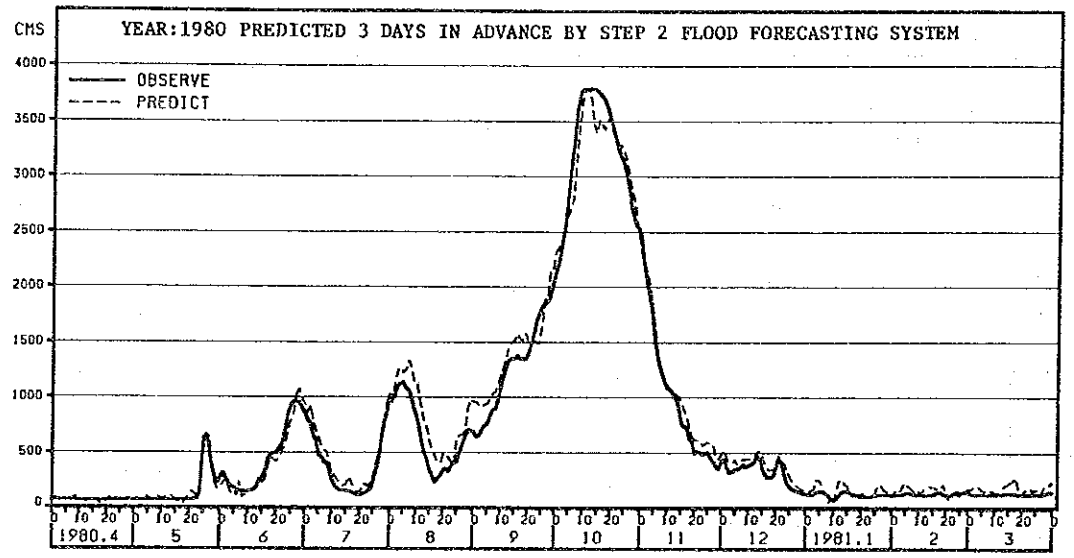


Fig. 7-8. DISCHARGE HYDROGRAPH PREDICTED 6 DAYS IN ADVANCE AT NAKHON SAWAN (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY





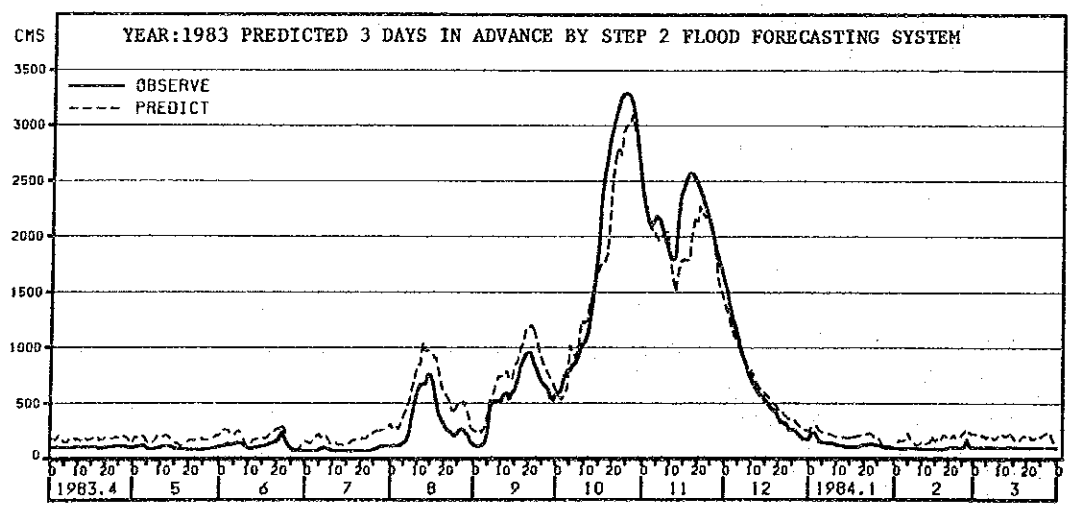


Fig. 7-9. DISCHARGE HYDROGRAPH PREDICTED 3 DAYS IN ADVANCE AT CHAI NAT (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

