



Efficient and Sustainable Use of Water for Agriculture under the New Climate Scenarios

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Presentation Outline

1. Overview

- **Overview of Thailand**
- **Overview of RID**

2. Climate Change in Thailand

3. Water Management in Chao Phraya Basin



Overview of Thailand

- Thailand is Land of “smile”
- Thailand is in the Southeast Asian
- 77 provinces.
- population over 68 million people
- Area 513,120 km² (Thailand is the world's 50th largest country)
- The capital is Bangkok.
- Religion : **Buddhism 94.6 %**
Islam 4.2 % and **Christianity 1.1 %**
- **Thai Language.**



About Thailand



- Thailand is located in Southeast Asia region
- Country area **51,312,000 hectares**
- Agriculture area base on land-use data
23,877,800 hectares (46.5% of country area)
- Paddy field area **8,930,006 hectares**
(37.4% of agricultural land area)
- Irrigated paddy field area **2,792,000 hectares**
(31.3% of paddy field area)

Source: Office of Agricultural Economics

Weather : "tropical wet and dry climate"

3 season

- Winter (Nov–Feb)
- Summer(Mar-May)
- Rainy (Mid May-Oct)

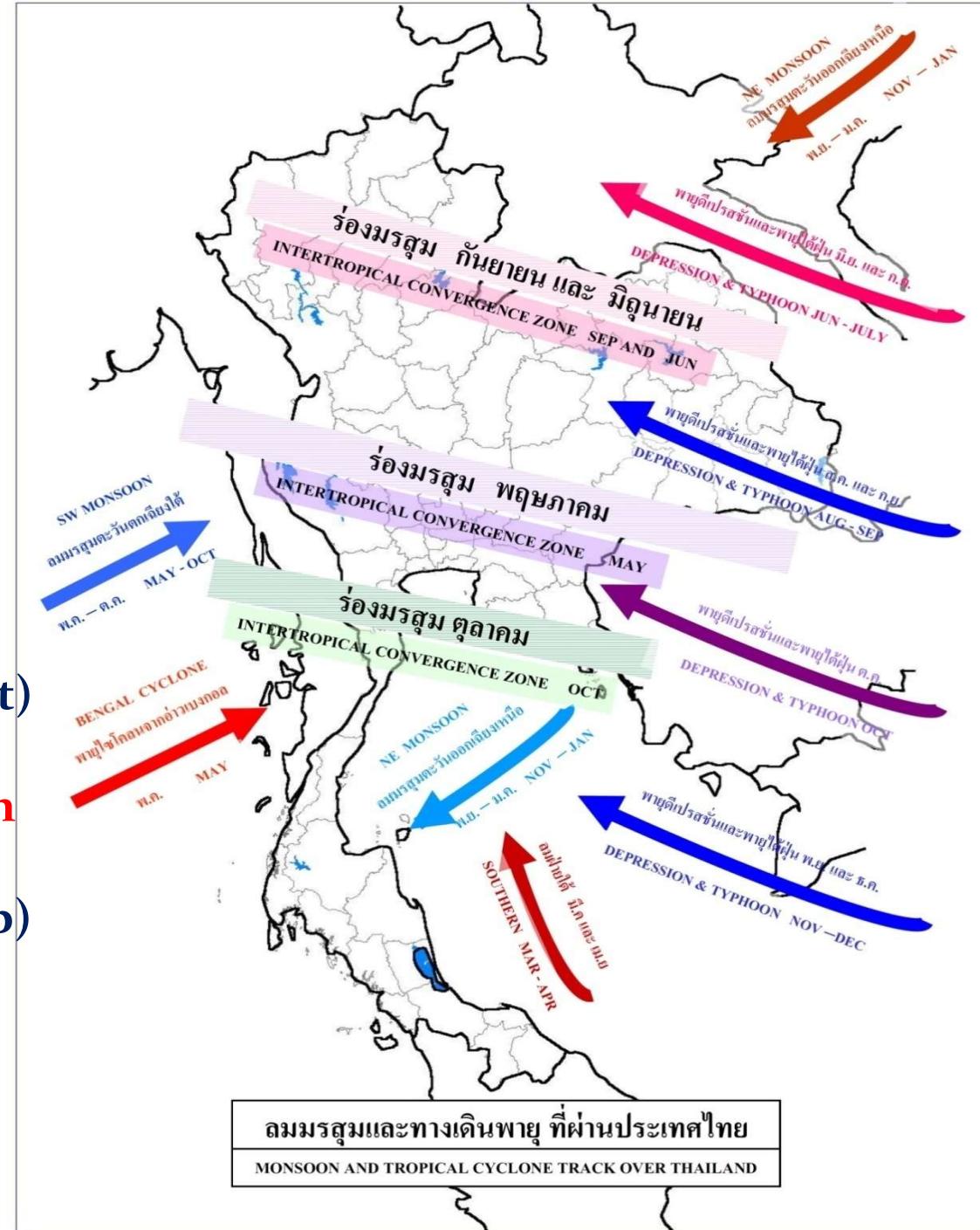
Except on South region

2 season:

- Rainy (Mid May-Feb)
- Summer(Mar-May)

Winter : 15-25 °C

Summer : 35-40 °C



Overview of RID

Vision

"Royal Irrigation Department is a leading organization in water resources development and integrated water management with the present irrigated area in the world top ten."



VISION & MISSION

Develop water resources &
increase irrigated area

area

Manage water allocation
(equitable and sustainable)

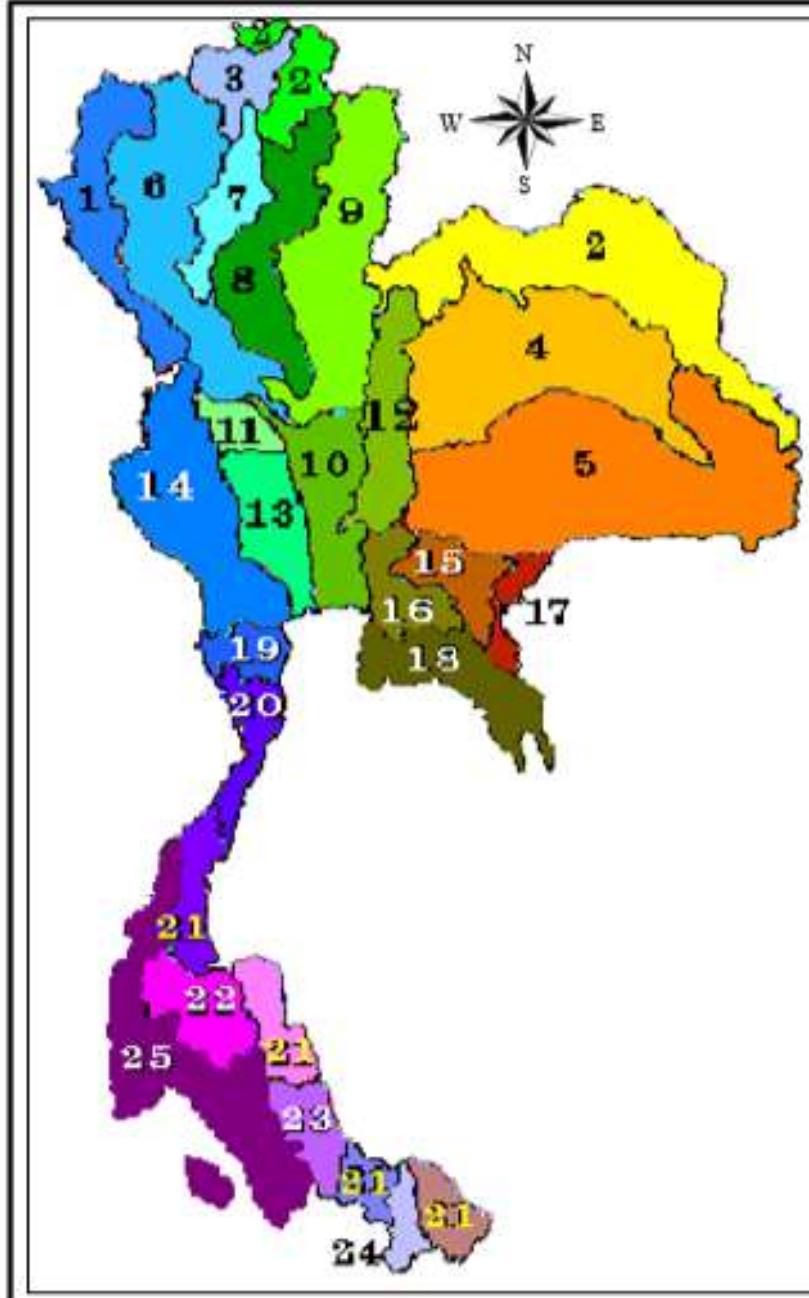
Prevent & mitigate water hazards

Encourage people participation
(water resources mgt & development)

Royal Irrigation
Department
intelligent organization,
emphasizes on water
security, to increase
the value of service within
B.E.2579 (2036)



25 Basin's Map



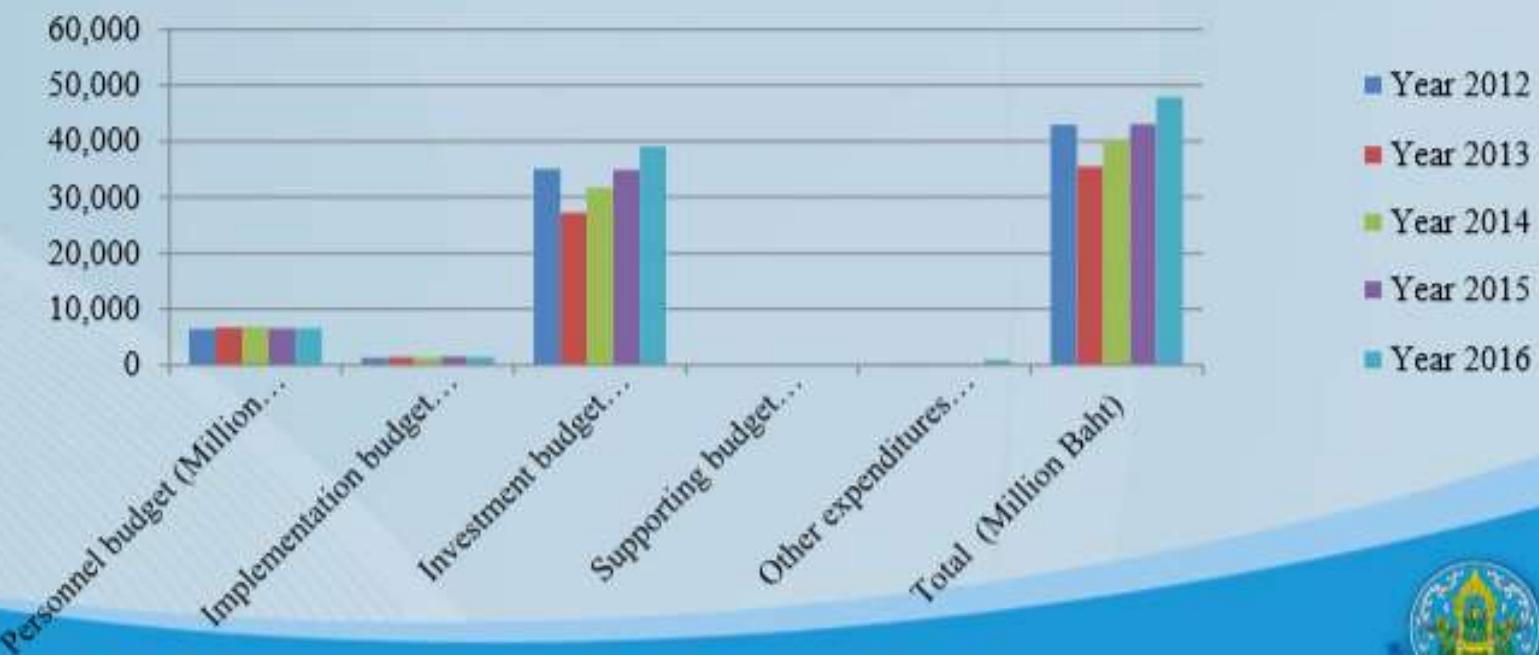
Main River Basins of Thailand

1. Mae Nam Salawin
2. Mae Nam Khong
3. Mae Nam Kok
4. Mae Nam Chi
5. Mae Nam Mun
6. Mae Nam Ping
7. Mae Nam Wang
8. Mae Nam Yom
9. Mae Nam Nan
10. Mae Nam Chao Phraya
11. Mae Nam Sakae Krang
12. Mae Nam Pasak
13. Mae Nam Thachin
14. Mae Nam Mae Klong
15. Mae Nam Prachin Buri
16. Mae Nam Bang Pra Kong
17. Tonle Sap
18. East-Coast Gulf
19. Mae Nam Petchaburi
20. West Coast Gulf
21. Peninsula-East coast
22. Mae Nam Tapi
23. Thale sap Songkhla
24. Mae Nam Pattani
25. Peninsula-West coast

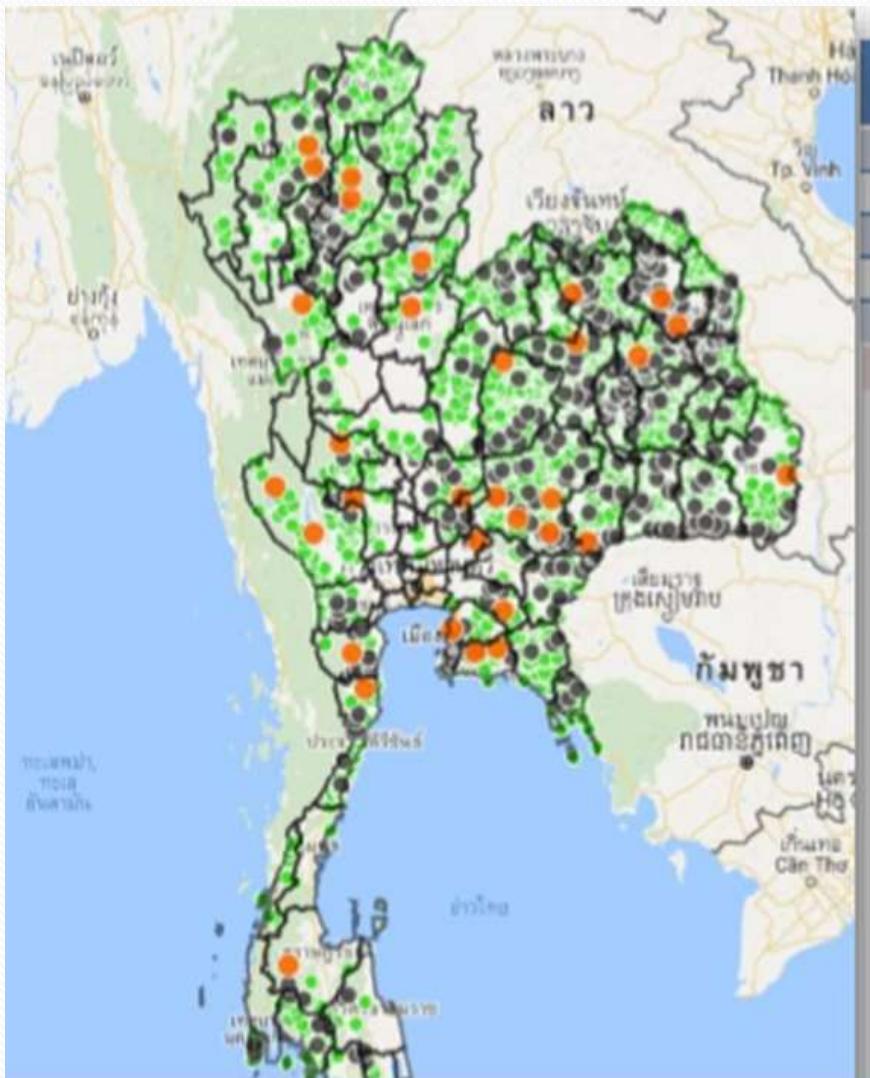


RID's Annual Budget

Budget Expenditures	Year 2012	Year 2013	Year 2014	Year 2015	Year 2016
Personnel budget (Million Baht)	6,438	6,708	6,832	6,537	6,547
Implementation budget (Million Baht)	1,300	1,392	1,392	1,498	1,309
Investment budget (Million Baht)	35,042	27,200	31,711	34,854	39,045
Supporting budget (Million Baht)	0.78	0.78	0.78	0.78	0.49
Other expenditures (Million Baht)	138	193	159	165	942
Total (Million Baht)	42,919	35,493	40,095	43,055	47,924



Irrigation Facilities in Thailand



Project	Number of Project	Capacity (MCM)	Irrigable Area (M.ha)
Large Scale	34	73,217	2.87
Medium Scale	671	4,219	1.05
Small Scale	13,842	1,790	0.18
Pumping Station	2,557	1	0.72
Detention storage	223	451	0.01



Capacity

79,677 MCM

Irrigated Area

4.84 Million hectares

Climate Change in Thailand

Key Risks and Adaptation in ASIA

Asia									
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation					
<p>Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia (<i>medium confidence</i>)</p> <p>[24.4]</p> <p>Flood</p>	<ul style="list-style-type: none"> Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications) Construction of monitoring and early warning systems; Measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods Economic diversification 		<p>Very low Present Near term (2030–2040) Long term 2°C (2080–2100) 4°C</p>	Very low	Medium	Very high			
<p>Increased risk of heat-related mortality (<i>high confidence</i>)</p> <p>[24.4]</p> <p>Heat</p>	<ul style="list-style-type: none"> Heat health warning systems Urban planning to reduce heat islands; Improvement of the built environment; Development of sustainable cities New work practices to avoid heat stress among outdoor workers 			Very low	Medium	Very high			
<p>Increased risk of drought-related water and food shortage causing malnutrition (<i>high confidence</i>)</p> <p>[24.4]</p> <p>Drought</p>	<ul style="list-style-type: none"> Disaster preparedness including early-warning systems and local coping strategies Adaptive/integrated water resource management Water infrastructure and reservoir development Diversification of water sources including water re-use More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture) 			Very low	Medium	Very high			
				Present	Near term (2030–2040)	Long term 2°C (2080–2100) 4°C			
Climate-related drivers of impacts									
 Warming trend	 Extreme temperature	 Drying trend	 Extreme precipitation	 Precipitation	 Snow cover	 Damaging cyclone	 Sea level	 Ocean acidification	 Carbon dioxide fertilization
						Level of risk & potential for adaptation			
						<p>Potential for additional adaptation to reduce risk</p>			
						<p>Risk level with high adaptation Risk level with current adaptation</p>			

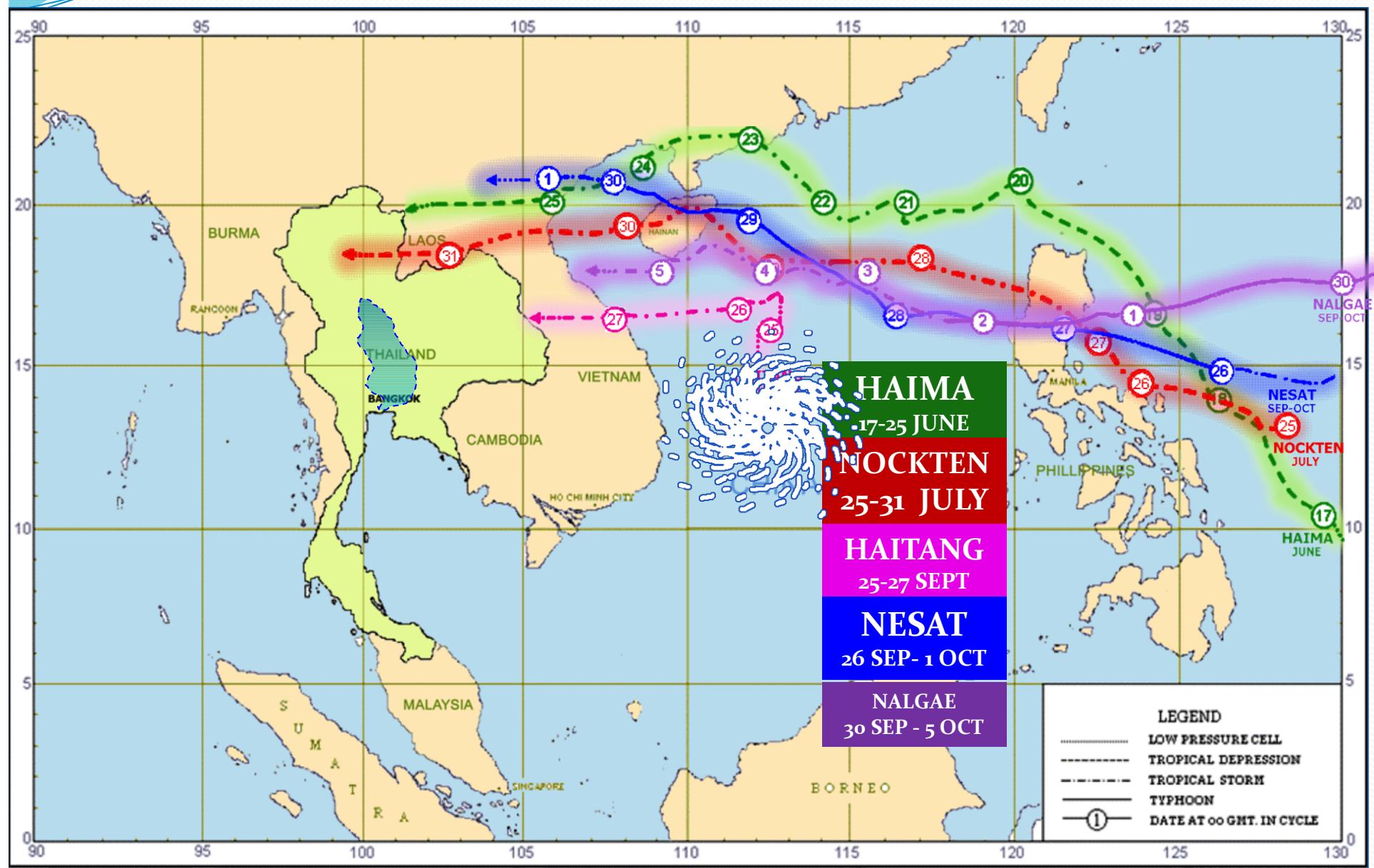
Key Risks and Adaptation in ASIA

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<p>Increased risk of drought-related water and food shortage causing malnutrition (<i>high confidence</i>) [24.4]</p> <p>Drought</p>	<ul style="list-style-type: none"> Disaster preparedness including early-warning systems and local coping strategies Adaptive/integrated water resource management Water infrastructure and reservoir development Diversification of water sources including water re-use More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture) 			<p>Adapt: Disaster Preparedness (Early warning, Local coping), IWRM, Water infrastructure & Reservoir development, More efficient water use, etc.</p>					
Climate-related drivers of impacts									
 Warming trend	 Extreme temperature	 Drying trend	 Extreme precipitation	 Precipitation	 Snow cover	 Damaging cyclone	 Sea level	 Ocean acidification	 Carbon dioxide fertilization
Level of risk & potential for adaptation									
<p>Potential for additional adaptation to reduce risk Risk level with high adaptation Risk level with current adaptation</p>									

The highlight of climate change in Thailand :

- Climate change tends to drive more seriously severity disasters, especially **storms**, **floods**, and **drought**.
- The annual average **temperature** in Thailand has increased about **0.56 °C** for **50 years**.
- The **average sea surface temperatures** in the Gulf of Thailand (East coast) and the Andaman Sea (West coast) tends **to increase about 0.1 °C per decade**.
- Mean sea level in the Gulf of Thailand has been **increased at a rate of 3.0 to 5.0 mm per year**.

TROPICAL STORMS AFFECTED THAILAND 2011



In 2011 Thailand : Extreme flooding



- Starting in late July and ends on 16 January 2012
- People have affected more than 12.8 million people
- the World Bank estimated losses of up to 1.44 trillion baht
- Extreme flooding cause more than 6 million hectares of land
- Farmland is expected to be damaged 0.45 million hectares

CC Key Risks in Thailand (Flood)



Sukhothai (28Jul.2017)

<http://news.thaflood.com/archives/1648>



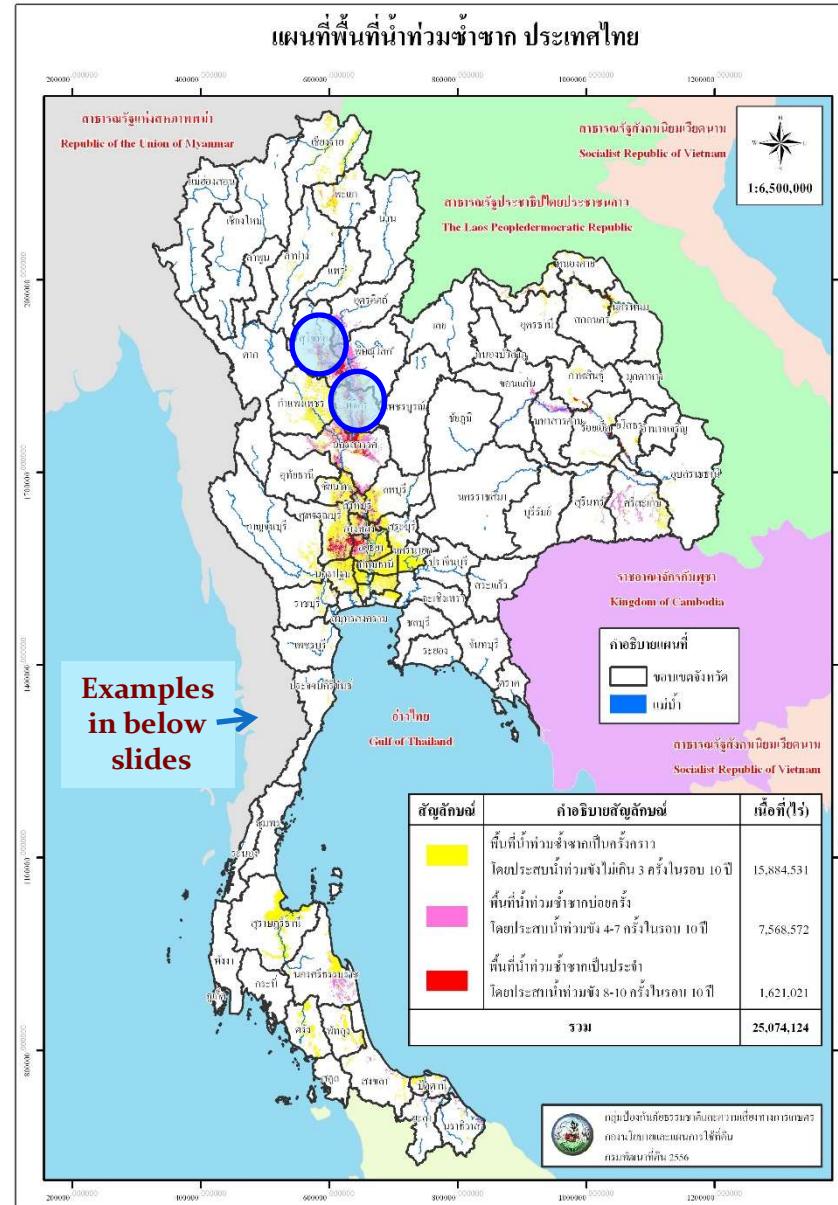
Sukhothai (28Jul.2017)

<http://www.bangkokbiznews.com/news/detail/766601>



Nakhon Sawan (20Oct.2017)

<https://www.pptvhd36.com/news/ประเทศไทย/67791>



CC Key Risks in Thailand (Flood)



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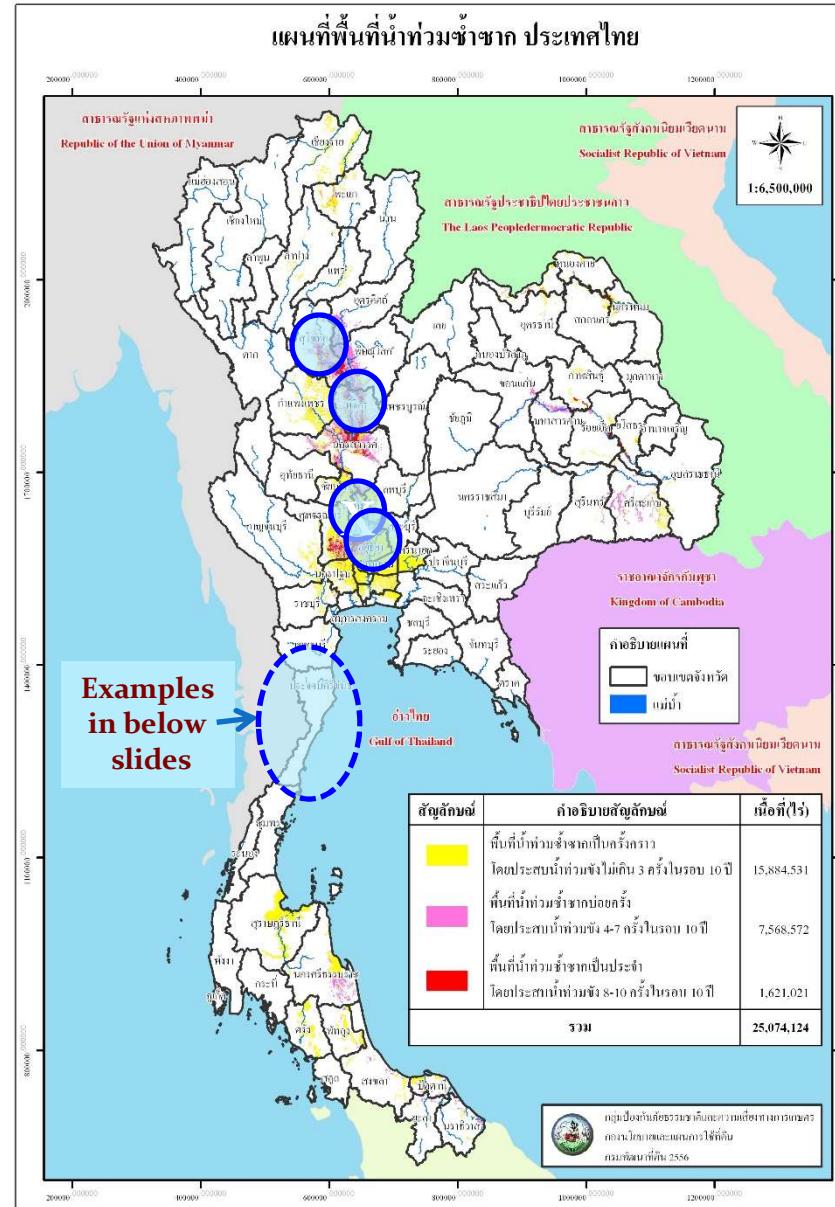
Sukhothai (28Jul.2017)

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Nakhon Sawan (20Oct.2017)

<https://www.pptvhd36.com/news/ประเดือนช่อง/67791>



Singburi: dike break (13Oct.2017)

<https://news.thaipbs.or.th/content/266894>



Anghthon: flow under dike (14Oct.2017)

<https://www.prachachat.net/general/news-54930>



Ayuthya: Sena lowland (25Sep.2016)

<http://news.thaipbs.or.th/content/256074>

In 2015-2016 Thailand has been extreme drought



➤ Thailand has been affected by the El Niño years of 1982 to 1983 and a second time in 1998. The rainfall amount is less than normal



CC Key Risks in Thailand (Drought)



Sukhothai (26Feb.2014)

<https://www.thairath.co.th/content/406250>



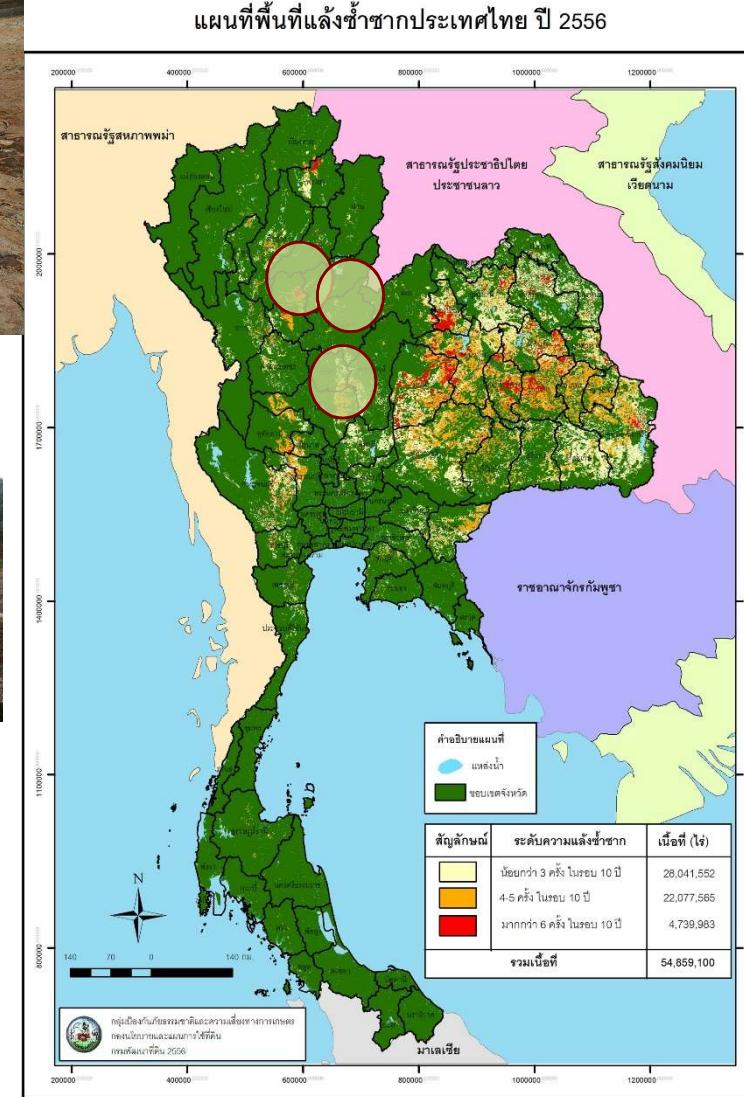
Phitsanulok (20 Jan. 2016)

<https://mgronline.com/local/detail/9590000006665>



Nakhon Sawan (6Jul.2015)

<https://www.thairath.co.th/content/509692>



CC Key Risks in Thailand (Drought)



Sukhothai (26Feb.2014)

<https://www.thairath.co.th/content/406250>



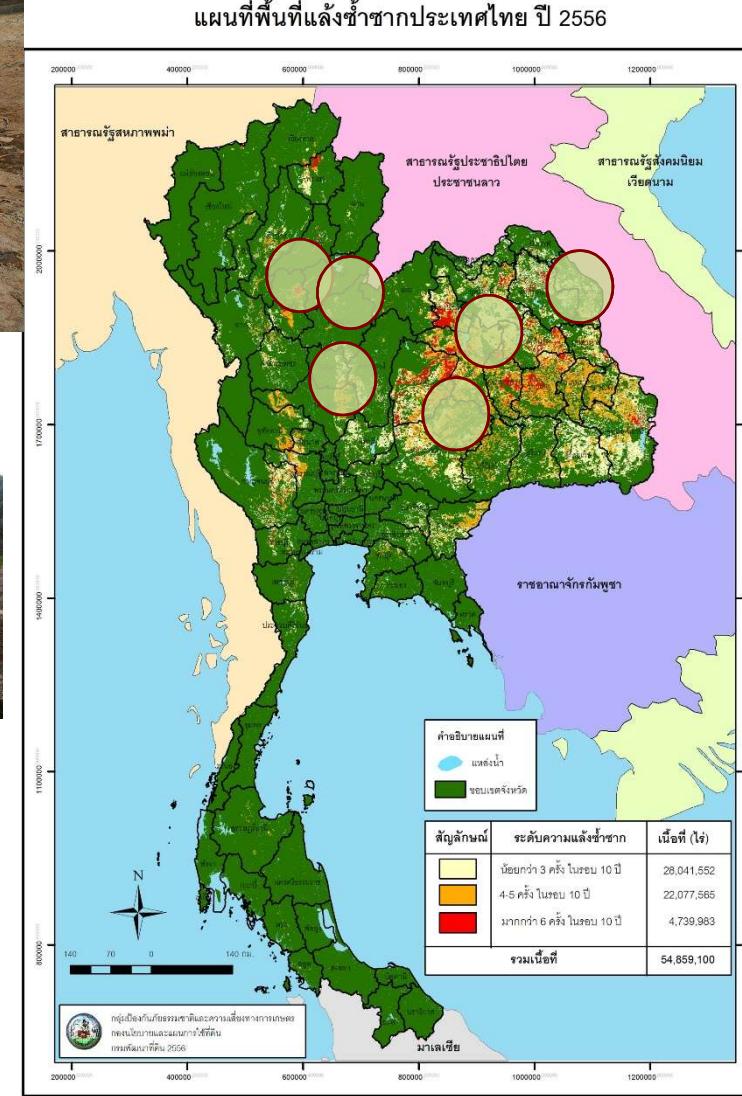
Phitsanulok (20 Jan. 2016)

<https://mgronline.com/local/detail/9590000006665>



Nakhon Sawan (6Jul.2015)

<https://www.thairath.co.th/content/509692>



Nakhon Panom: from Khong Riv. (24 Mar. 2016)

<https://www.thairath.co.th/content/595546>



Khon Kean (23 Feb. 20xx)

<http://www.khonkaenlink.info/home/news/1220.html>

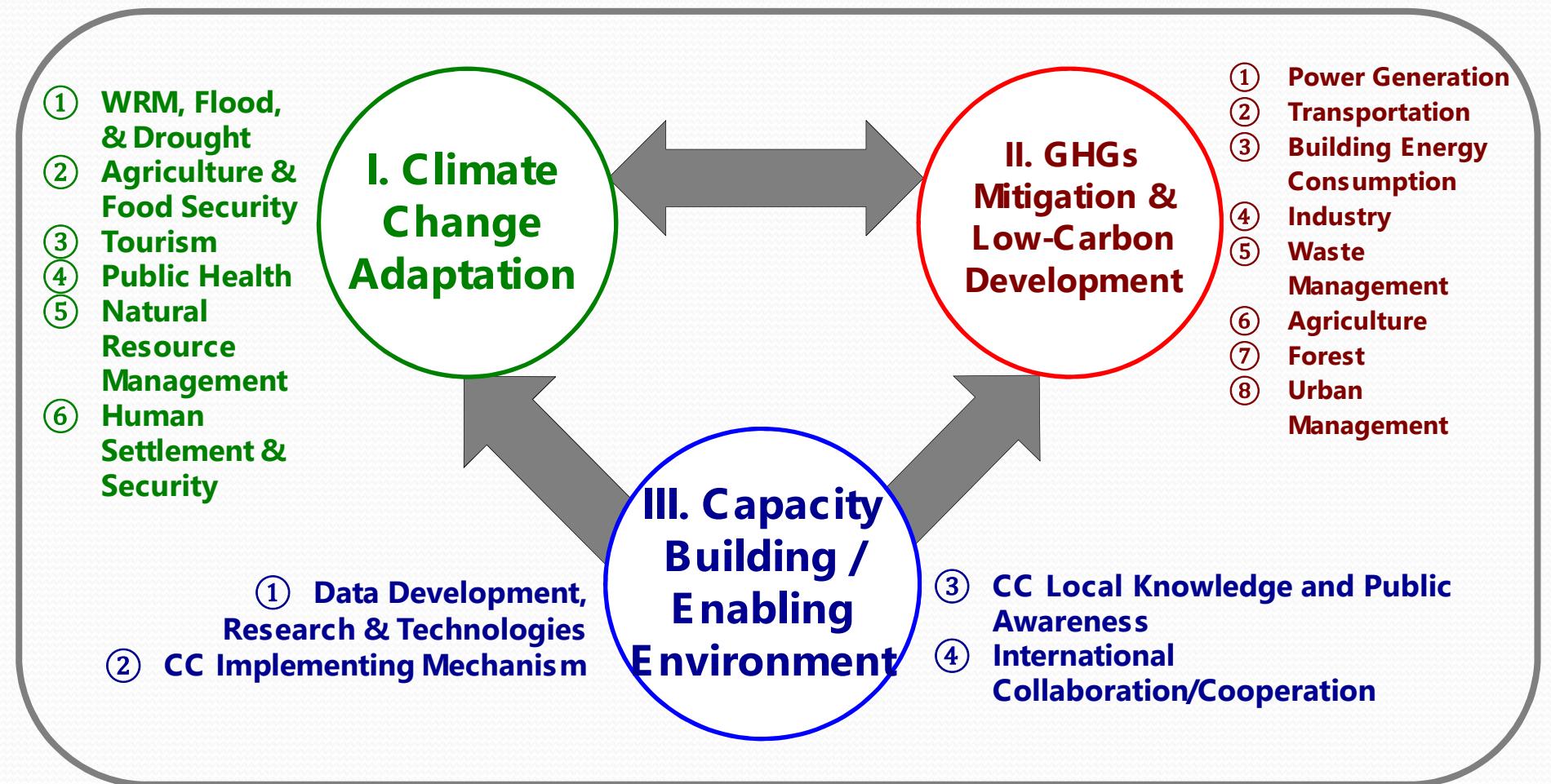


Korat (25 Mar. 2010)

