

D2.5.3 Estimated Inundation Area/Depth

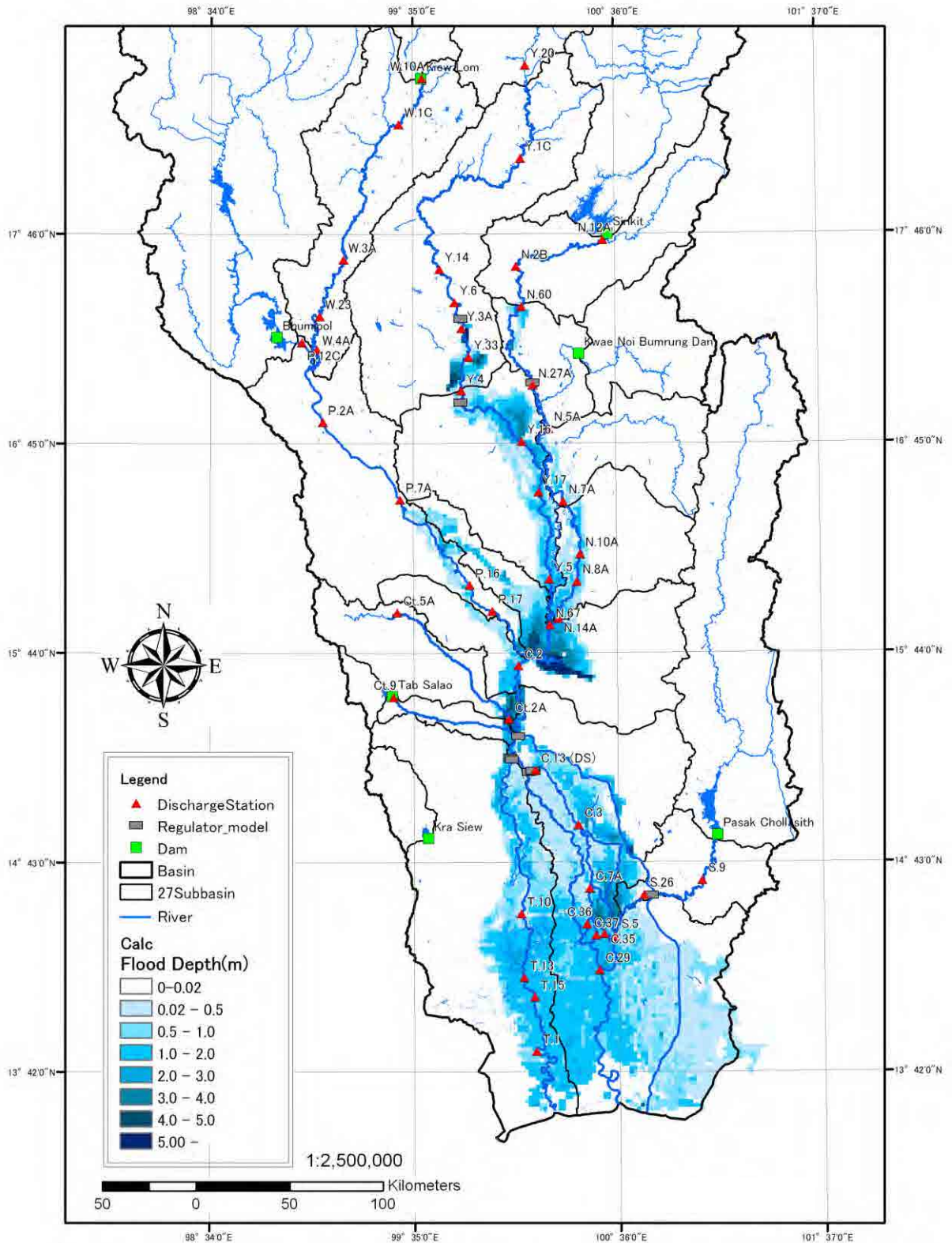


Figure D2.5.31 Diagrams of the Maximum Inundation Depth (Year 2011)
(Case 0 : Reproducing the 2011 Flood)

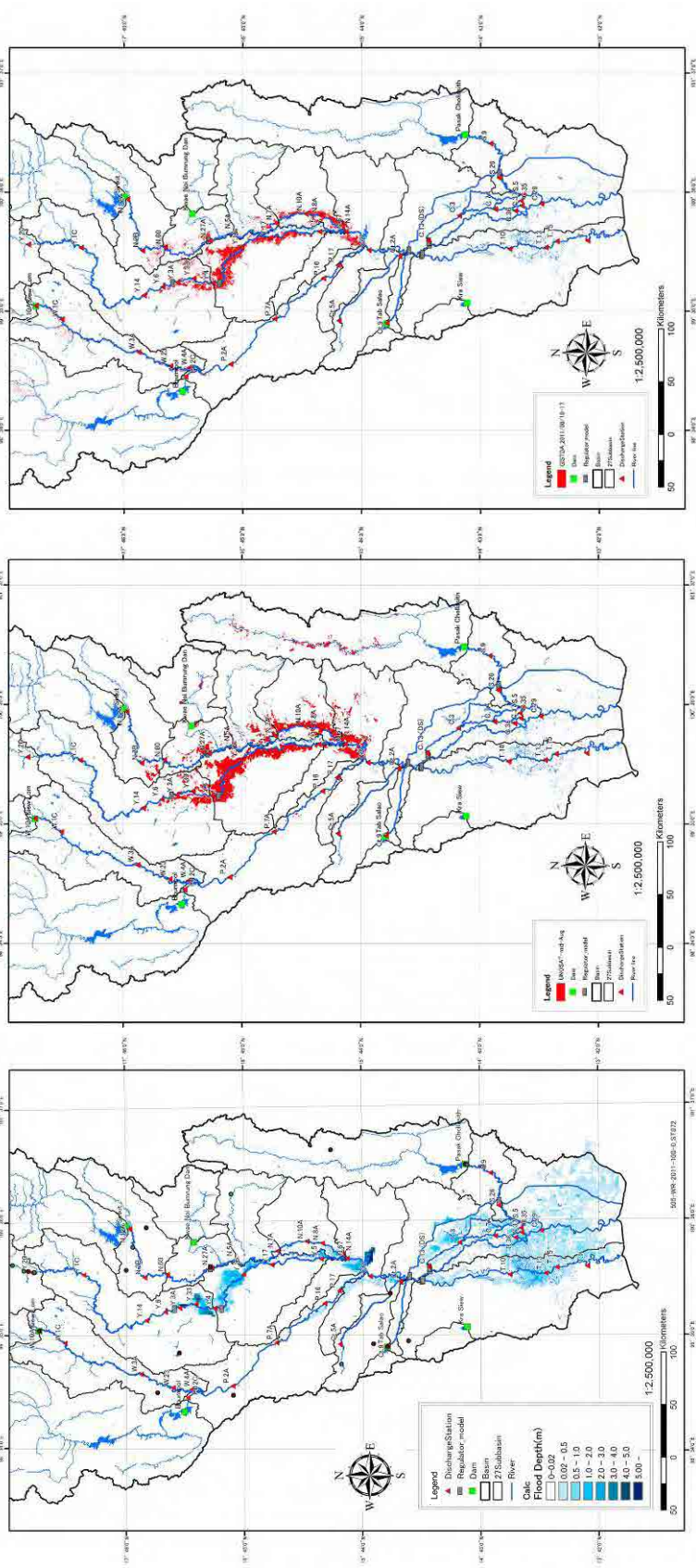


Figure D2.5.32 Comparison of Calculation Result in the Middle of August 2011
(Left : Calculation 8/12, Middle : UNOSAT Middle of August, Right : GISTDA 8/10-17) (Case 0 : Reproducing the 2011 Flood)

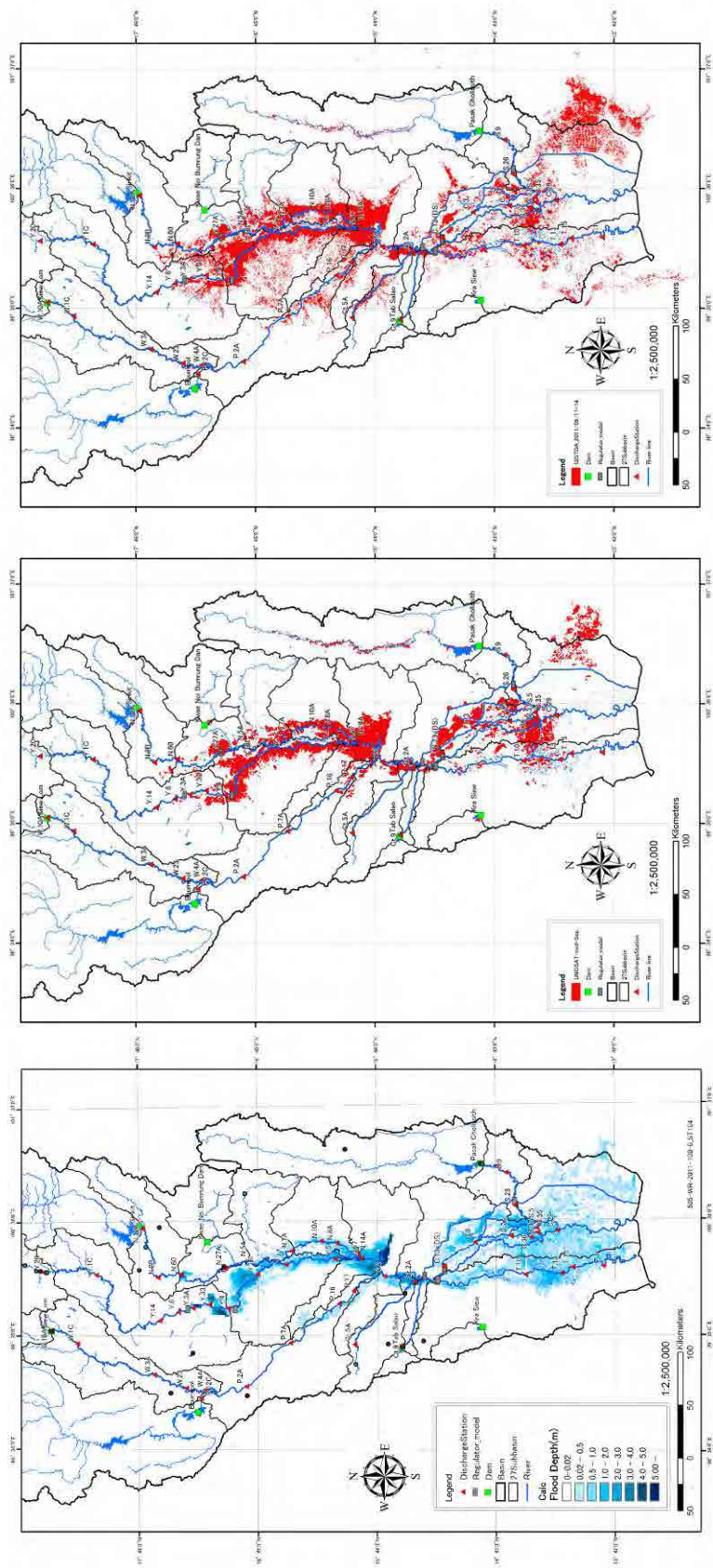


Figure D2.5.33 Comparison of Calculation Result in the Middle of September 2011
(Left : Calculation 9/13, Middle : UNOSAT Middle of September, Right : GISTDA 9/11-14) (Case 0 : Reproducing the 2011 Flood)

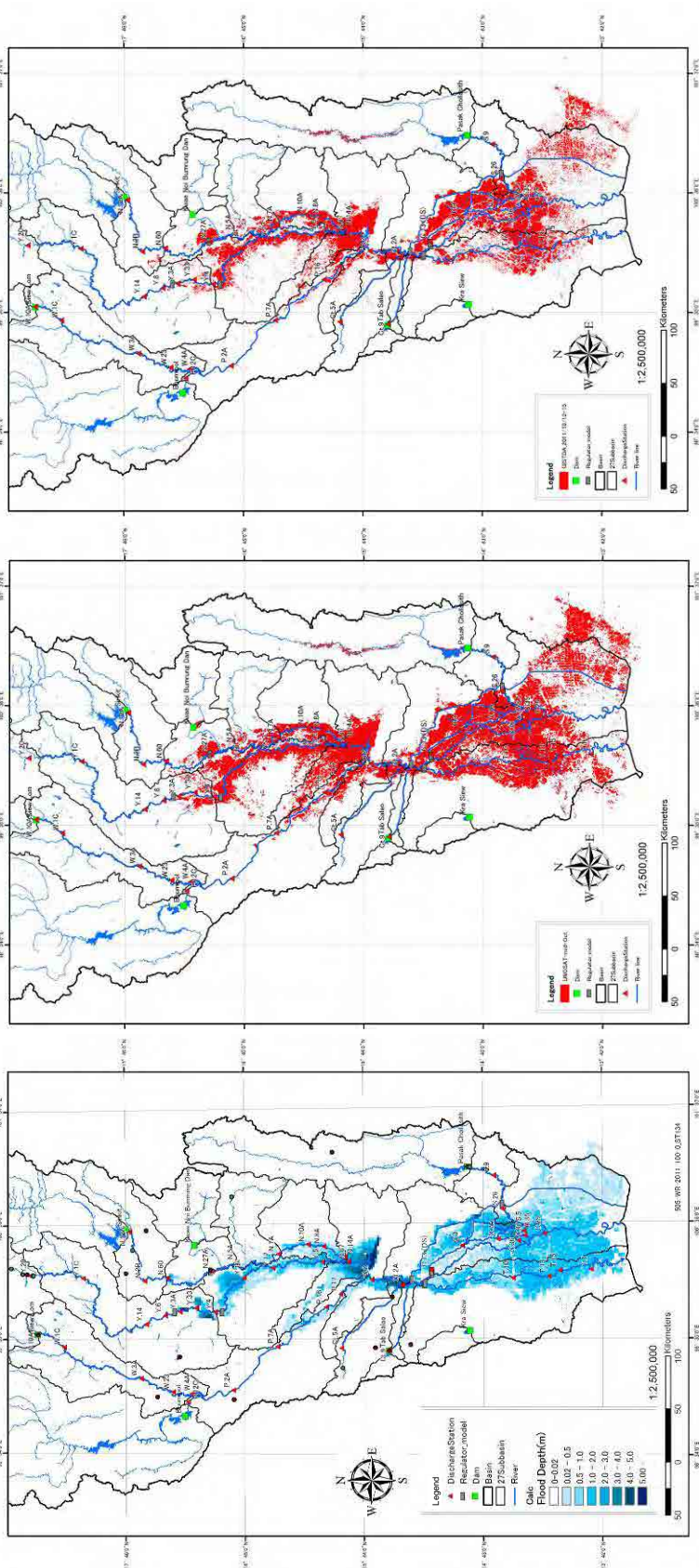
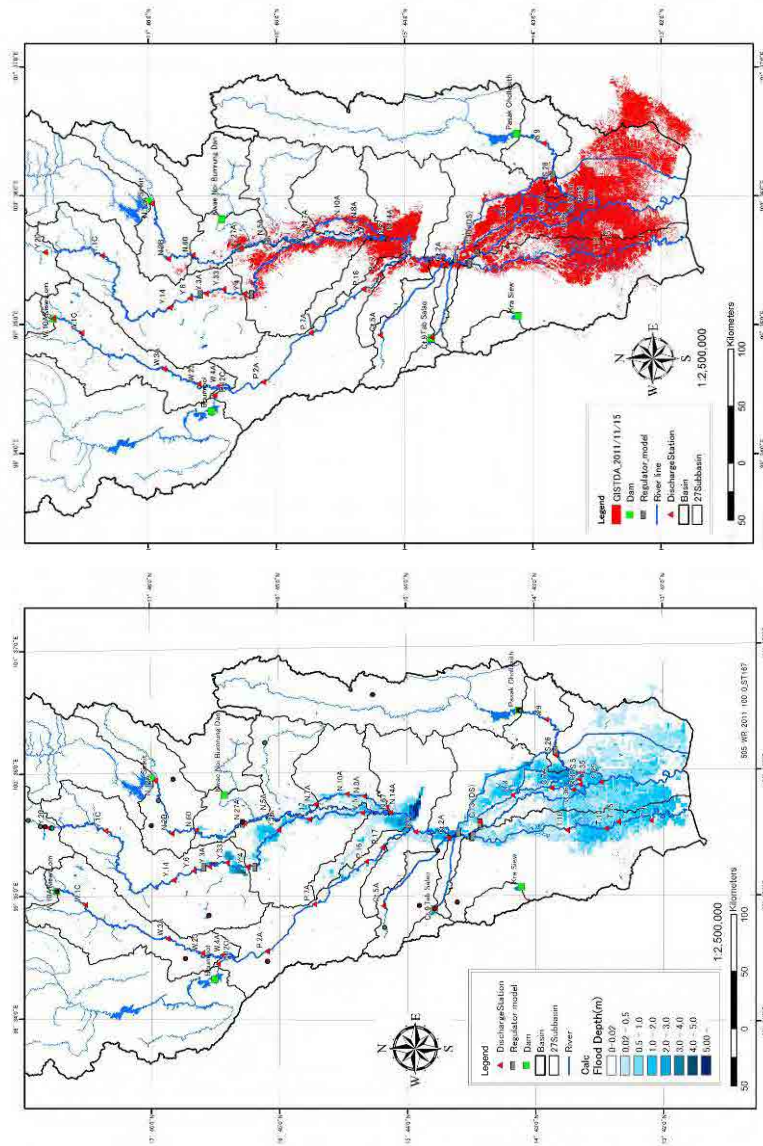


Figure D2.5.34 Comparison of Calculation Result in the Middle of October 2011
(Left : Calculation 10/13, Middle : UNOSAT Middle of October, Right : GISTDA 10/12-15) (Case 0 : Reproducing the 2011 Flood)



**Figure D2.5.35 Comparison of Calculation Result in the Middle of November 2011
(Left : Calculation 11/15, Right : GISTDA 11/15) (Case 0 : Reproducing the 2011 Flood)**

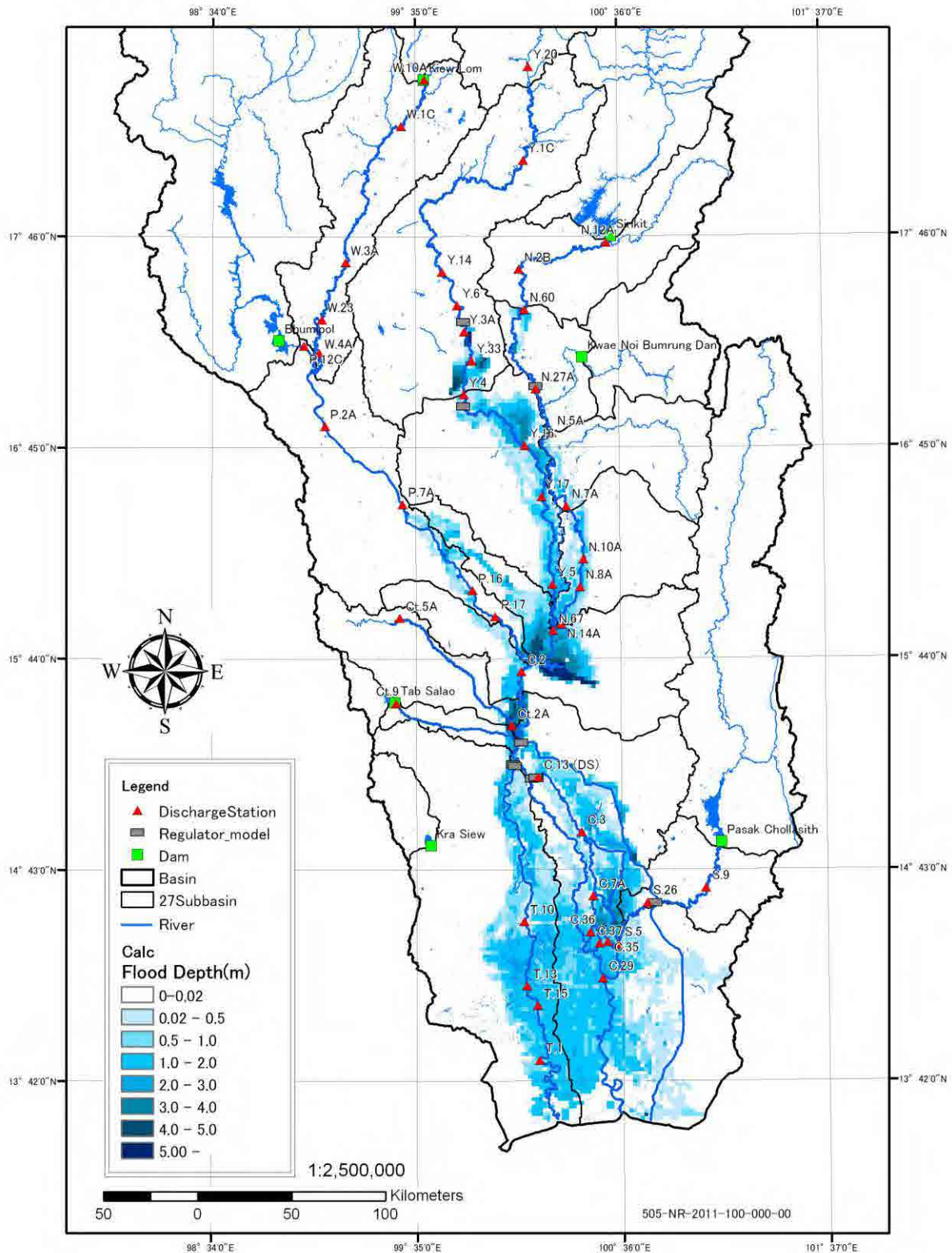
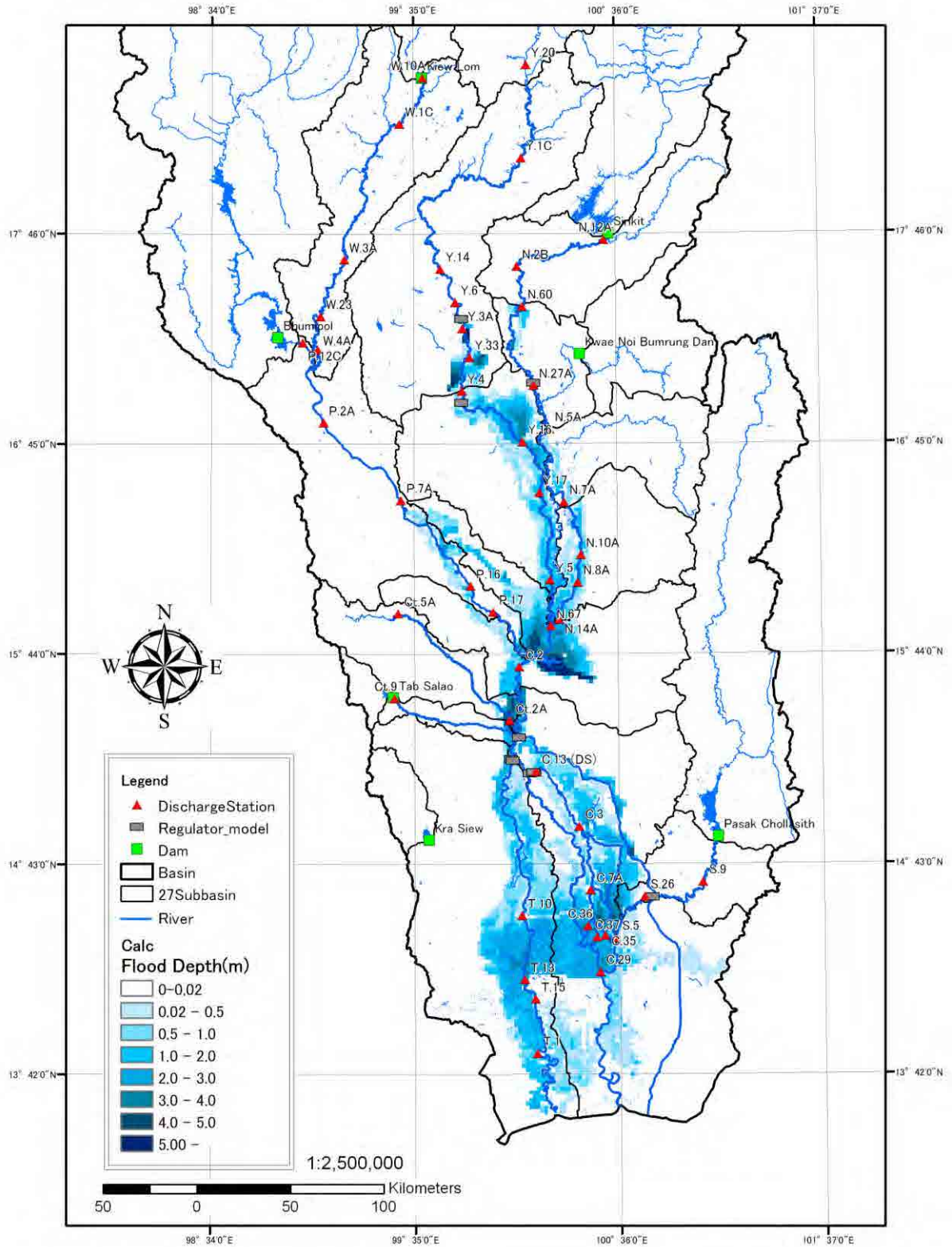


Figure D2.5.36 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 0-0)
(2011 Flood without Dike breaches)



**Figure D2.5.37 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 0-1)
(Dike Elevating around the Economic Zone by DOH, DOR near Bangkok Area)**

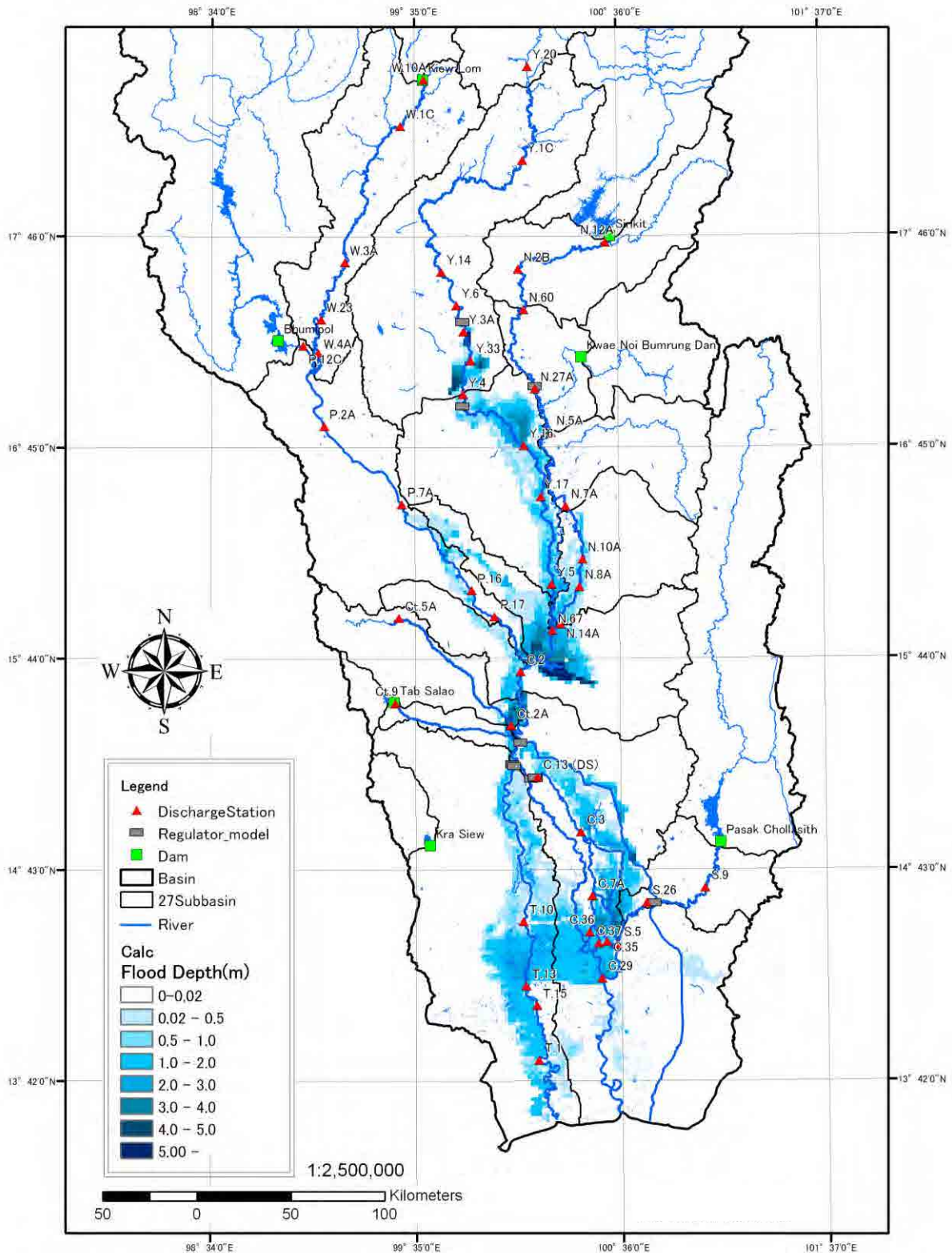


Figure D2.5.38 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 1)
(C2 : New Dams, C4 : Retention Ponds, C5-1 : Dike DHWL+0.5m, C6-1 : Diversion Channel 1,500 m³/s, C7 : Dam Operation Rule)

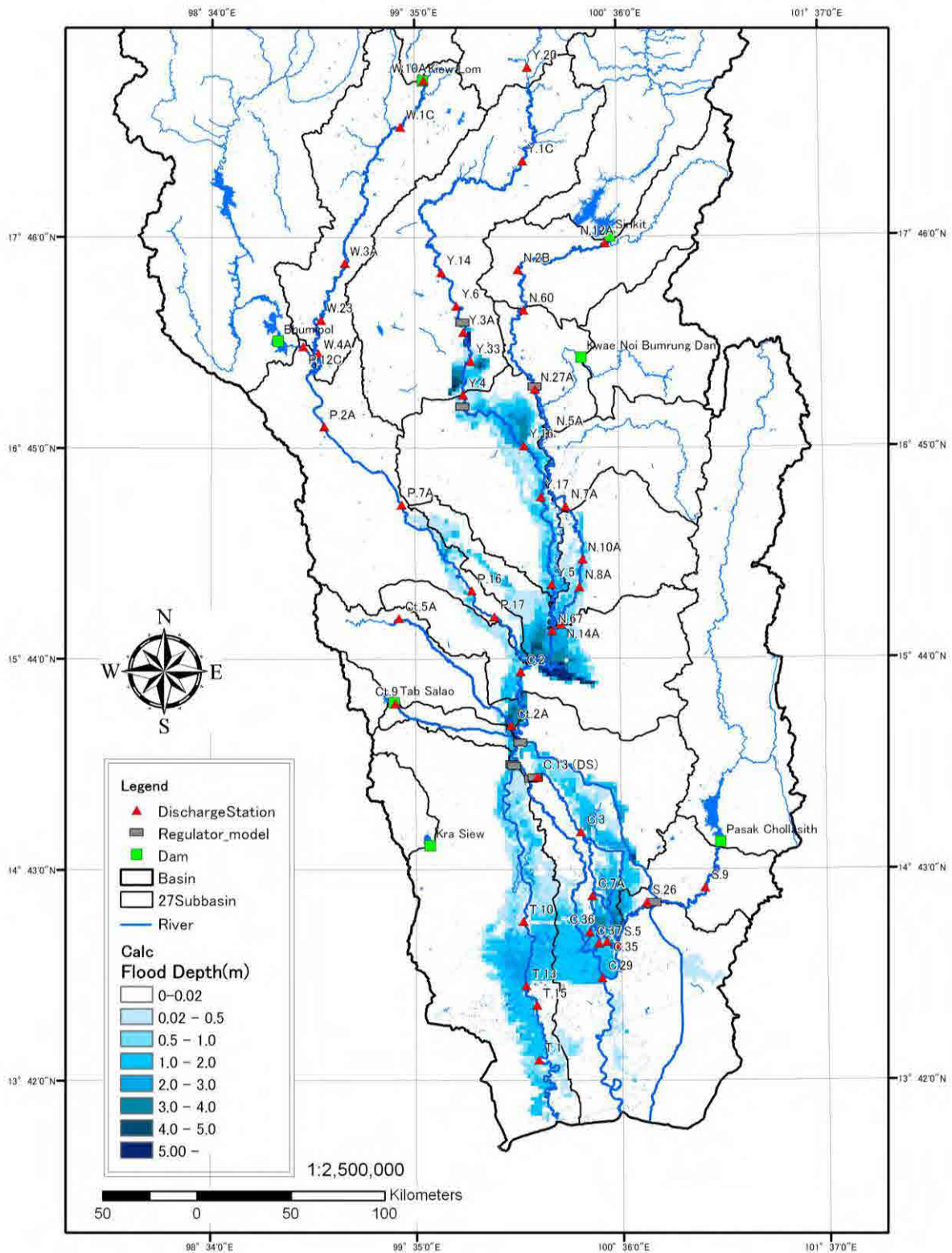


Figure D2.5.39 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 1-1)
(C2 : New Dams, C4 : Retention Ponds, C5-1 : Dike DHWL+0.5m, C6-1 : Diversion Channel
1,500 m³/s, C6-2: Central Diversion , C7 : Dam Operation Rule)

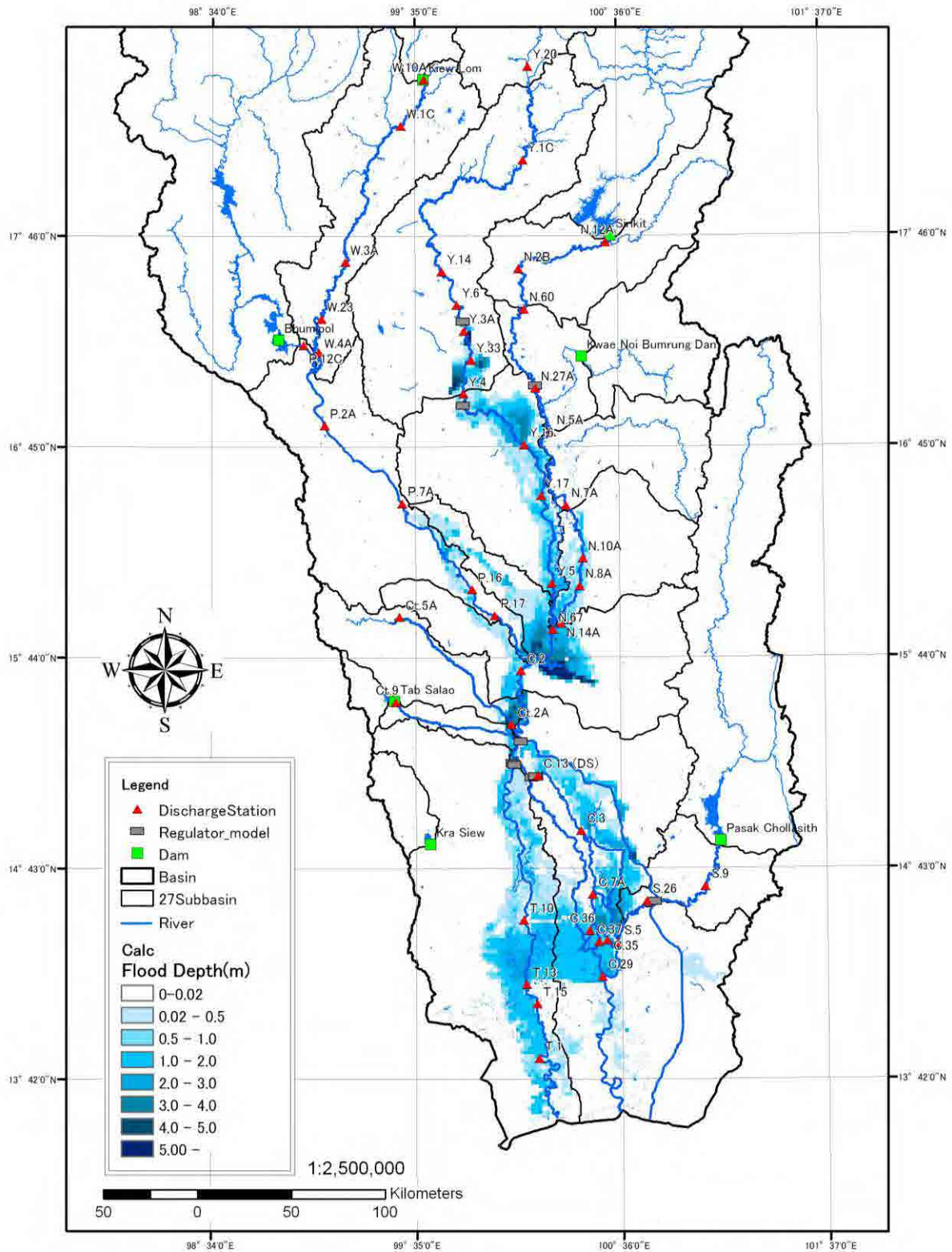


Figure D2.5.40 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 2)
(C2:New Dams, C4:Retention Ponds, C5-1:Dike DHWL+0.5m, C5-2:AyutthayaAyutthaya
Diversion, C6-1:Diversion Channel 1,500m³/s, C7:Dam Operation Rule)

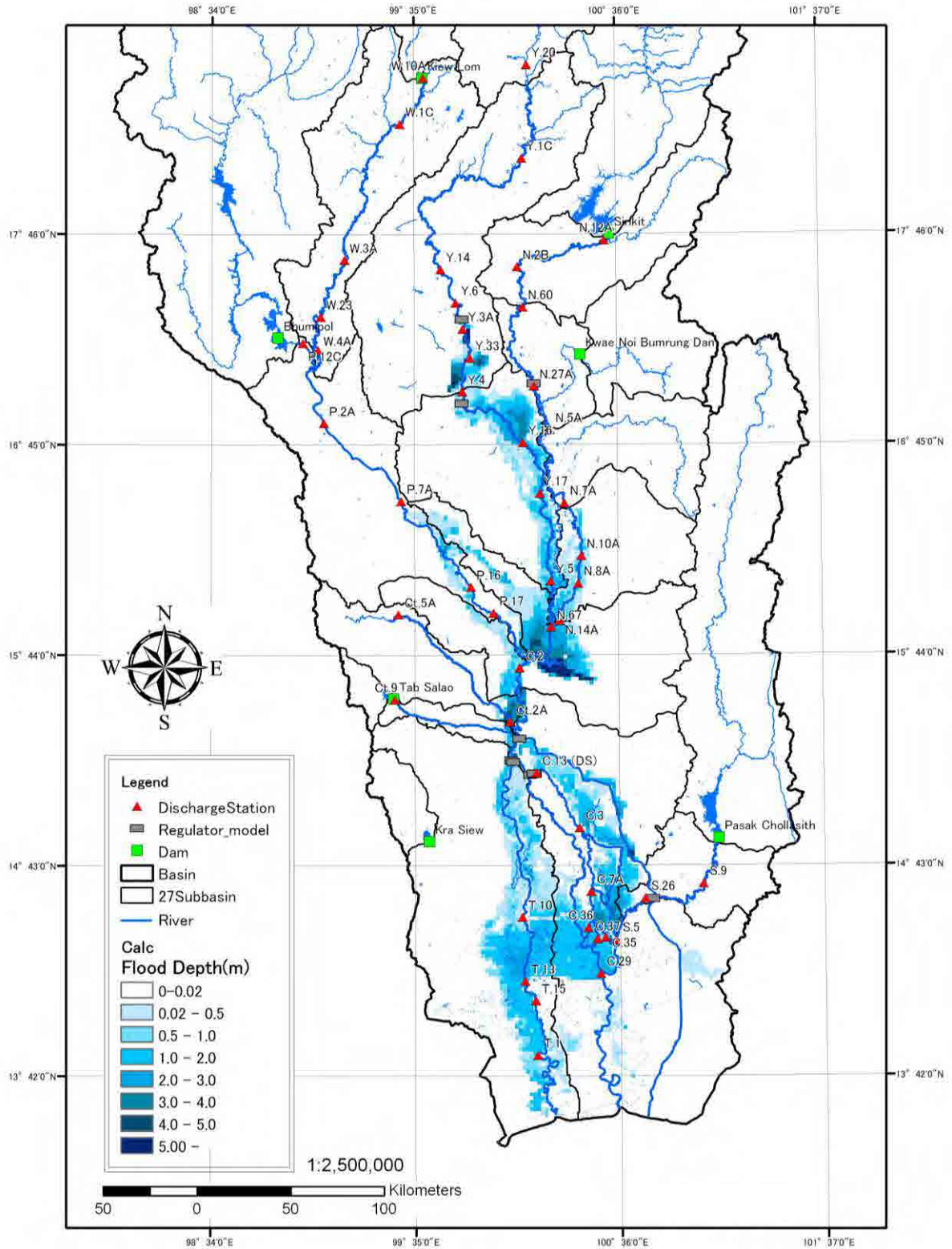
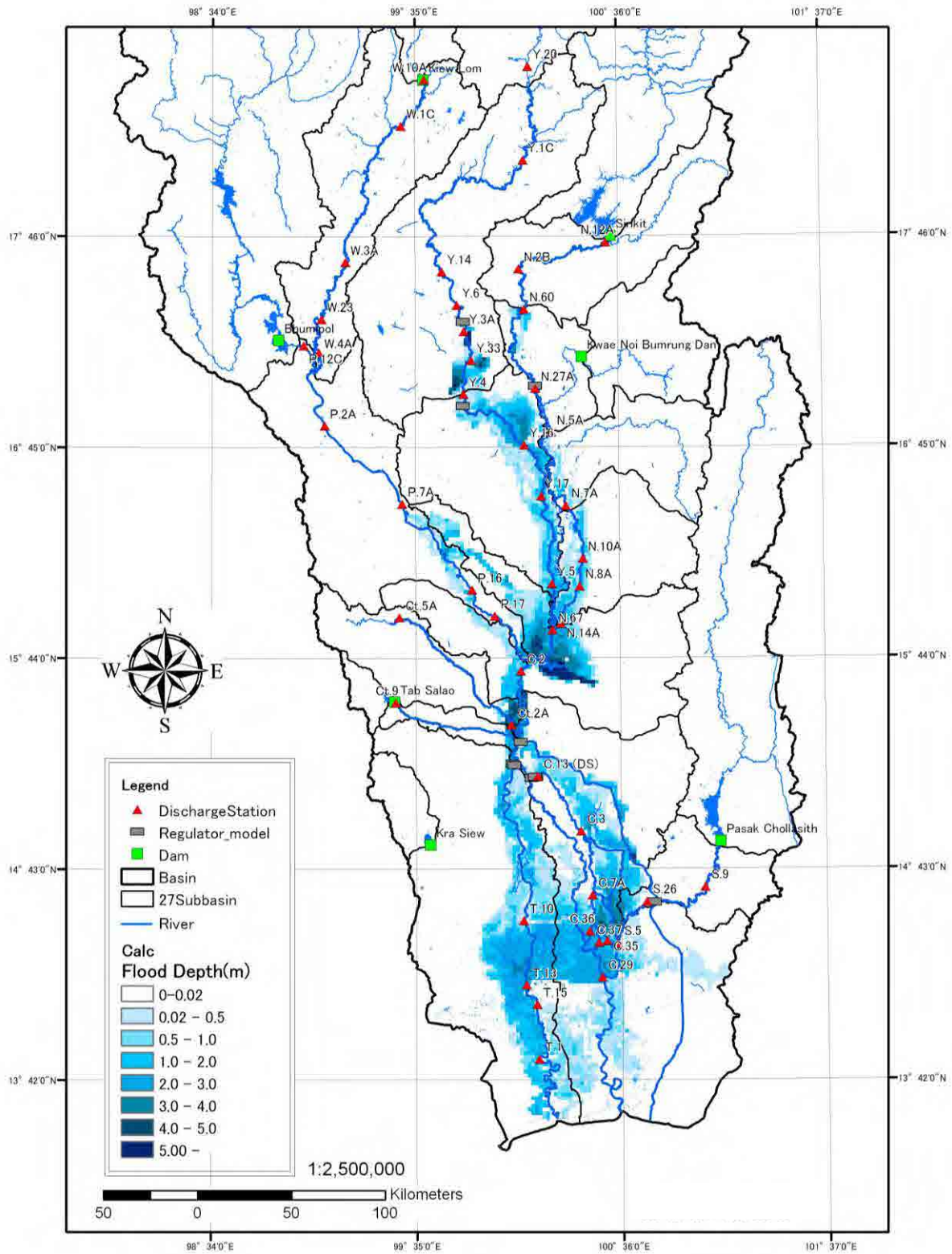


Figure D2.5.41 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 2-1)
C2:New Dam, C4:Retention Ponds, C5-1:Dike DHWL+0.5m, C5-2:AyutthayaAyutthaya
Diversion, C6-1:Diversion, C6-2:Central Diversion, C7:Dam Operation Rule)



**Figure D2.5.42 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 5)
(C5-1:Dike Elevating up to DHWL+0.5m)**

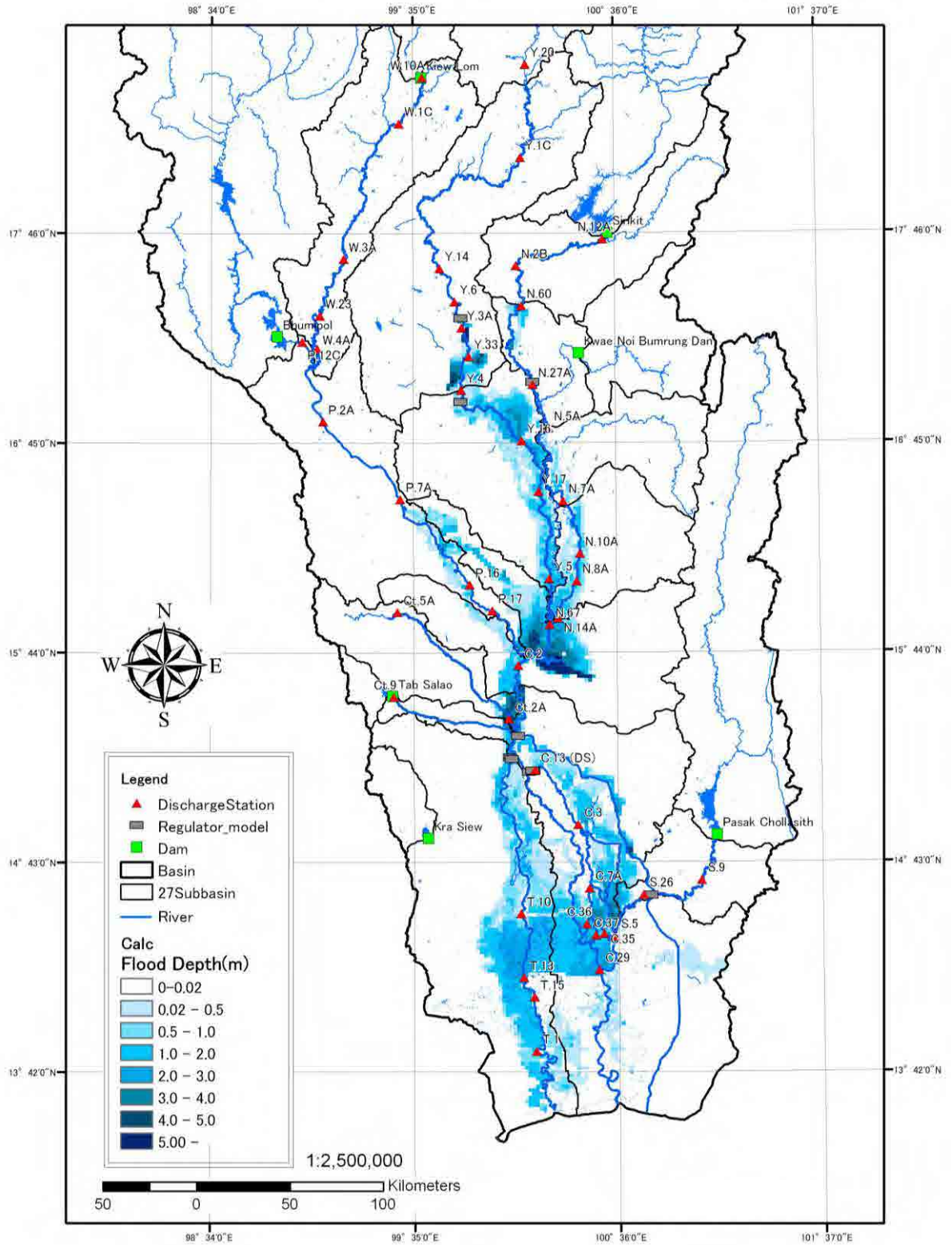
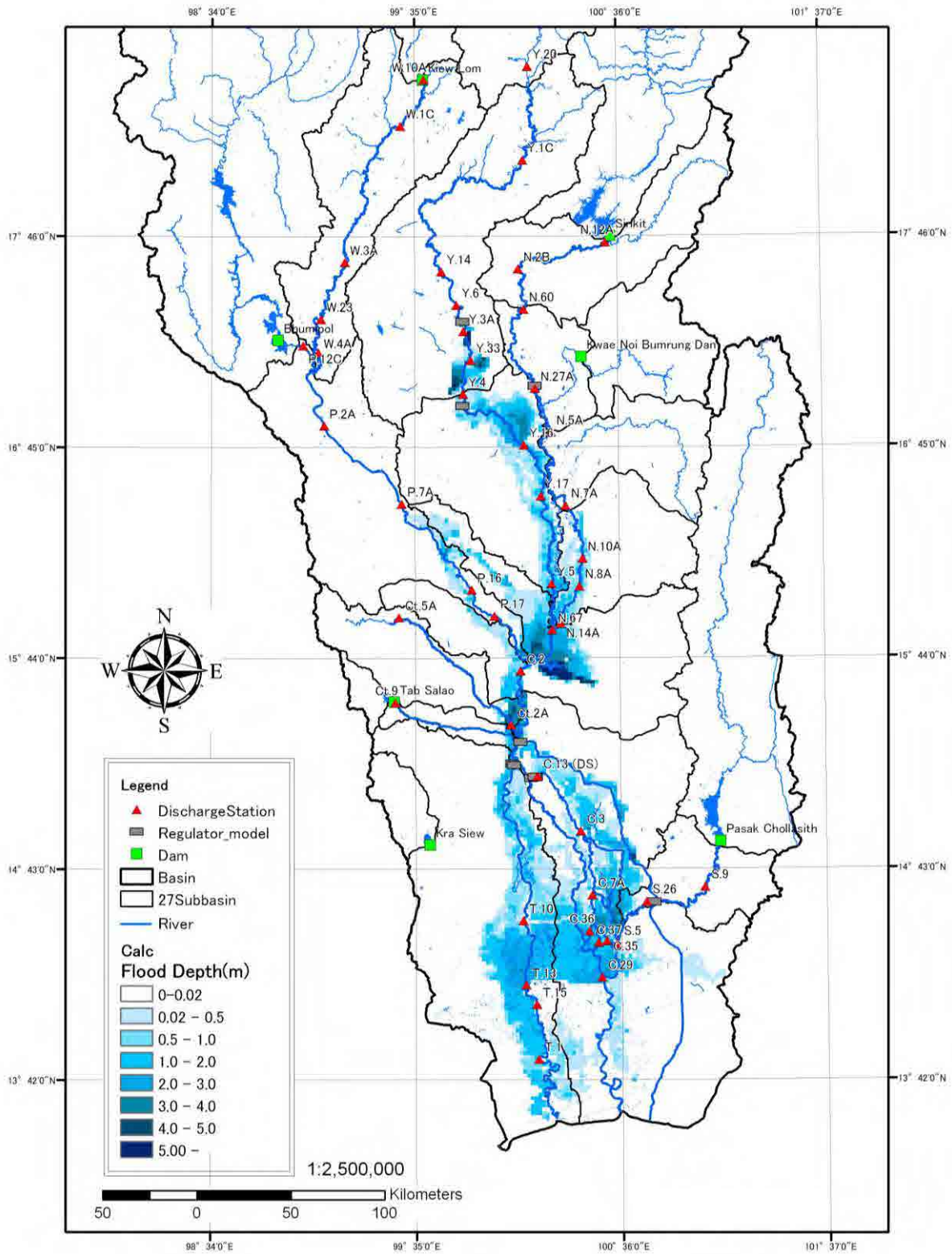


Figure D2.5.43 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 7)
(C5-1:Dike Elevating up to DHWL+0.5m, C6-1:Diversion Channel 1,500m³/s)



**Figure D2.5.44 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-1)
(C7 : Effective Operation of Existing Dams)**

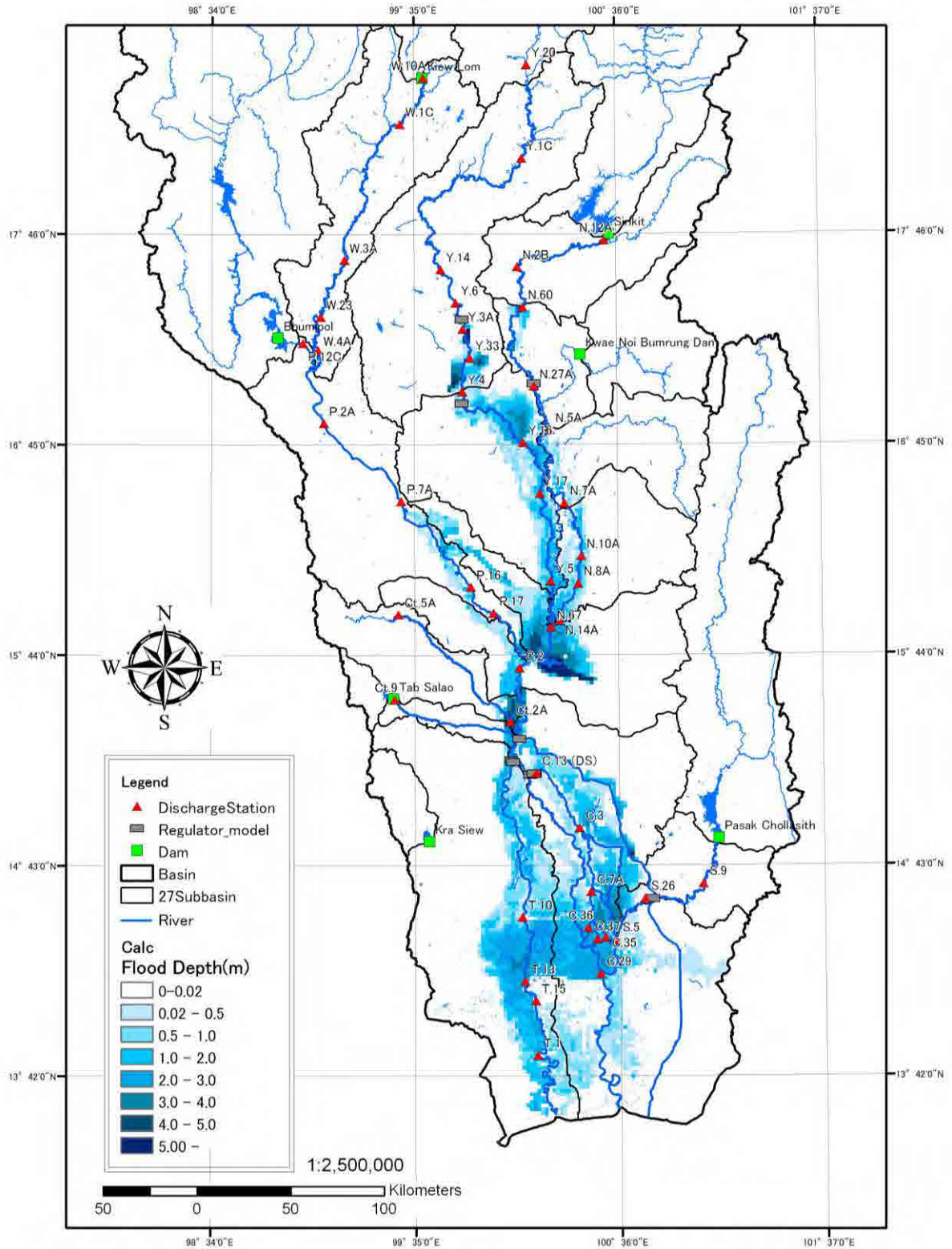
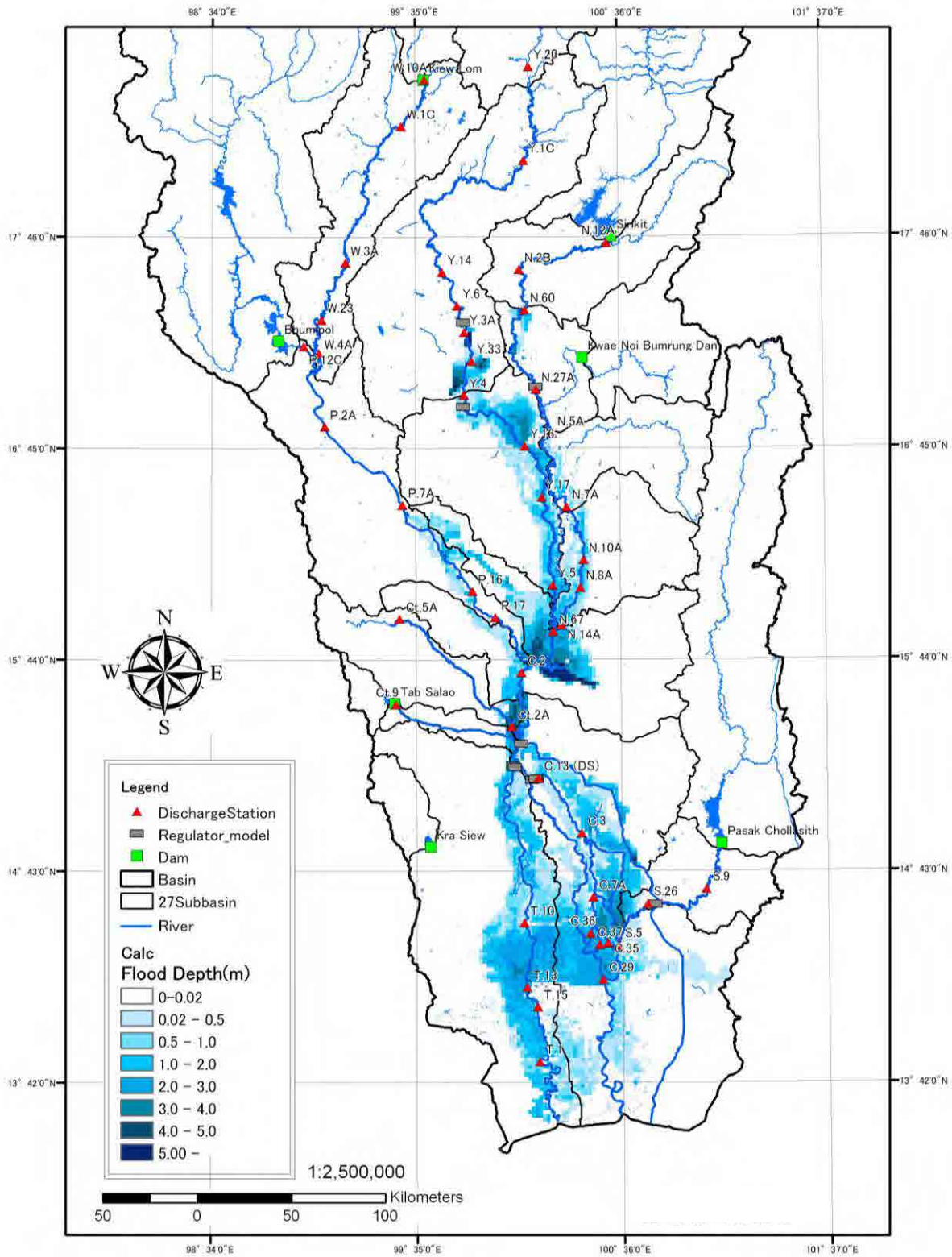
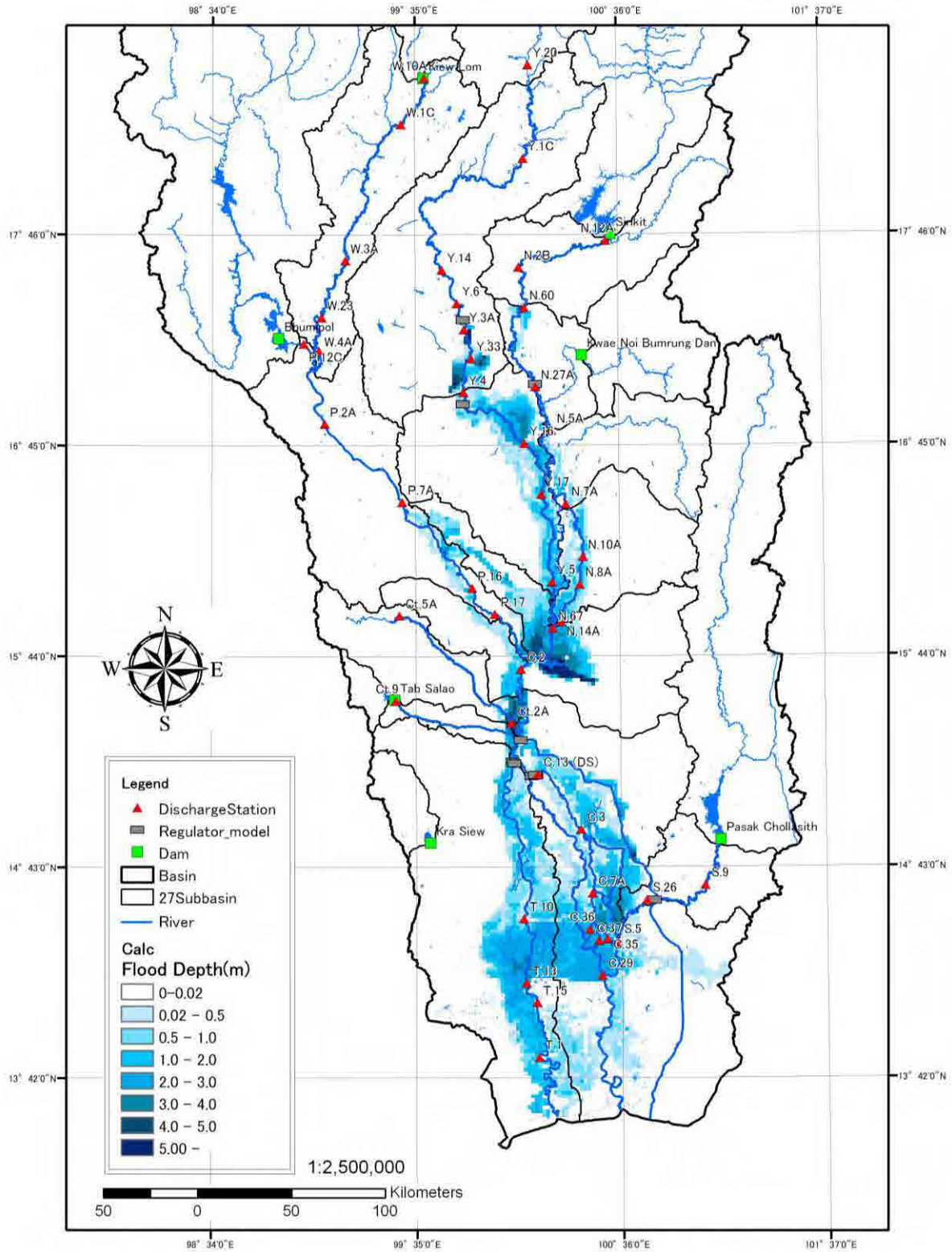


Figure D2.5.45 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-2)
(C2 : Flood Control Volume with New Dams)