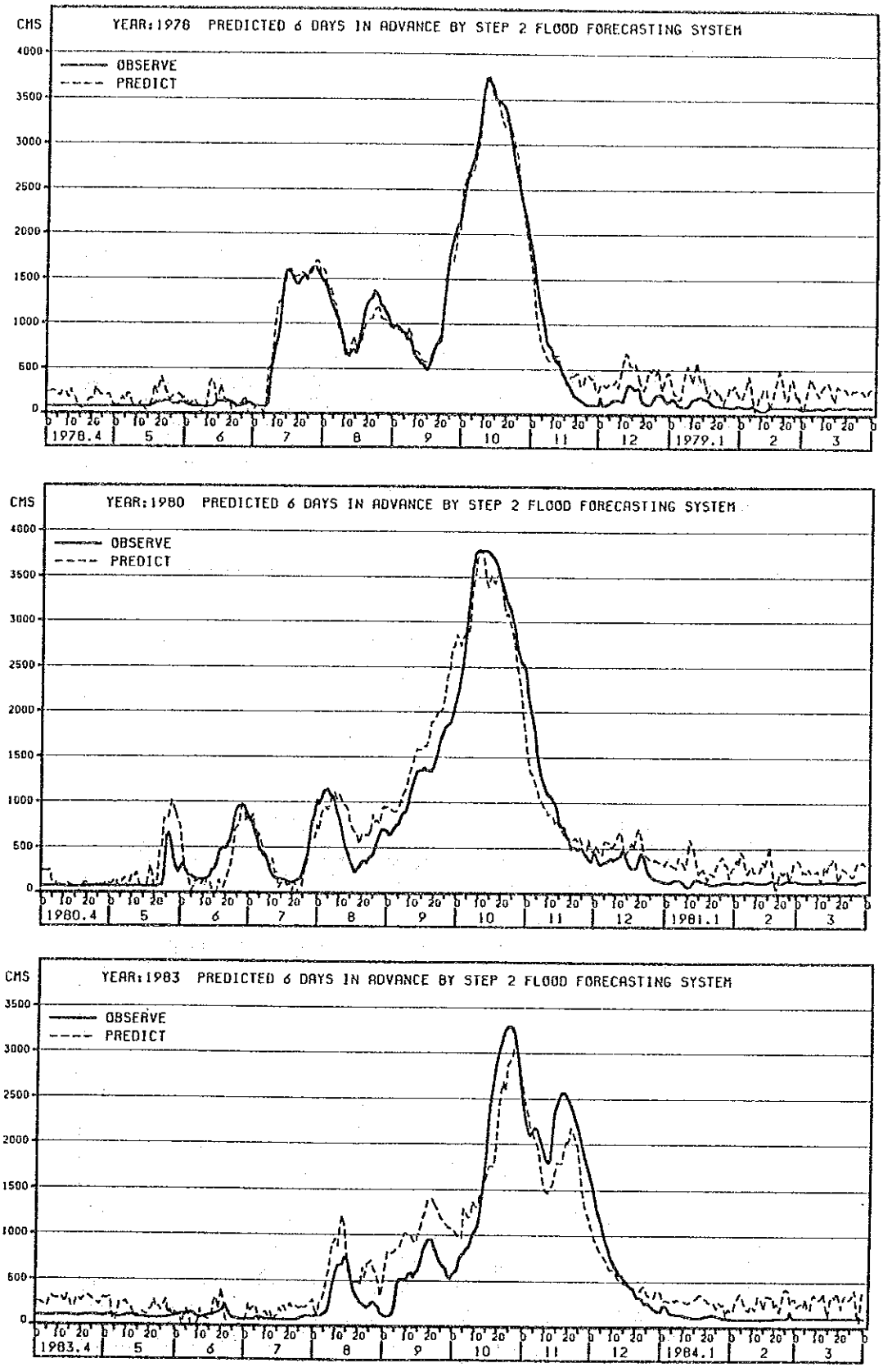


Fig. 7-10. DISCHARGE HYDROGRAPH PREDICTED 6 DAYS IN ADVANCE AT CHAI NAT (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

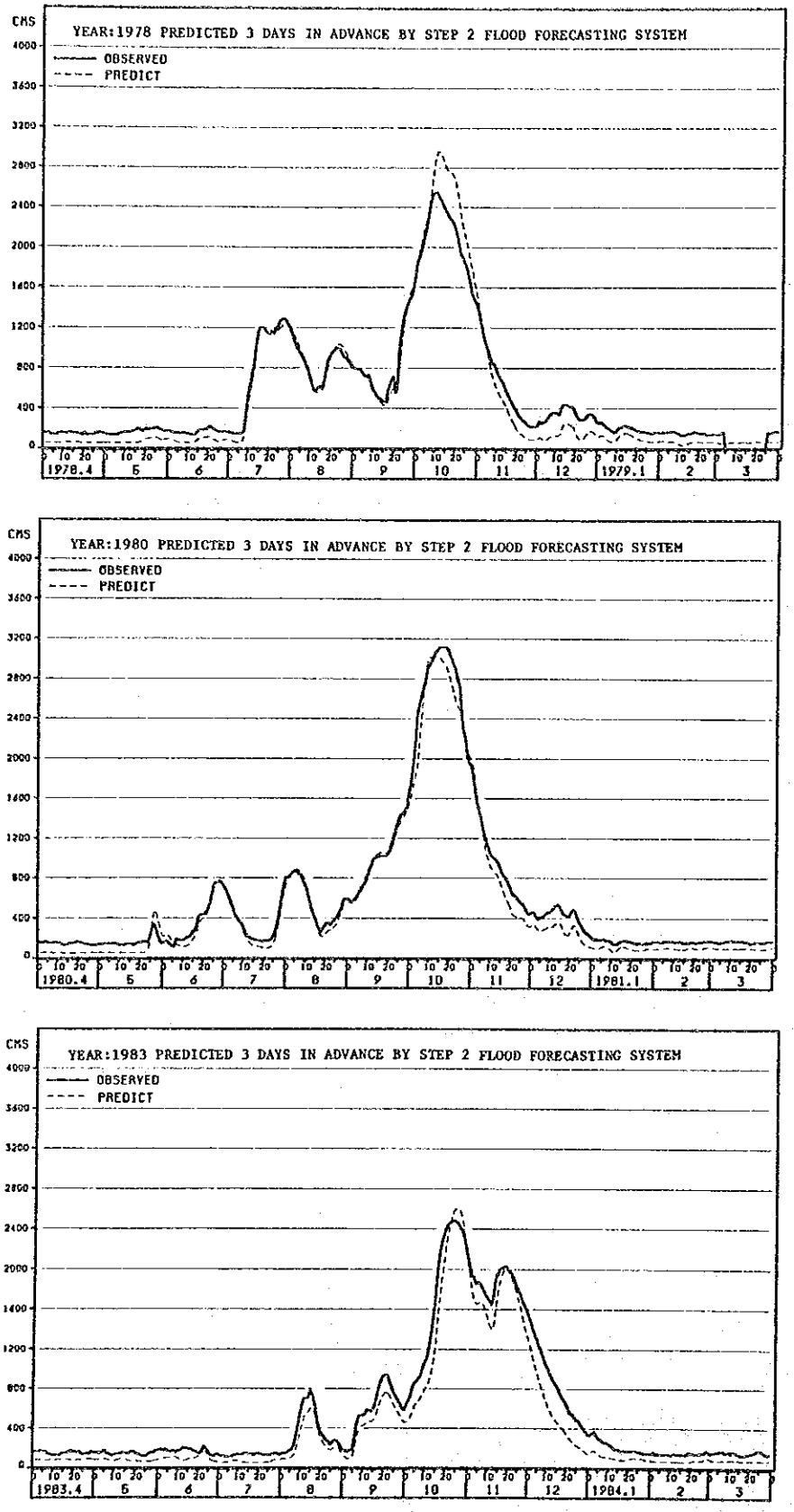
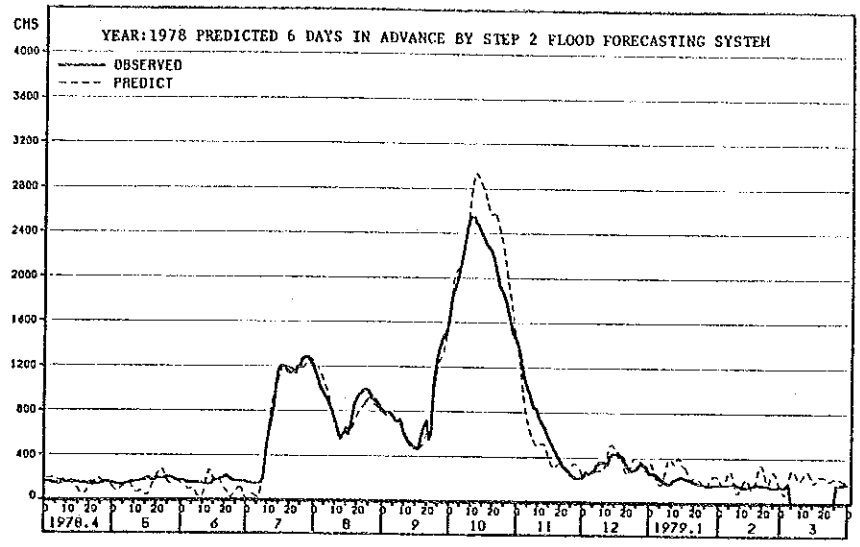
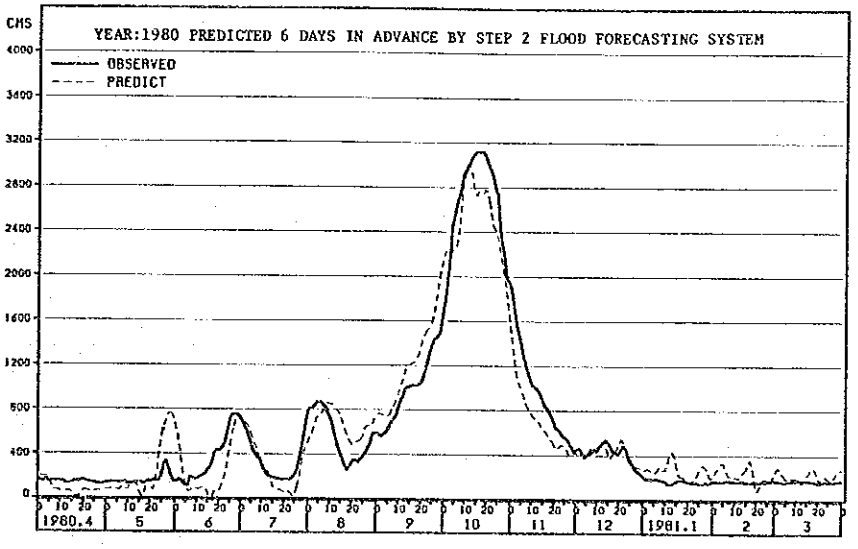