<https://www.thairath.co.th/content/72844>

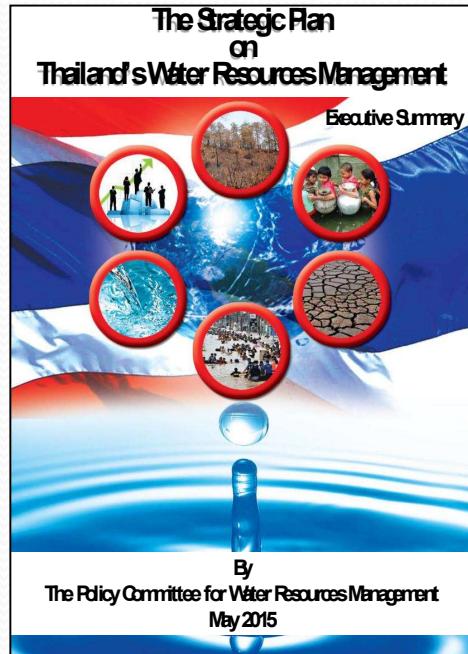
Climate Change Master Plan 2015-2050

Components



Achievements: Integrate climate change measures into national policies, strategies and planning (SDG13 Target)

The Strategic Plan on Thailand 's Water Resources Management



Situation	Trend	Water resources management direction
economic structure change to industrial structure trend	preparedness for production 2.2 An increase in income share from industrial sector 2.3 Emphasize on an increase in value chain in a production of upstream industry such as steel and petrochemical industry	2.2 Water allocation (quota) arrangement to avoid impact on other sectors
3. Agricultural production is a key for rural people's livelihoods	3.1 Change of production system to more of commercial production 3.2 Regional production mainly depending on agriculture 3.3 Higher competition in agricultural sector	3.1 Water supply provision, water development projects and an increase in efficiency of irrigation system 3.2 Change pattern of production to economic crops with high value and demand
4. Service and tourism sector	4.1 Bangkok and areas around Bangkok in the East, including areas in Northern and Southern regions will become important tourist areas.	4.1 Provide water resources in existing tourist areas having limitation and high cost of investment problems 4.2 Develop new tourist areas according to capacity in water resources provision
5. Climate change	5.1 Change of precipitation pattern to be more extreme 5.2 Impact on water supply and agricultural productivity	5.1 Accelerate provision of risk map for flood and drought, and develop efficient early warning system 5.2 Build resilience to respond and mitigate effects from flood and drought 5.3 Disseminate appropriate information and news effectively

3.1.2 Changes in resources and situation of Thailand affecting water resources management

Situation	Trend	Water resources management direction
1. Upstream and forest management	1.1 Ongoing upstream forest encroachment 1.2 Forest management and water resources development are not integrated into policy planning.	1.1 Upstream area management to mitigate overall impacts in the river basin, including flood and drought

Trend

1. Change of precipitation pattern to be more extreme
2. Impact on water supply and agricultural productivity

WRM direction

1. Accelerate provision of risk map for flood and drought, and develop efficient early warning system
2. Build resilience to respond and mitigate effects from flood and drought
3. Disseminate appropriate information and news effectively

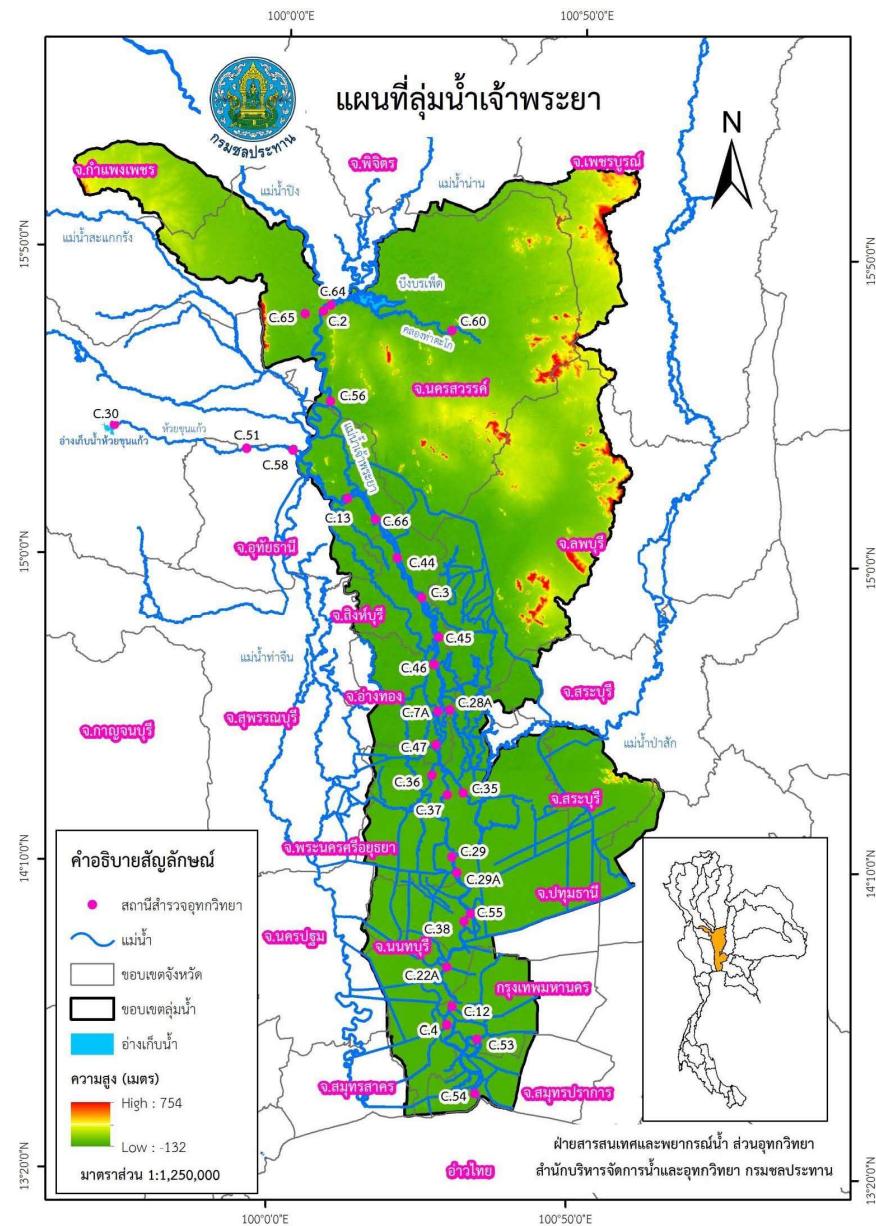
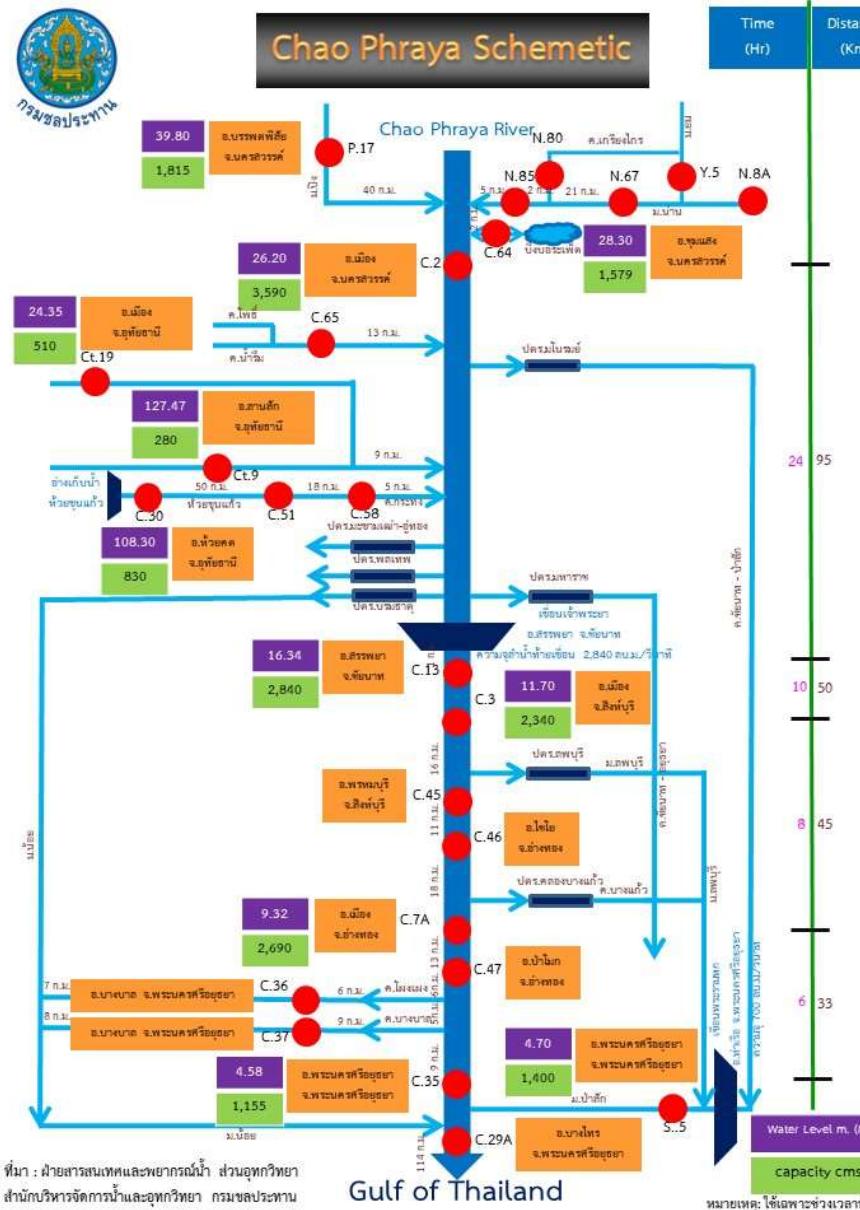


ROYAL IRRIGATION DEPARTMENT (RID)
MINISTRY OF AGRICULTURAL AND COOPERATIVES

Water Management in Chao Phraya Basin



Chao Phraya Basin Map



Length 372 km (231 mi), Basin size 160,400 km² (61,900 sq mi)

WATER MANAGEMENT

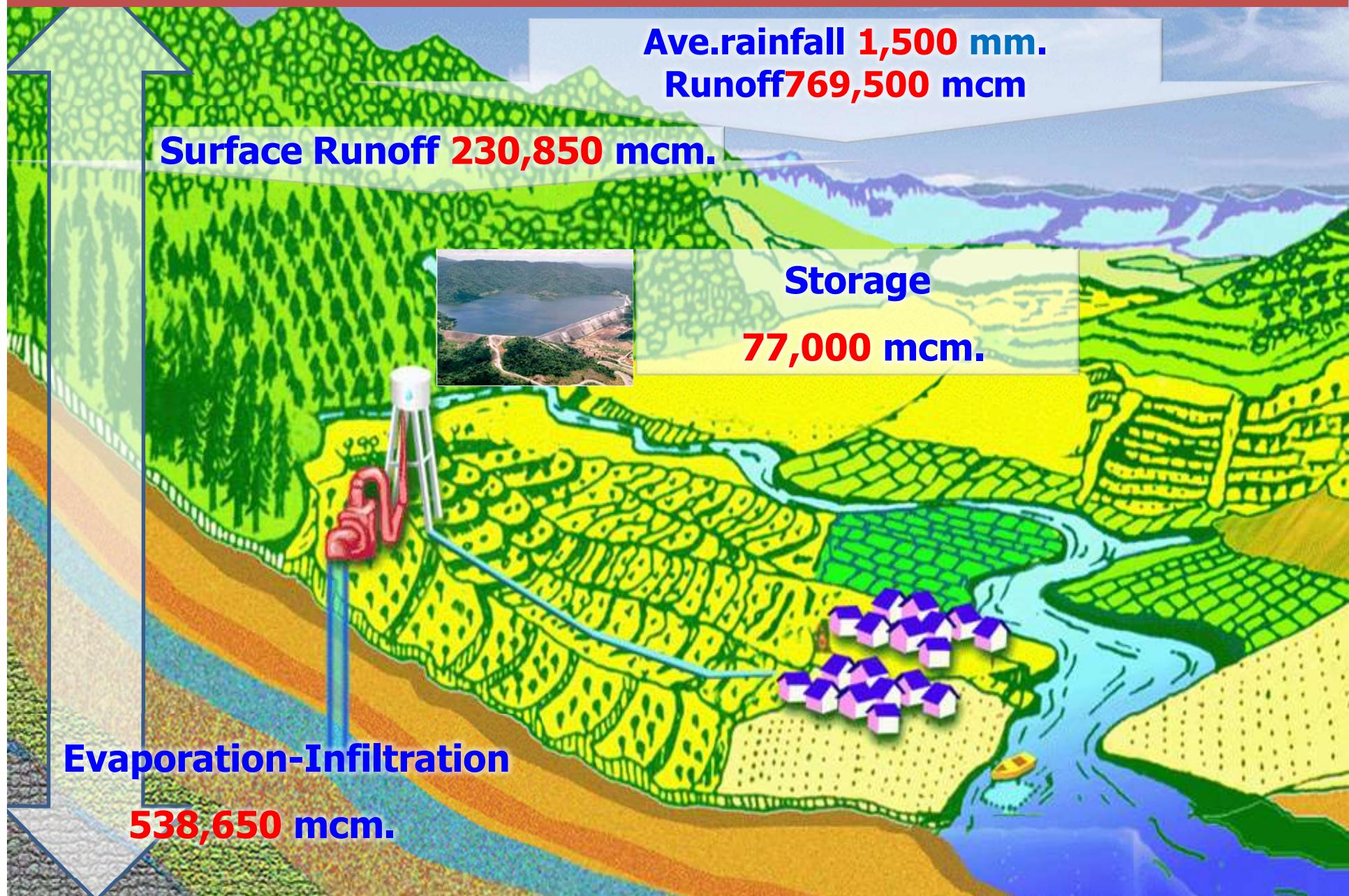
RISK!! For

FLOOD

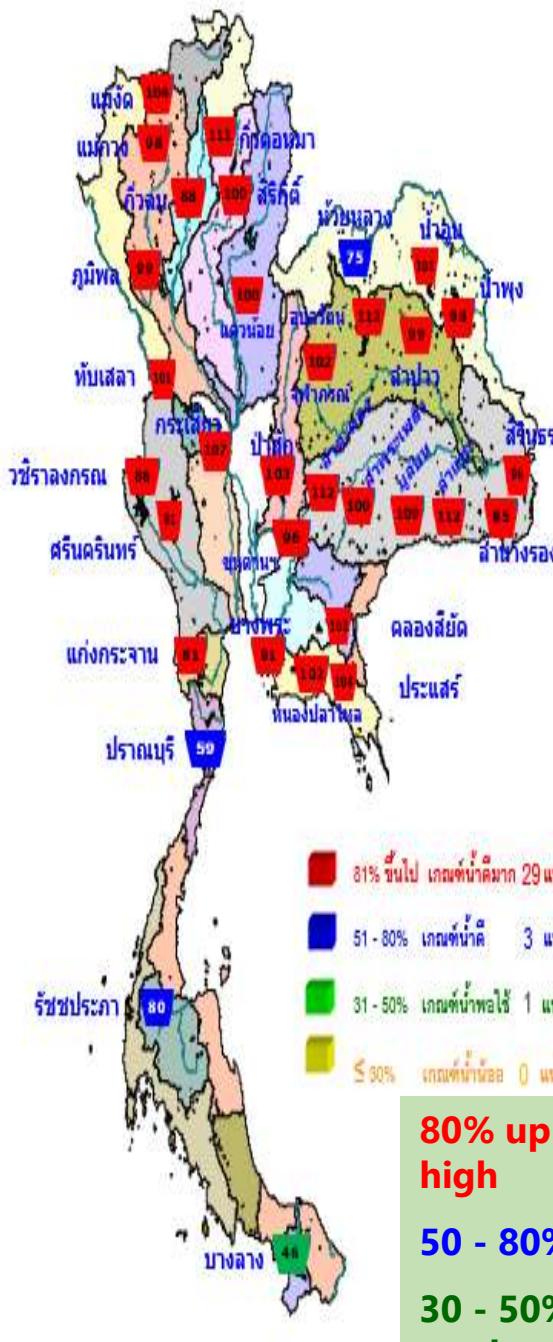
DROUGHT



Hydrological Data



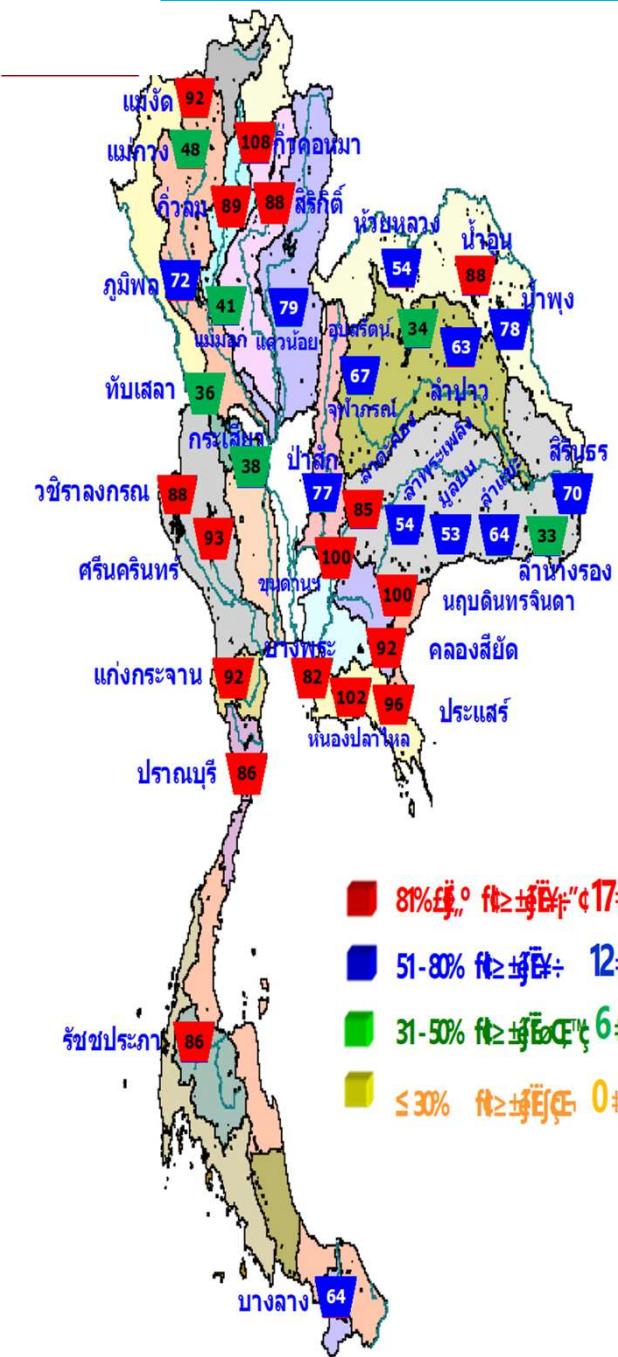
1 Nov 2011



1 Nov 2015

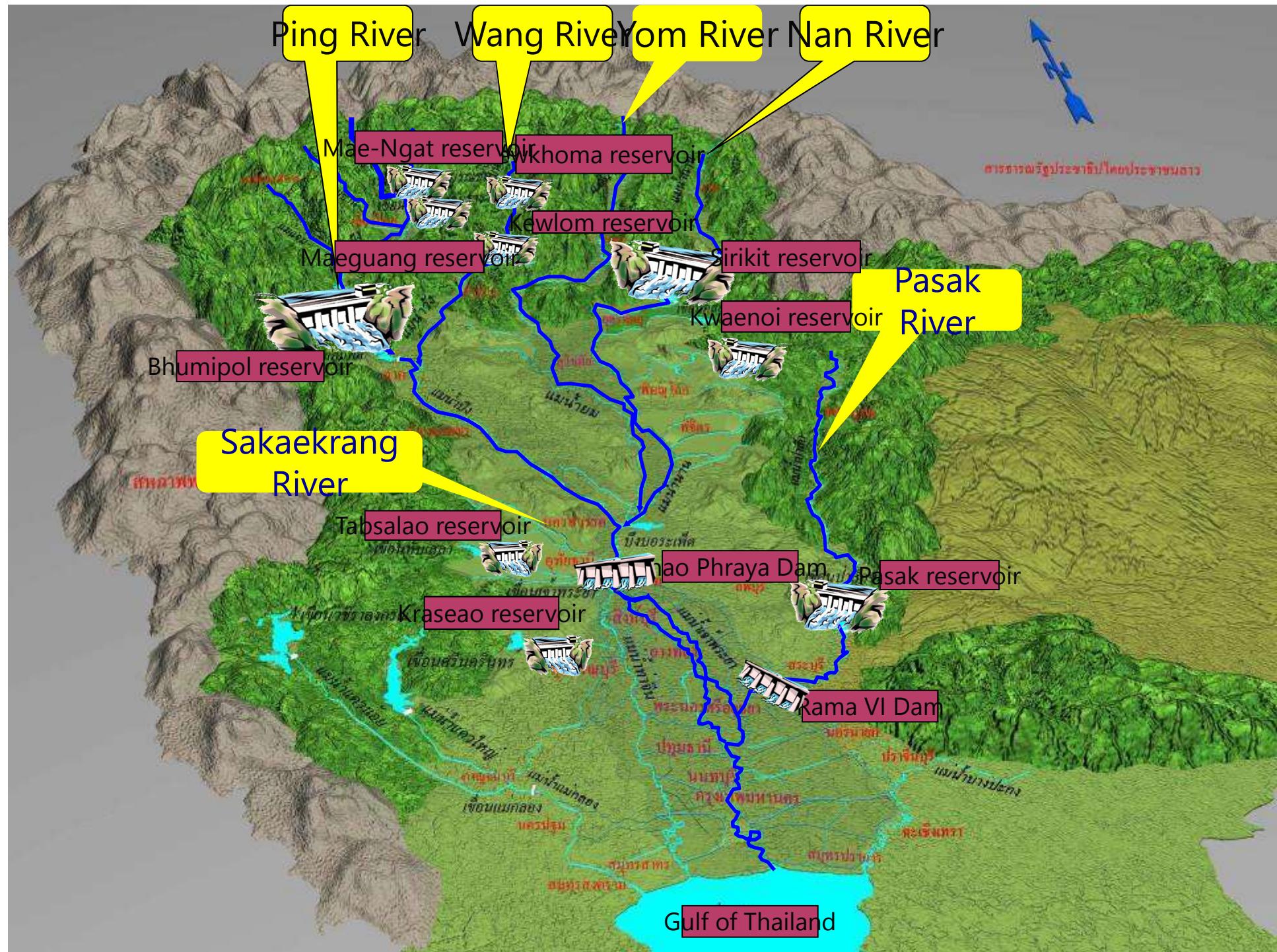


1 Nov 2018

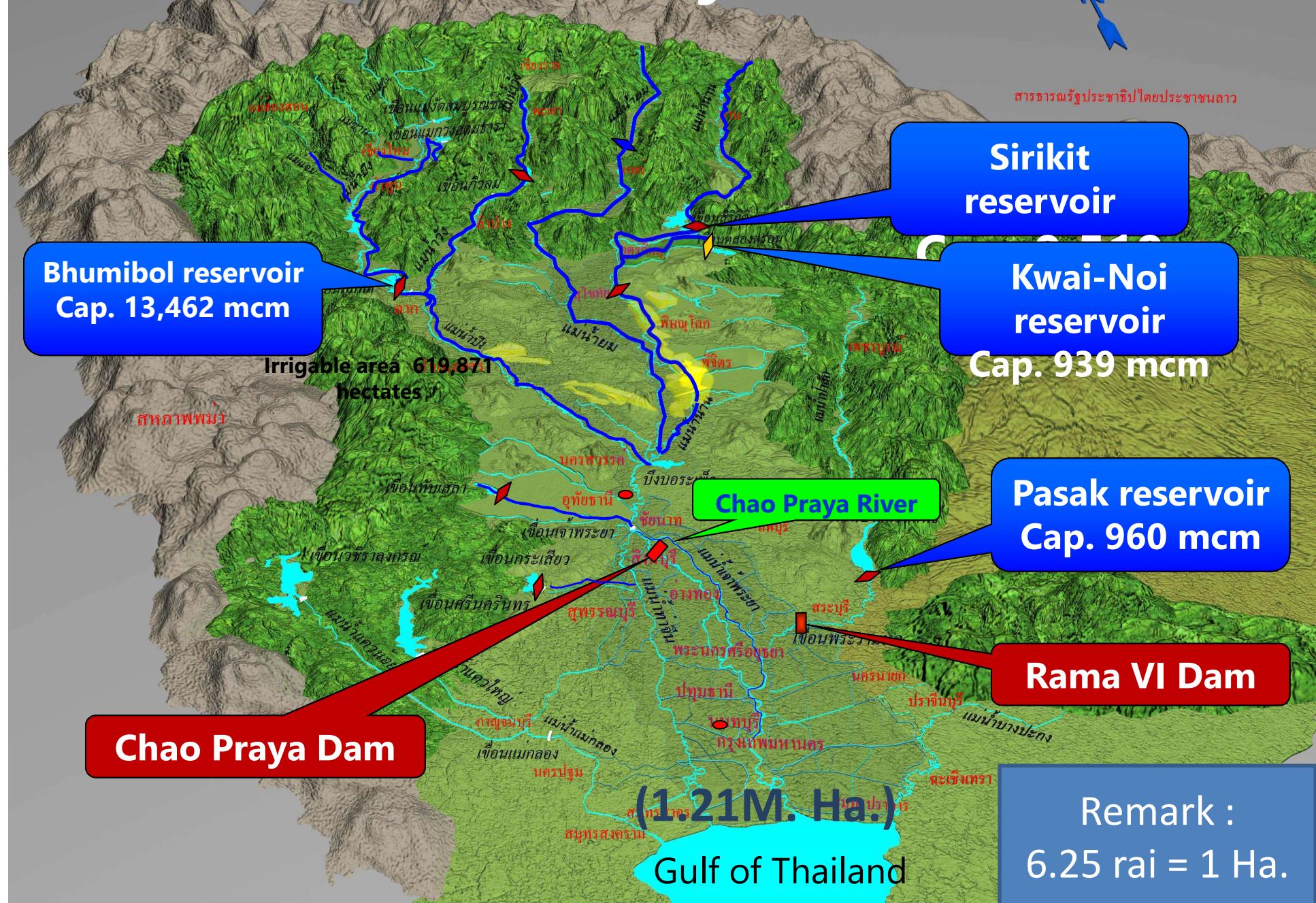


CHAO PHRAYA BASIN CENTRAL PLAIN

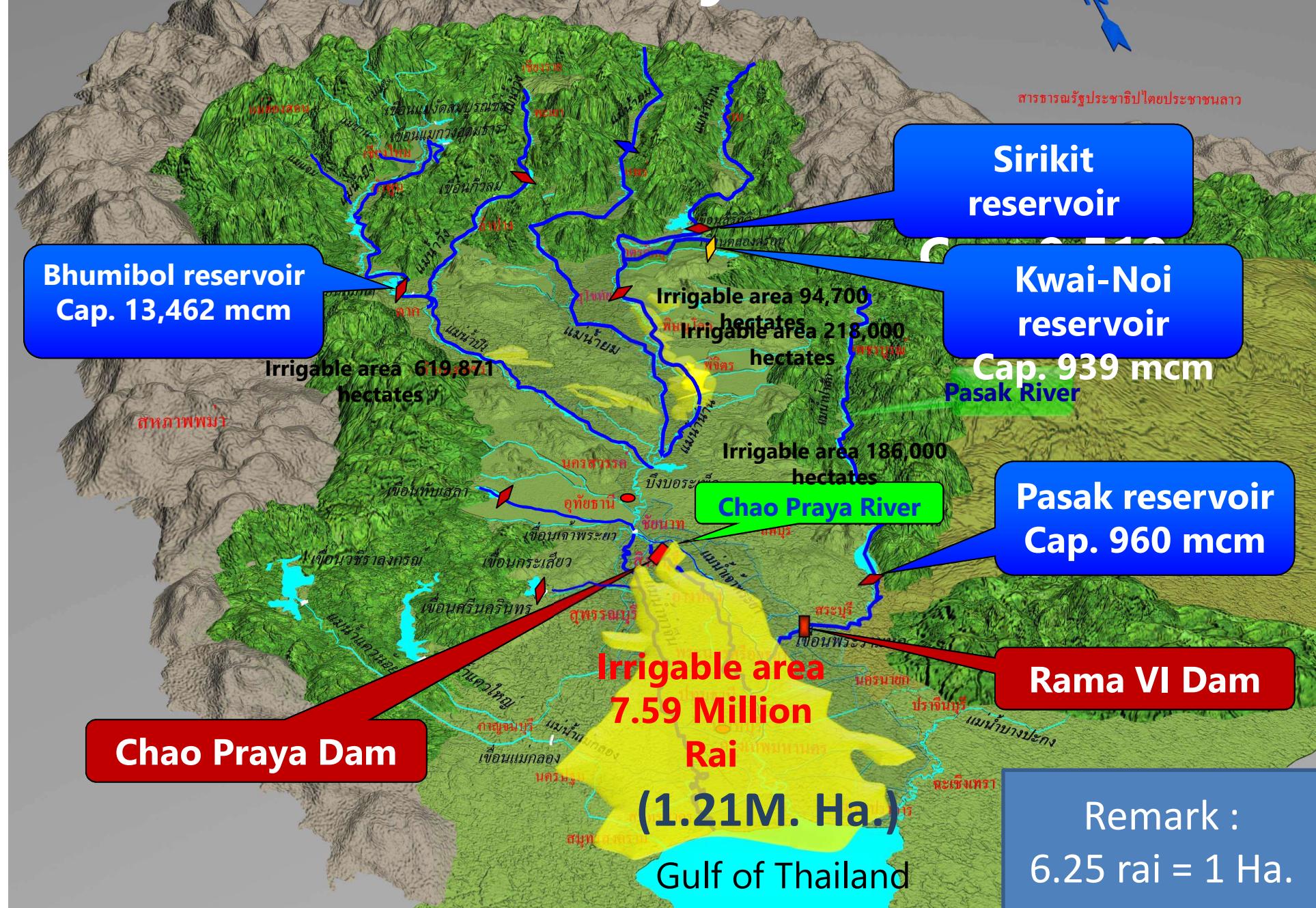




Chao Phraya Basin



Chao Phraya Basin



Water management during dry season in Thailand

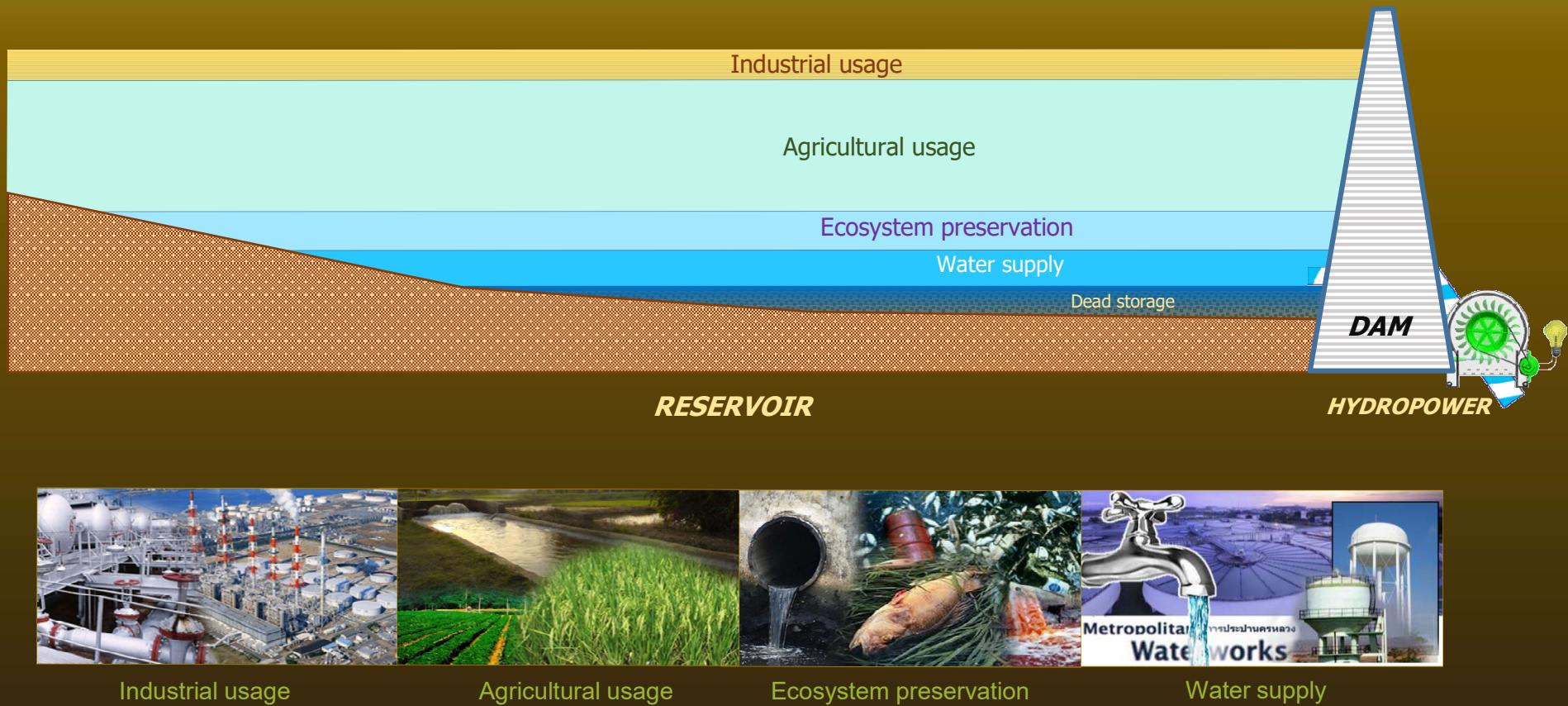


**The water management is based on available water of beginning season.
Priorities of water allocation are applied as follows:**

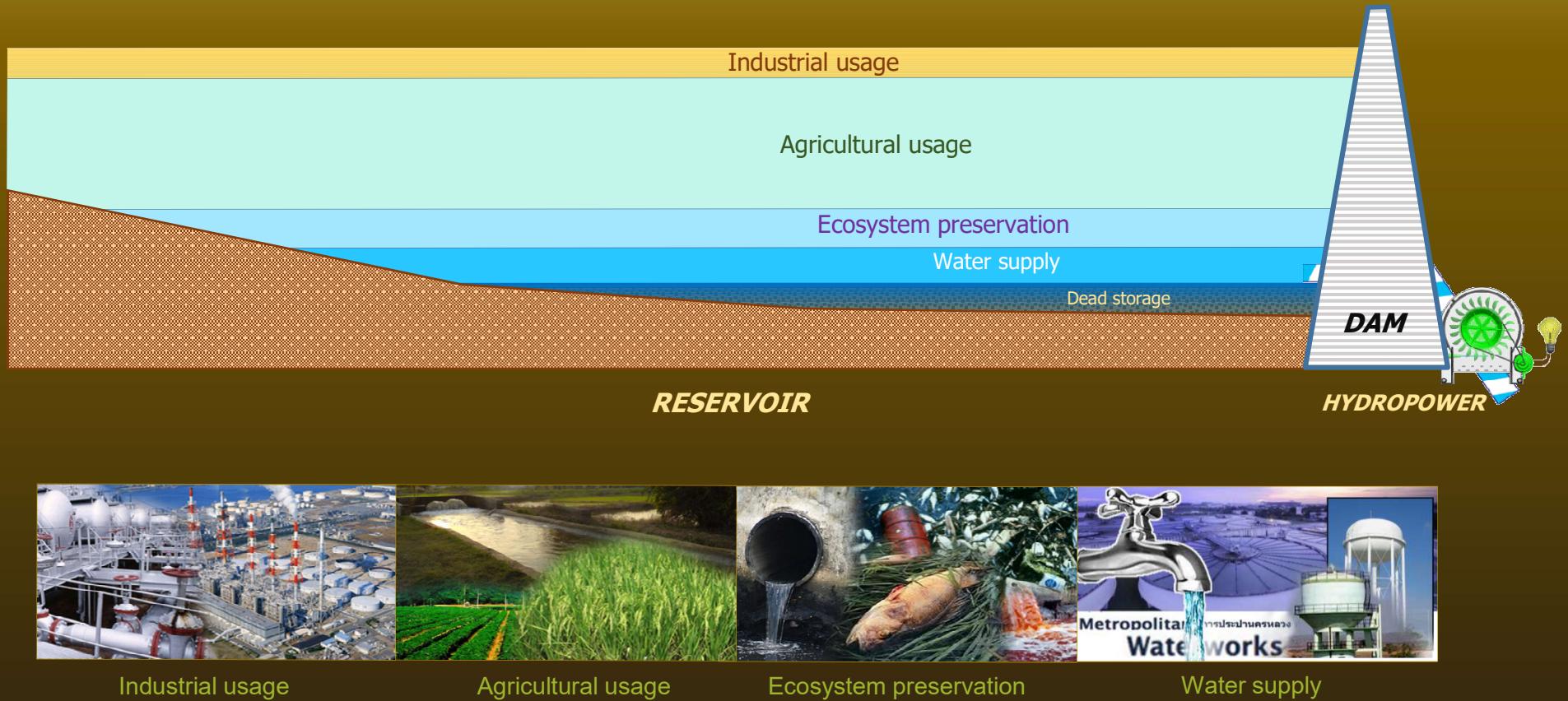
- 1. Water allocation for consumption (in dry season)**
- 2. Water allocation for ecosystem (in dry season)**
- 3. Water reservation for beginning of rainy season**
- 4. Water allocation for agriculture**
- 5. Water allocation for industry**



STORAGE ALLOCATION PRIORITY

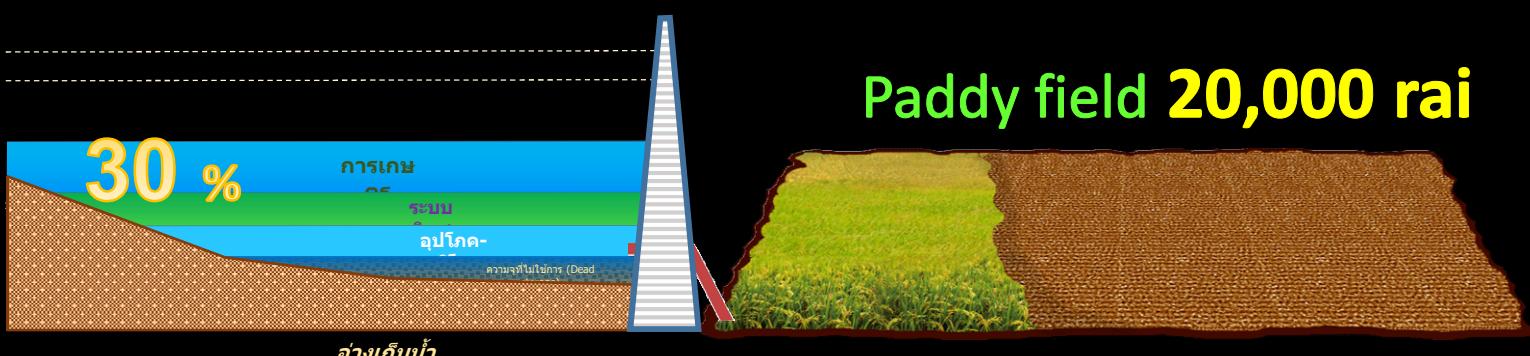
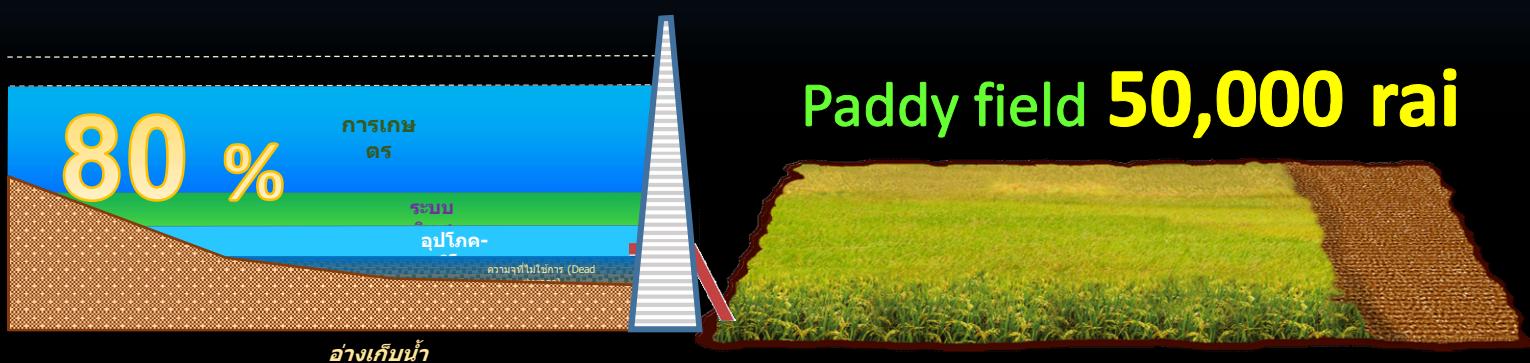