**Figure D2.5.46 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-3)
(C4 : Flood Control Volume in Retention Ponds)**



**Figure D2.5.47 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-4)
(C5-2 : Flood Control with Ayutthaya Diversion Channel 1,400m³/s)**

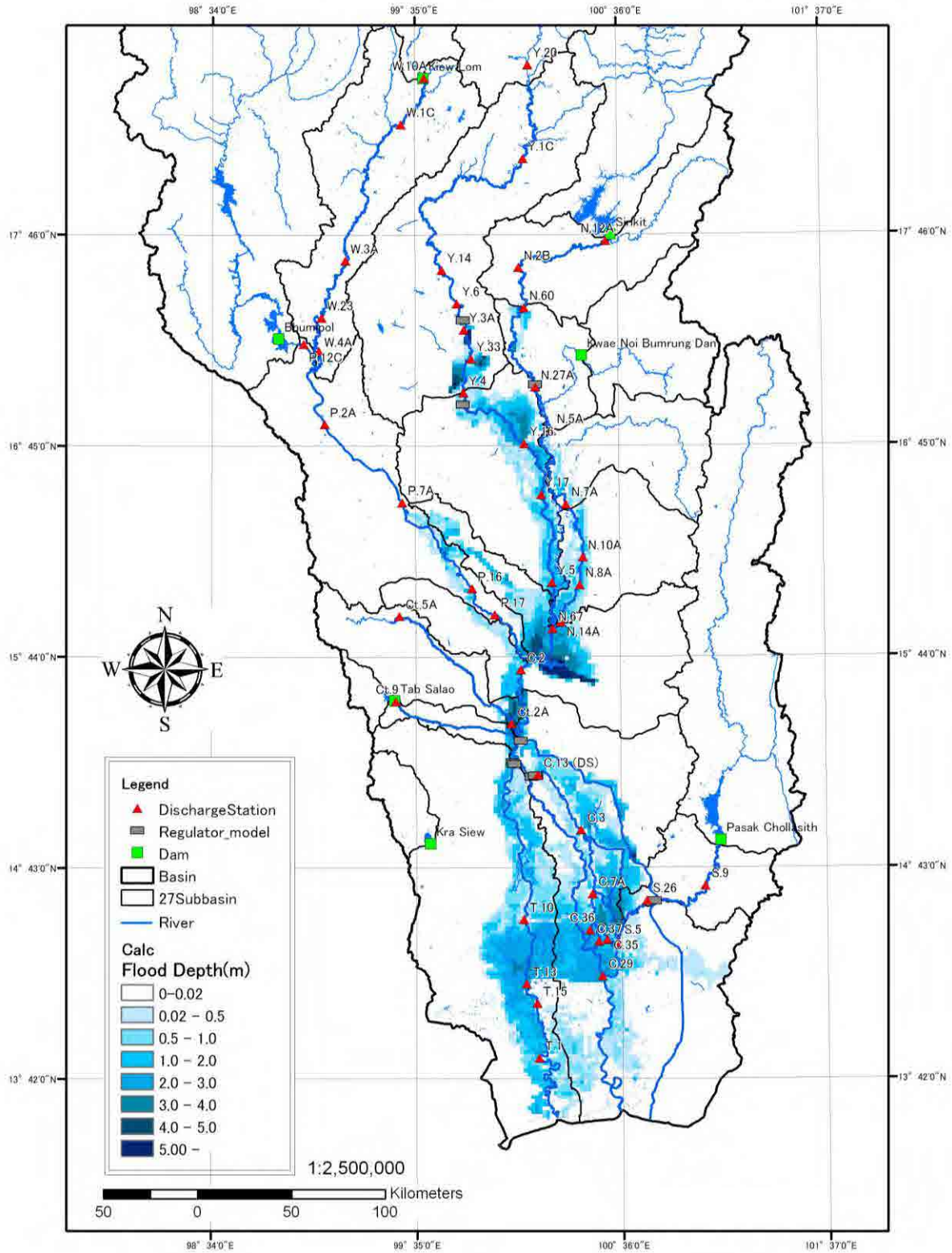


Figure D2.5.48 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-5)
(C6-2 : Flood Control with Central Diversion Channels 500 m³/s)

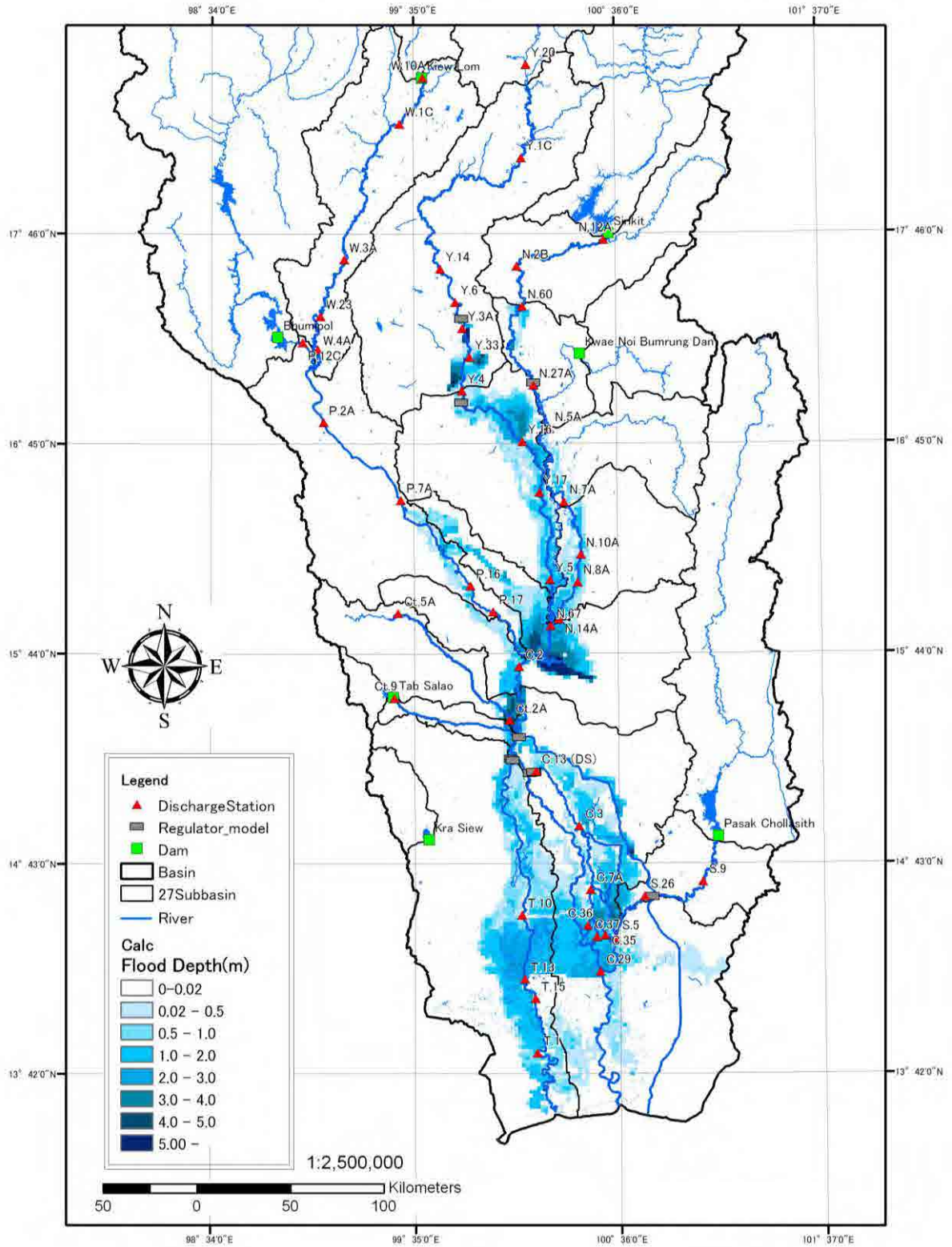
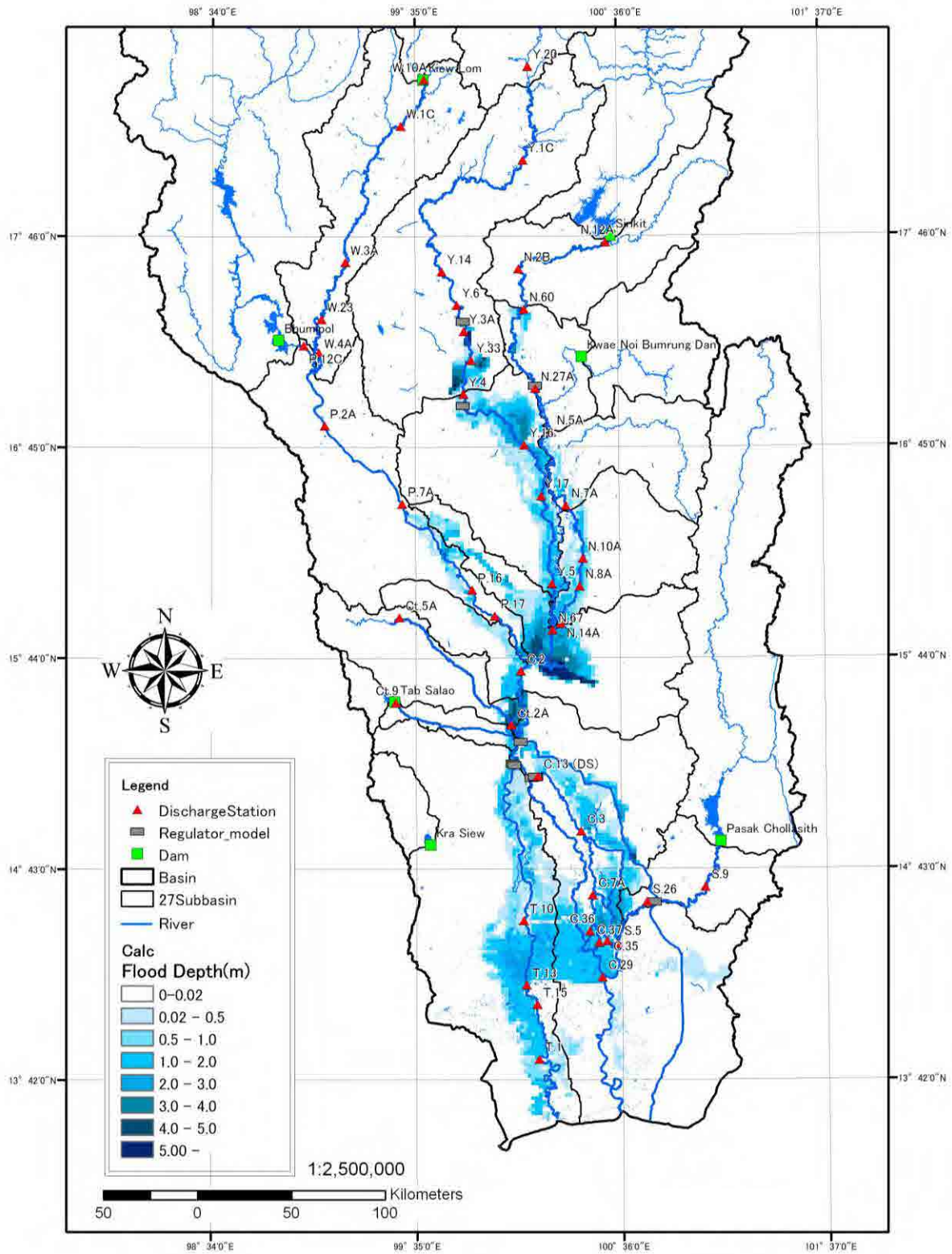


Figure D2.5.49 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-6)
(C6-1 : Flood Control with East or West Diversion Channels 1,500 m³/s)



**Figure D2.5.50 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-6-1)
(C6-1 : Flood Control with East or West Diversion Channels 3,000 m³/s)**

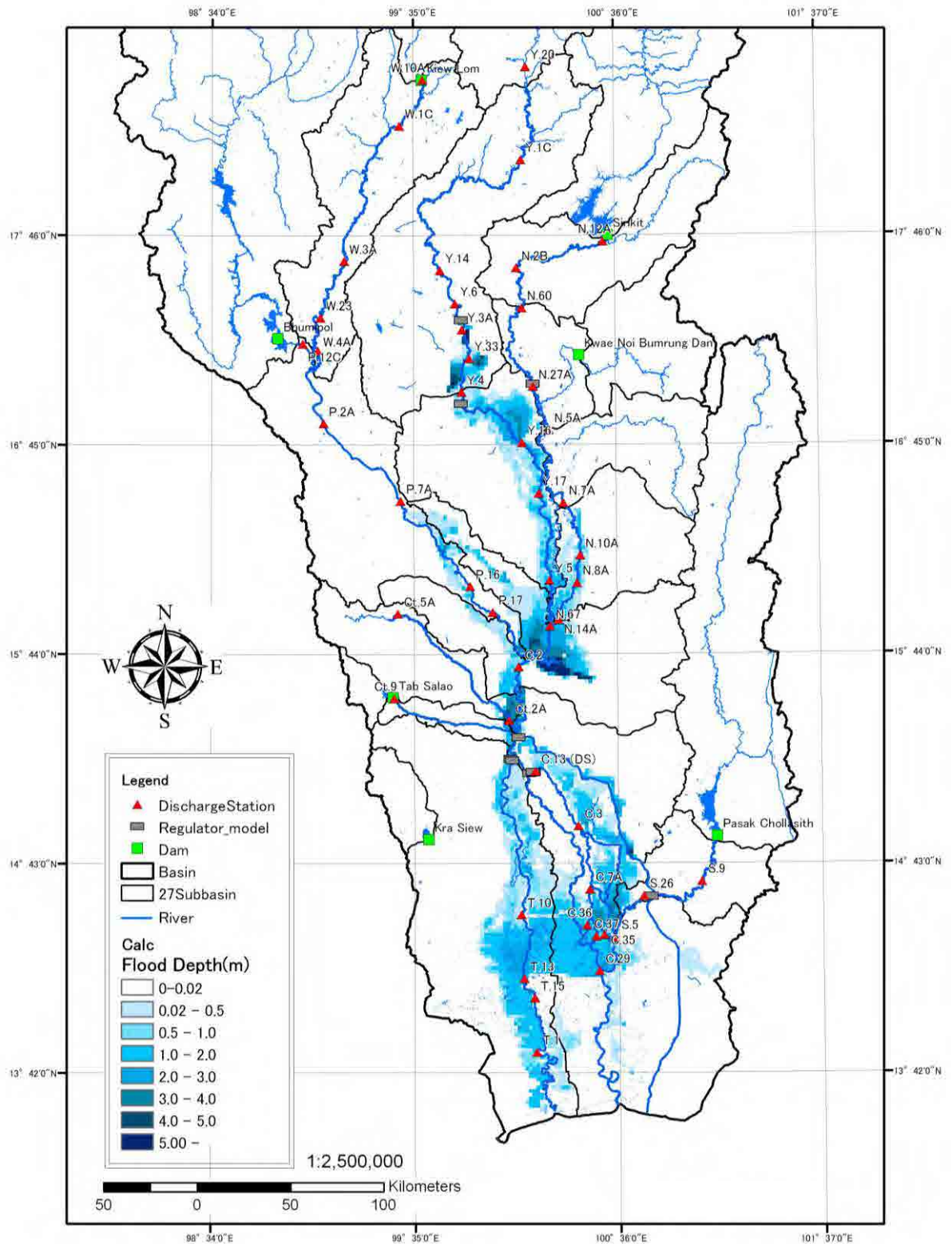


Figure D2.5.51 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 9-7)
(C6-1 : Effective Operation of Existing Dams, Flood Control with East or West Diversion
Channels 1,500 m³/s)

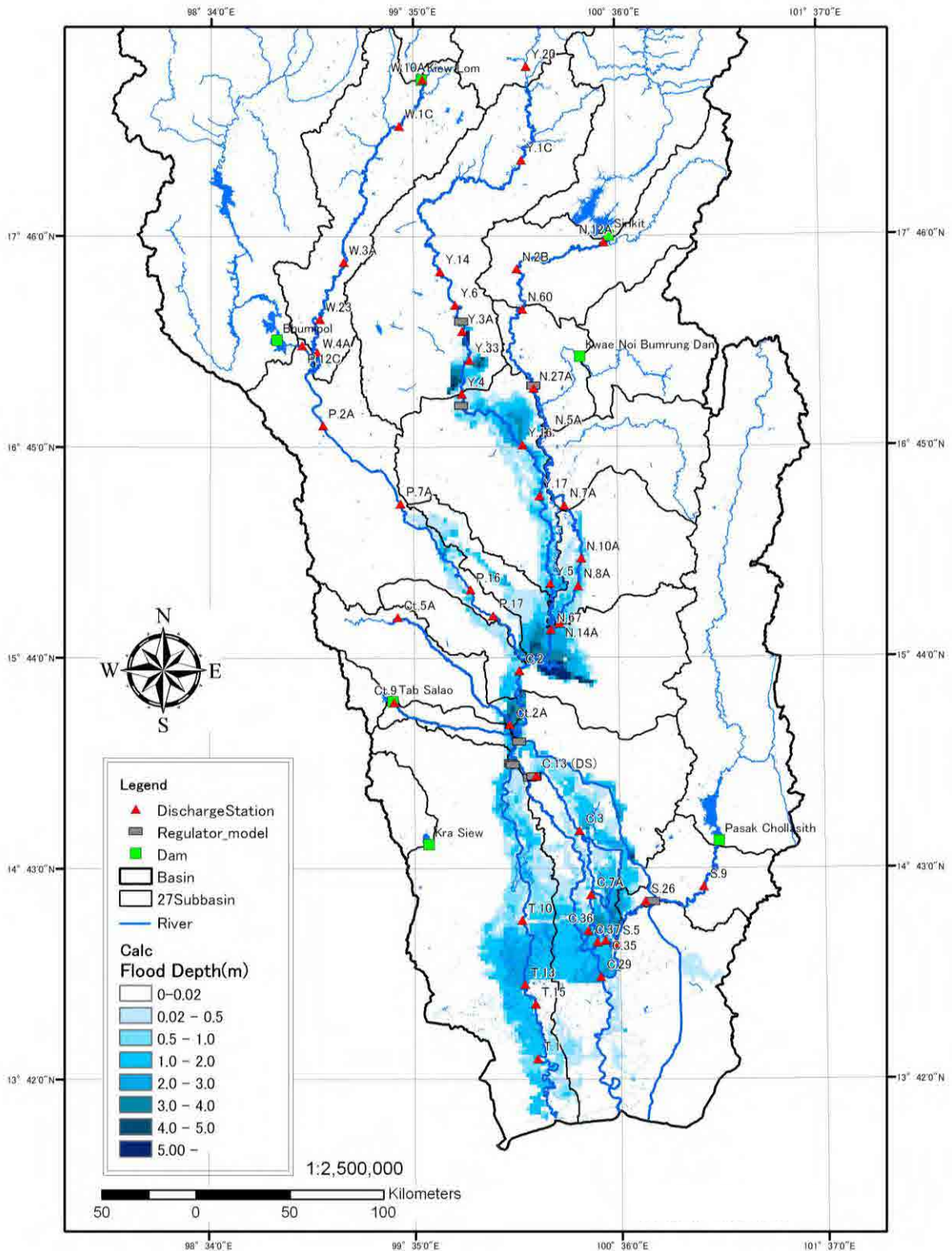


Figure D2.5.52 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 500 m³/s,
C7 : Effective Operation of Existing Dams)

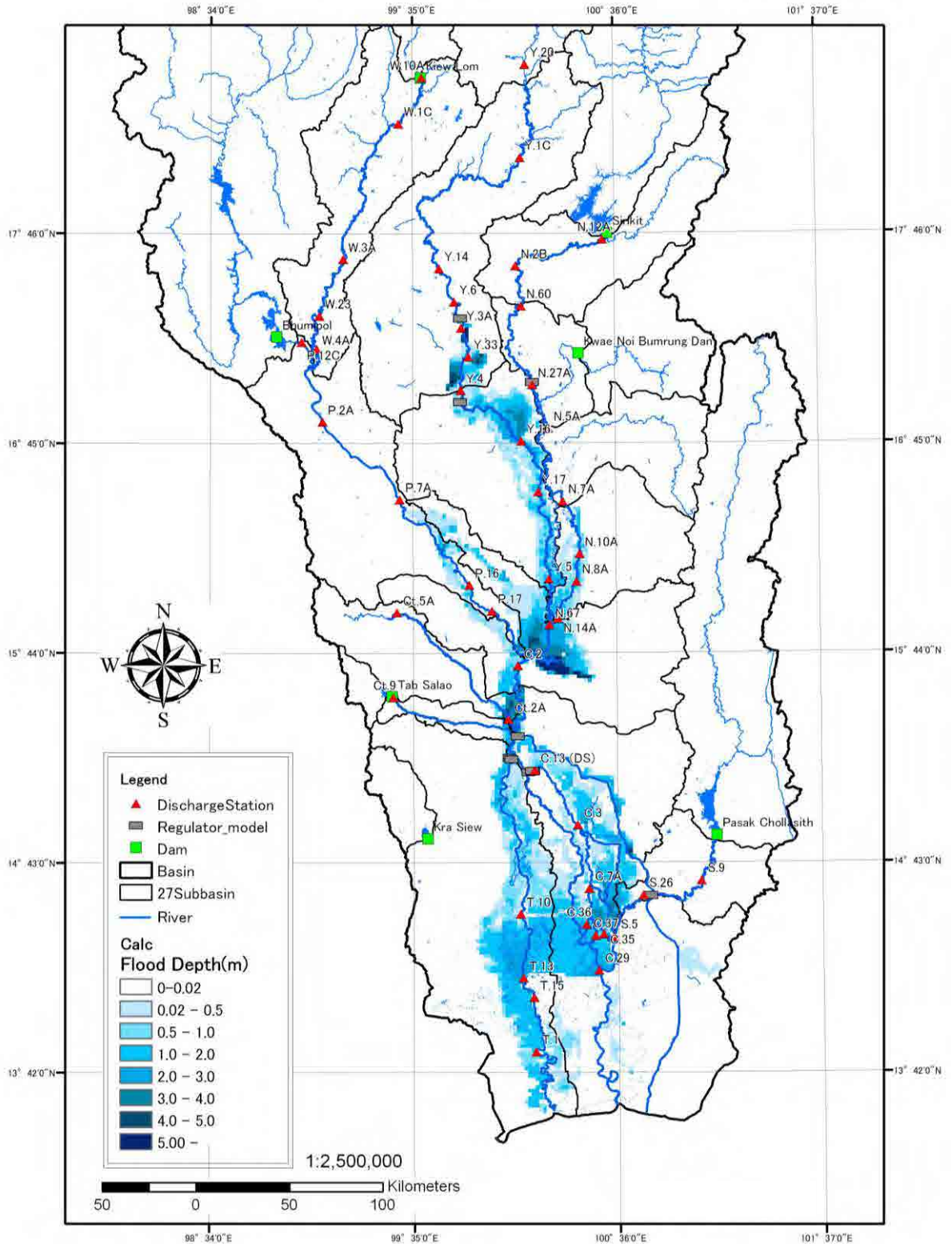


Figure D2.5.53 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-1)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams)

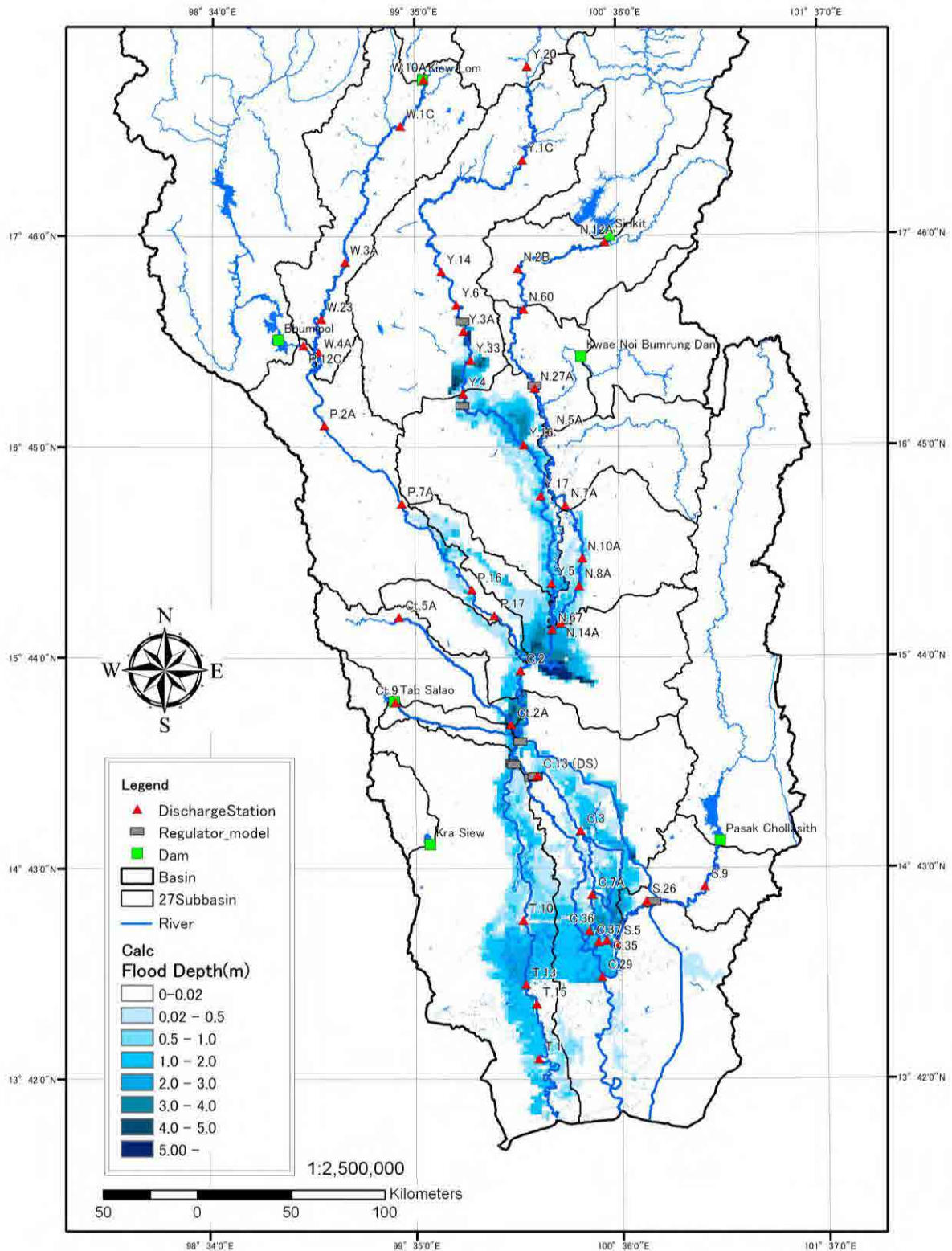


Figure D2.5.54 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-2-4sc-ng)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River without Gate)

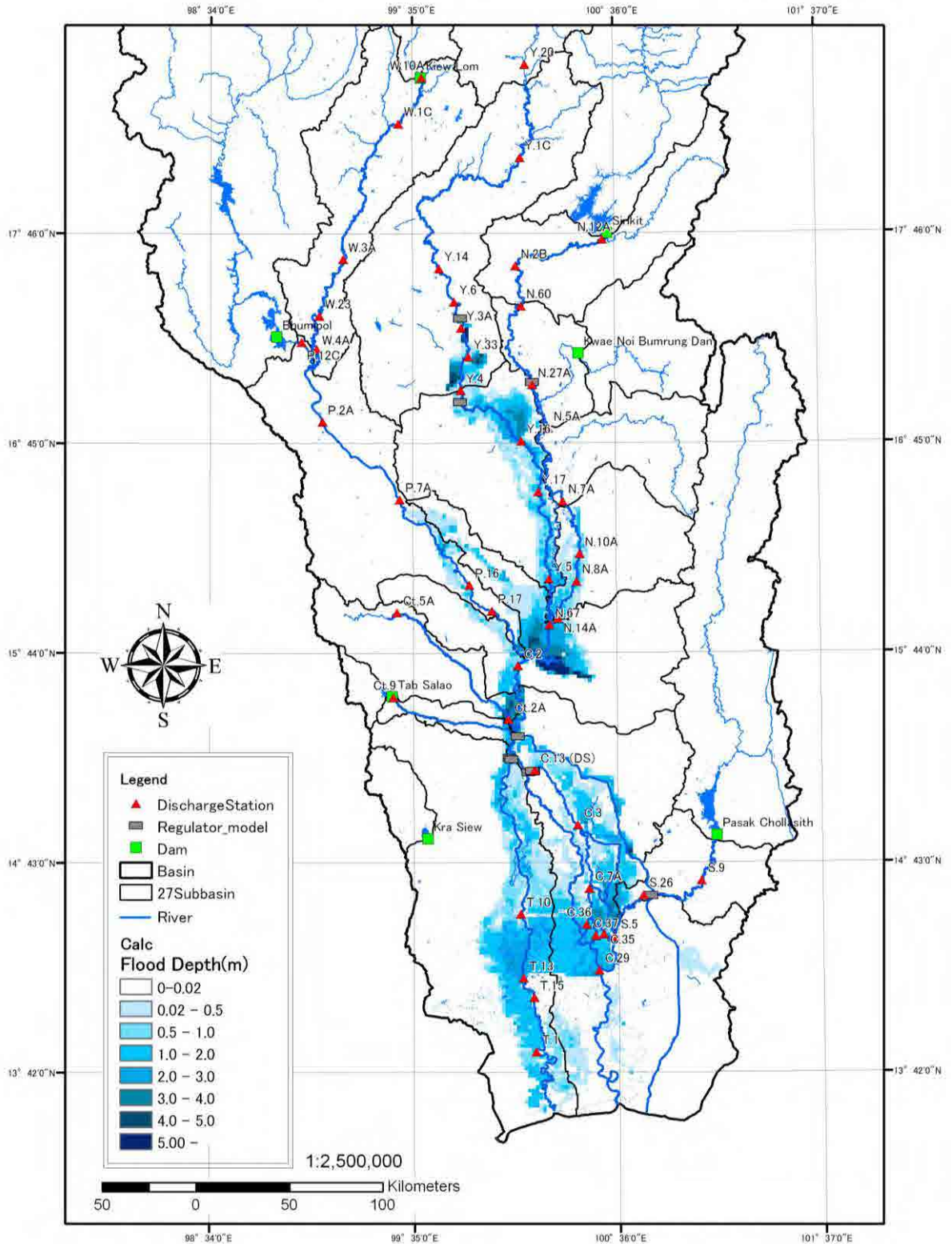


Figure D2.5.55 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-2-2sc-ng)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 2 Short Cuts of Tha Chin River without Gate)

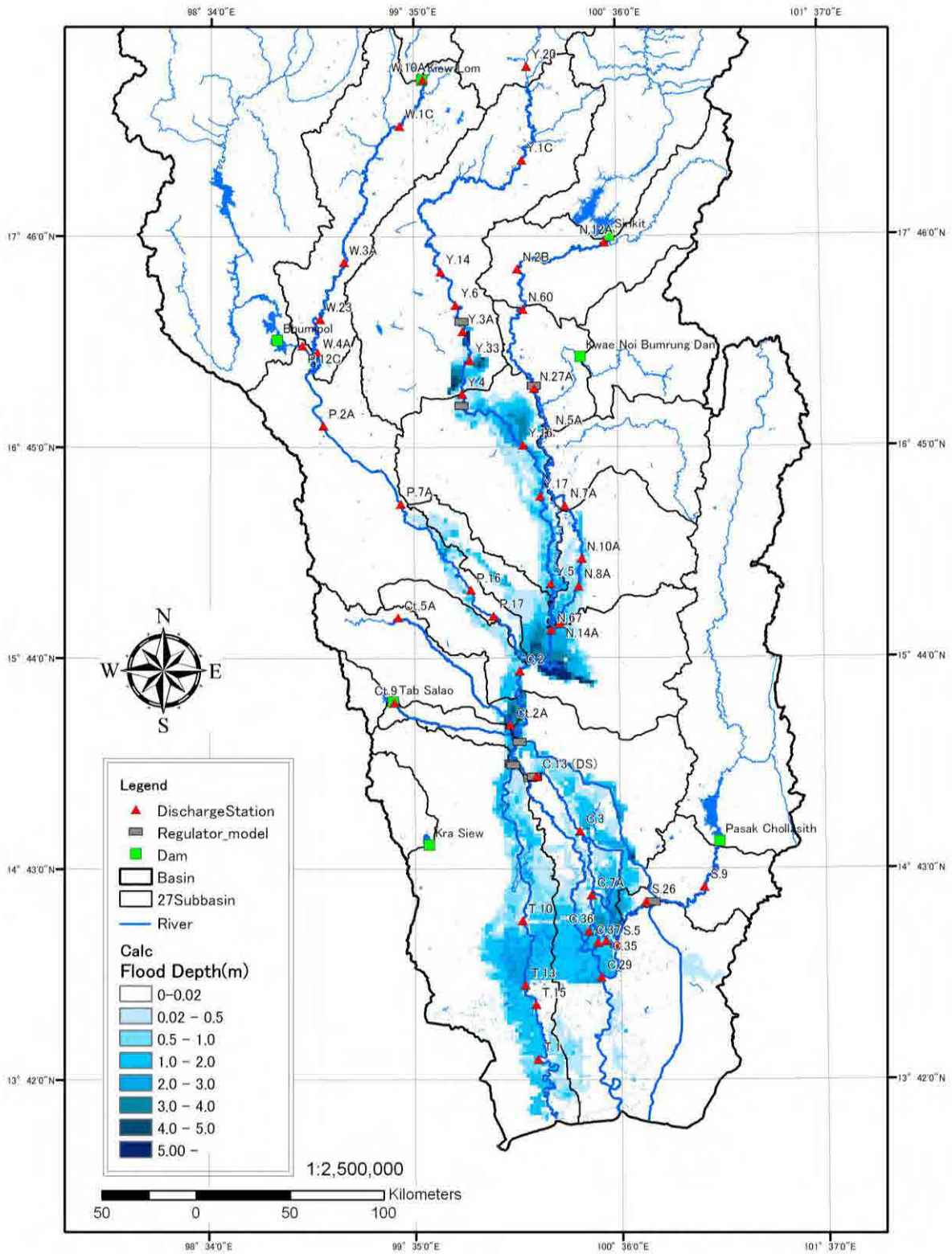


Figure D2.5.56 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-2-4sc-wg) (C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s, C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River with Gate)

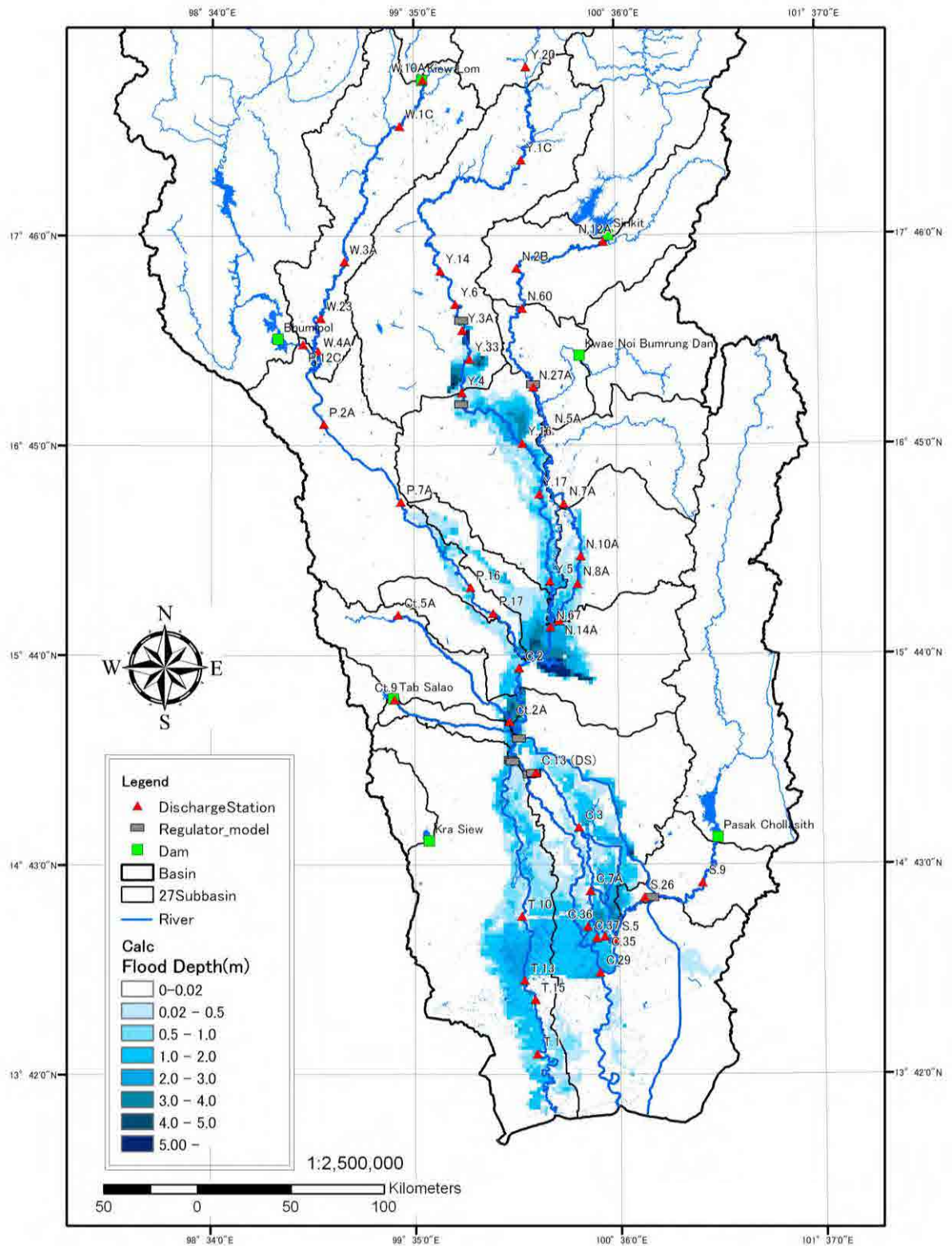


Figure D2.5.57 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-3)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River with Gate,
Widening of Tha Chin River)

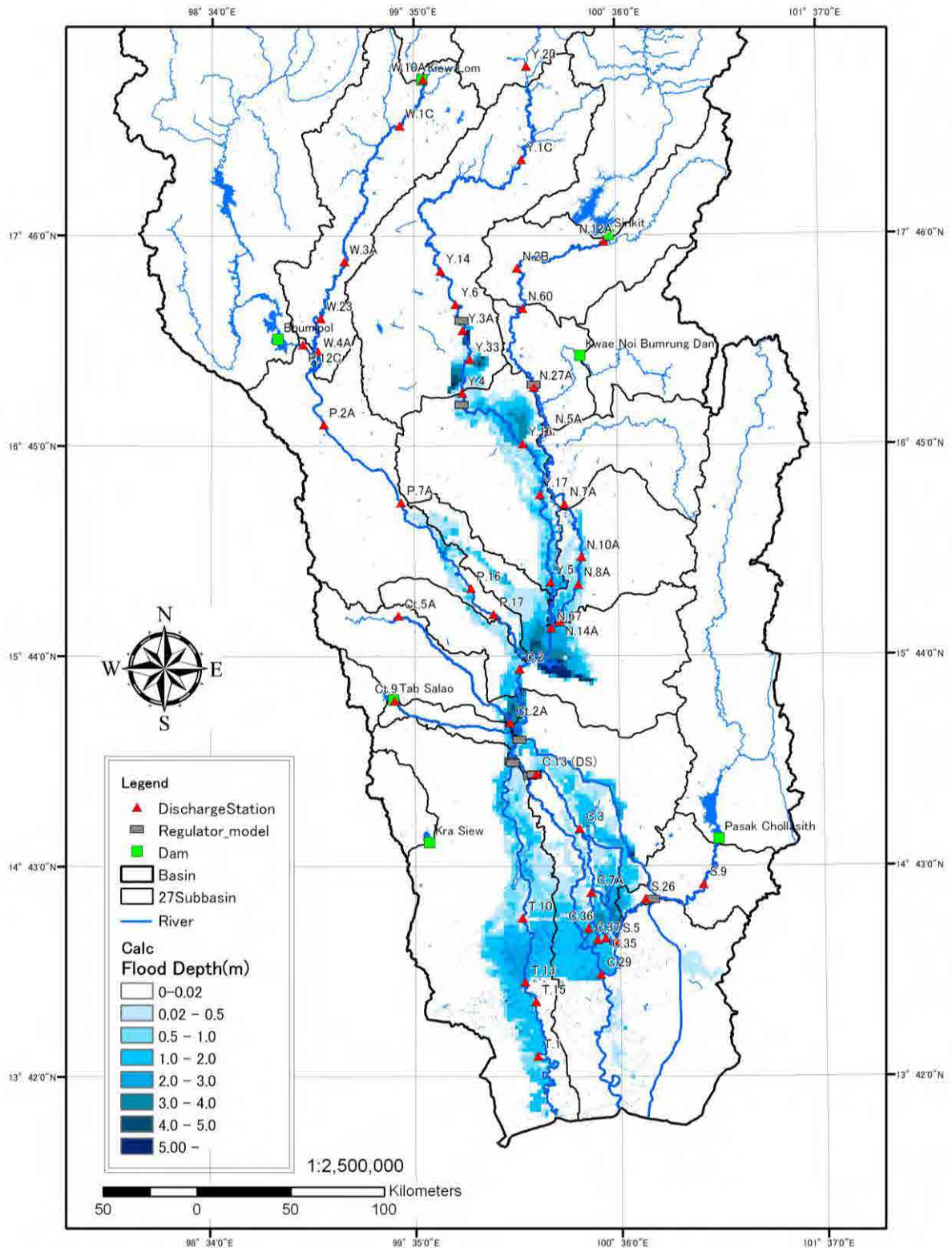


Figure D2.5.58 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-4)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River with Gate,
Widening of Tha Chin River, Left Flood Protection Wall of Tha Chin River)

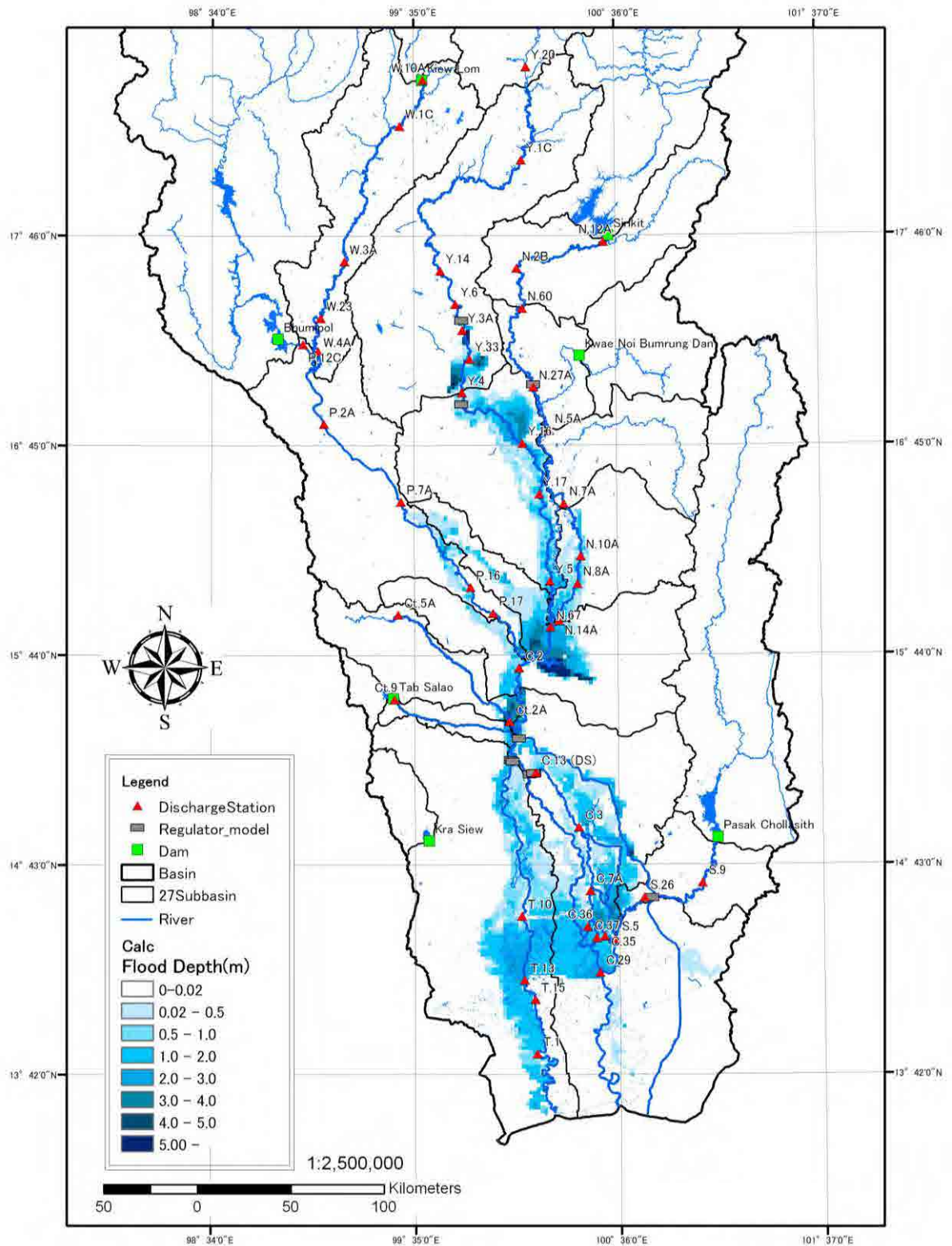


Figure D2.5.59 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-6)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, Right and Left Flood Protection Wall of Tha Chin
River)

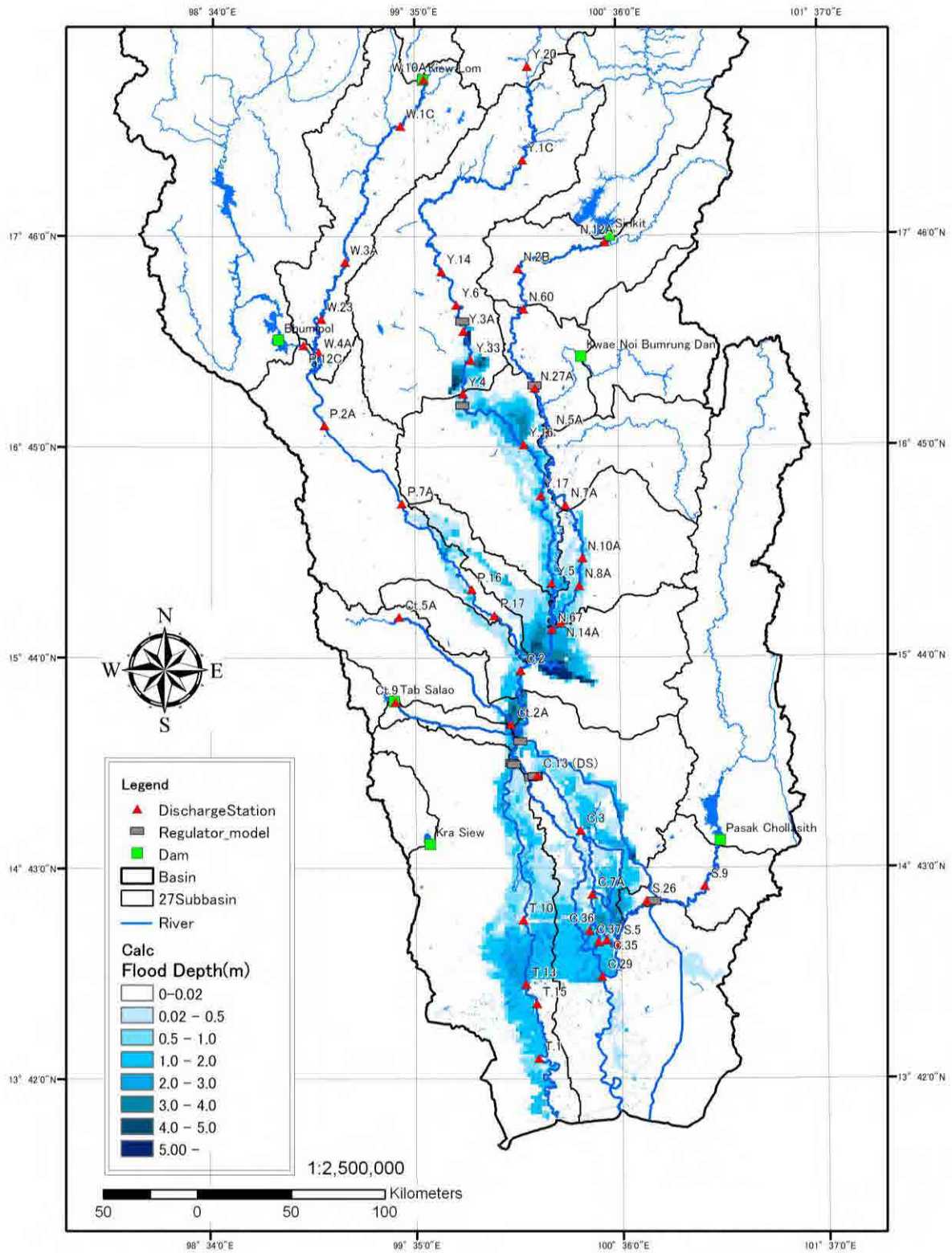


Figure D2.5.60 Diagrams of the Maximum Inundation Depth (Year 2011) (Case 10-7)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River without Gate, Right
and Left Flood Protection Wall of Tha Chin River)

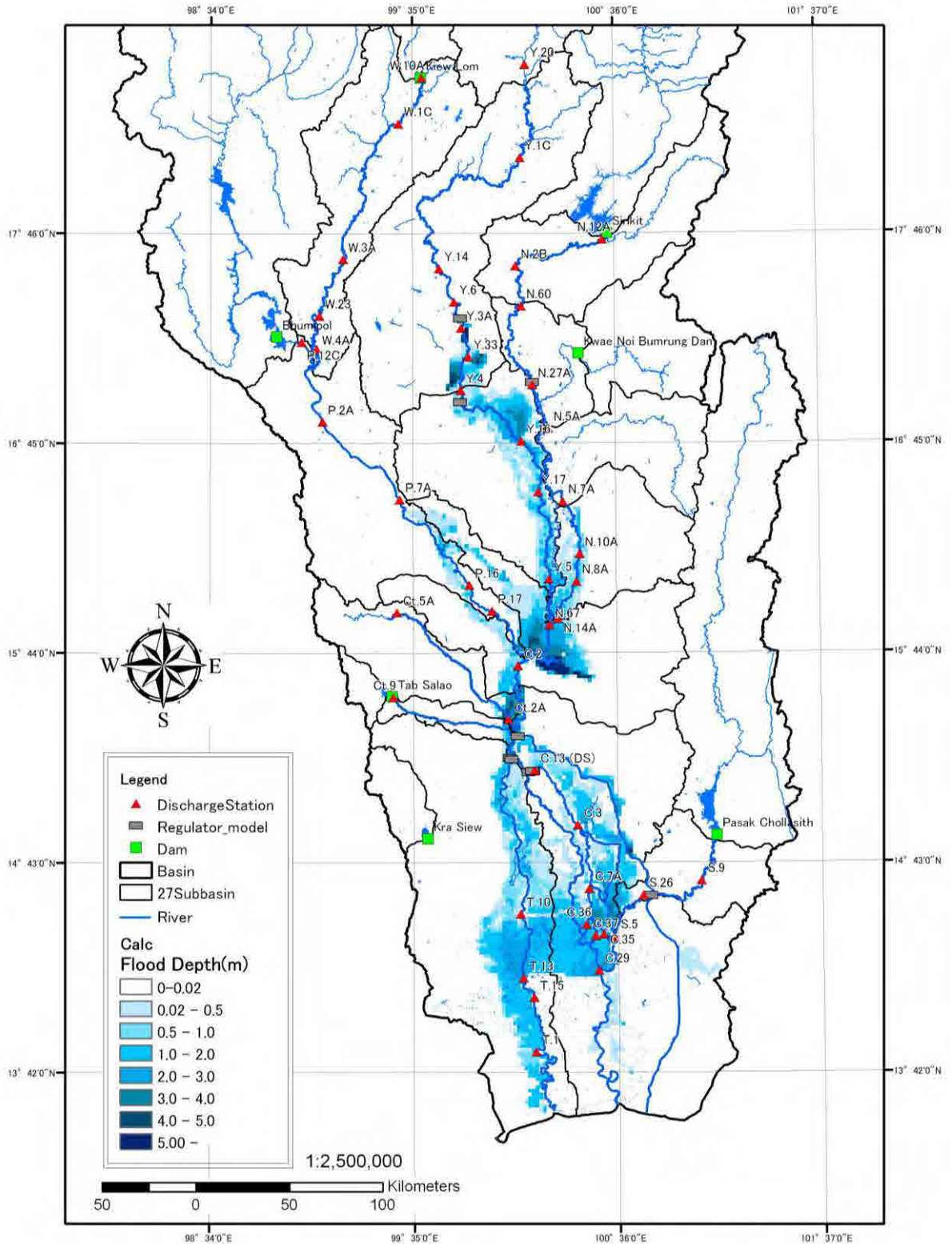


Figure D2.5.61 Diagrams of the Maximum Inundation Depth (Year 2011) (Case11-0)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 500 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River without Gate, Left
Flood Protection Wall of Tha Chin River)

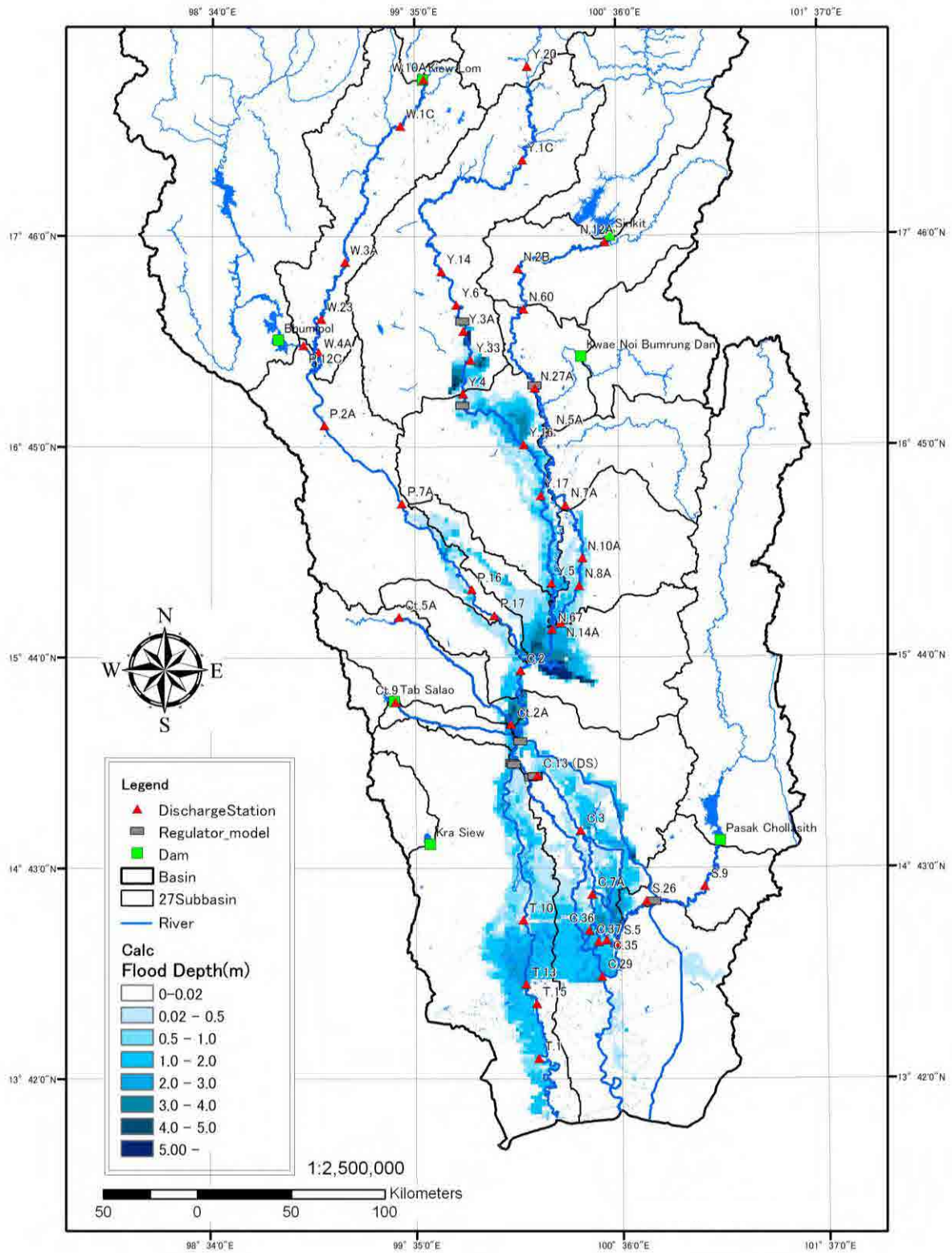


Figure D2.5.62 Diagrams of the Maximum Inundation Depth (Year 2011) (Case11-1)
(C5-2 : Ayutthaya Diversion Channel 1,400m³/s, C6-2 : Central Diversion Channels 1,000 m³/s,
C7 : Effective Operation of Existing Dams, 4 Short Cuts of Tha Chin River without Gate, Left
Flood Protection Wall of Tha Chin River)

D2.5.4 Time-Series Data at Inundation Block

Time-series data about inundated volume, depth, and area at each inundation blocks as shown in Figure D2.5.63 shall be presented.