Fig. 7-11. DISCHARGE HYDROGRAPH PREDICTED 3 DAYS IN ADVANCE AT ANG THONG (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY





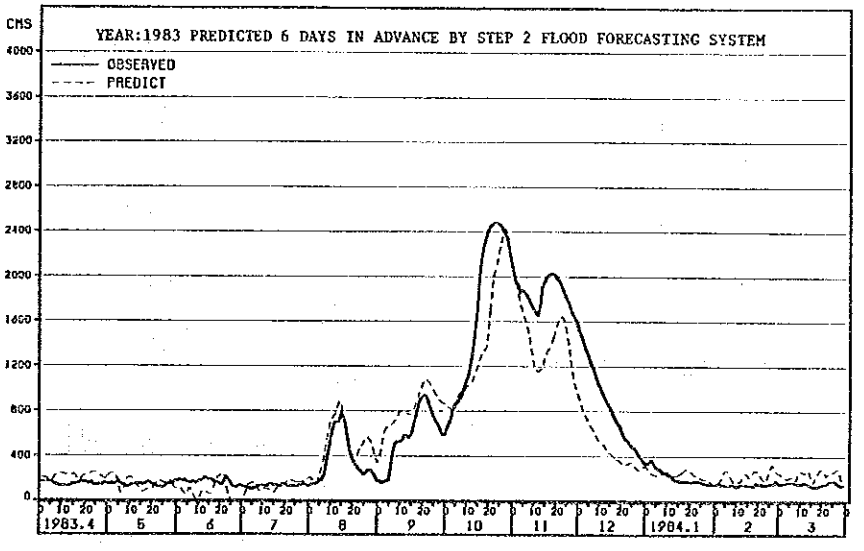
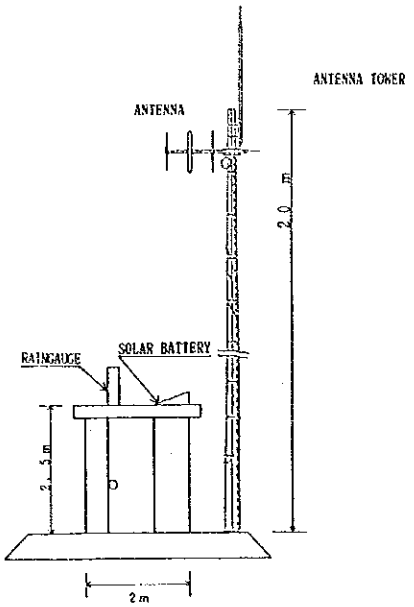


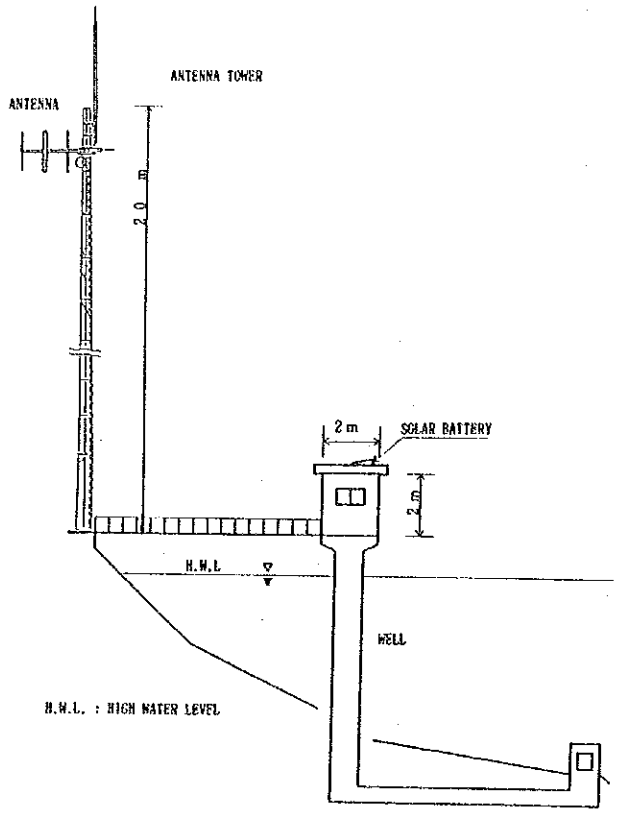
Fig. 7-12. DISCHARGE HYDROGRAPH PREDICTED 6 DAYS IN ADVANCE AT ANG THONG (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