STORAGE ALLOCATION PRIORITY



Water Management in Dry Season

Estimate the water demand for agriculture



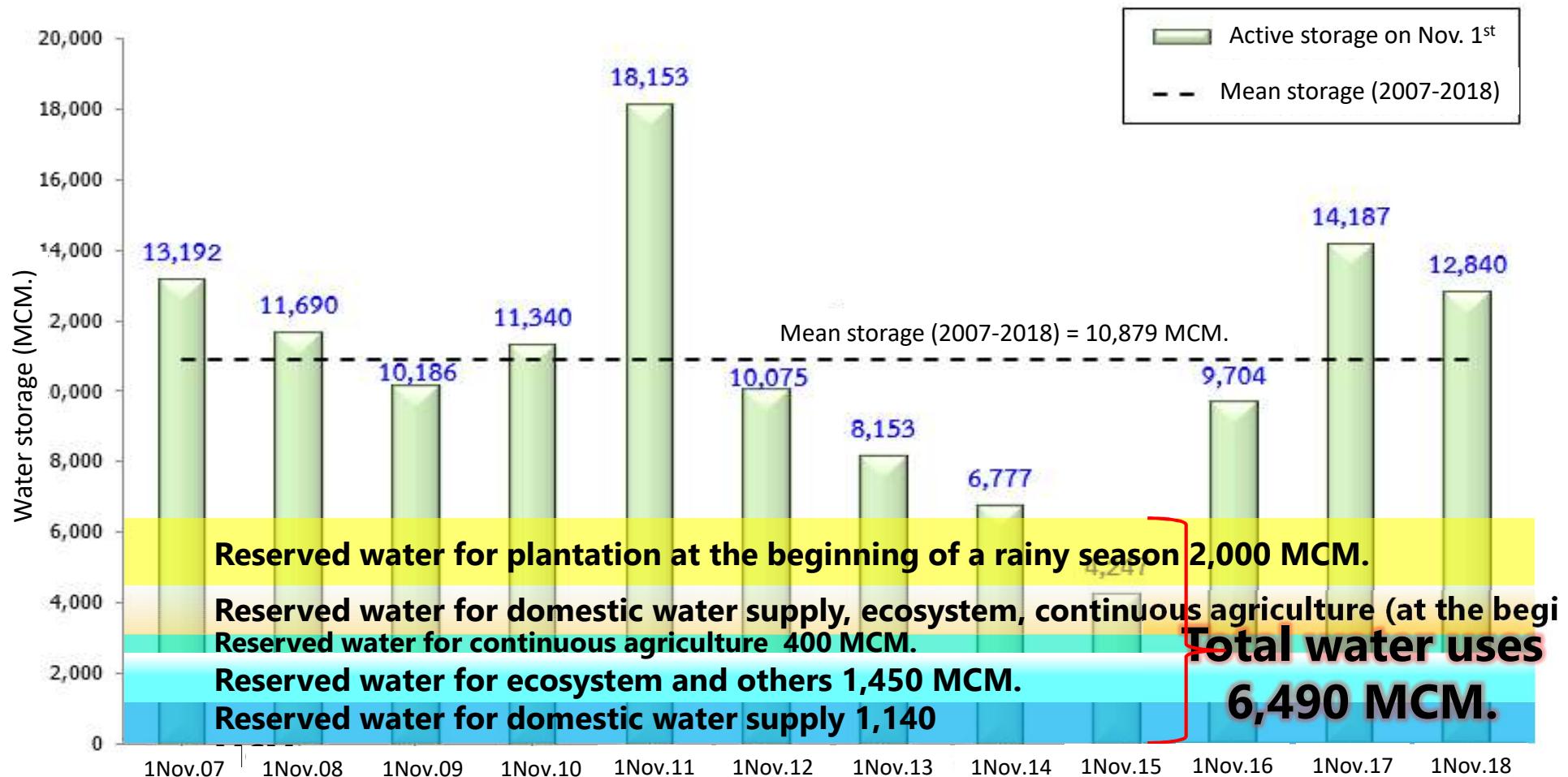
The minimum criteria for water reserved storage in Chao Phraya basin





Active reservoir storage of 4 reservoir located in Chao Phraya River Basin (2007-2018)

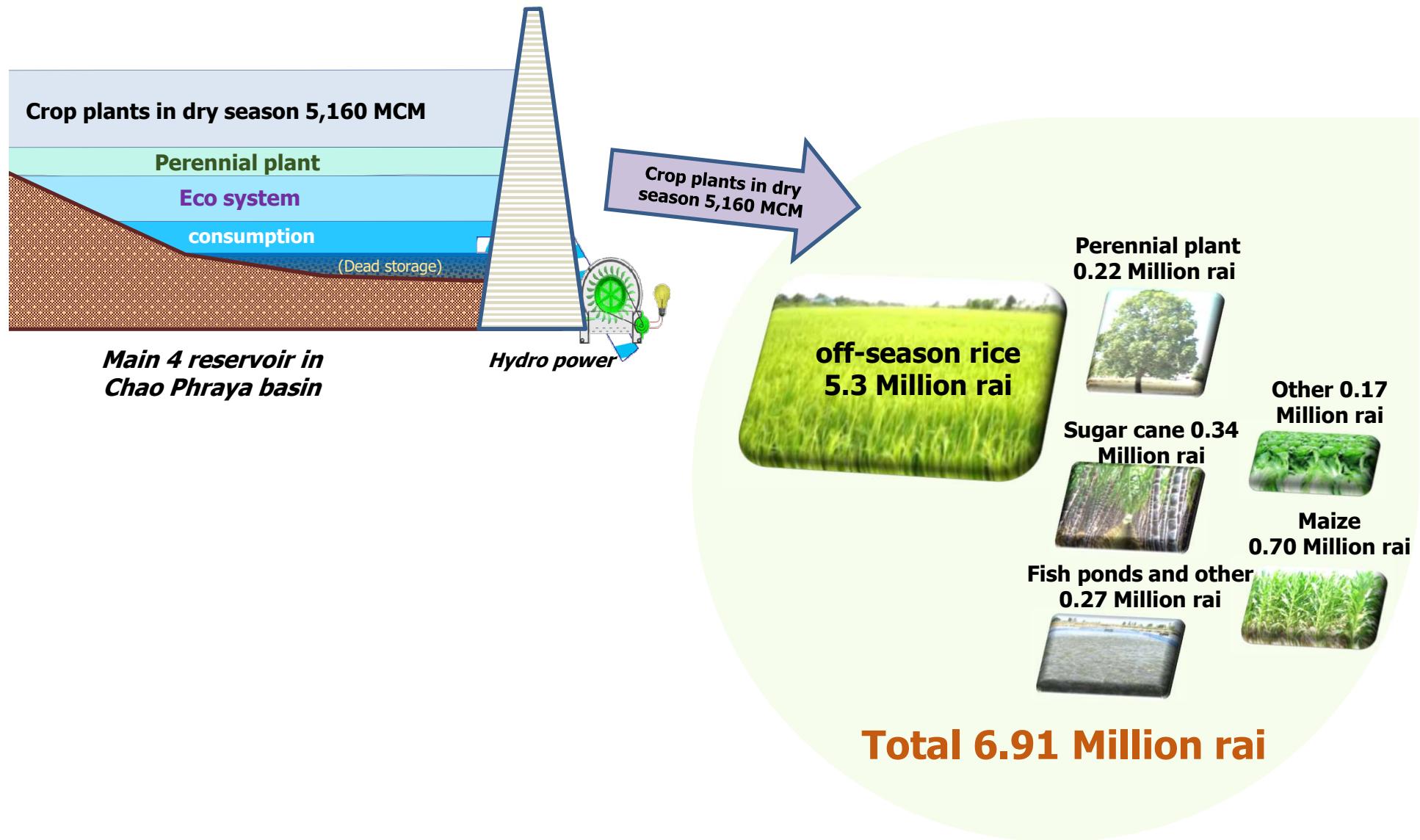
Active reservoir storage of 4 reservoir located in Chao Phraya River Basin (2007-2018)





Water allocation in Dry Season 2018/2019

(Chao Phraya basin)



THE CHALLENGE OF WATER MANAGEMENT

INCREASE
INCOME



WATER
RESOURCE



DECREASE
LOSSES



THE CHALLENGE OF WATER MANAGEMENT



MAXIMIZE BENEFITS

1. PROVIDE SUFFICIENT AND QUALITY WATER.
2. EFFICIENT IRRIGATION.
3. APPROPRIATE ALLOCATE FOR EVERY STAKEHOLDER.



EXCESS / SHORTAGE Of water



MINIMIZE LOSSES

1. FLOOD CONTROL
2. DROUGHT MITIGATION.
3. REDUCE IMPACTS OF DISASTERS.
- Damages, casualties

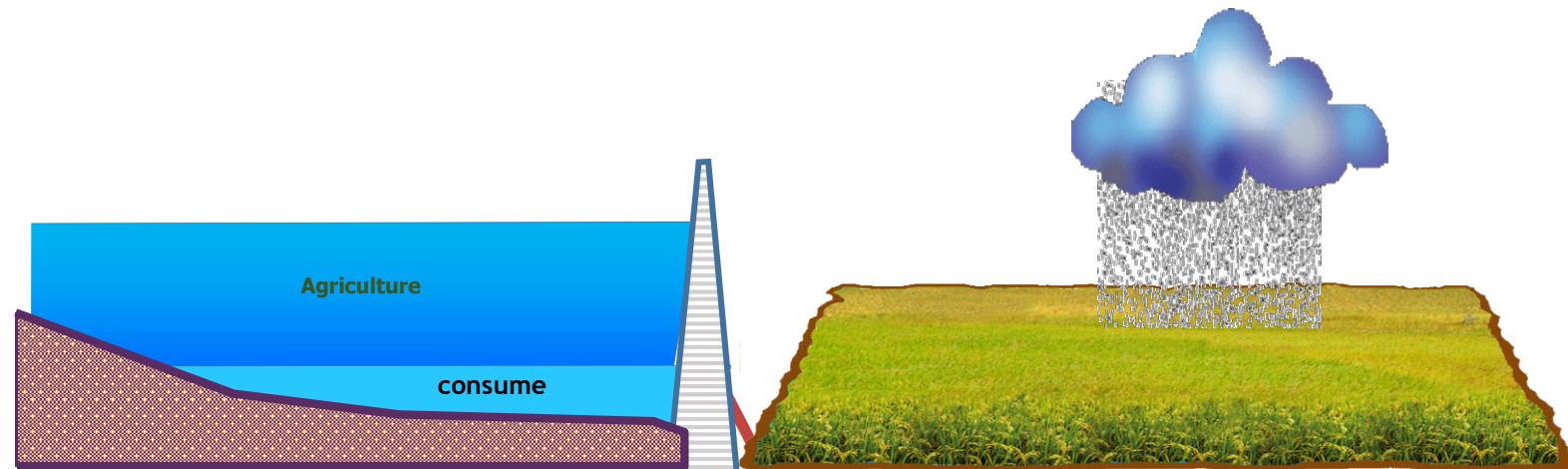


CASE 1 RESERVOIR CAPACITY GREATER THAN AVERAGE ANNUAL INFLOW

- Reserve water for in season crop (wet season)
- Reserve water for water shortage situation due to climate variability

CASE 1 RESERVOIR CAPACITY GREATER THAN AVERAGE ANNUAL INFLOW

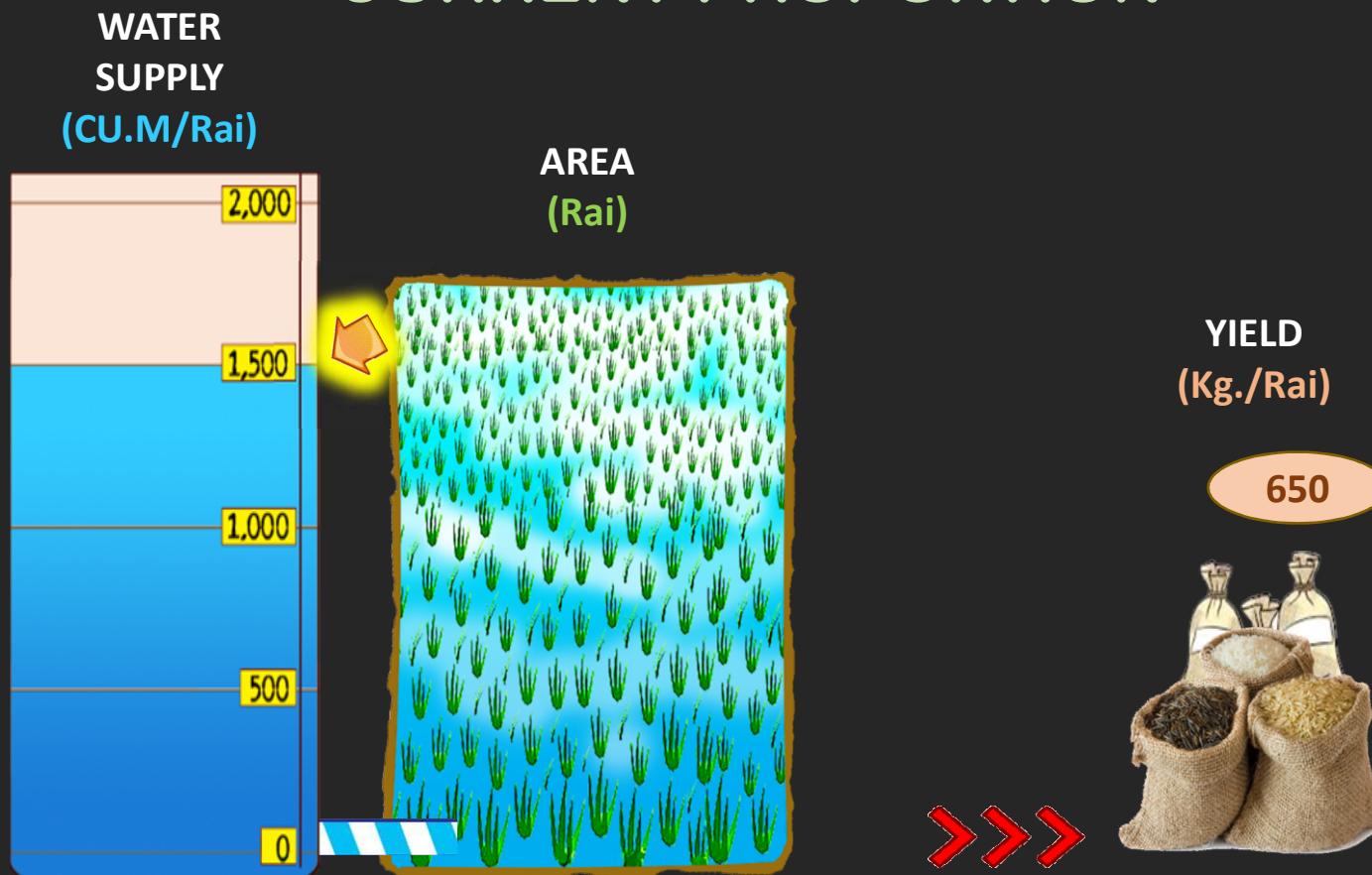
- Reserve water in wet season



TARGET

- Increase Irrigation Efficiency
- Increase Rice Yield

WATER SUPPLY : CROP YIELD CURRENT PROPORTION



1,500 Cu.M WATER -> 1 RAI (X 650 Kg.) =>
CROP YIELD = 650 Kg.

WATER VALUE : BY CROP YIELD

Water used



CROP YIELD

650



Rice price 12 baht / kg.

650 kg.=

7,800 baht
(per 1 Rai)

Water 1,500 Cu.M

=

7,800 baht



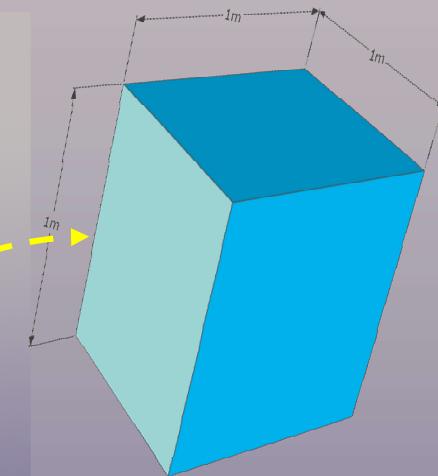
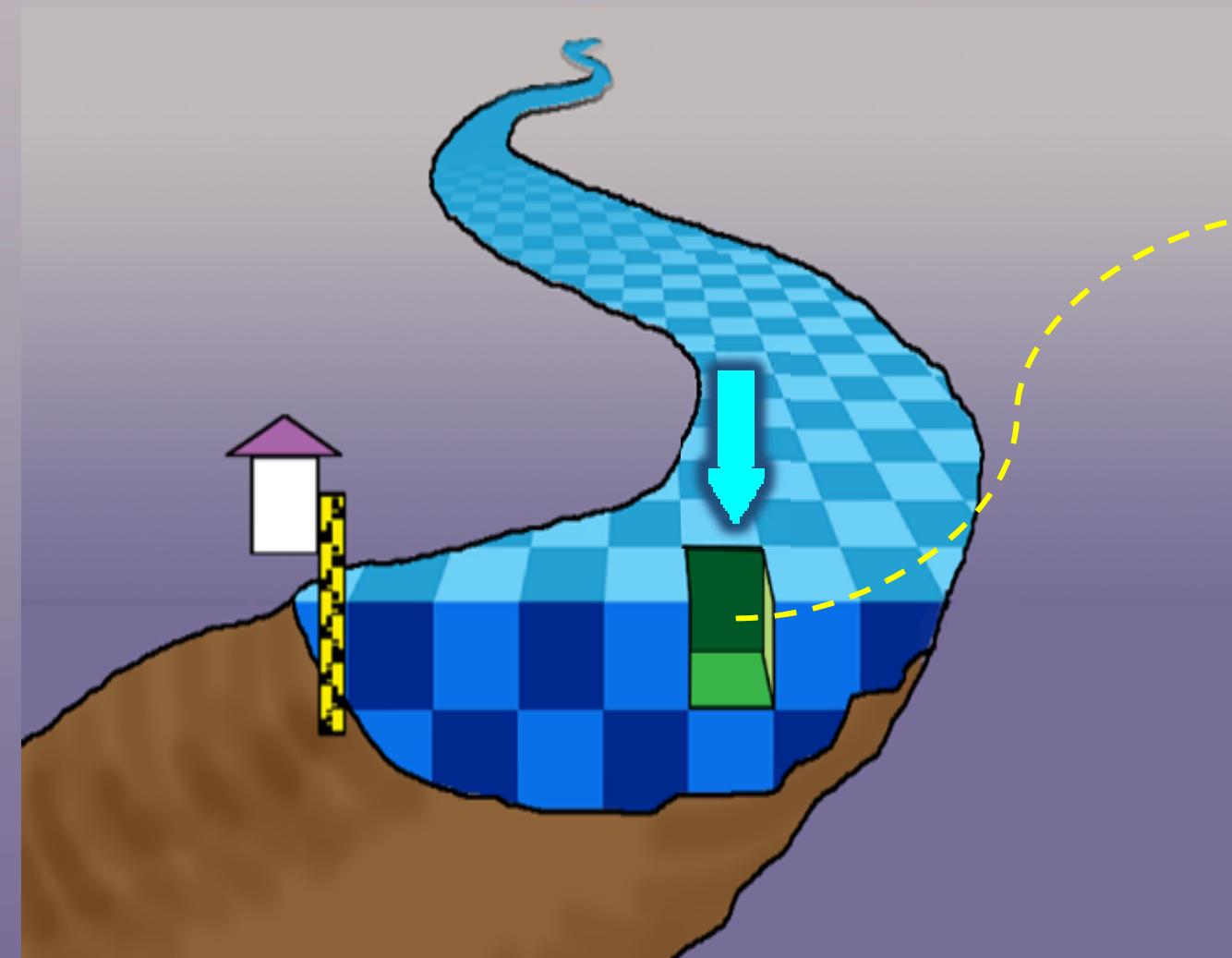
Water 1 Cu.M



= 5.2 baht

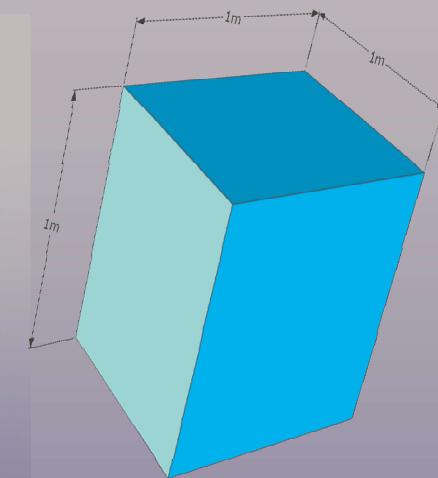
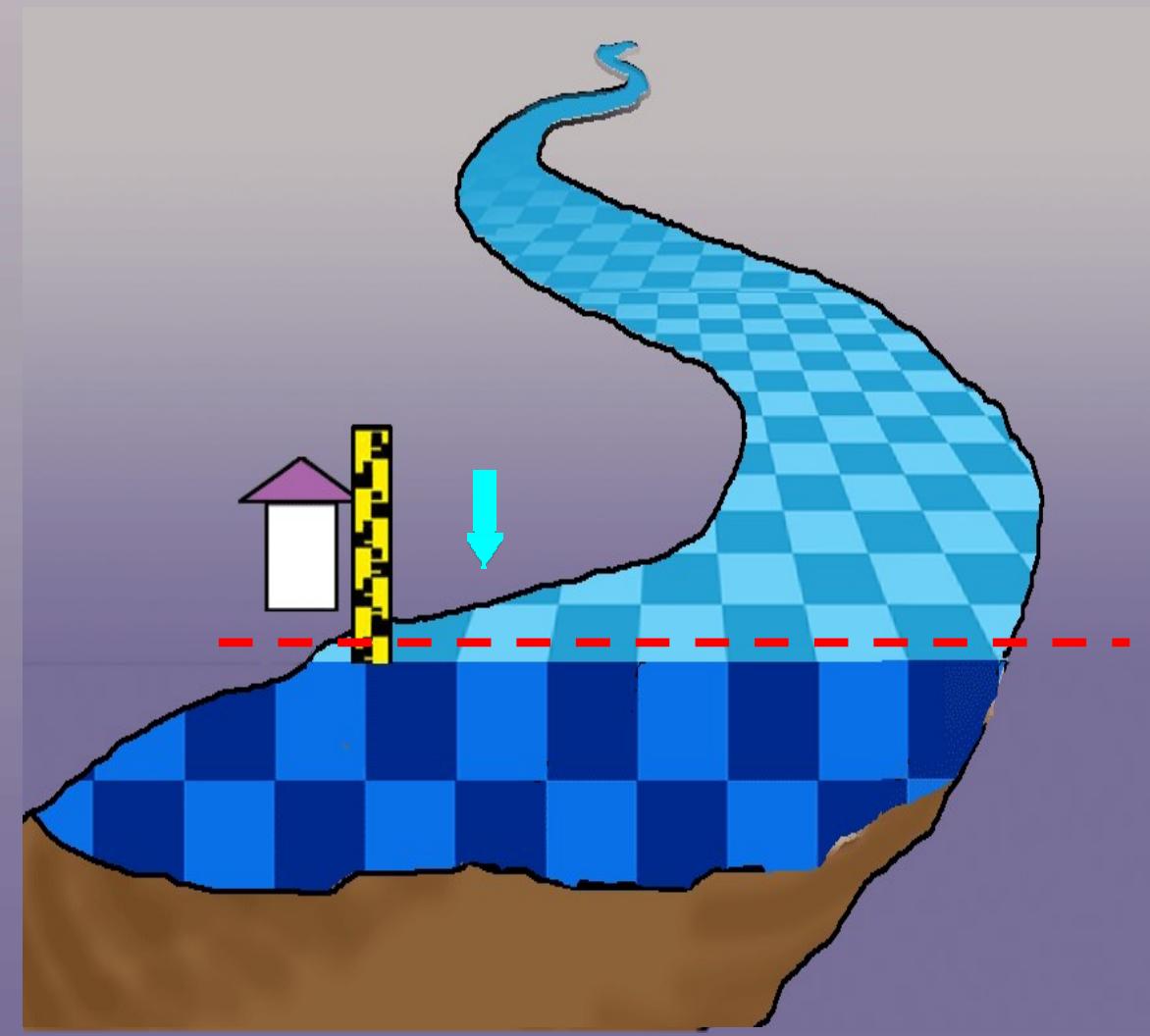


Discharge-cms

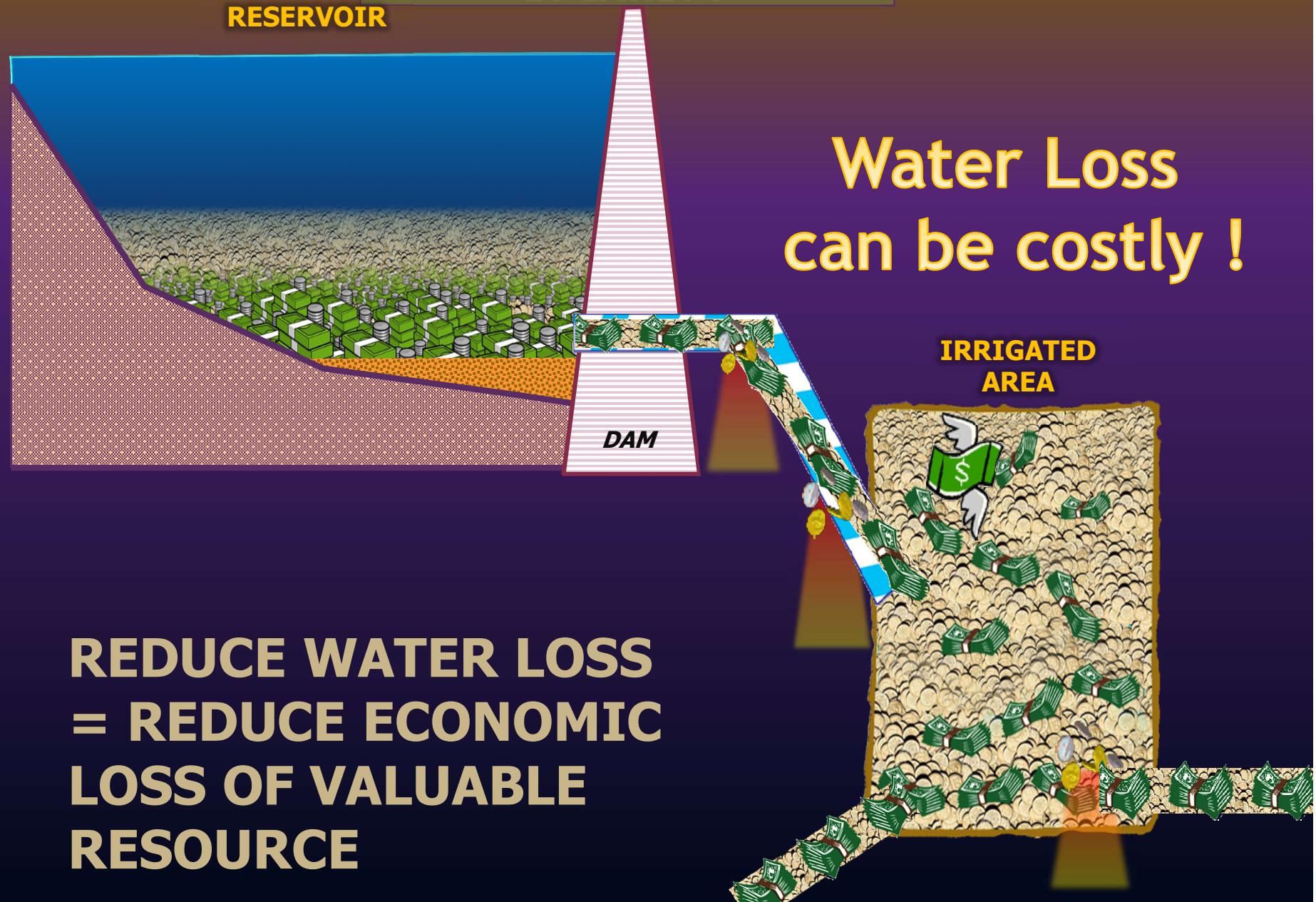


1 cms

Discharge-cms

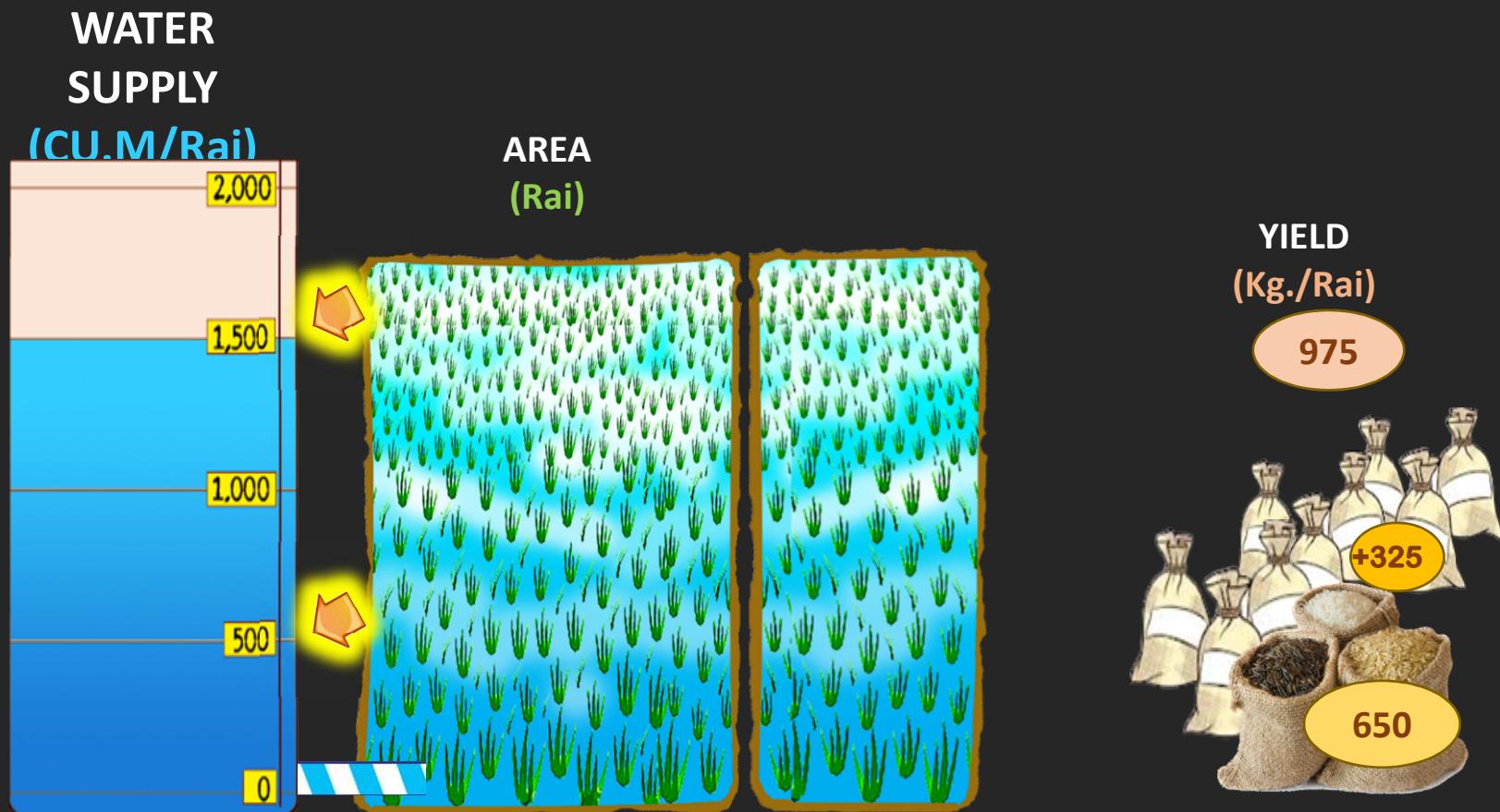


WATER : AS VALUABLE RESOURCE

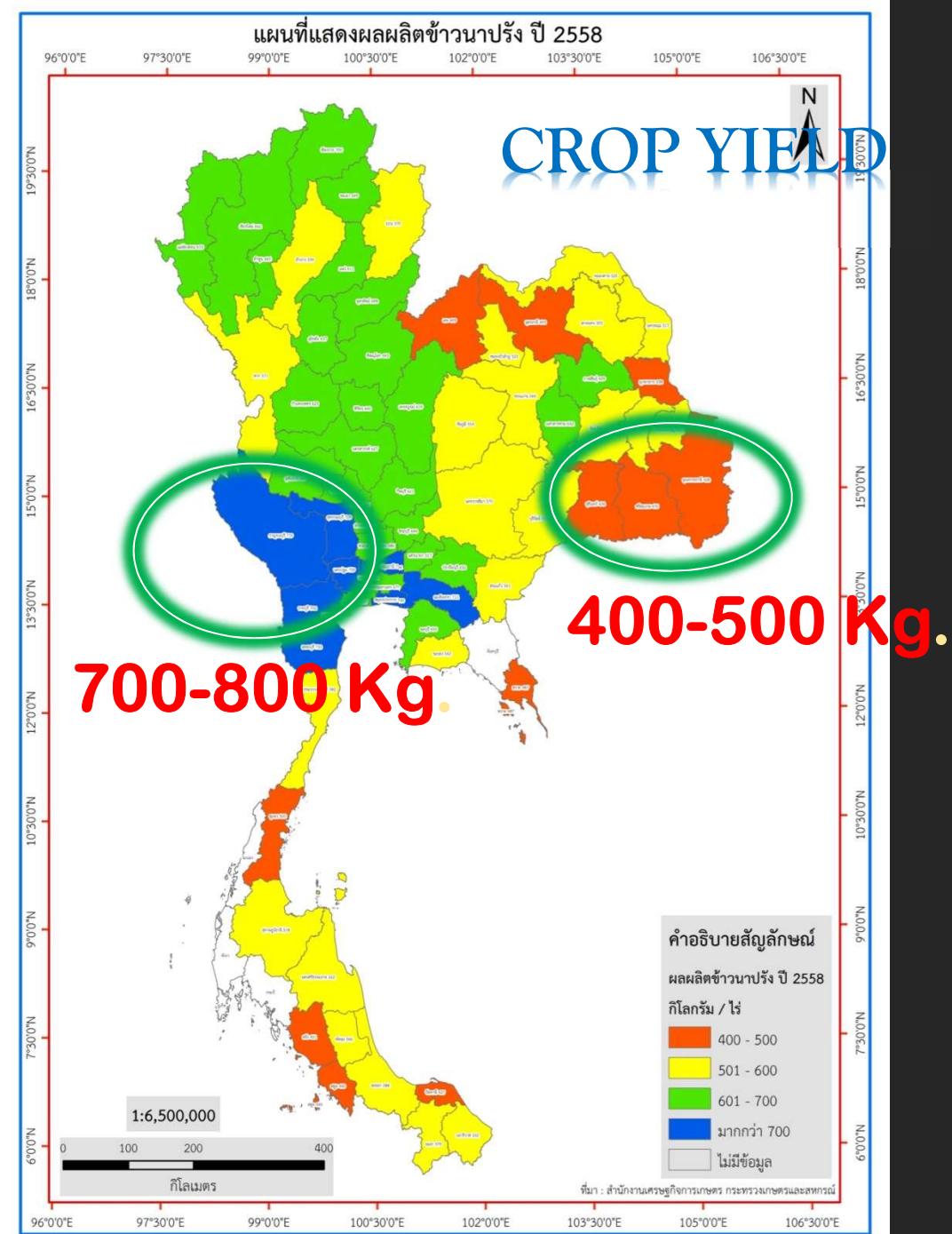


WATER SUPPLY : CROP YIELD

AIM 1 : REDUCE WATER – INCREASE AREA



1,500 Cu.M WATER -> 1.5 RAI (X 650 Kg.) =>
CROP YIELD = 975 Kg.