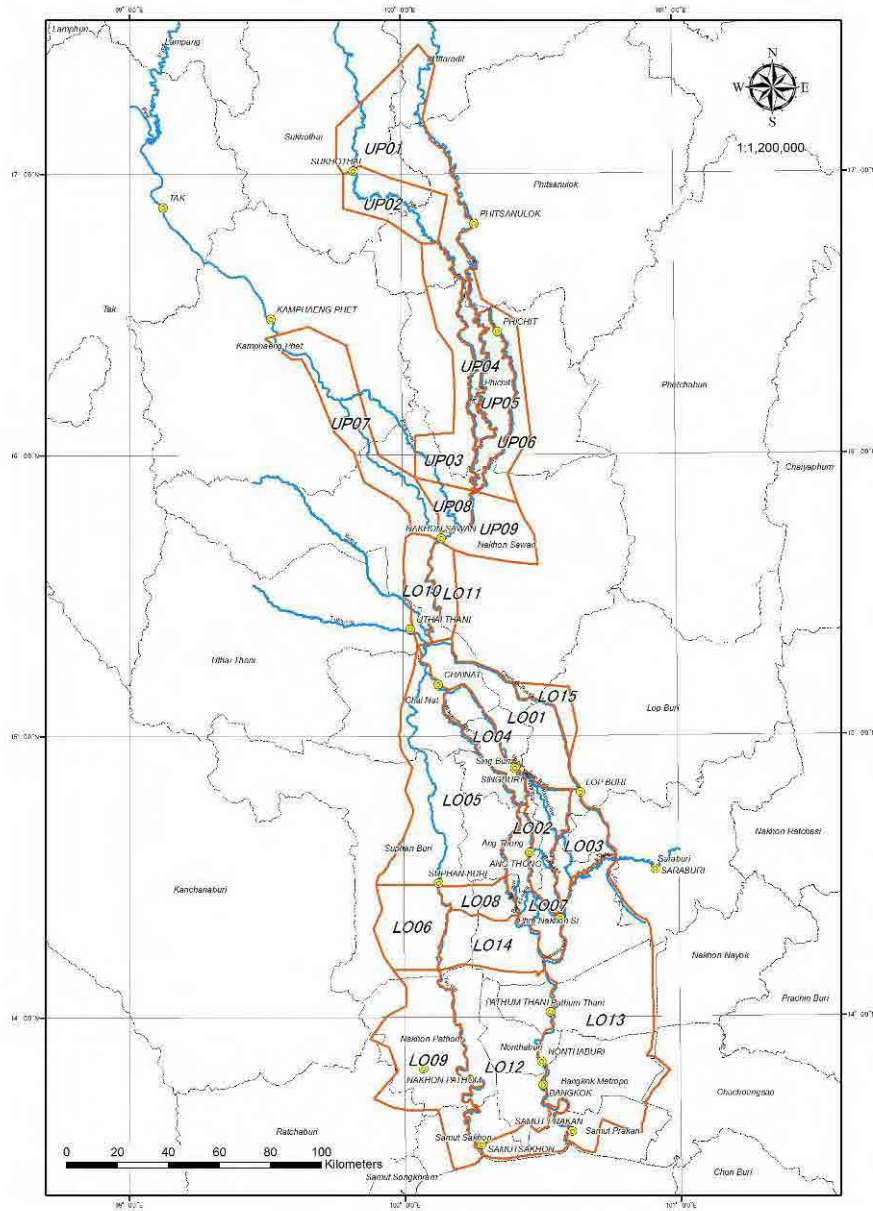


Figure- Proposed Inundation Block

Figure D2.5.63 Location of Inundation Block

(1) Inundated Volume

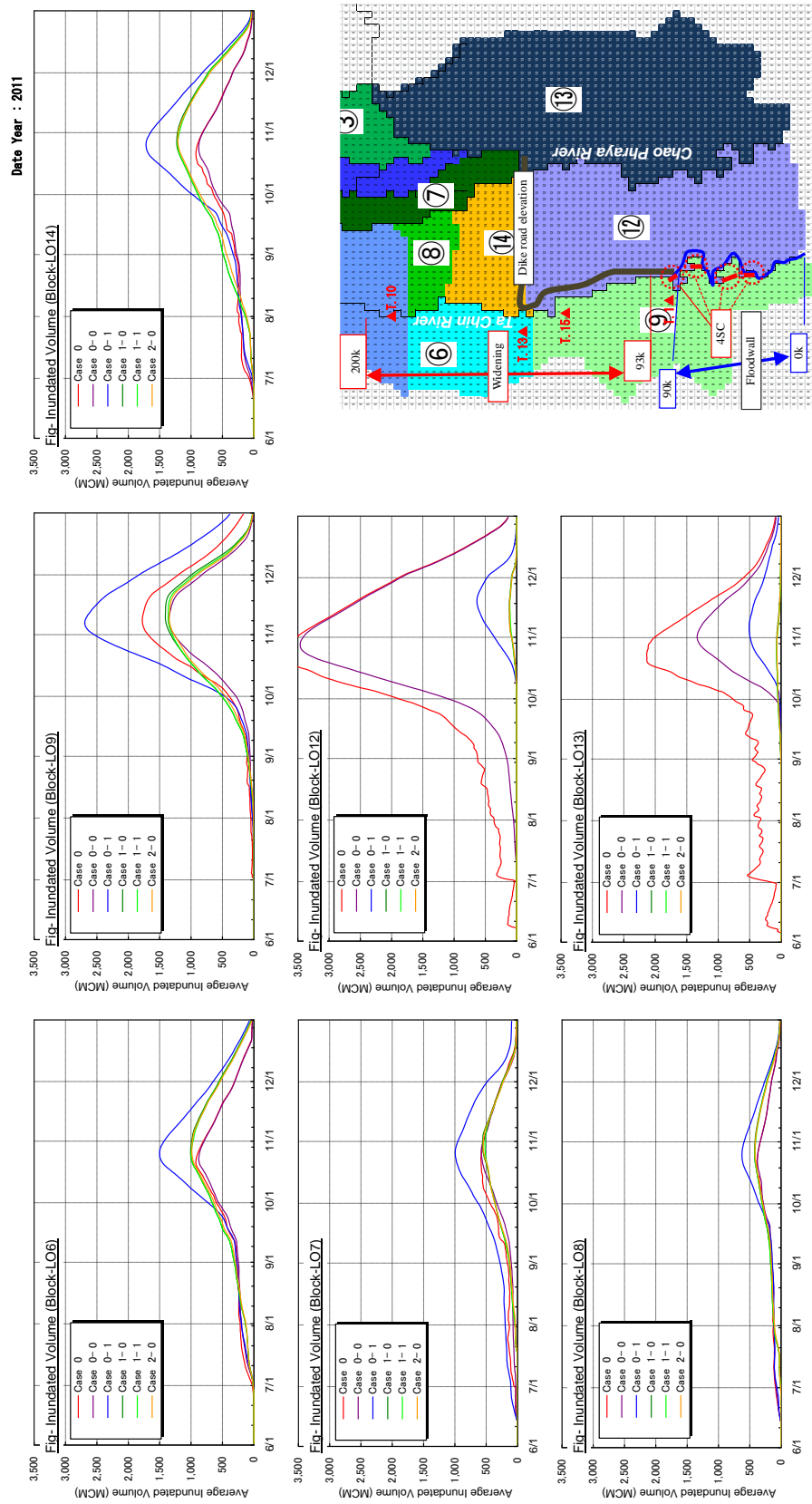


Figure D2.5.64 Time-Series Diagrams of Inundated Volume by Block (Case 0, 0-0, 0-1, 1-0, 1-1 and 2-0 of 2011 flood)

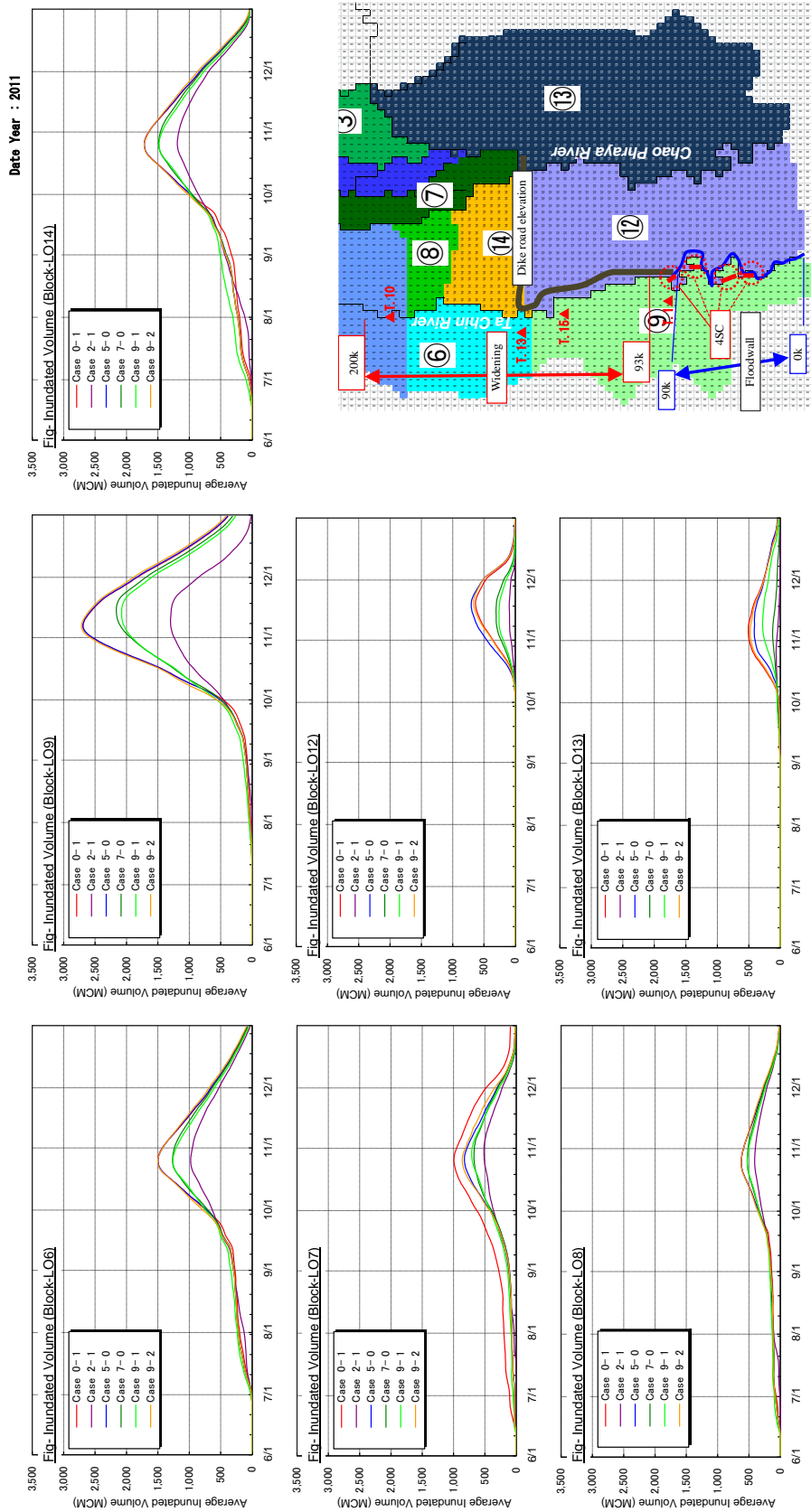


Figure D2.5.65 Time-Series Diagrams of Inundated Volume by Block (Case 0-1, 2-1, 5-0, 7-0, 9-1 and 9-2 of 2011 flood)

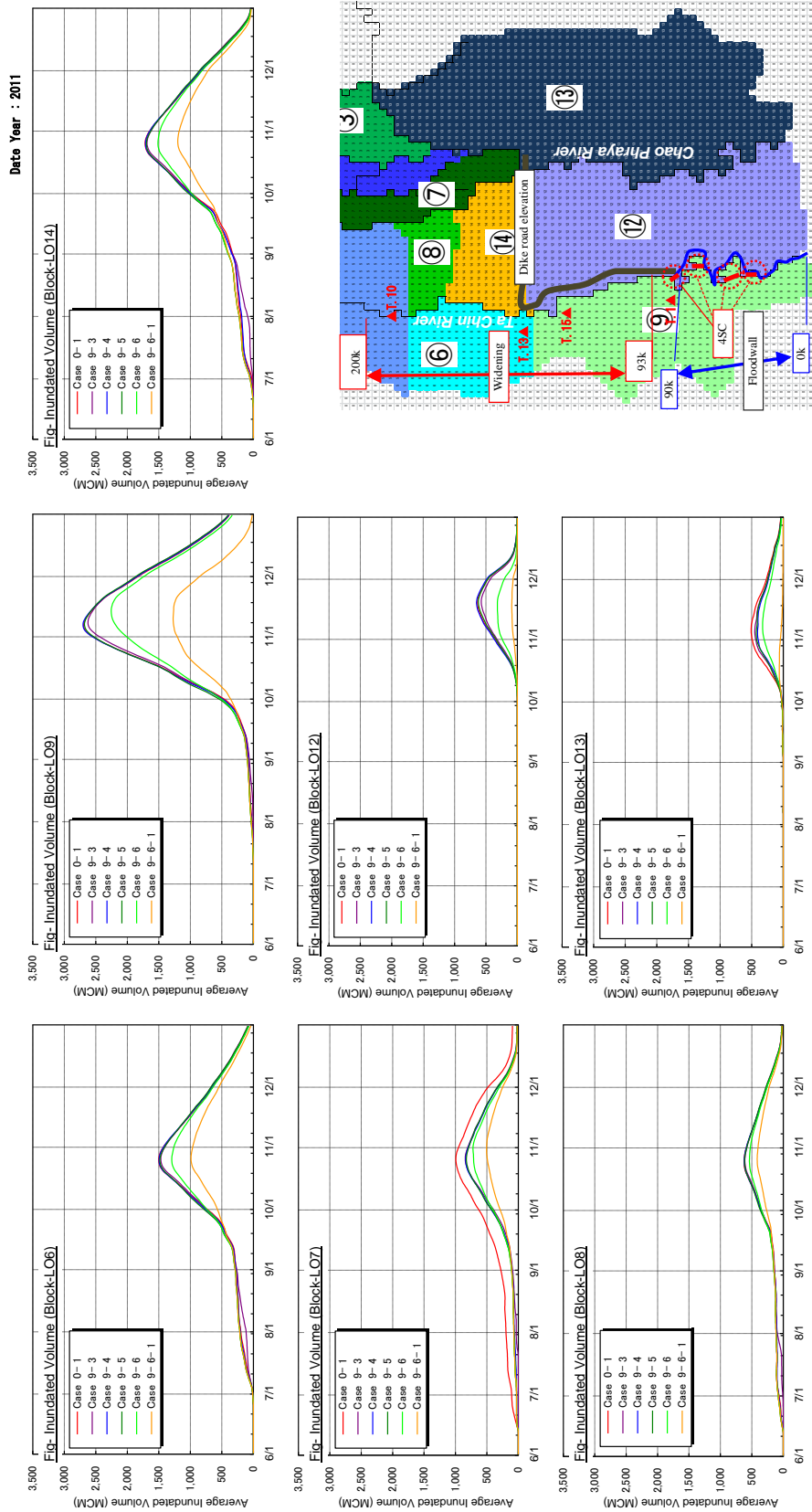


Figure D2.5.66 Time-Series Diagrams of Inundated Volume by Block (Case 0-1, 9-3, 9-4, 9-5, 9-6 and 9-6-1 of 2011 flood)

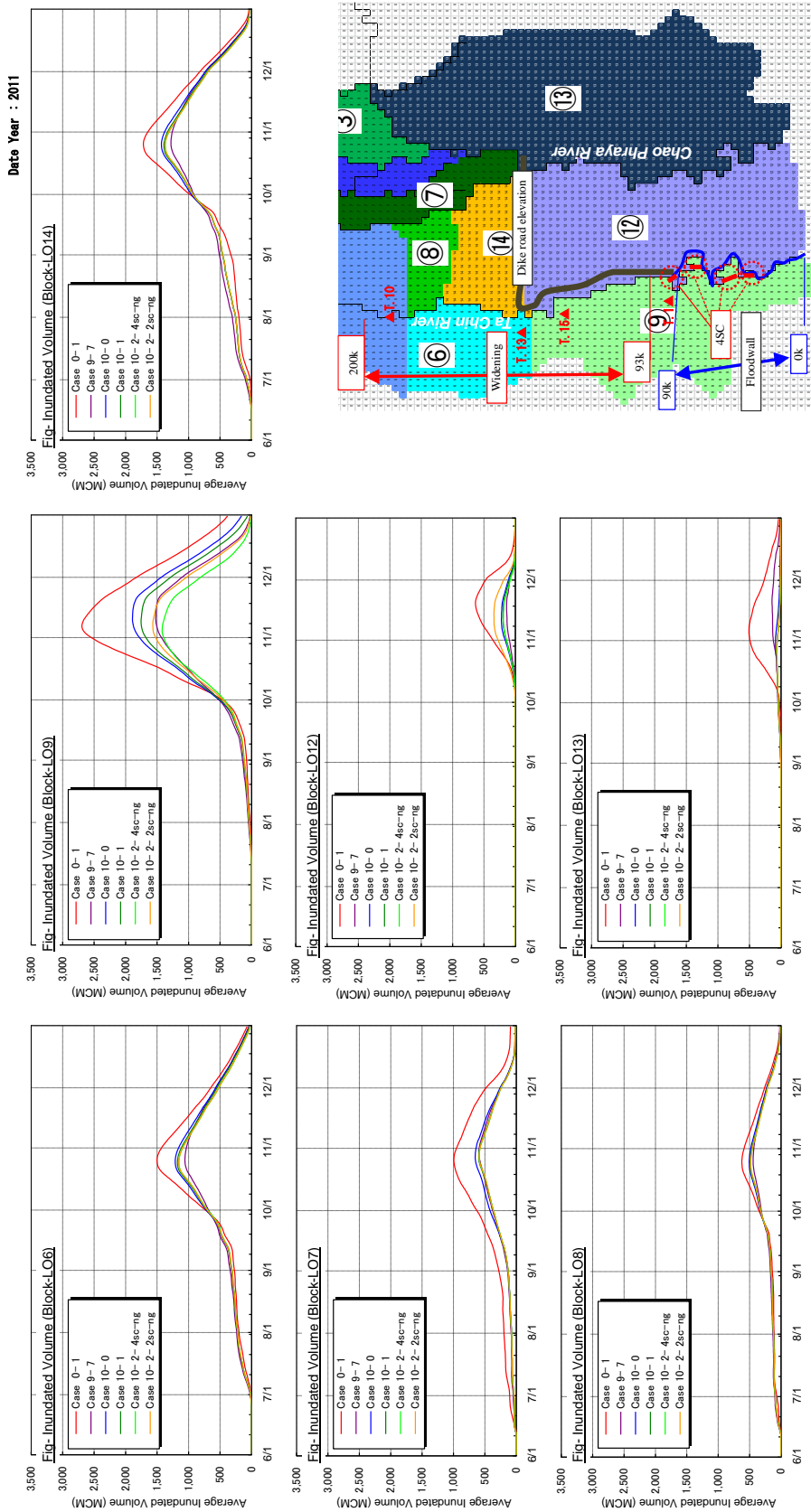


Figure D2.5.67 Time-Series Diagrams of Inundated Volume by Block (Case 0-1, 9-7, 10-0, 10-1, 10-2-4sc-ng and 10-2-2sc-ng of 2011 flood)

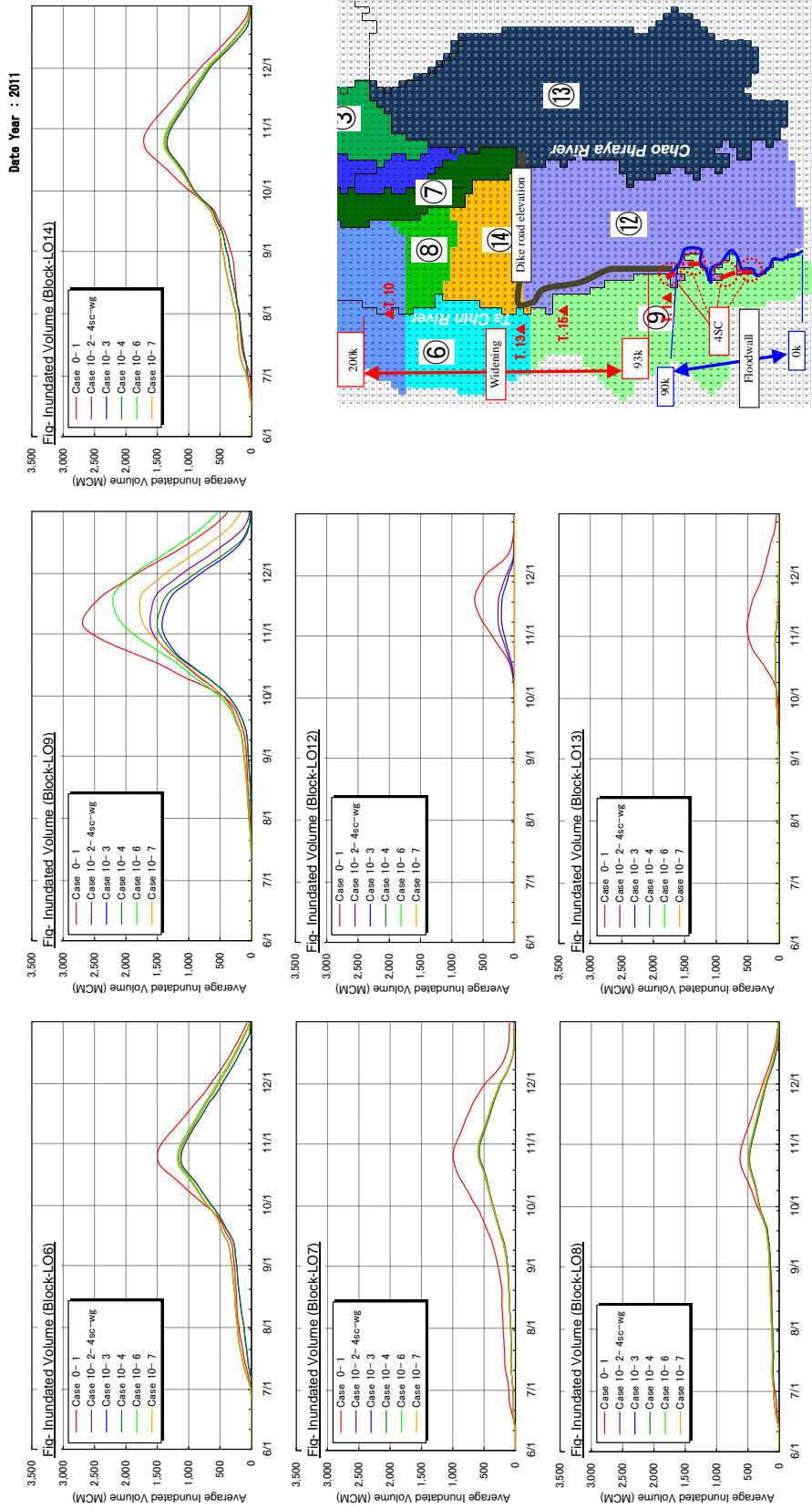


Figure D2.5.68 Time-Series Diagrams of Inundated Volume by Block (Case 0-1, 10-2-4sc-wg, 10-3, 10-4, 10-6 and 10-7 of 2011 flood)

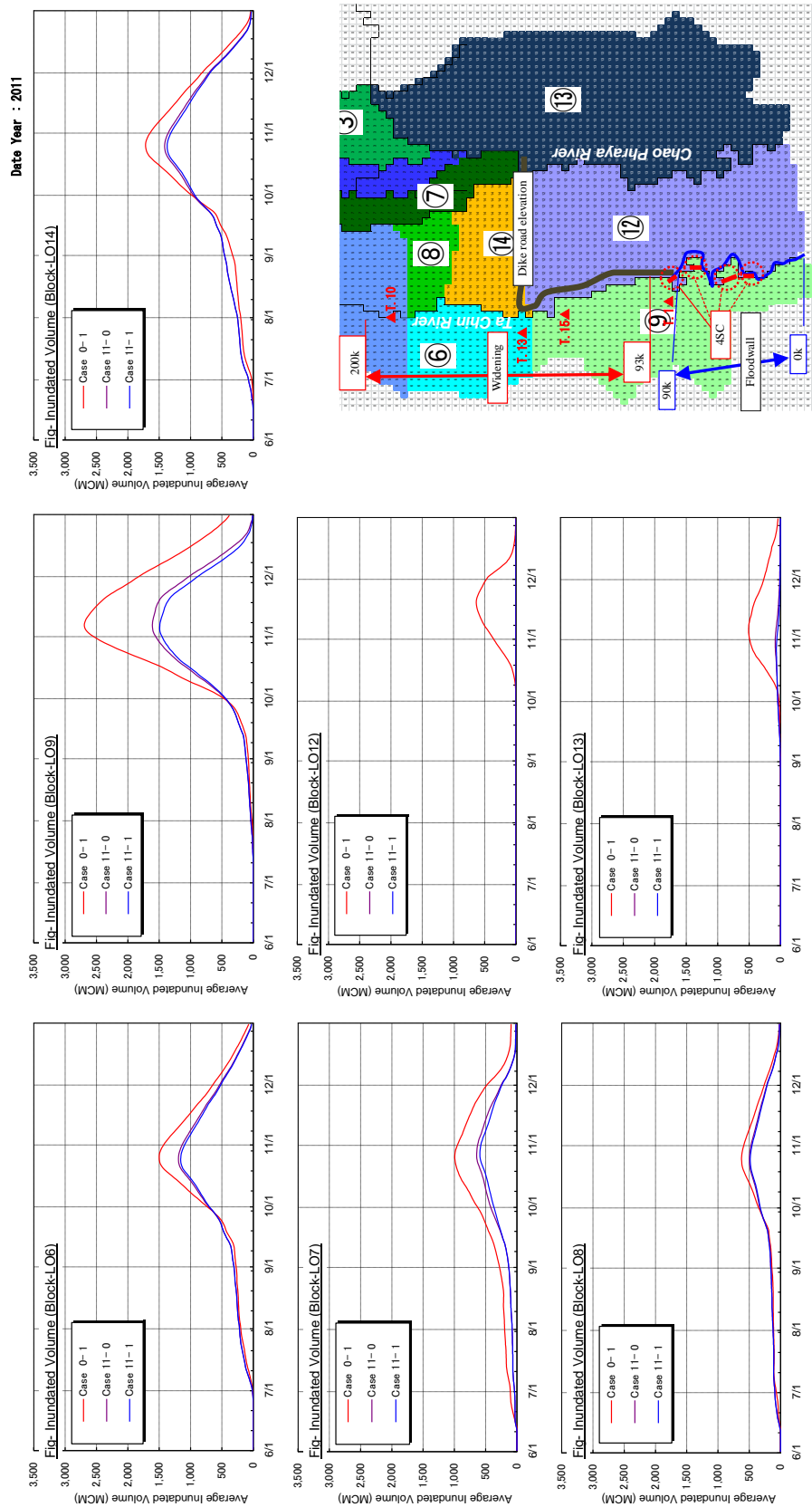


Figure D2.5.69 Time-Series Diagrams of Inundated Volume by Block (Case 0-1, 11-0 and 11-1 of 2011 flood)

(2) Average Inundated Depth

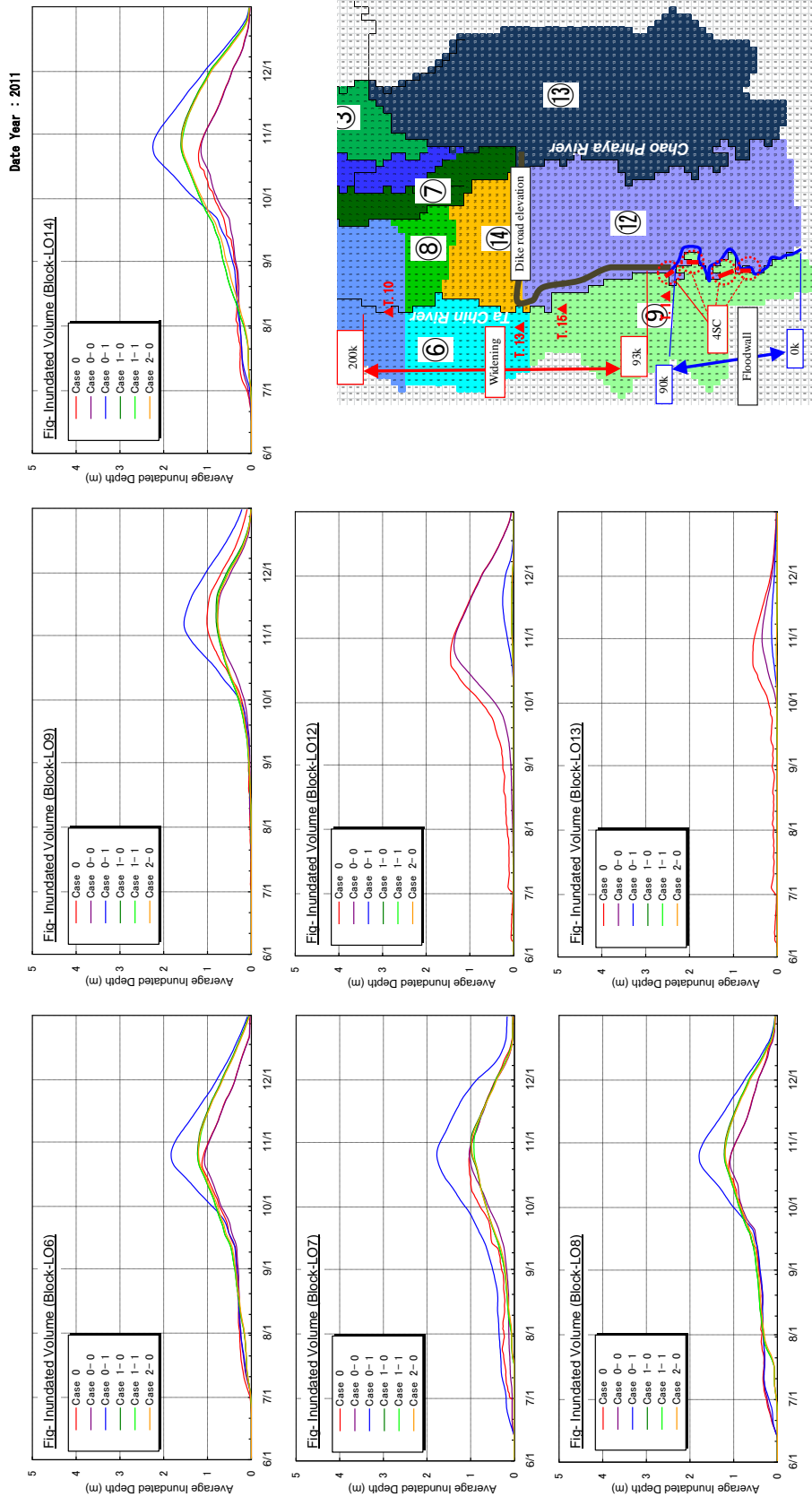
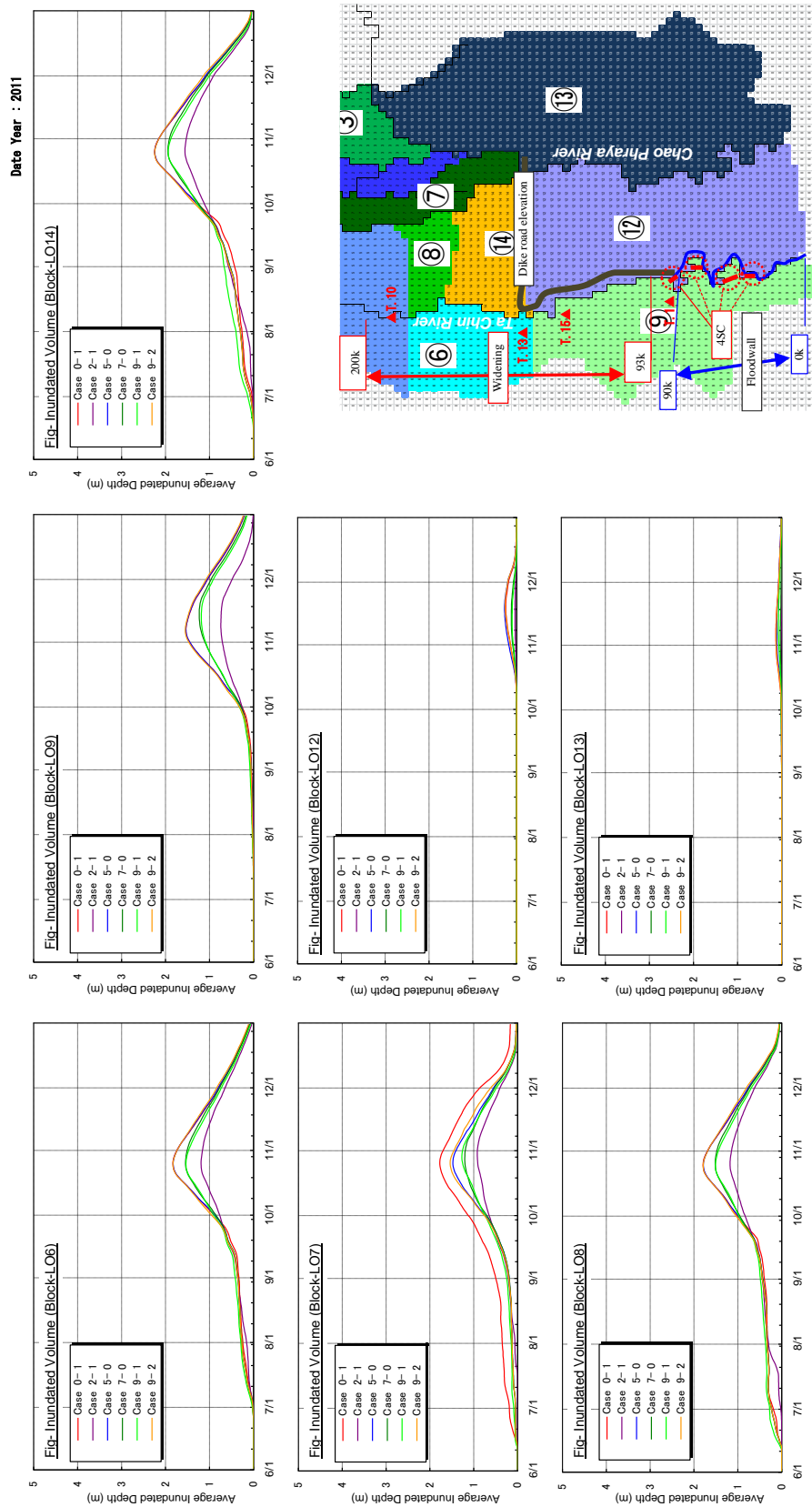


Figure D2.5.70 Time-Series Diagrams of Inundated Depth by Block (Case 0, 0-0, 0-1, 1-0, 1-1 and 2-0 of 2011 flood)



Average Inundated Depth (m) = Inundated Volume (MCM) / Inundated Area (km²)

Figure D2.5.71 Time-Series Diagrams of Inundated Depth by Block (Case 0-1, 2-1, 5-0, 7-0, 9-1 and 9-2 of 2011 flood)

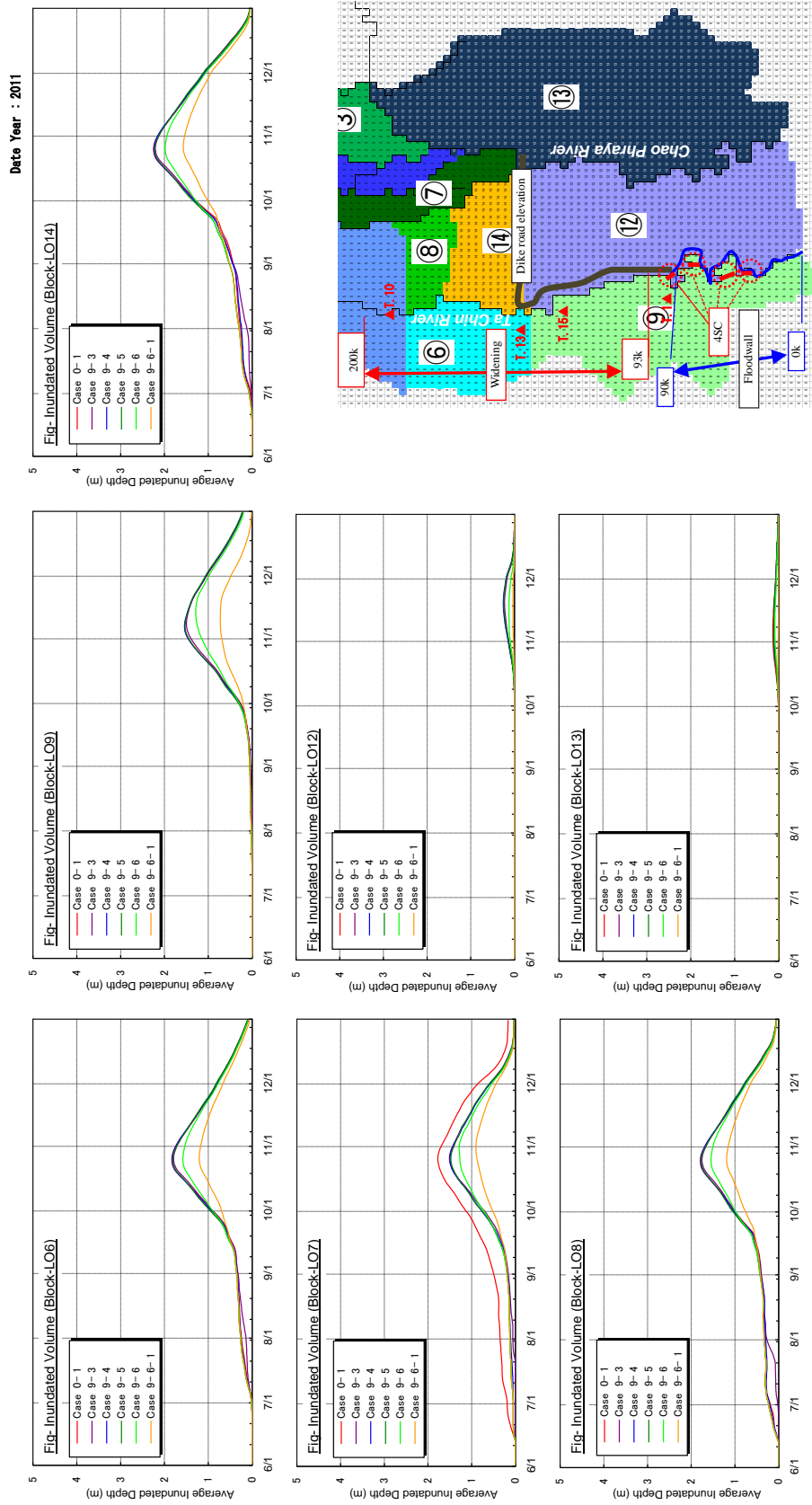


Figure D2.5.72 Time-Series Diagrams of Inundated Depth by Block (Case 0-1, 9-3, 9-4, 9-5, 9-6 and 9-6-1 of 2011 flood)

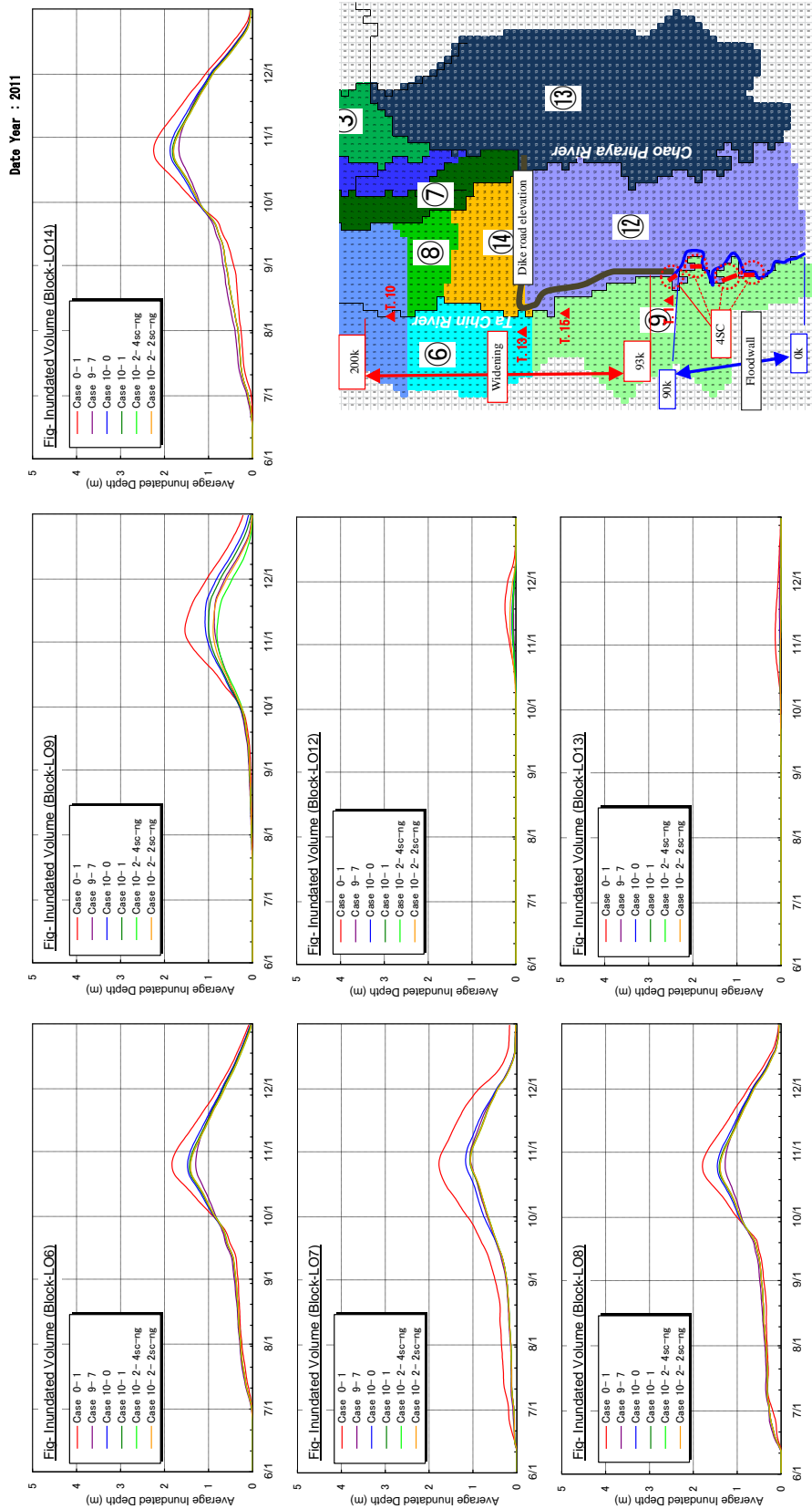


Figure D2.5.73 Time-Series Diagrams of Inundated Depth by Block (Case 0-1, 9-7, 10-0, 10-1, 10-2-4sc-ng and 10-2-2sc-ng of 2011 flood)

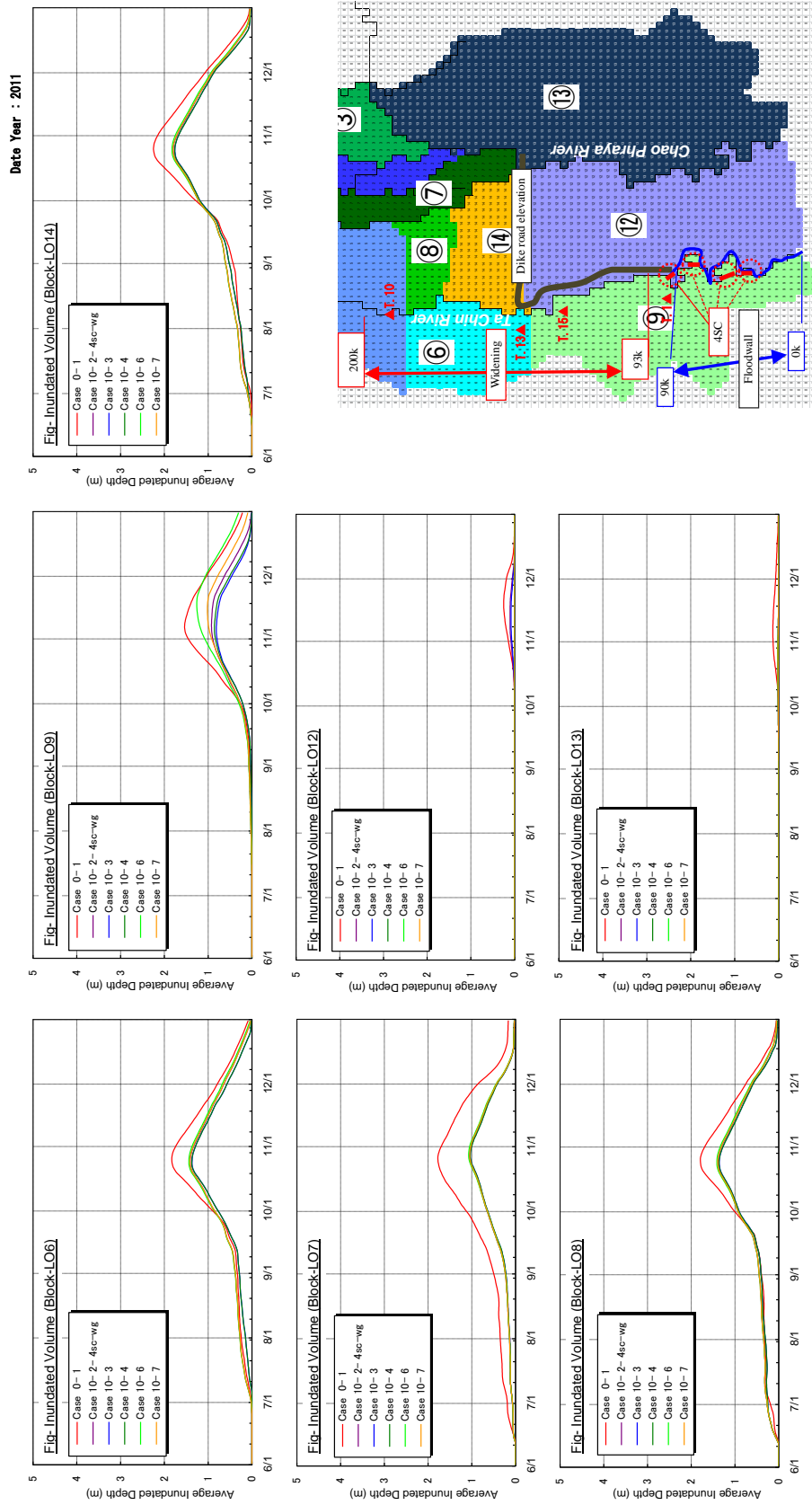


Figure D2.5.74 Time-Series Diagrams of Inundated Depth by Block (Case 0-1, 10-2-4sc-wg, 10-3, 10-4, 10-6 and 10-7 of 2011 flood)

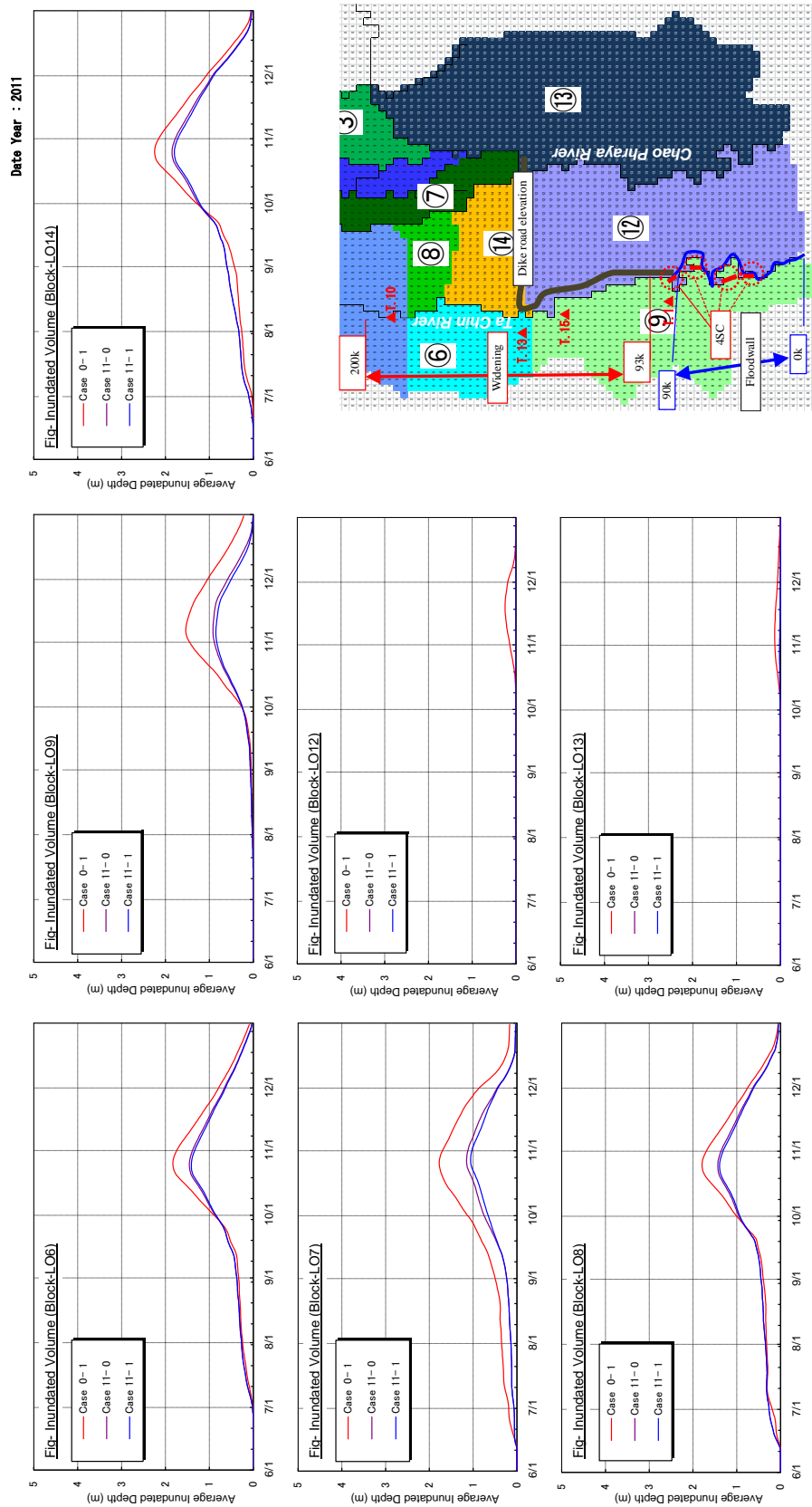


Figure D2.5.75 Time-Series Diagrams of Inundated Depth by Block (Case 0-1, 11-0 and 11-1 of 2011 flood)

(3) Inundated Area

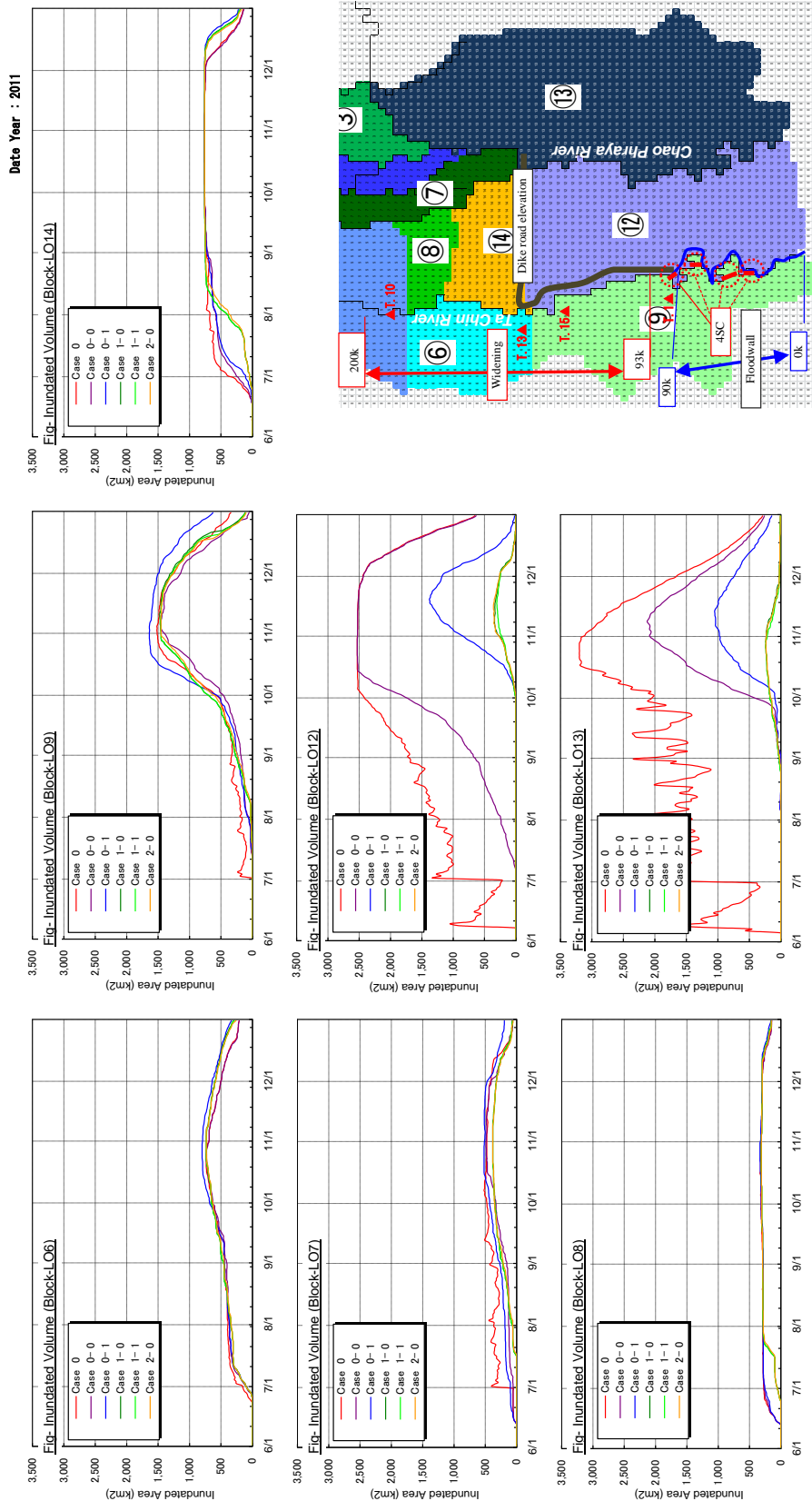


Figure D2.5.76 Time-Series Diagrams of Inundated Area by Block (Case 0, 0-0, 0-1, 1-0, 1-1 and 2-0 of 2011 flood)

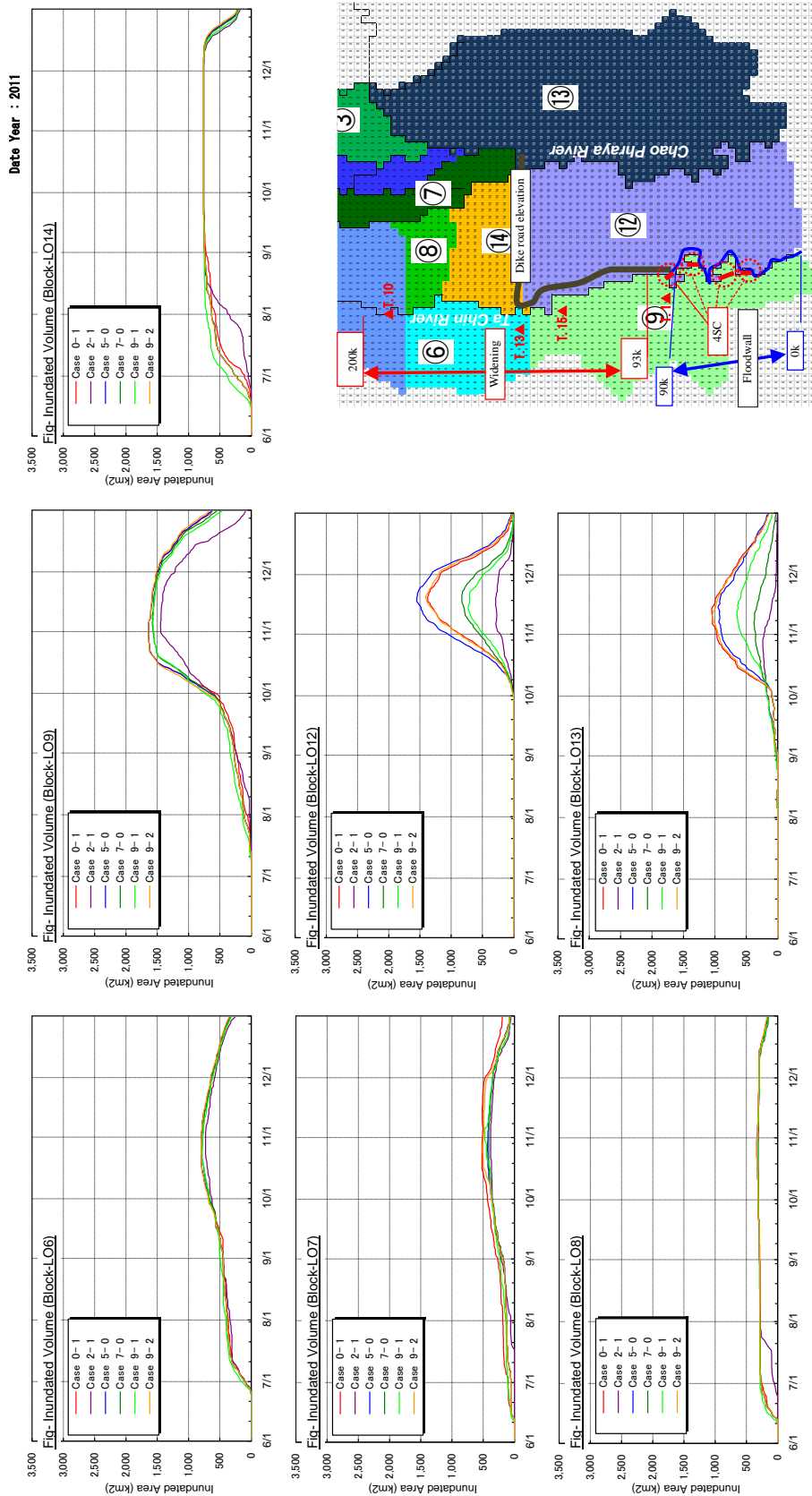


Figure D2.5.77 Time-Series Diagrams of Inundated Area by Block (Case 0-1, 2-1, 5-0, 7-0, 9-1 and 9-2 of 2011 flood)

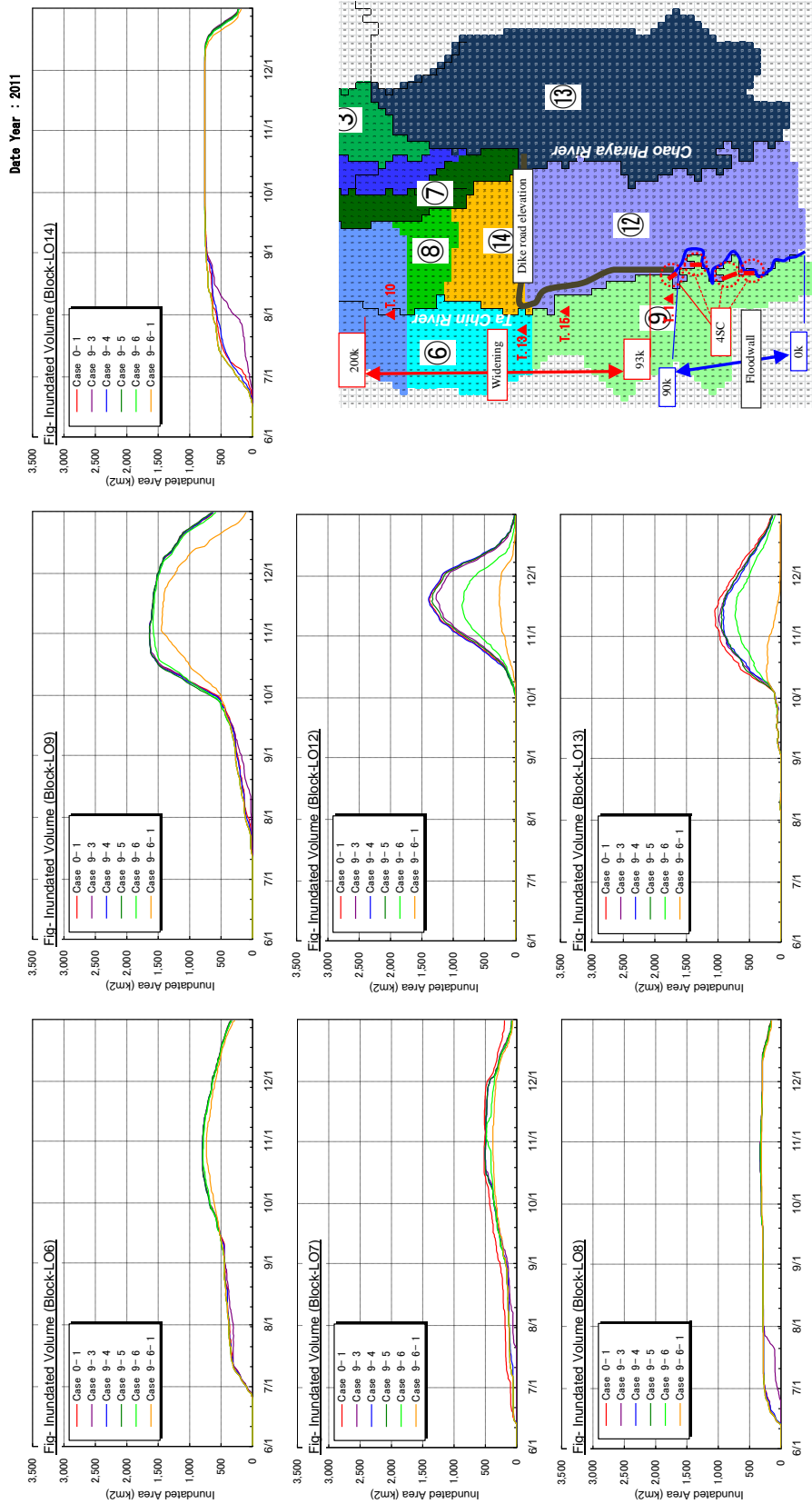


Figure D2.5.78 Time-Series Diagrams of Inundated Area by Block (Case 0-1, 9-3, 9-4, 9-5, 9-6 and 9-6-1 of 2011 flood)

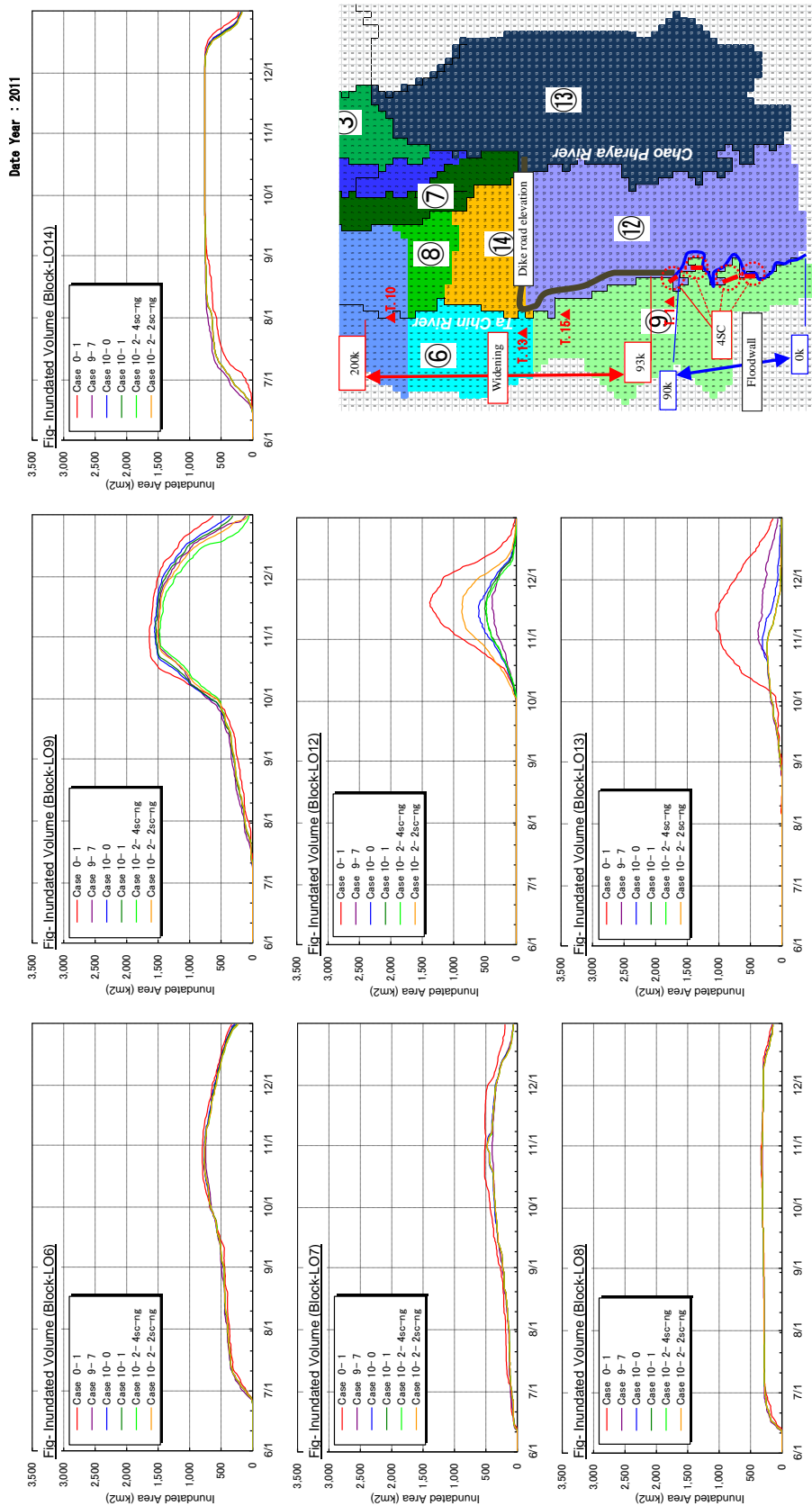


Figure D2.5.79 Time-Series Diagrams of Inundated Area by Block (Case 0-1, 9-7, 10-0, 10-1, 10-2-4sc-ng and 10-2-2sc-ng of 2011 flood)

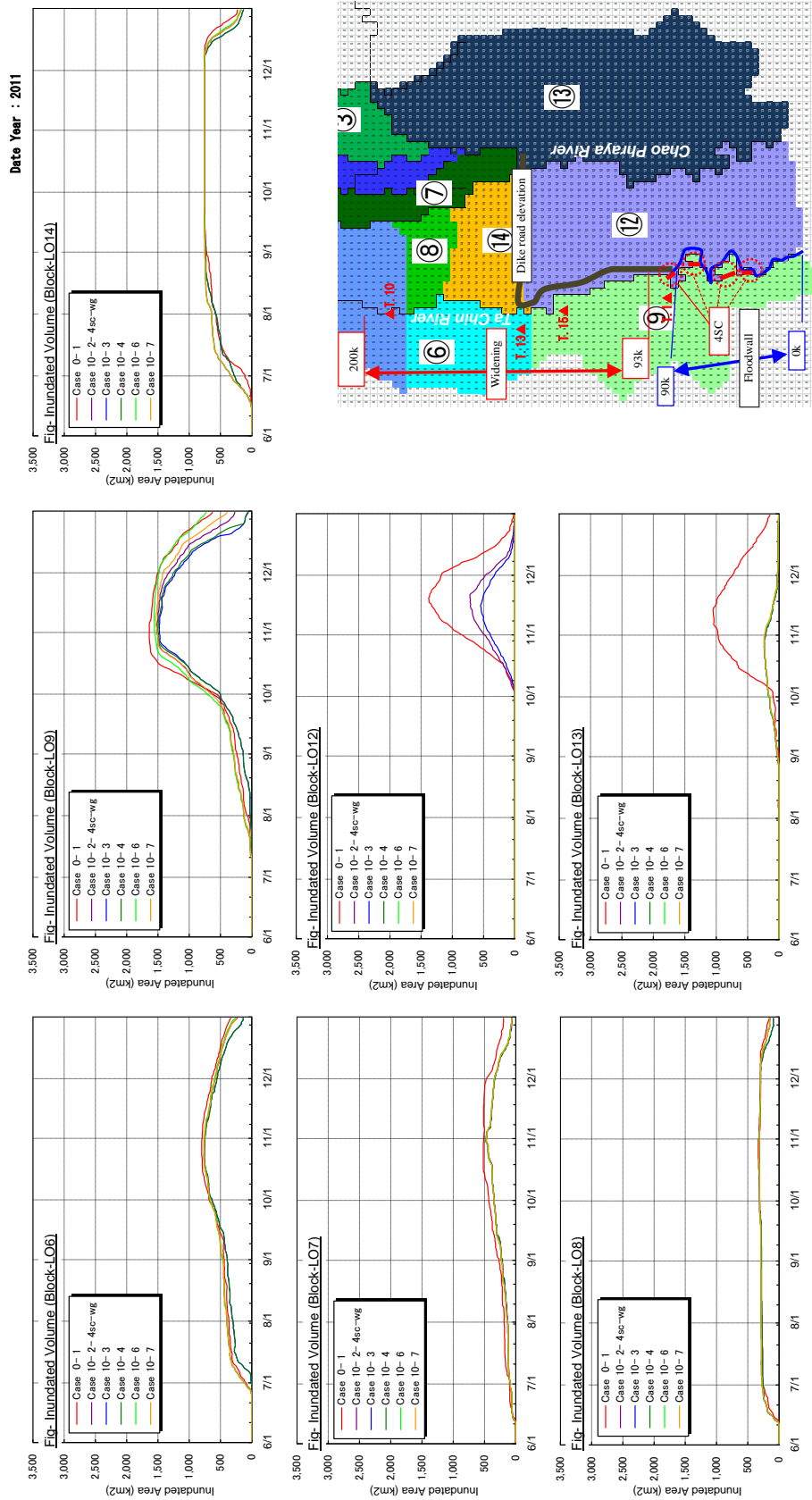


Figure D2.5.80 Time-Series Diagrams of Inundated Area by Block (Case 0-1, 10-2-4sc-wg, 10-3, 10-4, 10-6 and 10-7 of 2011 flood)

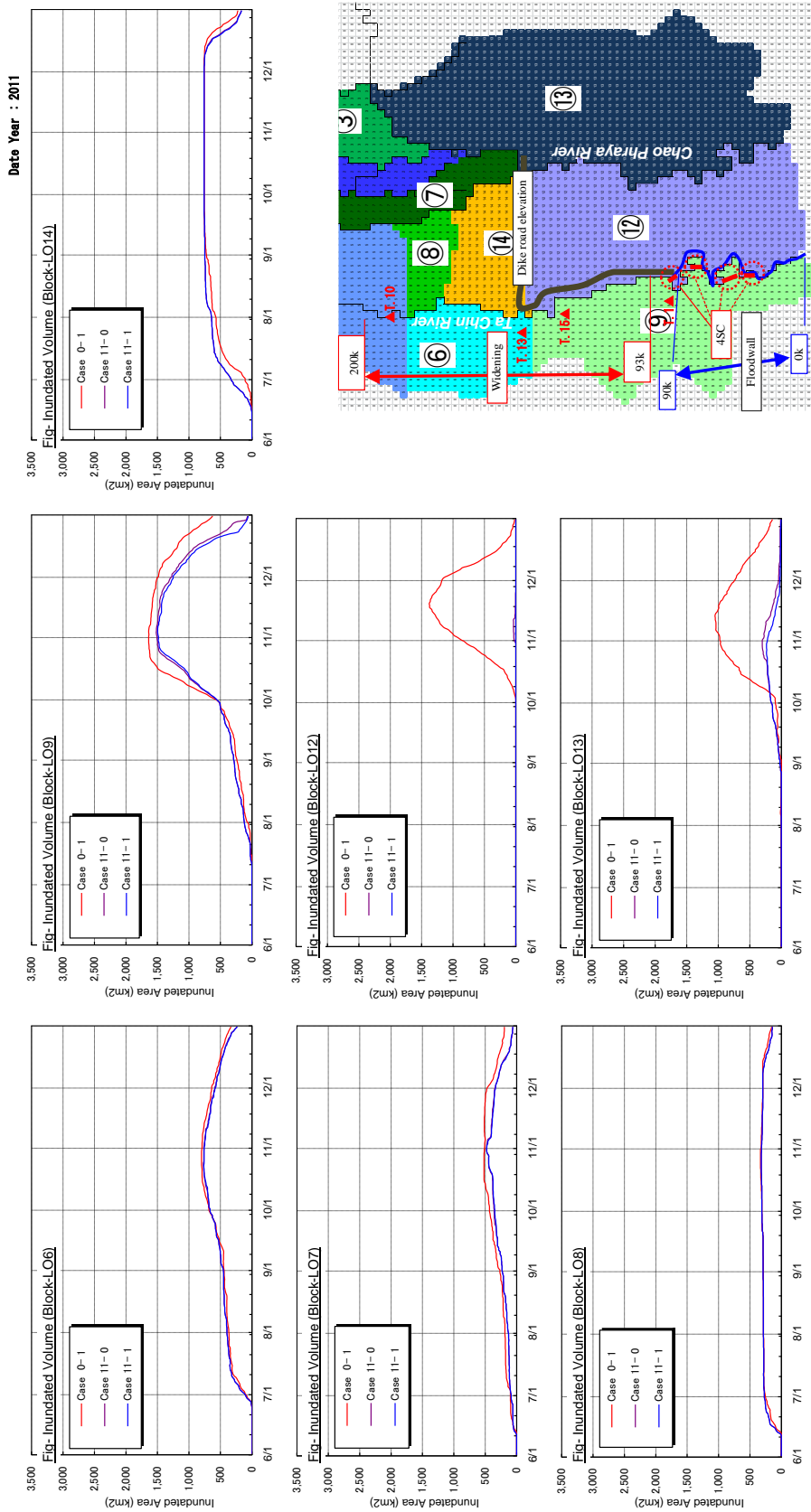


Figure D2.5.81 Time-Series Diagrams of Inundated Area by Block (Case 0-1, 11-0 and 11-1 of 2011 flood)

D2.6 Hydraulic Examination (Different Flood Scale)

To understand the flood condition in different flood scale including discharge, inundated area, inundation depth and so on, additional flood analysis is done. In this study, the flood analysis under 5-year, 10-year, 30-year, 50-year and 100-year return period is conducted for estimation of B/C (refer to Chapter 11).