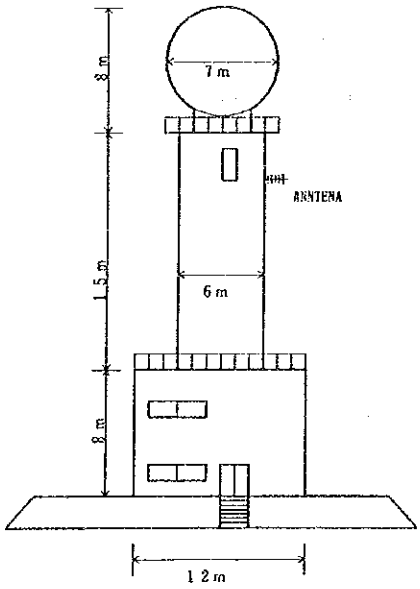
POINT RAINFALL GAUGING STATION



WATER LEVEL GAUGING STATION



RADAR RAINGAUGE STATION



REPEATER STATION

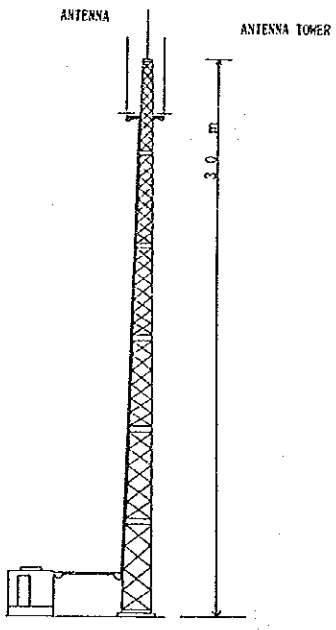
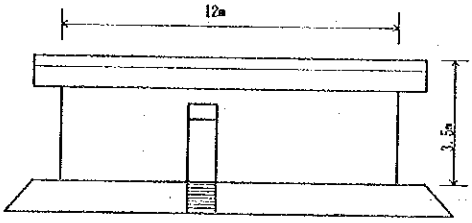