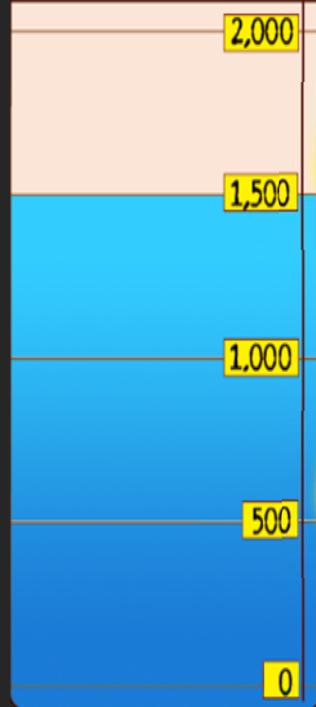


WATER SUPPLY : CROP YIELD

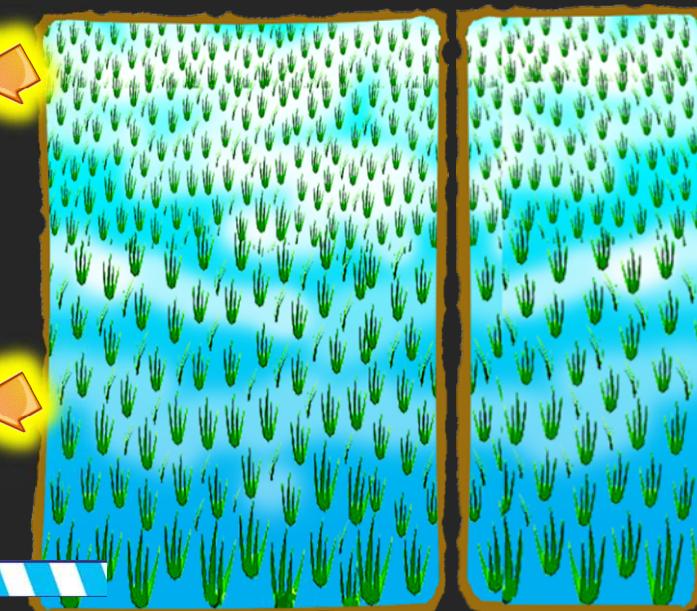
AIM 2 : REDUCE WATER - INCREASE AREA + YIELD

WATER
SUPPLY

(Cu.M/Rai)



AREA
(Rai)



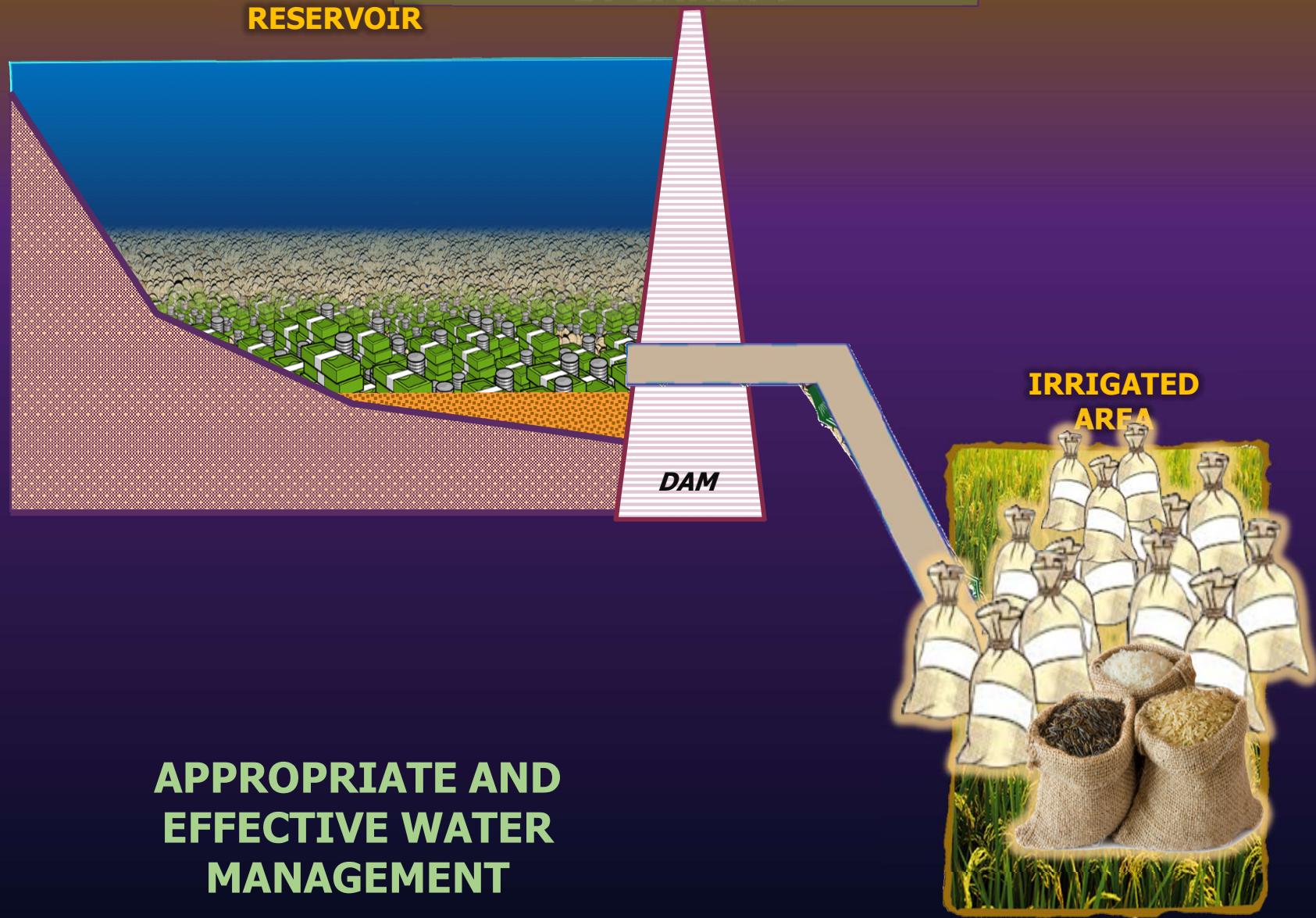
YIELD
(Kg./Rai)

1,200



1500 Cu.M WATER -> 1.5 RAI (X 800 Kg.) =>
CROP YIELD = 1200 Kg.

WATER : AS VALUABLE RESOURCE



APPROPRIATE AND
EFFECTIVE WATER
MANAGEMENT

Off-season crop statistics

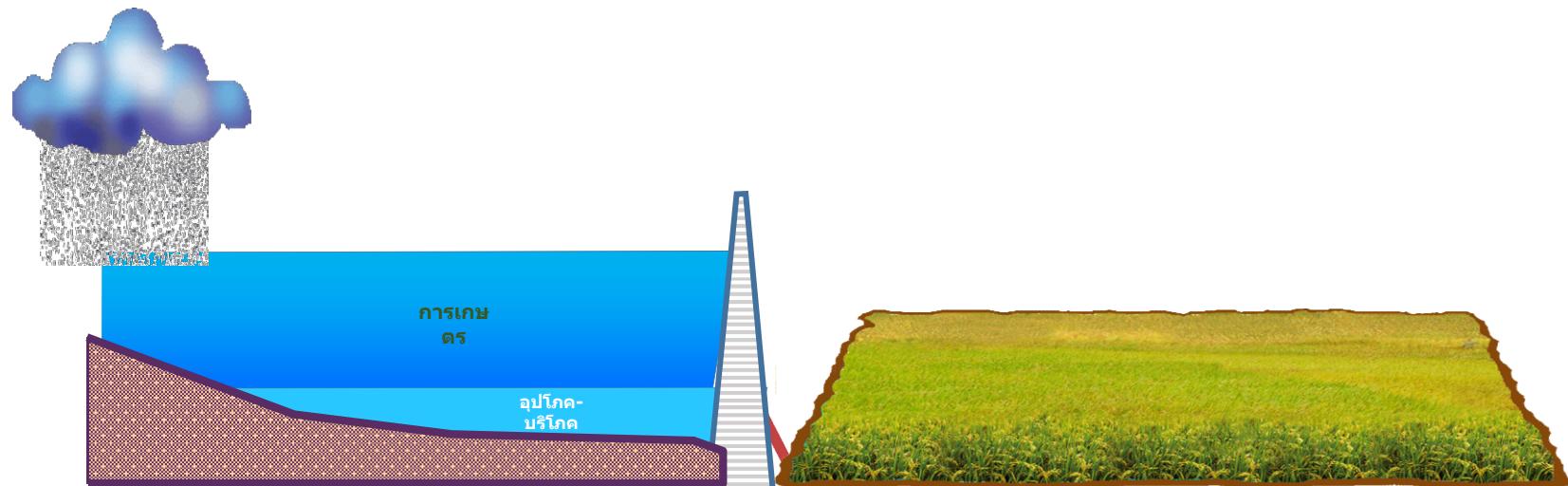
year	ปริมาณน้ำตันกรด (ล้านลบ.ม.)	off-season paddy field						การใช้น้ำเฉลี่ย (ลบ.ม. / ไร่)
		วันที่		พื้นที่เพาะปลูก (ไร)		การใช้น้ำ (ล้านลบ.ม.)		
		เริ่มต้น	สิ้นสุด	ตามแผน	ปัจจุบัน	ตามแผน	ใช้จริง	
2007	231.230	25 ม.ค. 2550	7 มี.ย. 2550	62,082	62,082	93	51.21	824.93
2008	183.847	7 ก.พ. 2551	6 มิ.ย. 2551	36,145	36,145	54	40.81	1,128.95
2009	263.000	15 ม.ค. 2552	20 พ.ค. 2552	85,277	85,277	128	73.80	865.44
2010	208.640	14 ม.ค. 2553	18 พ.ค. 2553	73,042	73,042	110	81.39	1,114.32
2011	242.840	13 ม.ค. 2554	24 พ.ค. 2554	78,092	78,092	117	103.69	1,327.73
2012	280.440	5 ม.ค. 2555	4 พ.ค. 2555	91,572	91,572	137	136.92	1,495.18
2013	-	-	-	-	-	-	-	-

Plan to use water **1,500 m³ / Rai**

Average actual water usage **1,135 m³ / Rai**

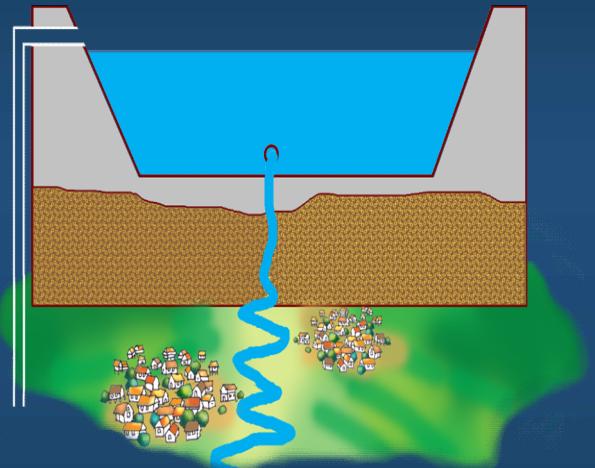
CASE 2 RESERVOIR CAPACITY LESS THAN AVERAGE ANNUAL INFLOW

- Flood monitoring



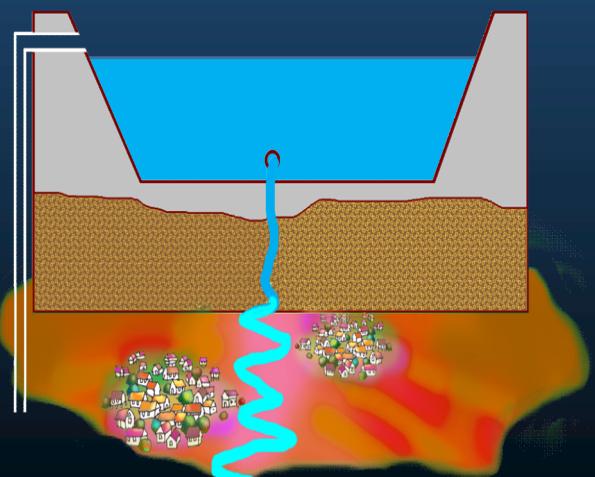


FLOOD-DROUGHT CONTROL BY DAM OPERATION



1. FLOOD PREVENTION

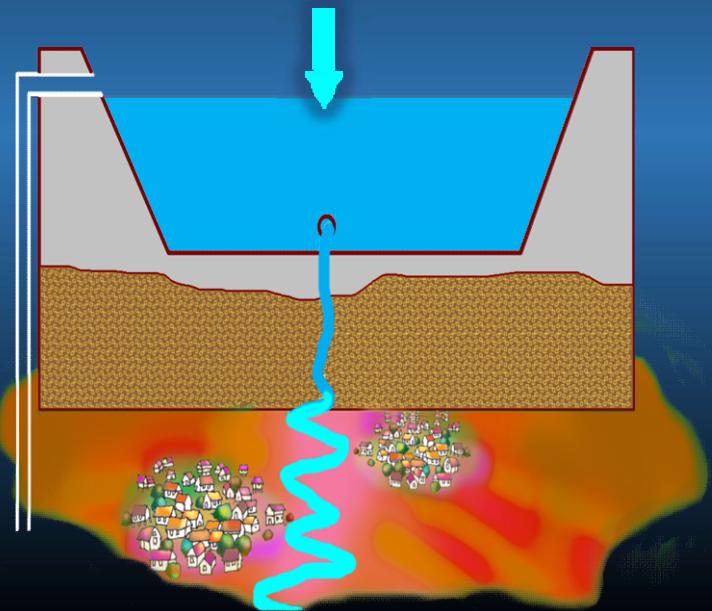
Storage drained to increase reservoir capacity before the coming storms.



2. DROUGHT MITIGATION

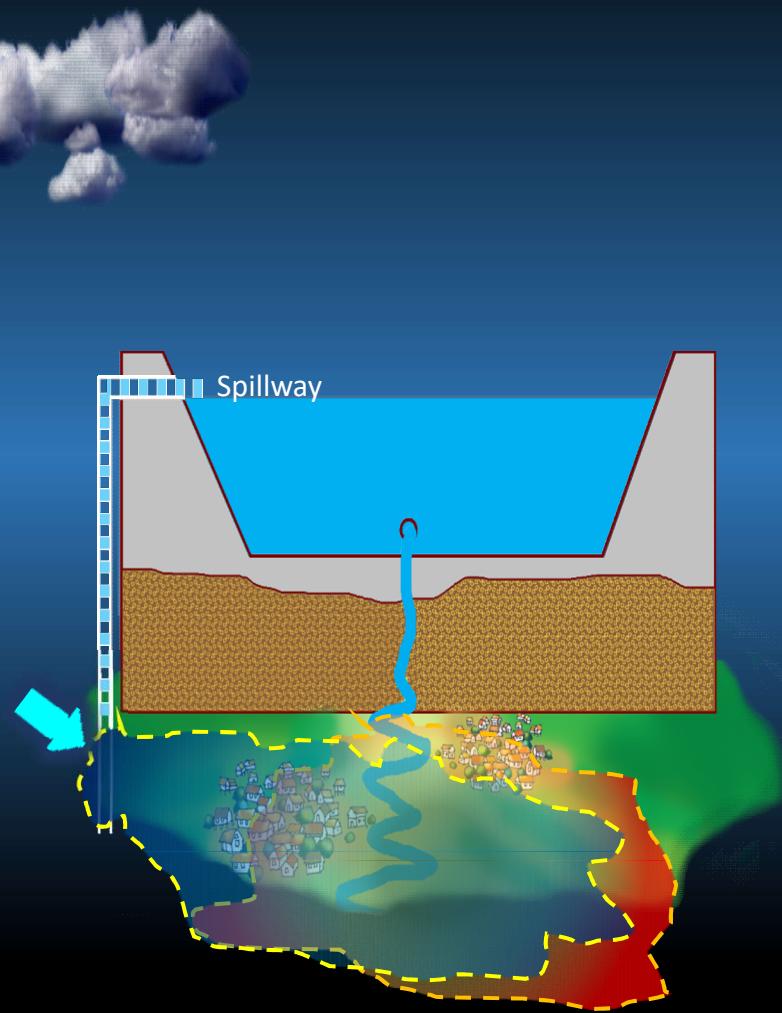
Maximum storage reserved for dry season.

PROBLEM OF THE RIGHT TIME DECISION MAKING BETWEEN STORAGE SAVING AND DRAINAGE



DECREASE STORAGE
TO PREPARE ROOM FOR COMING STORMS
- BUT.....

No rain.....and no
water for drought



PREPARE FOR THE DROUGHT
SAVING MAXIMUM STORAGE –
BUT.....

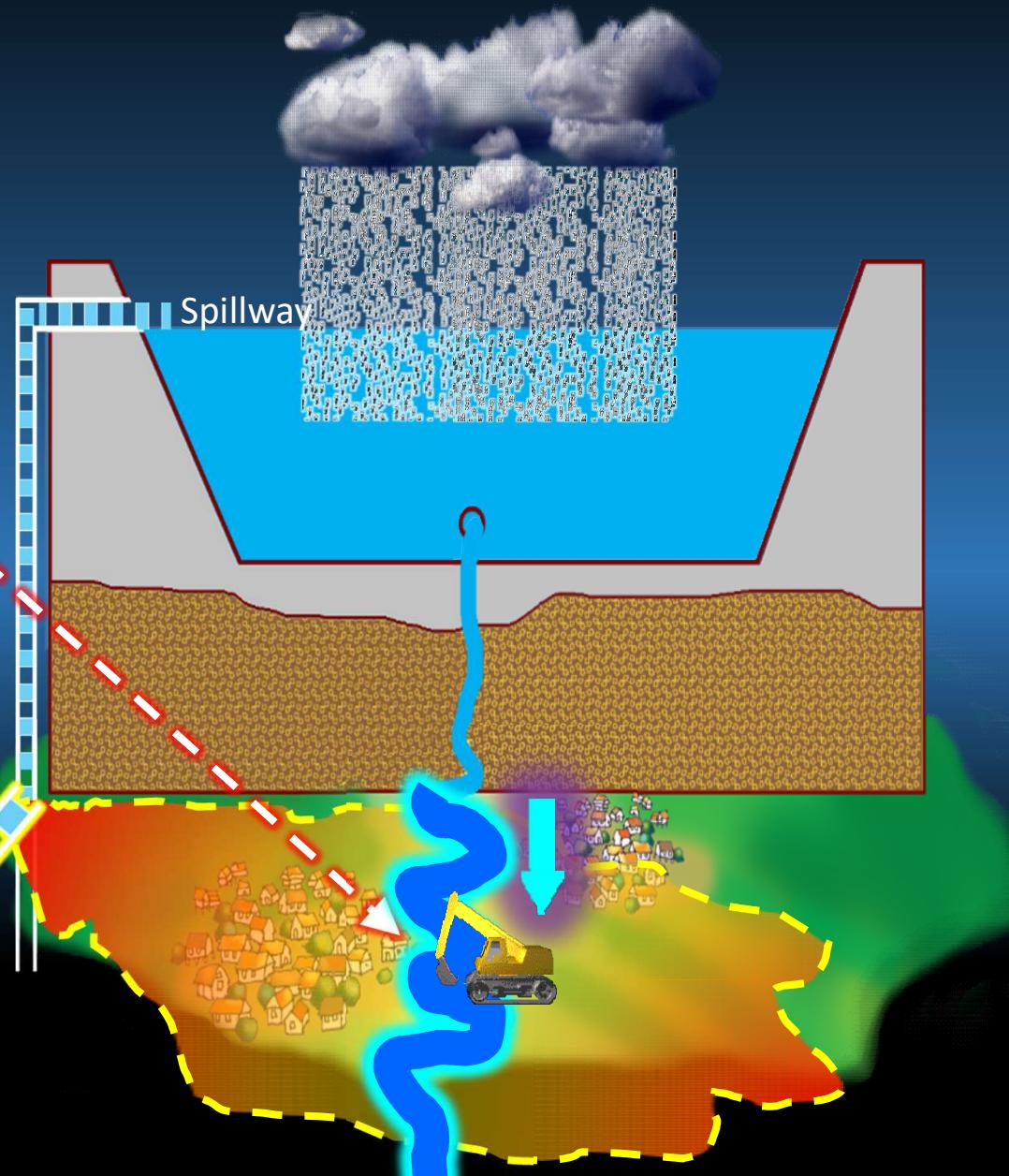
Continuous heavy

MAIN CHANNEL CAPACITY AND FLOODWAY

1. **INCREASE THE DRAINAGE EFFICIENCY OF THE MAIN CHANNEL** (by enlargement, dredging or embankment....)

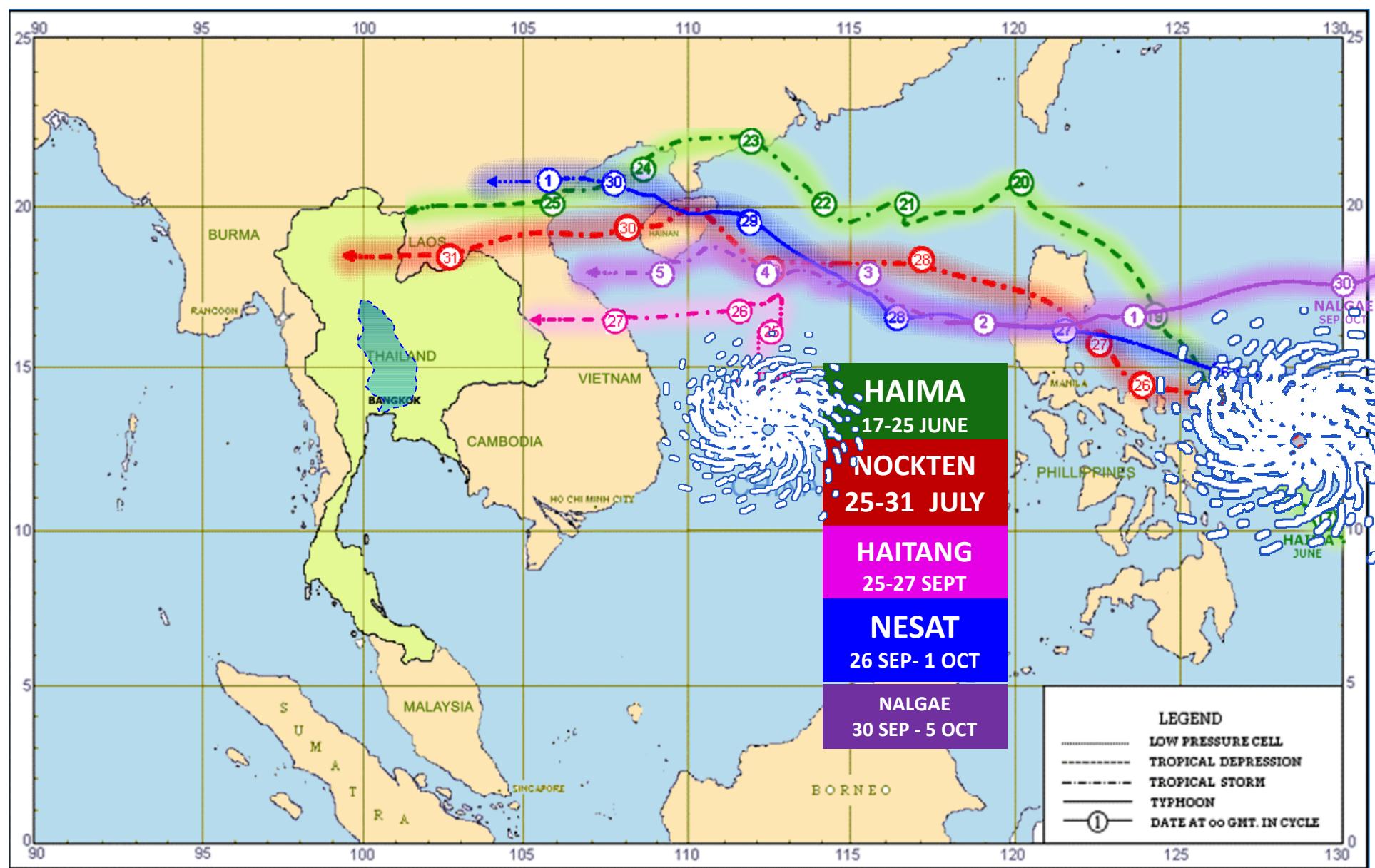
2. **FLOODWAY OR BYPASS**

SAVING STORAGE AND AVOID FLOODING AT THE SAME TIME

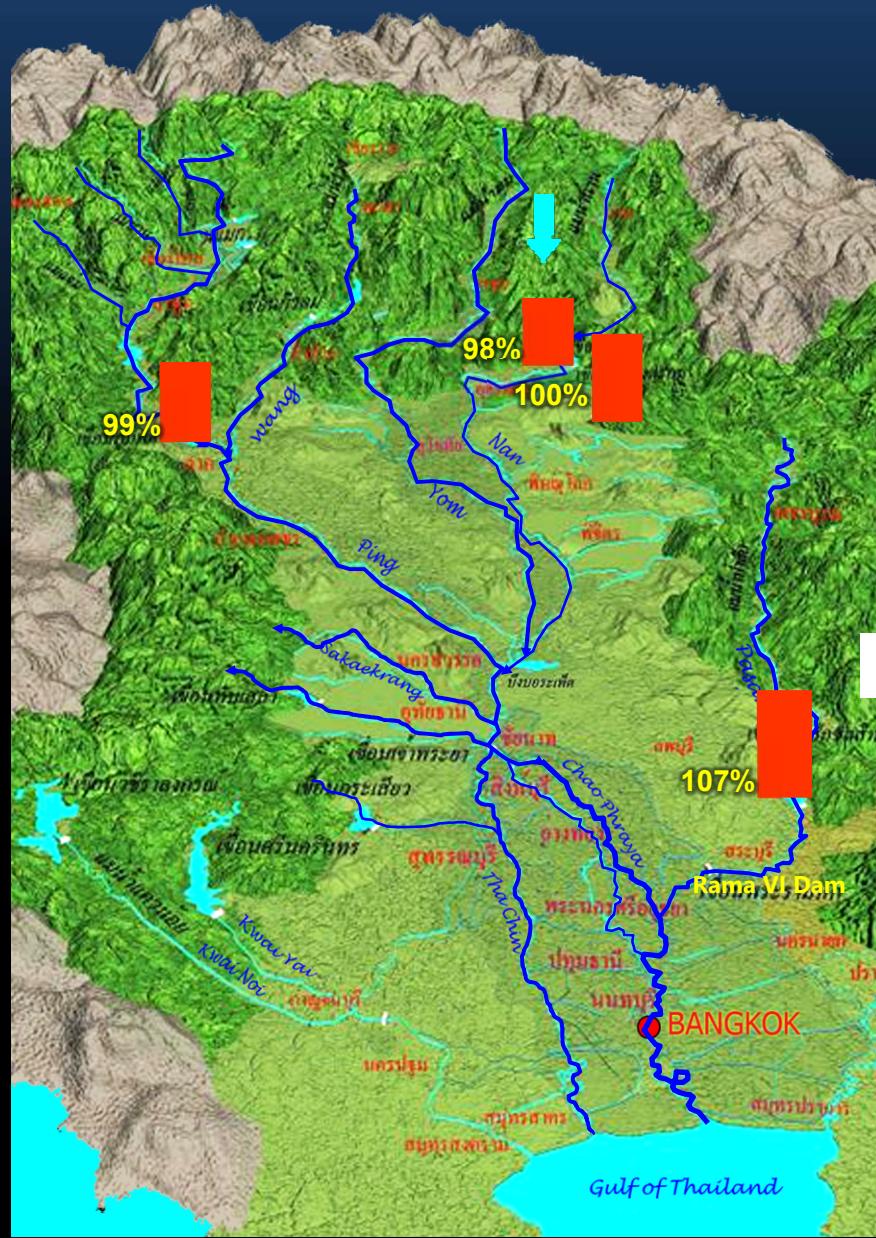


Factor of Flood

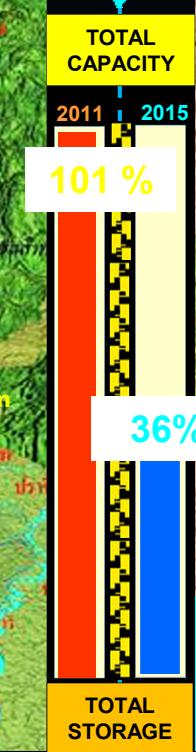
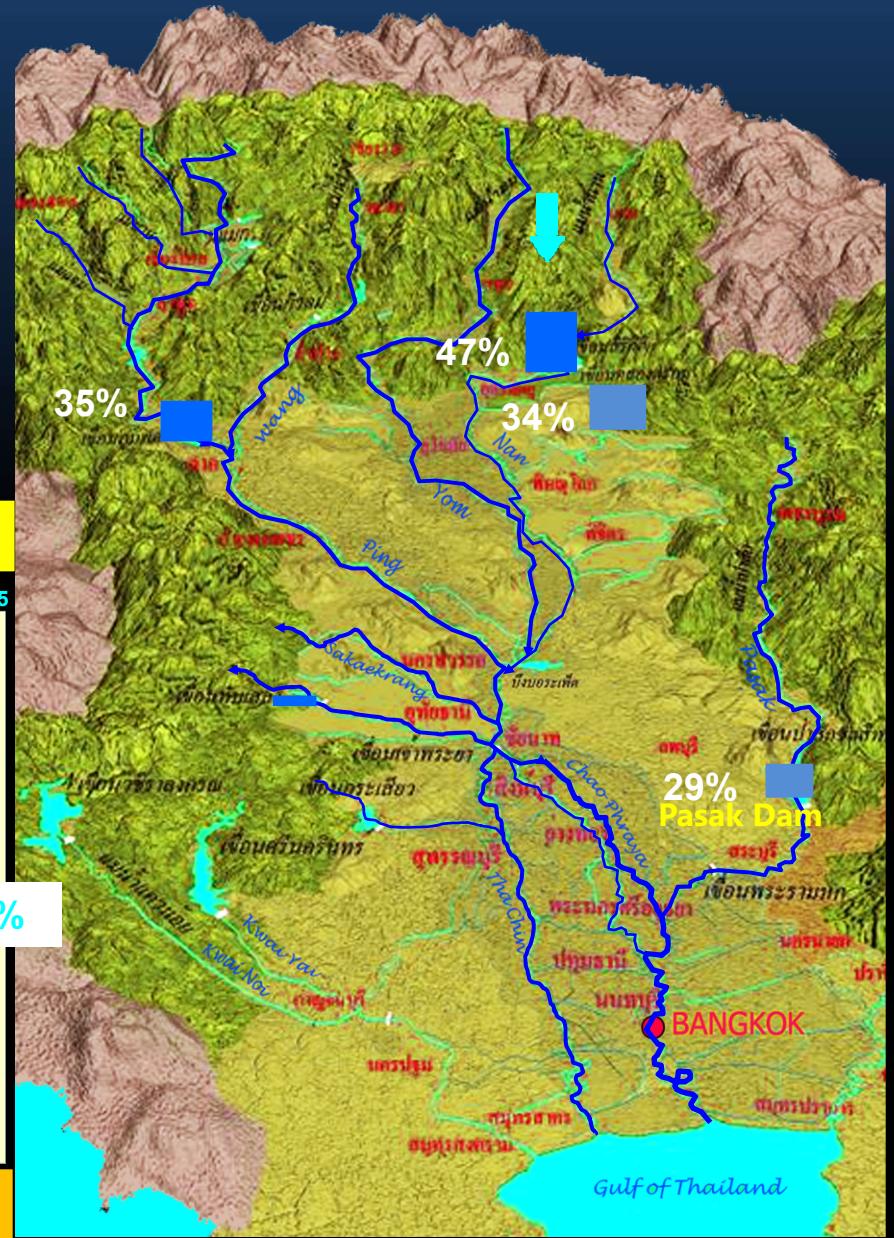
TROPICAL STORMS AFFECTED THAILAND 2011



RESERVOIRS STORAGE 2011
11 Oct 2011



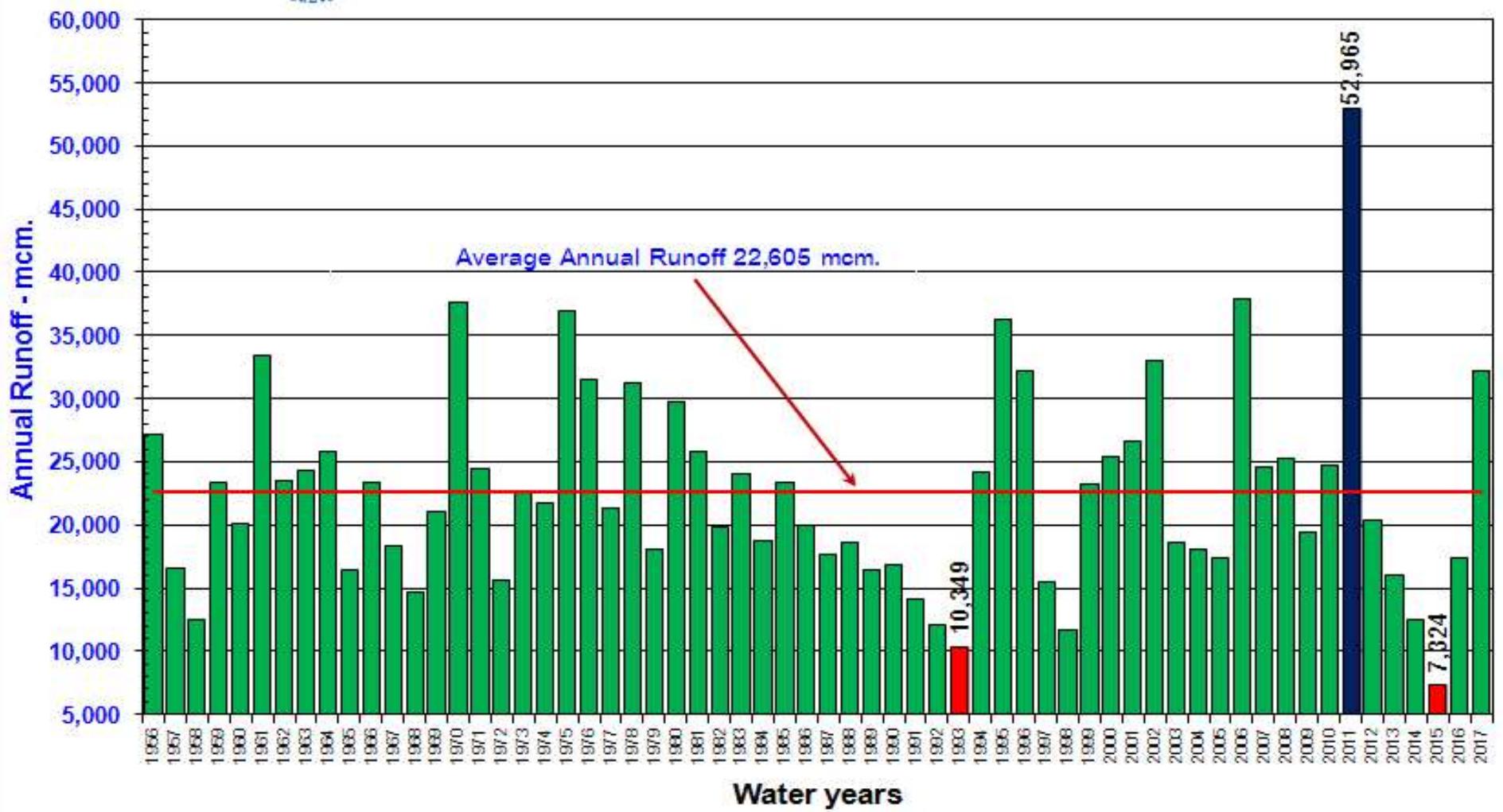
RESERVOIRS STORAGE 2015
11 Oct 2015





Annual Runoff

Station C.2 Chao Phraya River A.Mueang, Nakhon Sawan



Types of Flood in Chaopraya Basin

1 Overbank flow
inundation



2 Flash flood

How ?

To Reduce Flood

FLOOD PREVENTION PROCEDURES

1. STRUCTURAL PREVENTION

- Dams, reservoirs and retarding areas.
- Bypass, floodway.
- Dredging or enlarging channels.
- River embankment, levee .

2. NON-STRUCTURAL PREVENTION

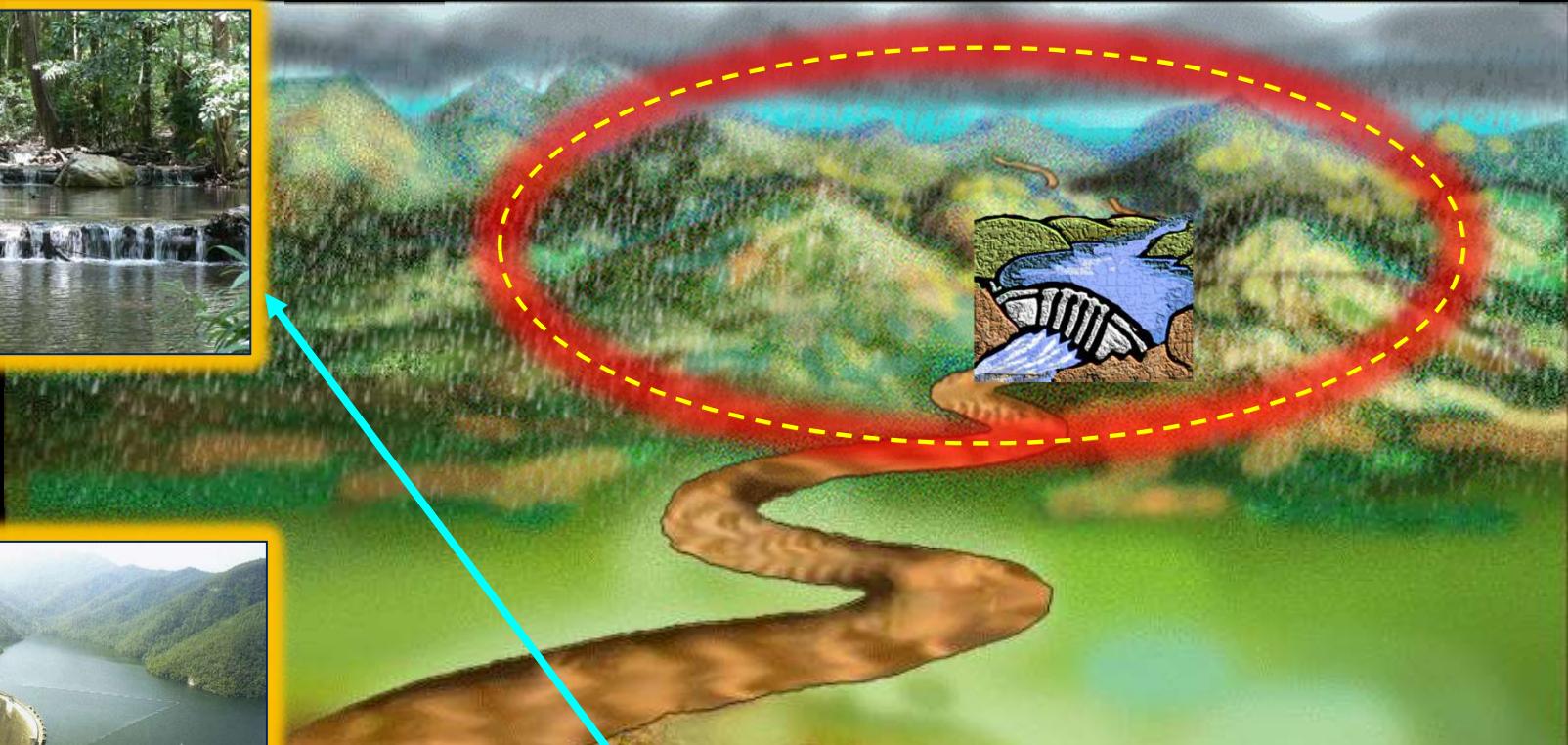
- WATER MANAGEMENT
- FLOOD MONITORING AND WARNING

FLOOD PREVENTION PROCEDURES



NORMAL SITUATION

1. STRUCTURAL PREVENTION UPSTREAM AREA



Reduce upstream runoff inflow

Check dams

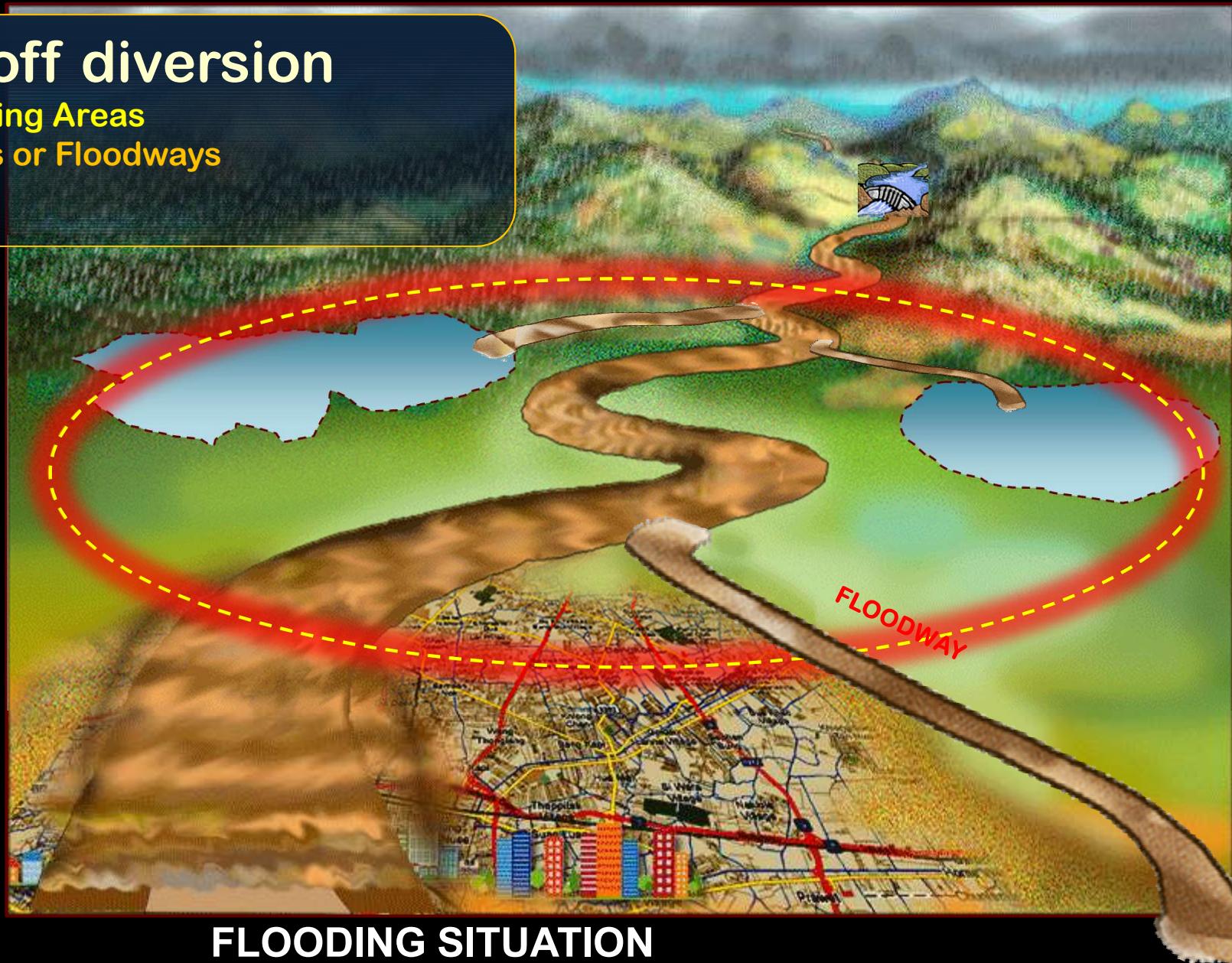
Create the new reservoir

FLOODING SITUATION

1. STRUCTURAL PREVENTION MIDDLESTREAM AREA

Runoff diversion

- Retarding Areas
- Bypass or Floodways



1. STRUCTURAL PREVENTION DOWNSTREAM AREA

Specific vulnerable area protection

River embankment for
economic and City areas



2. NON-STRUCTURAL PREVENTION :

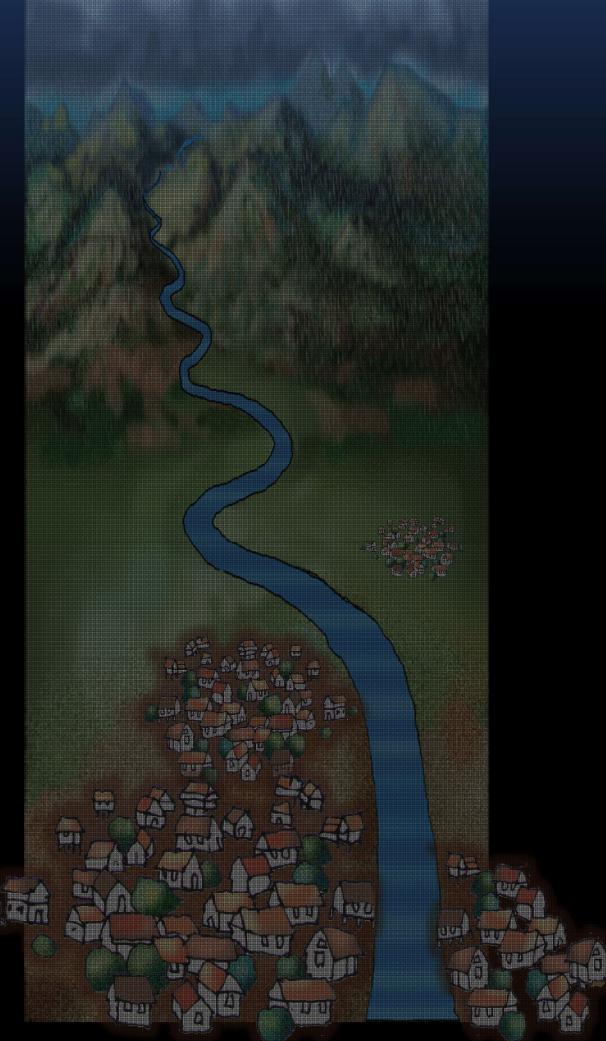
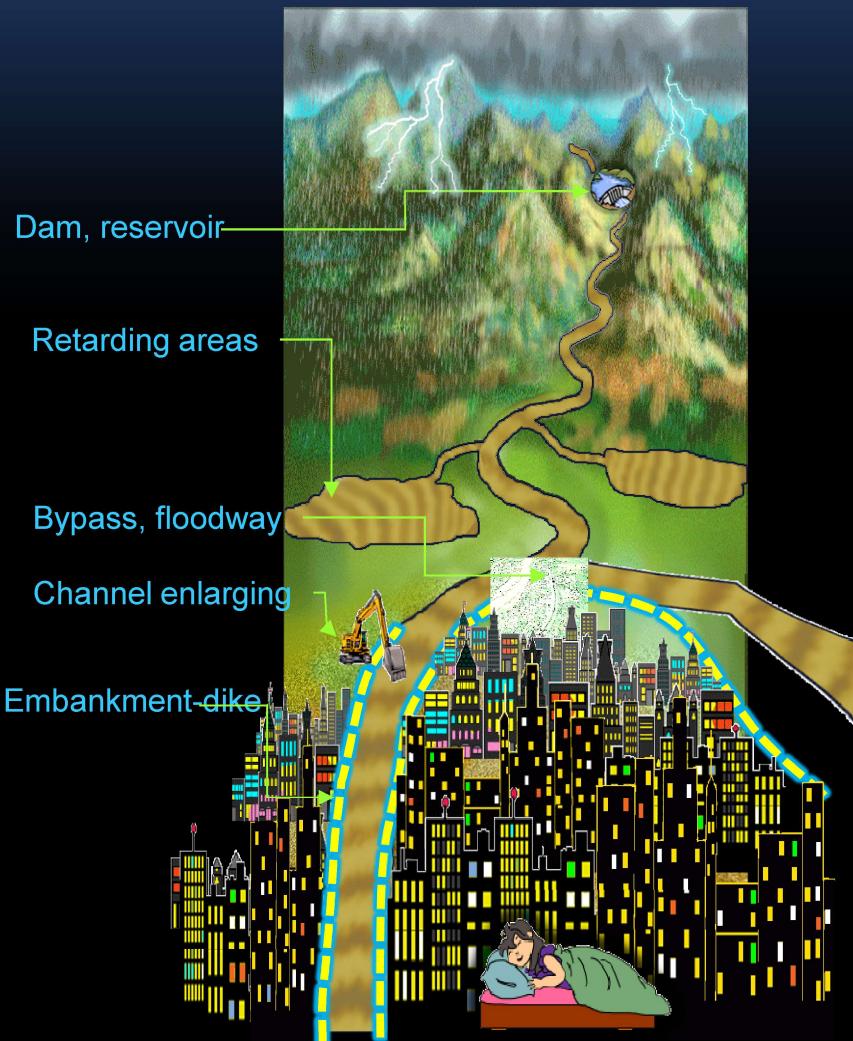
*FLOOD MONITOR
AND WARNING*