Table D2.6.2 and Table D2.6.3 show the discharge at major point in Chao Phraya River in different flood scale, and the longitudinal profiles of discharge and water level are shown in Figure D2.6.1 to Figure D2.6.4.

Table D2.6.1 Probable Rainfall in Chao Phraya River Basin

Return Period	Rainfall (mm/6month)	
	Upper Nakhon Sawan (C.2)	Whole Basin
	Area: 105,000km ²	Area: 163,000km ²
5	1,209	1,165
10	1,278	1,227
30	1,371	1,311
50	1,410	1,346
100	1,459	1,390

*Rainfall Duration: 6 month, equal to 183days
Probability density function: LN2PM

Table D2.6.2 Discharge in Different Flood Scale (1/2)

Return Period	Peak Discharge (m ³ /s)						Remarks
	Case 0-1: Existing Condition			Case 1-1: SCWRM M/P Full Menu			
	Nakhon Sawan	Ayutthaya	Bang Sai	Nakhon Sawan	Ayutthaya	Bang Sai	
M/P Study	4,800	1,100	4,300	4,200	1,000	3,500	
5	3,800	900	3,000	3,200	700	1,800	Different flood scale
10	4,000	900	3,400	3,500	750	2,100	
30	4,500	1,000	3,800	3,800	800	2,400	
50	4,700	1,050	4,100	4,000	900	3,000	
100	4,800	1,100	4,300	4,200	1,000	3,500	

Table D2.6.3 Discharge in Different Flood Scale (2/2)

Return Period	Peak Discharge (m ³ /s)						Remarks
	Case 11-0: Proposed Combination 1			Case 11-1: Proposed Combination 2			
	Nakhon Sawan	Ayutthaya	Bang Sai	Nakhon Sawan	Ayutthaya	Bang Sai	
M/P Study	4,400	300	3,800	4,400	300	3,500	Design flood
5	3,400	300	2,300	3,400	300	1,900	Different flood scale
10	3,600	300	2,900	3,600	300	2,300	
30	4,000	300	3,300	4,000	300	2,800	
50	4,200	300	3,600	4,200	300	3,200	
100	4,400	300	3,800	4,400	300	3,500	

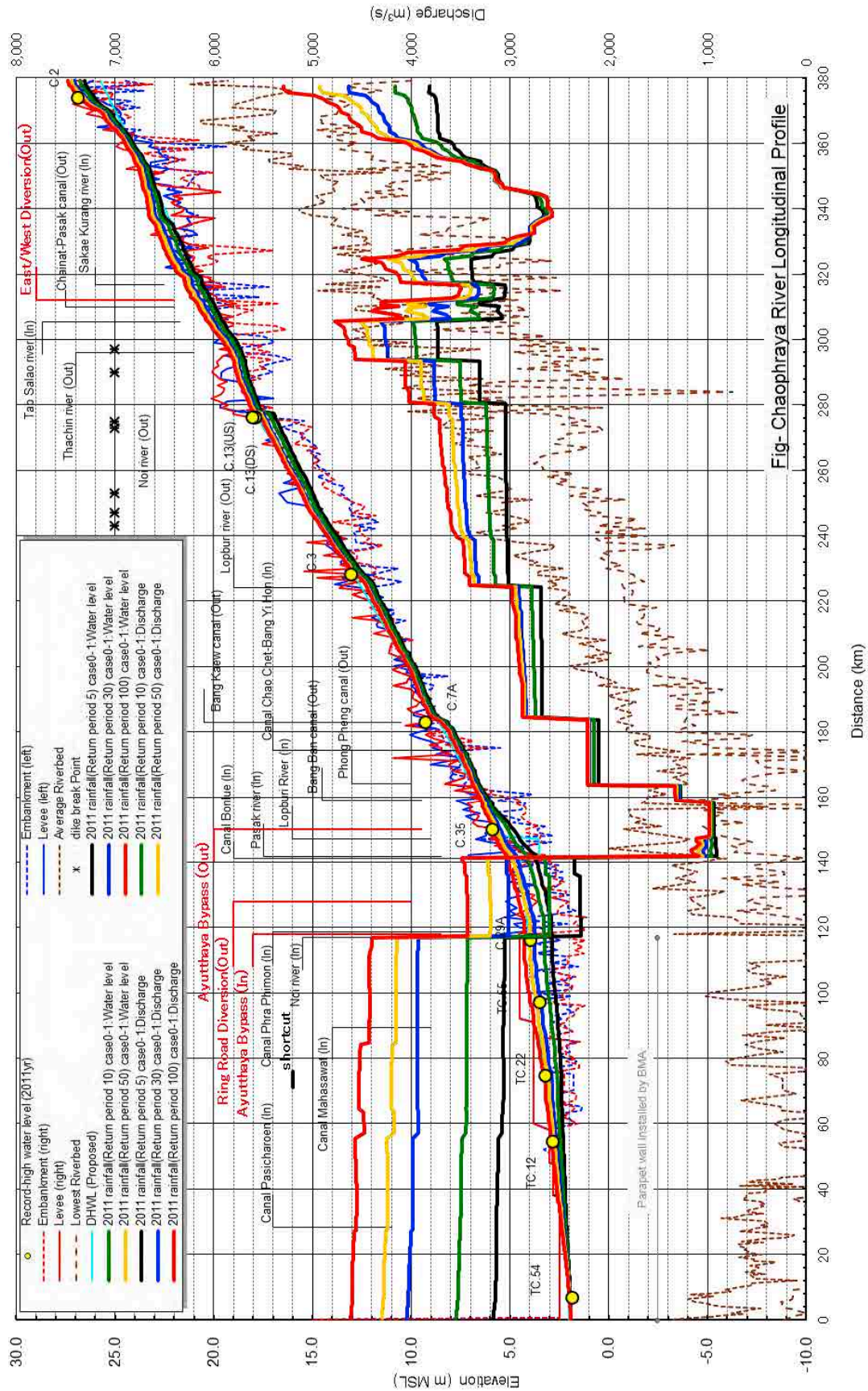


Figure D2.6.1 Longitudinal Profiles of River Discharge and Water Level with Different Flood Scale (Case 0-1)

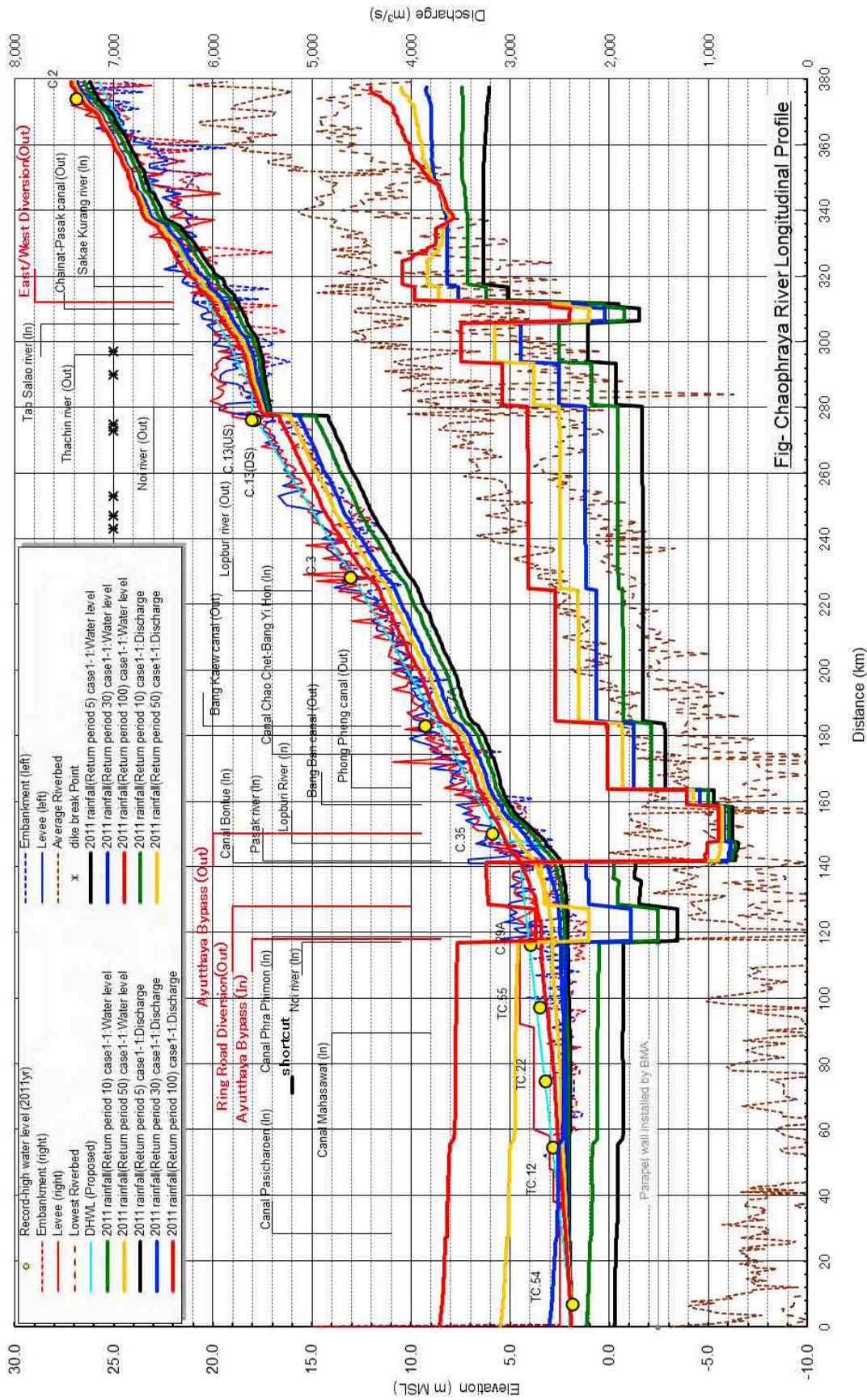


Figure D2.6.2 Longitudinal Profiles of River Discharge and Water Level with Different Flood Scale (Case 1-1)

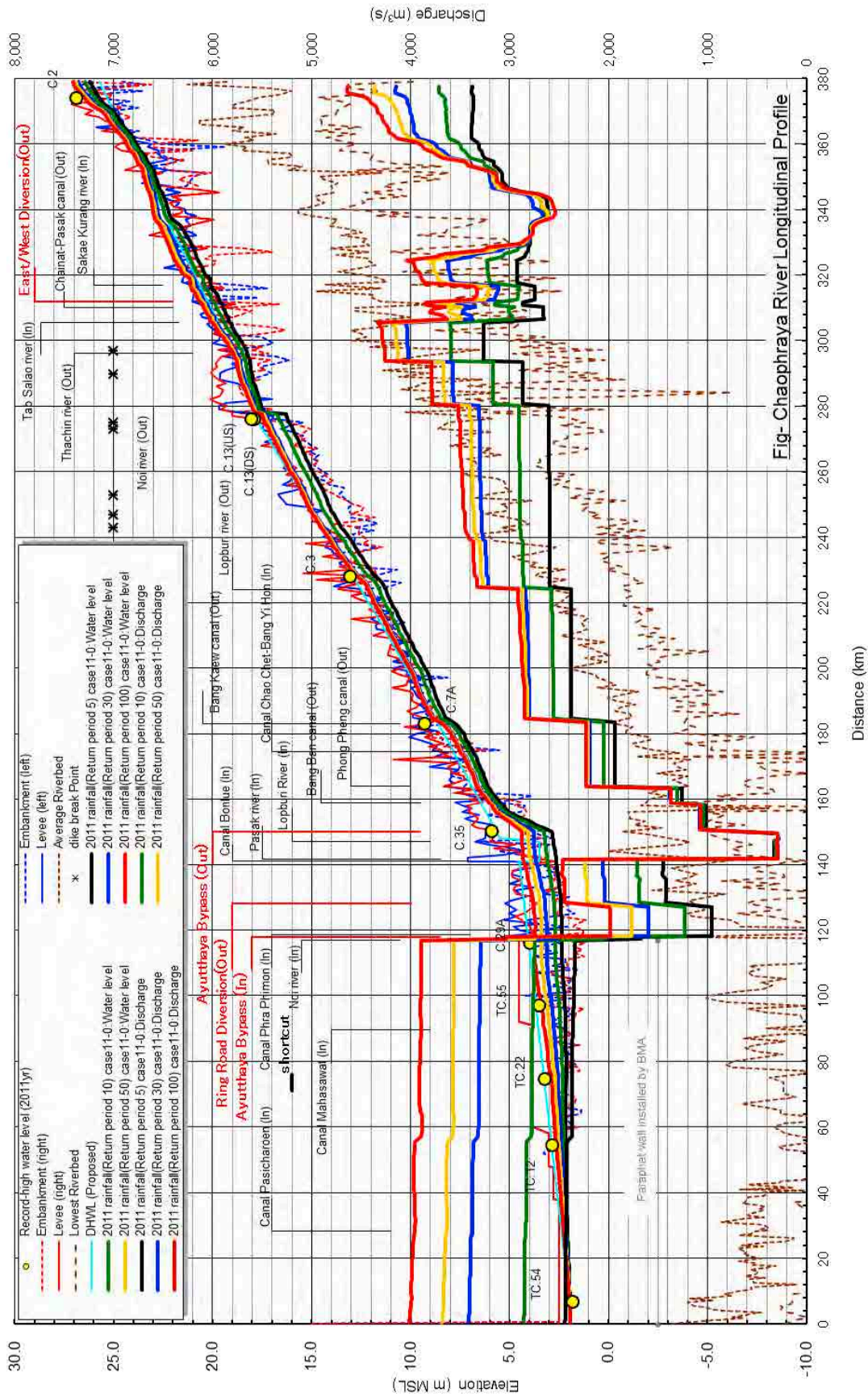


Fig- Chaophraya River Longitudinal Profile

Figure D2.6.3 Longitudinal Profiles of River Discharge and Water Level with Different Flood Scale (Case 11-0)

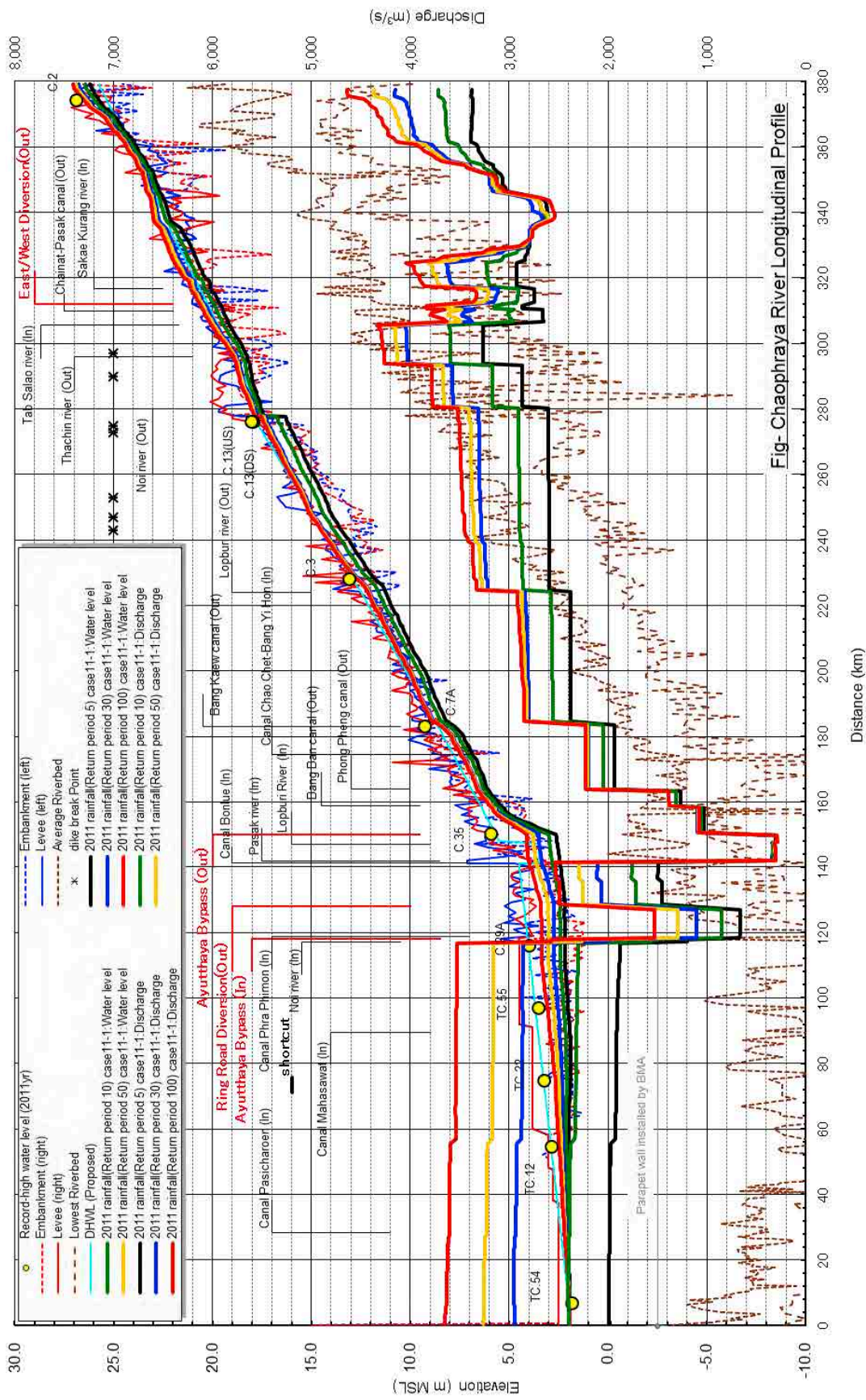


Figure D2.6.4 Longitudinal Profiles of River Discharge and Water Level with Different Flood Scale (Case 11-1)

***Sector E: Evaluation of Countermeasures
with Other Rainfall Pattern***

**PROJECT FOR THE COMPREHENSIVE FLOOD MANAGEMENT PLAN
FOR THE CHAO PHRAYA RIVER BASIN**

**FINAL REPORT
VOLUME 3: SUPPORTING REPORT**

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CHAPTER E1 STUDY CASE

E1.1 Calculation Case

The list of calculation case and condition are shown in following table.

Table E1.1.1 List of Calculation Case

Study Case	Rainfall in the Downstream Area	Dike Breaching	Protection of the economic zone	Dike raising on Chao phraya river and peak river based on the BMA and DOH	Improved operation	Construction of dam(new)	Improvement of the retention area(monkey check)	Dike raising up to 4.0 or 5m (all river/canal)	Construction of dike (east and/or west)	Construction of dike up to 0.5m (small river/canal)	Anythage in the BMA (1,400m ² /s)	Construction of central floodway (capacity 500m ³ /s)	Short cut of Tachin River	Widening of Tachin River	Flood protection wall of Tachin River	Flood protection wall of Tachin River	Flood protection wall of Tachin River	Flood protection wall of Tachin River
case0	•	•																
case0-0																		
case0-1			•															
case1			•															
case1-1			•															
case2			•															
case2-1			•															
case5			•															
case7			•															
case8			•															
case8-1			•															
case8-2			•															
case8-3			•															
case8-4			•															
case8-5			•															
case8-6			•															
case8-6-1			•															
case8-7			•															
case10-0			•															
case10-1			•															
case10-2-4sc-ng			•															
case10-2-2sc-ng			•															
case10-3-4sc-ng			•															
case10-4-4sc-ng			•															
case10-6			•															
case10-7-4sc-ng			•															
case11-0			•															
case11-1			•															

*1) 4 shortcut: No.1(75.9-87.1K), No.2(80.7-70.8K), No.3(83.3-4

*2) 2 shortcut: No.1(75.9-87.1K), No.2(80.7-70.8K)

Table E1.1.2 Calculation Condition

Target Flood	Item	Study conditions for 2011 proposed measures	(Enlarged) Calculation conditions for the 6 typical floods (1970,1975,1980,1994,1995,2006)
Runoff calculation	Evapotranspiration	0.8 times the observed values in 2011 (TMD)	0.8 times the averages of observed values during 1980-2011 (TMD)
	Rainfall	Observed values in 2011	Enlarged rate of representative 6 months 1970yr: x 1.128 1975yr: x 1.192 1980yr: x 1.152 1994yr: x 1.190 1995yr: x 1.130 2006yr: x 1.098
	Initial values for calculation	Water level on Jan 1, 2011 in the sequential calculation for the past 30 years.	Averages on Jan 1 for the past 30 years (Each average on Jan 1 during 1981-2011).
Inundation calculation	Runoff at the end of upstream	WANG	Observed discharges (W.10A) Calculated runoff in Basin 5+6
		PING	Water volume discharged from Bhumibol Dam (Discharges with current & modified operations)
		YOM	Observed discharges (Y.20) Calculated runoff in Basin 8
		NAN	Water volume discharged from Sirikit Dam (Discharges with current & modified operations)
		TAB SALAO	Observed water volume discharged from Tab Salao Dam Calculated runoff in Basin 22
		KRA SIEW	Observed water volume discharged from Kra Siew Dam Calculated runoff in Basin 26
		MAE WANG	Observed discharges (Ct.5A) Calculated runoff in Basin 21
		KWAE NOI	Water volume discharged from Kwae Noi Dam (Discharges with current & modified operations)
		PASAK	Water volume discharged from Pasak Dam (Discharges with current & modified operations)
	Tidal level	Observed values in 2011 • Chao Phraya: Pomprachul Station (16cm below the observed after correcting std. height) • Tha Chin: Samut Sakhon Station (34cm below the observed after correcting std. height)	
Evapotranspiration & Under seepage	Considering penetration and un-modeled discharge system, to set the average of pan evaporation for the past 30 years deriving from inundation meshes plus 10mm/day at most.		

CHAPTER E2 RESULT OF STUDY

E2.1 Effectiveness of the Countermeasures of M/P for the 2011 flood

The effectiveness of countermeasures proposed in M/P study against 2011 flood have been examined. The evaluation items were as follows: discharge, water level, inundation area/depth and inundated volume in flood plain.

E2.1.1 Discharge and Water Level in the Chao Phraya River and the Tha Chin River

The results express the following findings:

- In the mainstream of the Chao Phraya River, the peak flow in Ayutthaya area is drastically lowered due to the effects of the Ayutthaya Bypass Diversion Channel.
- In the Tha Chin River, dike road elevation enables much inundated water to inflow into river channels at the point 80km, but drainage capacity increases by installing short cut channels.

The longitudinal profile including calculated discharge and water level is shown in next page.

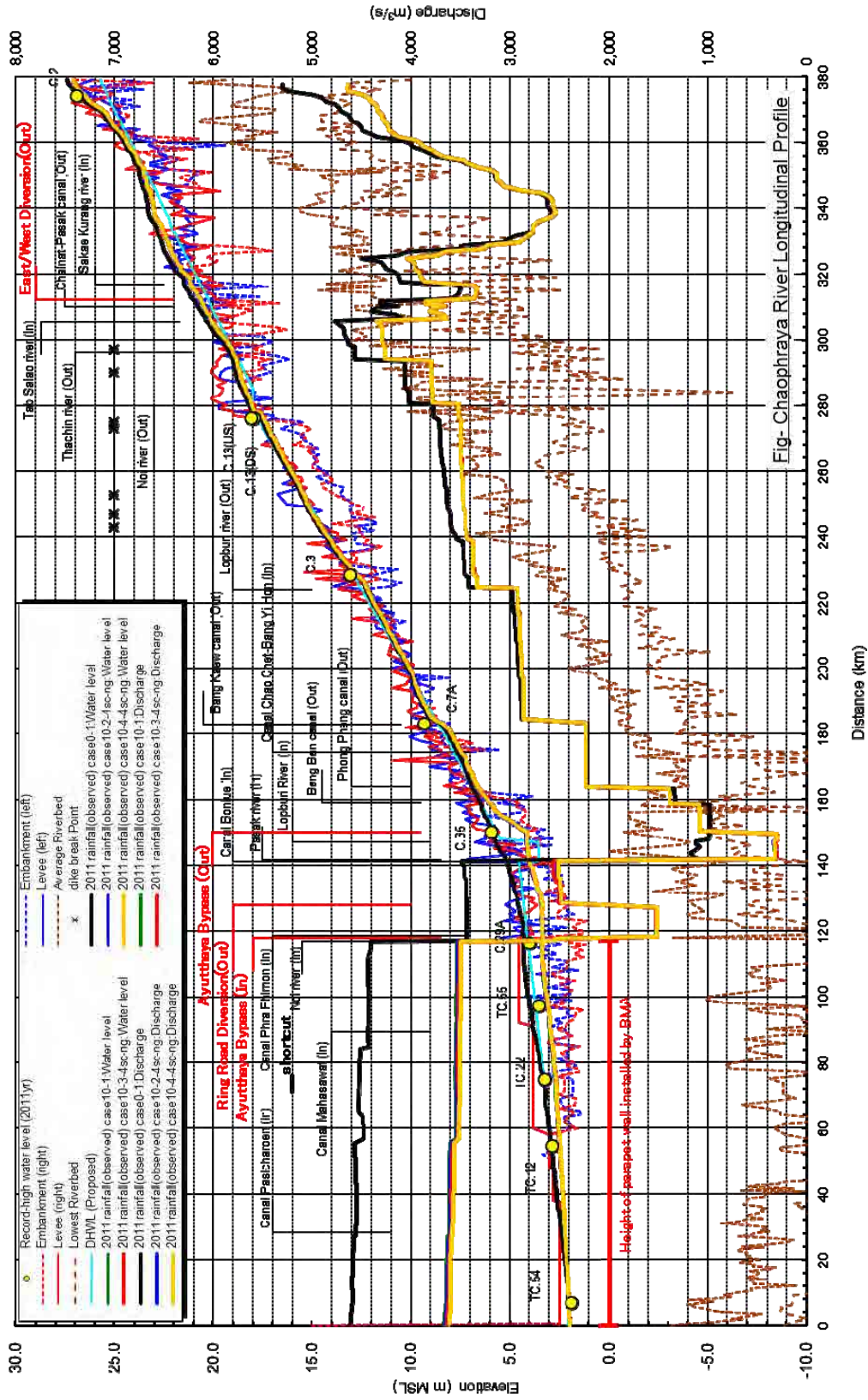


Figure E2.1.1 Comparative Longitudinal Profiles in All Cases (Year 2011) Chao Phraya River (Case 10-1, 10-2, 10-3, 10-4)

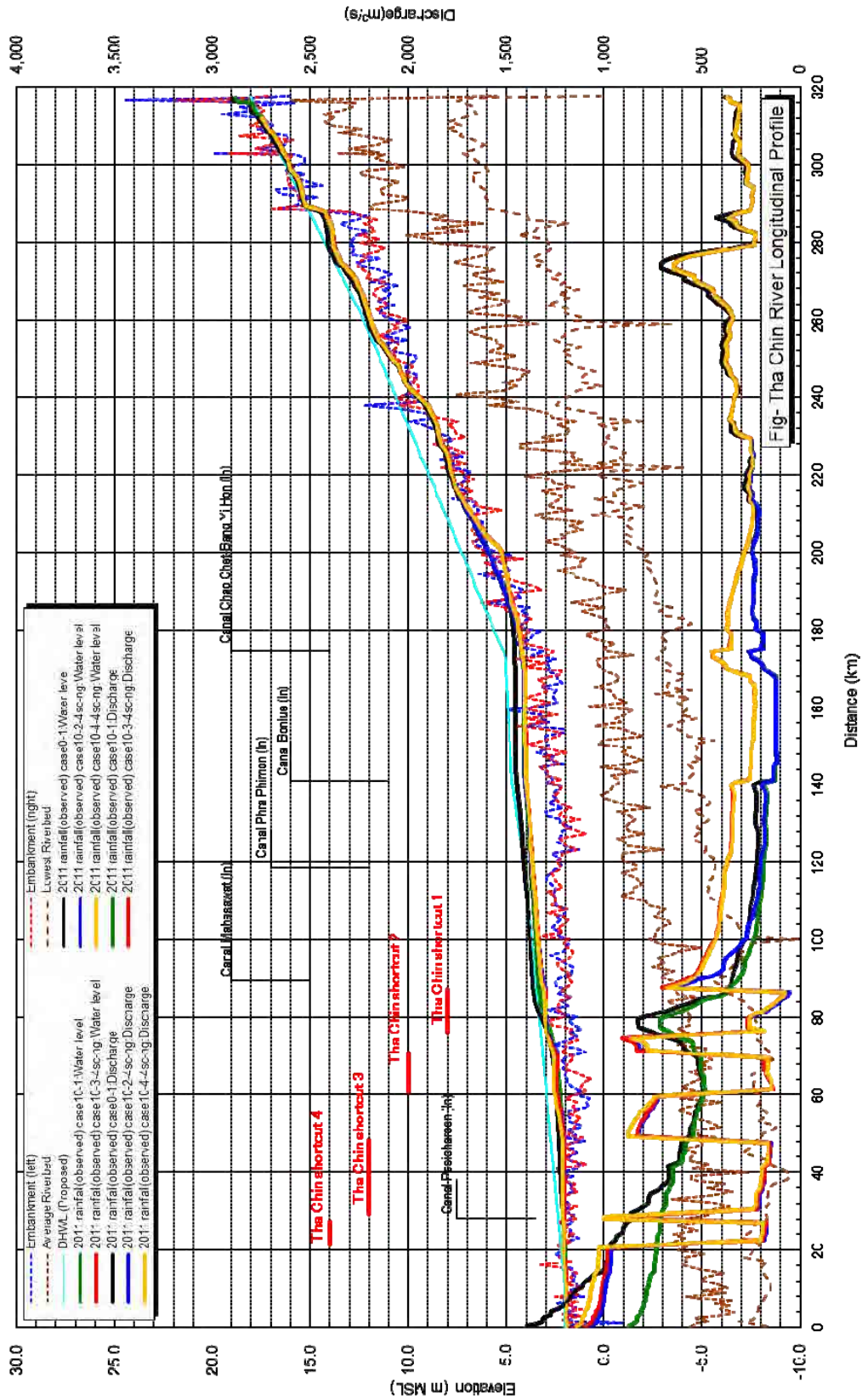


Figure E2.1.2 Comparative Longitudinal Profiles in All Cases (Year 2011) Tha Chin River (Case10-1, 10-2, 10-3, 10-4)

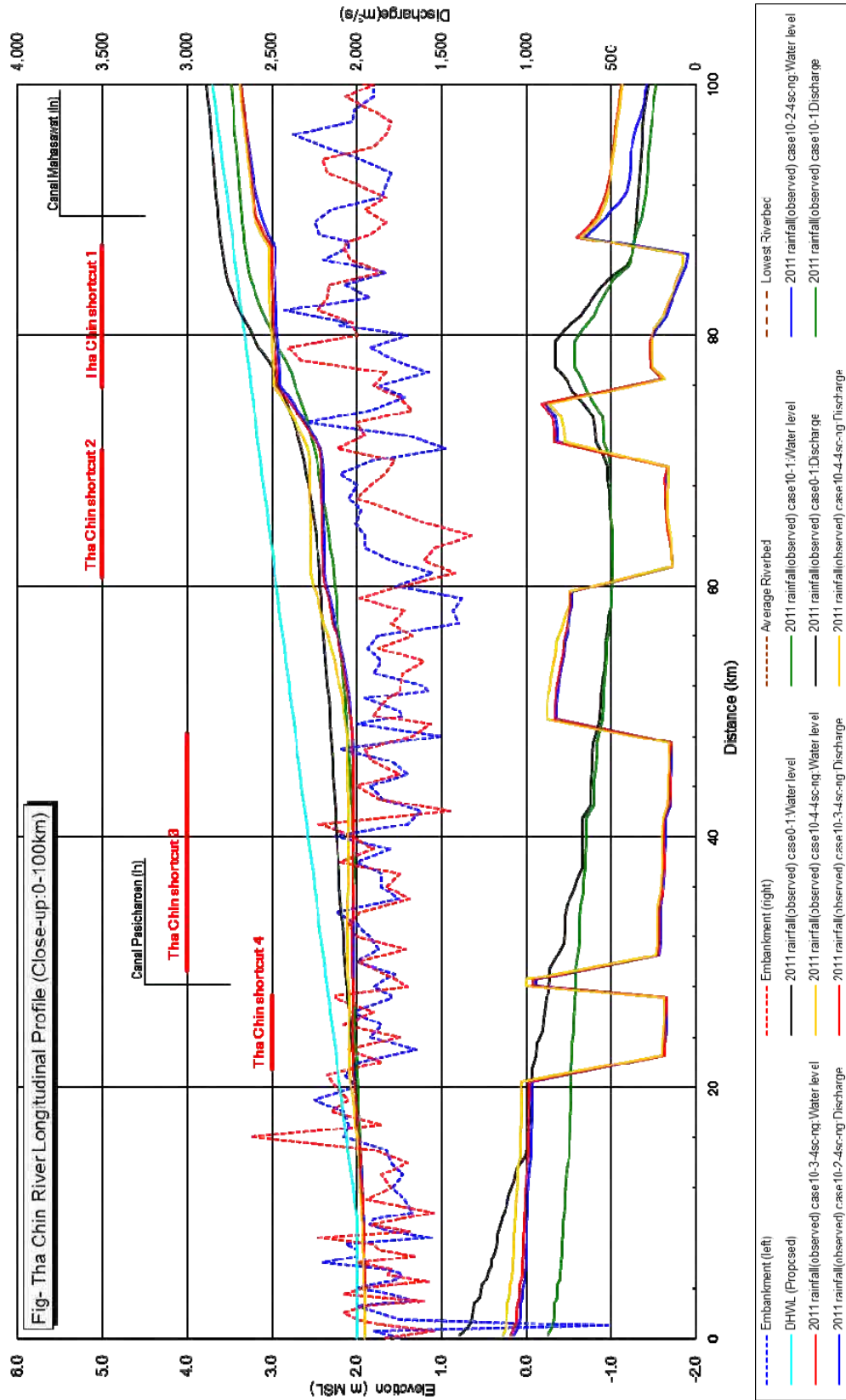


Figure E2.1.3 Comparative Longitudinal Profiles in All Cases (Year 2011) Tha Chin River 0-100k close-up (Case10-1,10-2,10-3,10-4)

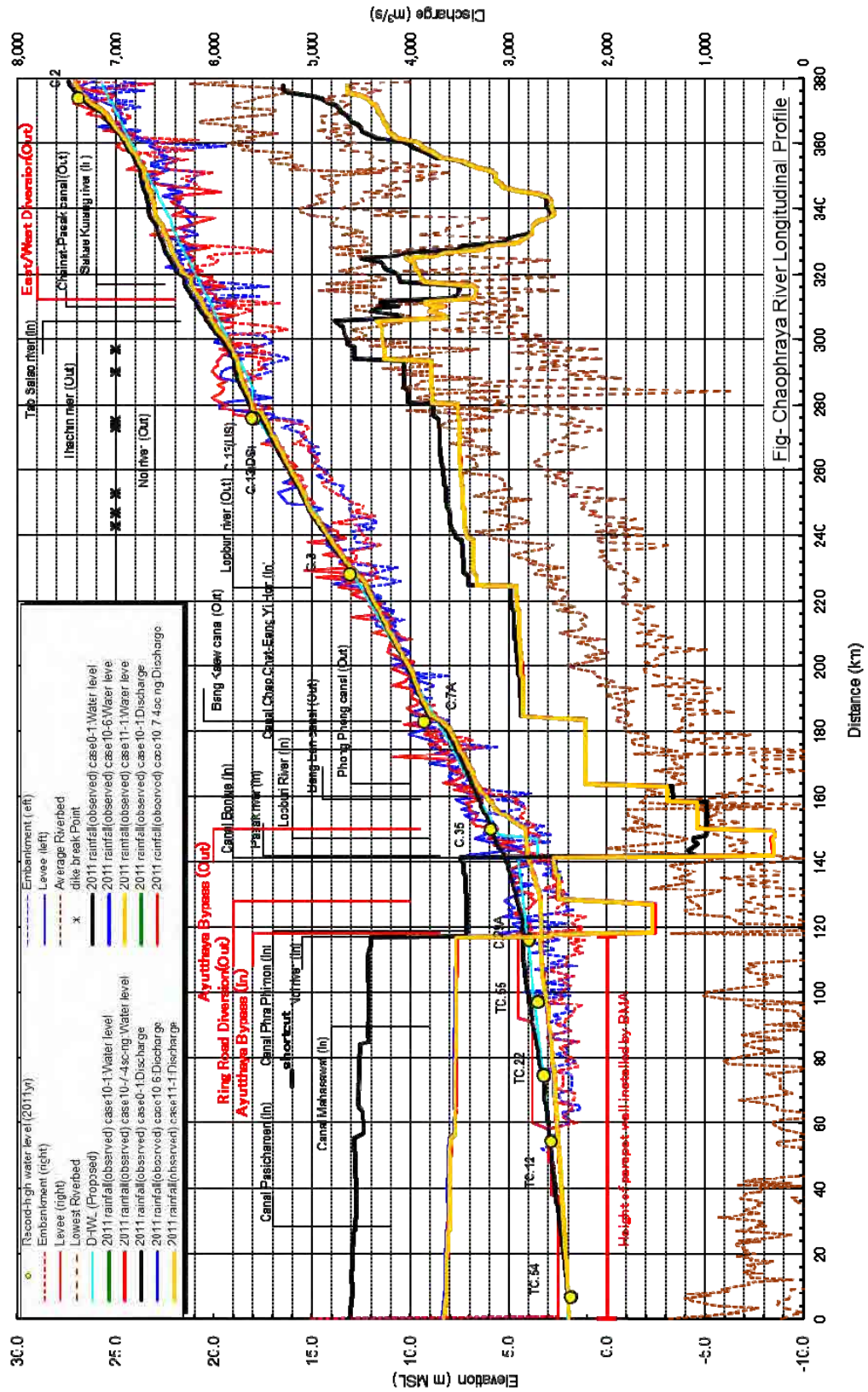


Figure E2.1.4 Comparative Longitudinal Profiles in All Cases (Year 2011) Chao Phraya River (Case10-6, 10-7, 11-1)

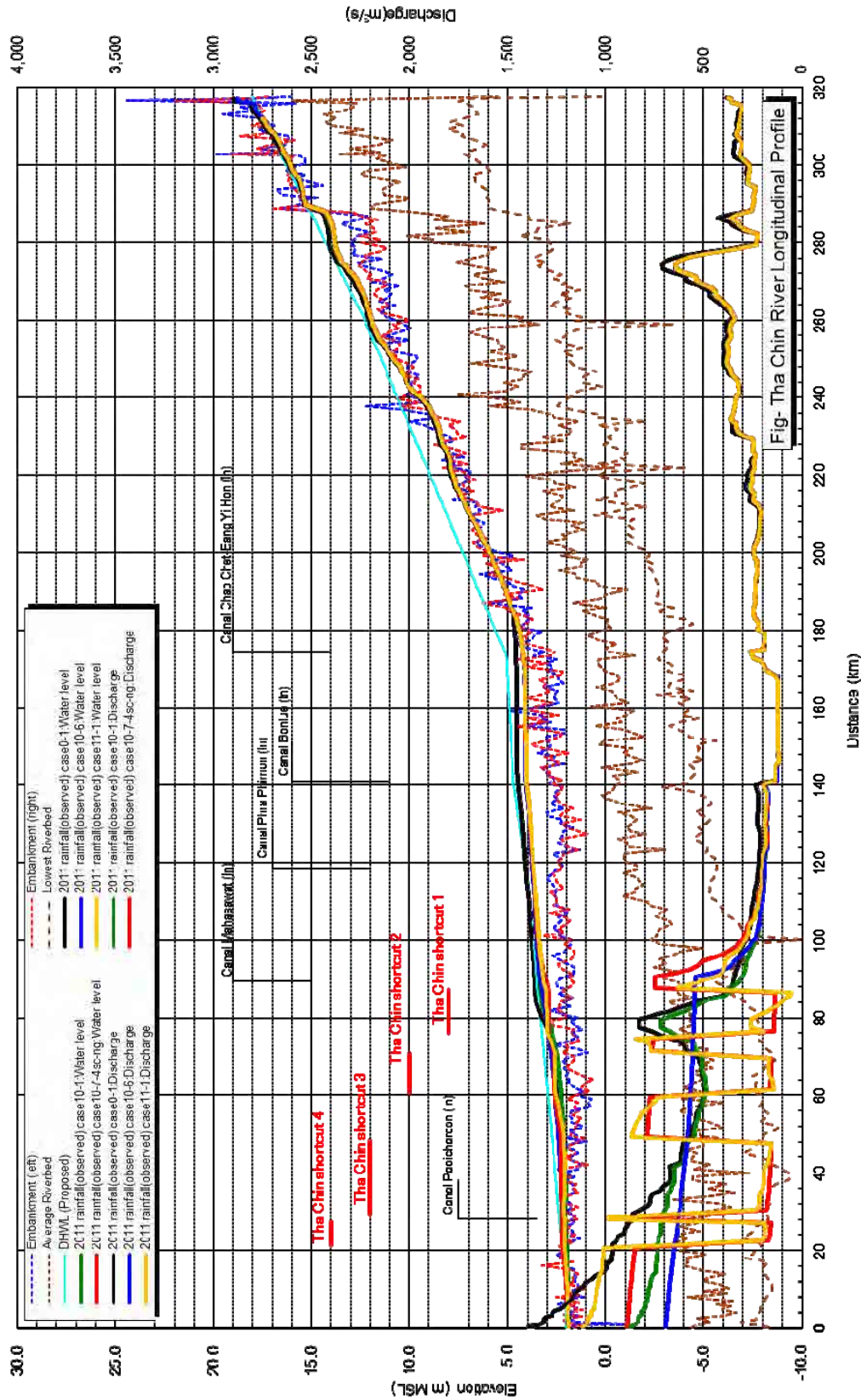


Fig- Tha Chin River Longitudinal Profile

Figure E2.1.5 Comparative Longitudinal Profiles in All Cases (Year 2011) Tha Chin River (Case10-6, 10-7, 11-1)

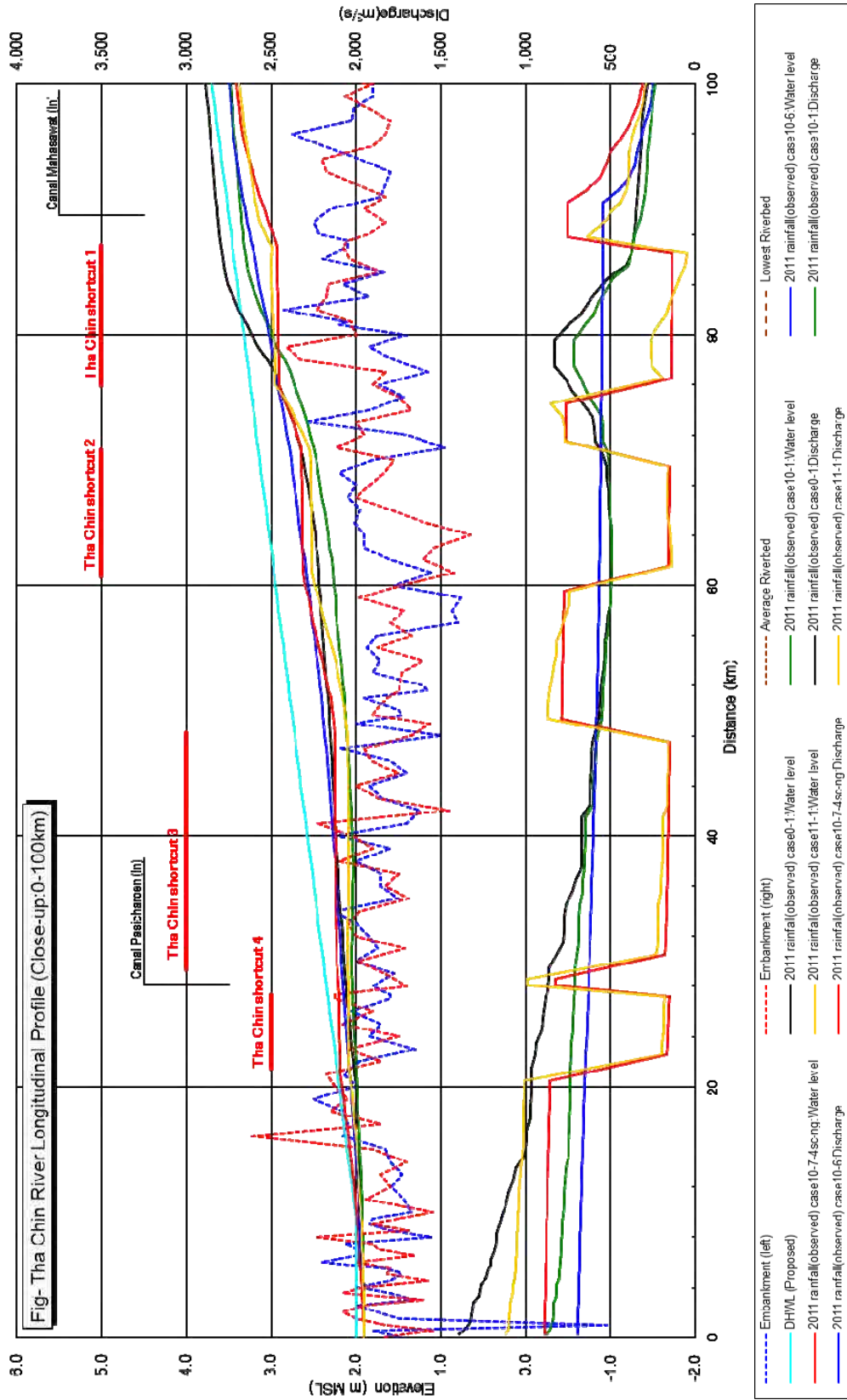


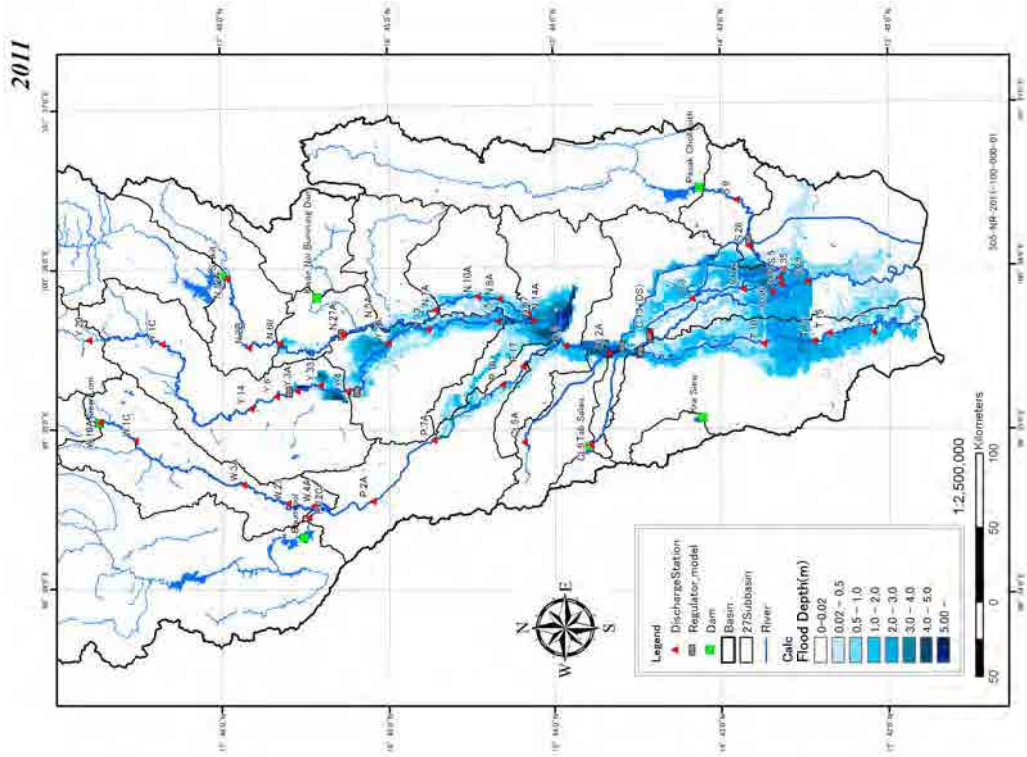
Figure E2.1.6 Comparative Longitudinal Profiles in All Cases (Year 2011) Tha Chin River 0-100k close-up (Case10-6,10-7,11-1)

E2.1.2 Maximum Inundation Area and Depth

Diagrams of the maximum inundation area and depth by each study case are presented below. The results express the following findings:

- Elevation of dike roads reduces inundation in the economically important zones, but floods from the left bank of the Tha Chin River occur in the lower basin (Case0-1).
- Although overflow streams from the left bank of the Tha Chin River occur until Case10-3, installing floodwalls along the left bank enables to prevent the inundation on the left bank completely.

2011 Rainfall (observed) Case0-1



2011 Rainfall (observed) Case0-0

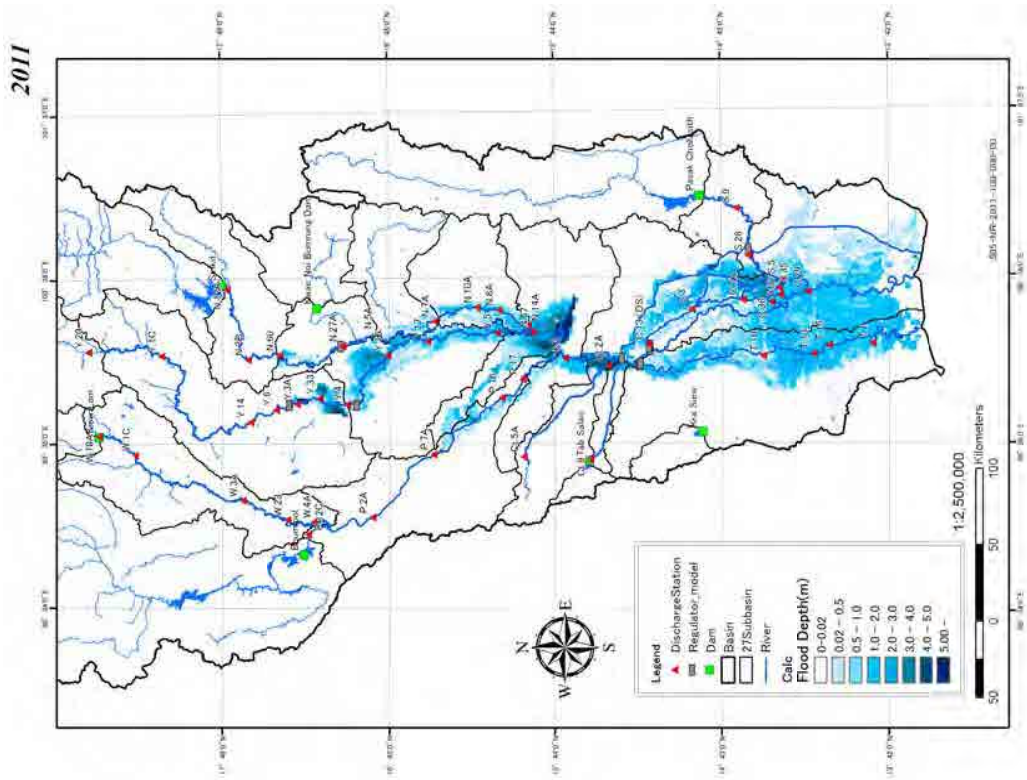
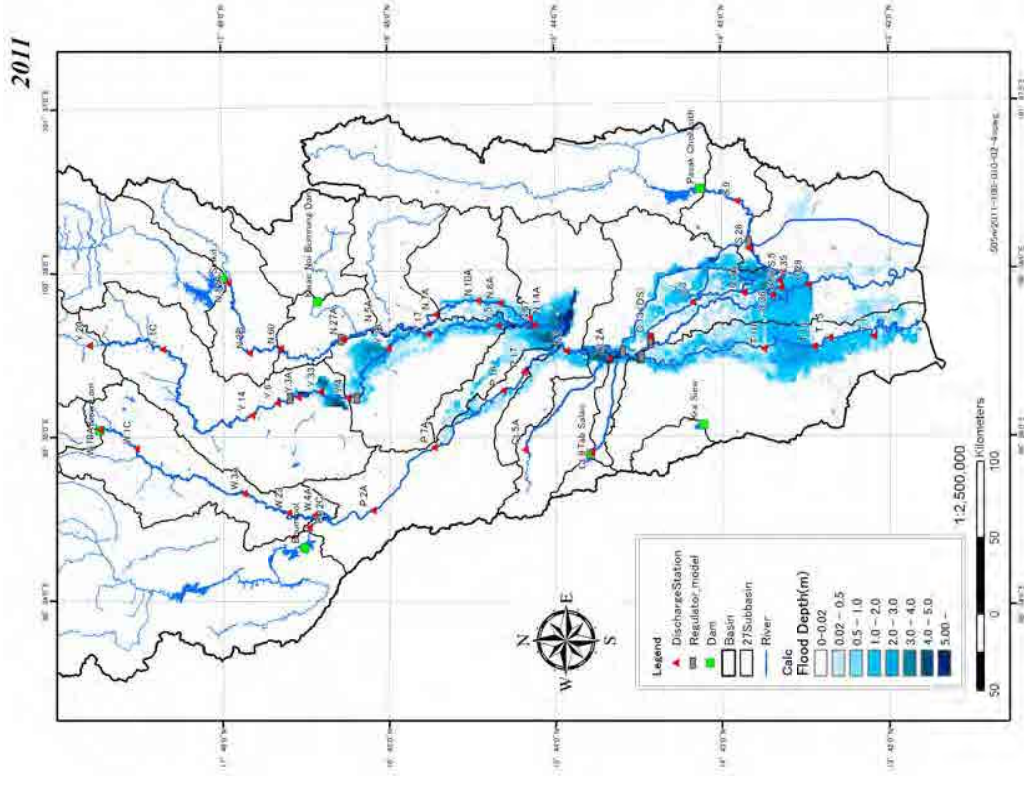


Figure E2.1.7 Diagrams of the Maximum Inundation Depth (Year 2011) (1)

2011 Rainfall (observed) Case10-2-4sc-wg



2011 Rainfall (observed) Case10-1

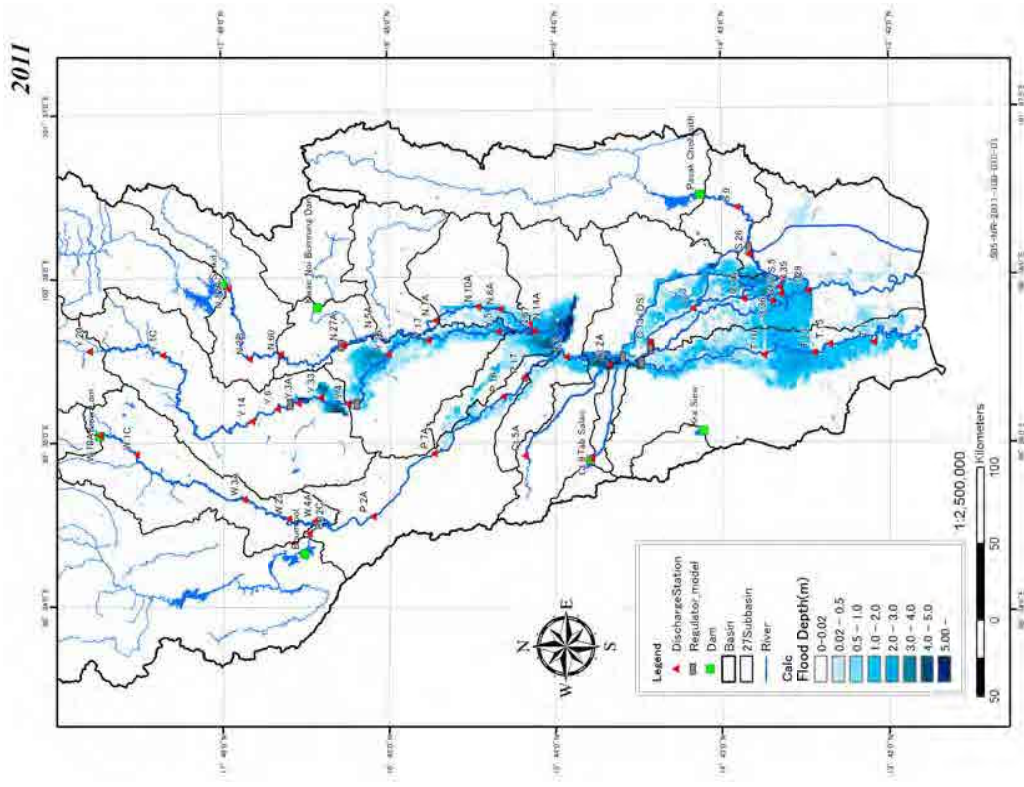
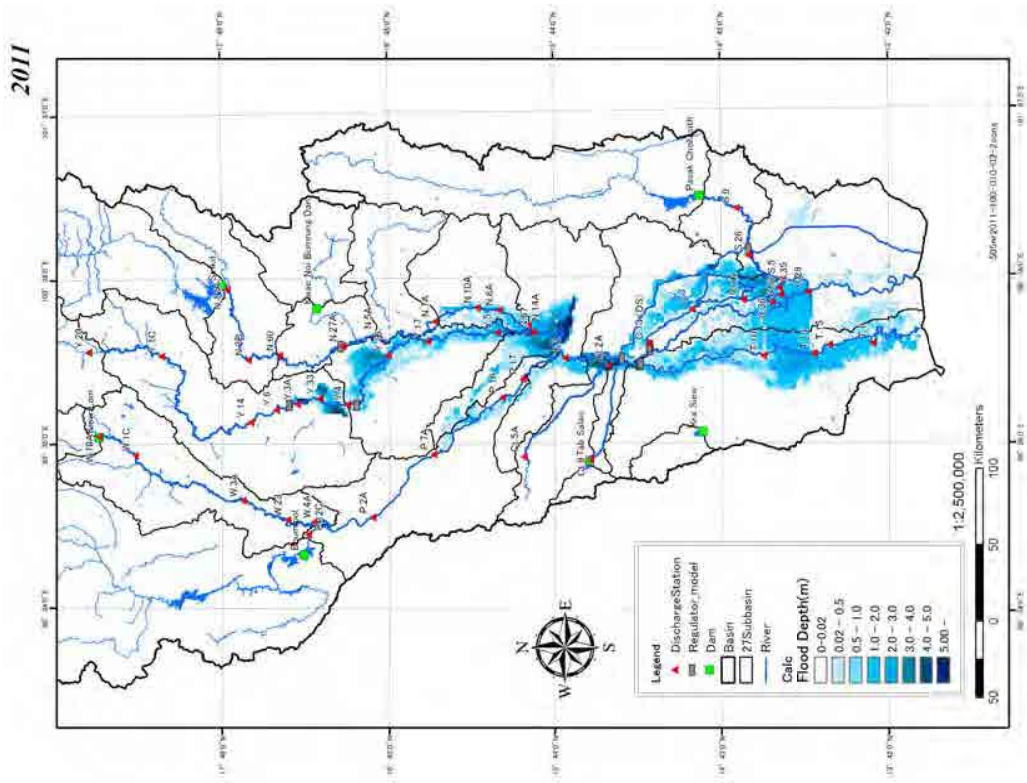