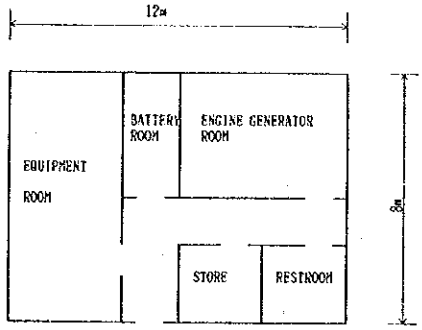
Fig. 7-13. STANDARD DRAWING OF STATION

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

SUBSTATION

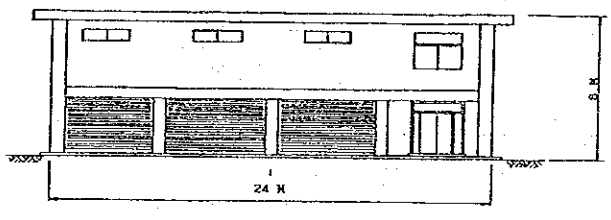


FRONT VIEW

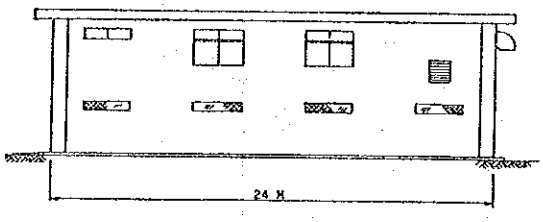


PLAN VIEW

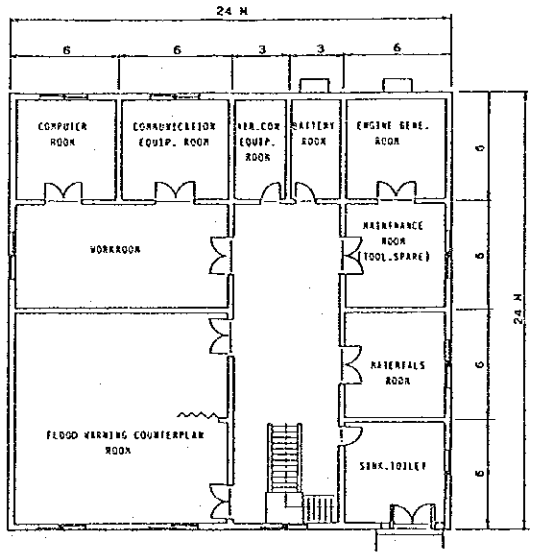
FLOOD FORECASTING CENTER



FRONT VIEW



RIGHT SIDE VIEW



PLAN VIEW

Fig. 7-14. STANDARD DRAWING OF HOUSING

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

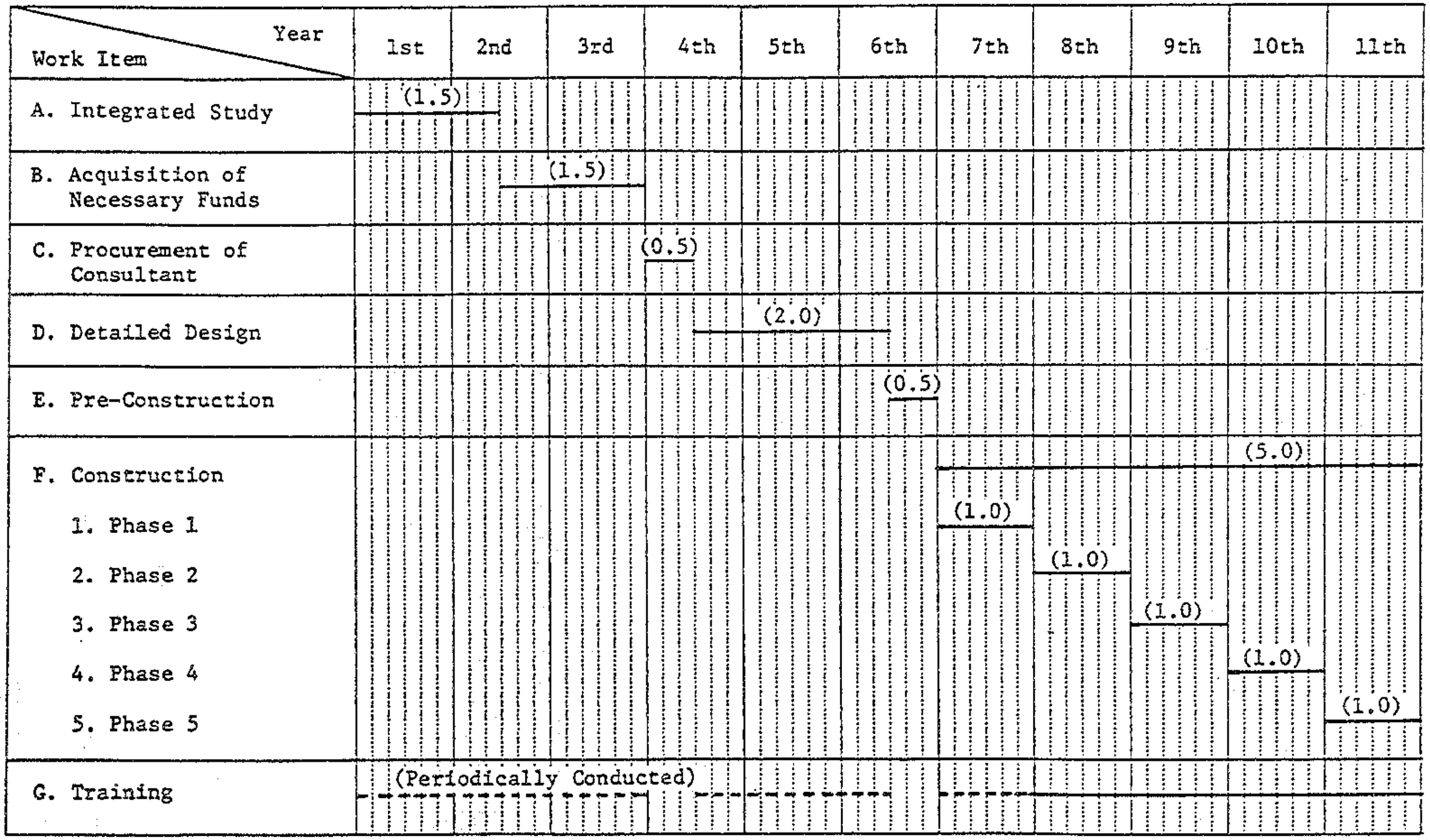


Fig. 7-15. IMPLEMENTATION SCHEDULE (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