FLOODING SITUATION

WATER-RELATED DISASTER PREVENTION MEASURES IN THAILAND

STRUCTURAL MEASURES

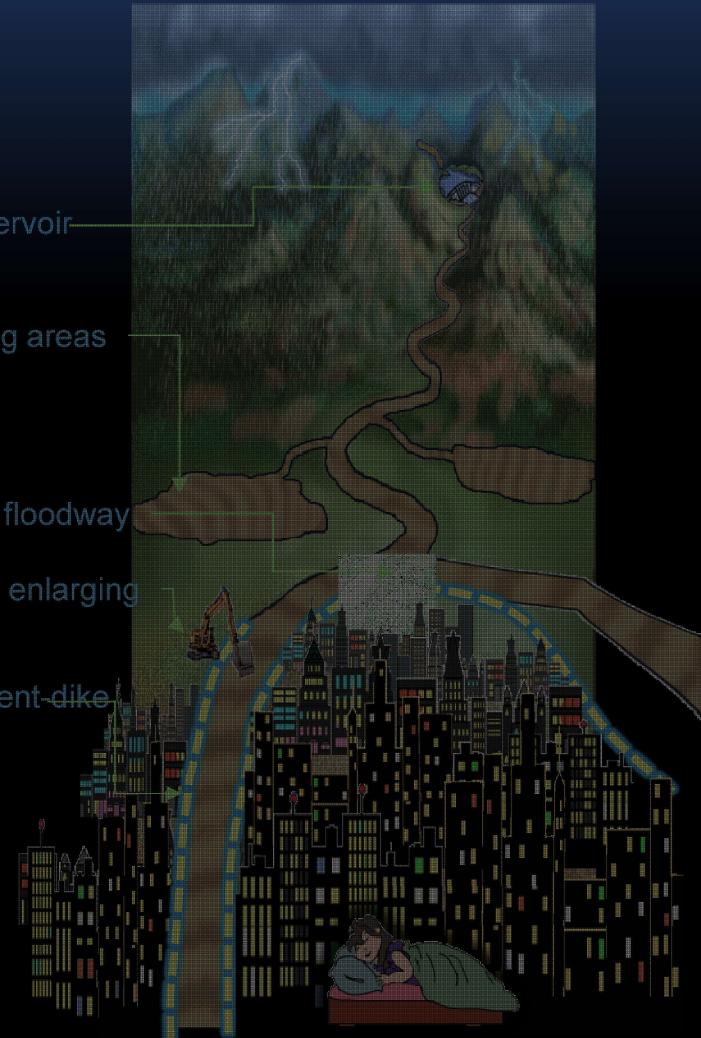


**MOVE WATER...!! NOT
MOVE PEOPLE**

WATER-RELATED DISASTER PREVENTION MEASURES IN THAILAND

STRUCTURAL MEASURES

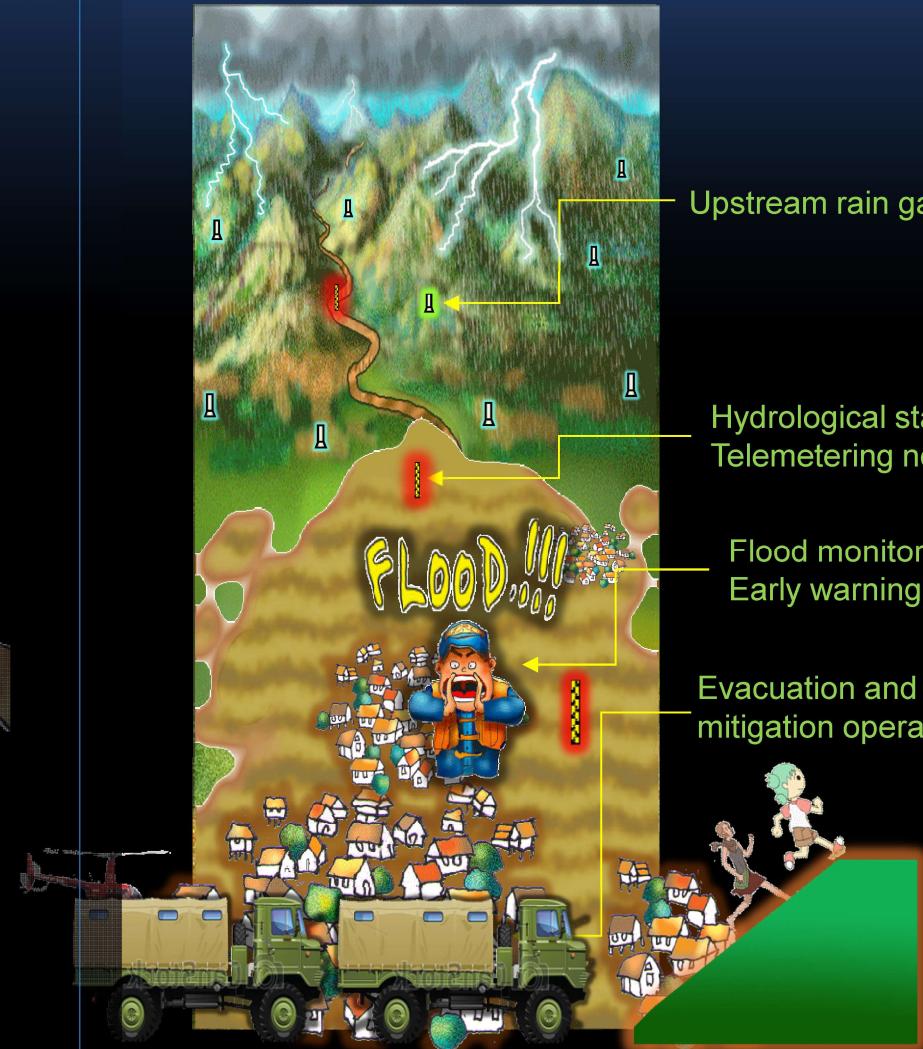
Dam, reservoir
Retarding areas
Bypass, floodway
Channel enlarging
Embankment-dike



**MOVE WATER....!!
NOT MOVE PEOPLE**

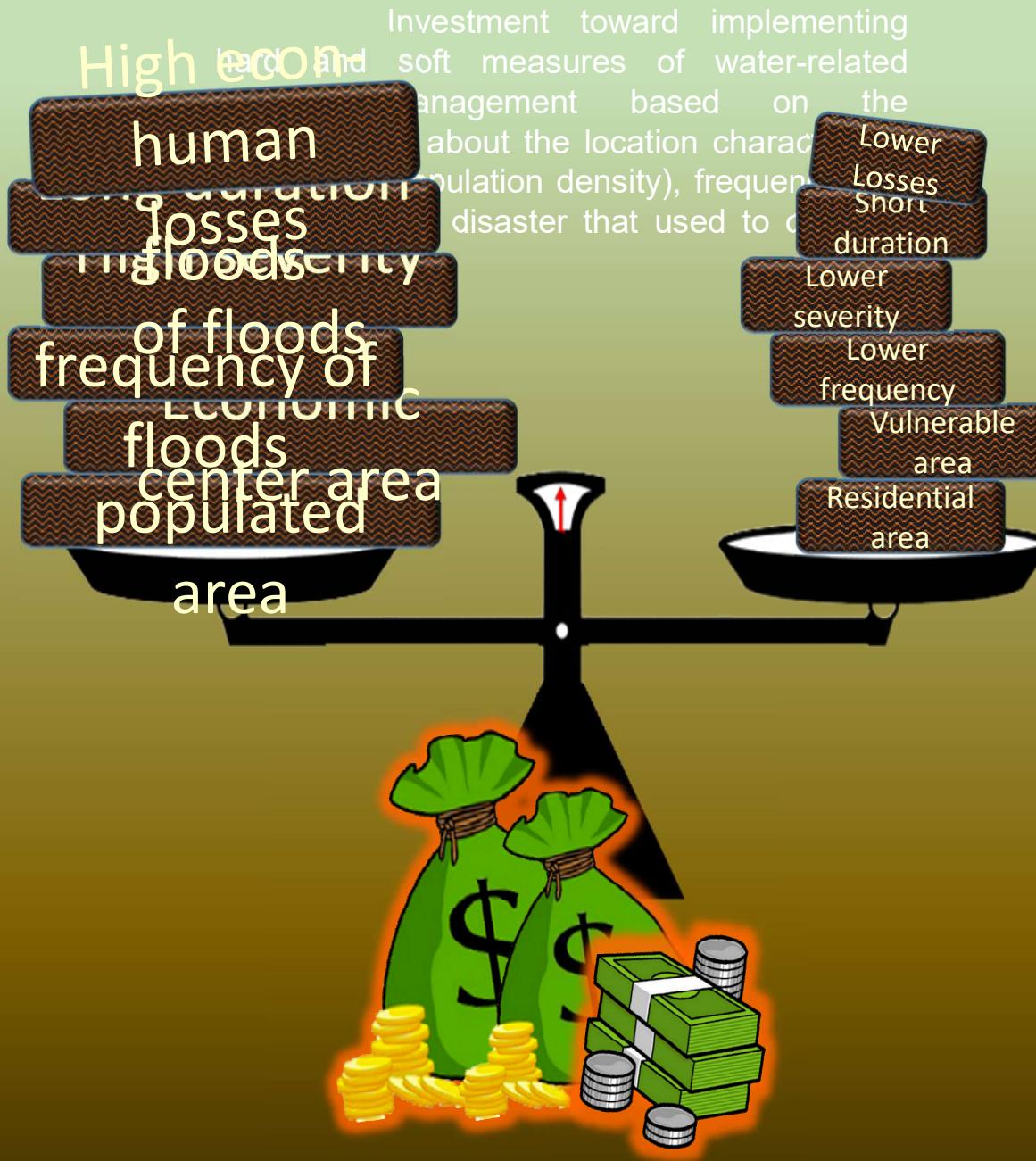
NON-STRUCTURAL MEASURES

Upstream rain gauge network
Hydrological stations, Telemetering network
Flood monitoring and Early warning system
Evacuation and mitigation operation



**MOVE PEOPLE....
NOT MOVE WATER**

WATER-RELATED DISASTER PREVENTION MEASUREMENTS IN THAILAND

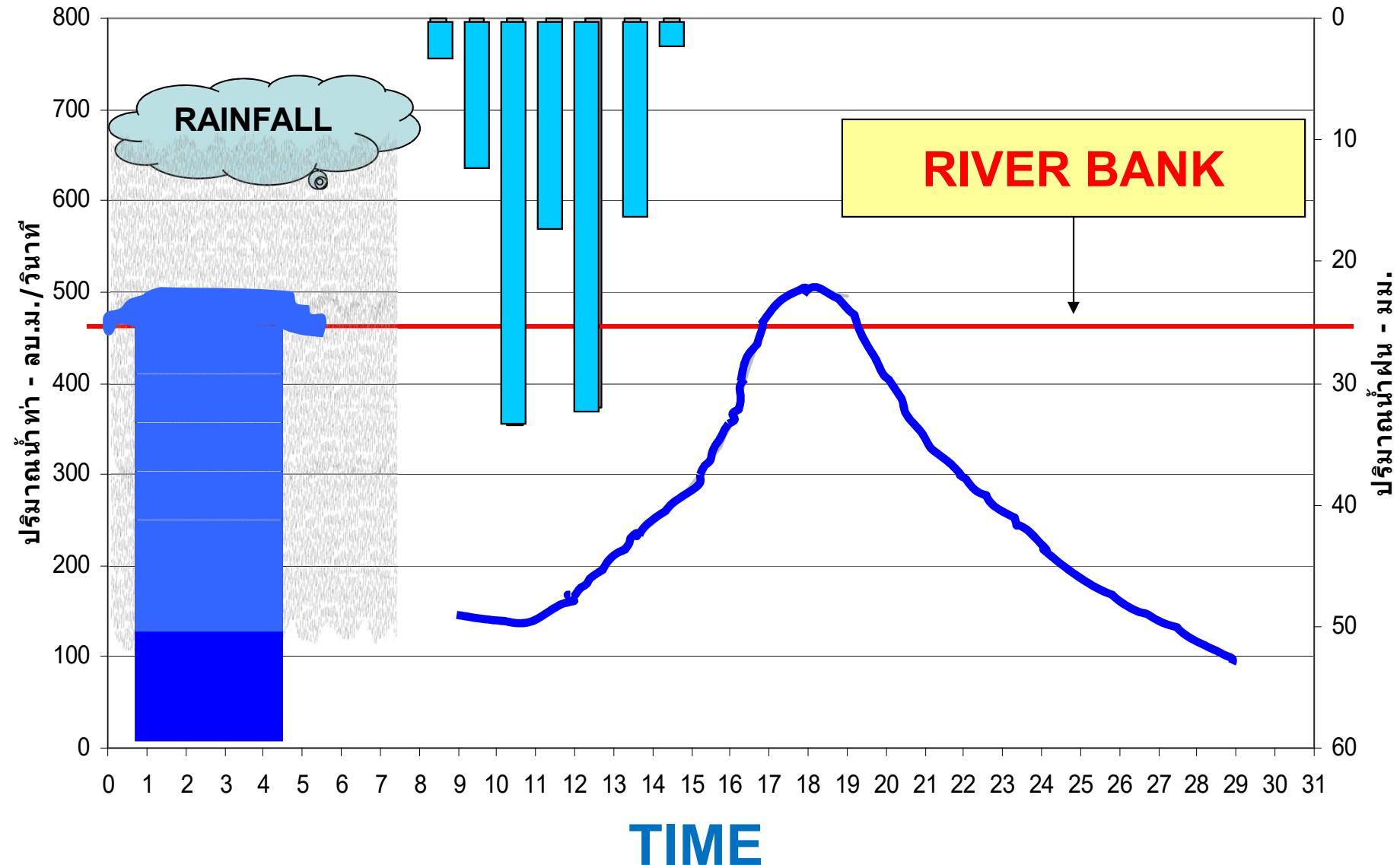


WATER-RELATED DISASTER PREVENTION MEASUREMENTS IN THAILAND

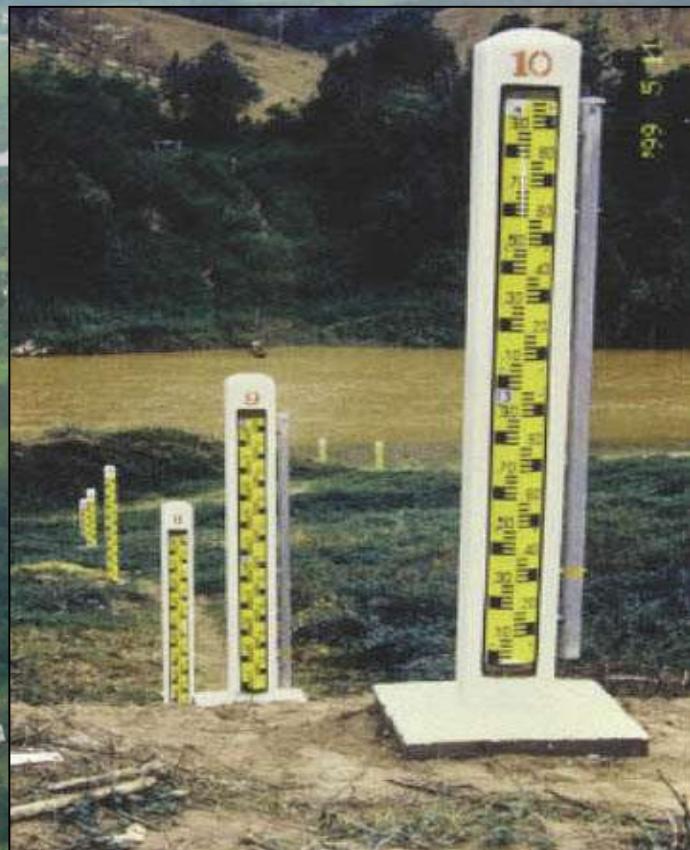


Flooding Possibility Period of Experience Area

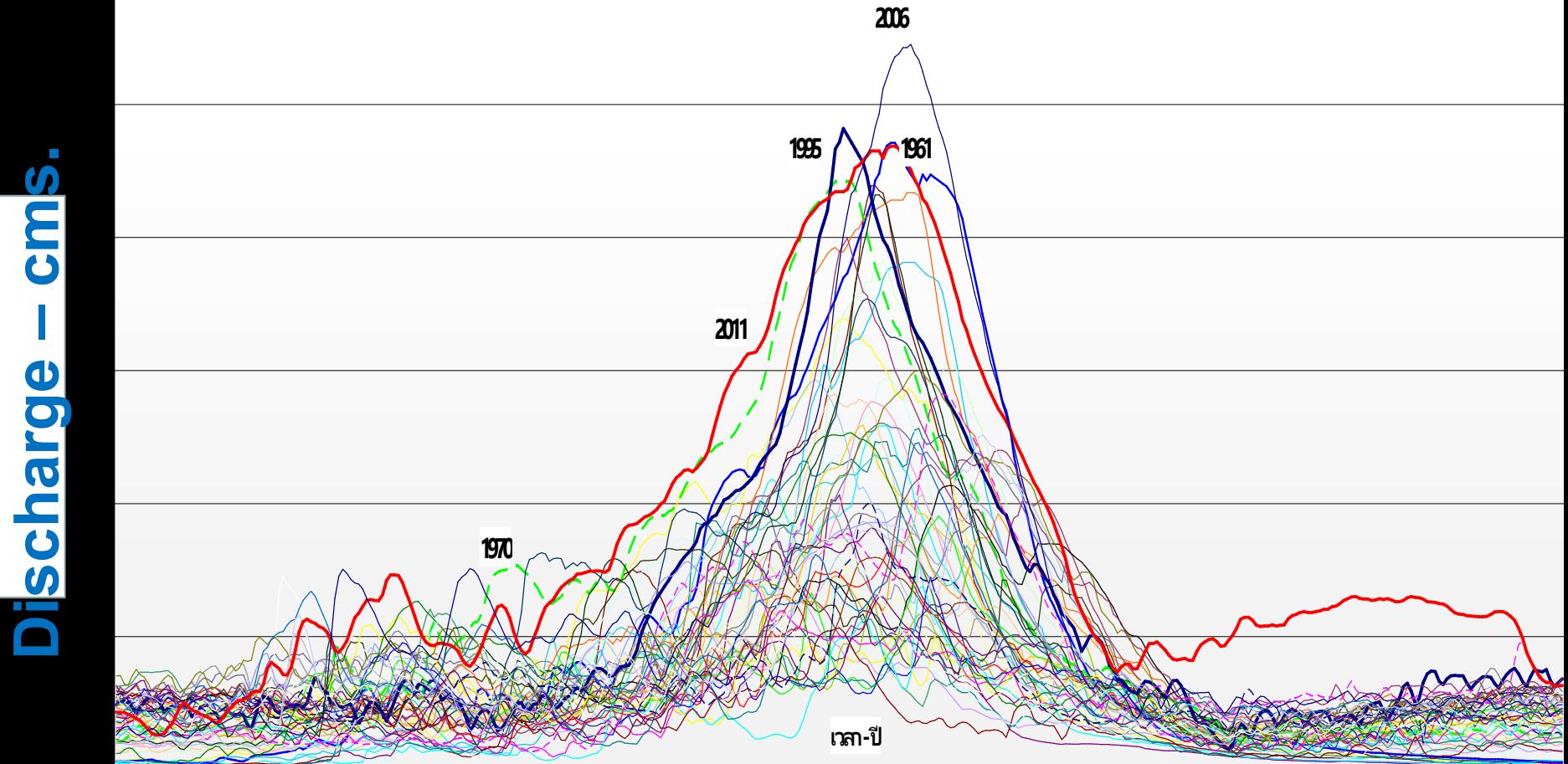




Water level

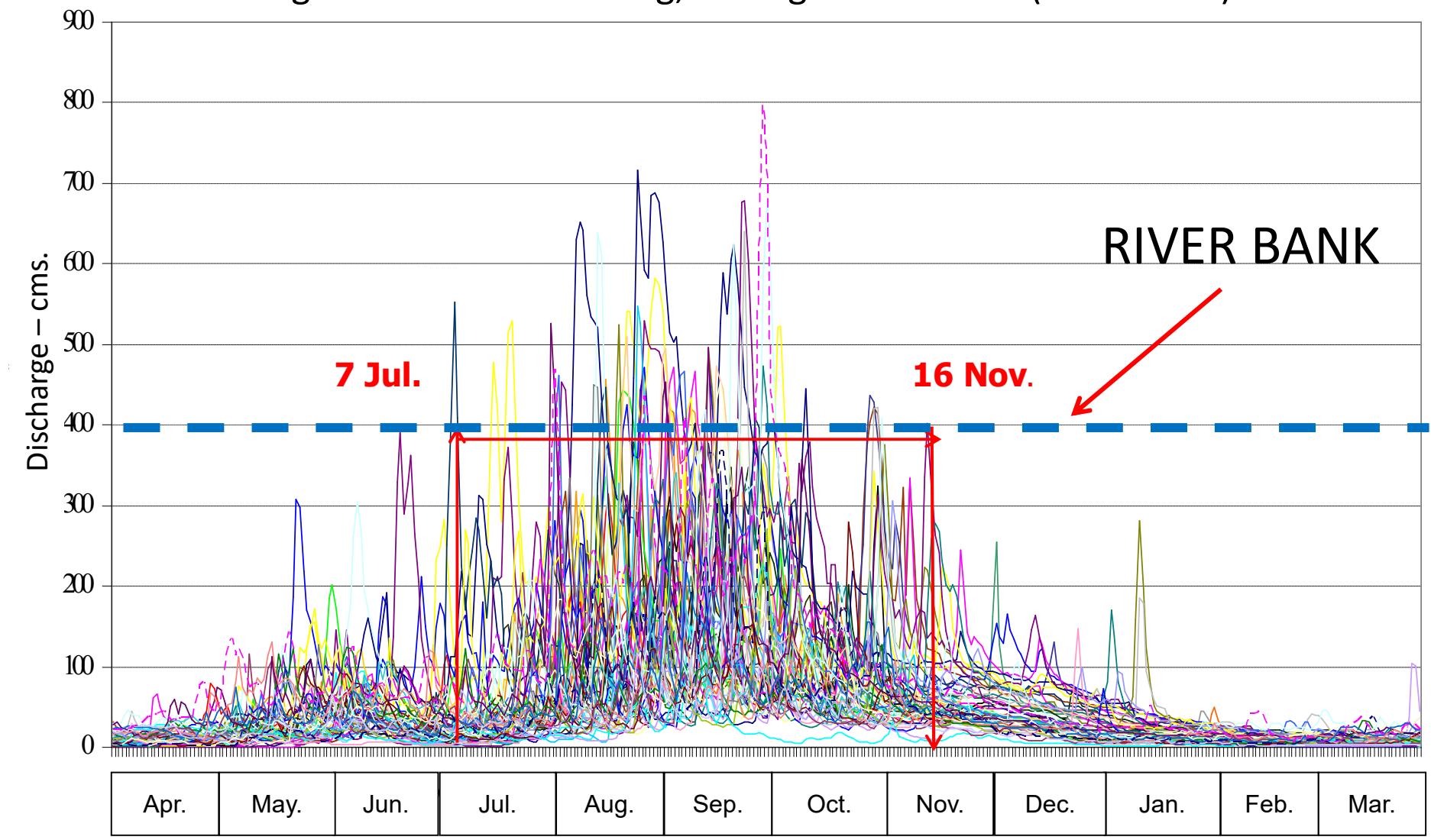


Daily Discharge of Chao Phraya River at Station

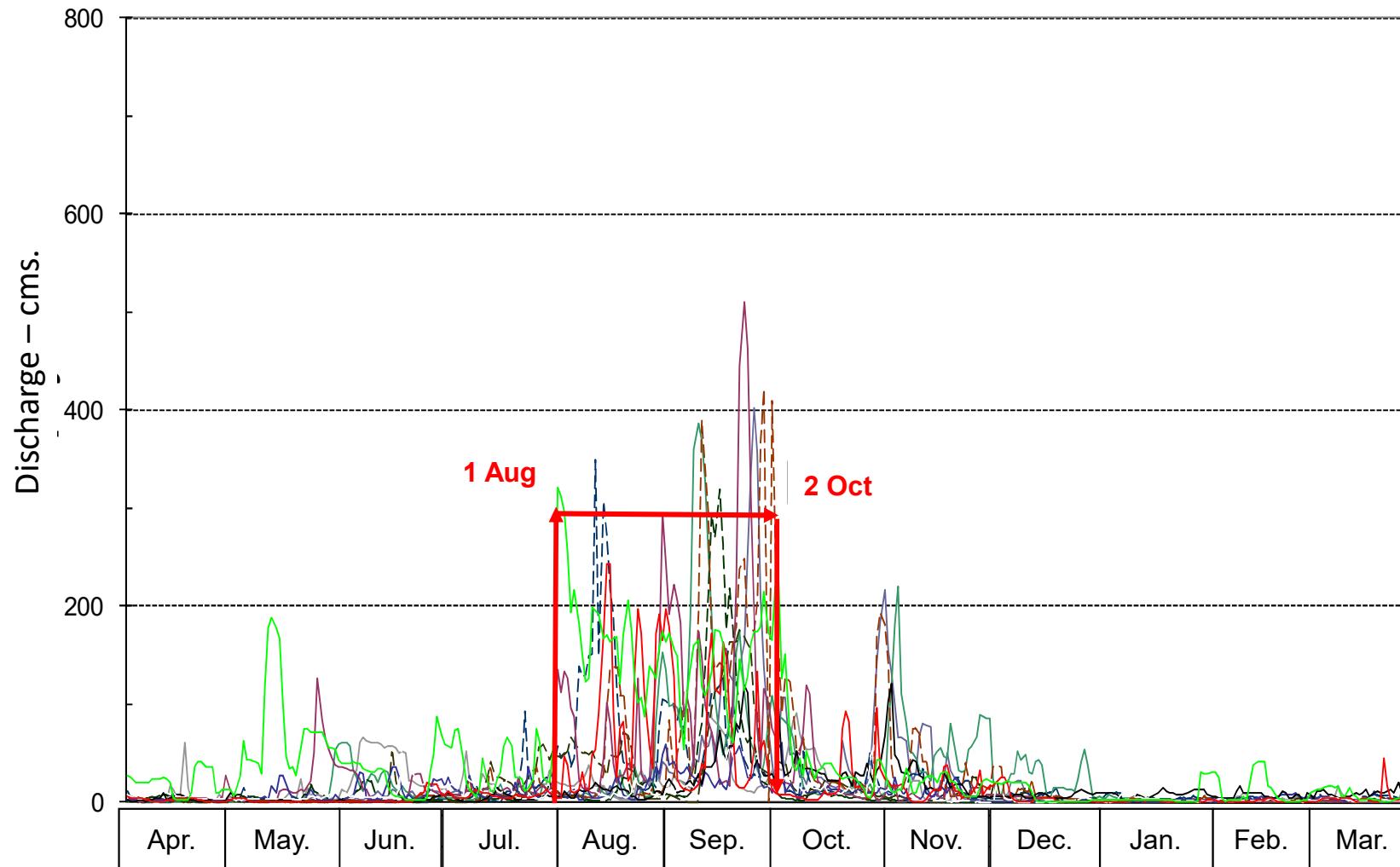


Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar

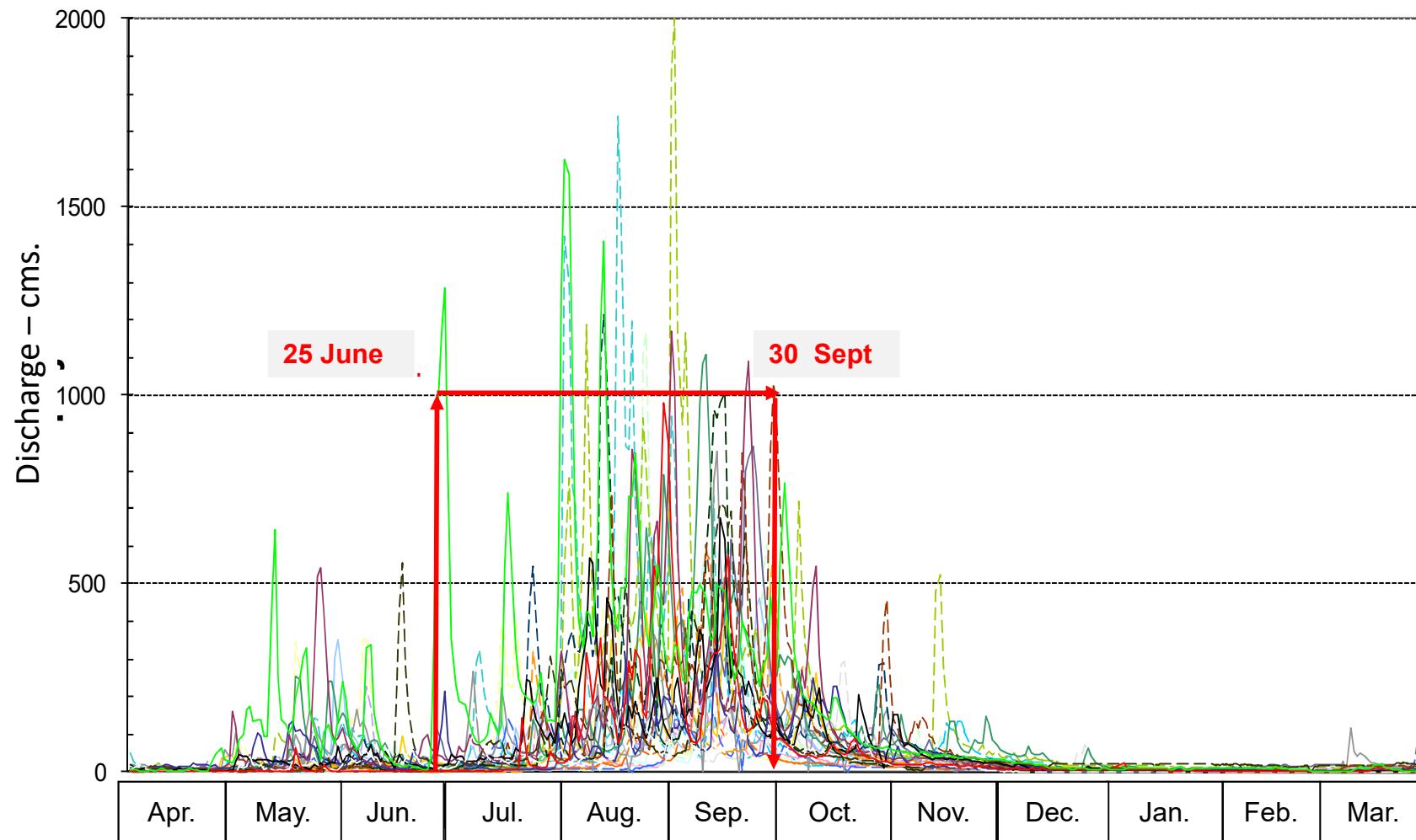
Ping river at P.1 A.Mueang, Chiangmai Province (1956-2011)



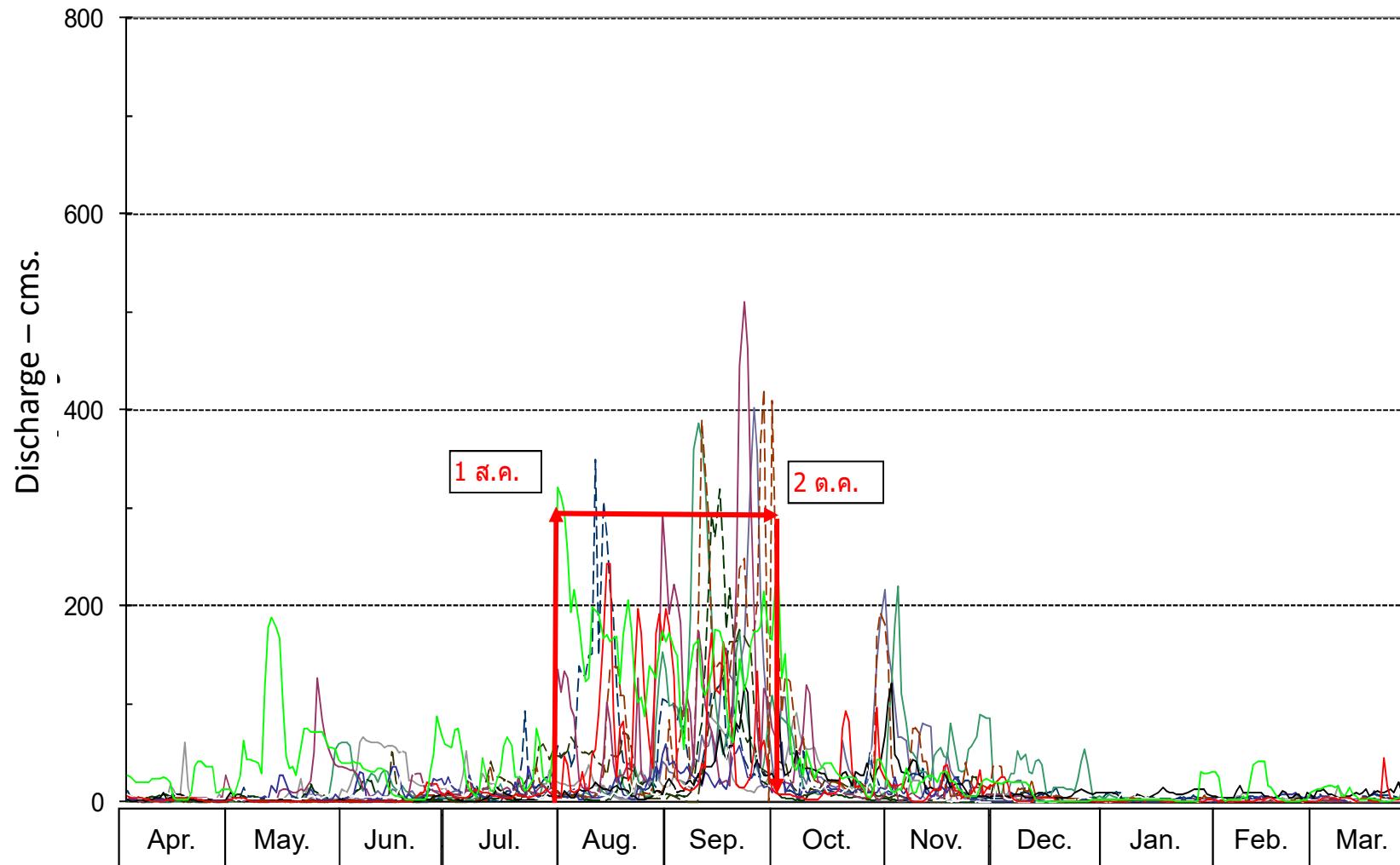
Wang river at W.1C A.Mueang, Lampang Province (1999-2011)



Yom river at Y.1C A.Mueang, Phrae Province (1966-2011)



Wang river at W.1C A.Mueang, Lampang Province (1999-2011)



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

**AUG
UST**

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON

RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



YEARLY FLOODING POSSIBILITY DURING RAINY SEASON RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEM
BER

DECEMB
ER



YEARLY FLOODING POSSIBILITY DURING DRY SEASON RAINY SEASON

(According to the areal statistics)

MONTH

JUNE

JULY

AUGUST

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER



FLOODING POSSIBILITY PERIODS OF EXPERIENCED AREAS

	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	PROVINCES
1				4 Jun. – 12 Nov.					PETCHABUN
2				25 Jun. – 16 Nov.					NAN
3				25 Jun. – 30 Sep.					PHRAE
4				25 Jun. – 10 Nov.					PRACHINBU RI
5									CHANTHABU RI
6									PHANGNGA
7				7 Jul. – 16 Nov.					CHIANG MAI
8				15 Jul. – 15 Nov.					UBONRATCHAT HANI
9				1 Aug. – 2 Oct.					LAMPANG
10				1 Aug. – 8 Oct.					PHITSANULO K
11					1 Sep. – 15 Nov.				NAKHORNSA WAN
12					29 Sep. – 17 Nov.				PHETBURI
13						1 Nov. – 20 Dec.			SONGKHLAR B

FLOOD WARNING

DATA COLLECTING

DATA ANALYSING
TO ASSESS SITUATION

FLOODING

WARNING DISSEMINATION

PRE-FLOODING

- Announce the scale of flooding
Small, medium, large)
- Announce location, area, date and time of flooding

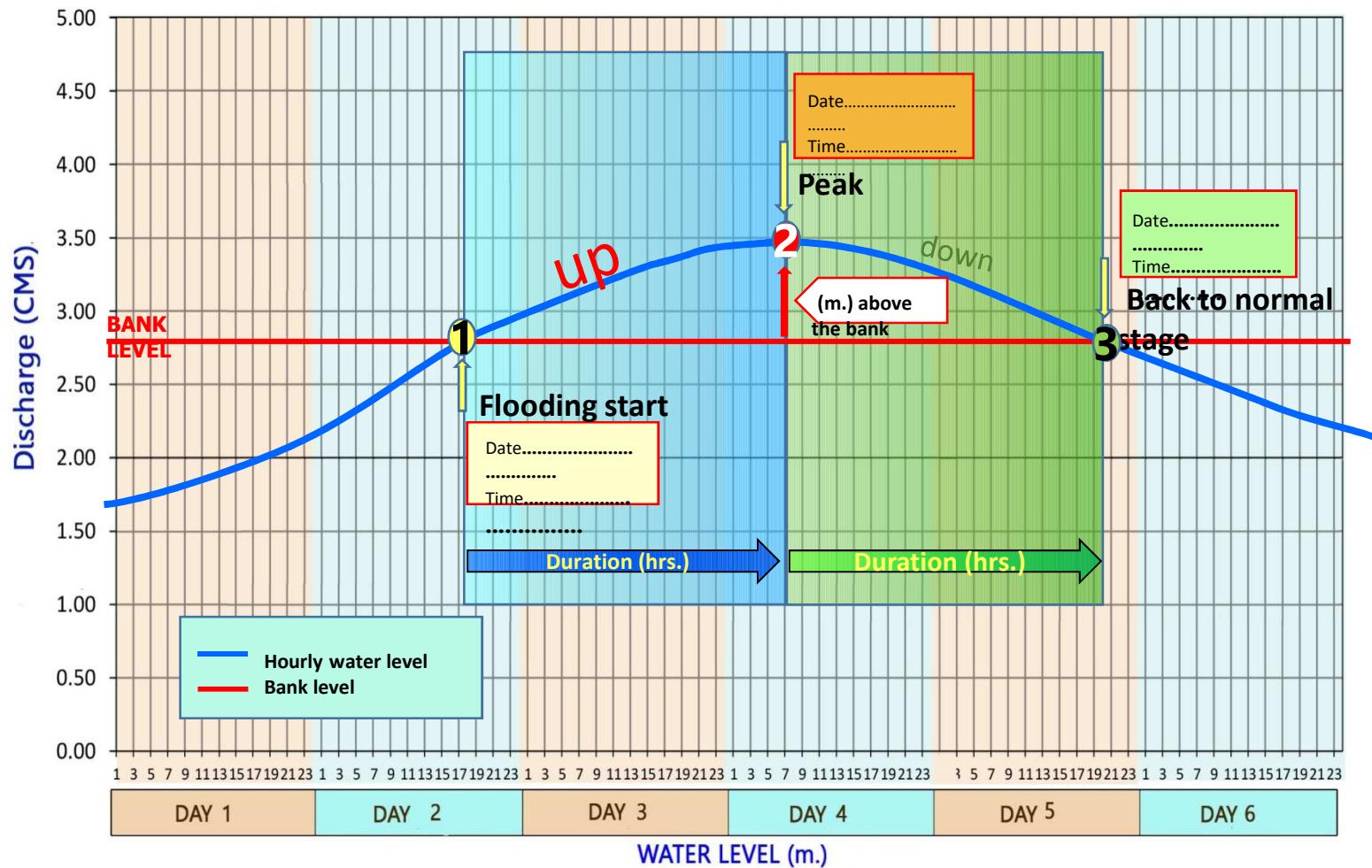
DURING FLOODING

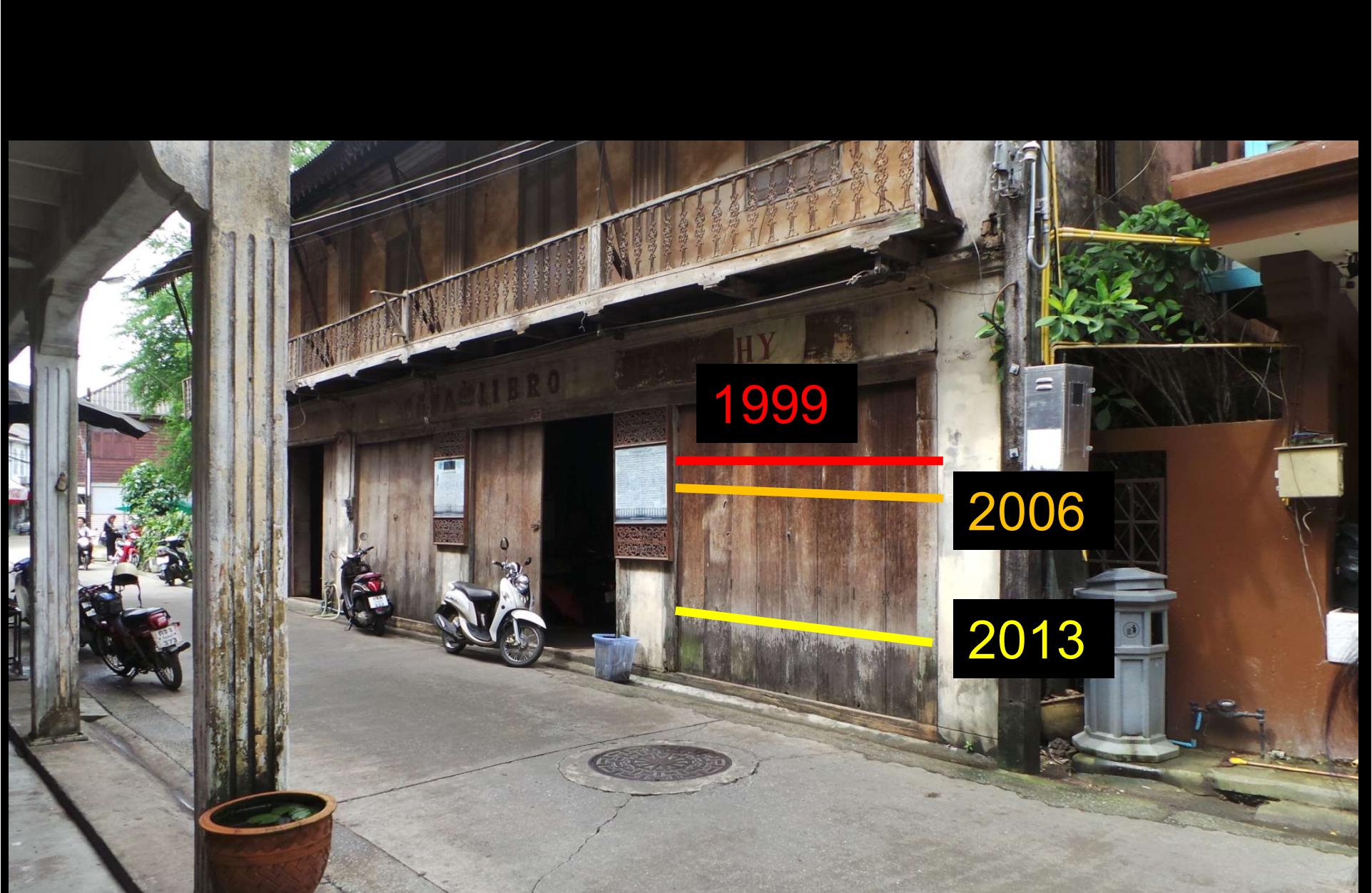
- Announce trend of flooding scale increase / decrease.