Figure E2.1.8 Diagrams of the Maximum Inundation Depth (Year 2011) (2)

2011 Rainfall (observed) Case10-2-2sc-ng



2011 Rainfall (observed) Case10-2-4sc-ng

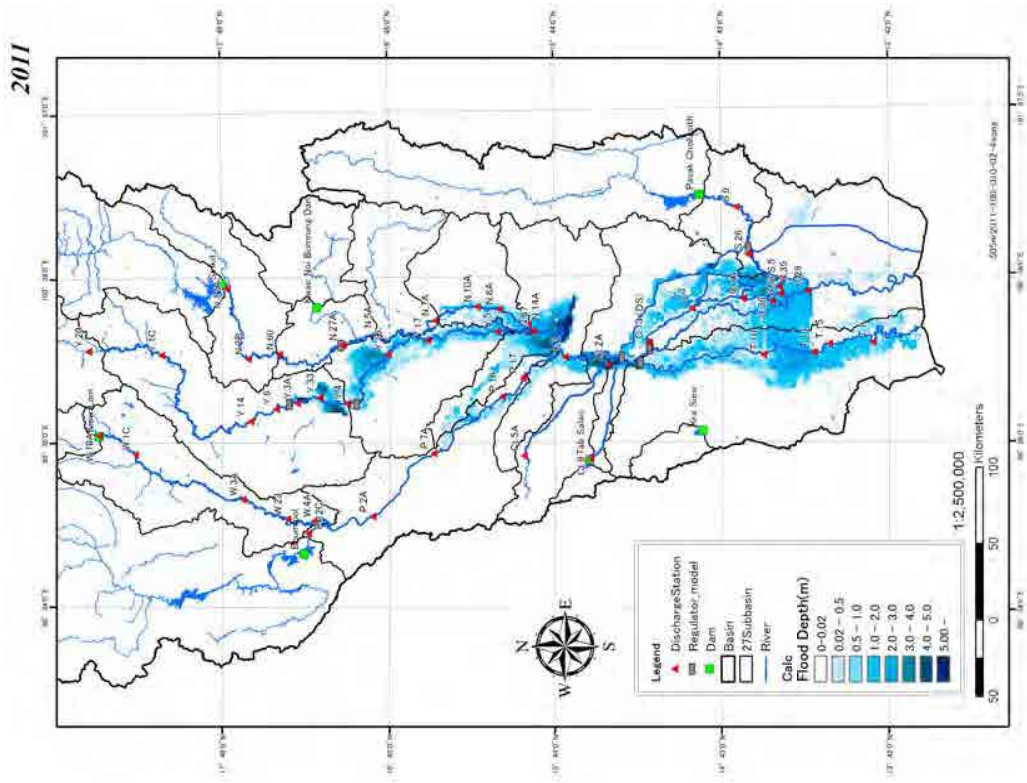
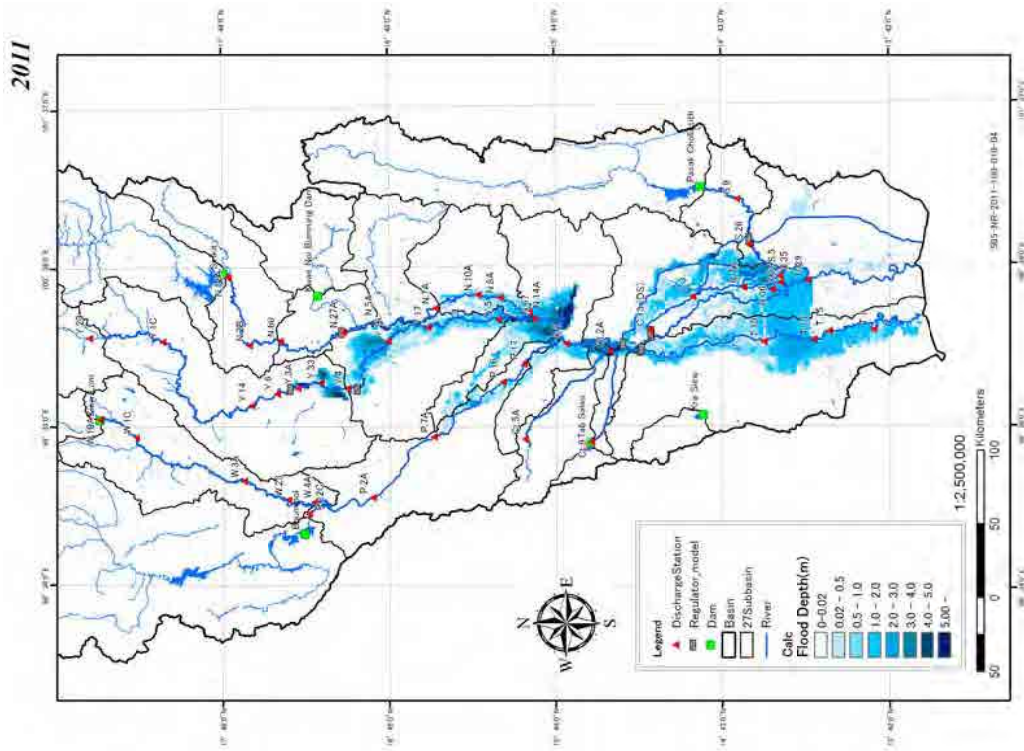


Figure E2.1.9 Diagrams of the Maximum Inundation Depth (Year 2011) (3)

2011 Rainfall (observed) Case10-4



2011 Rainfall (observed) Case10-3

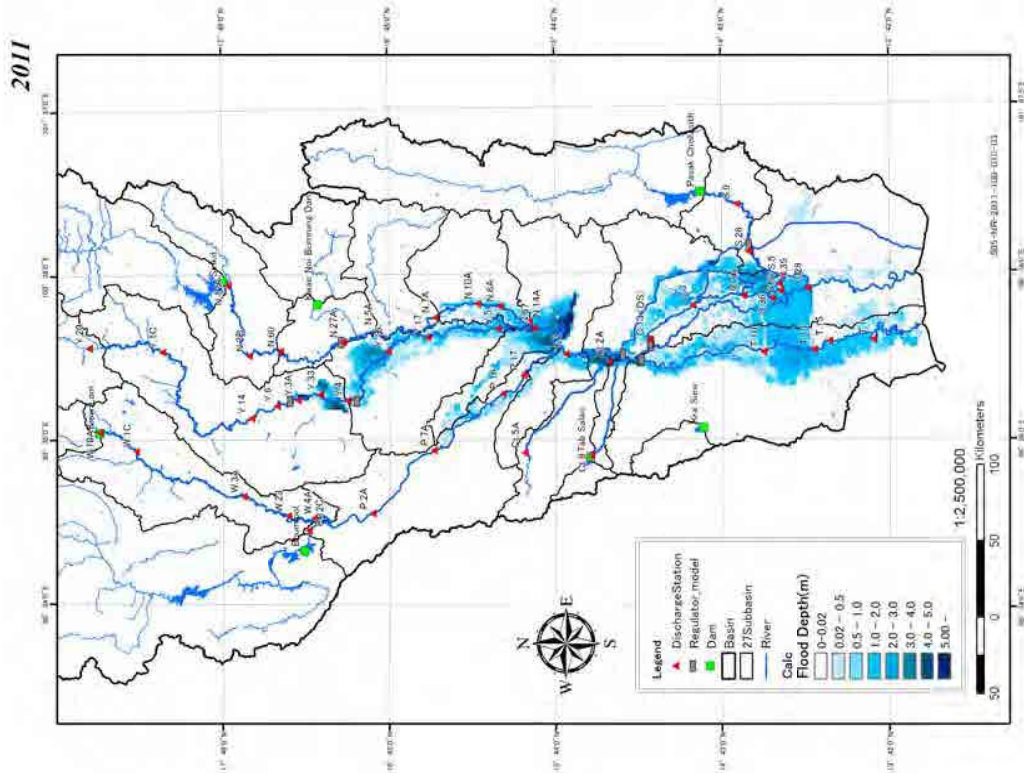
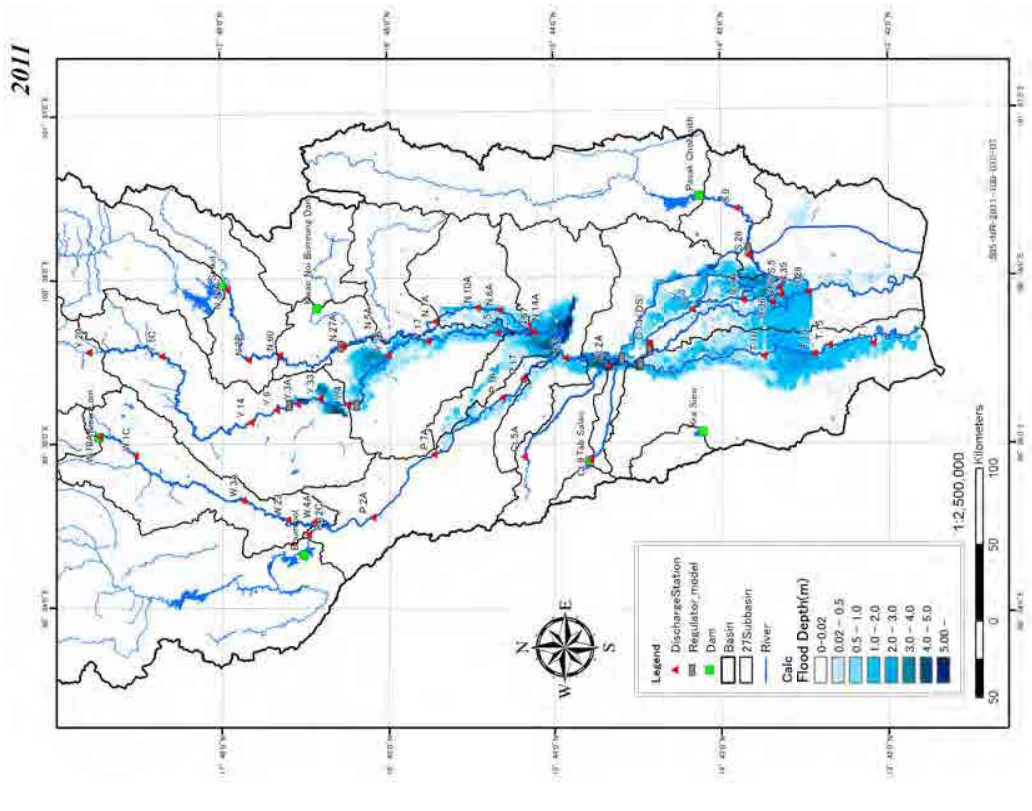


Figure E2.1.10 Diagrams of the Maximum Inundation Depth (Year 2011) (4)

2011 Rainfall (observed) Case10-7



2011 Rainfall (observed) Case10-6

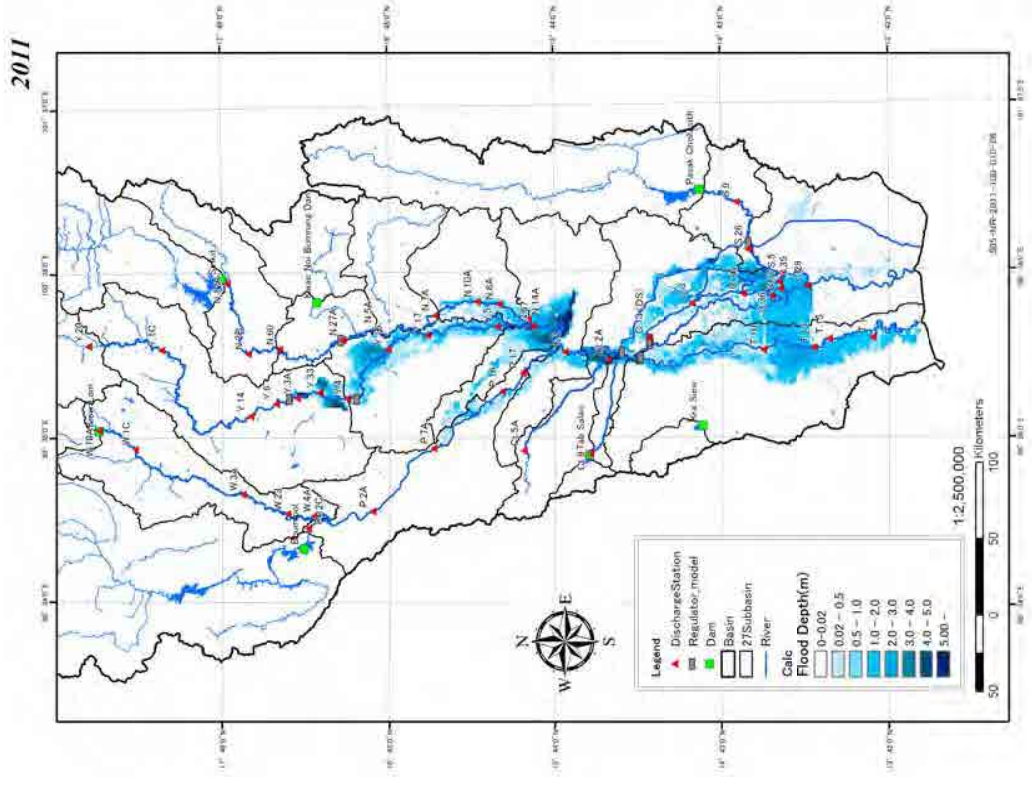
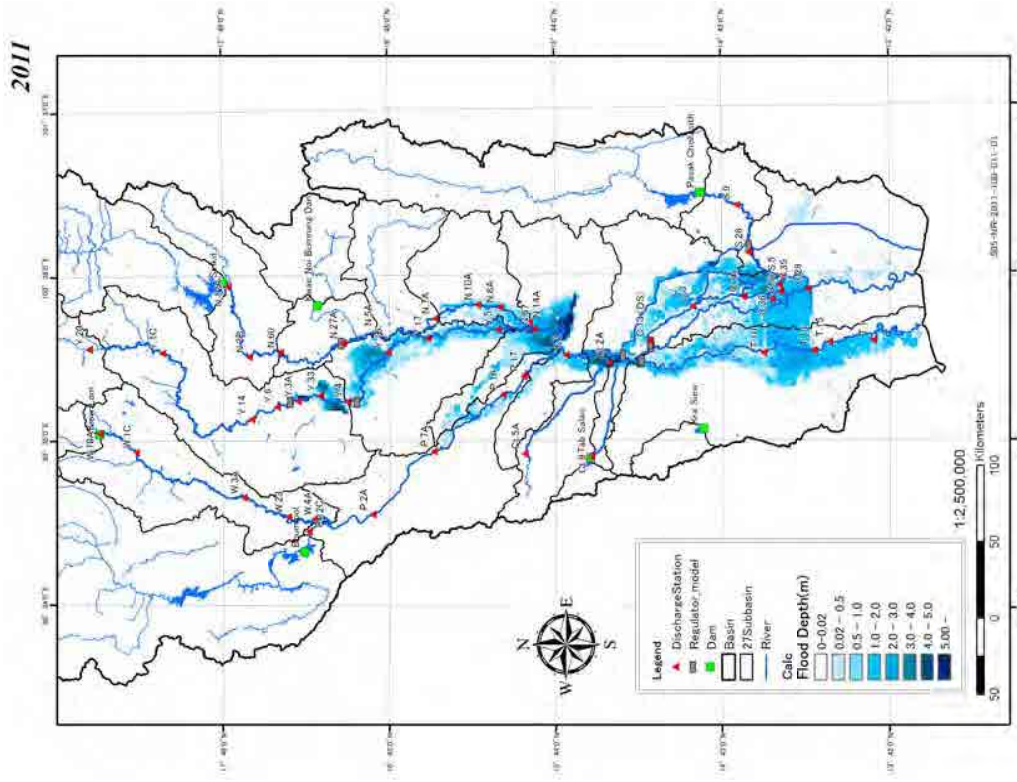


Figure E2.1.11 Diagrams of the Maximum Inundation Depth (Year 2011) (5)

2011 Rainfall (observed) Case11-1



2011 Rainfall (observed) Case11-0

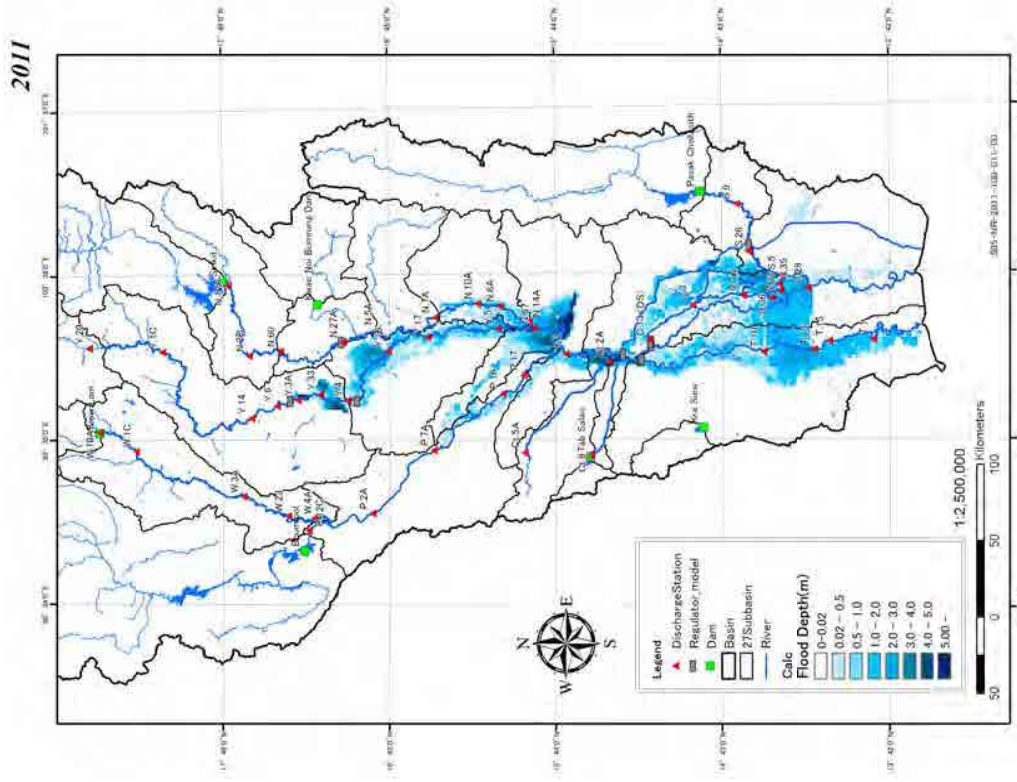


Figure E2.1.12 Diagrams of the Maximum Inundation Depth (Year 2011) (6)

E2.1.3 Inundated Volume in Flood Plain

Time-series diagrams of inundated volume by block by each study case are presented below. The effectiveness of targets is evaluated by comparisons of time-series inundated volume by block divided in the lower basin. The results express the following findings:

- In the area where dike road elevation in Block No.12 and 13 can protect from the inundation, the inundated volume greatly lowers in Case0-1.
- Adversely, the inundation volume increases on the right bank of the Tha Chin River by the dike road elevation (comparison between Case0-0 and Case0-1).
- Effects of the Central Floodway drastically reduce the inundated volume in the whole lower basin because of a decrease in the runoff in the mainstream of the Chao Phraya River (comparison between Case0-1 and Case10-1).
- In Block No.9 on the right bank of the Tha Chin River, installing short cut channels in the River reduces the inundated volume in protected lowlands by prompt drainage (comparison between Case10-1 and Case11-1).

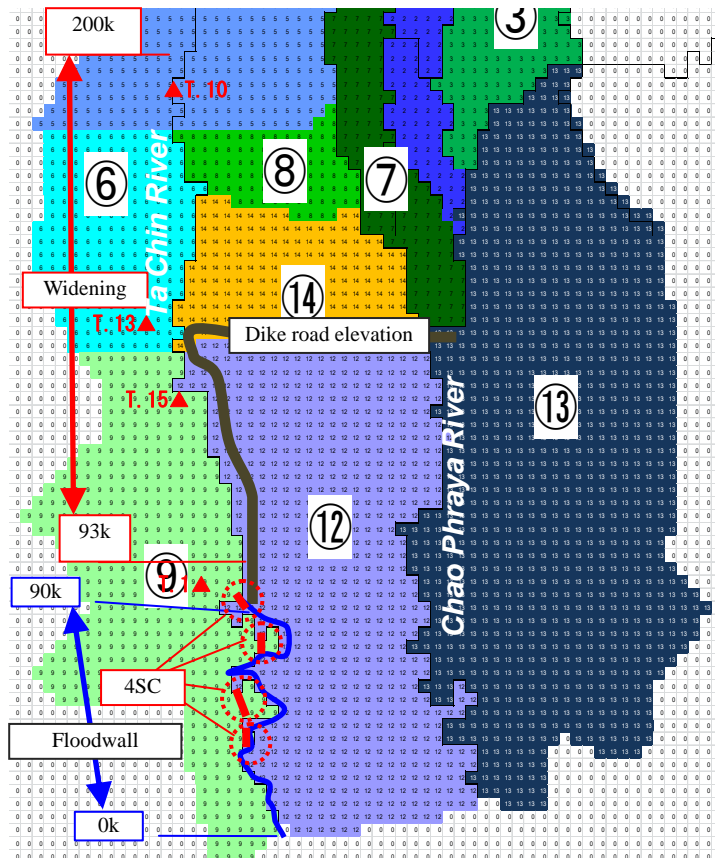


Figure E2.1.13 Block Arrangement Map in the Flood Area

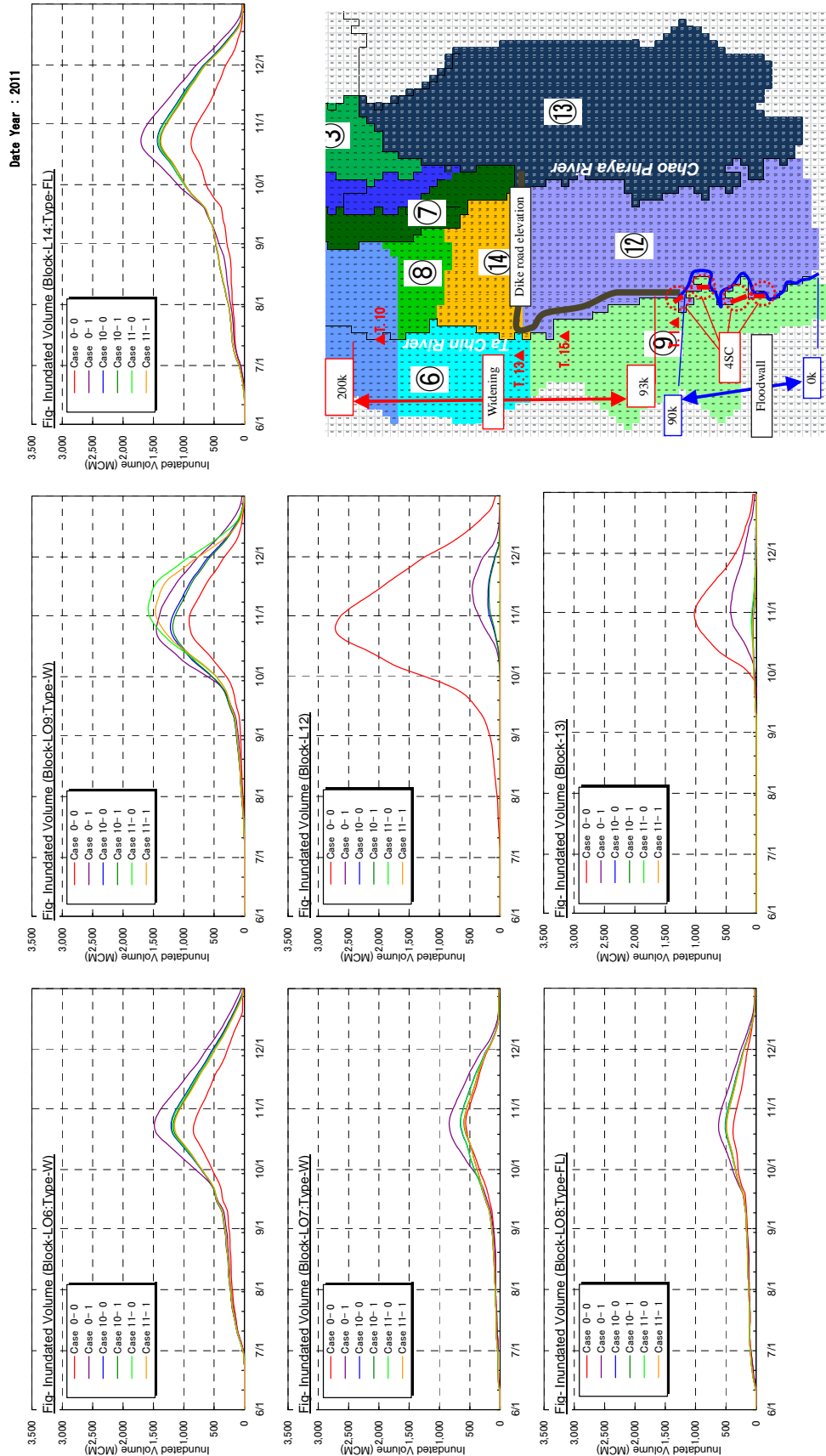


Figure E2.1.14 Time-series Diagrams of Inundated Volume by Block (Year 2011)

E2.2 Verification of Effectiveness with the Observed Rainfall in the 6 Representative Floods

E2.2.1 Flood Analysis with Observed Rainfall

Comparisons of the effectiveness are made with observed rainfall in the Six Representative floods under the condition of conducting the countermeasures in the Master Plan for 2011 flood control. The outputs show the comparisons of effectiveness of the countermeasures (Case11-1) to the flood in 2011 with those in each year. The calculation condition is shown in the following table.

Table E2.2.1 Calculation Condition under the Observed Rainfall (Case11-1)

Target Flood	Item	Calculation condition for the 6 typical floods (actual rainfall basis) (1970,1975,1980,1994,1995,2006)	
Runoff calculation	Evapotranspiration	0.8 times the averages during 1980-2011	
	Rainfall	Observed values in each year	
	Initial values for calculation	Averages on Jan 1 derived from the sequential calculation for the past 30 years (Each average on Jan 1 during 1981-2011)	
Inundation calculation	Runoff at the end of upstream	WANG	Calculated runoff in basin 5+6
		PING	Water volume discharged from Bhumibol Dam (Modified dam operation)
		YOM	Calculated runoff in basin 8
		NAN	Water volume discharged from Sirikit Dam (Modified dam operation)
		TAB SALAO	Calculated runoff in basin 22
		KRASIEW	Calculated runoff in basin 26
		MAE WANG	Calculated runoff in basin 21
		KWAE NOI	Water volume discharged from Kwae Noi Dam (Modified dam operation)
	PASAK	Water volume discharged from Pasak Dam (Modified dam operation)	
	Tidal level	Observed values in 2011 • Chao Phraya: Pomprachul (16cm below the observed) • Tha Chin: Samut Sakhon (34cm below the observed)	
Evapotranspiration & Underseepage	Considering penetration and un-modeled discharge system, to set the average of pan evaporation for the past 30 years deriving from inundation meshes plus 10mm/day at most.		

Longitudinal profile including discharge and water level, inundation area/depth and inundated volume are shown below.

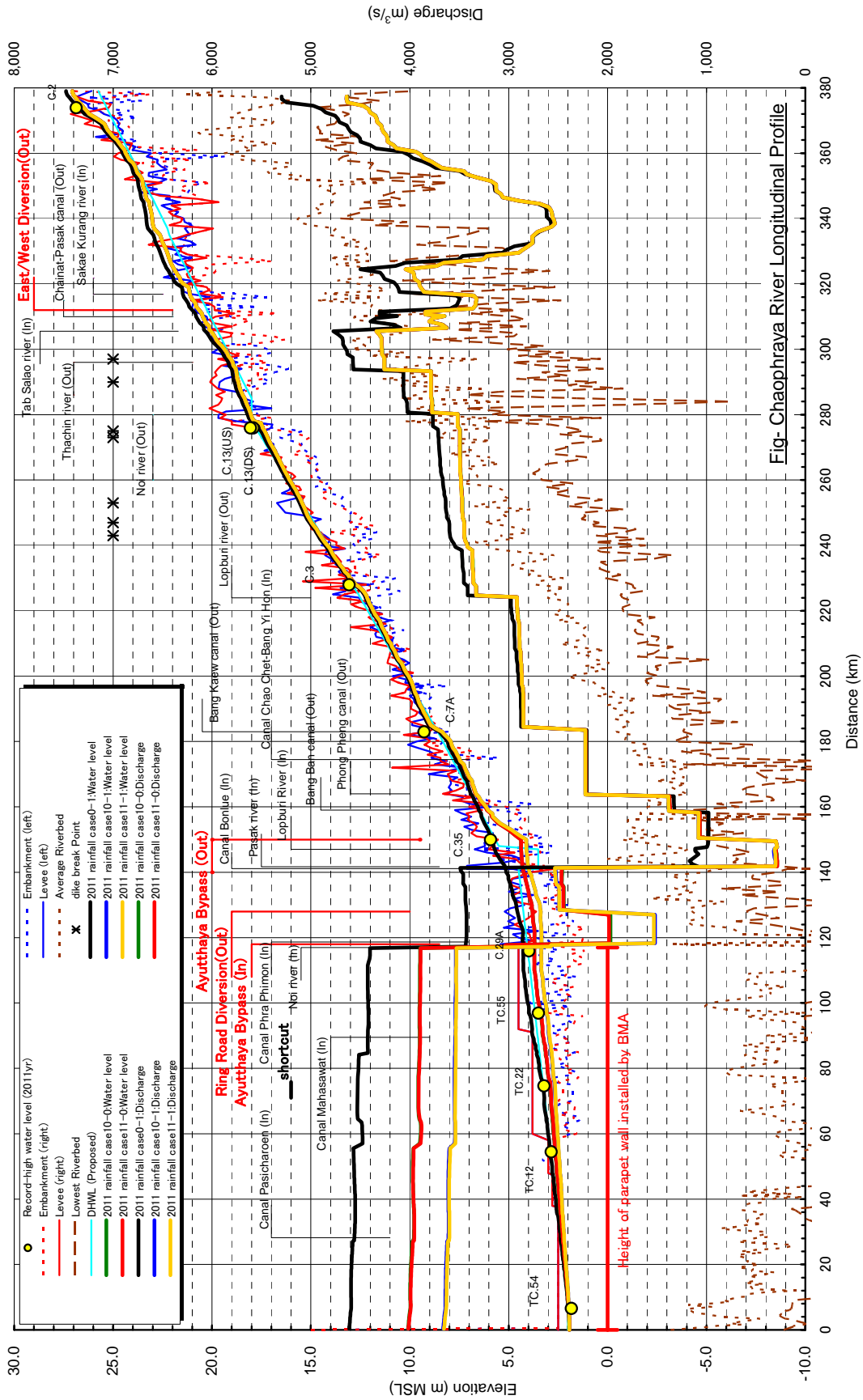


Figure E2.2.1 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 2011 Rainfall

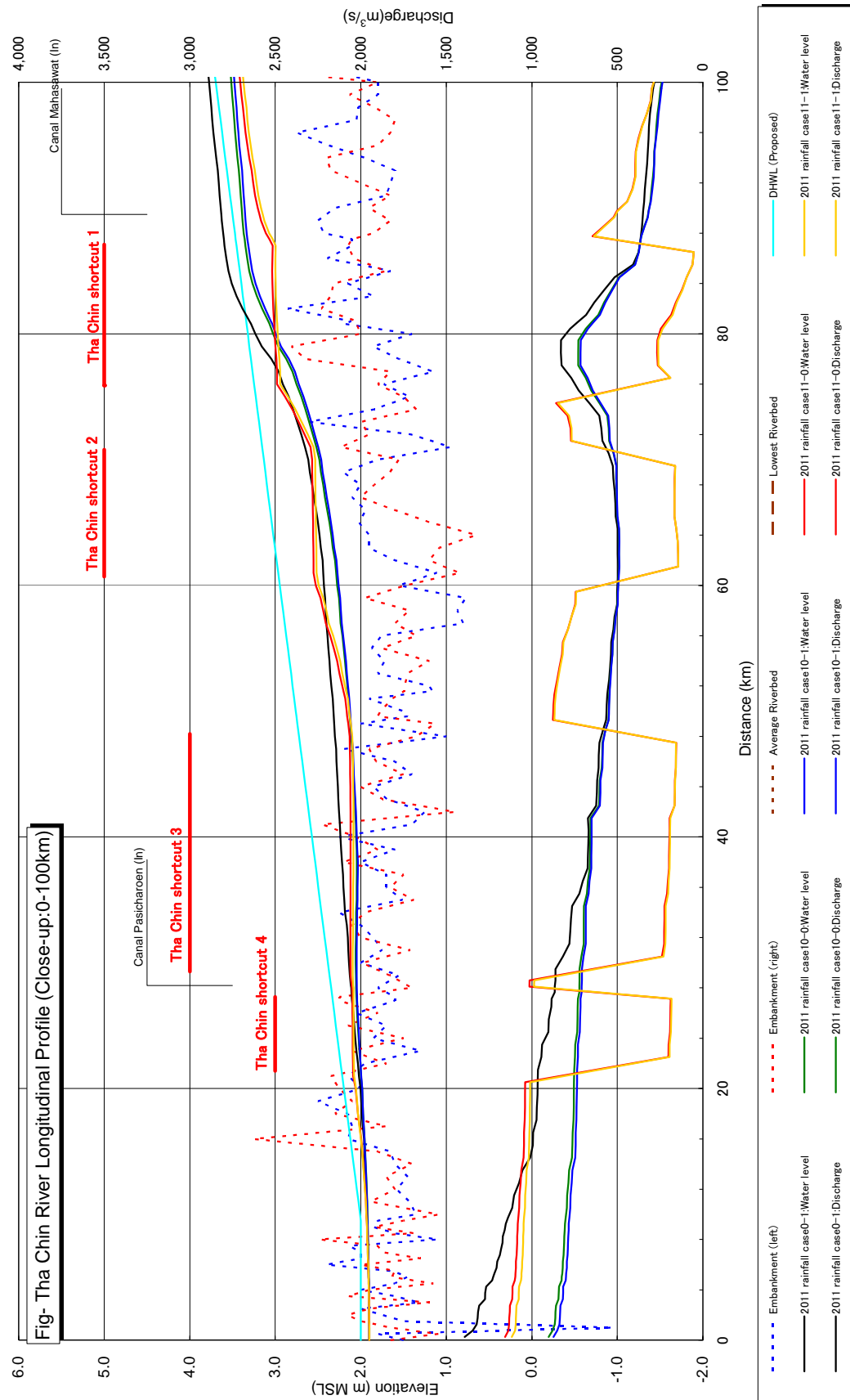


Figure E2.2.2 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 2011 Rainfall

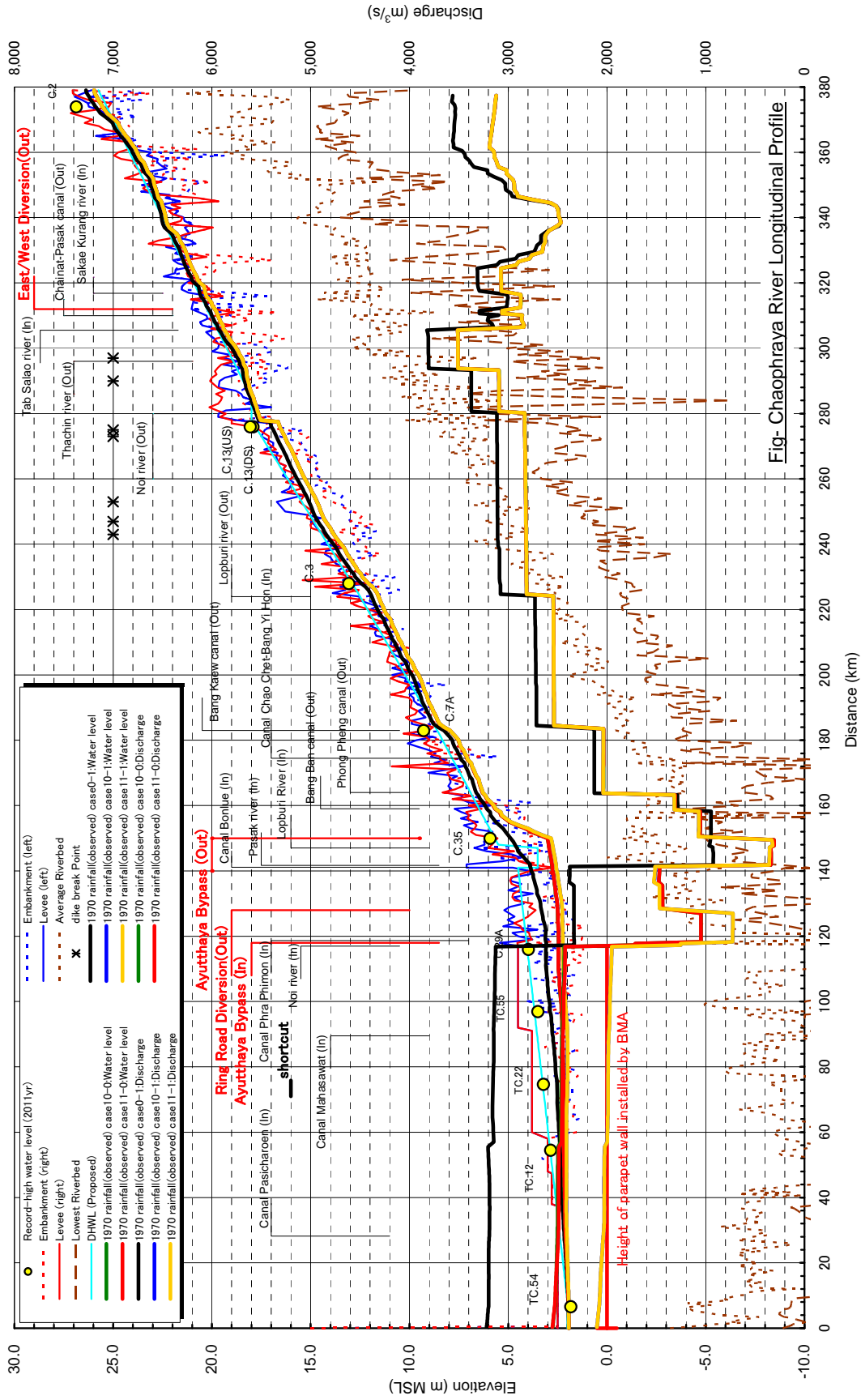


Fig- Chao Phraya River Longitudinal Profile
Figure E2.2.3 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1970 Rainfall (observed)

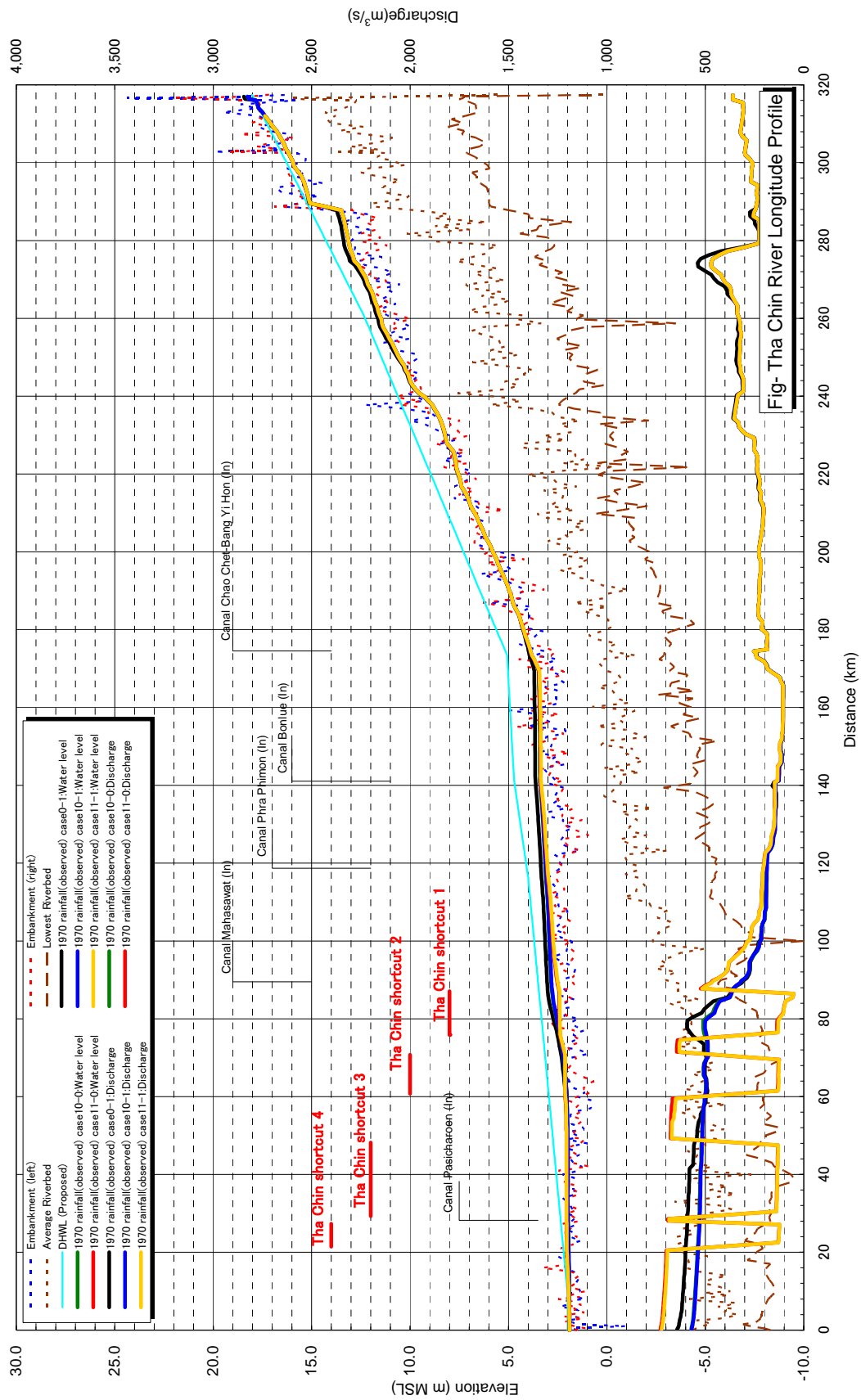


Figure E2.2.4 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1970 Rainfall (observed)

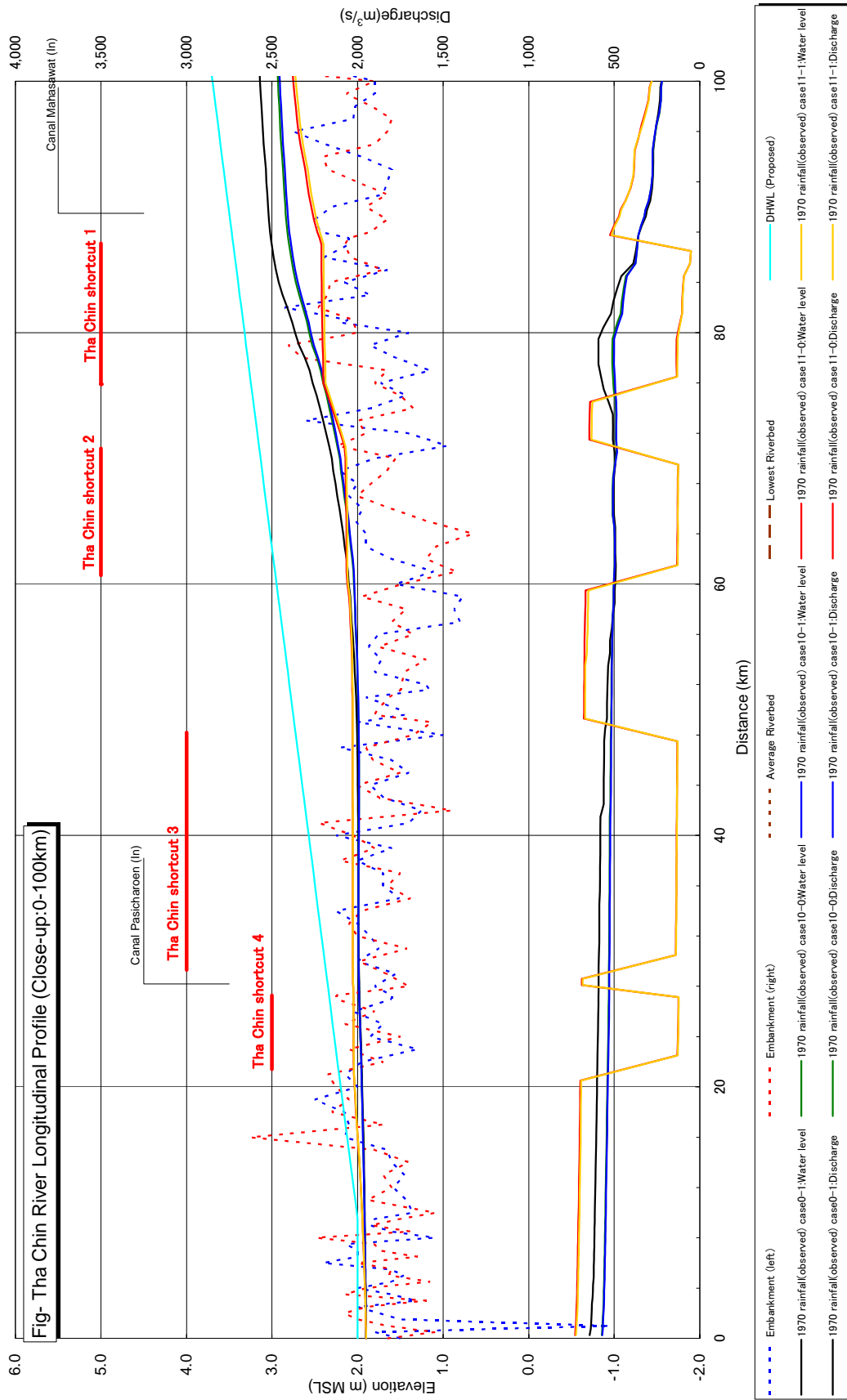


Fig- Tha Chin River Longitudinal Profile (Close-up:0-100km)

Figure E2.2.5 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1970 Rainfall (observed)

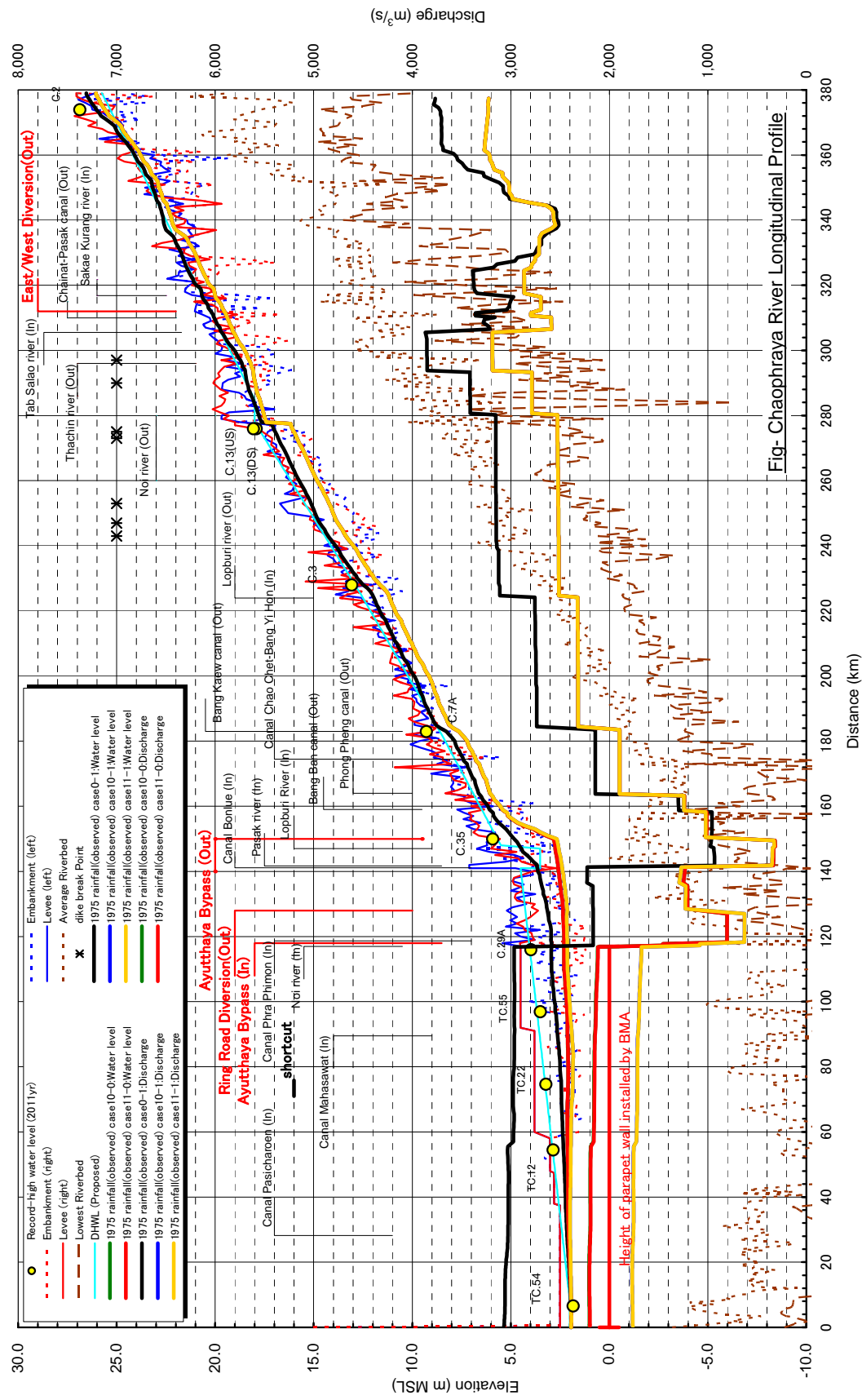


Figure E2.2.6 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1975 Rainfall (observed)

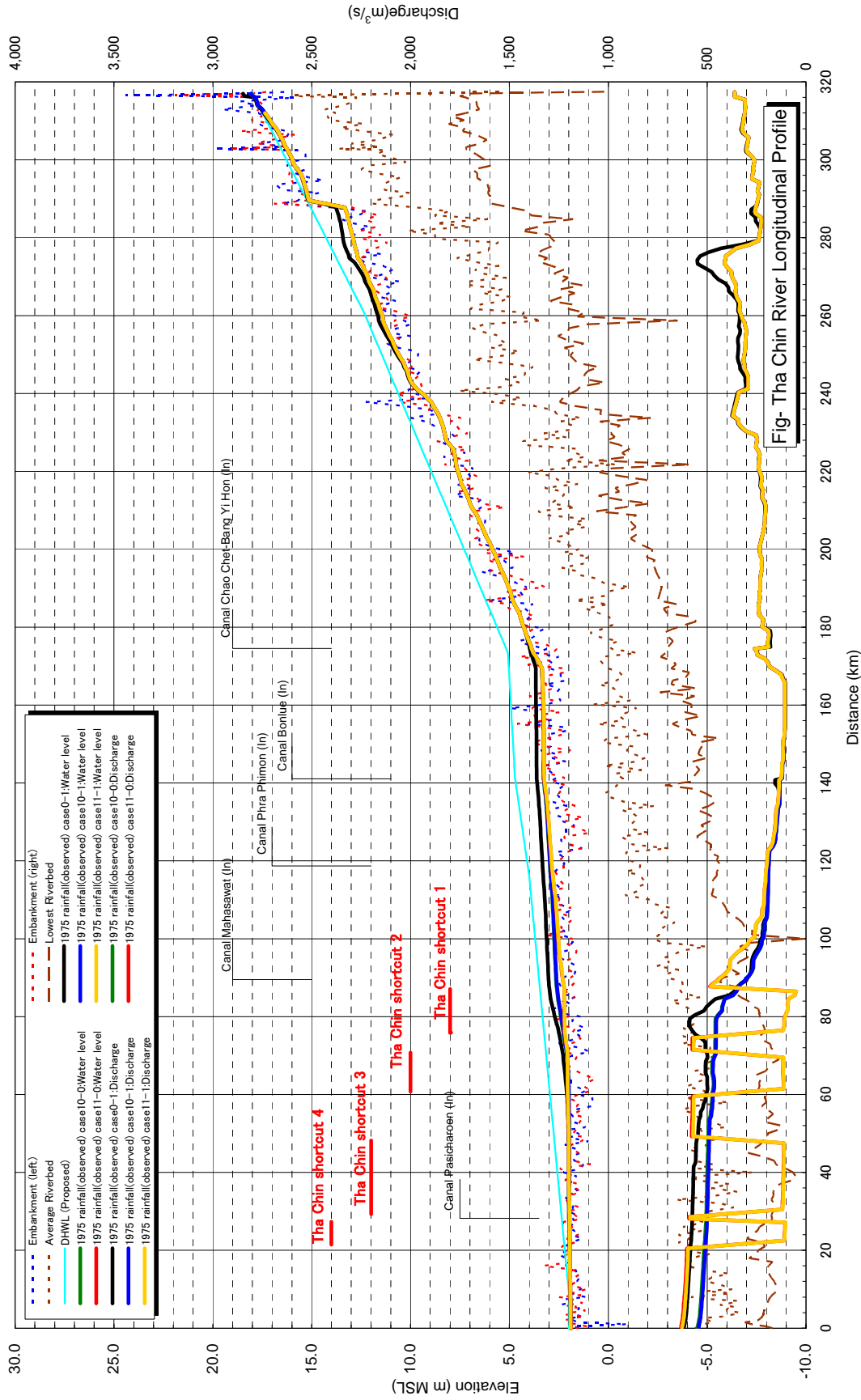


Figure E2.2.7 Comparison of Longitudinal Profile (Case 10-0, 10-1, 11-0, 11-1) Tha Chin River 1975 Rainfall (observed)

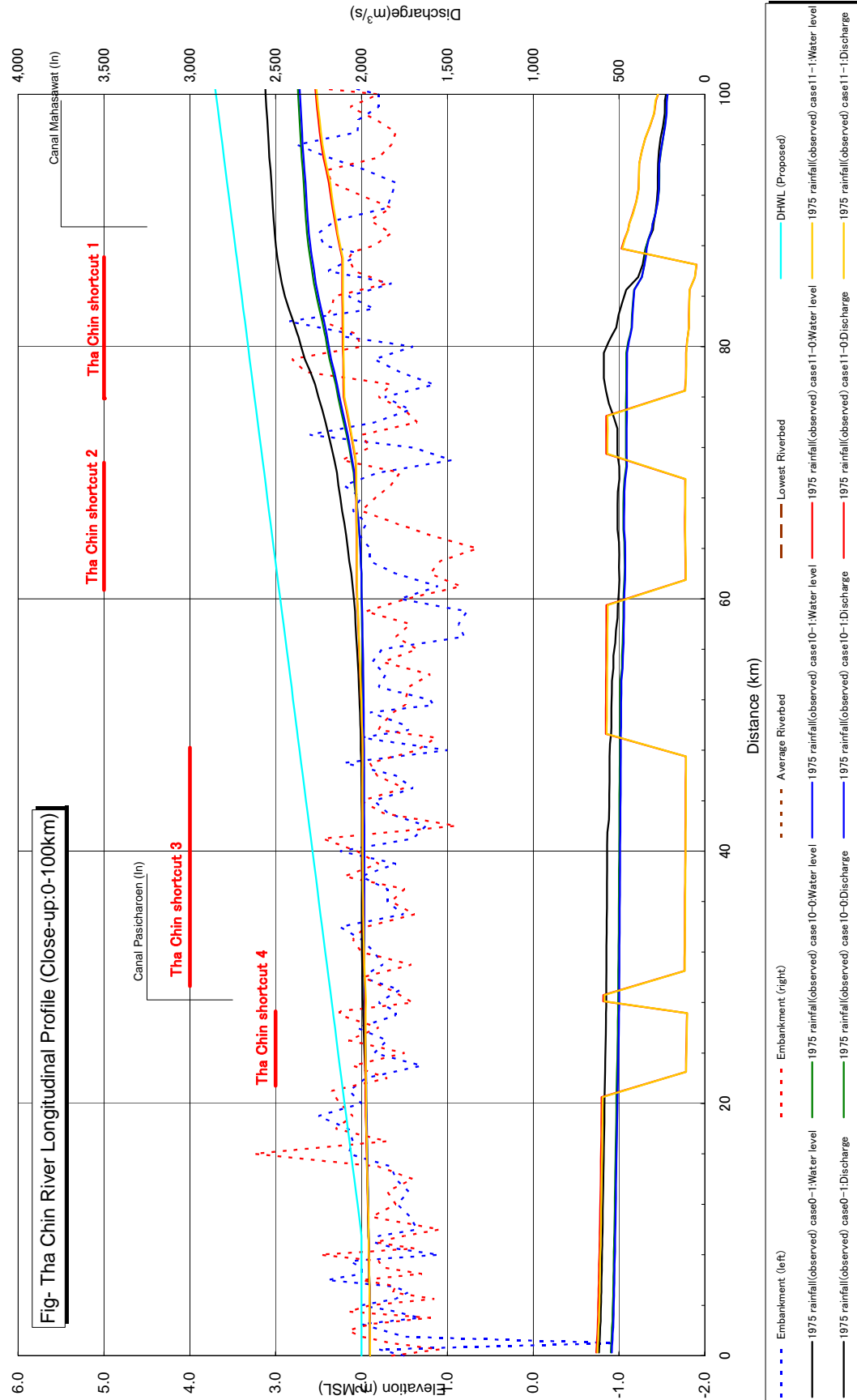


Fig- Tha Chin River Longitudinal Profile (Close-up:0-100km)

Figure E2.2.8 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1975 Rainfall (observed)

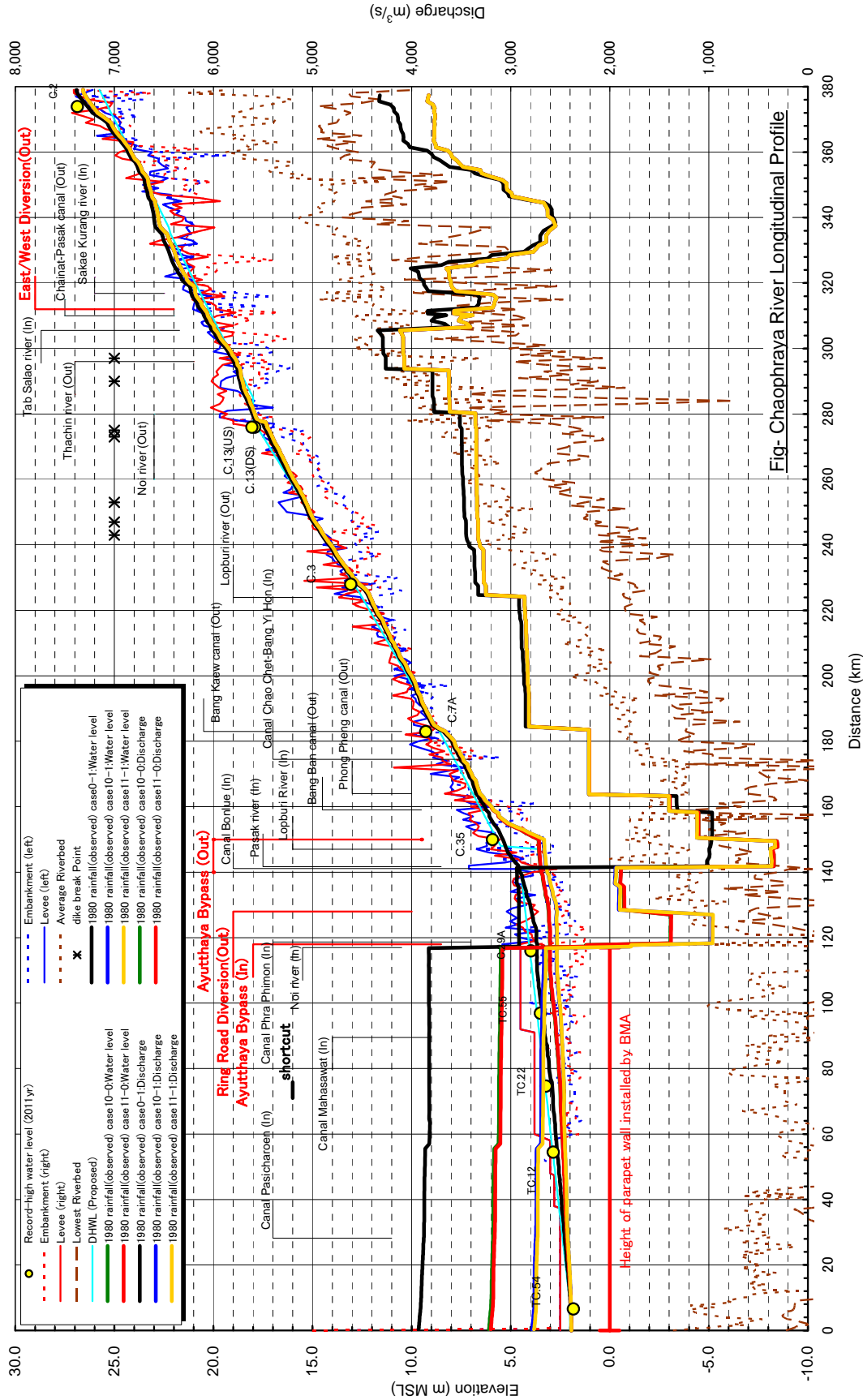


Figure E2.2.9 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1980 Rainfall (observed)