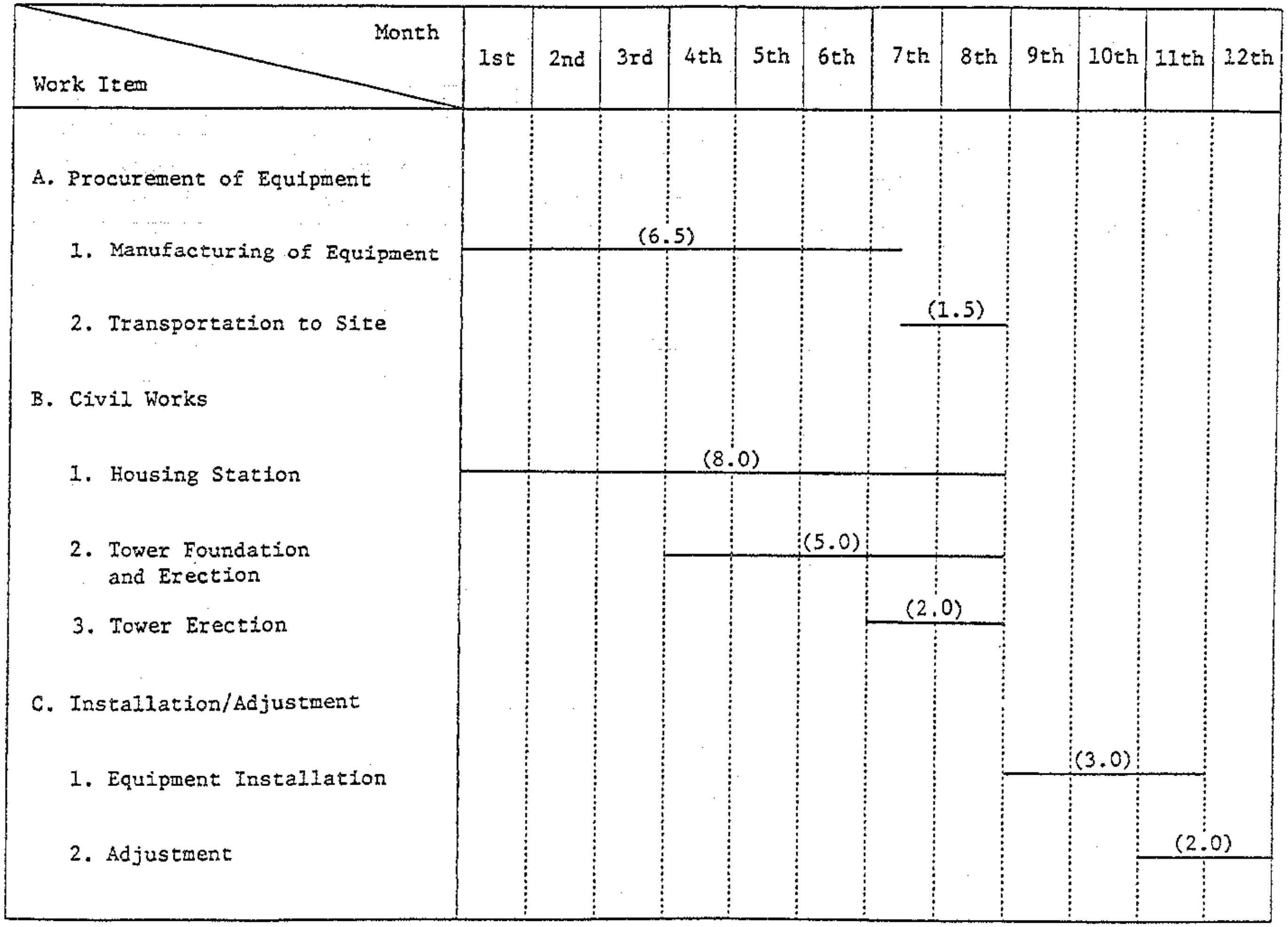


Fig. 7-16. CONSTRUCTION SCHEDULE FOR EACH PHASE

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

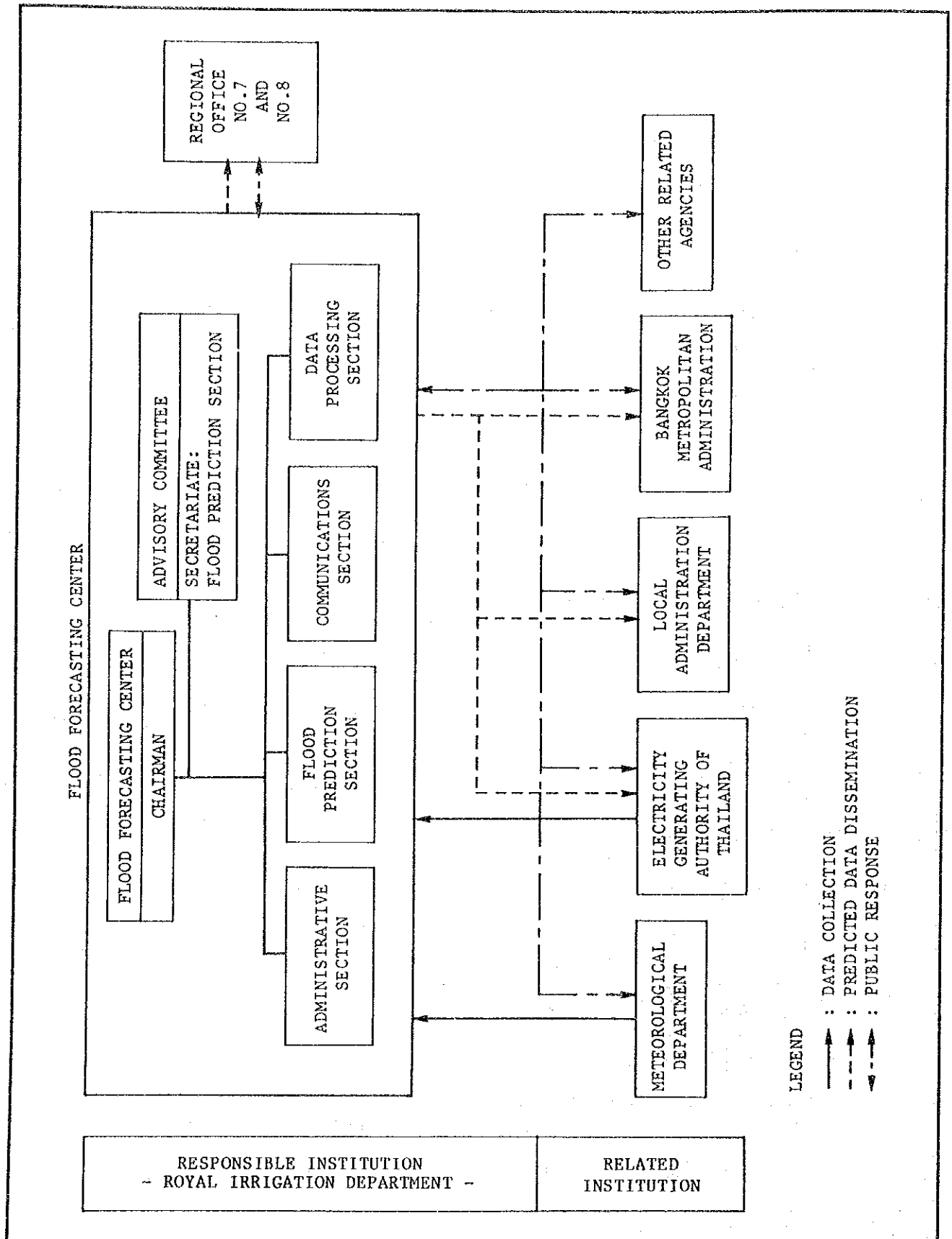


Fig. 7-17. PROPOSED ORGANIZATION CHART FOR FLOOD FORECASTING CENTER (STEP 2)

FLOOD FORECASTING SYSTEM
IN THE CHAO PHRAYA RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

CHAPTER 8. RECOMMENDATIONS

8.1 In this study, the Step 2 Flood Forecasting System is formulated in a manner of master plan study stage through the installation of updated facilities. Since the study on water management system where some of the facilities will be utilized in common with the flood forecasting system is still under way, adjustment between both studies may be finally necessary. In this connection, it is recommended that further study of this flood forecasting system be commenced as early as possible after the completion of the water management system study.

8.2 To urgently cope with the flooding problems, a flood forecasting system utilizing the existing facilities is formulated as the Step 1 system. This system can directly proceed to the detailed design and construction phase and it requires only one (1) year for its establishment, though its effectiveness is not so high compared with Step 2.

Aside from promoting the study on the Step 2 system, it is recommended that the Step 1 system be executed with the least lapse of time to fulfill the objectives of flood forecasting until the Step 2 system is established.

8.3 The Step 1 system is formulated to promptly realize the flood forecasting system. To upgrade its reliability, it is desirable to introduce in the early stage some of the facilities applied to the Step 2 system such as telemetering system depending on the availability of funds.

8.4 In the formulation of the Step 2 system, the TOT ground communication line has been finally selected through the comparison study on economical and technical aspects, together with the applicability of the satellite line.

The communication system by satellite line has rapidly developed, so that in the future the satellite system may have

great economical and technical advantages over the ground communication. In this sense, the applicability of the satellite line should be studied further in the future stage.

8.5 The flood prediction model consisting of four basic mathematical models developed in this study showed relatively good results. Since the flood prediction model was developed on the basis of the limited data, further improvement is expected in the next stage.

For the purpose of improvement, the necessary data should be arranged in advance; especially, the inundation area, depth and duration; the detail topographic map; and the river cross section and profile around the flood retarding area in the upper reaches from Nakhon Sawan. These data are presently insufficient in both quality and quantity and they have to be arranged in the early stage.

8.6 The flood forecasting system can cope with the flood damage problem urgently and effectively. To solve the problem substantially, flood control structures should also be provided through the study of a comprehensive flood control plan. In this connection, the formulation of a master plan of flood control project is recommended in parallel with the promotion of the flood forecasting system.

8.7 For the smooth promotion of the foregoing flood control and flood forecasting works, it is necessary to strengthen the capability of RID in this field. Therefore, it is recommended that RID should be provided with qualified foreign experts to give advice on such matters.