POST-FLOODING

- Announce the duration of flooding.

HOURLY WATER LEVELS MONITORING BEFORE AND AFTER FLOODING







Before flood

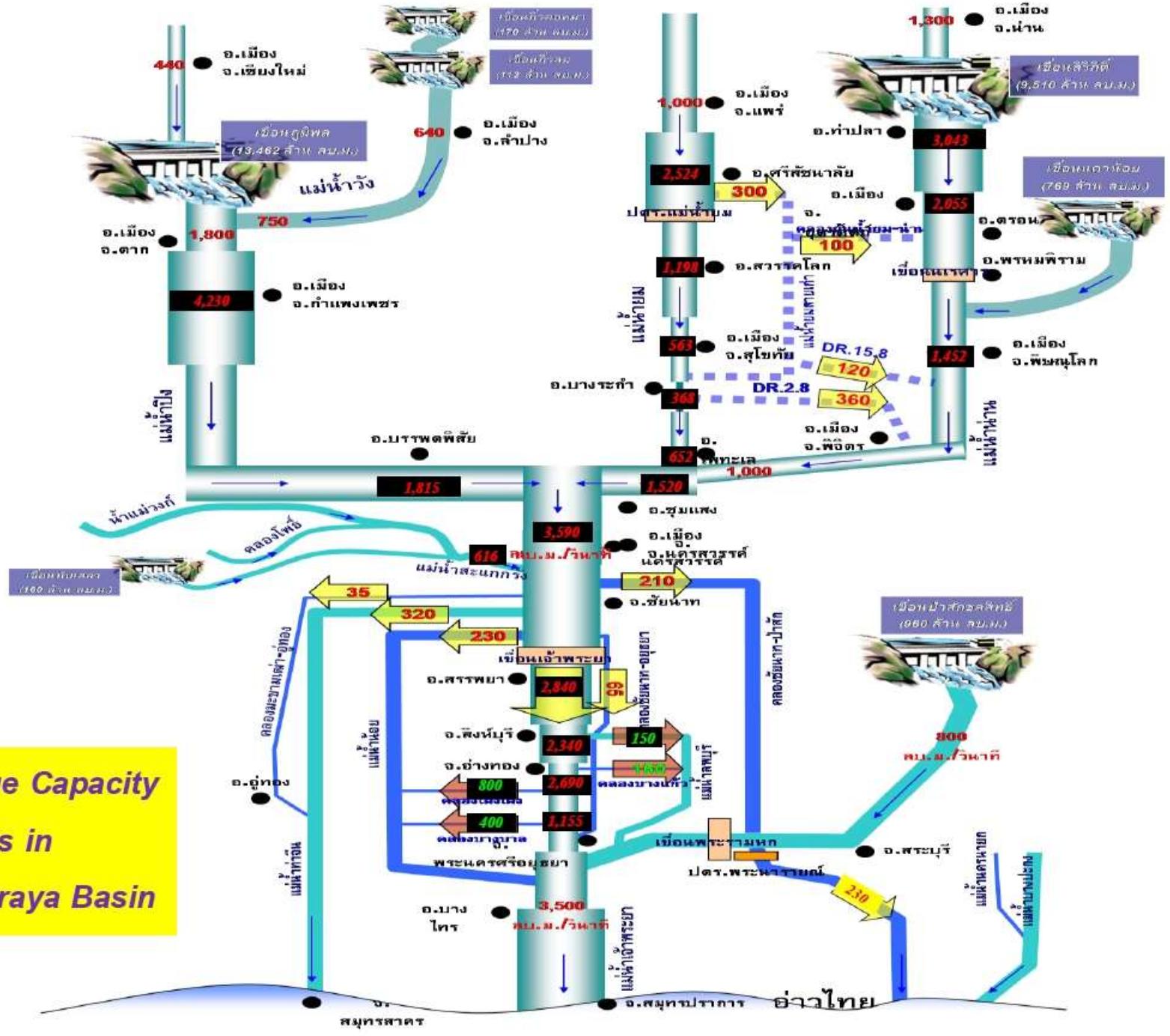


flooding

FLOOD MONITORING AND WARNING FOR CHAO PHRAYA BASIN FLOOD RISK AREAS

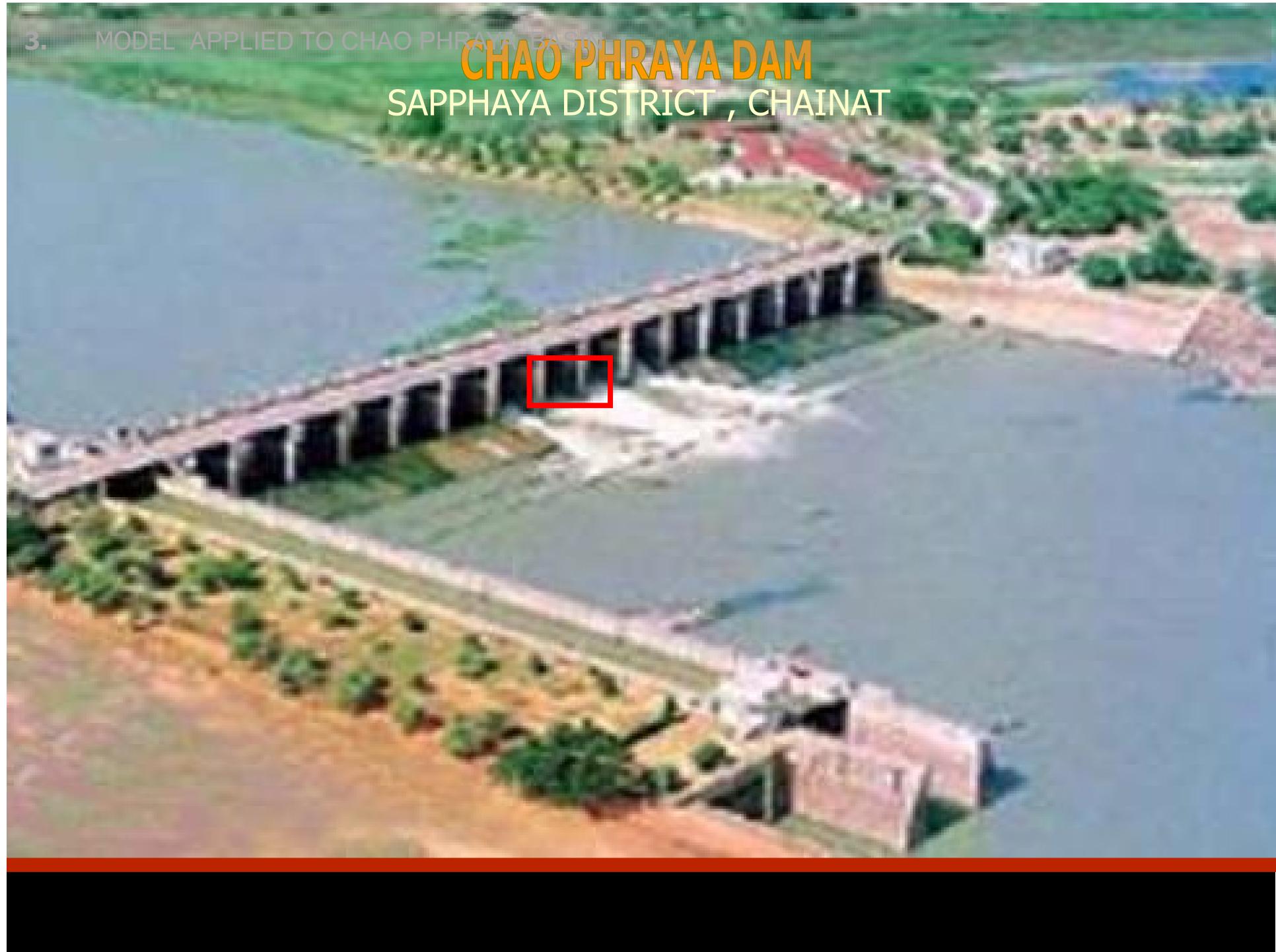


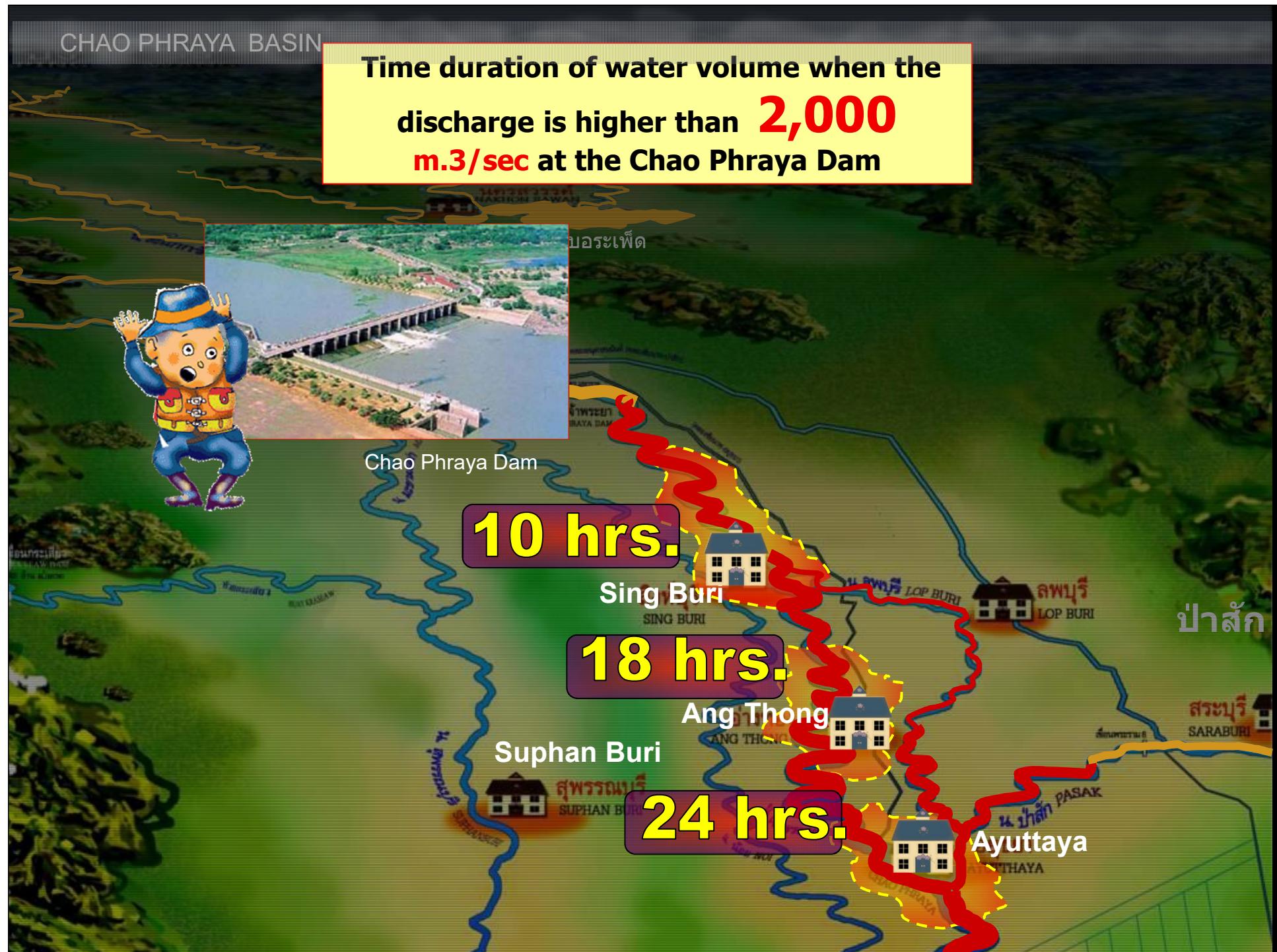
Discharge Capacity of Rivers in Chao Phraya Basin



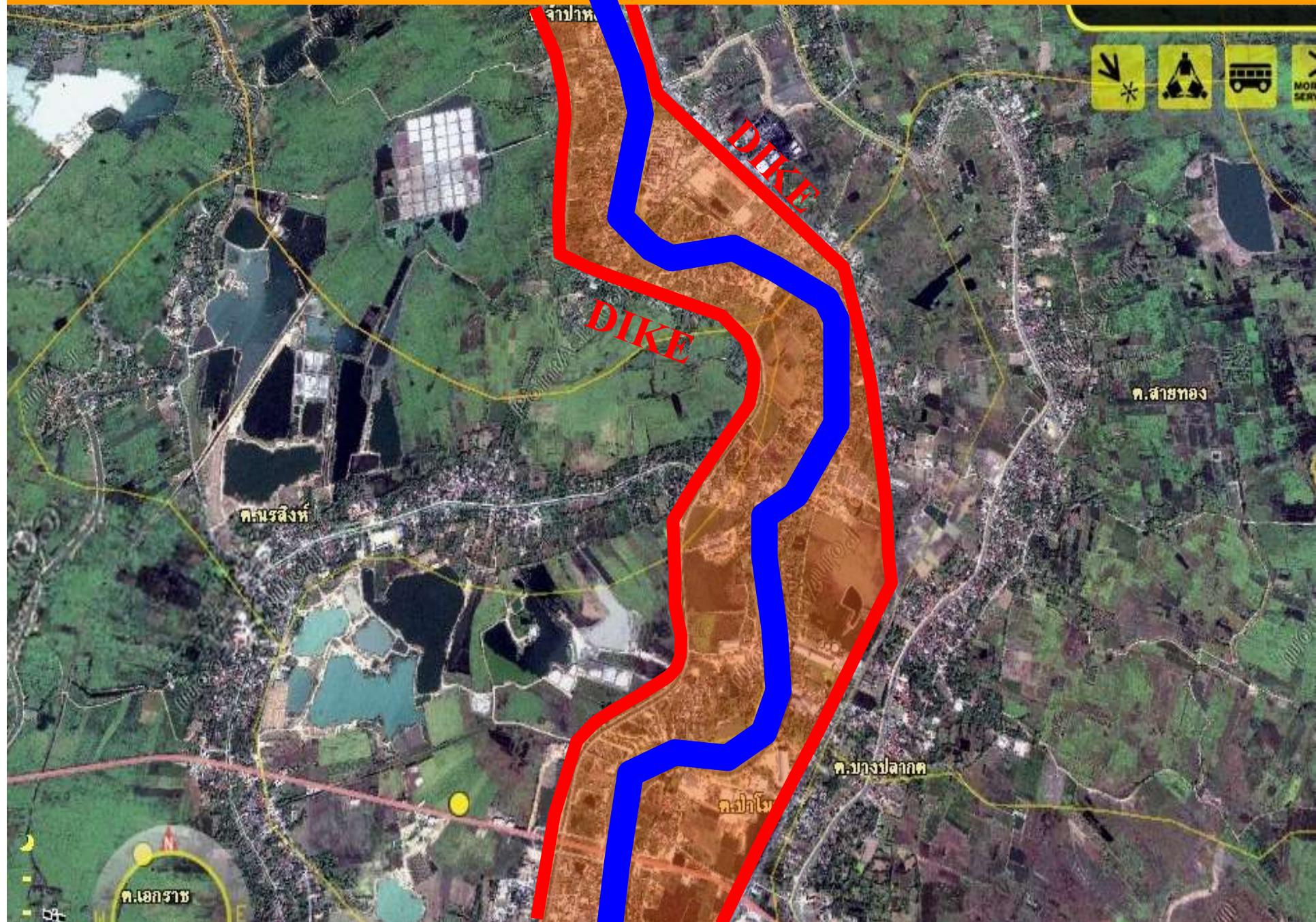
3. MODEL APPLIED TO CHAO PHRAYA RIVER

CHAO PHRAYA DAM SAPPHAYA DISTRICT , CHAINAT





แนวคันเขนบแม่น้ำเจ้าพระยา

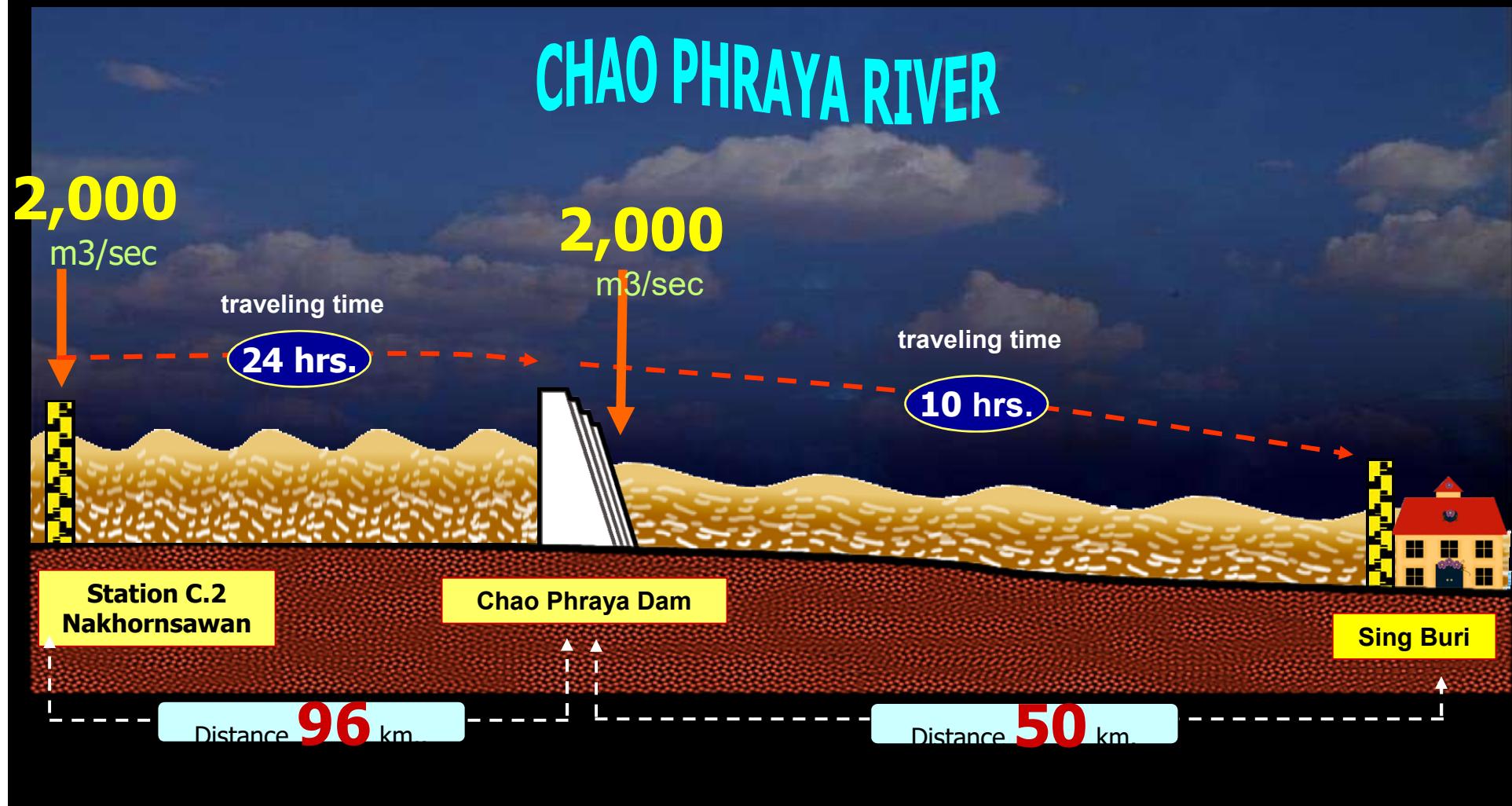




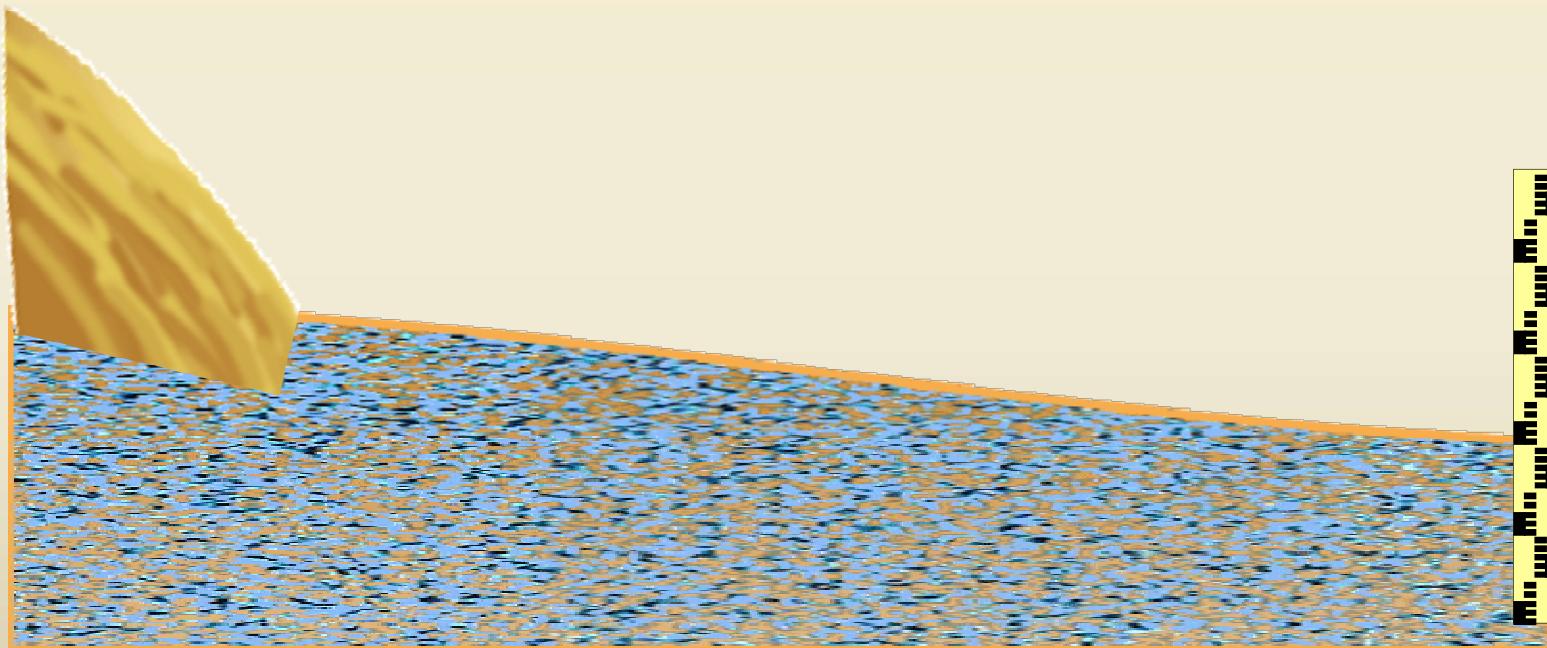
3. MODEL APPLIED TO CHAO PHRAYA BASIN

Time lag of water levels between Station C.2 and
the flood risk downstream cities

STATION C.2 - SING BURI

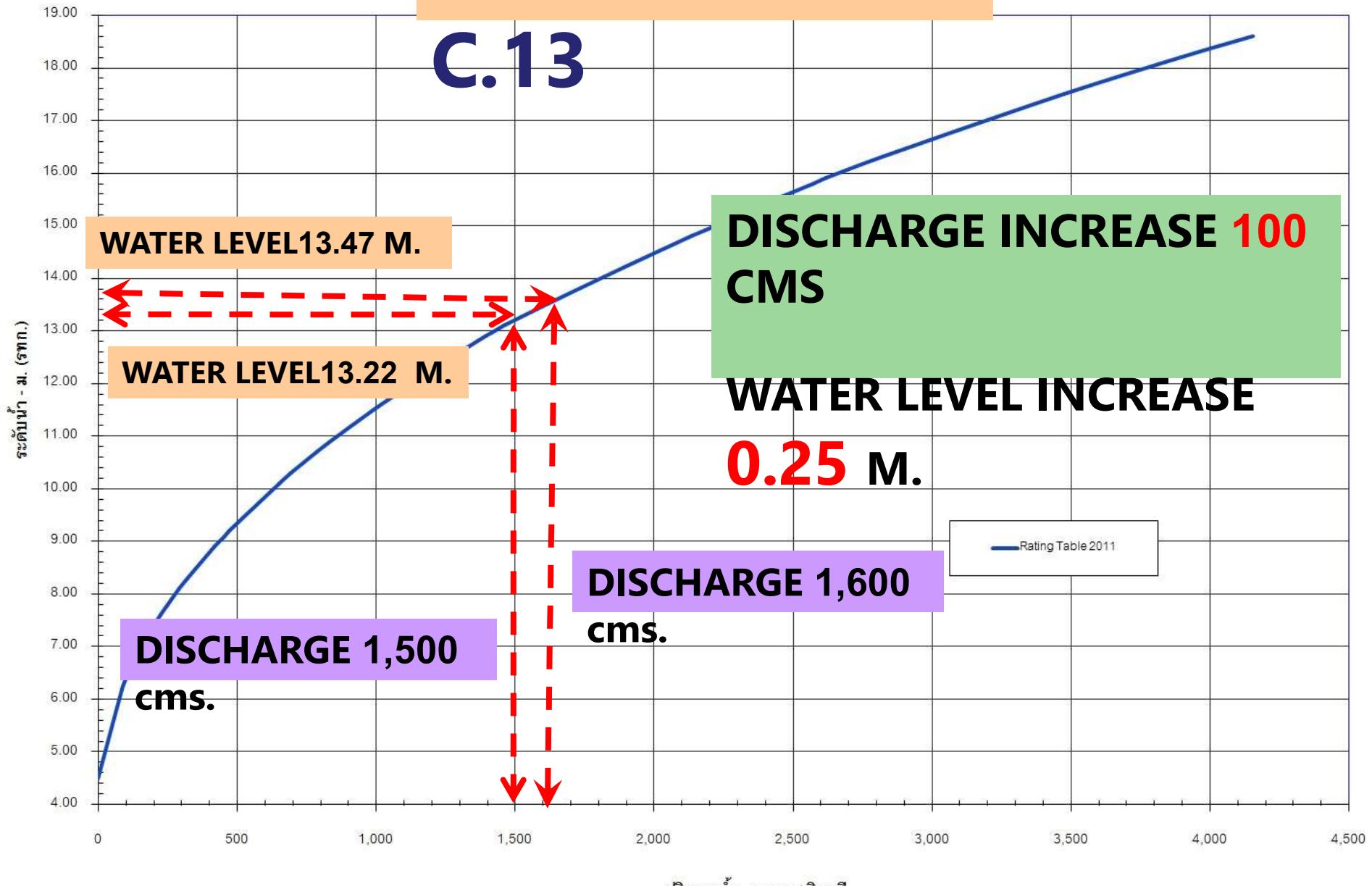


CORRELATION BETWEEN CHAO PHRAYA DAM DISCHARGE AND DOWNSTREAM WATER LEVELS



STATION

C.13



ระดับน้ำ - ปริมาณ น้ำ

C.2		
Q	ระดับ	ผลต่าง
1000	20.93	
1100	21.27	0.34
1200	21.60	0.33
1300	21.92	0.32
1400	22.22	0.30
1500	22.52	0.30
1600	22.80	0.28
1700	23.05	0.25
1800	23.29	0.24
1900	23.50	0.21
2000	23.70	0.20
2100	23.90	0.20
2200	24.09	0.19
2300	24.28	0.19

ระดับน้ำ - ปริมาณ น้ำ

C.13		
Q	ระดับ	ผลต่าง
1000	11.69	
1100	12.02	0.33
1200	12.34	0.32
1300	12.65	0.31
1400	12.93	0.28
1500	13.21	0.28
1600	13.47	0.26
1700	13.73	0.26
1800	13.98	0.25
1900	14.23	0.25
2000	14.47	0.24
2100	14.71	0.24
2200	14.95	0.24
2300	15.19	0.24

ระดับน้ำ - ปริมาณ น้ำ

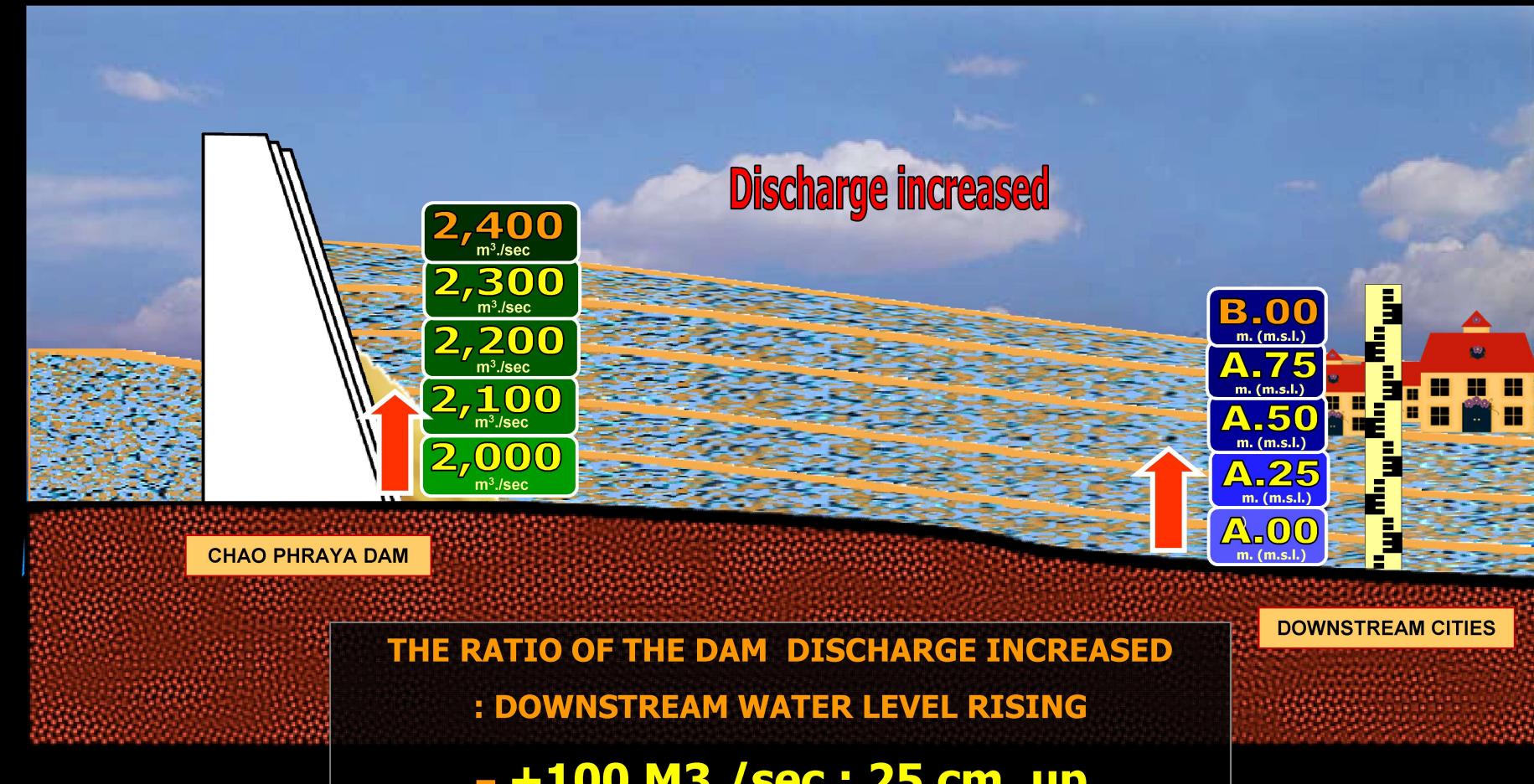
C.3		
Q	ระดับ	ผลต่าง
1000	7.82	
1100	8.20	0.38
1200	8.55	0.35
1300	8.87	0.32
1400	9.18	0.31
1500	9.48	0.30
1600	9.77	0.29
1700	10.06	0.29
1800	10.34	0.28
1900	10.60	0.26
2000	10.85	0.25
2100	11.10	0.25
2200	11.35	0.25
2300	11.60	0.25

ระดับน้ำ – ปริมาณ น้ำ

C.7A		
Q	ระดับ	ผลต่าง
1000	4.83	
1100	5.17	0.34
1200	5.49	0.32
1300	5.79	0.30
1400	6.08	0.29
1500	6.37	0.29
1600	6.64	0.27
1700	6.91	0.27
1800	7.17	0.26
1900	7.42	0.25
2000	7.67	0.25

CORRELATION BETWEEN CHAO PHRAYA DAM DISCHARGE AND DOWNSTREAM WATER LEVELS

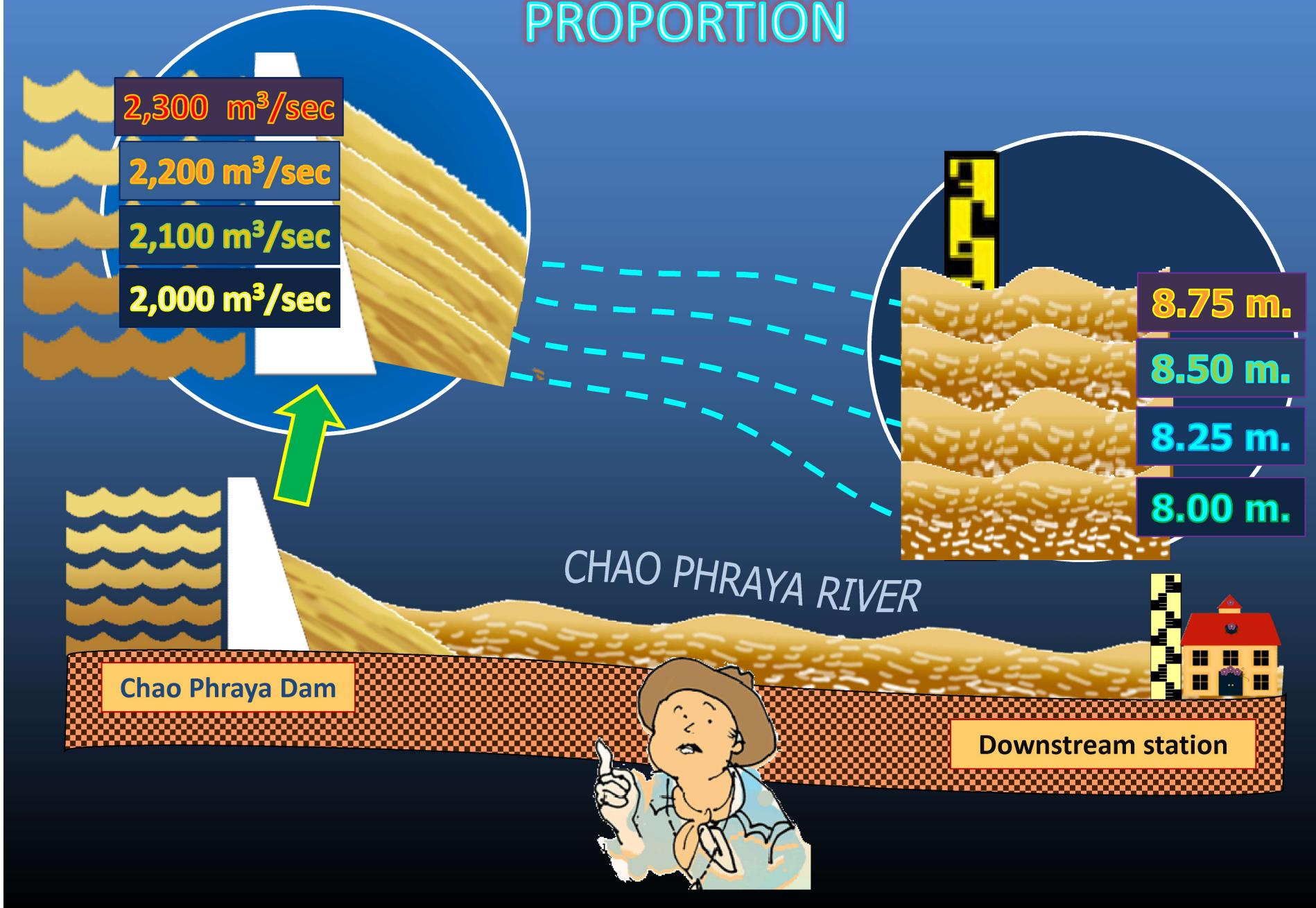
Downstream cities = Sing Buri, Ang Thong and Ayutthaya