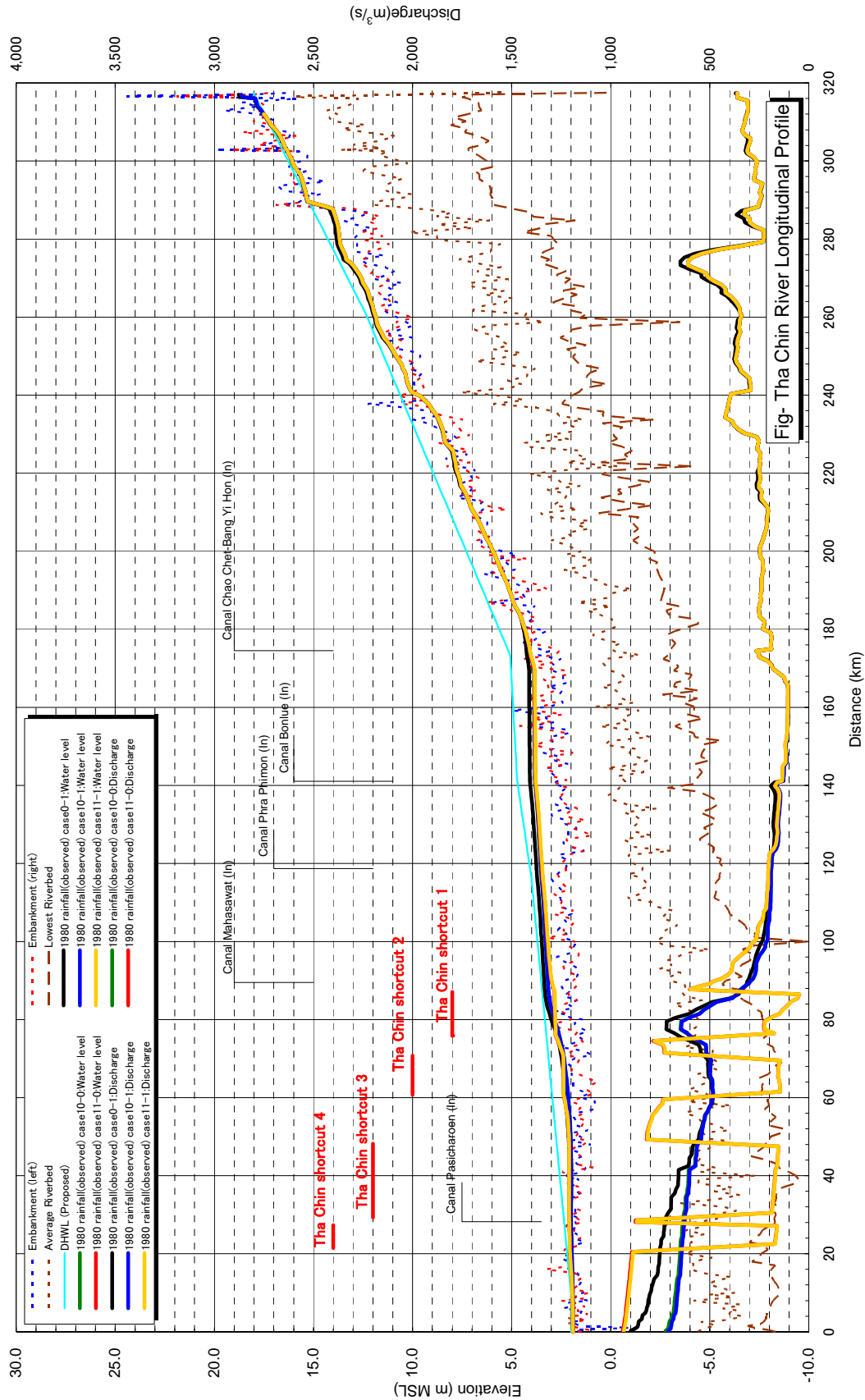


Figure E2.2.10 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1980 Rainfall (observed)

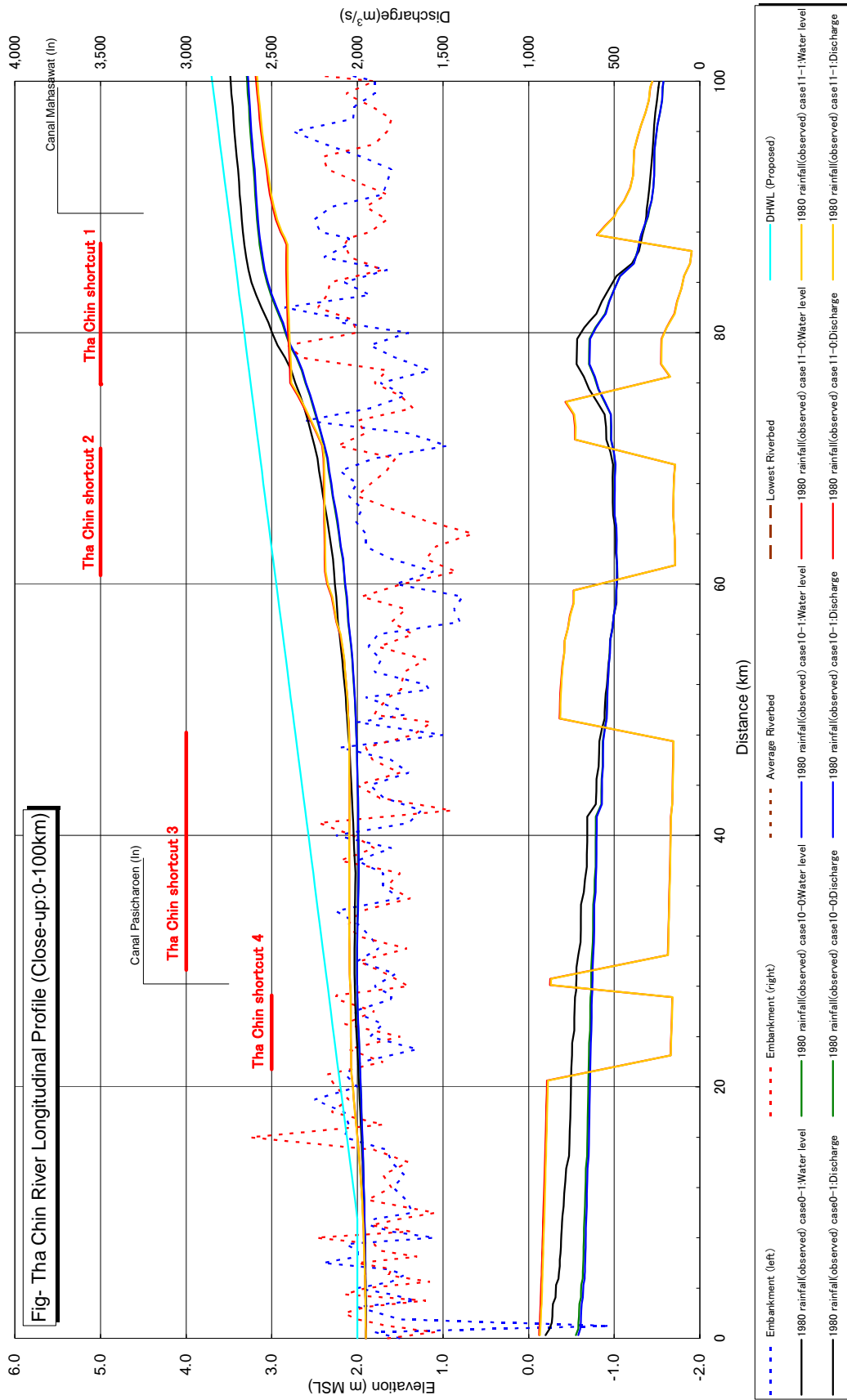


Fig- Tha Chin River Longitudinal Profile (Close-up: 0-100km)

Figure E2.2.11 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1980 Rainfall (observed)

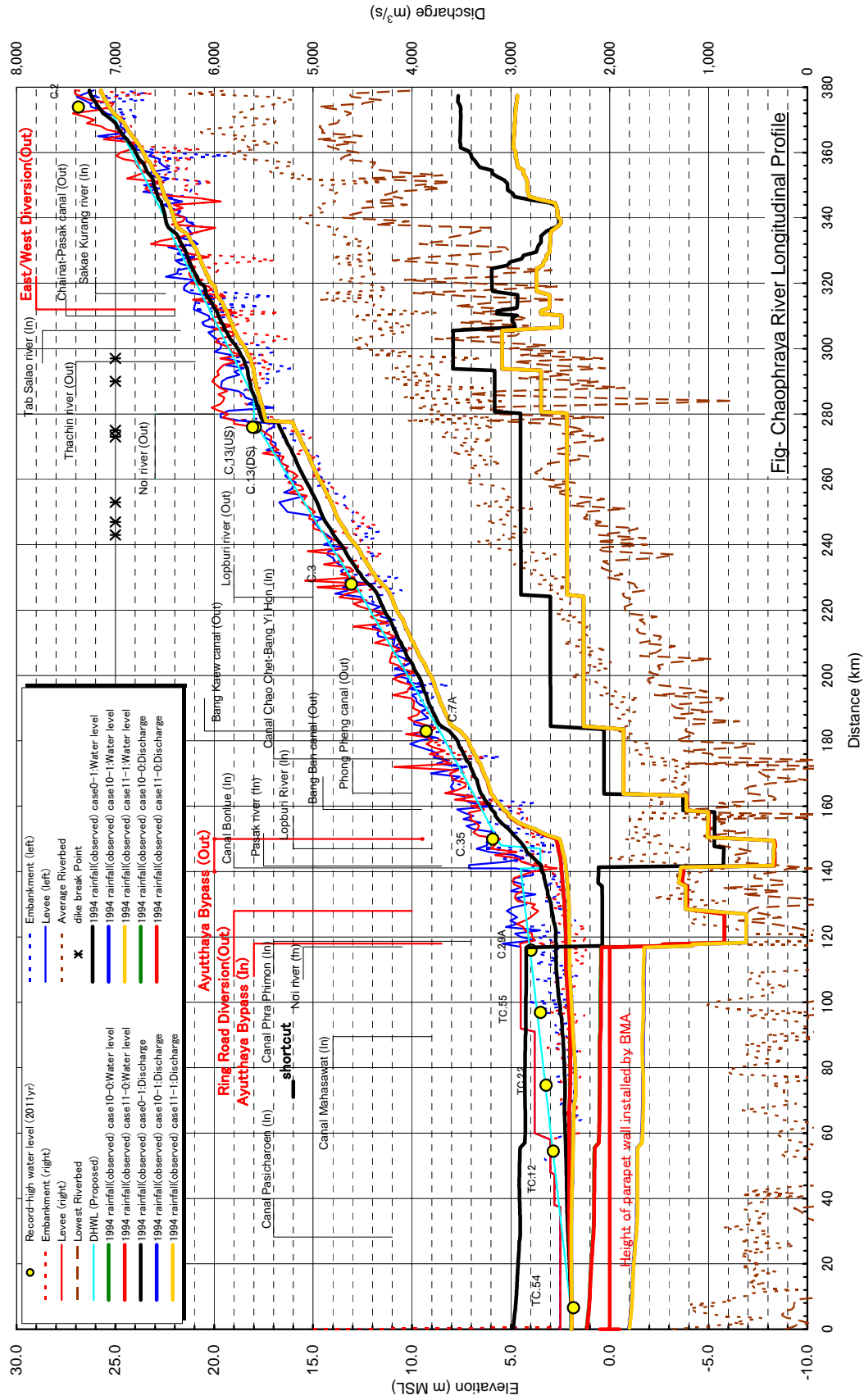


Figure E2.2.12 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1994 Rainfall (observed)

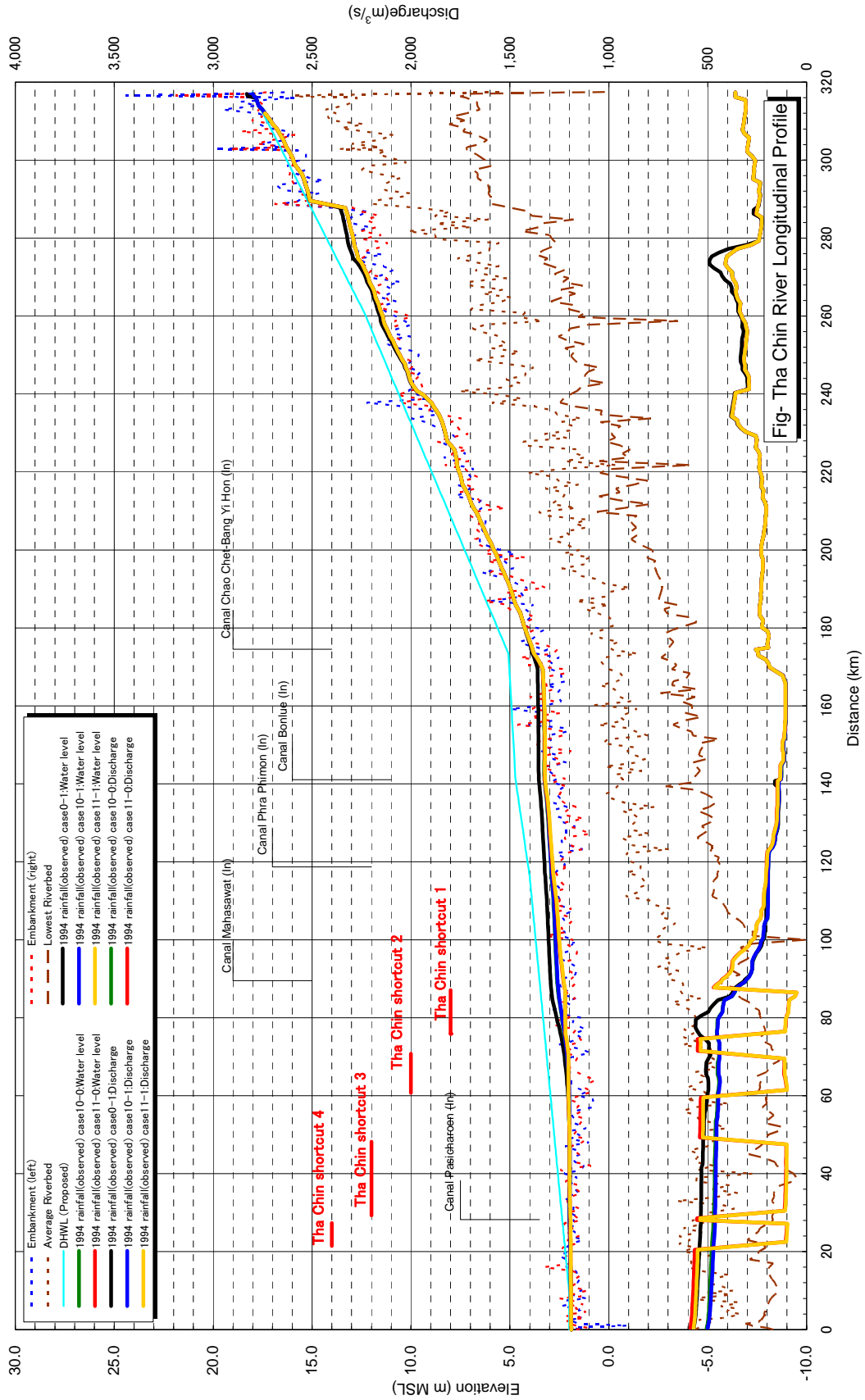


Figure E2.2.13 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1994 Rainfall (observed)

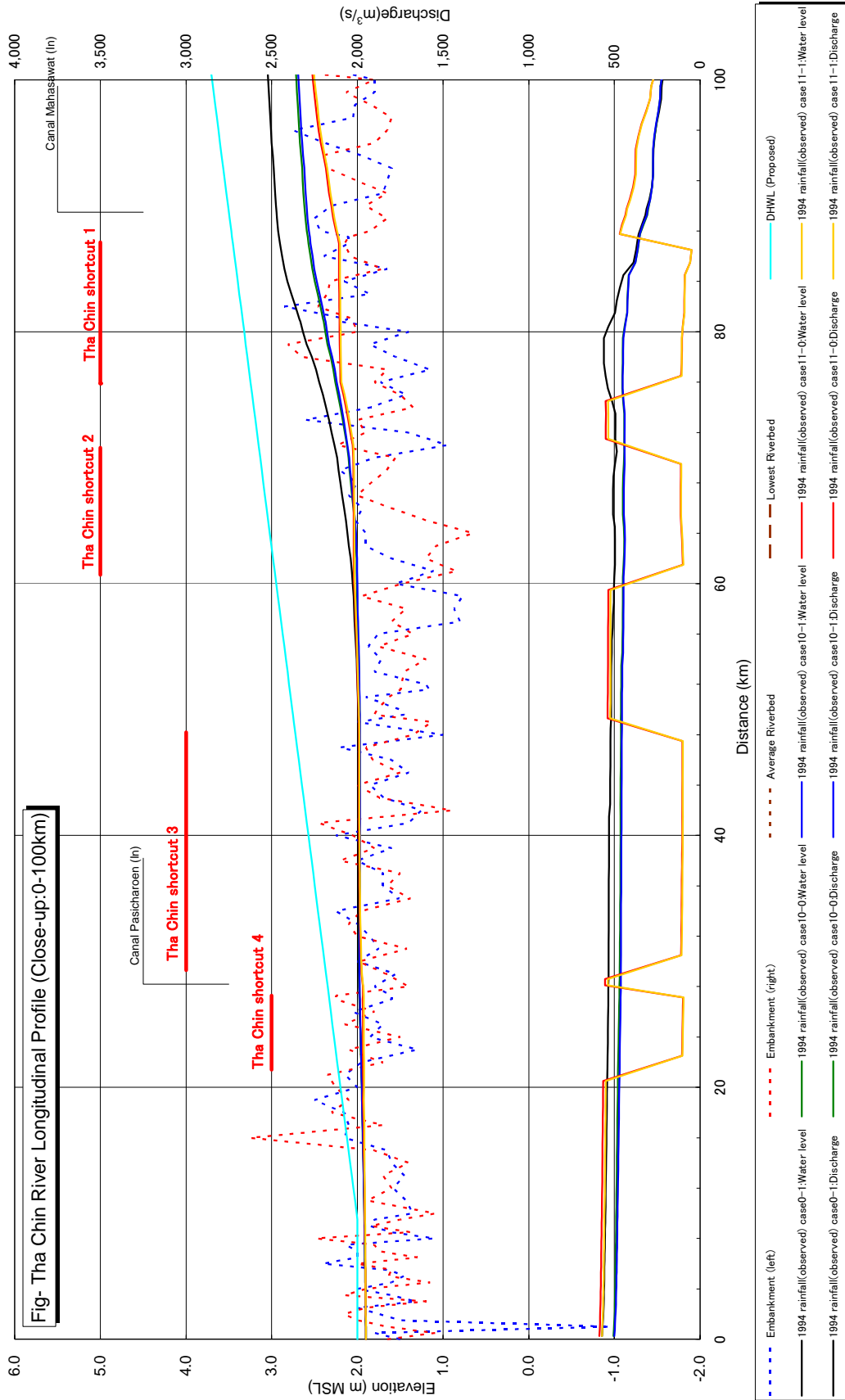


Figure E2.2.14 Comparison of Longitudinal Profile (Case 10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100km close-up 1994 Rainfall (observed)

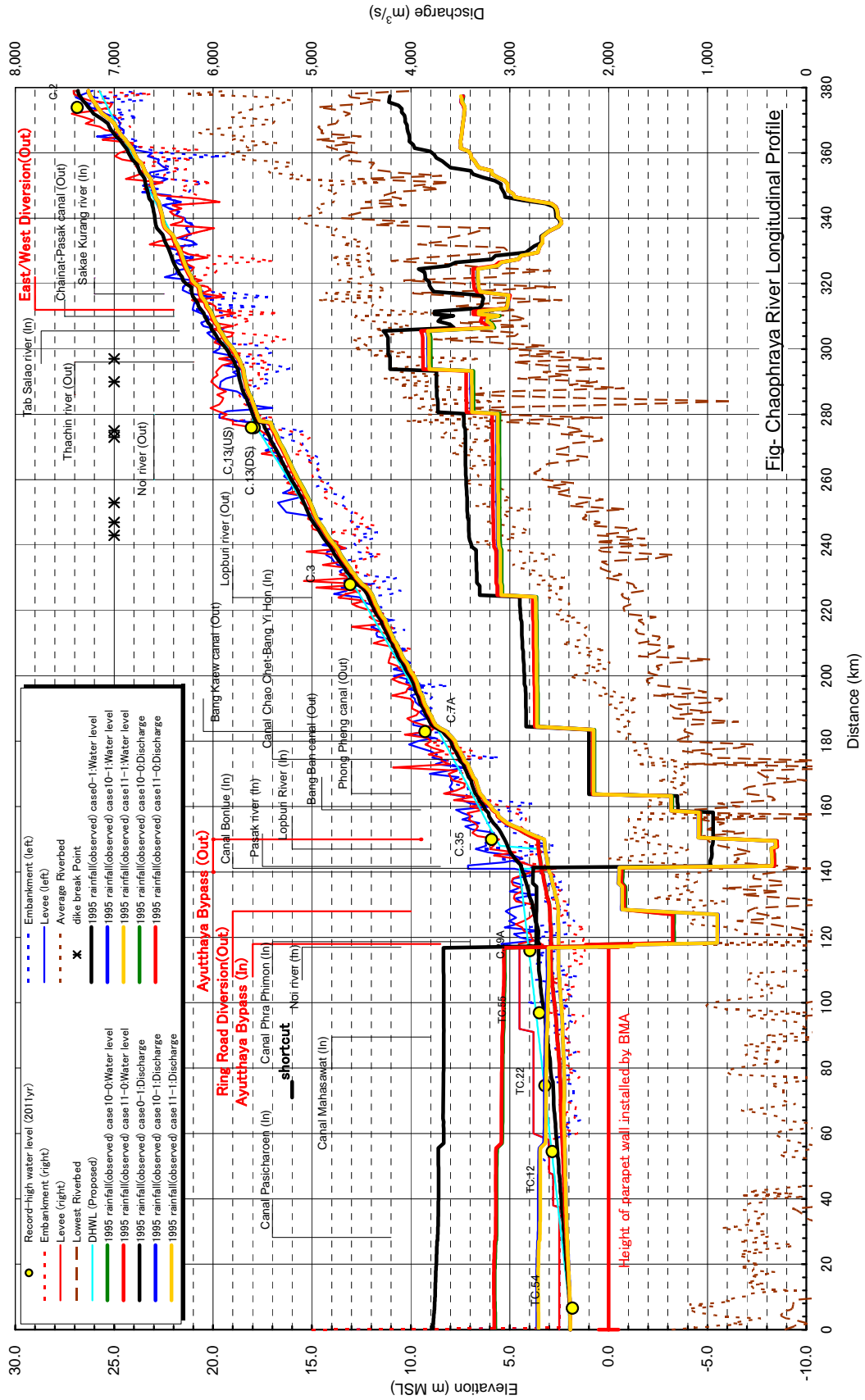


Fig- Chao Phraya River Longitudinal Profile

Figure E2.2.15 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1995 Rainfall (observed)

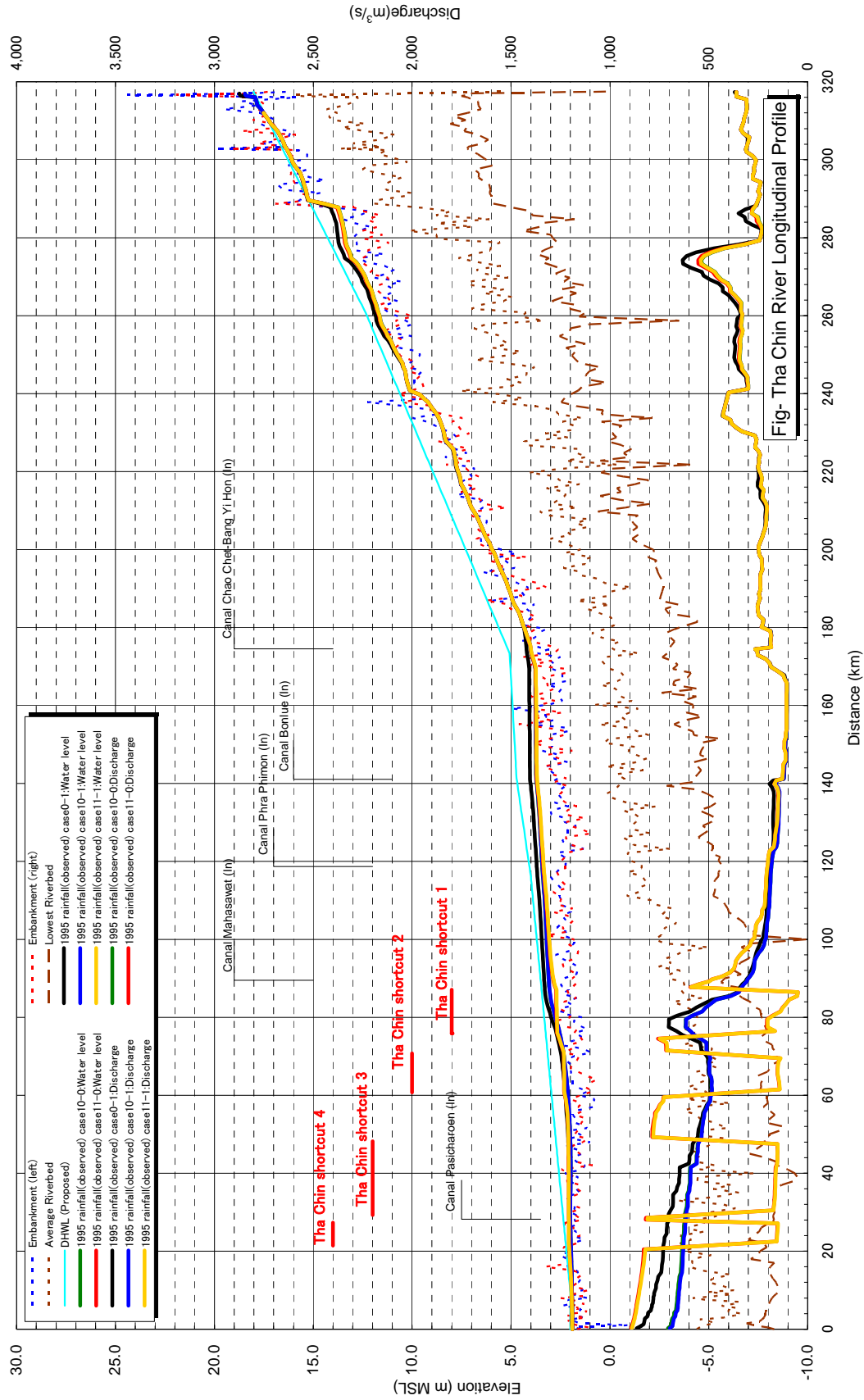


Figure E2.2.16 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1995 Rainfall (observed)

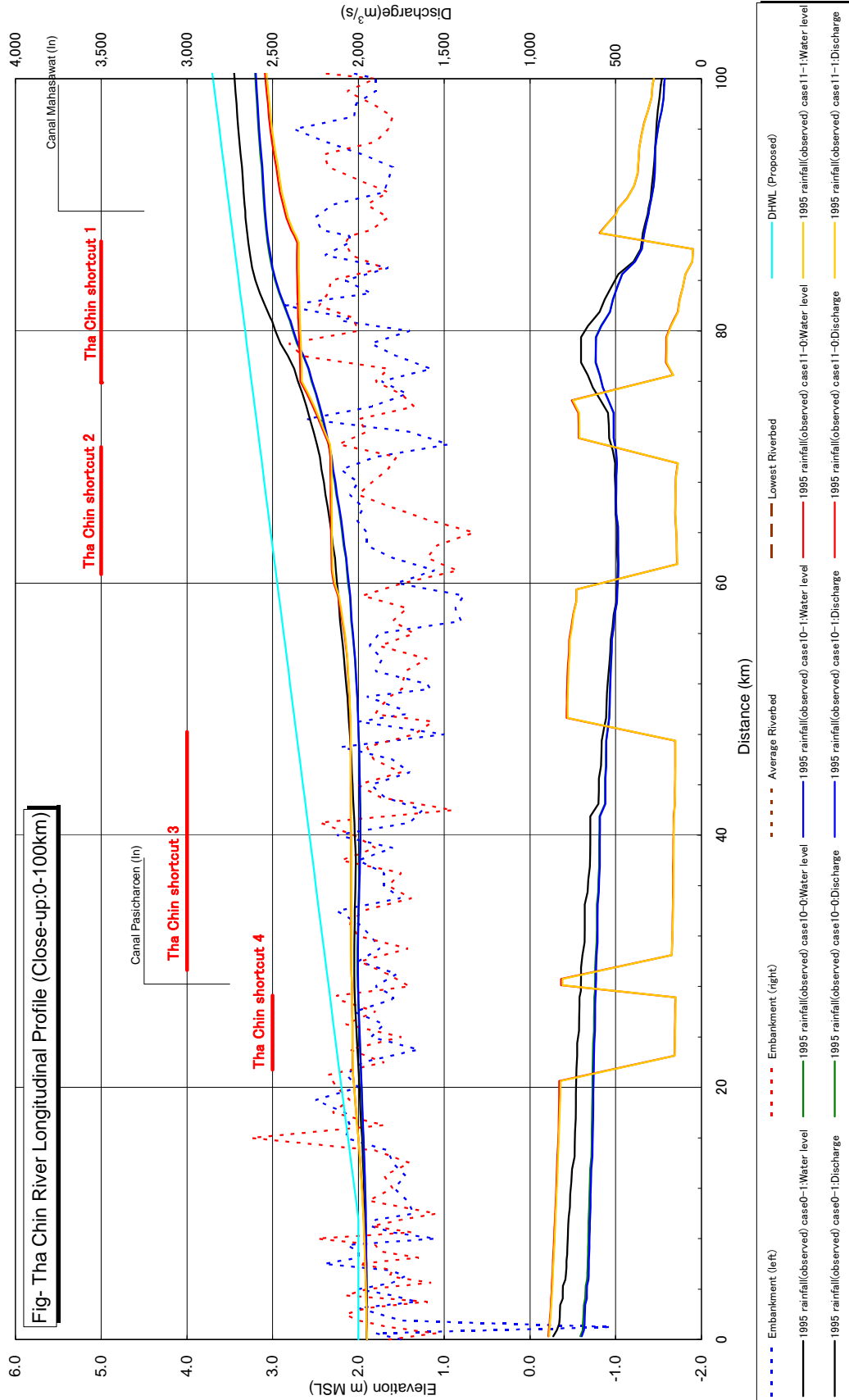


Figure E2.2.17 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1995 Rainfall (observed)

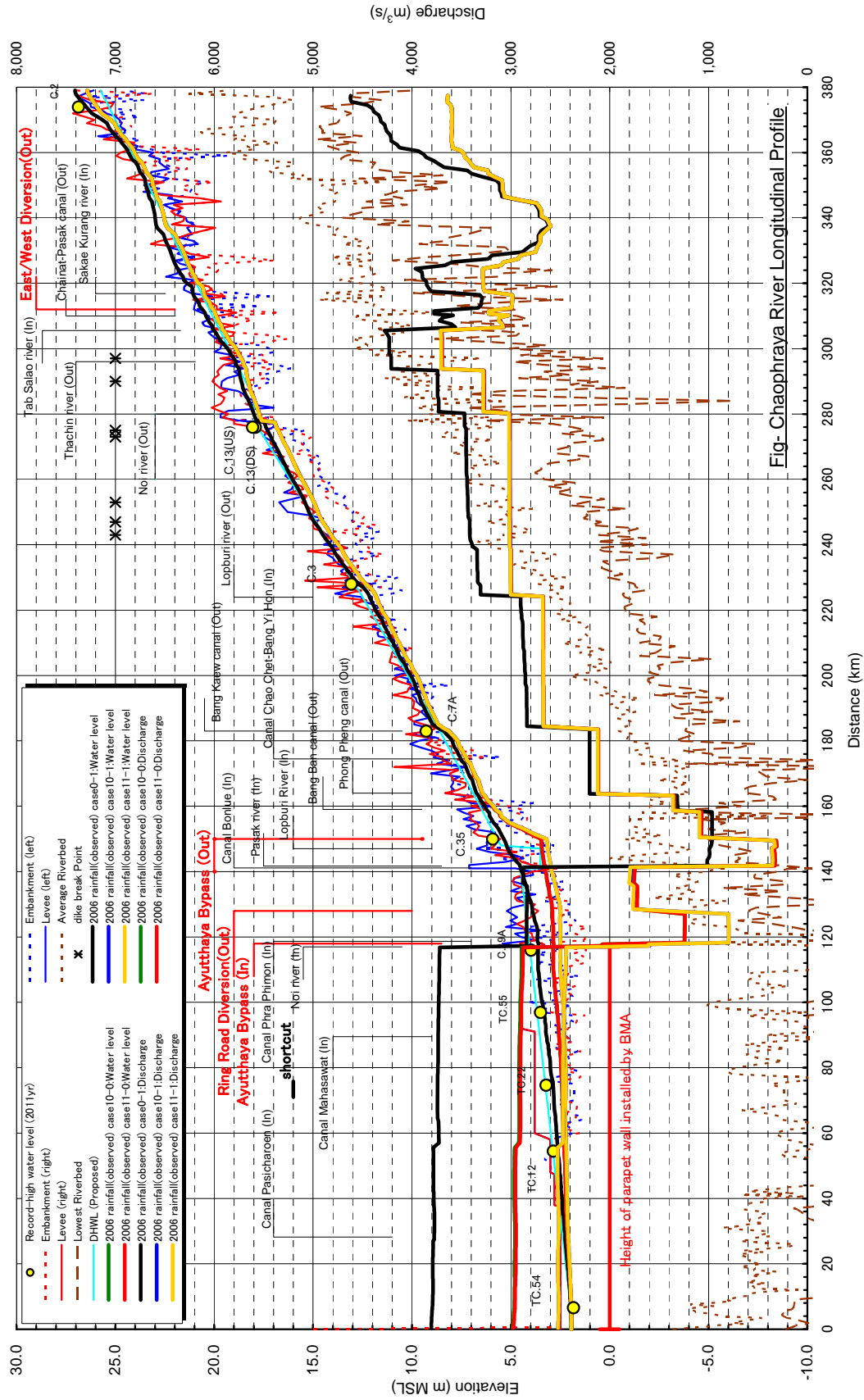


Fig- Chao Phraya River Longitudinal Profile

Figure E2.2.18 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 2006 Rainfall (observed)

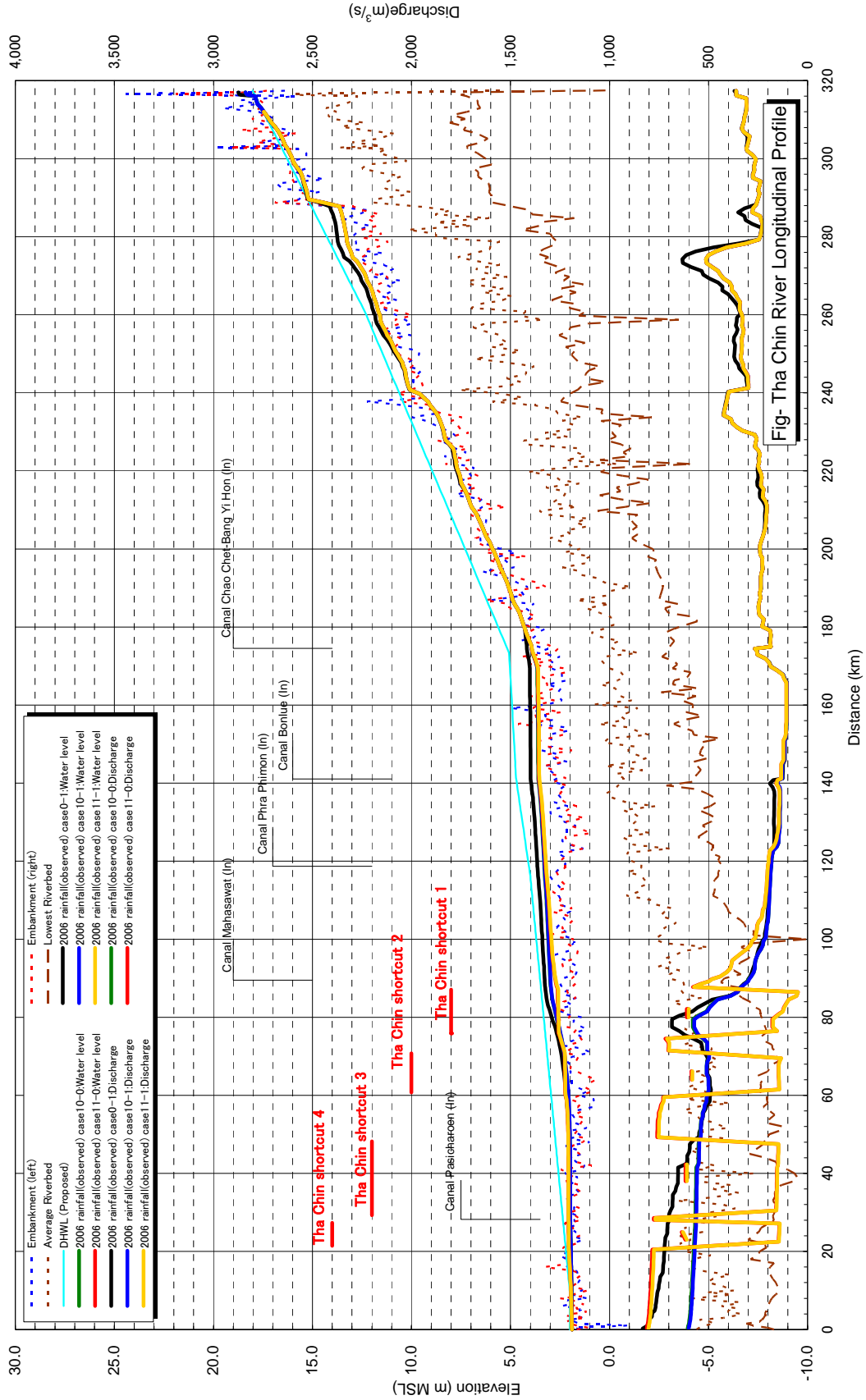


Figure E2.2.19 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 2006 Rainfall (observed)

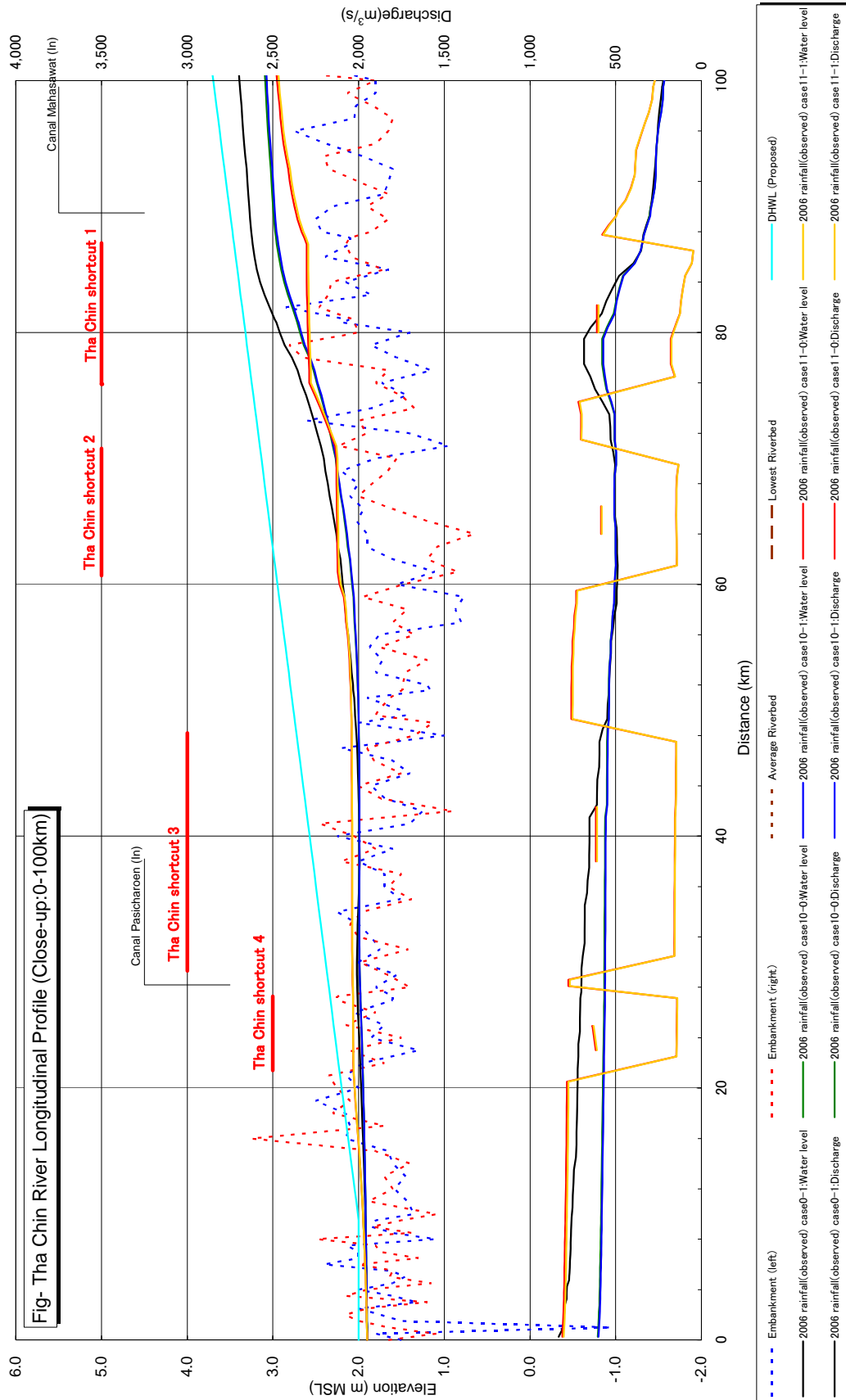
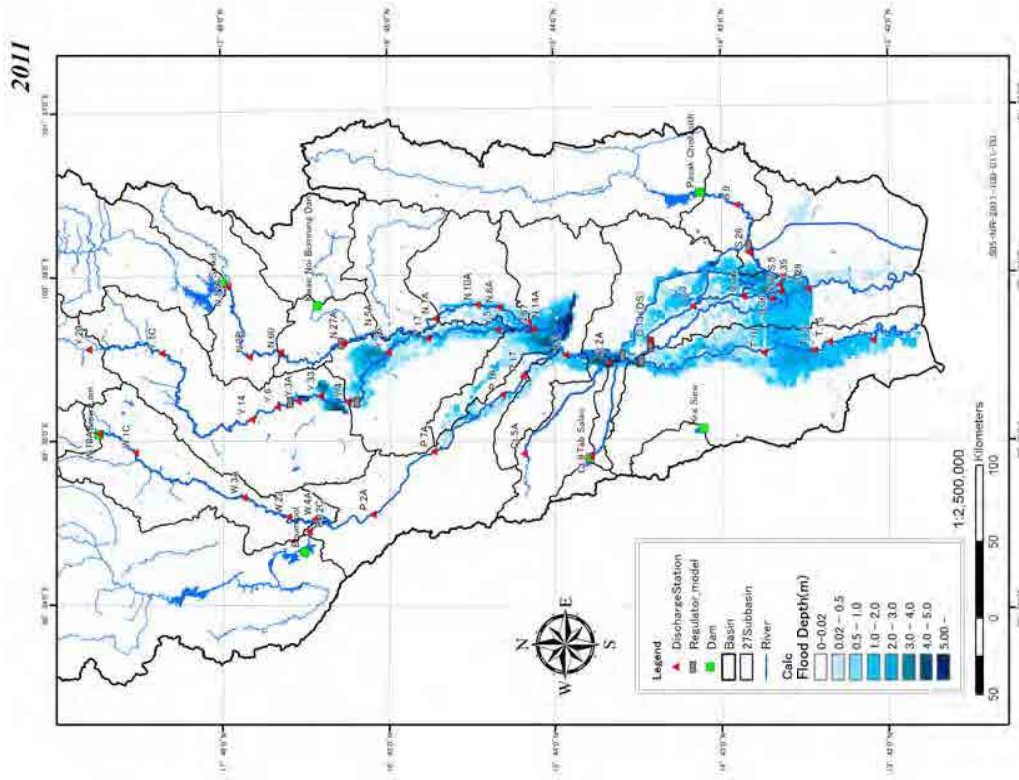


Figure E2.2.20 Comparison of Longitudinal Profile (Case 10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 2006 Rainfall (observed)

2011 Rainfall (observed) Case11-0



1970 Rainfall (observed) Case11-0

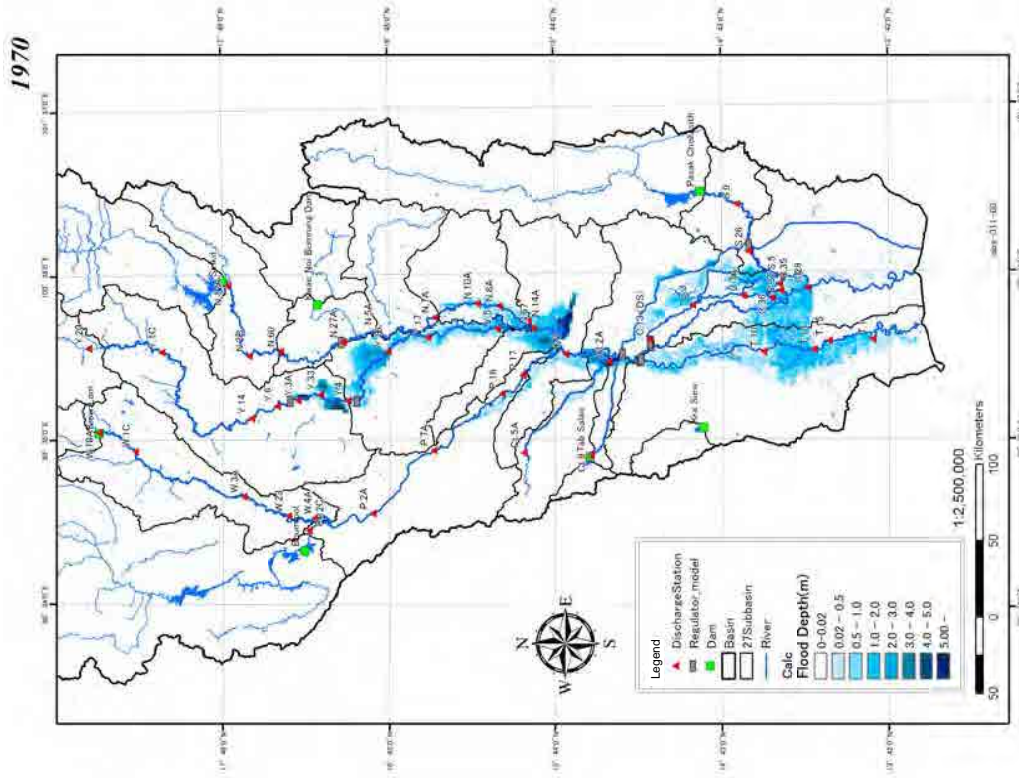
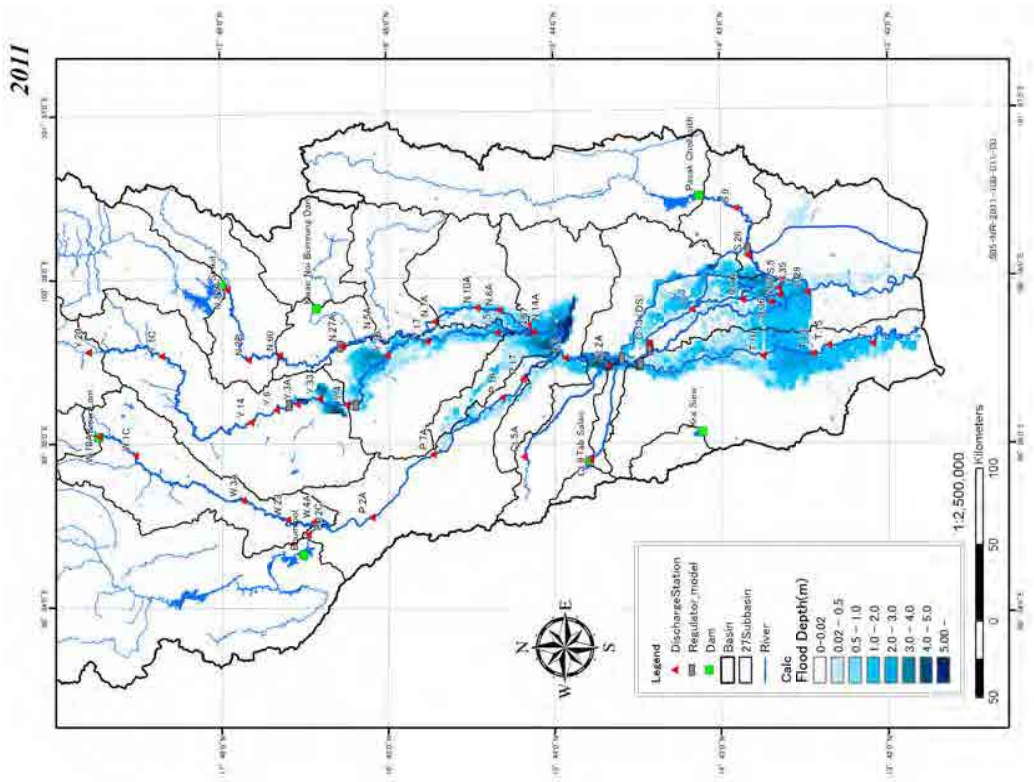


Figure E2.2.21 Comparison of Estimated Inundation Area (Case11-0 : Left 1970, Right: 2011)

2011 Rainfall (observed) Case11-0



1975 Rainfall (observed) Case11-0

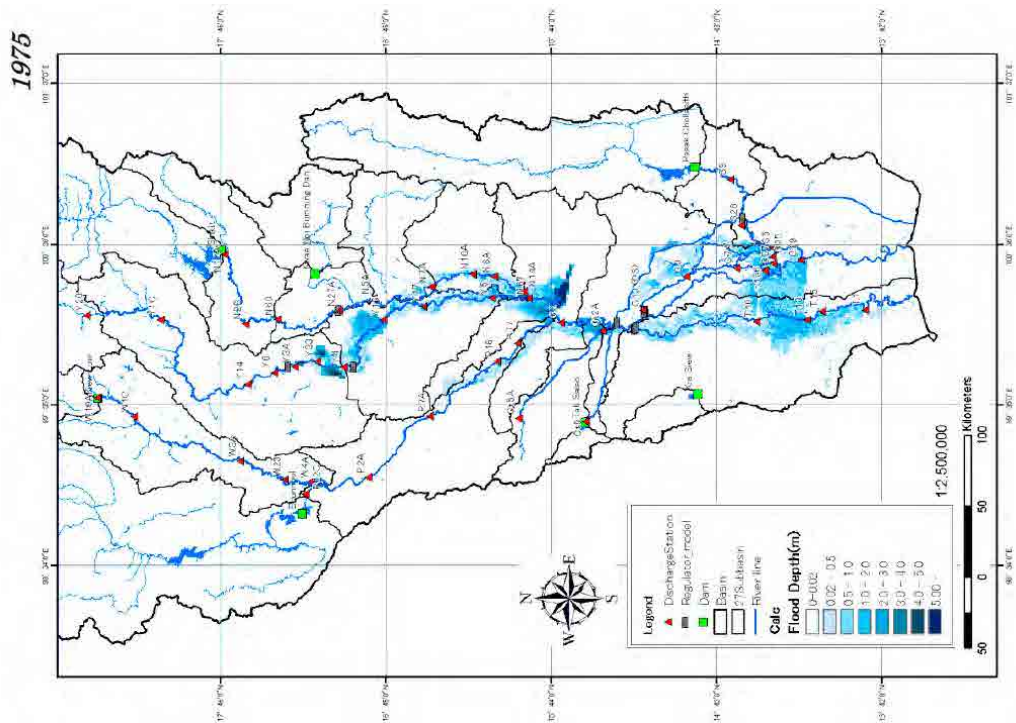
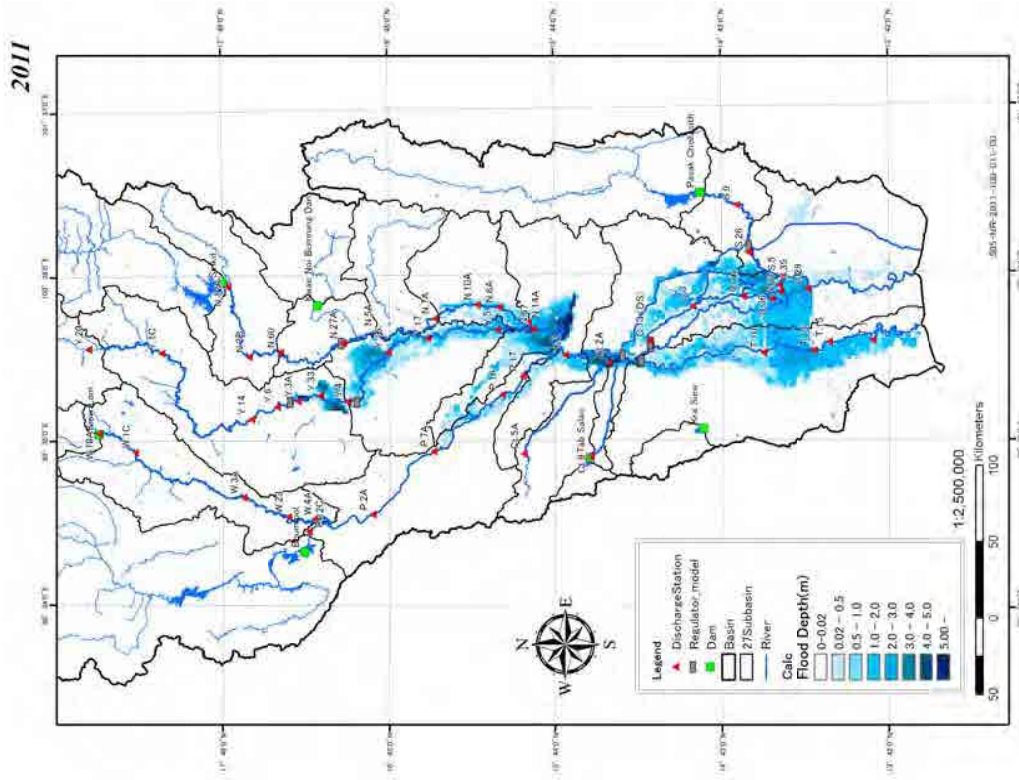


Figure E2.2.22 Comparison of Estimated Inundation Area(Case11-0 : Left:1975, Right:2011)

2011 Rainfall (observed) Case11-0



1980 Rainfall (observed) Case11-0

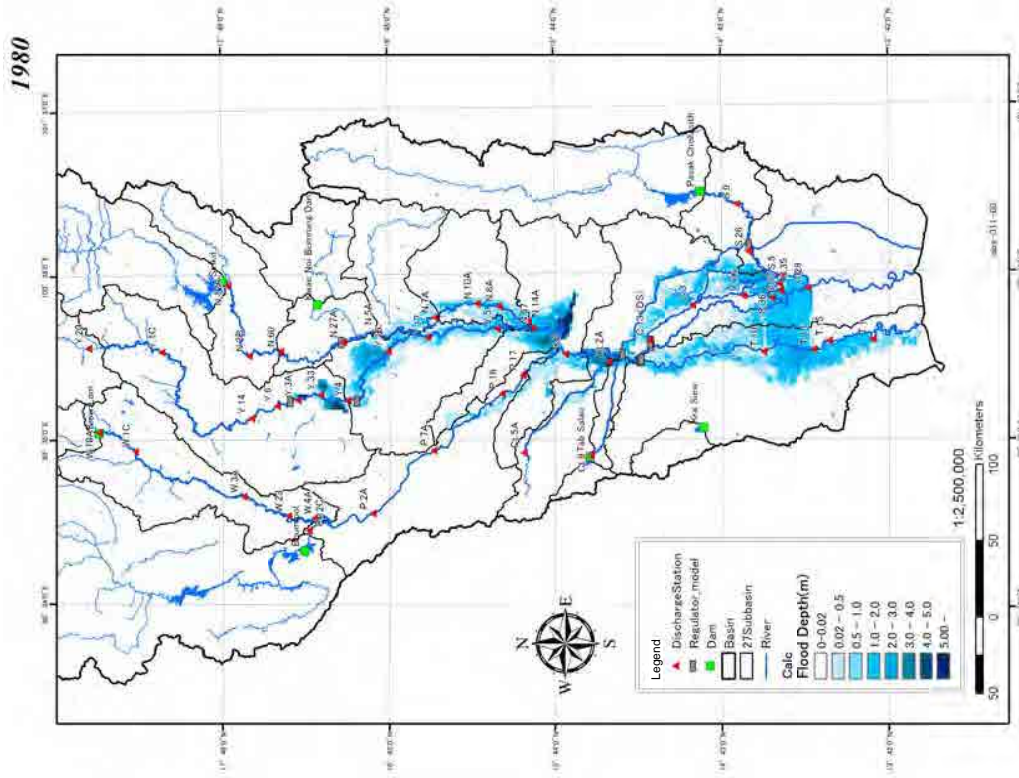
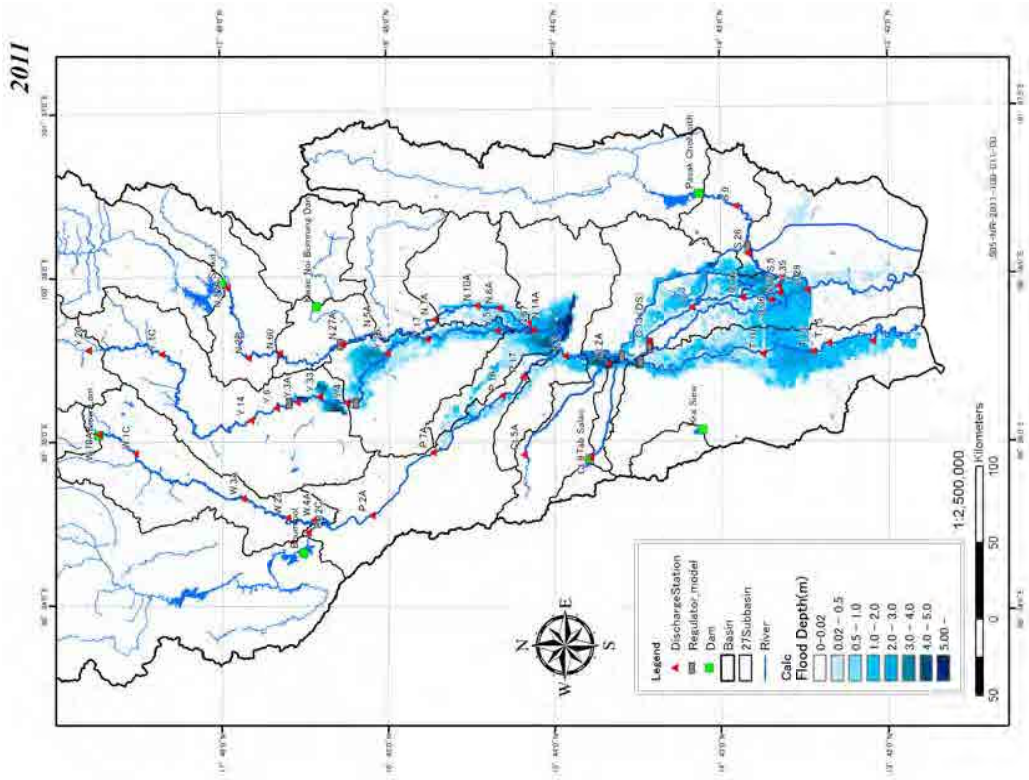


Figure E2.2.23 Comparison of Estimated Inundation Area (Case11-0 : Left:1980, Right:2011)

2011 Rainfall (observed) Case11-0



1994 Rainfall (observed) Case11-0

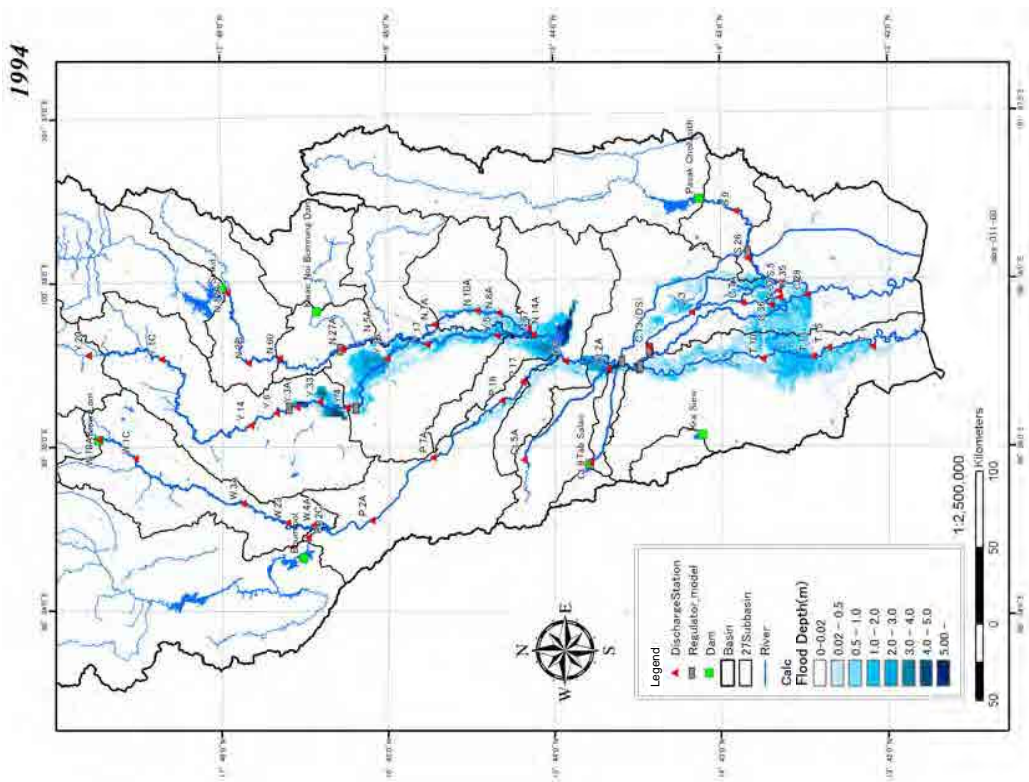
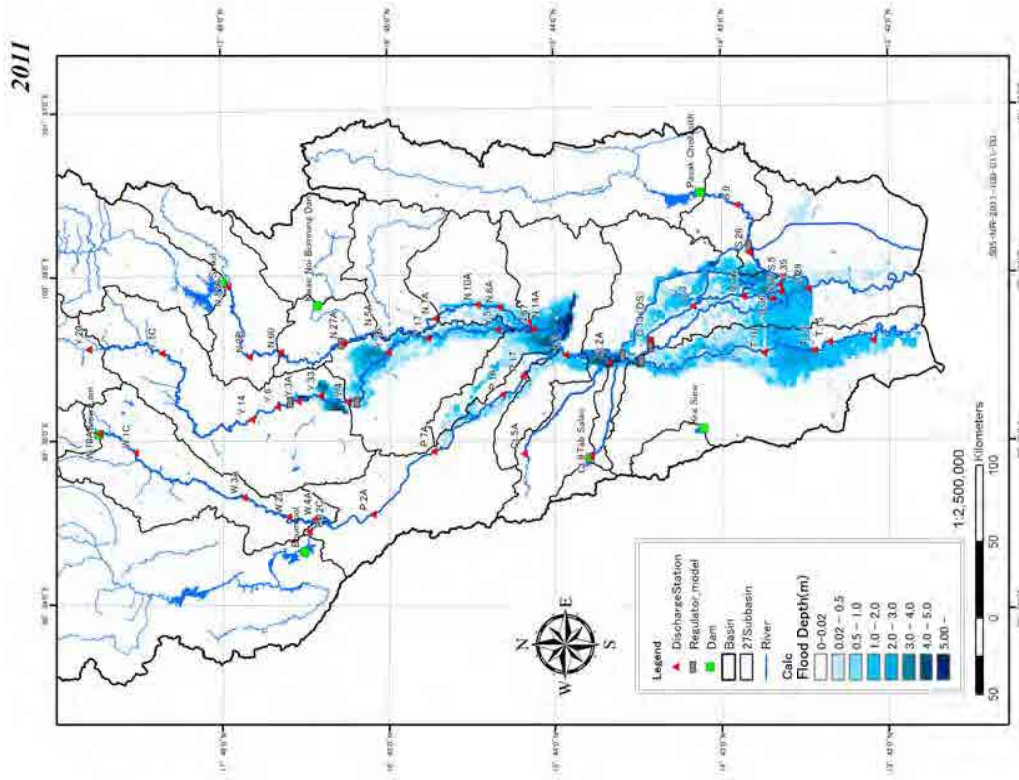


Figure E2.2.24 Comparison of Estimated Inundation Area (Case11-0 : Left:1994, Right:2011)