APPENDIX

MINUTES OF MEETING

OF

THE INCEPTION REPORT FOR THE STUDY

ON

FLOOD FORECASTING SYSTEM

IN

THE CHAO PHRAYA RIVER BASIN

IN

THE KINGDOM OF THAILAND

BANGKOK, FEBRUARY 19, 1987

Mr. Suha Thanomsingha
Director General
Royal Irrigation Department
Ministry of Agriculture
and Cooperatives
The Kingdom of Thailand

Mr. Katsuhisa Abe
Team Leader
JICA Study Team for
the Study on Flood
Forecasting System
in the Chao Phraya
River Basin

witnessed by

Mr. Sukehisa Aoki
Chairman
Advisory Committee for
The Study

Joint meeting between the Royal Irrigation Department (RID) and the JICA Study Team (the Team) in the presence of the Advisory Committee was held on February 16, to discuss on the contents of the Inception Report. The Team submitted thirty-five (35) copies of the Inception Report to RID.

After discussion, the contents of the Report were agreed by and between both parties with confirmation of the following items :

(1) Hydrological Observation Network

The flood forecasting system will be formulated in three (3) stages. Among these stages, the first stage flood forecasting system is provided to predict flood discharge at the reference points along the river for the area covering Bangkok Metropolis and the suburban area. For the purpose, the hydrological observation network will be provided downstream from Nakhon Sawan in main river basin and the other tributaries such as Pasak river, Sakaekrang river, etc.

(2) Data Management System

In this study, the facilities for the data management system is designed on the basis of the data volume necessary for the flood forecasting system.

(3) Dissemination system

RID will select the related agencies to which the flood information should be disseminated ; and will inform the selected agencies to the Team in early stage.

Besides, RID desired the Team to pay attention for the following points in this study :

- To make every endeavour for development of the suitable model so as to satisfy the necessary accuracy for the flood prediction.
- To select the suitable telecommunication network considering the capability of RID for operation and maintenance for telecommunication network.

And, in order to elaborate the flood prediction model, RID kindly offered cooperation in the cross sectional surveying works along the main river and tributaries within the possible extent of RID.

The list of attendants is attached hereto.

LIST OF ATTENDANCE

No	NAME	DESIGNATION
1	Mr. Vira Poomvises	Chief Civil Engineer
2	Dr. Boonyok Vadhanaphuti	Director, Project Planning Div.
3	Mr. Taweechai Mackaman	Director, Hydrology Div.
4	Mr. Sompote Sukhumparnich	Director, Data Processing Div.
5	Mr. Sinserm Ketudat	Act. Director, Communications Div.
6	Mr. Suthi Songvoravit	Chief, Project Planning Div.
7	Mr. Prasert Milintangul	Chief, Research & Applied Hydrology Div.
8	Mr. Virat Khao-Uppatum	Hydraulic Engineer, O & M Div.
9	Mr. Prasong Jitseri	Hydrologist, Hydrology Div.
10	Mr. Narumi Yamada	JICA Expert, Project Planning Div.
11	Mr. Toshiharu Kai	JICA Thailand Office
12	Mr. Sukehisa Aoki	Chairman, JICA Advisory Committee
13	Mr. Seiko Fukuda	JICA Advisory Committee
14	Mr. Fumio Kikuchi	JICA Advisory Committee
15	Mr. Katsuhisa Abe	Leader, JICA Study Team
16	Mr. Yoshiharu Matsumoto	JICA Study Team
17	Mr. Makihiko Otogawa	JICA Study Team
18	Mr. Yutaro Hoshi	JICA Study Team

MINUTES OF MEETING

OF

THE PROGRESS REPORT FOR THE STUDY

ON

FLOOD FORECASTING SYSTEM

IN

THE CHAO PHRAYA RIVER BASIN

IN

THE KINGDOM OF THAILAND

BANGKOK, JUNE 29, 1987

V. Poomvises

Mr. Vira Poomvises
Chief Civil Engineer
Royal Irrigation Department
Ministry of Agriculture
and Cooperatives
The Kingdom of Thailand

Mr. Katsuhiko Abe
Team Leader
JICA Study Team for
the Study on Flood
Forecasting System
in the Chao Phraya
River Basin

Witnessed by

Tukehisa Aoki

Mr. Tukehisa Aoki
Chairman
Advisory Committee for
the Study

Joint meeting between the Royal Irrigation Department(RID) and the JICA Study Team (the Team) in the presence of the Advisory Committee was held on June 25, to discuss on the contents of the Progress Report. The Team submitted thirty-five (35) copies of the Progress Report to RID.

After discussion, the contents of the Report were agreed by and between both parties. In the meeting, the followings are specifically discussed:

- The target area shall include urban areas along the Chao Phraya river course such as Sing Buri, Lop Buri and Ang Thong in addition to the areas stipulated in the Progress Report.

- The necessity of hydrological observation stations between Bang Sai and Bangkok Memorial Bridge will be studied to predict the flood discharge precisely.

The list of attendants is attached hereto.

LIST OF ATTENDANCE

NO.	NAME	DESIGNATION
1	Mr. Vira Poomvises	Chief Civil Engineer
2	Mr. Taweechai Mackaman	Director, Hydrology Div.
3	Mr. Sompote Sukhumparnich	Director, Data Processing Div.
4	Mr. Prasert Milintangul	Chief, Reserch & Applied Hydrology
5	Mr. Prasong Jitseri	Hydrology Div.
6	Mr. Virat Khao-Uppatum	O & M Div.
7	Mr. Theerawat Tangpanich	Project Planning Div.
8	Mr. Putchai Nitakorn	Communication Div.
9	Mr. Hideo Matsuda	Embassy of Japan
10	Mr. Toshiharu Kai	JICA Thailand Office
11	Mr. Sukehisa Aoki	Chairman, JICA Advisory Committee
12	Mr. Fumio Kikuchi	JICA Advisory Committee
13	Mr. Katsuhisa Abe	Team Leader, JICA Study Team
14	Mr. Yoshiharu Matsumoto	JICA Study Team
15	Mr. Yutaro Hoshi	JICA Study Team
16	Mr. Masashi Furutaguchi	JICA Study Team
17	Mr. Yoshinori Ohyama	JICA Study Team
18	Mr. Junji Kamata	JICA Study Team
19	Mr. Yuzo Mizota	JICA Study Team
20	Mr. Kinichi Ohno	JICA Study Team