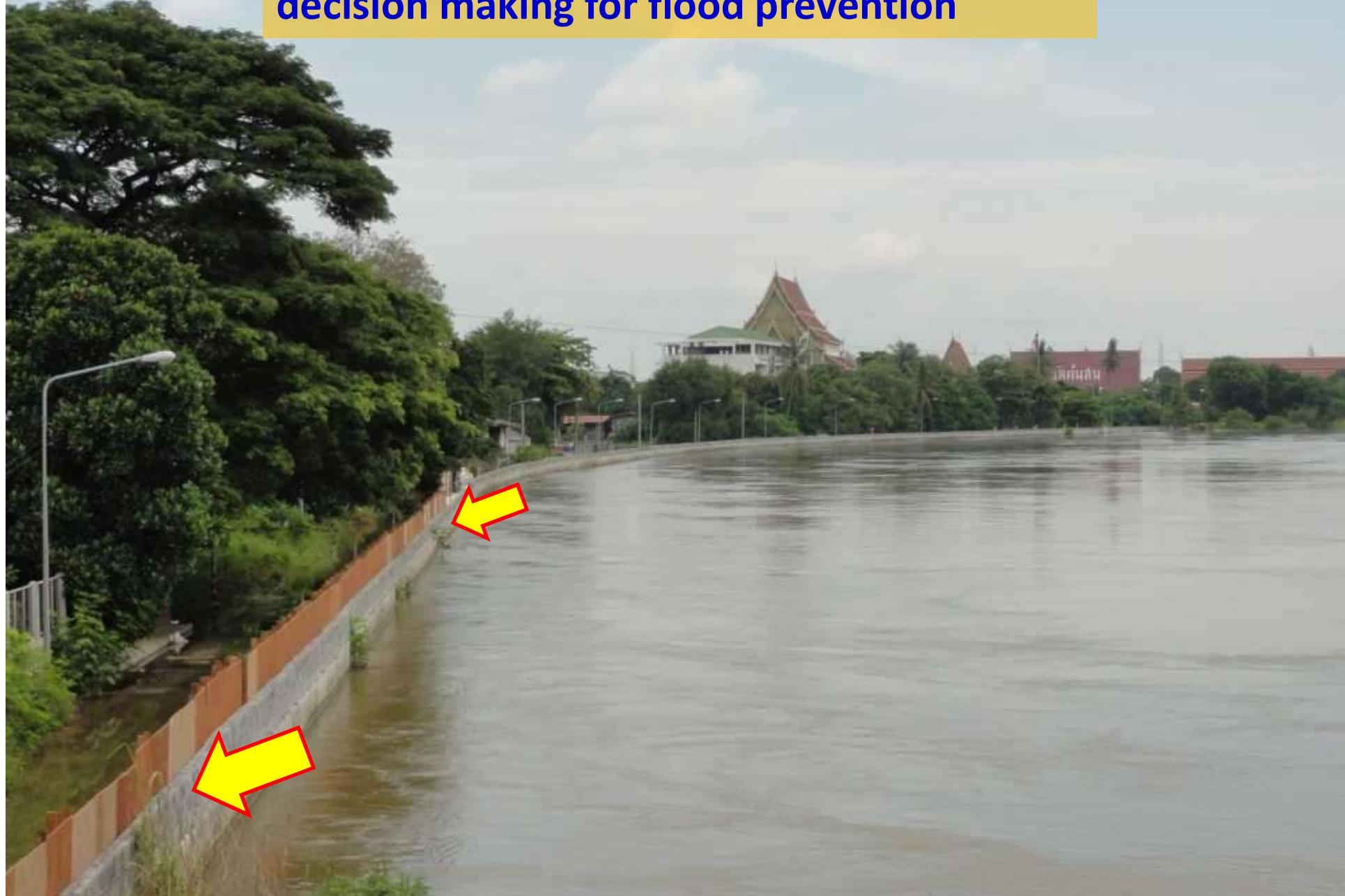
Water level information could help in decision making for flood prevention



DAM DISCHARGE (m³/sec) : DOWNSTREAM WATER LEVEL INCREASE (cm.)
PROPORTION



Water level information could help in decision making for flood prevention



Water level information could help in decision making for flood prevention



Water level information could help in decision making for flood prevention



RELATION BETWEEN DAM DRAINAGE AND FLOODING AREA



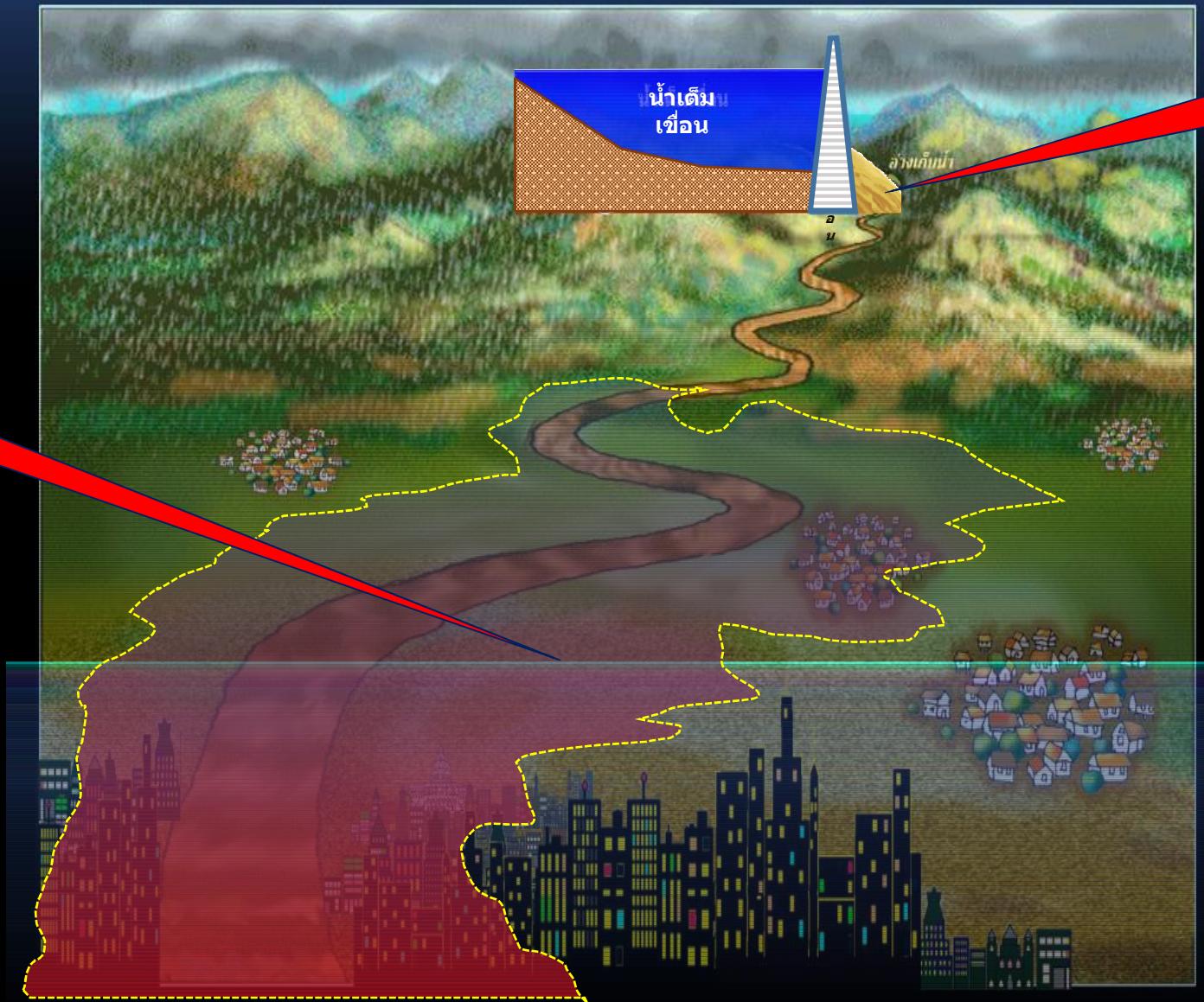
RELATION BETWEEN DAM DRAINAGE AND FLOODING AREA



RELATION BETWEEN DAM DRAINAGE AND FLOODING AREA

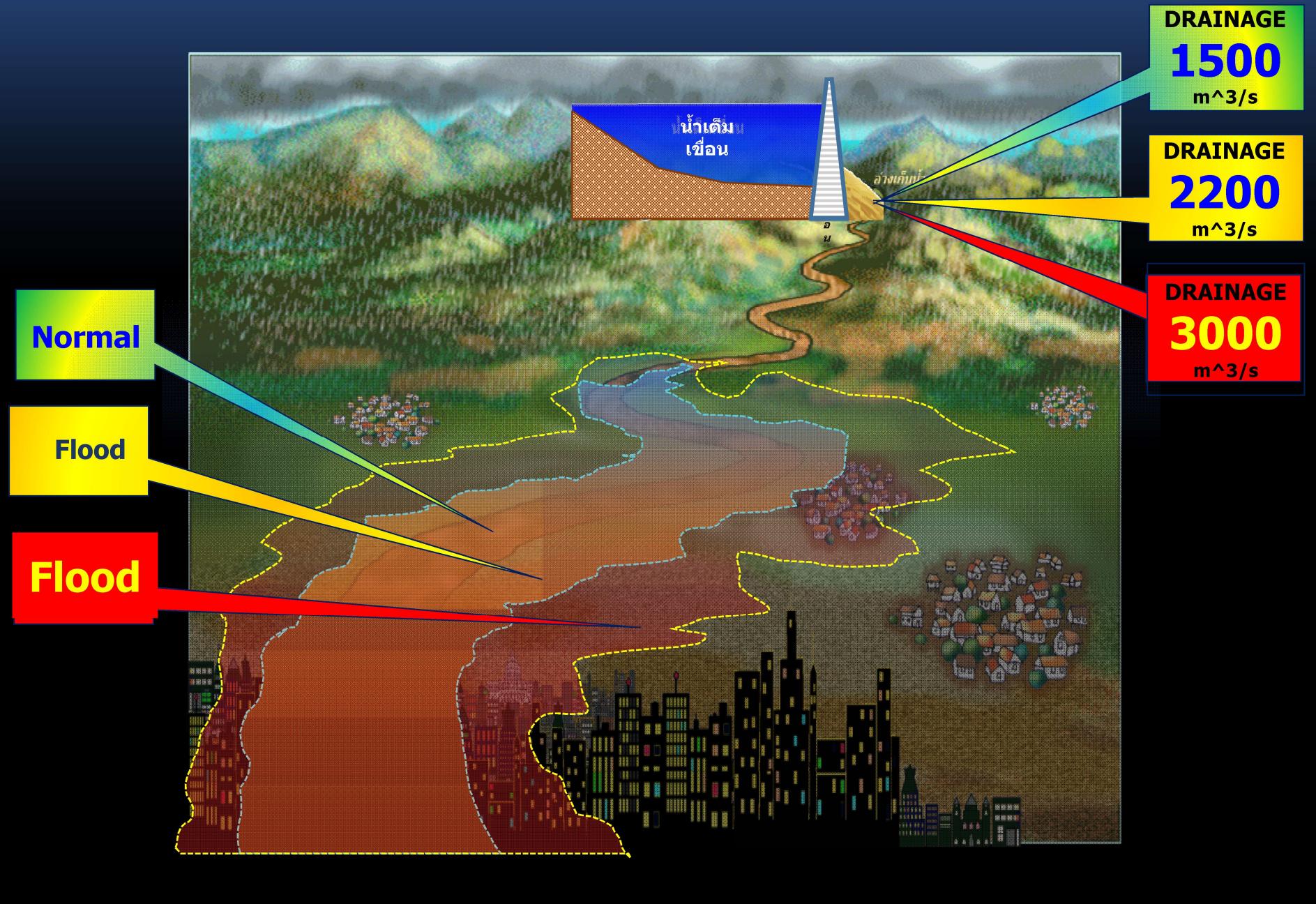


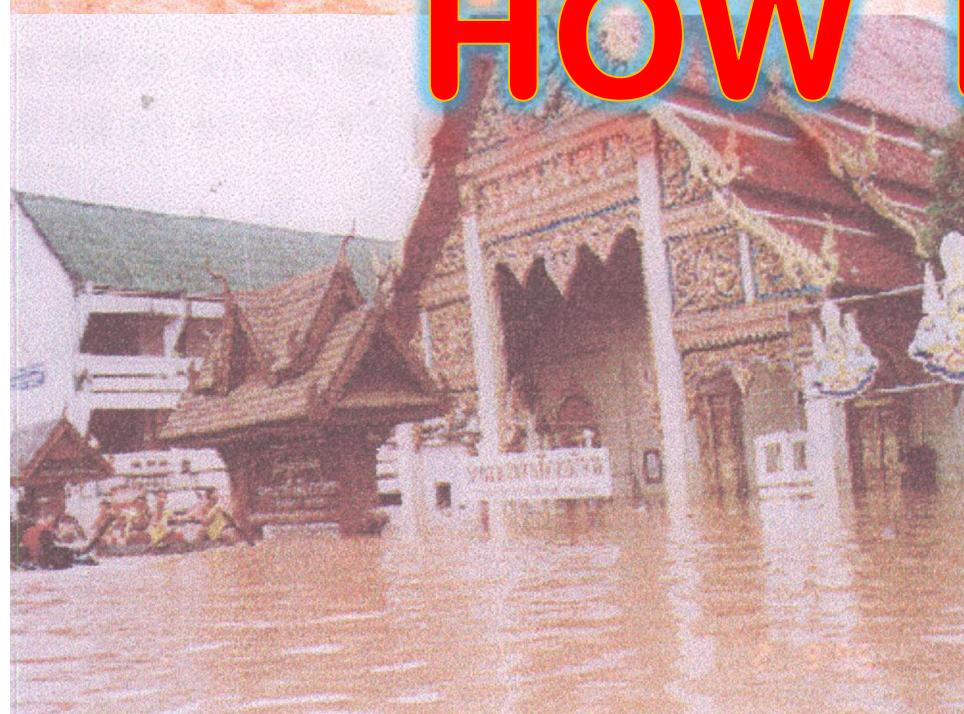
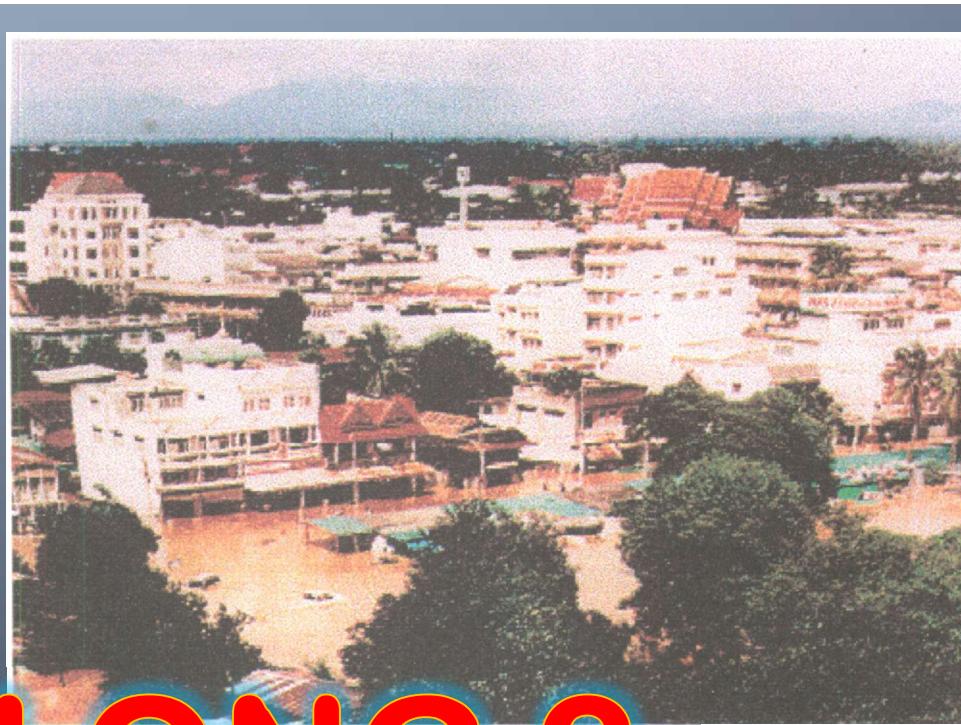
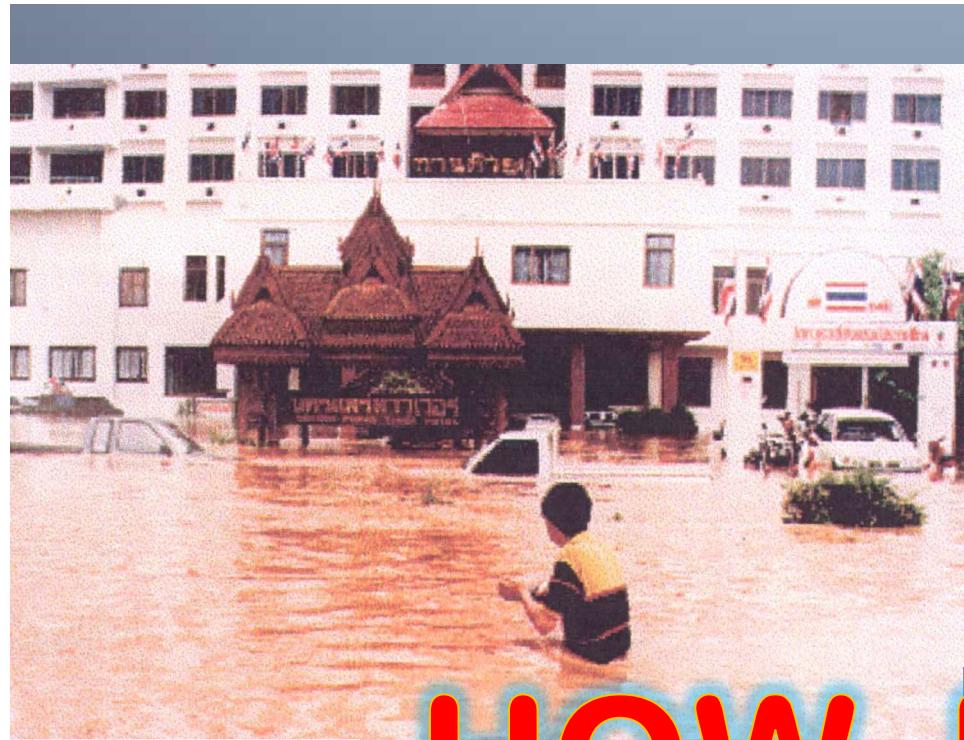
RELATION BETWEEN DAM DRAINAGE AND FLOODING AREA



DRAINAGE
3000
m³/s

RELATION BETWEEN DAM DRAINAGE AND FLOODING AREA



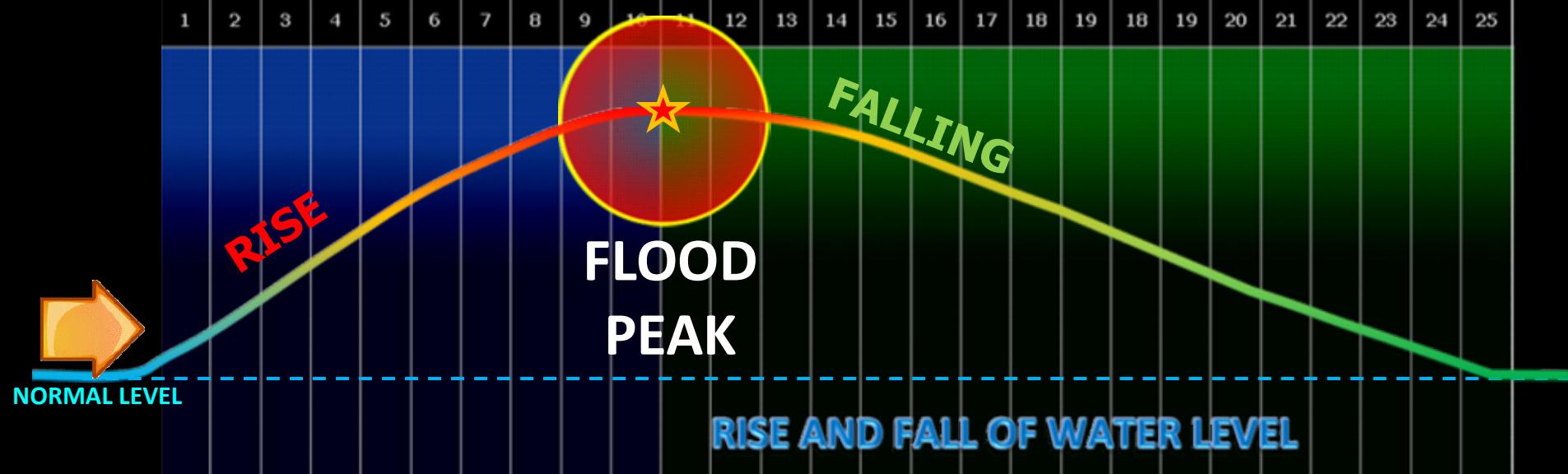


HOW LONG?

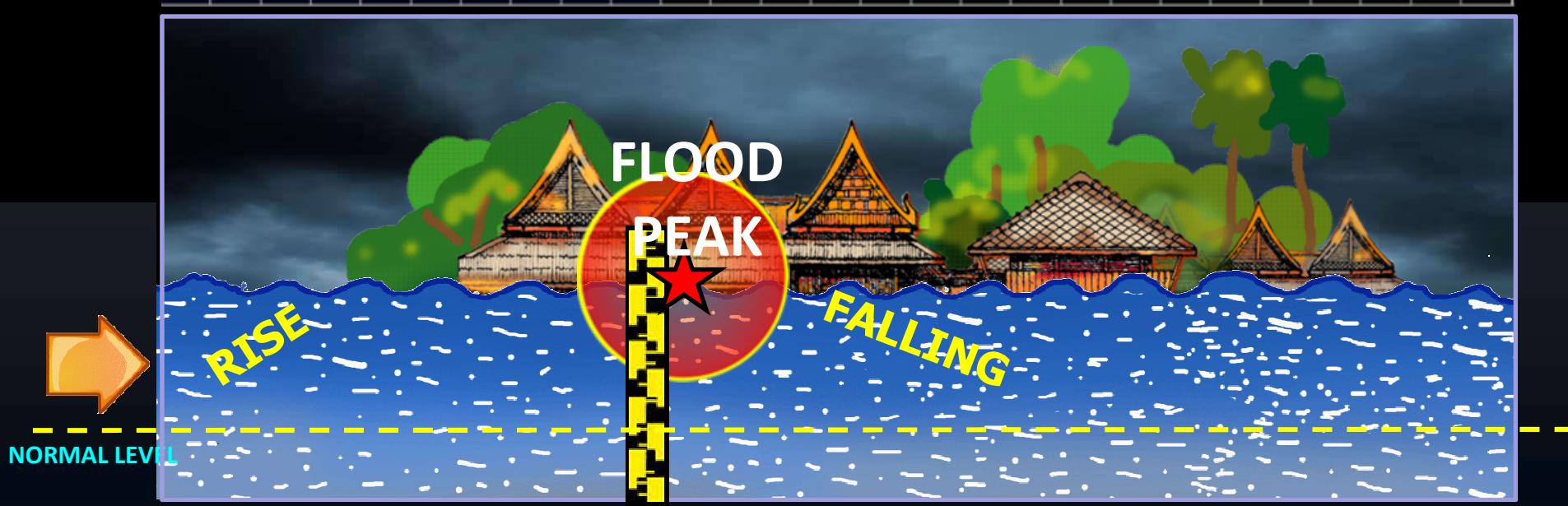
3. MODE

WATER LEVEL RISING PERIOD (HOUR)

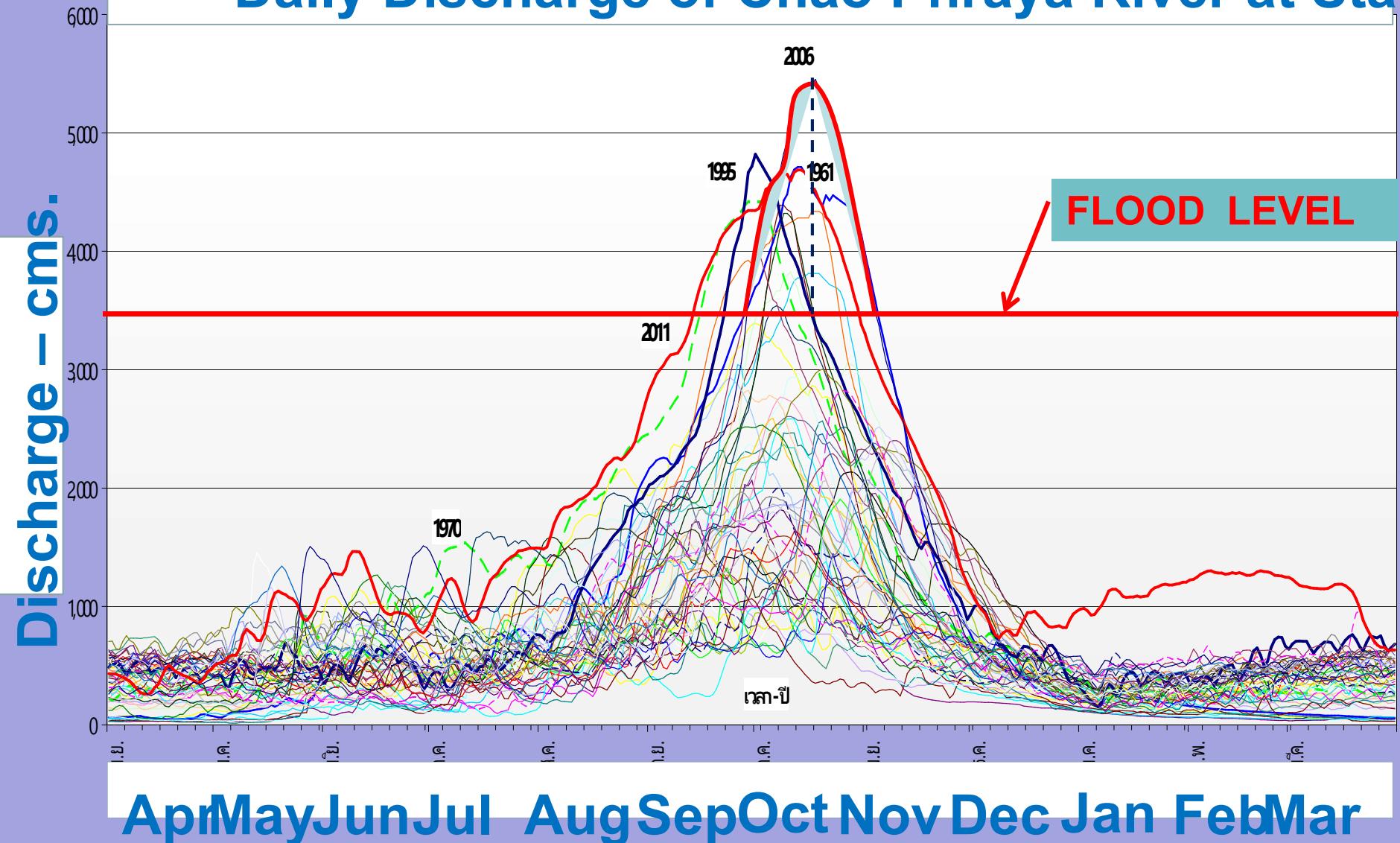
WATER LEVEL FALLING PERIOD (HOUR)



RISE AND FALL OF WATER LEVEL

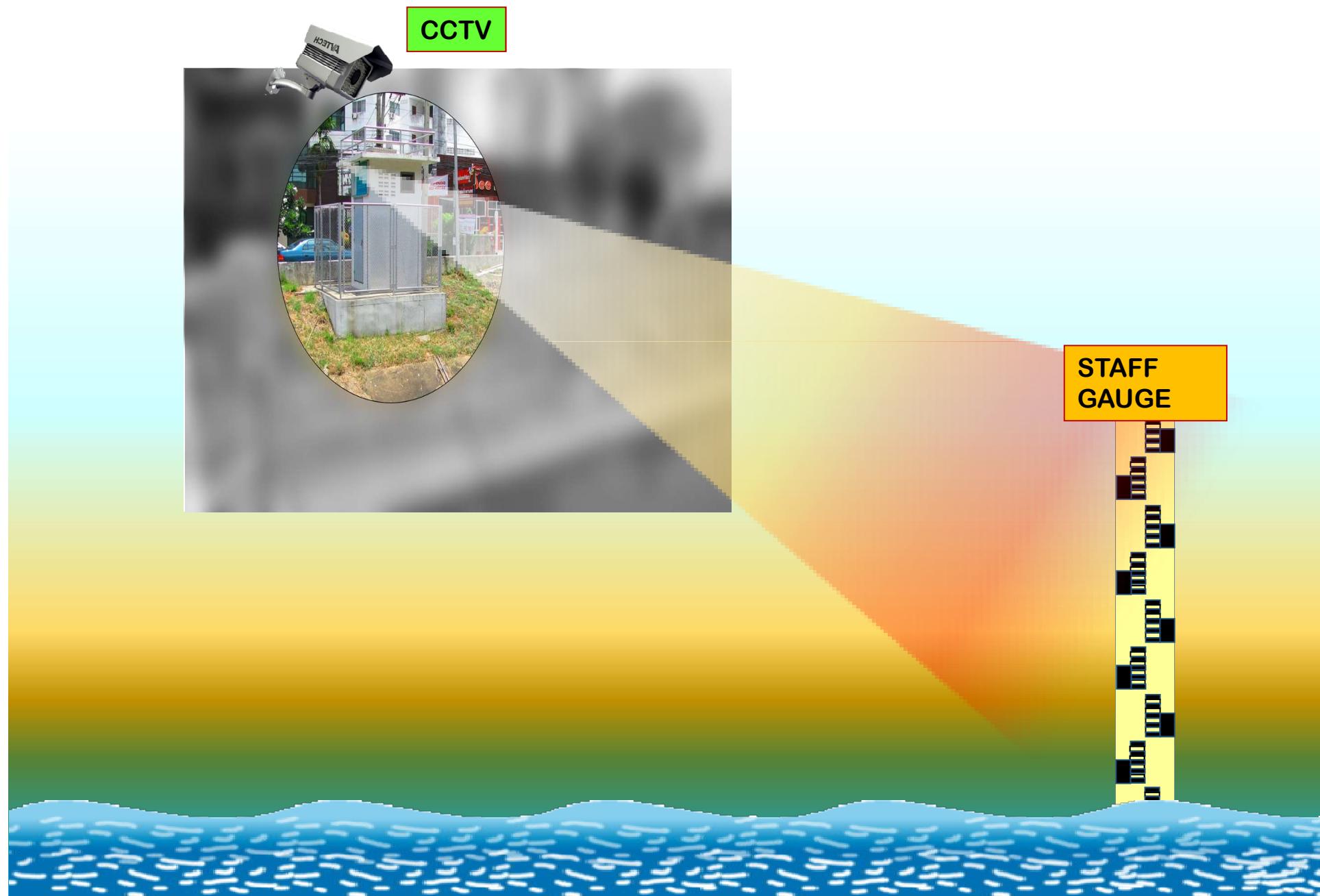


Daily Discharge of Chao Phraya River at Station



Warning and Information board at the landmark of the community

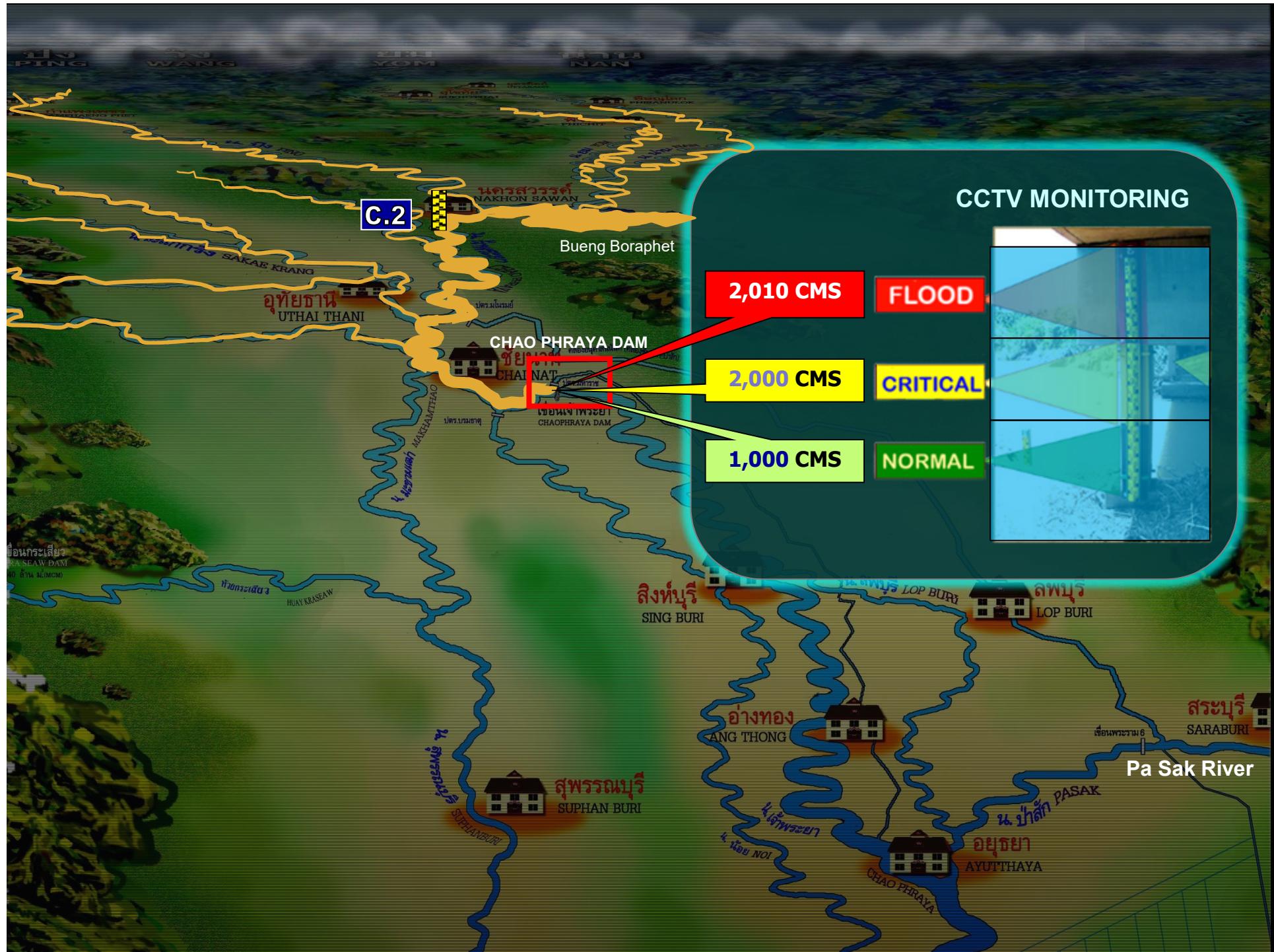




CHAO PHRAYA DAM

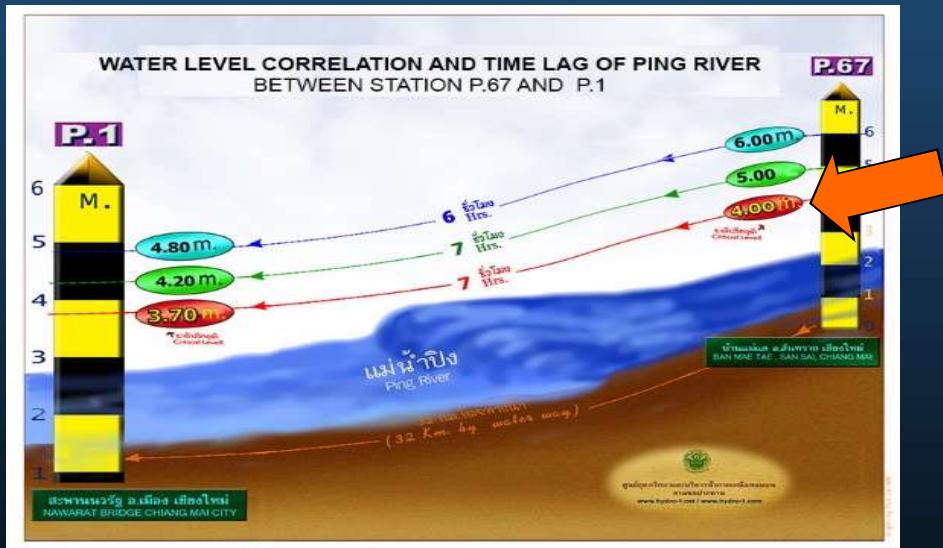
Sapphaya district, Chainat





River monitoring and Flood Warning system

- Water level correlation and time lag between upstream and downstream stations.

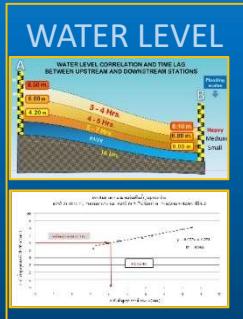
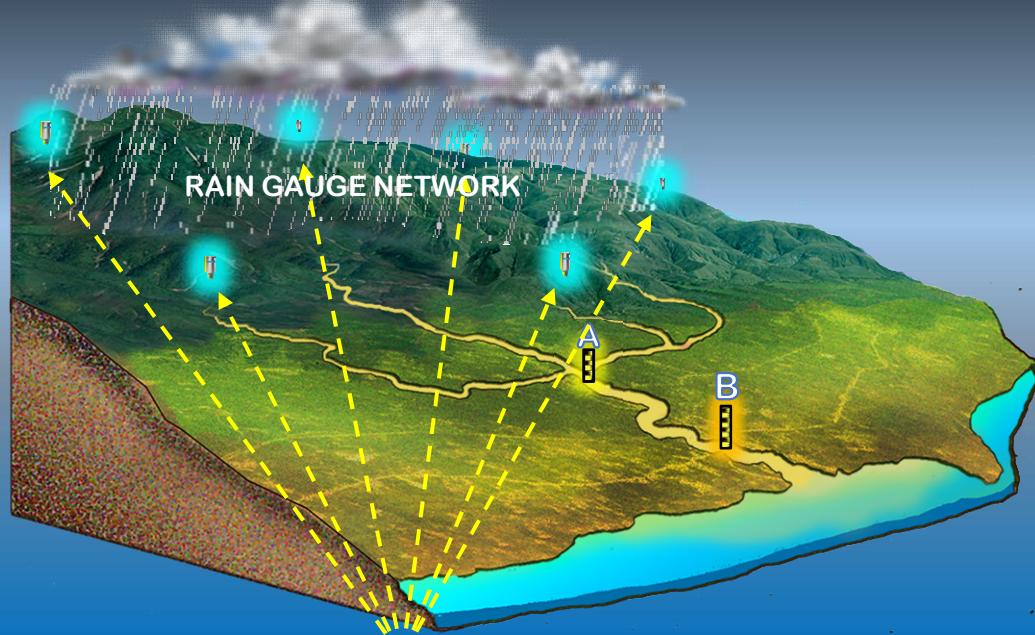


Current warning system
Using river stage correlation between upstream station P.67 and downstream station P.1 for flood monitoring and warning.