2011 Rainfall (observed) Case11-0



1995 Rainfall (observed) Case11-0

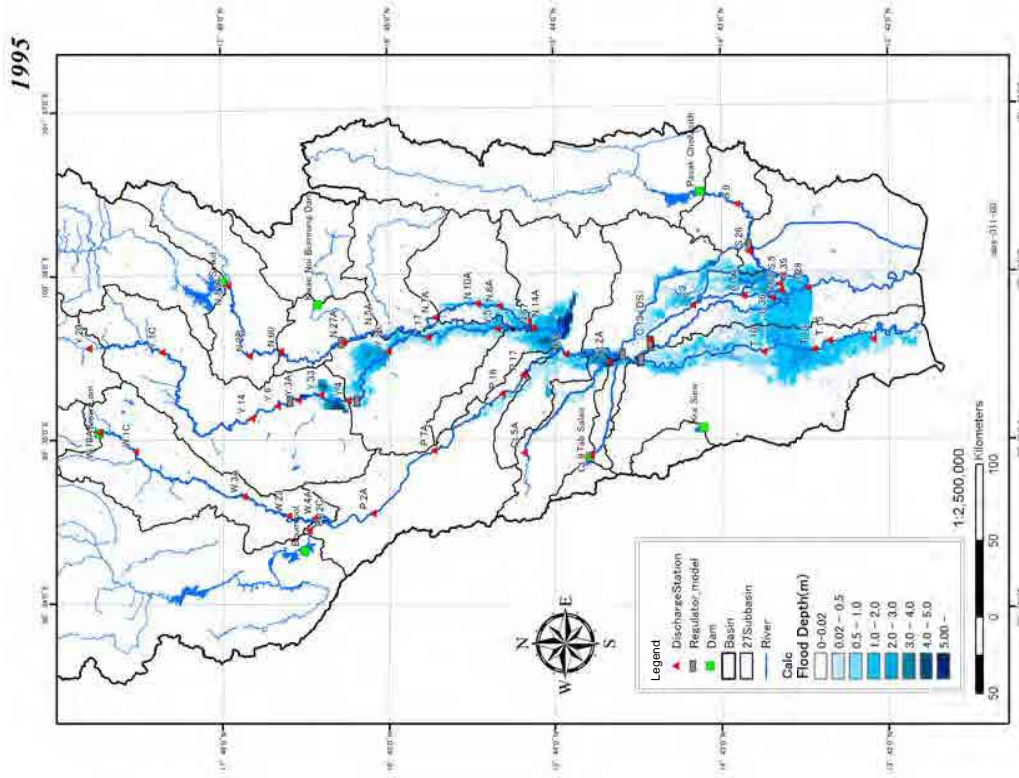
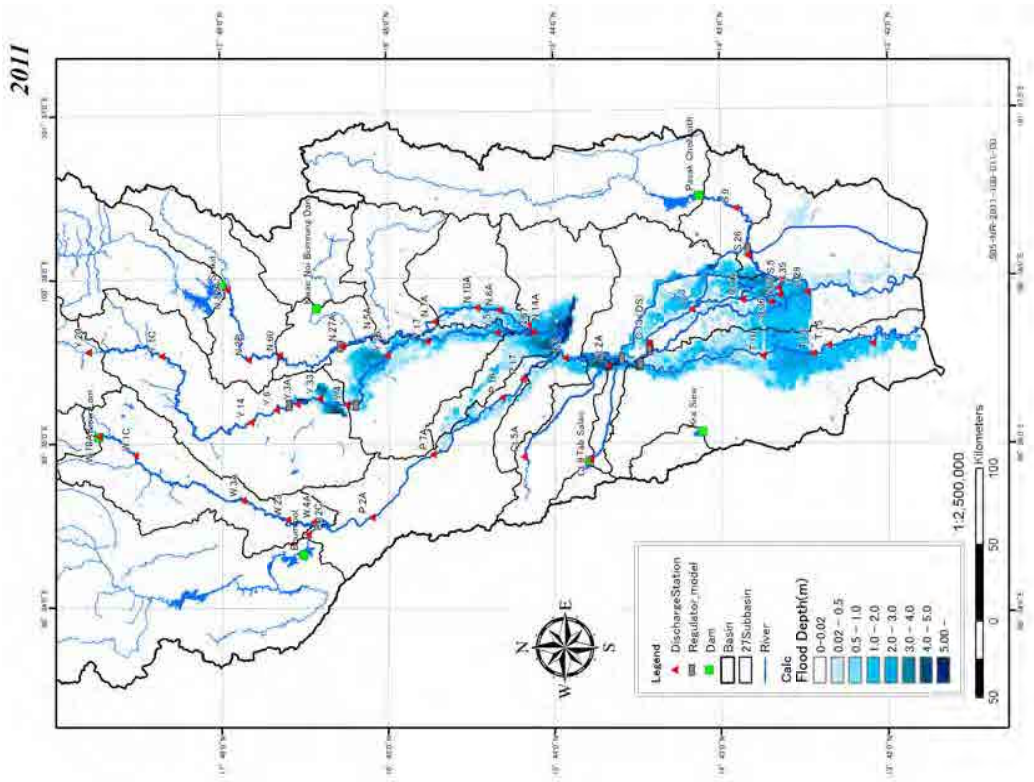


Figure E2.2.25 Comparison of Estimated Inundation Area (Case11-0 : Left:1995, Right:2011)

2011 Rainfall (observed) Case11-0



2006 Rainfall (observed) Case11-0

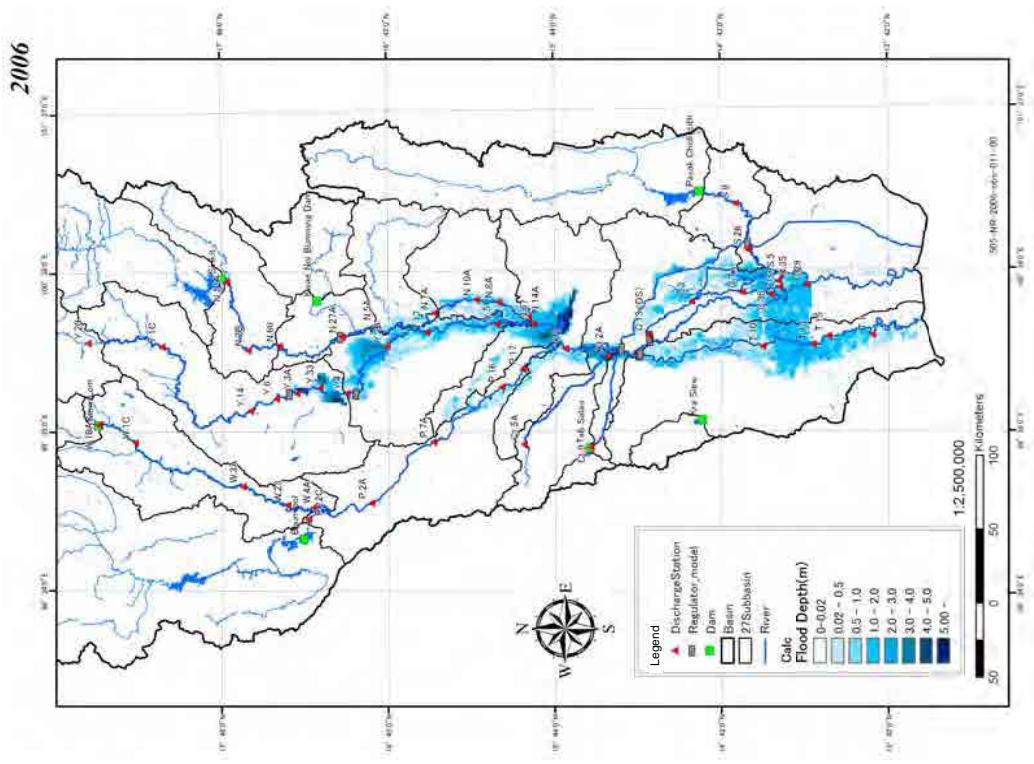
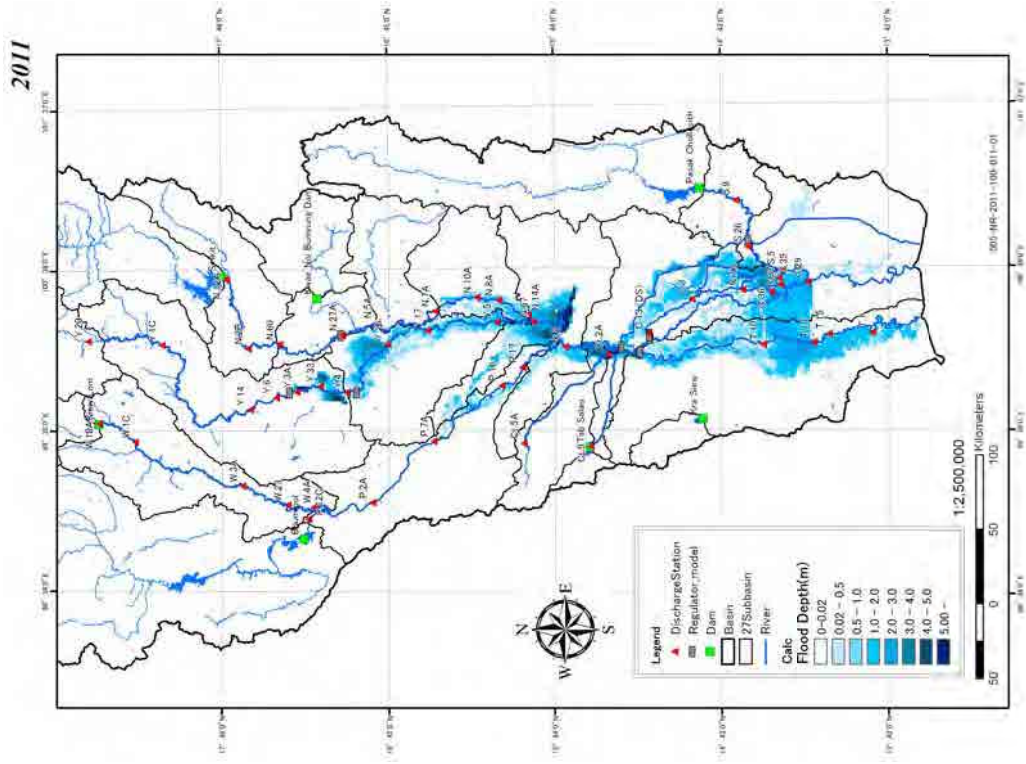


Figure E2.2.26 Comparison of Estimated Inundation Area (Case11-0 : Left:2006, Right:2011)

2011 Rainfall (observed) Case11-1



1970 Rainfall (observed) Case11-1

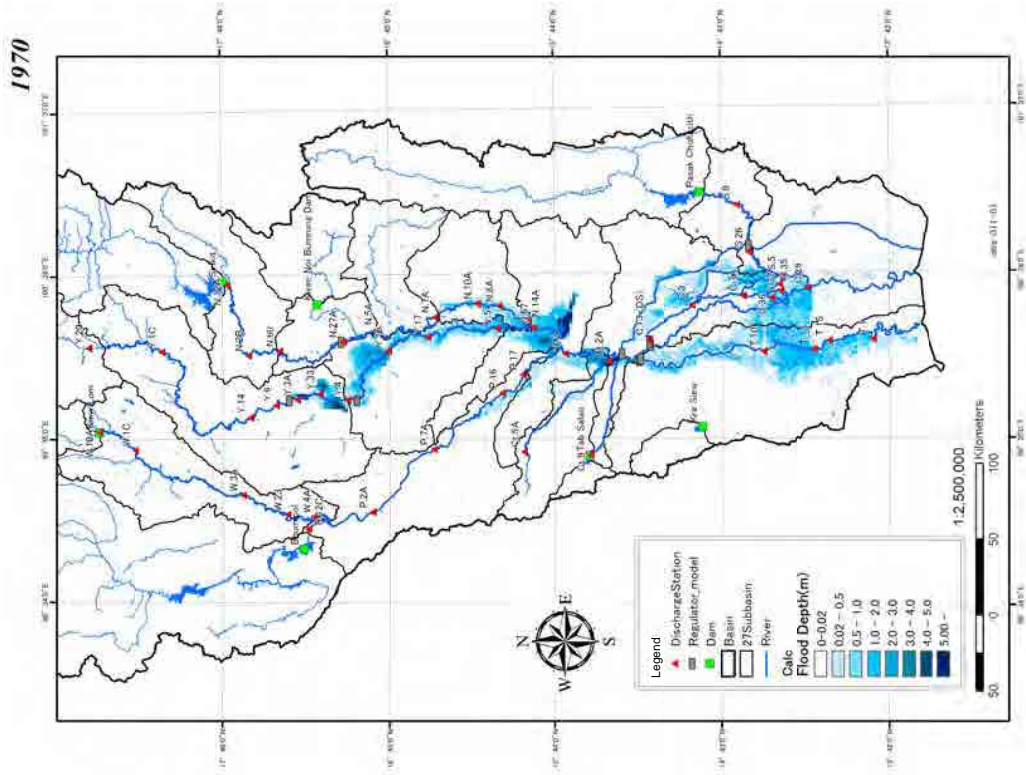
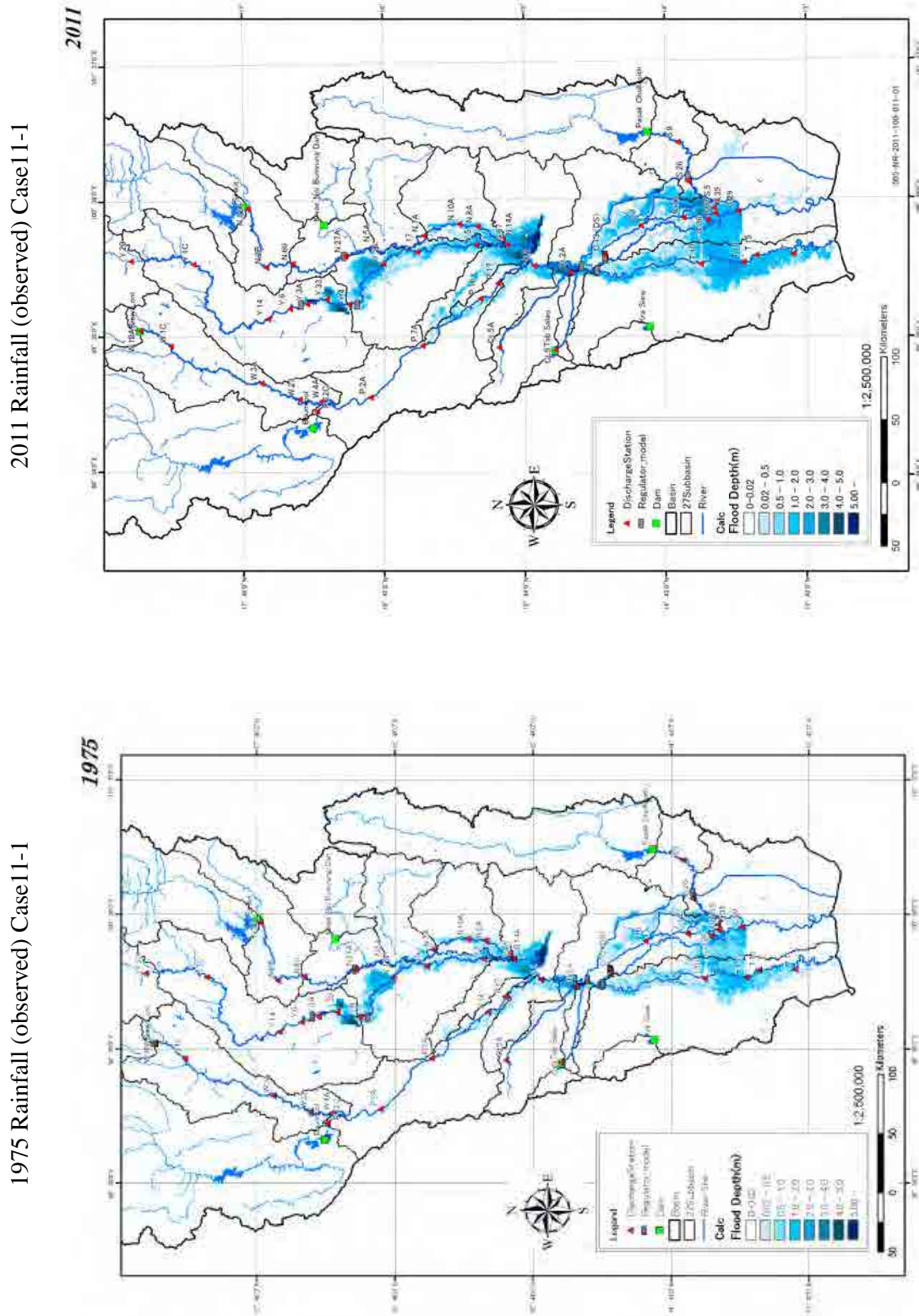


Figure E2.2.27 Comparison of Estimated Inundation Area (Case11-1 : Left 1970, Right: 2011)

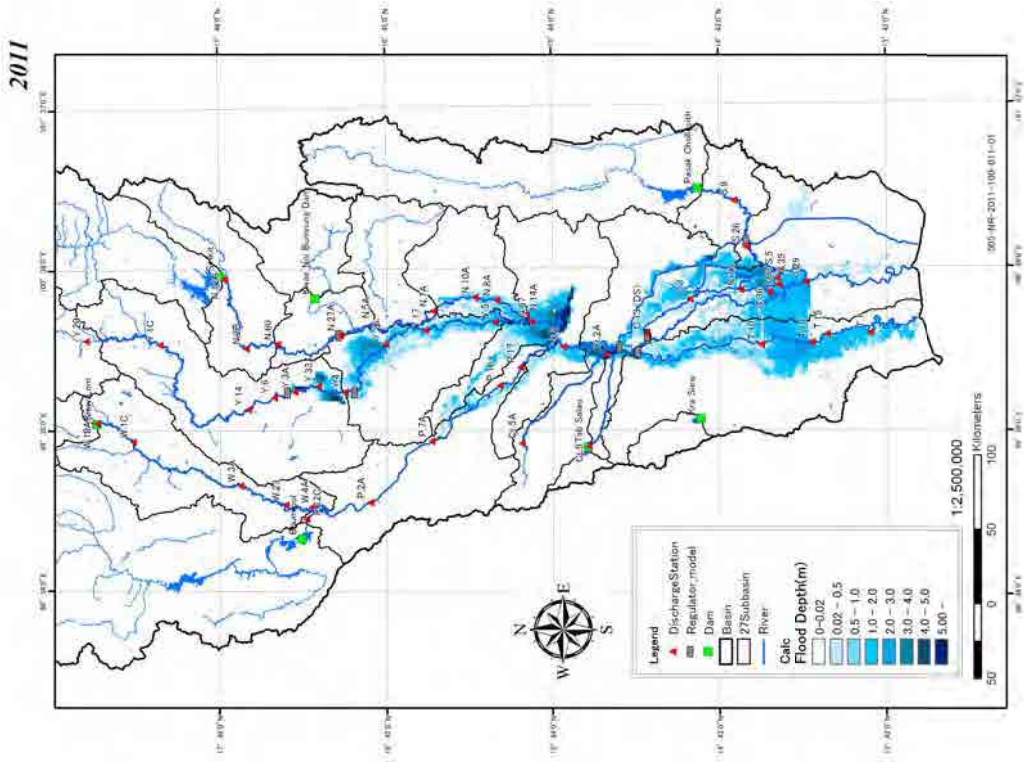


2011 Rainfall (observed) Case11-1

1975 Rainfall (observed) Case11-1

Figure E2.2.28 Comparison of Estimated Inundation Area (Case11-1 : Left:1975, Right:2011)

2011 Rainfall (observed) Case11-1



1980 Rainfall (observed) Case11-1

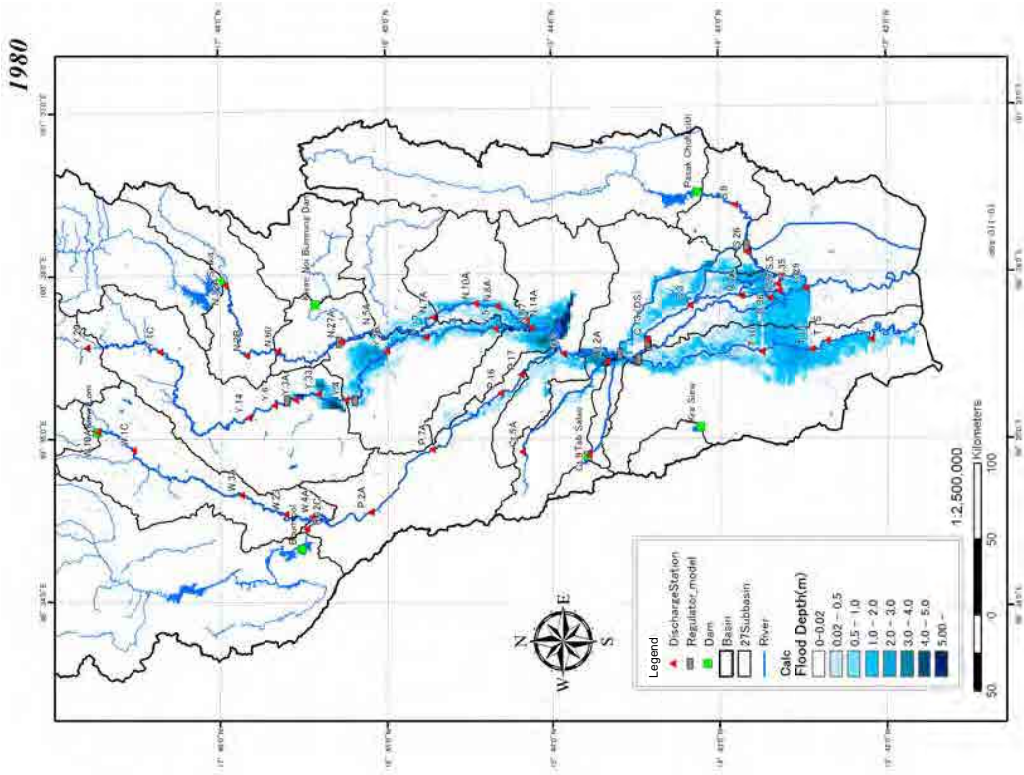
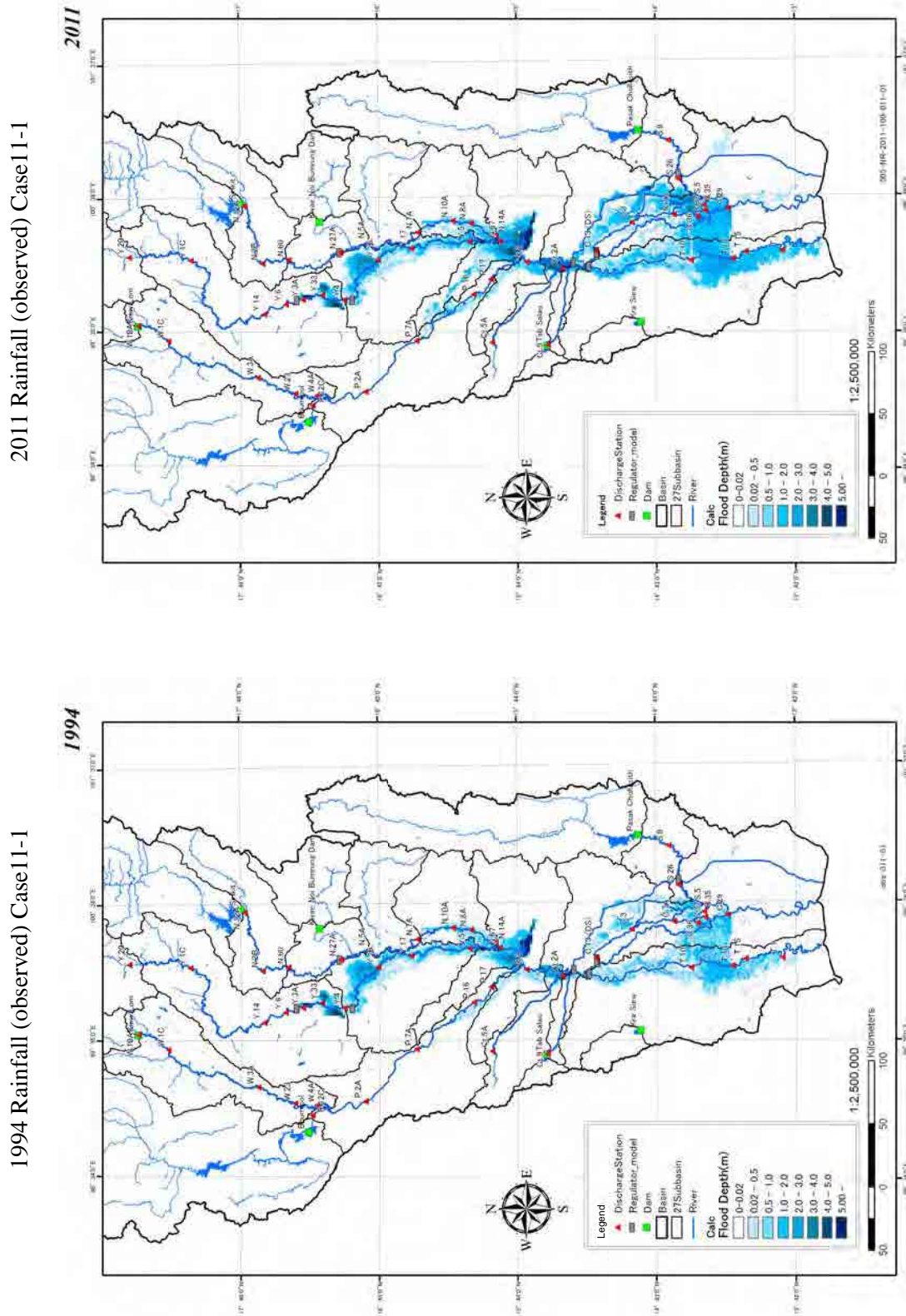


Figure E2.2.29 Comparison of Estimated Inundation Area (Case11-1 : Left:1980, Right:2011)

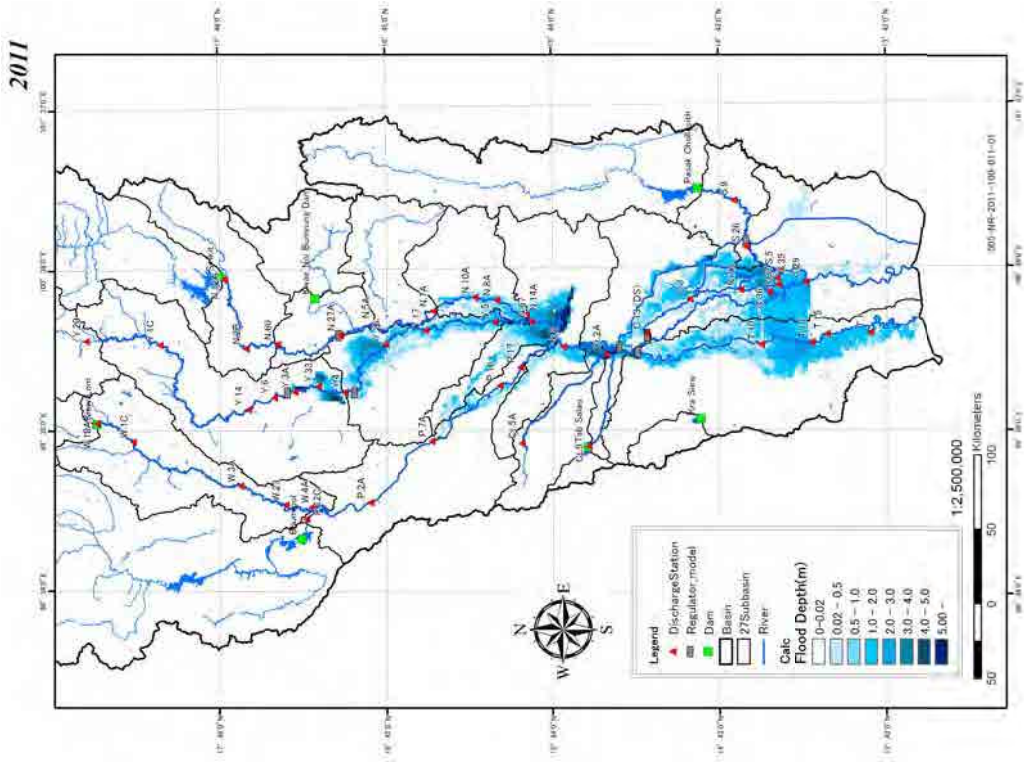


2011 Rainfall (observed) Case11-1

1994 Rainfall (observed) Case11-1

Figure E2.2.30 Comparison of Estimated Inundation Area (Case11-1 : Left:1994, Right:2011)

2011 Rainfall (observed) Case11-1



1995 Rainfall (observed) Case11-1

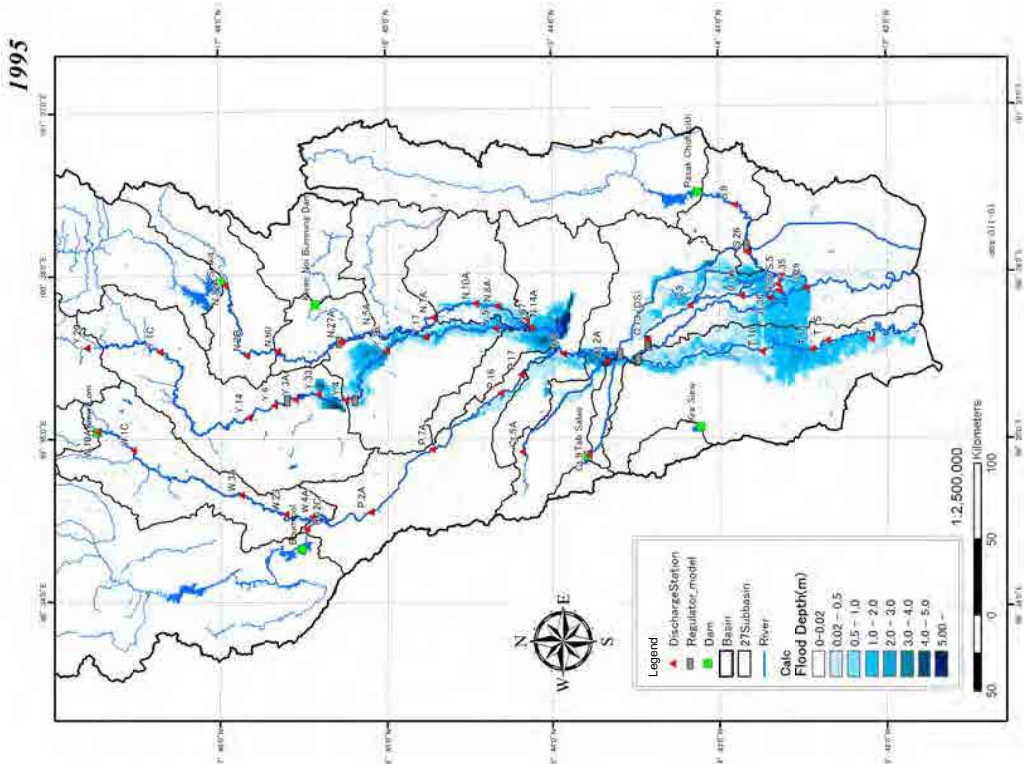
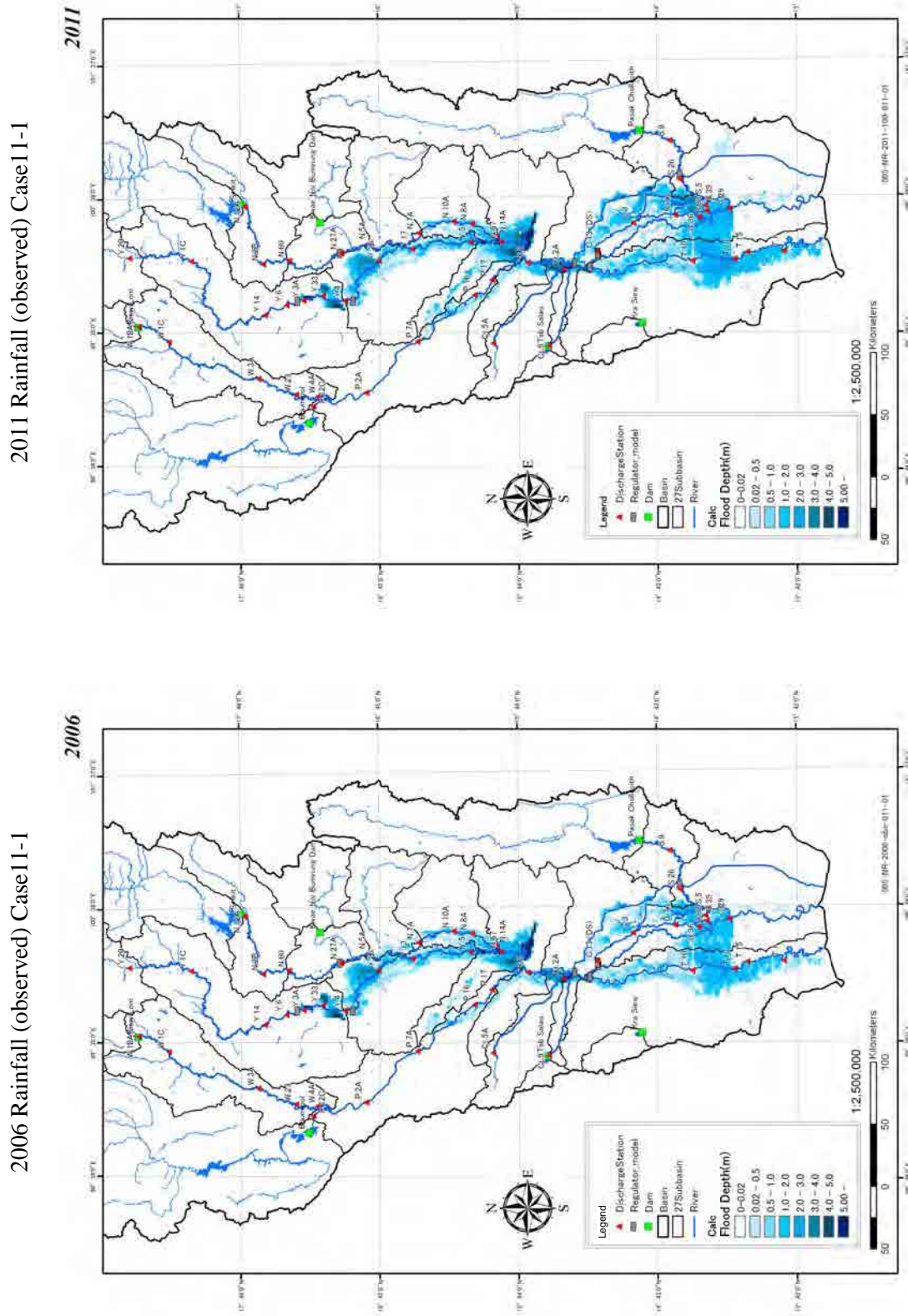


Figure E2.2.31 Comparison of Estimated Inundation Area (Case11-1 : Left:1995, Right:2011)



2011 Rainfall (observed) Case11-1

2006 Rainfall (observed) Case11-1

Figure E2.2.32 Comparison of Estimated Inundation Area (Case11-1 : Left:2006, Right:2011)

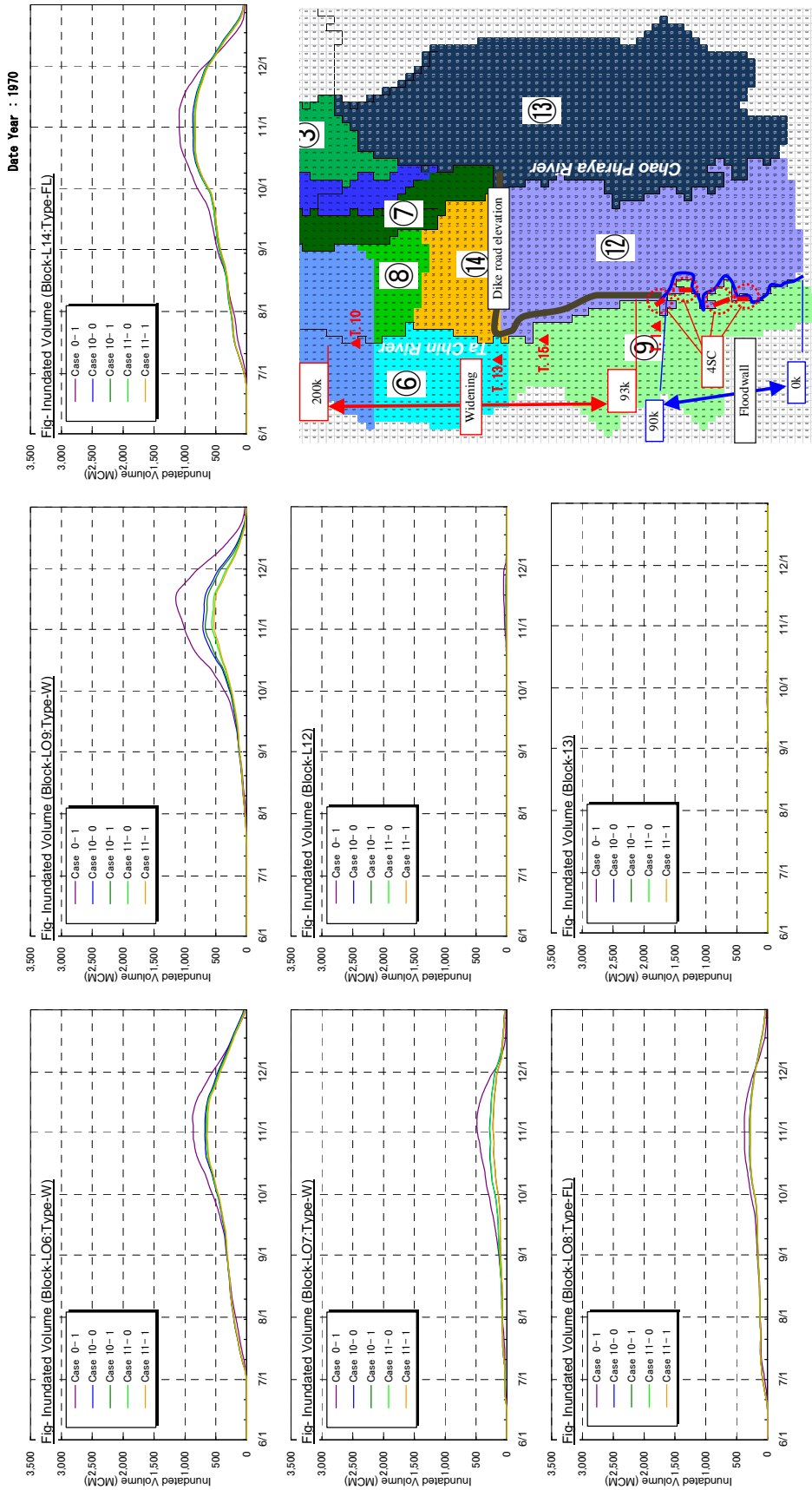


Figure E2.2.33 Time-series Diagrams of Inundated Volume by Block (Year 1970 observed)

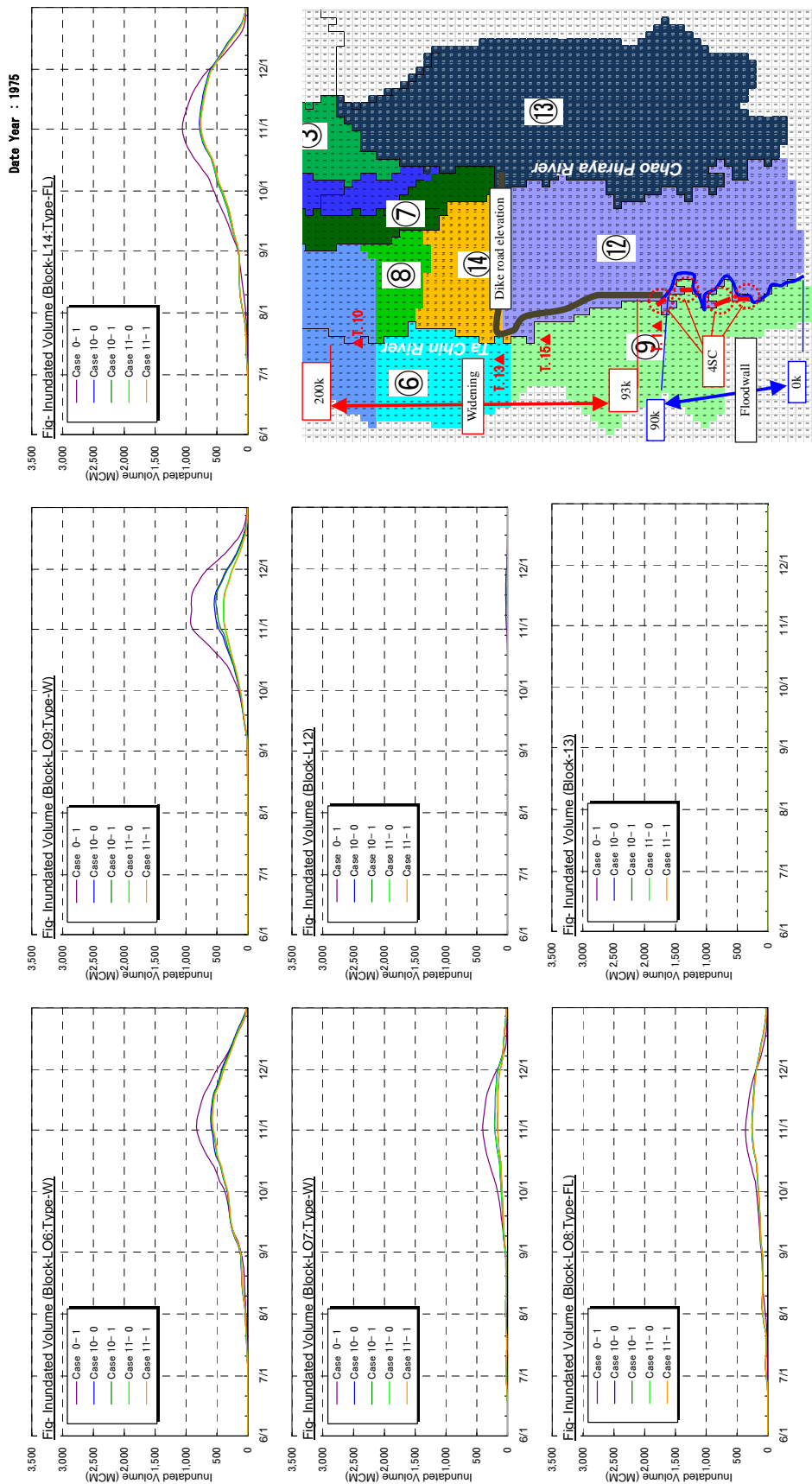


Figure E2.2.34 Time-series Diagrams of Inundated Volume by Block (Year 1975 observed)

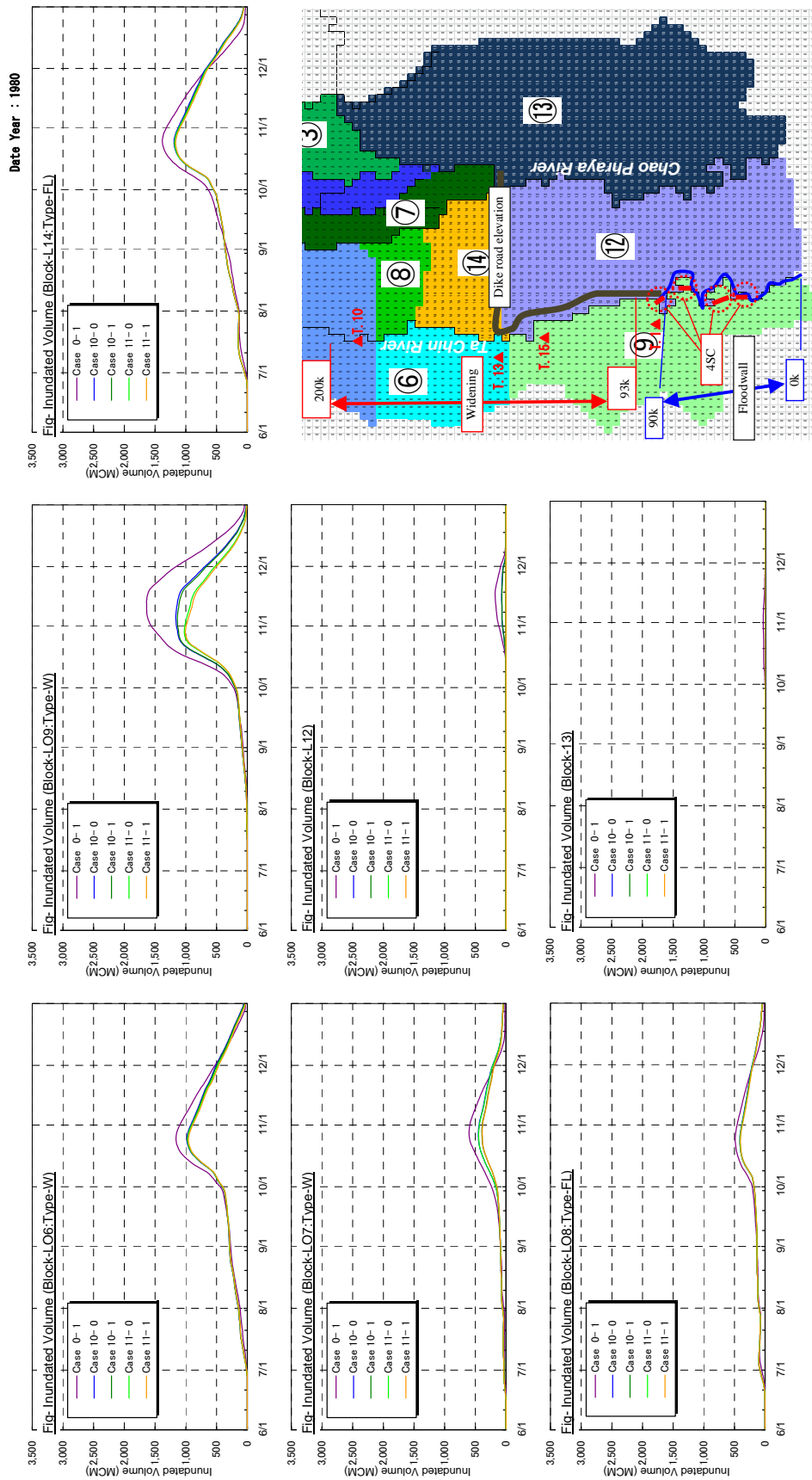


Figure E2.2.35 Time-series Diagrams of Inundated Volume by Block (Year 1980 observed)

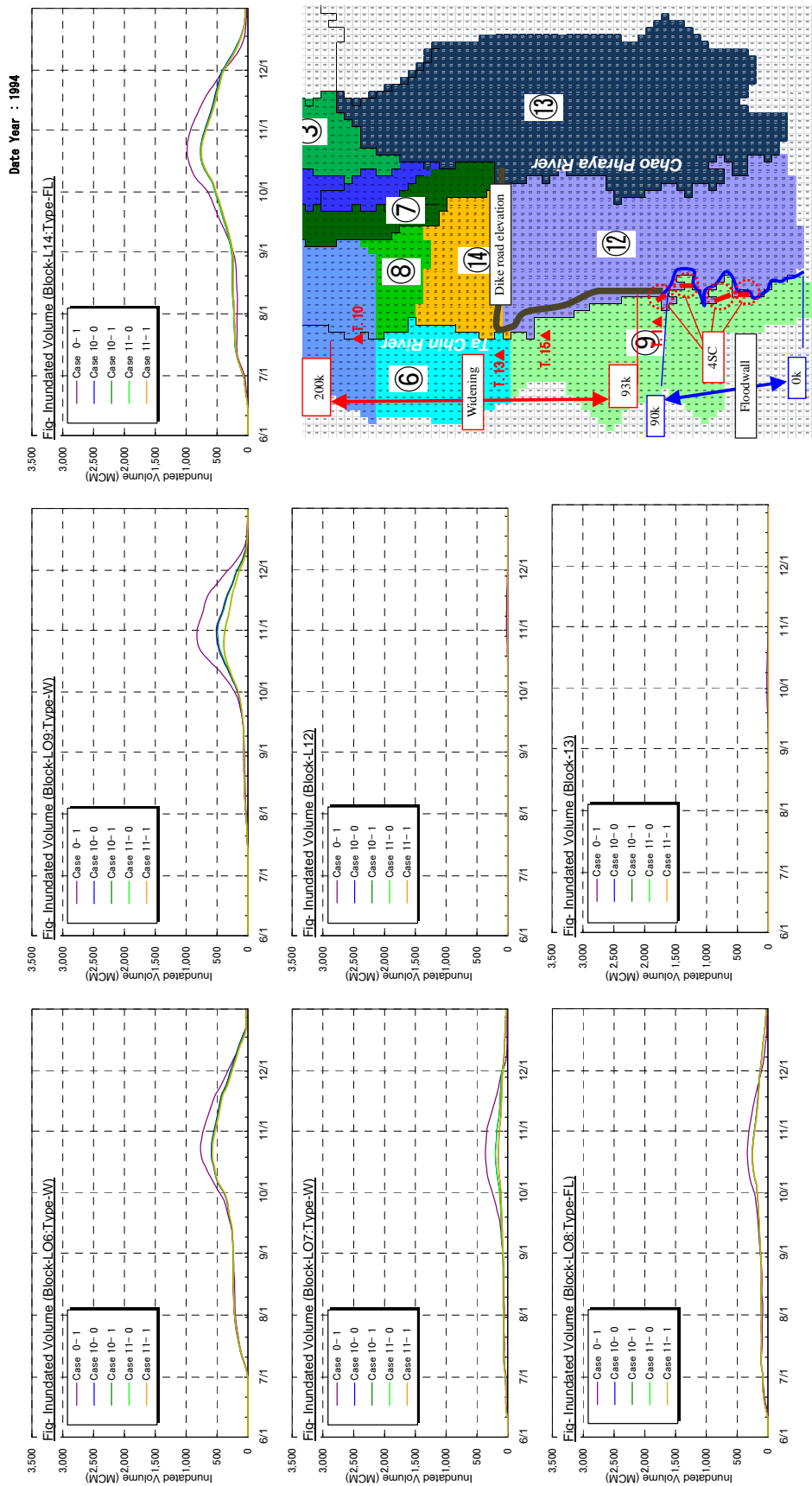


Figure E2.2.36 Time-series Diagrams of Inundated Volume by Block (Year 1994 observed)

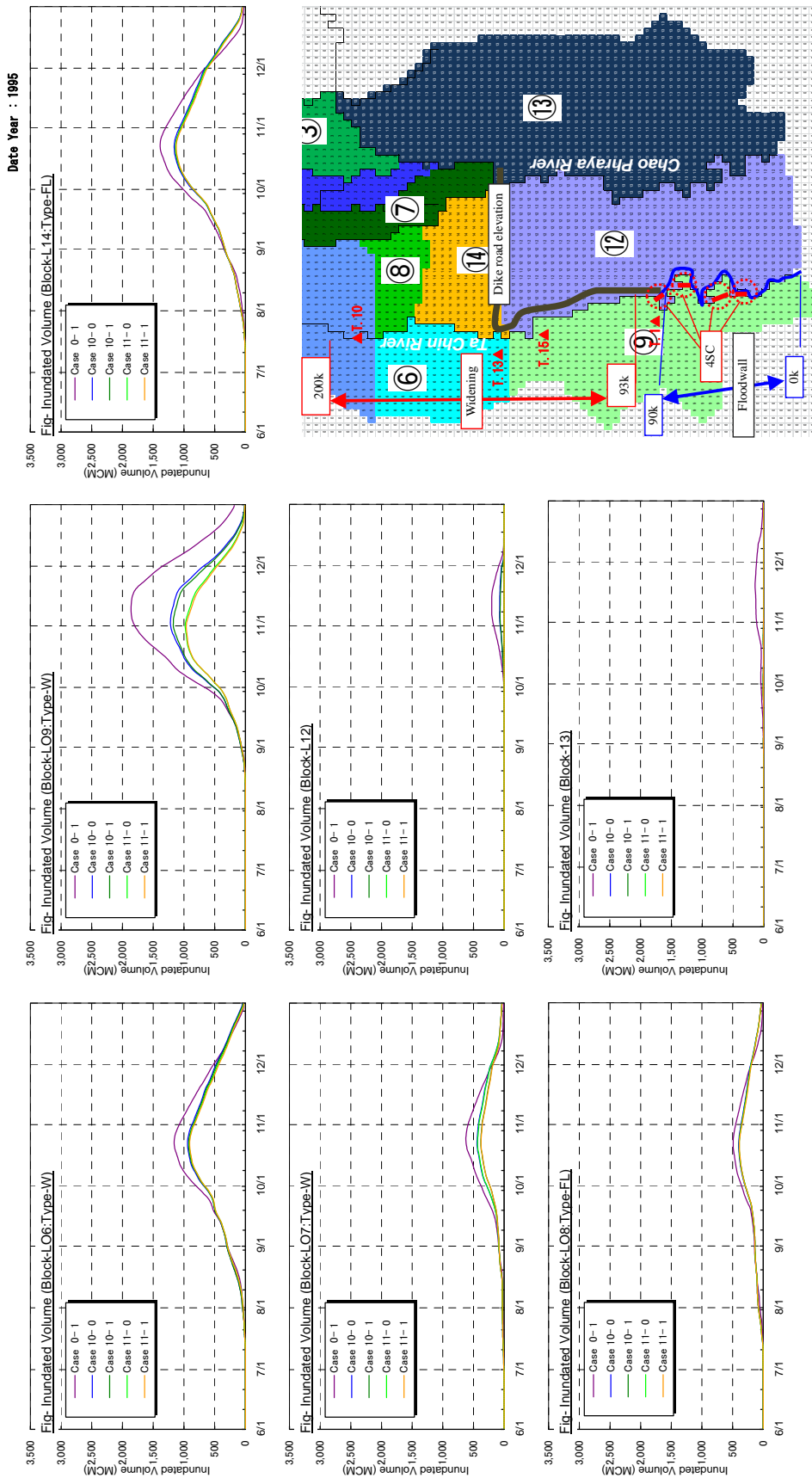


Figure E2.2.37 Time-series Diagrams of Inundated Volume by Block (Year 1995 observed)

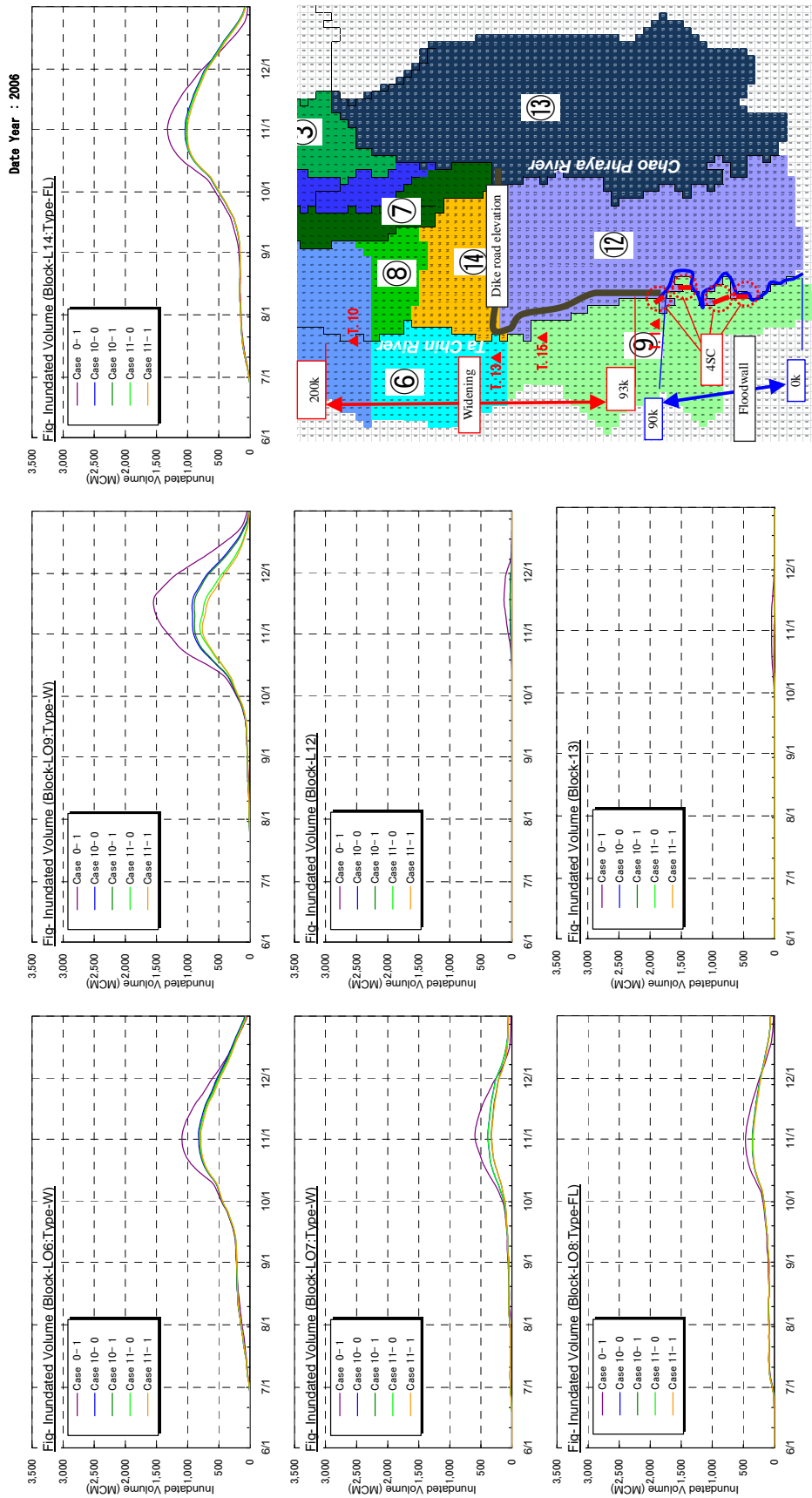


Figure E2.2.38 Time-series Diagrams of Inundated Volume by Block (Year 2006 observed)

E2.2.2 Flood Analysis with Enlarged Rainfall

According to the rainfall analysis, the flood analysis with enlarged rainfall shall be done. Longitudinal profile including discharge and water level, inundated area/depth and inundated volume are shown below.