MINUTES OF MEETING

OF

THE INTERIM REPORT FOR THE STUDY

ON

FLOOD FORECASTING SYSTEM

IN

THE CHAO PHRAYA RIVER BASIN

IN

THE KINGDOM OF THAILAND

BANGKOK, NOVEMBER 30, 1987

Suha Thanomsingha

Mr. Suha Thanomsingha
Director General
Royal Irrigation Department
Ministry of Agriculture
and Cooperatives
the Kingdom of Thailand

Mr. Katsuhisa Abe
Team Leader
JICA Study Team for
the Study on Flood
Forecasting System
in the Chao Phraya
River Basin

witnessed by

Sukehisa Aoki

Mr. Sukehisa Aoki
Chairman
Advisory committee for
the Study

Joint meeting between the Royal Irrigation Department (the RID) and the JICA Study Team (the Team) was held on November 26 in the presence of the Advisory Committee to discuss on the contents of the Interim Report. The JICA Study Team submitted 35 copies of the Interim Report to the RID in accordance with the scope of works.

Through discussion, the contents of the Report were agreed by and between both parties. The major items discussed are enumerated as below:

- The RID revealed his intention to carry the plan of Step 1 Flood Forecasting System into the implementation on the premises of eligible external assistance.

- The RID had a quotation about the possibility for the Team to provide the development works on the detailed computer programming for the Flood Prediction Model within this study period. In this connection, the Team made an explanation that such computer programming works are not within the scope of work but will be performed during the implementation stage.

- In accordance with a request from the RID, a certain modification might be made to the implementation schedule for Step 1 Flood Forecasting System specified in the Interim Report. Details of the modification will be clarified by the RID and discussed with the Team before the Team leaves to Japan.

- In addition to the Interim Report which principally describes the plan of Step 1 Flood Forecasting System, the Team will prepare the material to present the outline of Step 2 Flood Forecasting System and discuss its contents with the RID before the Team leaves to Japan.

The list of attendance is attached hereto:

LIST OF ATTENDANCE

No	NAME	DESIGNATION
1	Mr. Chareuk Nonthathum	Chief Civil Engineer
2	Mr. Prasert Milintangul	Chief, Research & Applied Hydrology Div.
3	Mr. Sinserm Ketudat	Director, Communications Div.
4	Mr. Sompote Sukhumparnich	Director, Data Processing Div.
5	Mr. Kitla Thepalagleka	Project Planning Div.
6	Mr. Prasong Jitseri	Hydrologist, Hydrology Div.
7	Mr. Virat Khao-Uppatum	Hydraulic Engineer, O & M div.
8	Mr. Lek Prapasajchavet	O & M Div.
9	Mr. Narumi Yamada	JICA Expert, Project Planning Div.
10	Mr. Sukehisa Aoki	Chairman, JICA Advisory Committee
11	Mr. Tadahiko Nakao	JICA Advisory Committee
12	Mr. Seiko Fukuda	JICA Advisory Committee
13	Mr. Fumio Kikuchi	JICA Advisory Committee
14	Mr. Katsuhisa Abe	Leader, JICA Study Team
15	Mr. Yoshiharu Matsumoto	JICA Study Team
16	Mr. Makihiko Otogawa	JICA Study Team
17	Mr. Yutaro Hoshi	JICA Study Team
18	Mr. Yoshinori Oyama	JICA Study Team
19	Mr. Hideki Oguchi	JICA Study Team
20	Mr. Kinichi Ohno	JICA Study Team
21	Mr. Yuzo Mizota	JICA Study Team

MINUTES OF MEETING

OF

THE DRAFT FINAL REPORT FOR THE STUDY

ON

FLOOD FORECASTING SYSTEM

IN

THE CHAO PHRAYA RIVER BASIN

IN

THE KINGDOM OF THAILAND

BANGKOK, MARCH 22, 1988.

J. Tejasen

Mr. Jumsak Tejasen
Director of Research and
Laboratory Division
Acting for chief Civil
Engineer

Mr. Katsuhisa Abe
Team Leader
JICA Study Team for
the Study on Flood Forecasting
System in the Chao
Phraya River Basin

Witnessed by

Sukehisa Aoki

Mr. Sukehisa Aoki
Chairman
Advisory committee for
the study

Joint meeting between the Royal Irrigation Department (RID) and the JICA Study Team (the Team) was held on March 21 in the presence of the Advisory Committee to discuss on the contents of the Draft Final Report. The Team submitted the Draft Final Report consisting of 35 copies of main report and executive summary report and 10 copies of supporting report.

Through discussion, the contents of the Report were agreed by and between both parties. The major items discussed are enumerated as below :

- In response to the question on the long term flood prediction in the step-2 flood forecasting System, the Team explained that the system can be used for longer flood prediction than that described in the Report by the model developed in this Study, though the accuracy of the flood prediction results tends to lower.

- RID revealed the intention to promote the step-1 flood forecasting system including facilities for data collection, data transmission and data management in the manner of the grant aid by Japanese Government.

The list of attendants is attached hereto.

J. Tejasi.

S. a,

LIST OF ATTENDANCE

NO	NAME	DESIGNATION
1.	Mr. Chareuk Nonthathum	Chief Civil Engineer
2.	Mr. Taweechai Mackaman	Director, Hydrology Div.
3.	Mr. Sompote Sukhumparnich	Director, Data Processing Div.
4.	Mr. Sinserm Ketudat	Director, Communications Div.
5.	Mr. Prasert Milintangul	Chief, Research & Applied Hydrology Branch
6.	Mr. Kitla Thepalagleka	Project Planning Div.
7.	Mr. Prasong Jitseri	Hydrologist, Hydrology Div.
8.	Mr. Virat Khao-Uppatum	O & M Div.
9.	Mr. Chatchawan Panyawatinondha	O & M Div.
10.	Mr. Chairat Kua-Arun	Data Processing Div.
11.	Mr. Narumi Yamada	JICA Expert, Project Planning Div.
12.	Mr. Sukehisa Aoki	Chairman, JICA Advisory Committee
13.	Mr. Seiko Fukuda	JICA Advisory Committee
14.	Mr. Fumio Kikuchi	JICA
15.	Mr. Katsuhisa Abe	Leader, JICA Study Team
16.	Mr. Yoshiharu Matsumoto	JICA Study Team
17.	Mr. Makihiko Otogawa	JICA Study Team
18.	Mr. Yutaro Hoshi	JICA Study Team