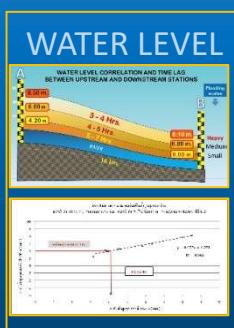
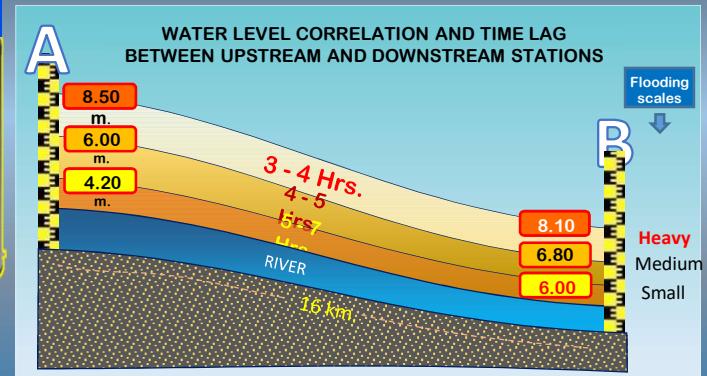
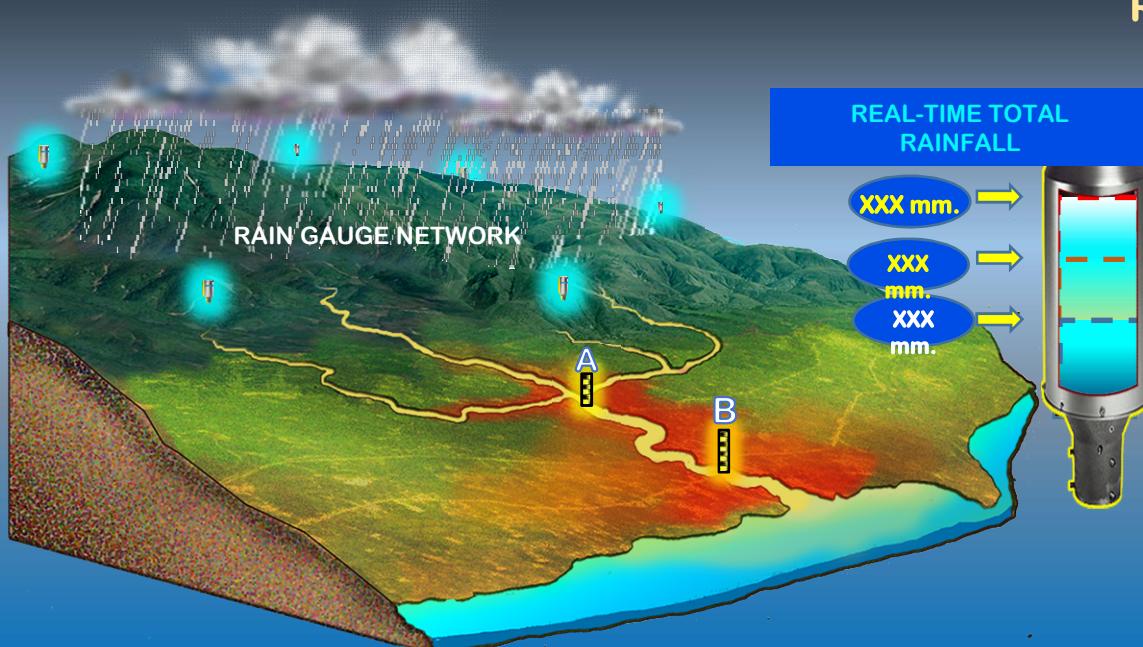


RAINFALL-RUNOFF CORRELATIONSHIP FOR FLOOD EARLY WARNING



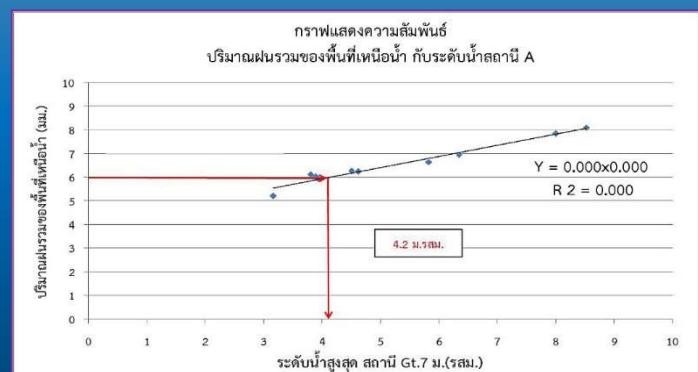
RAIN GAUGE

RAINFALL-RUNOFF CORRELATIONSHIP FOR FLOOD EARLY WARNING

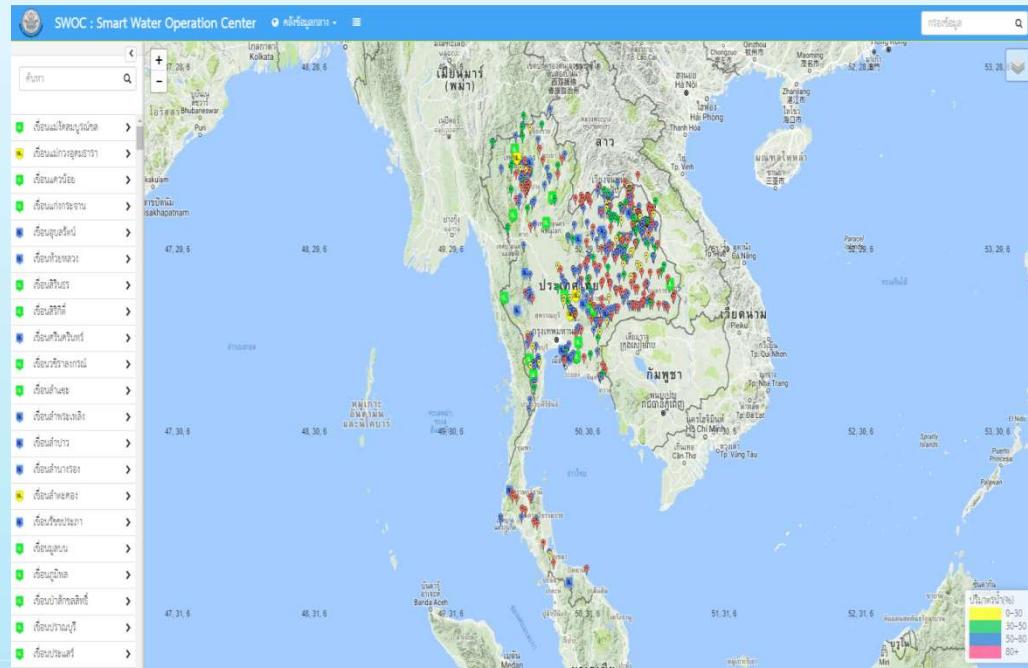


EQUATION $Y = Ax + B$

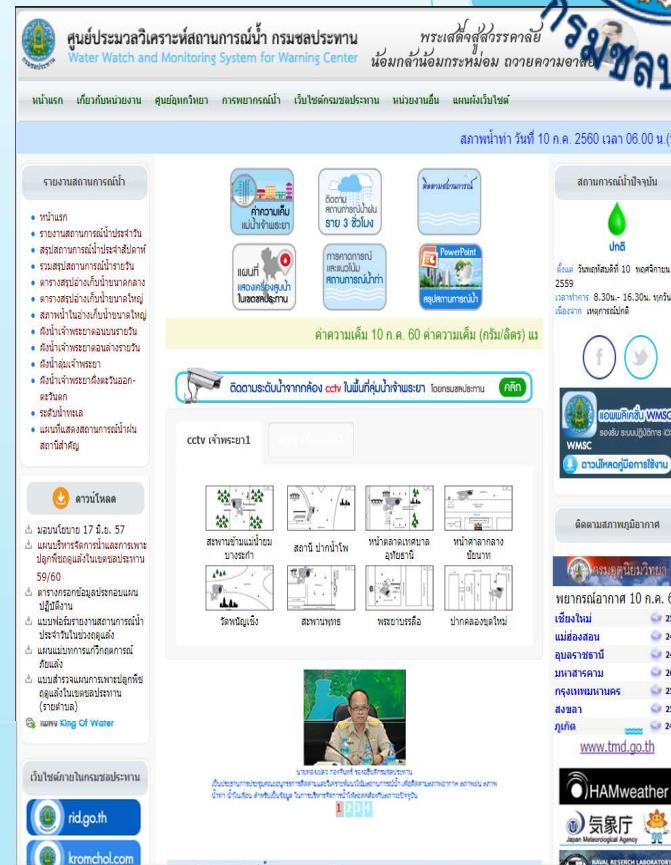
Y = ปริมาณฝนรวมสูงสุด (total rainfall)
X = Runoff at Station A (upstream)
A, B = ค่าคงที่
R = สัมประสิทธิ์ความสัมพันธ์ฝน-ระดับน้ำ



Web Application

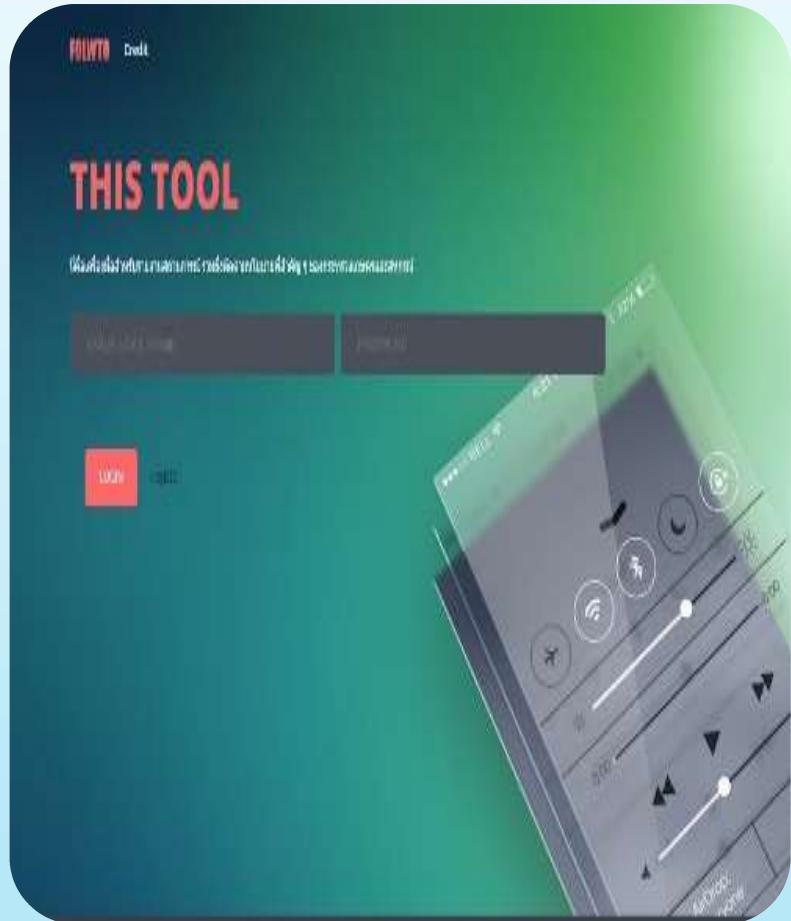


swoc.rid.go.th

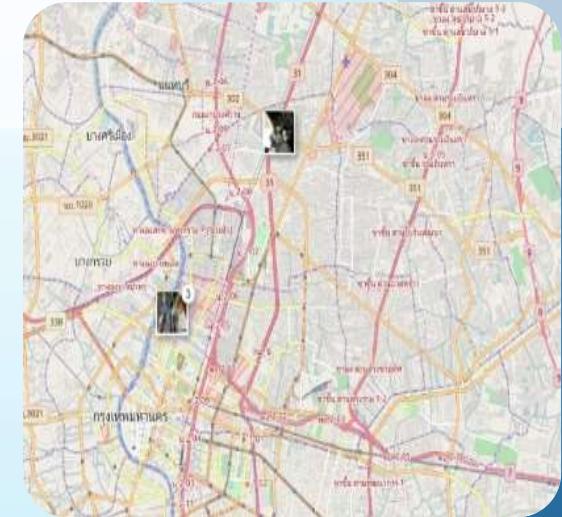


wmsc.rid.go.th

WTO Application



Flowto เป็นเครื่องมือสำหรับรายงานสถานการณ์ บันทึกและติดตามเหตุการณ์ต่างๆ ด้วยข้อความ ภาพ พิกัดและเวลา ด้วยมือถือของคุณ และแสดงผลในรูปแบบแผนที่สามารถใช้งานได้ทั้งบนสมาร์ทโฟนและเว็บбраузอร์สำหรับคอมพิวเตอร์โดยที่

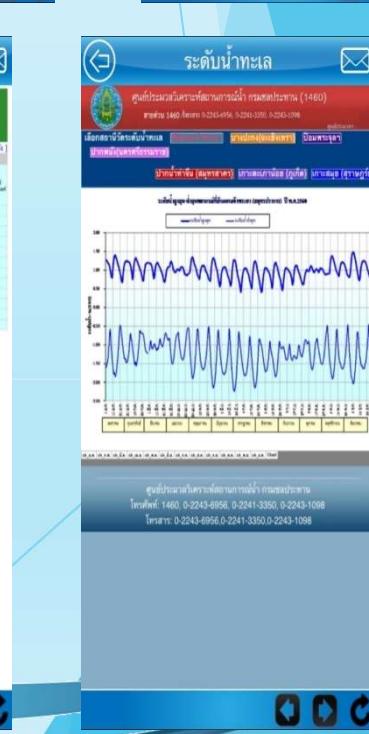
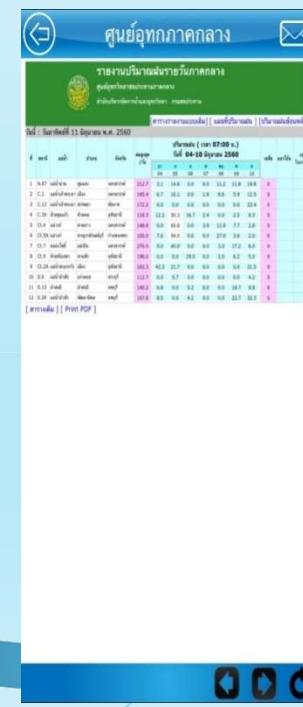
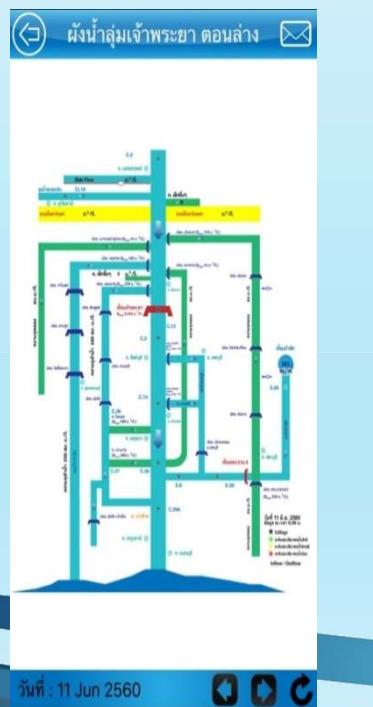
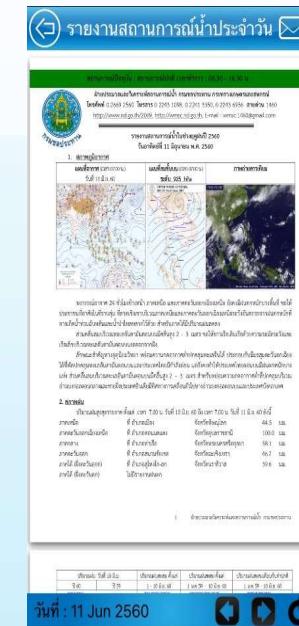


APPLICATION

MSC Application

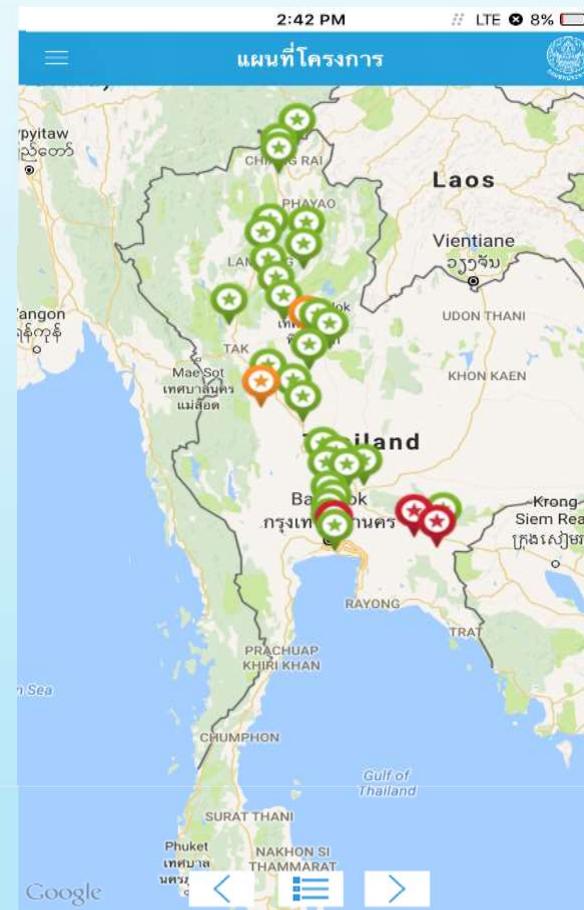


แอปพลิเคชันสำหรับแสดง
สถานการณ์น้ำประจำวันที่ได้มีการ
จัดเก็บรวบรวมฐานข้อมูลไว้ซึ่งจะช่วย
อำนวยความสะดวกในการประเมินผล
และประกอบการตัดสินใจในการบริหาร
จัดการน้ำรวมถึงเกษตรกร และ



XY Monitor Application

องค์ประกอบ CPY Monitor Application



水 SMART Application

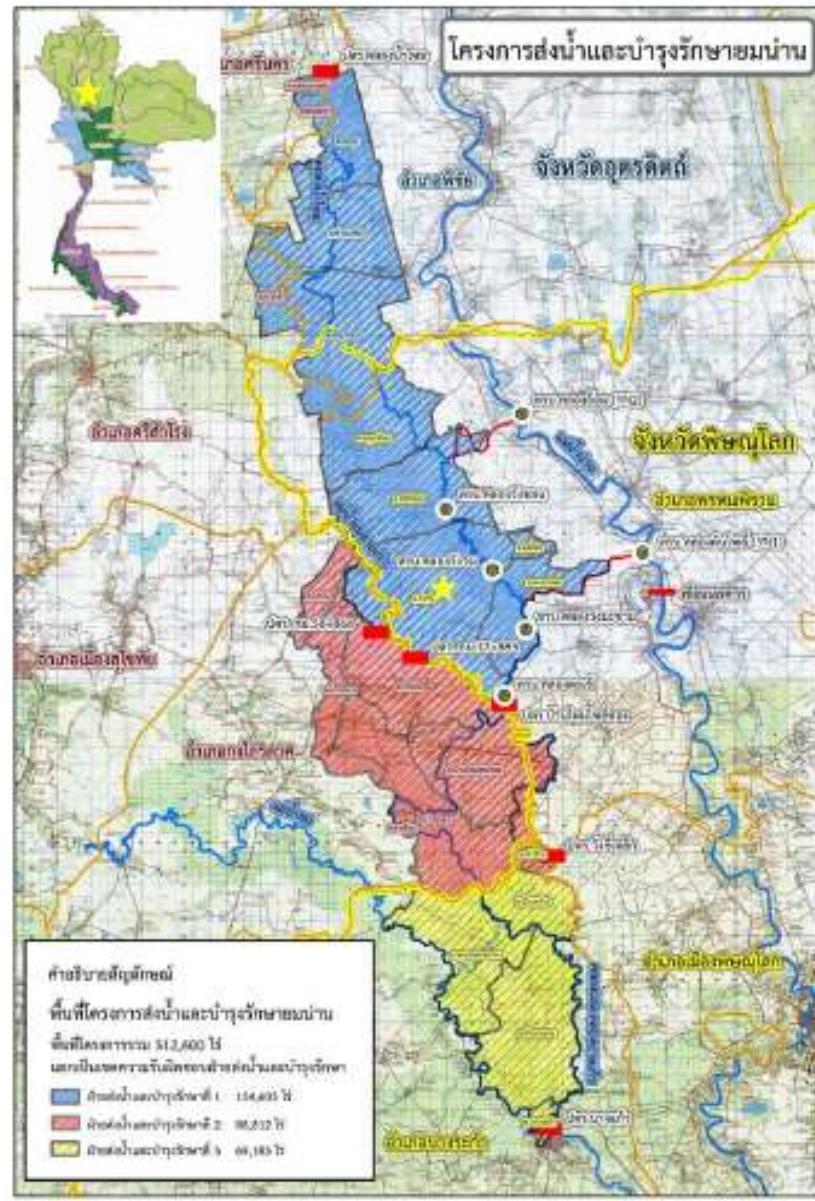
องค์ประกอบ Water SMART Application



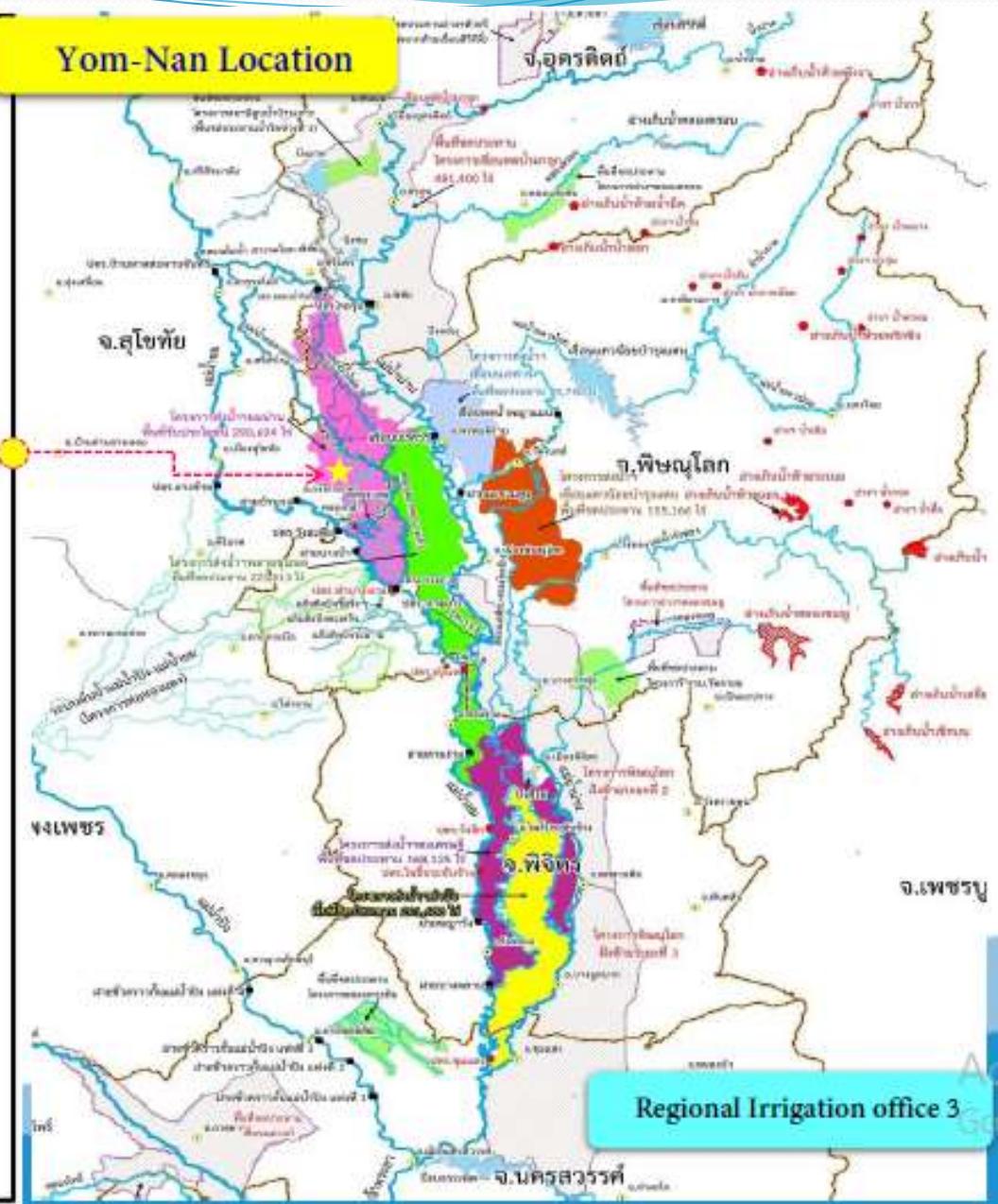
BEST PRACTICE WATER MANAGEMENT

Case 1 : Bang Rakam Model

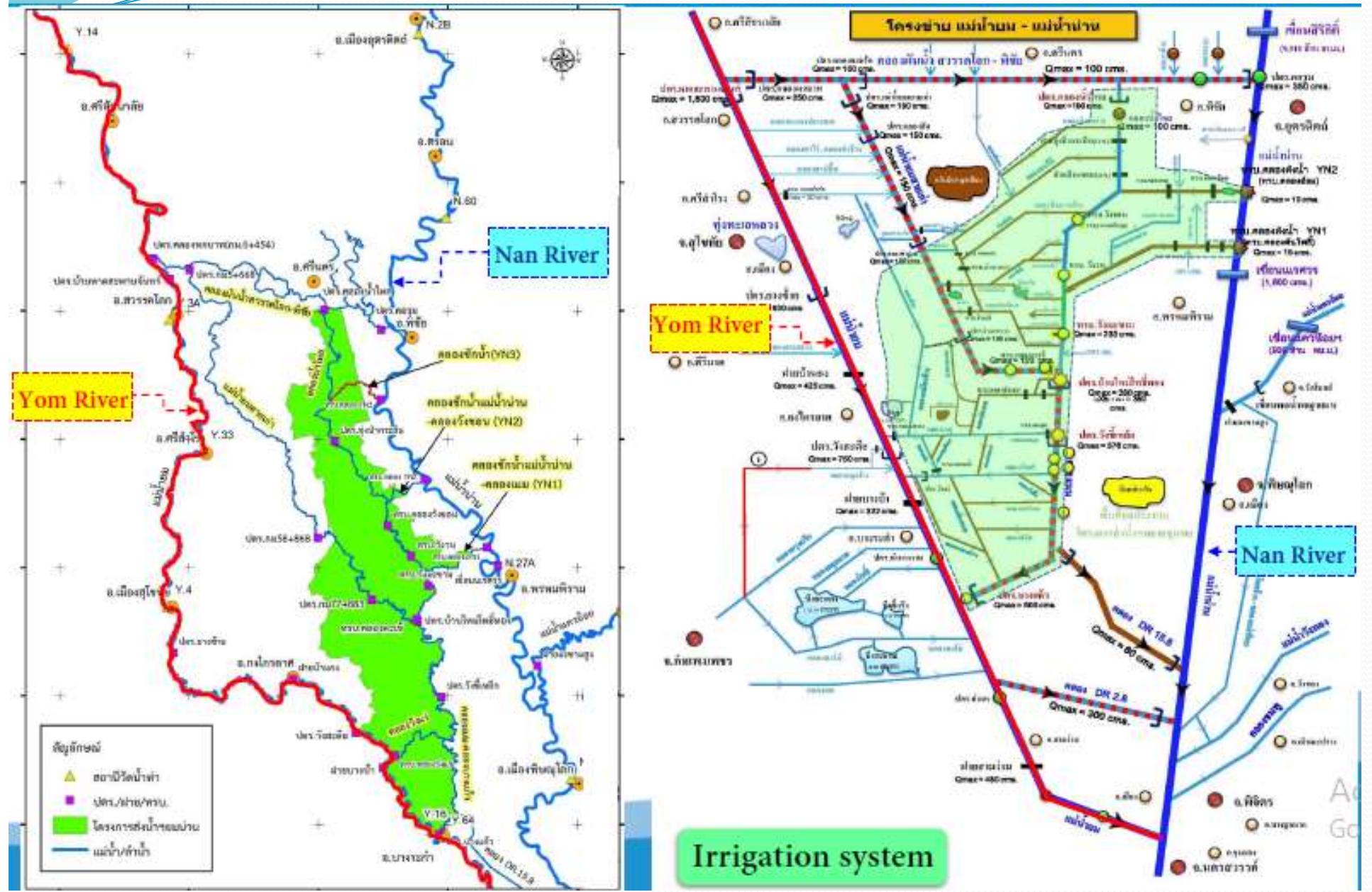
YOM - NAN Project



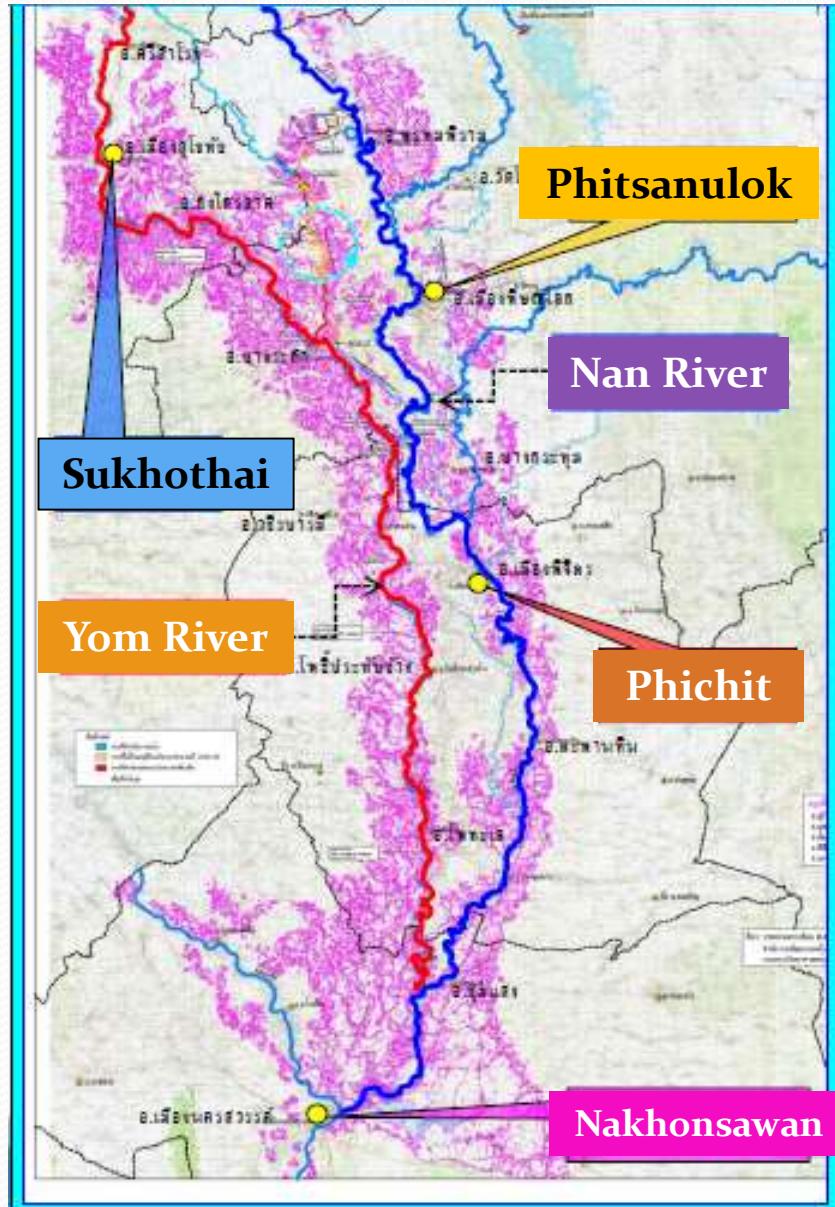
Yom-Nan Location



Irrigation system at Yom – Nan Project



Flood Problem In Bang Rakam



Water Management in rainy season



2 principles for water management in Bang Rakam model

1

Adjust the planting calendar



2

Using rice fields harvested to support detention storage area



Water Management Plan of Bang Rakam Field

Water drainage out
of the water
retention area

2017

พื้นที่ท่วมน้ำได้
265,000 ไร่

400 MCM

2018

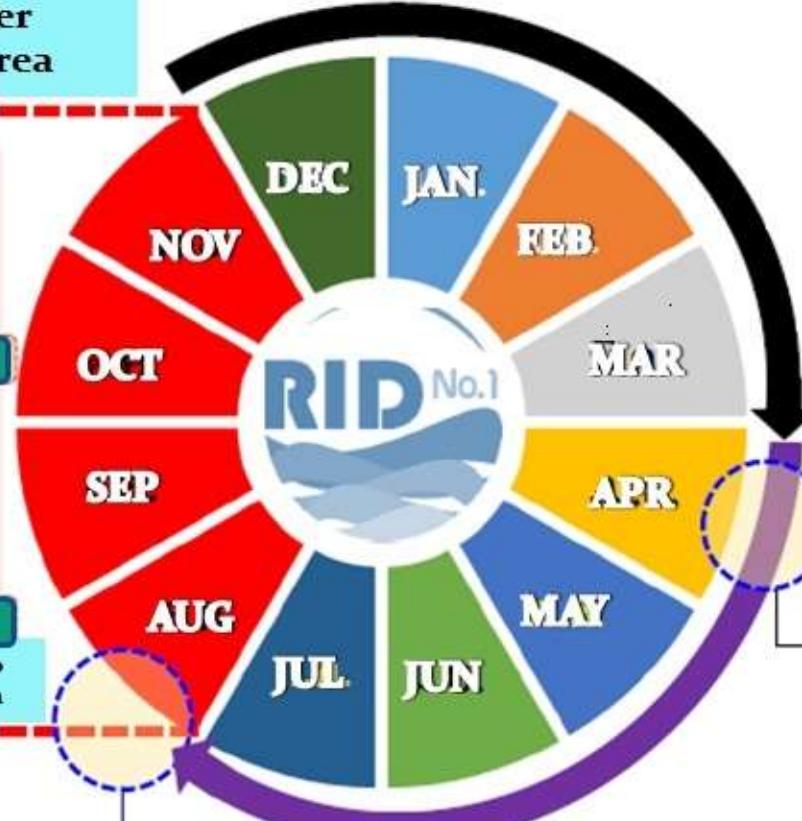
พื้นที่ท่วมน้ำได้
382,000 ไร่

500 MCM

To drain water into
the water retention

ผลผลิตเสียหาย

off-season paddy field



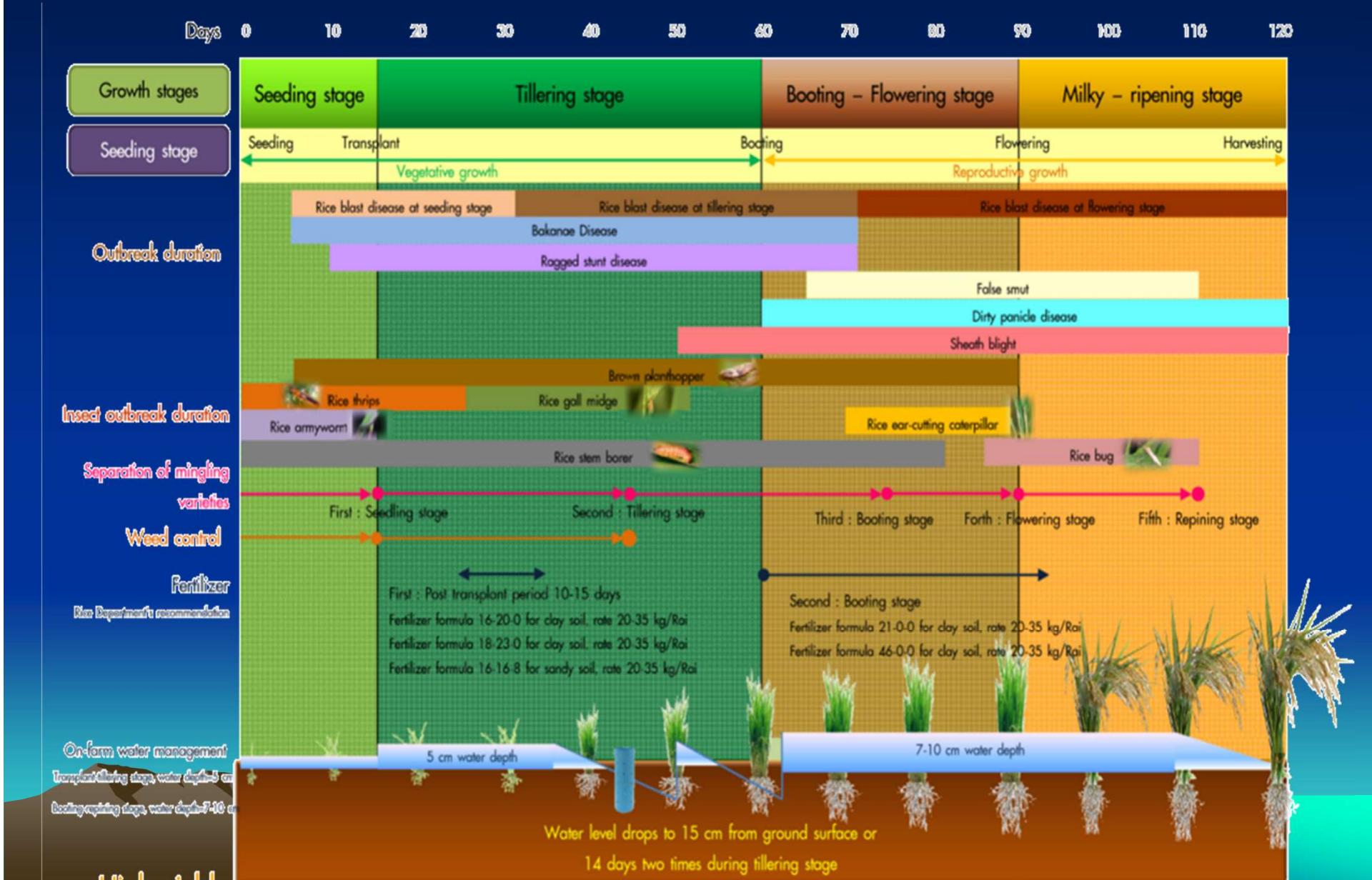
in-season rice field

- The beginning of in-season rice farming season 20-31 March 2017 : To distribute water into water allocation system for farmers in order to start the cultivation on 1 April 2017
- Control and prevention of agricultural area 10 May – 15 August 2017 : To manage water and prevent flood in order to avert impacts and farmers can harvest crops before rainy season.
- To drain water into the water retention field 15 August – 31 October 2017 : To prepare for retention areas for flooding from Yom and Nan River Basins and other sub-river basin as well as abundant rain volume served as temporary natural water retention areas and water can be retarded at the 400 million cubic meters. of maximum level.
- Water drainage out of the water retention area 1-25 November 2017 : To drain water out of the water retention area to start the off-season rice farming season of farmers under the cropping calendar of Royal Irrigation Department.

BEST PRACTICE WATER MANAGEMENT

Case 2 : alternative wetting and drying of paddy dry season Crop

Suggestion for alternative wetting and drying of paddy dry season Crop with transplanting machine (Nursery tray)



Rice quality

Profit+ cumulated capital

Yield

Quality of life

Unity of community



increases
and
reduces



Water
Seed
Labor
Chemical fertilizer
Chemical substance

Overall Results

Irrigation water is reduced by one-third.



Chemical fertilizers needed
70-100% less.



Cost of cultivation is cut by half.



Rice yield increases by 25%.



Future Extension

- Thailand has the irrigable area using 12,500 million cubic meter of irrigation on water. In case the Integrated Smart Farming – AWDI technique is applied throughout the country, irrigation water could be saved in dry season by 33% or more than 4,100 million cubic meter



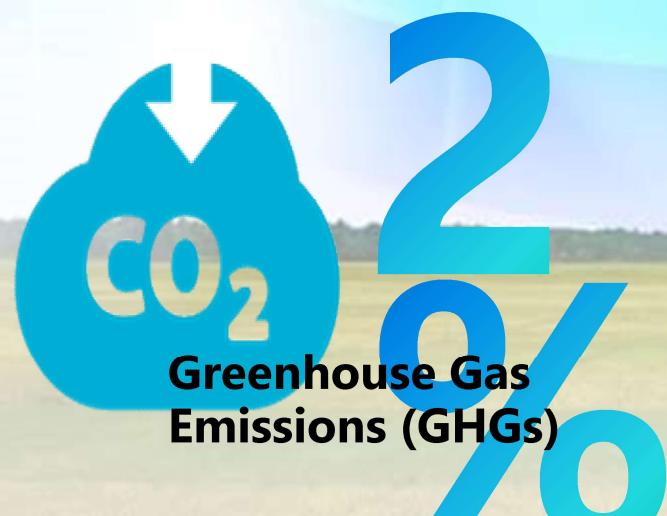
saved in dry
season

33
% or

4,100 Million
cubic meter

Future Extension [2]

- According to the United Nations Framework Convention on Climate Change “Conference of Parties No.21” to which 196 countries including Thailand are signatories, there is an international commitment of keeping global warming below a 2°C increase. Consequently Thailand has to achieve 20% Greenhouse Gas Emissions (GHGs) reduction by the year 2030. The Integrated Smart Farming - AWDI technique can reduces GHGs and therefore might be a major factor to Thailand to fulfill its legal obligations. More important, perhaps this technique has proven itself to significantly contribute to making the world a healthier and more sustainable resource for future generations.



**healthier and
sustainable resource
for
future
generation**

Thank you so much for your Attention



Royal Irrigation Department

Thailand