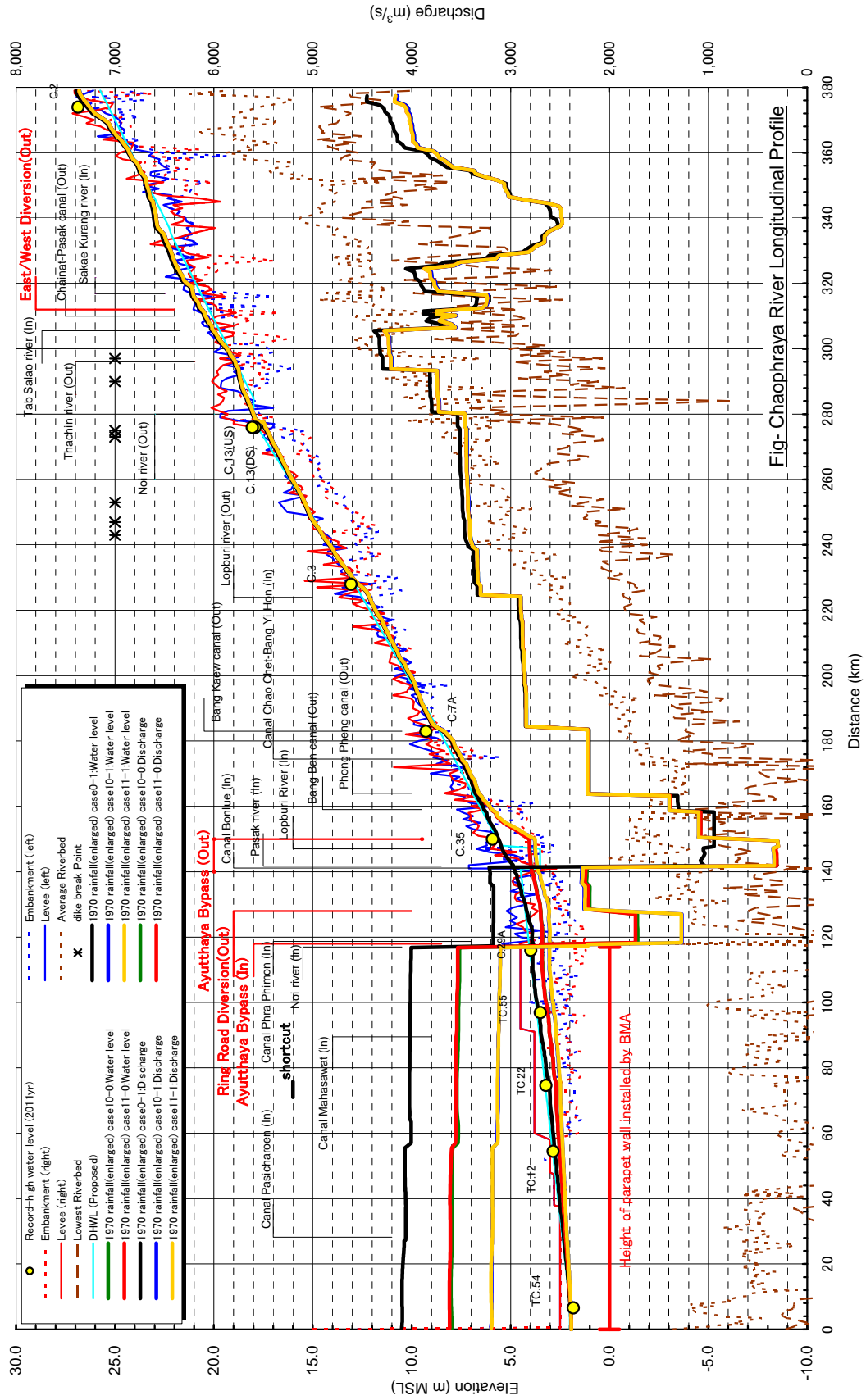


Fig- Chao Phraya River Longitudinal Profile

Figure E2.2.39 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1970 Rainfall (enlarged)

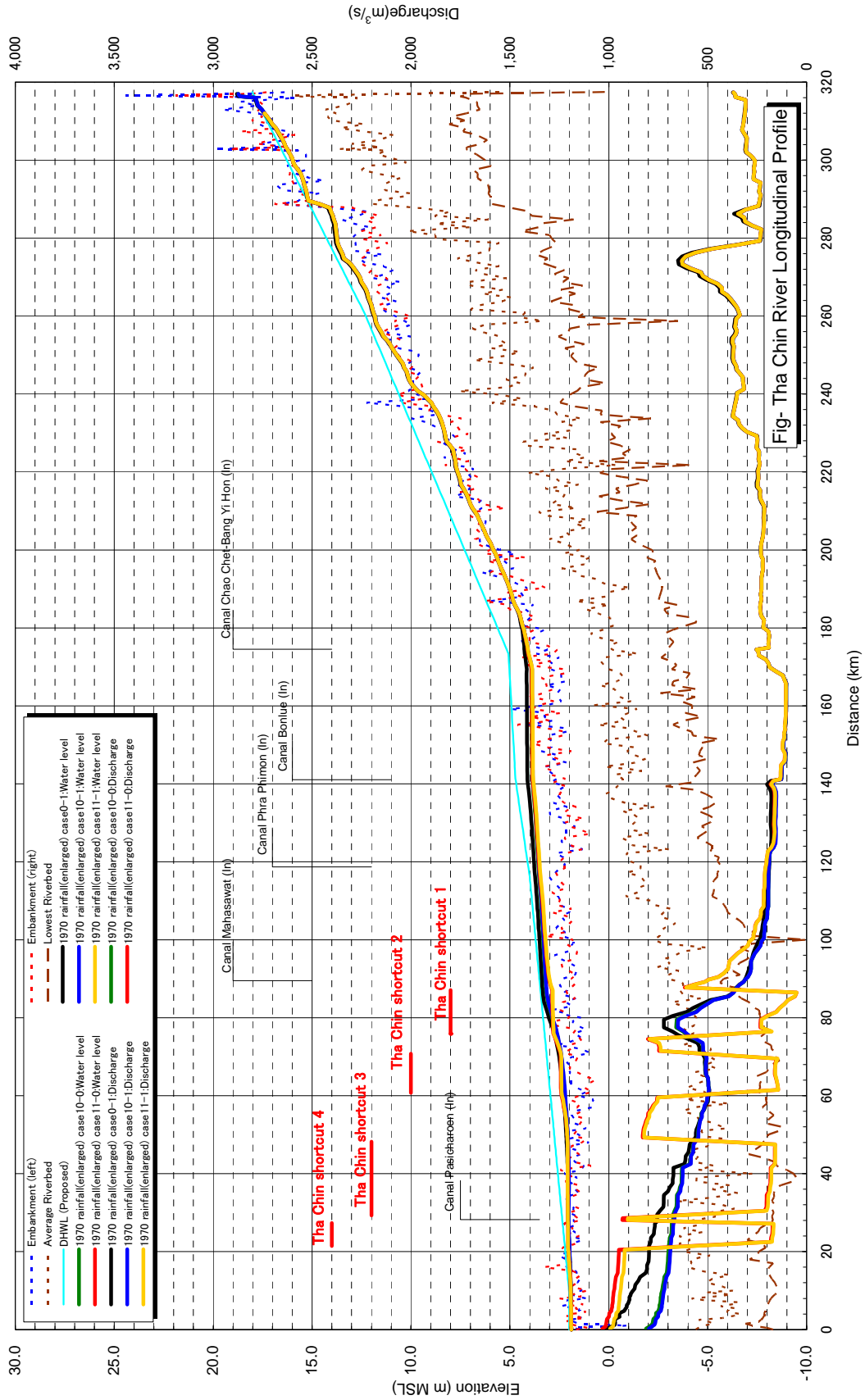


Figure E2.2.40 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1970 Rainfall (enlarged)

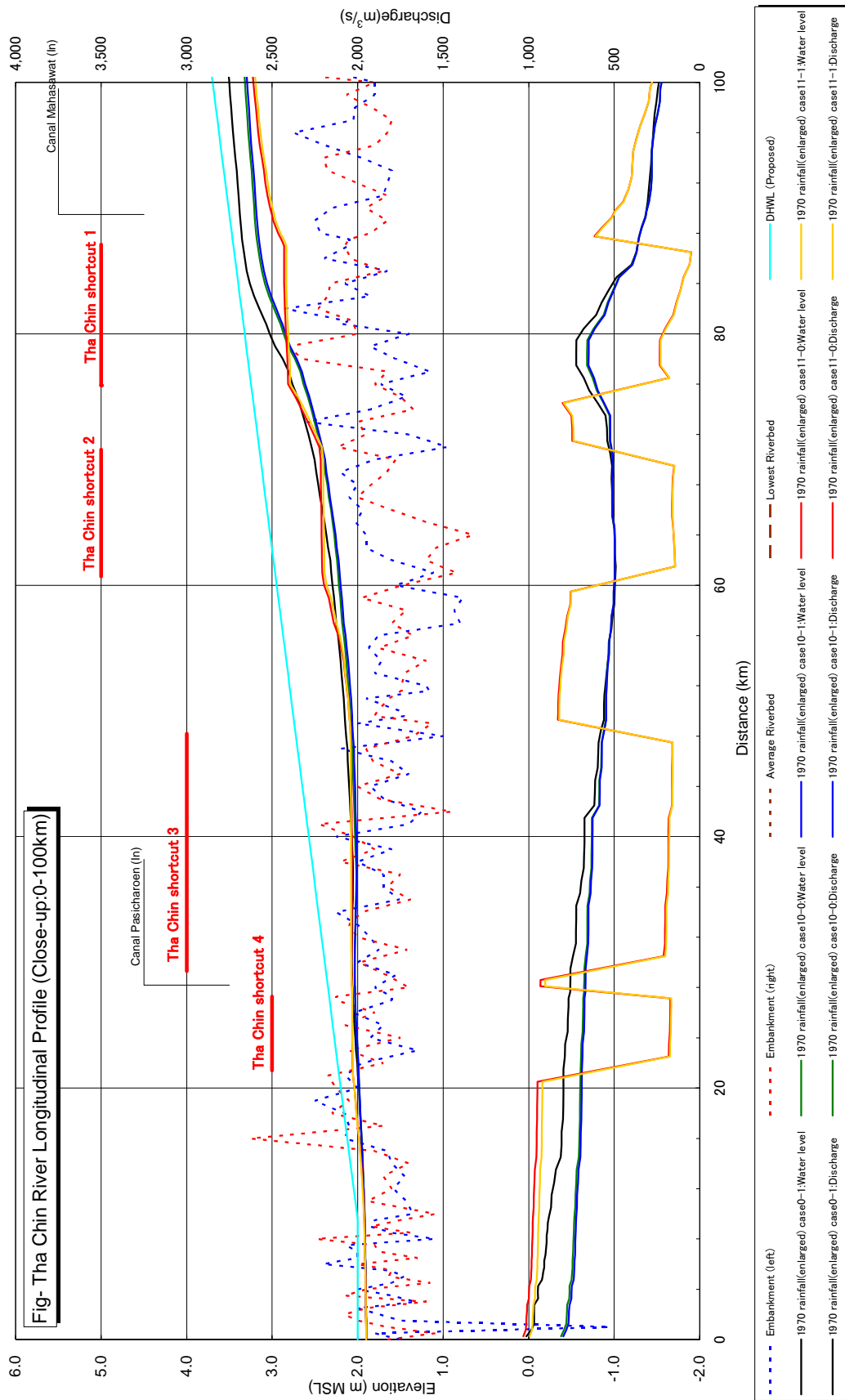


Figure E2.2.41 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0 — 100k close-up 1970 Rainfall (enlarged)

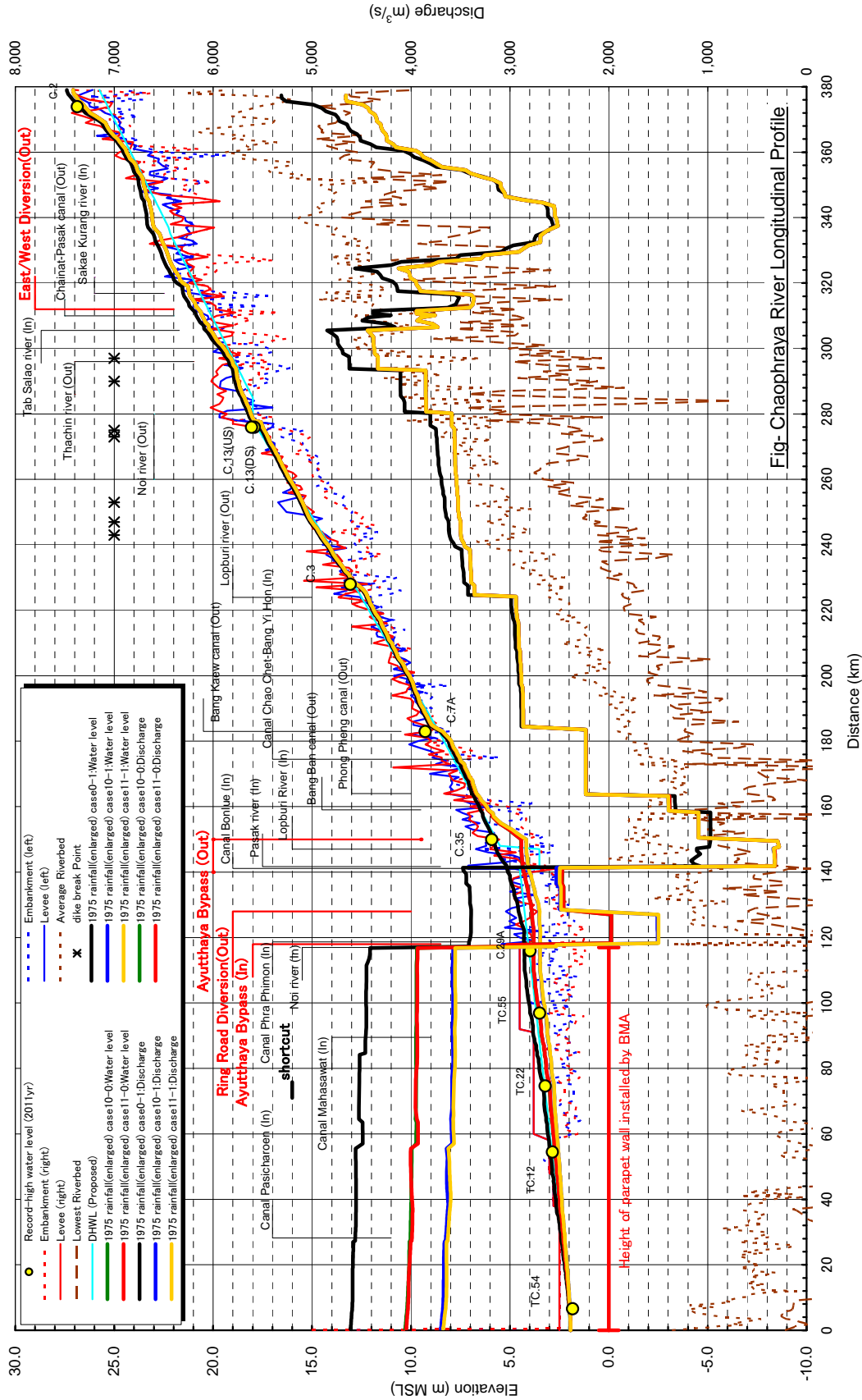


Figure E2.2.42 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1975 Rainfall (enlarged)

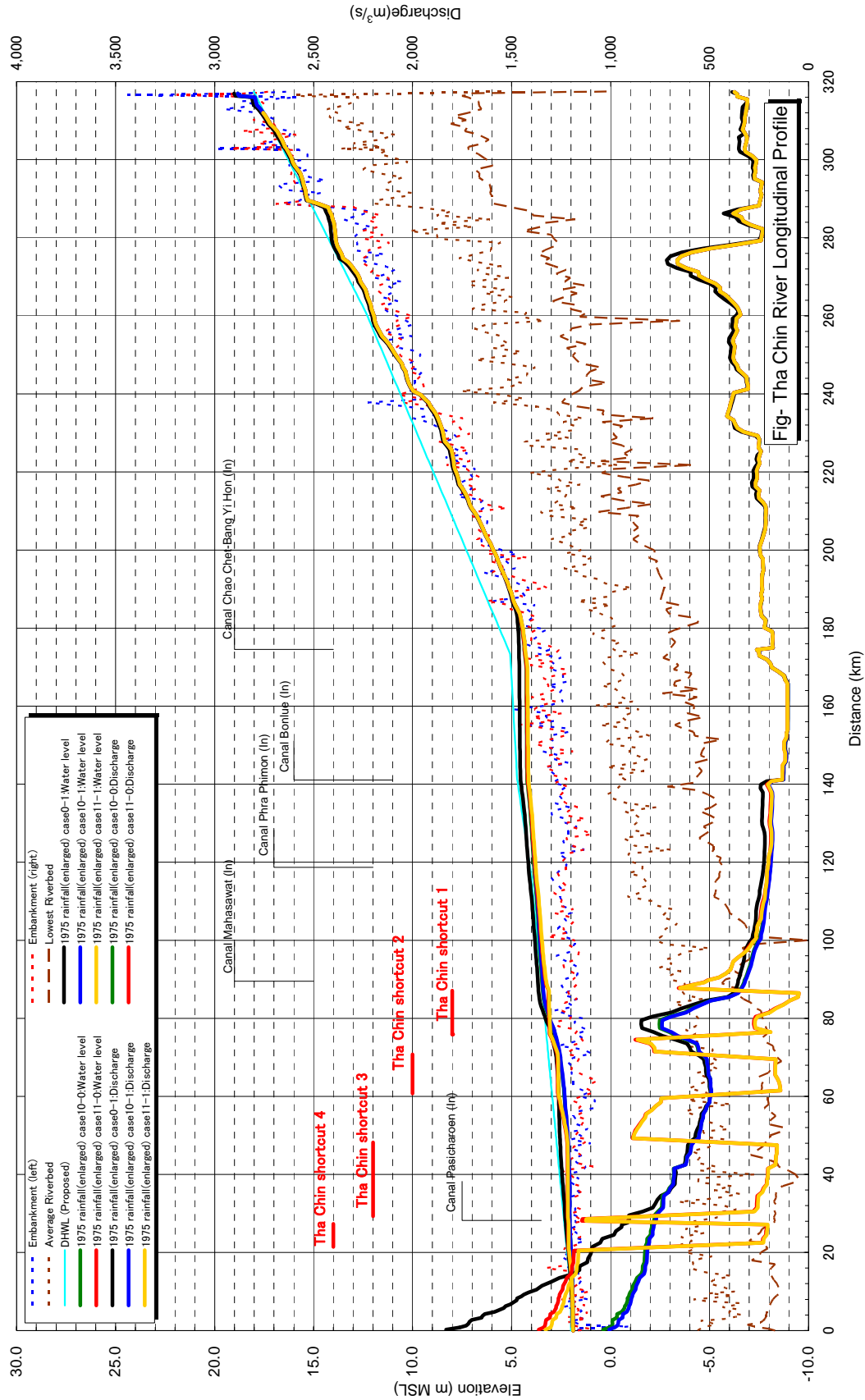


Figure E2.2.43 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1975 Rainfall (enlarged)

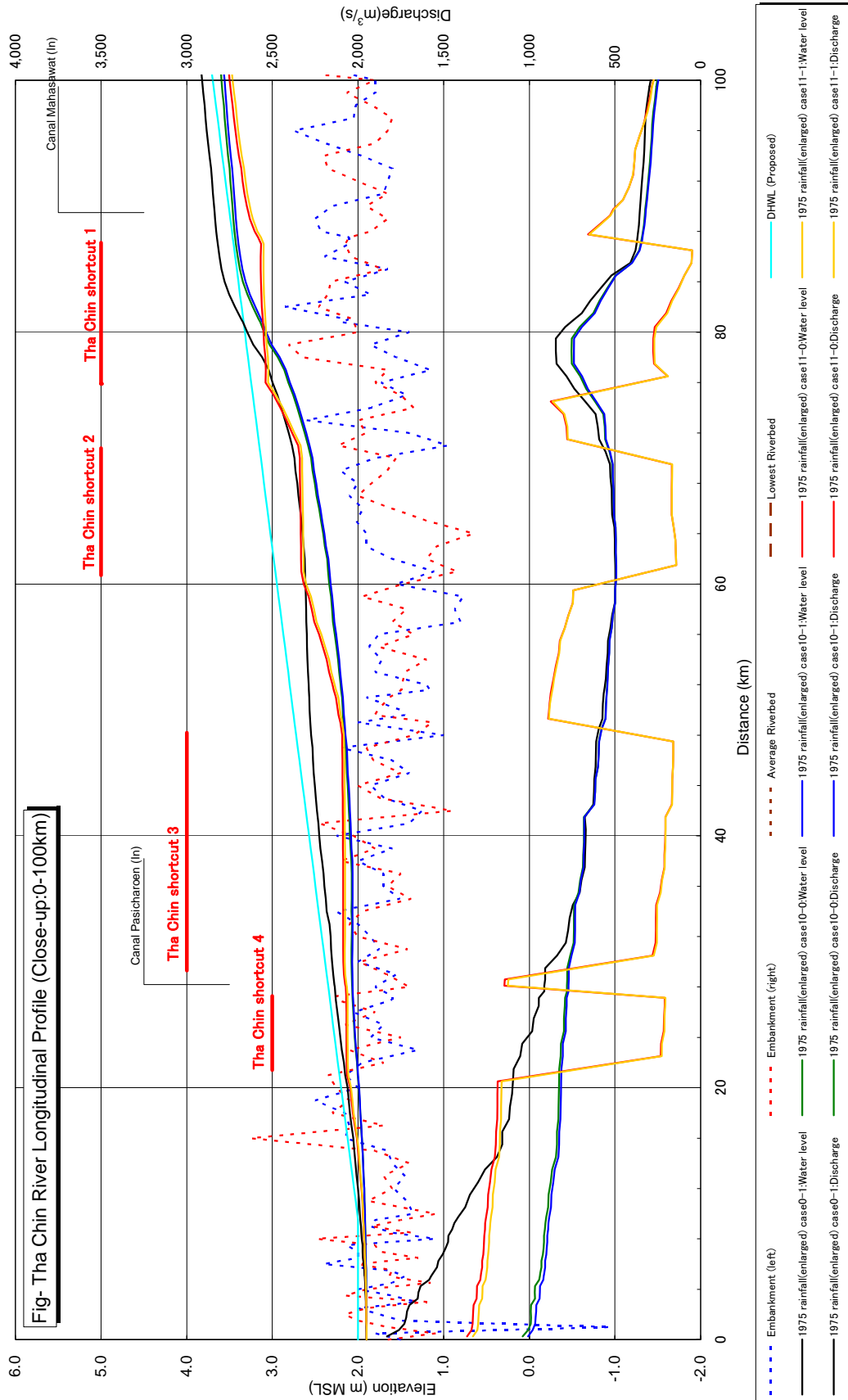


Figure E2.2.44 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1975 Rainfall (enlarged)

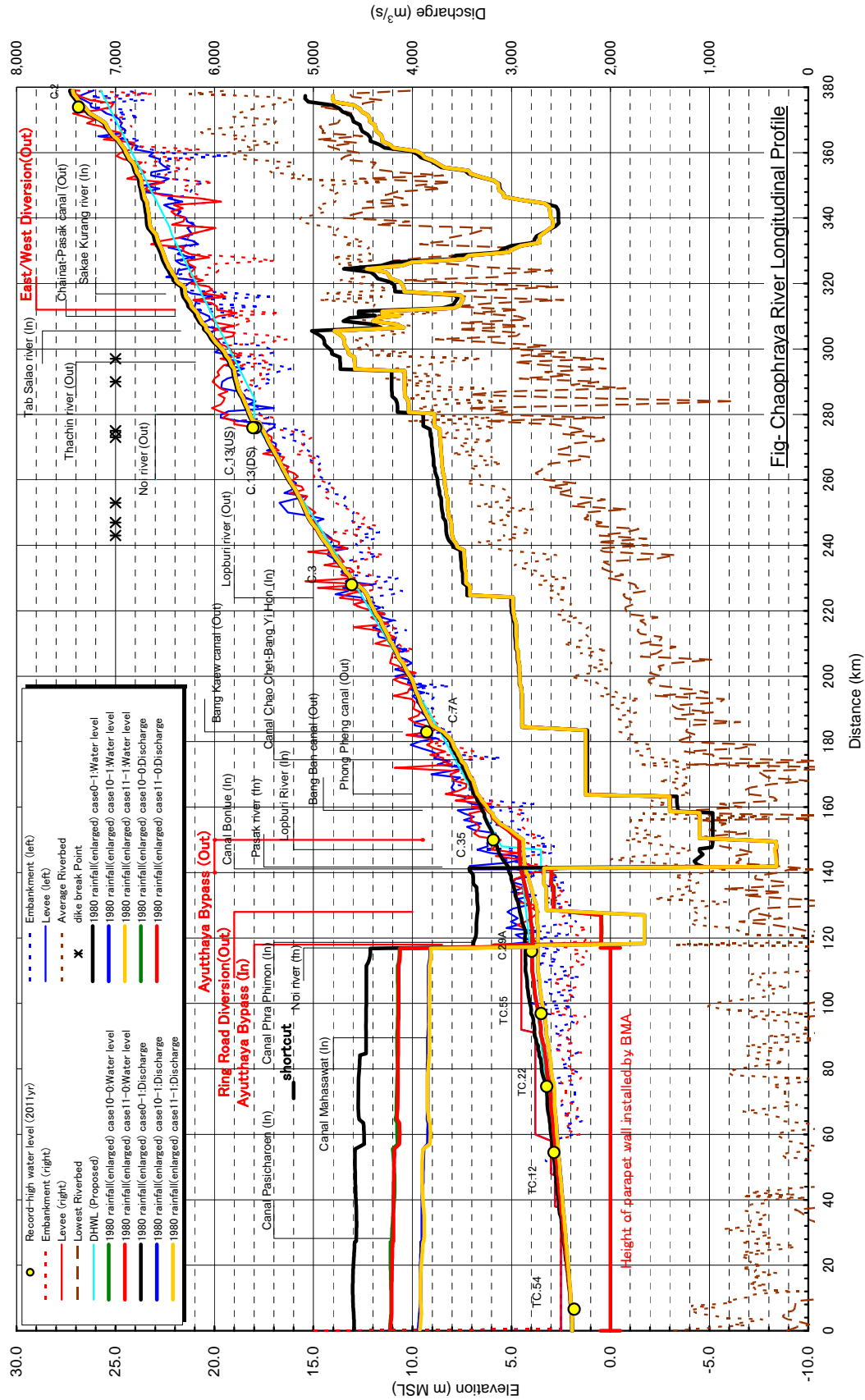


Figure E2.2.45 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1980 Rainfall (enlarged)

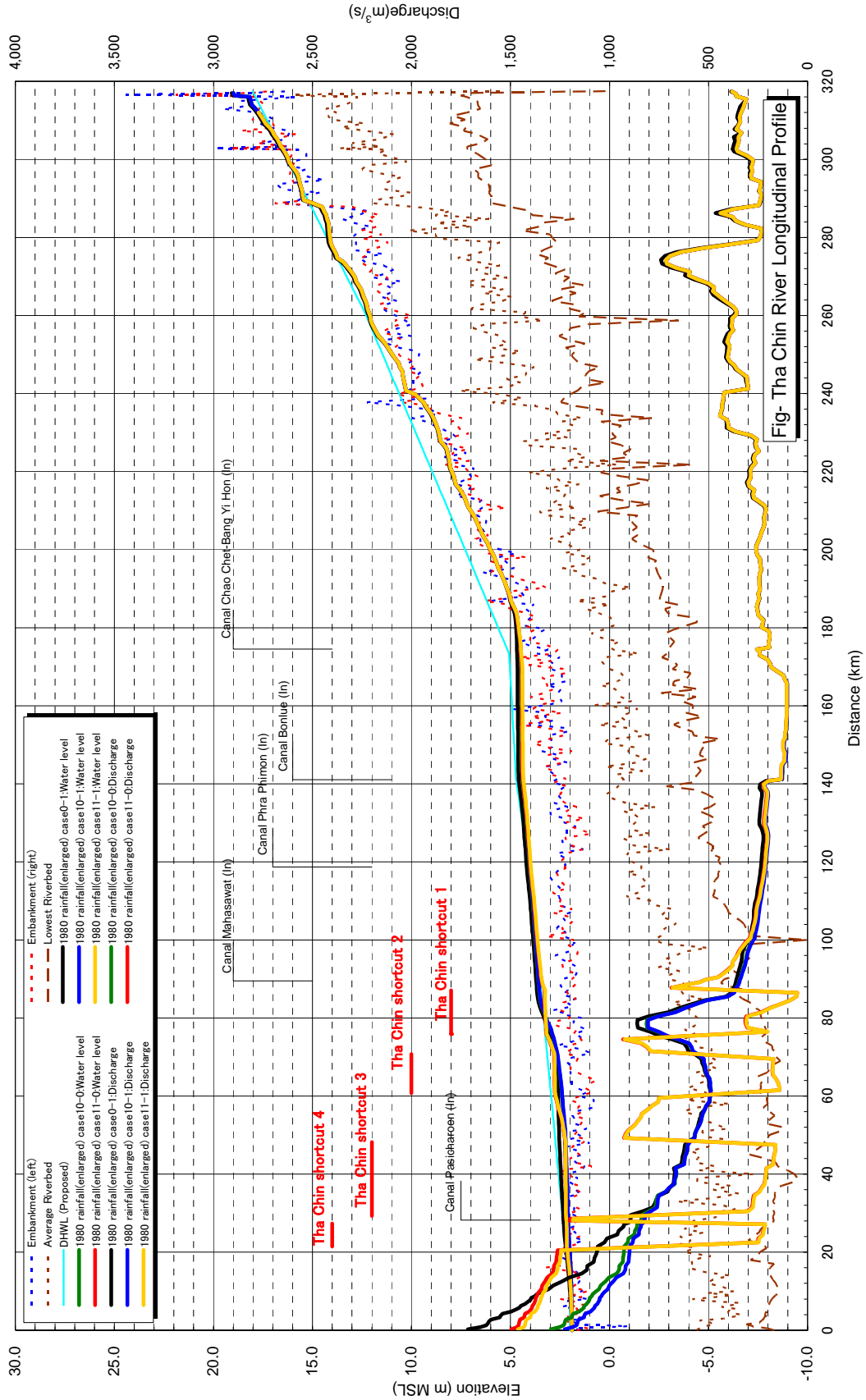


Figure E2.2.46 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1980 Rainfall (enlarged)

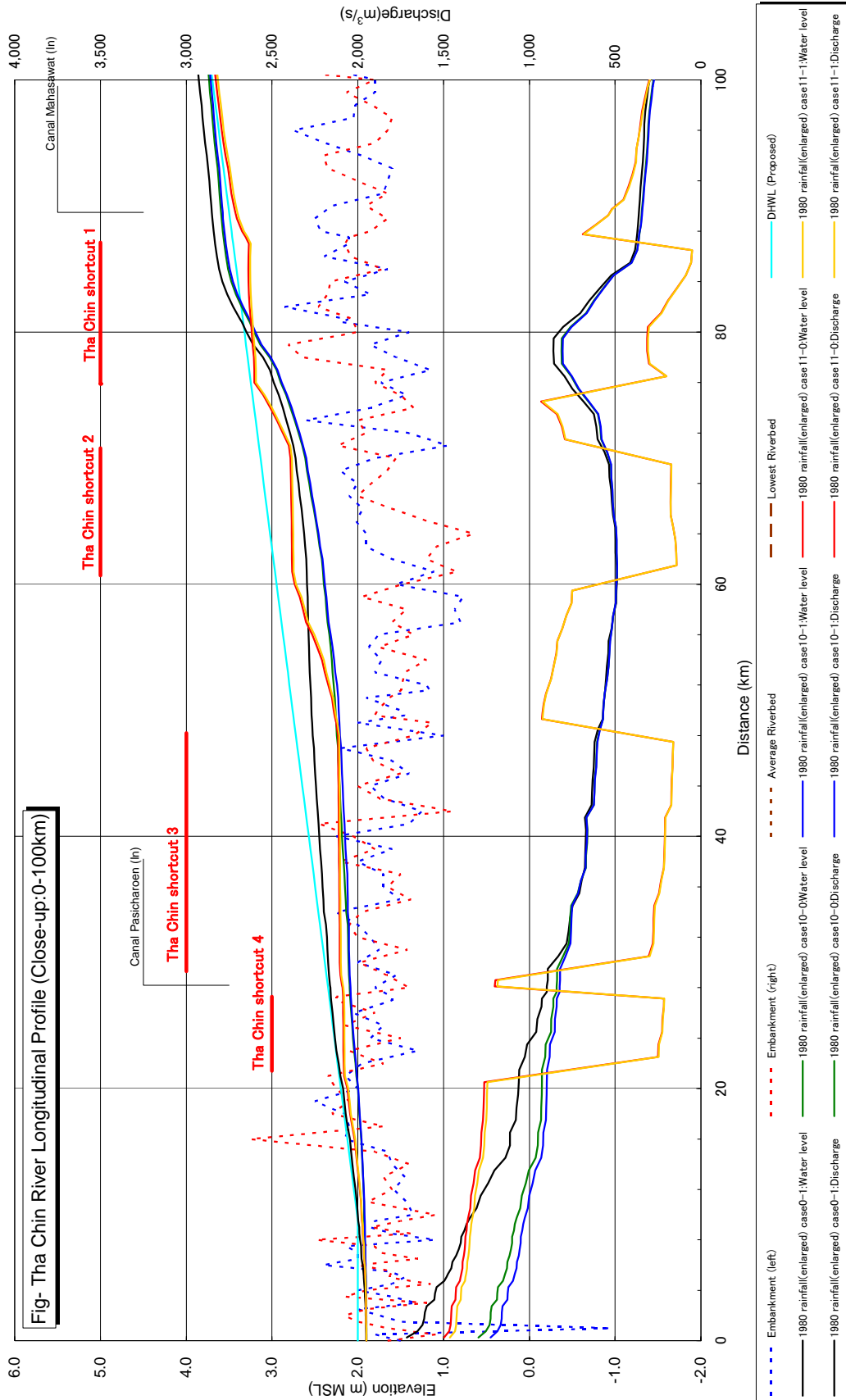


Fig- Tha Chin River Longitudinal Profile (Close-up:0-100km)

Figure E2.2.47 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0—100k close-up 1980 Rainfall (enlarged)

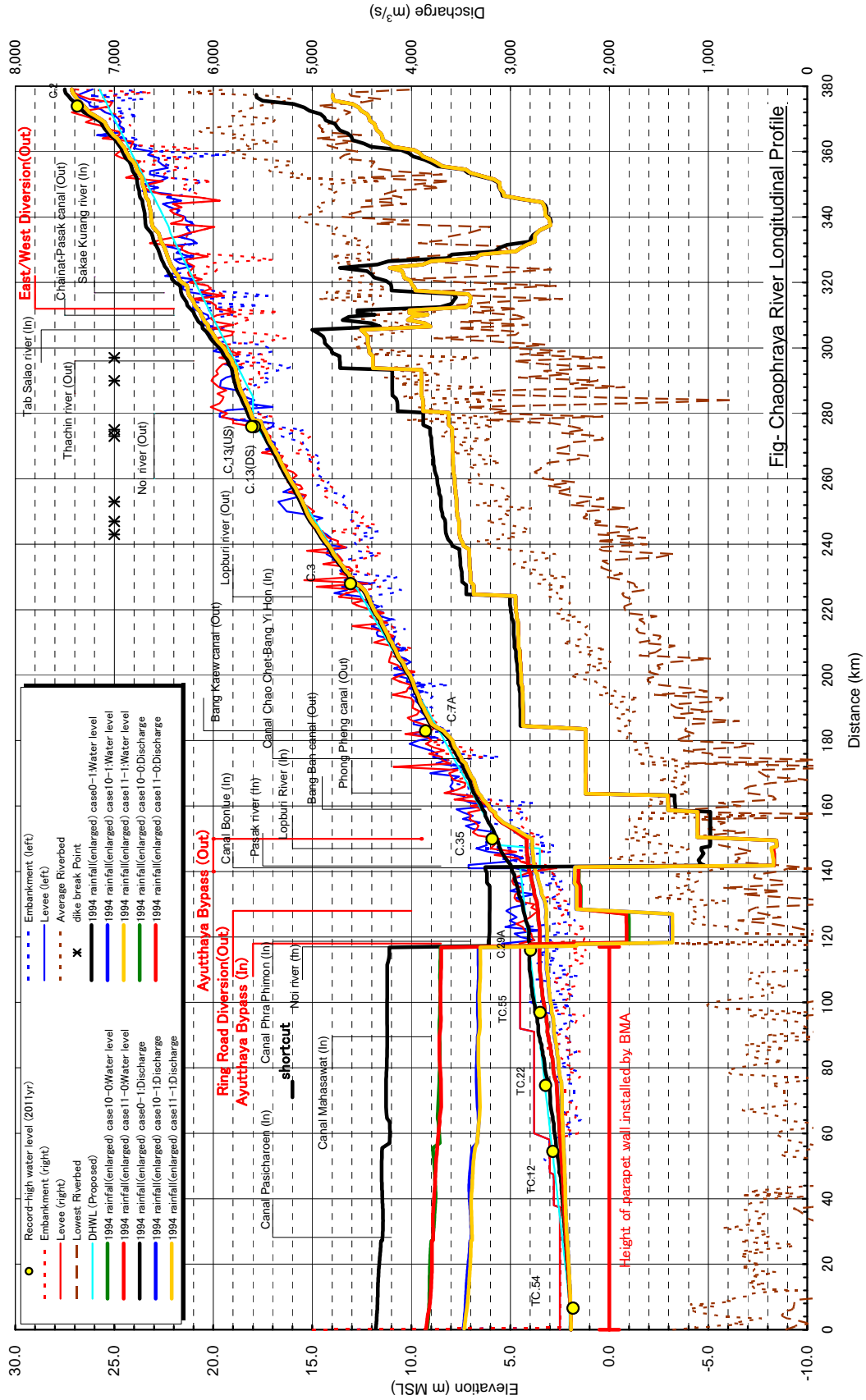


Figure E2.2.48 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1994 Rainfall (enlarged)

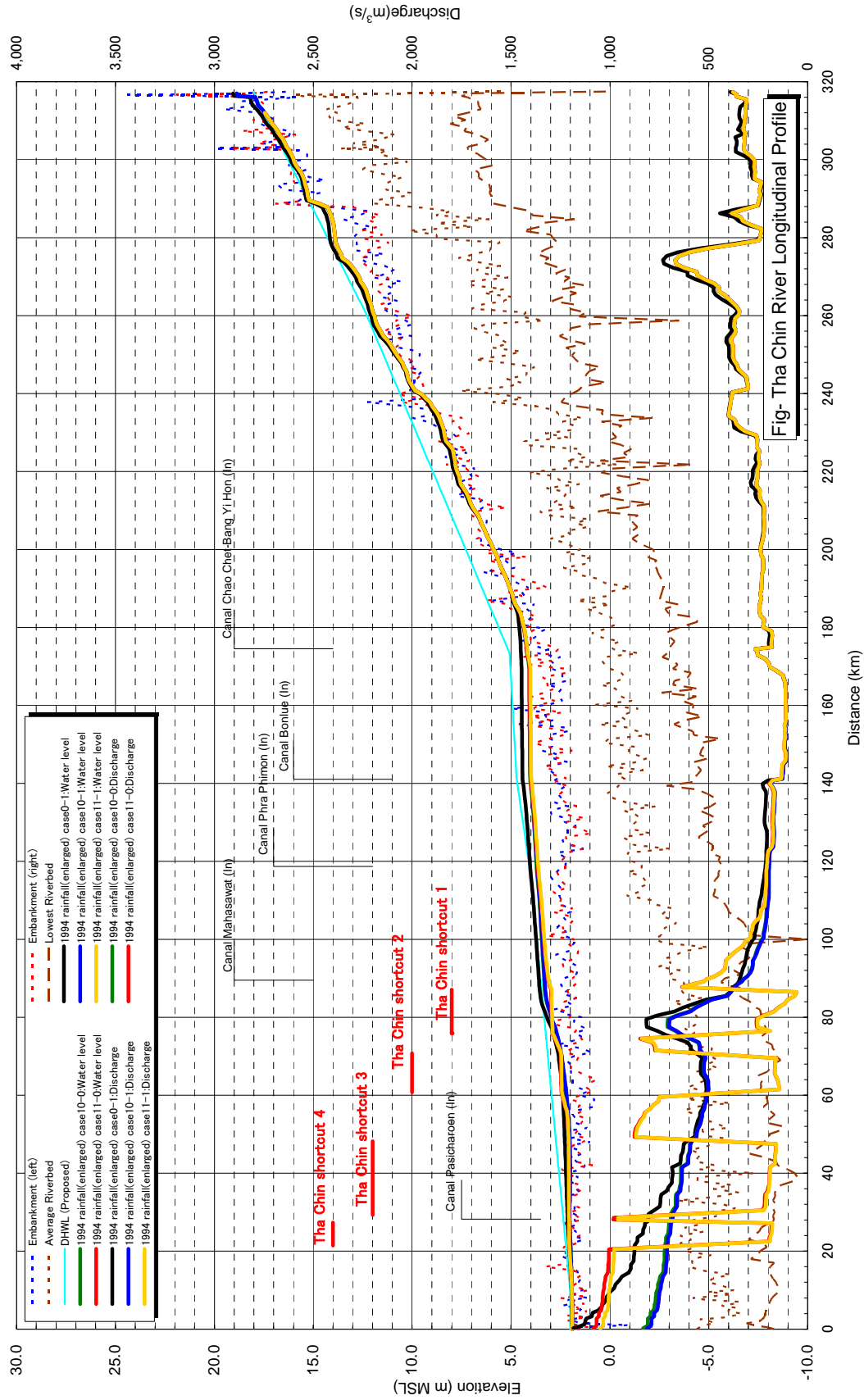


Figure E2.2.49 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1994 Rainfall (enlarged)

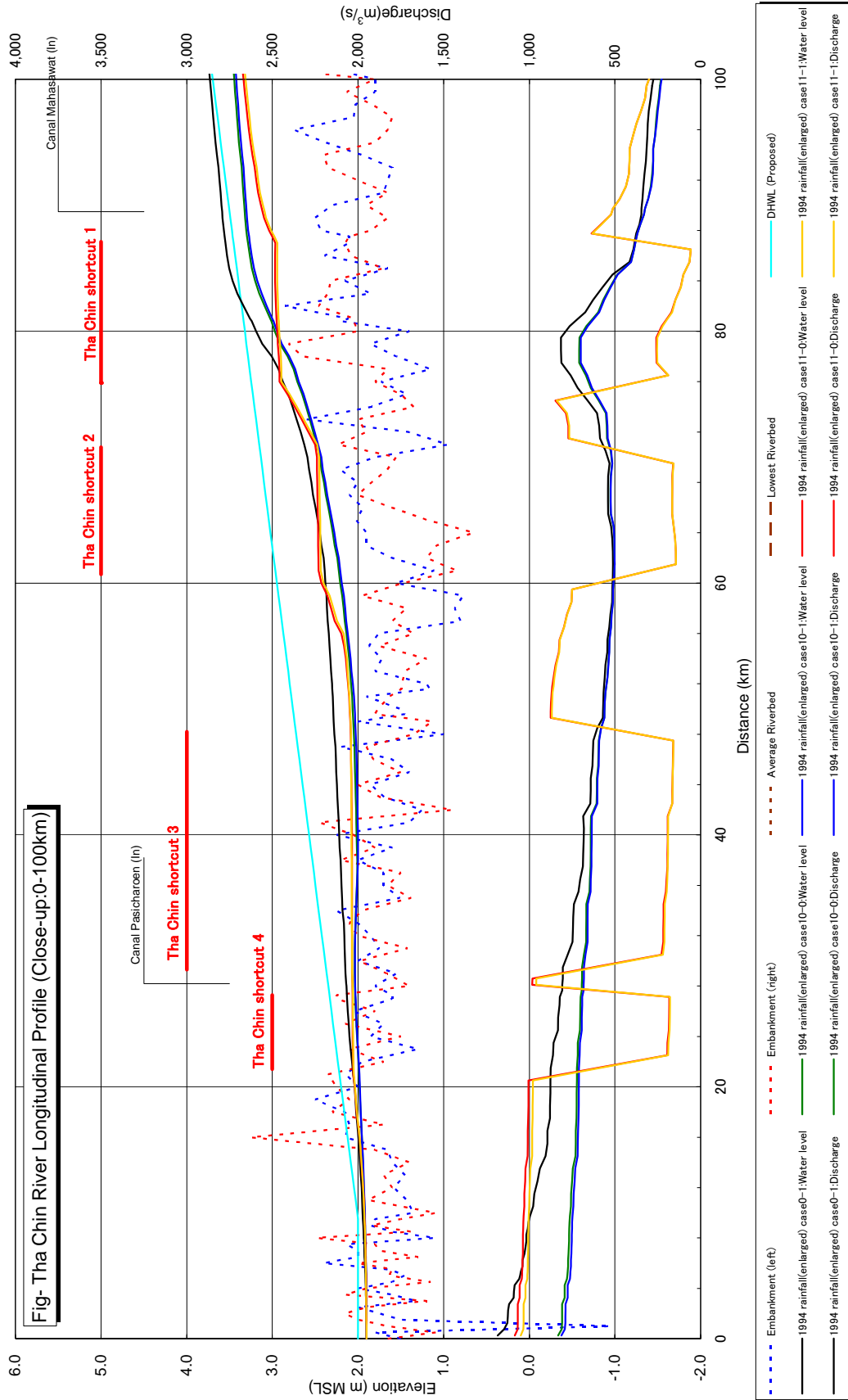


Figure E2.2.50 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1994 Rainfall (enlarged)

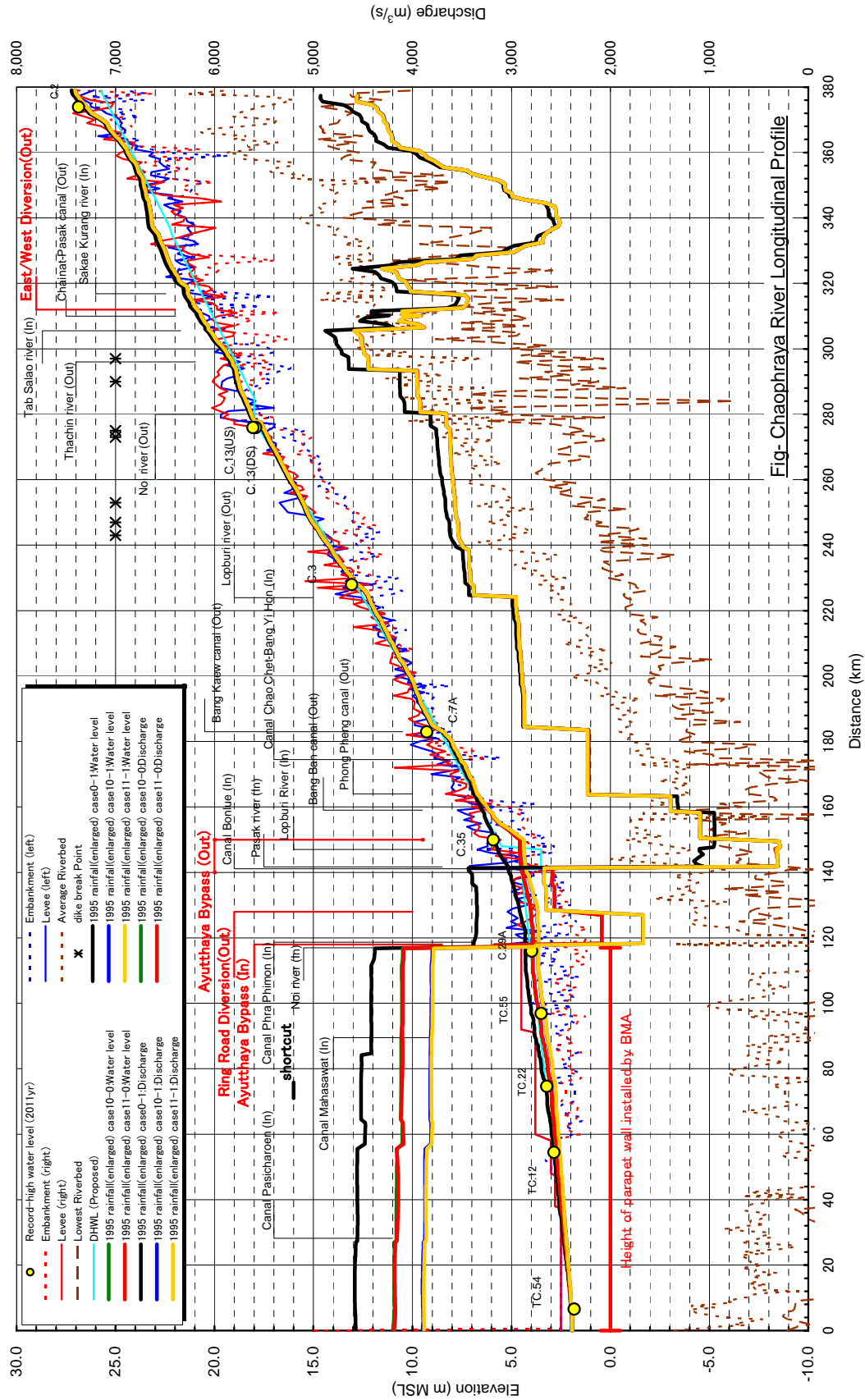


Figure E2.2.51 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 1995 Rainfall (enlarged)

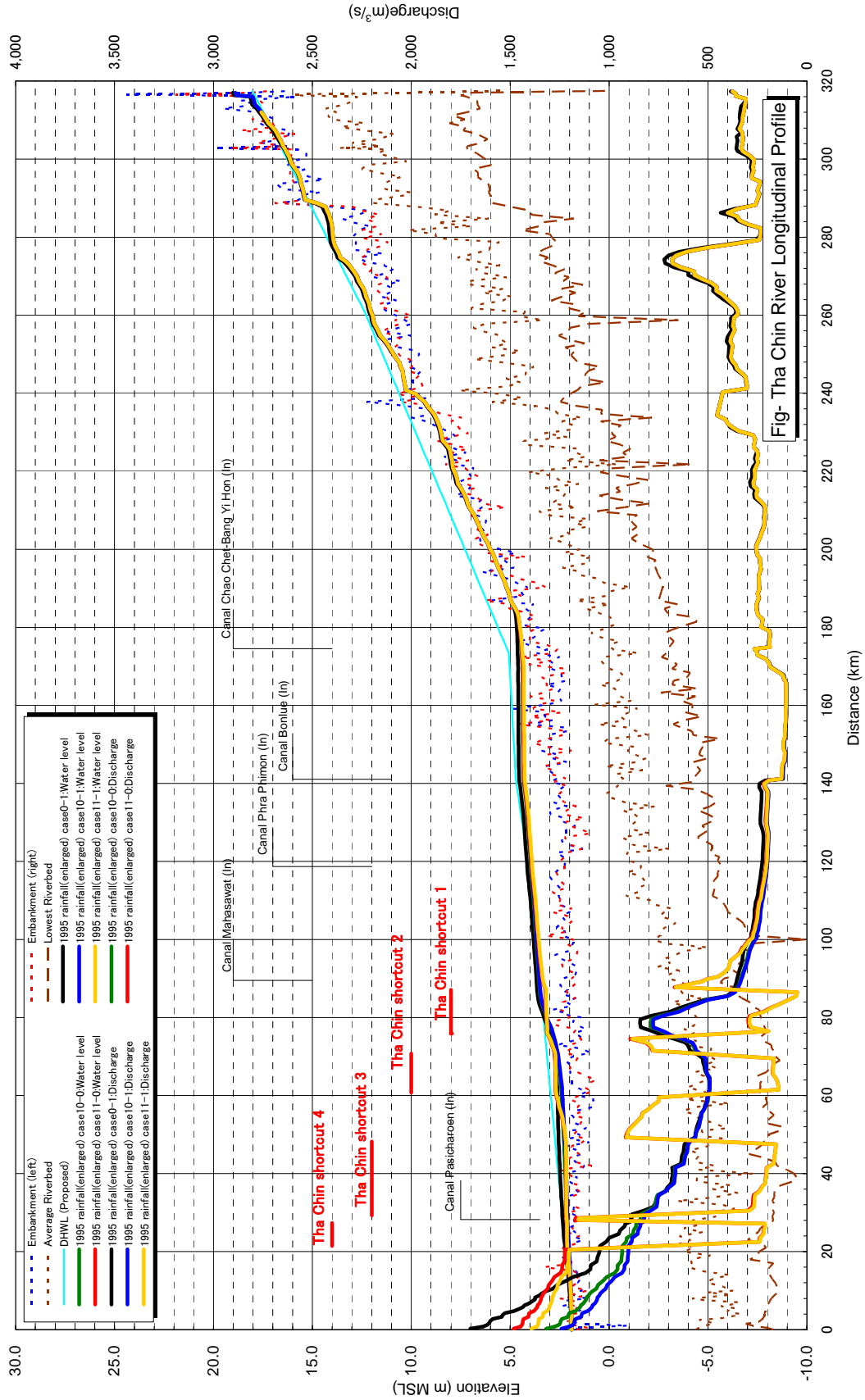


Fig- Tha Chin River Longitudinal Profile

Figure E2.2.52 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 1995 Rainfall (enlarged)

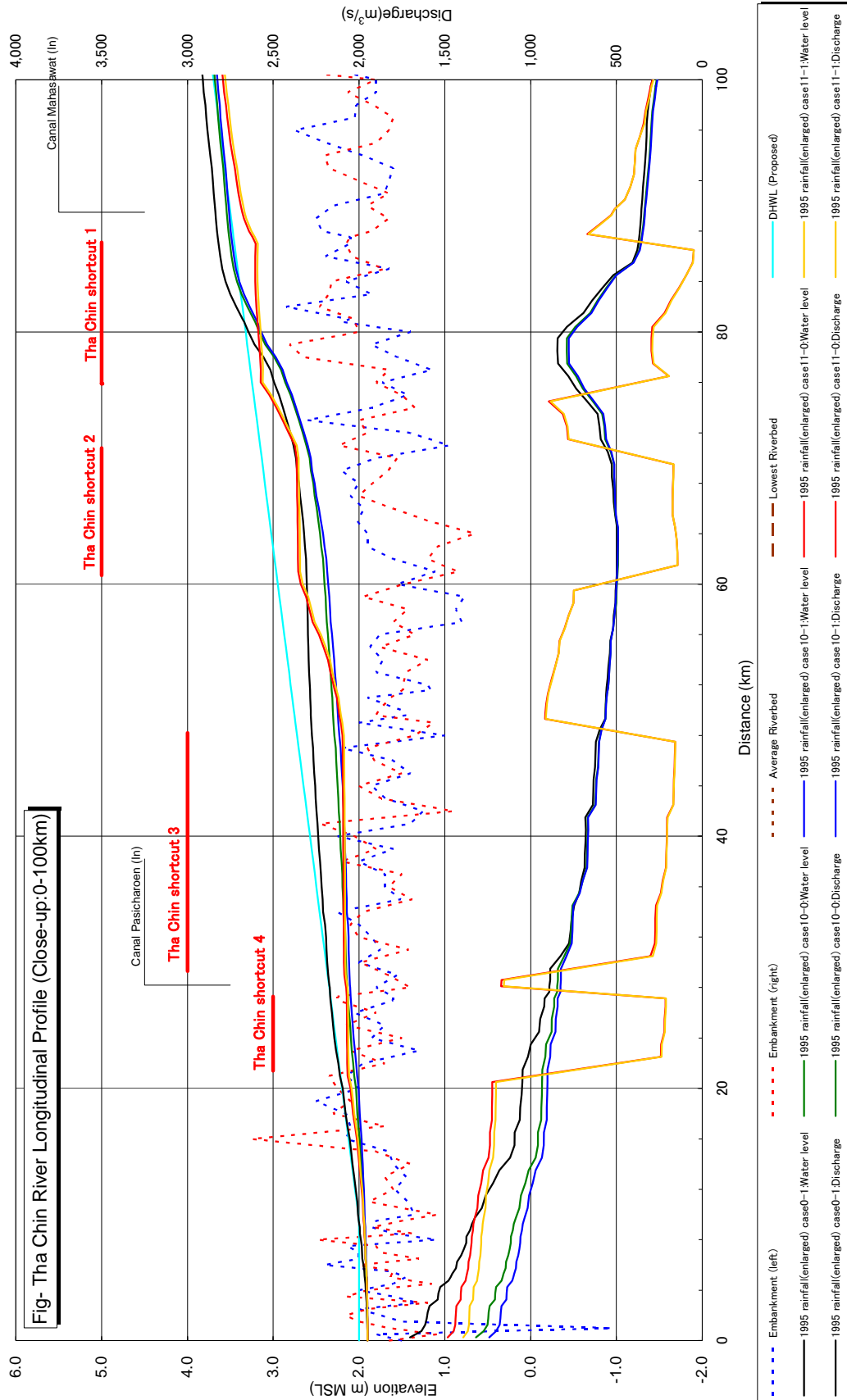


Figure E2.2.53 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 0-100k close-up 1995 Rainfall (enlarged)

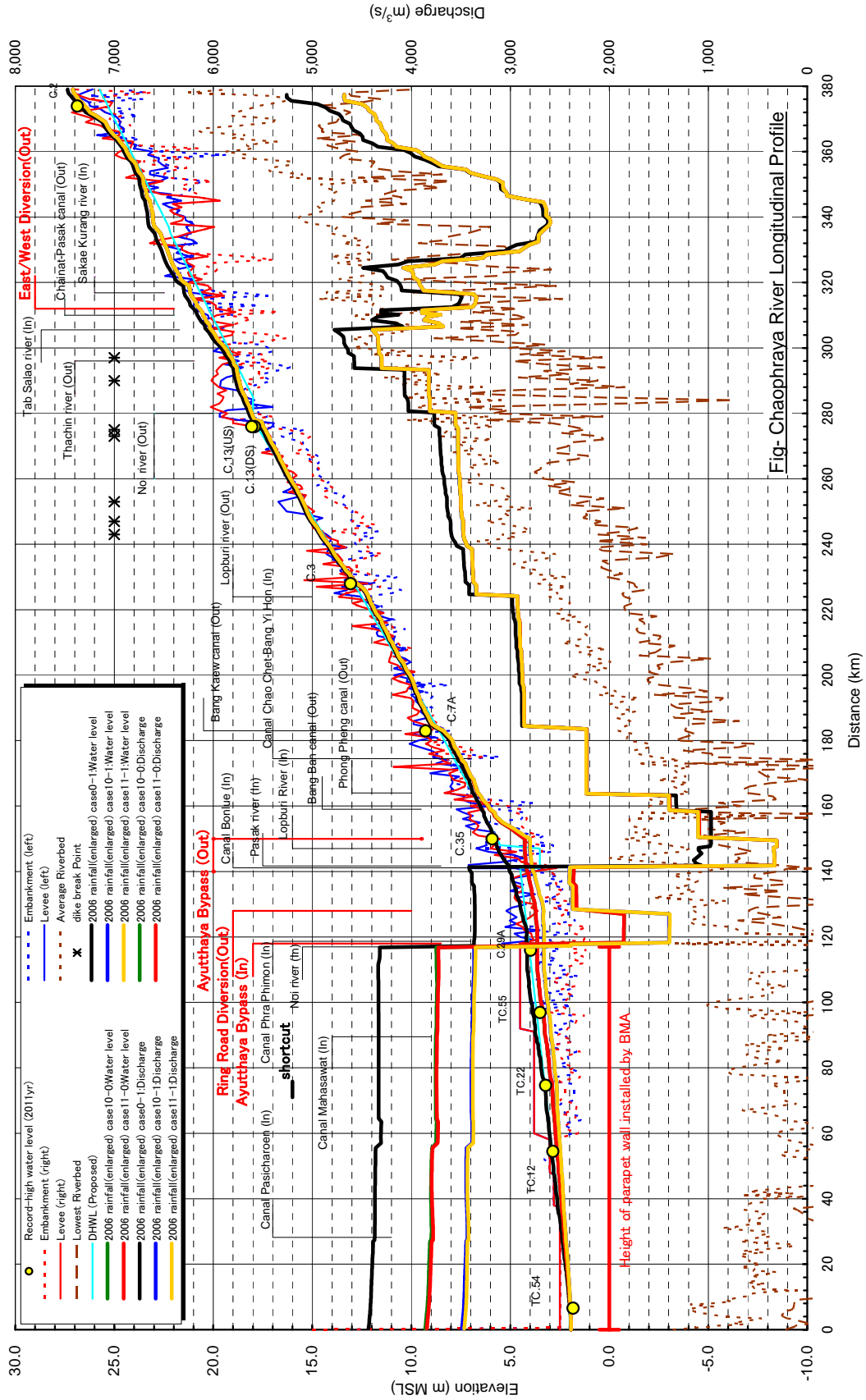


Figure E2.2.54 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Chao Phraya River 2006 Rainfall (enlarged)

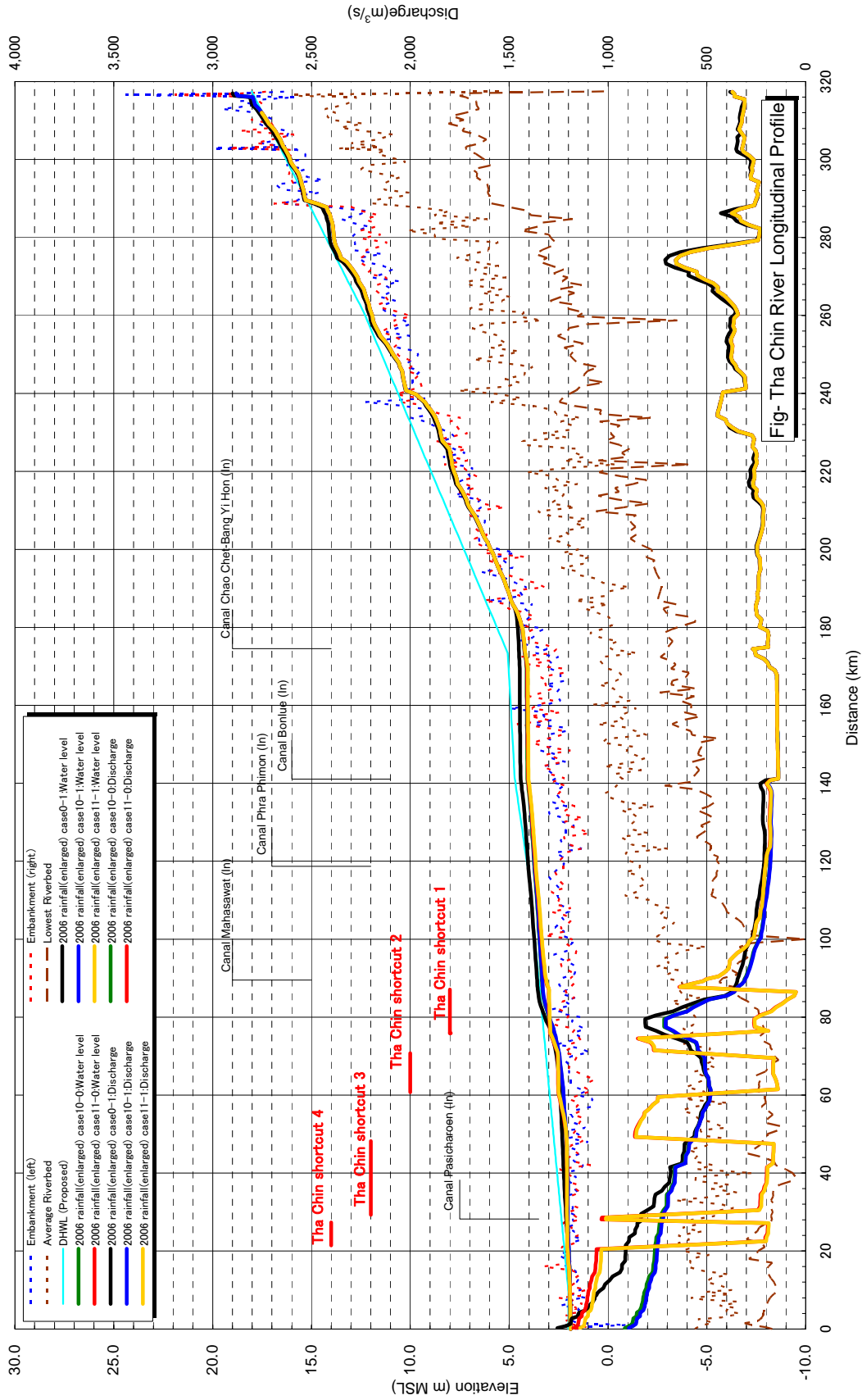


Fig- Tha Chin River Longitudinal Profile

Figure E2.2.55 Comparison of Longitudinal Profile (Case10-0, 10-1, 11-0, 11-1) Tha Chin River 2006 Rainfall (enlarged)

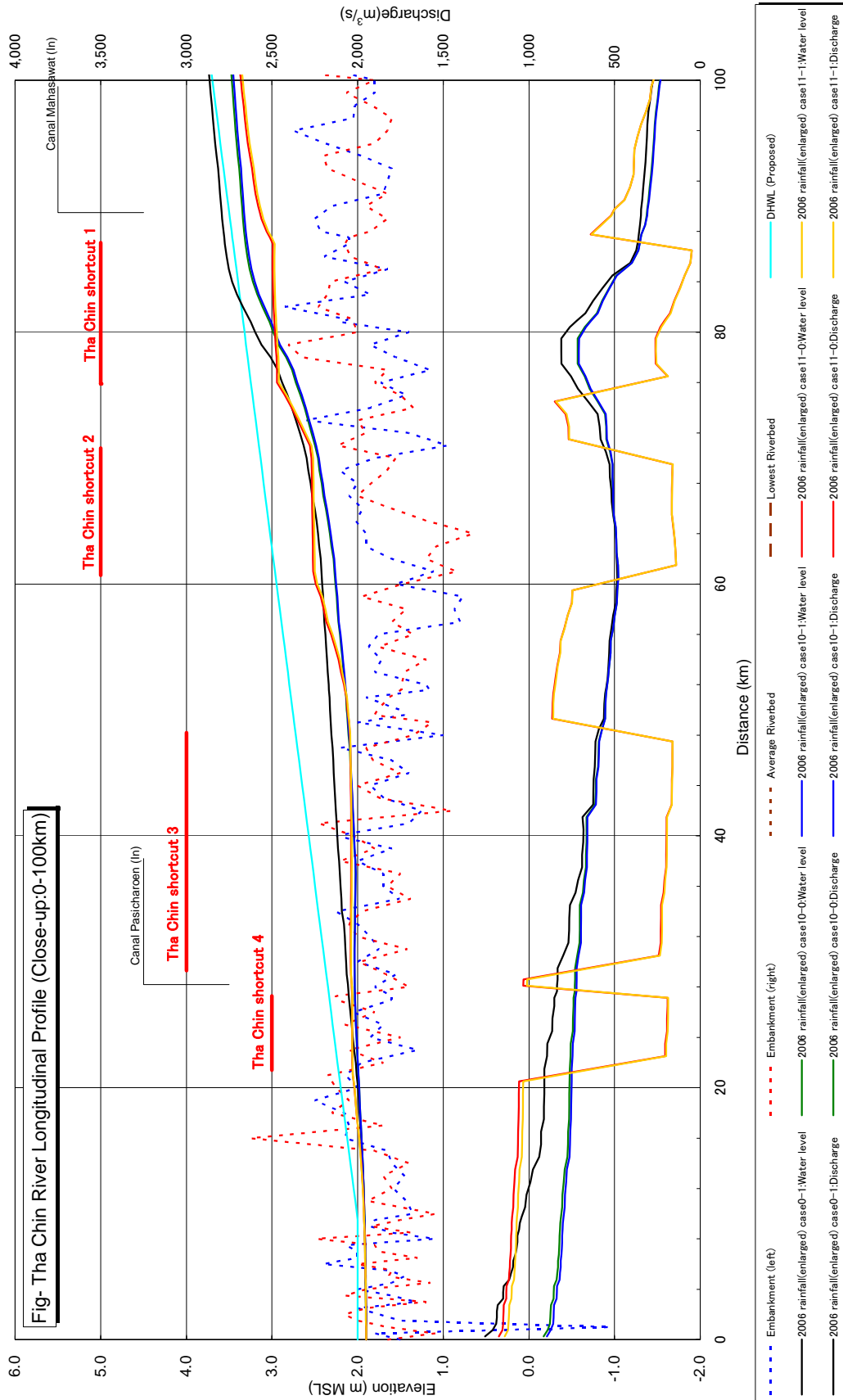


Figure E2.2.56 Comparison of Longitudinal Profile (Case 10-0, 10-1, 11-0, 11-1) Tha Chin River 0 – 100k close-up 2006 Rainfall (enlarged)