Flood Mitigation and Management in Thailand

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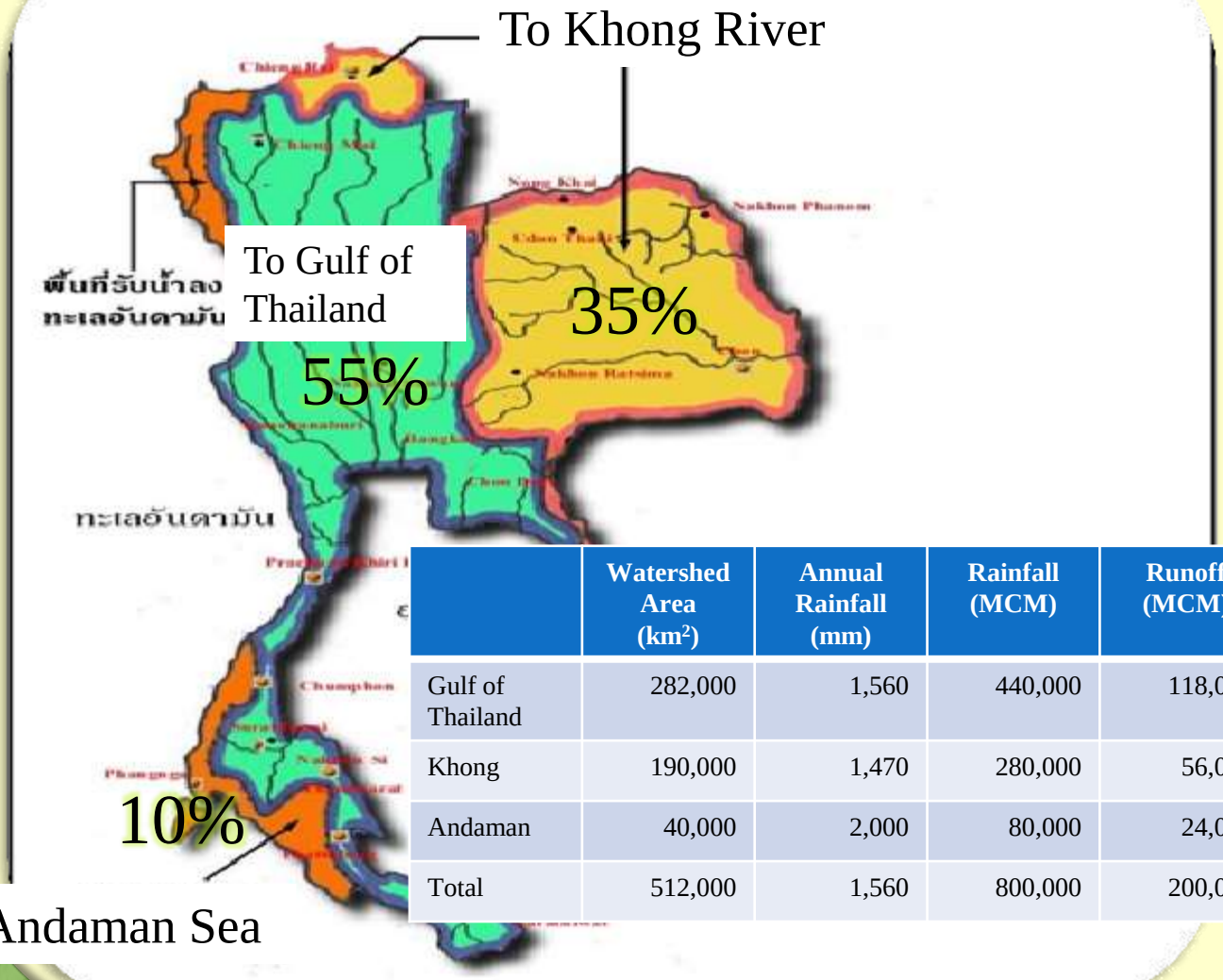
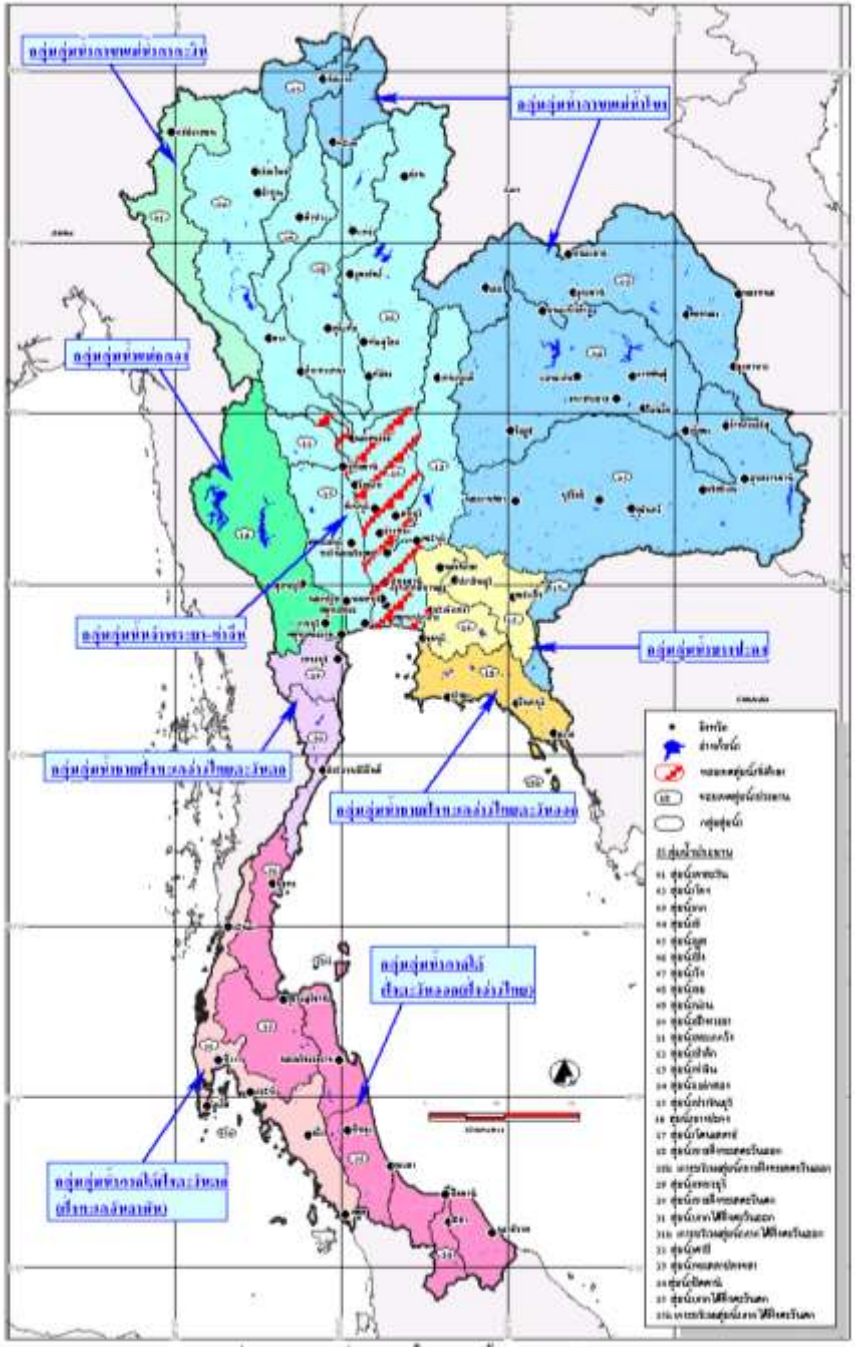
Drainage area of Thailand

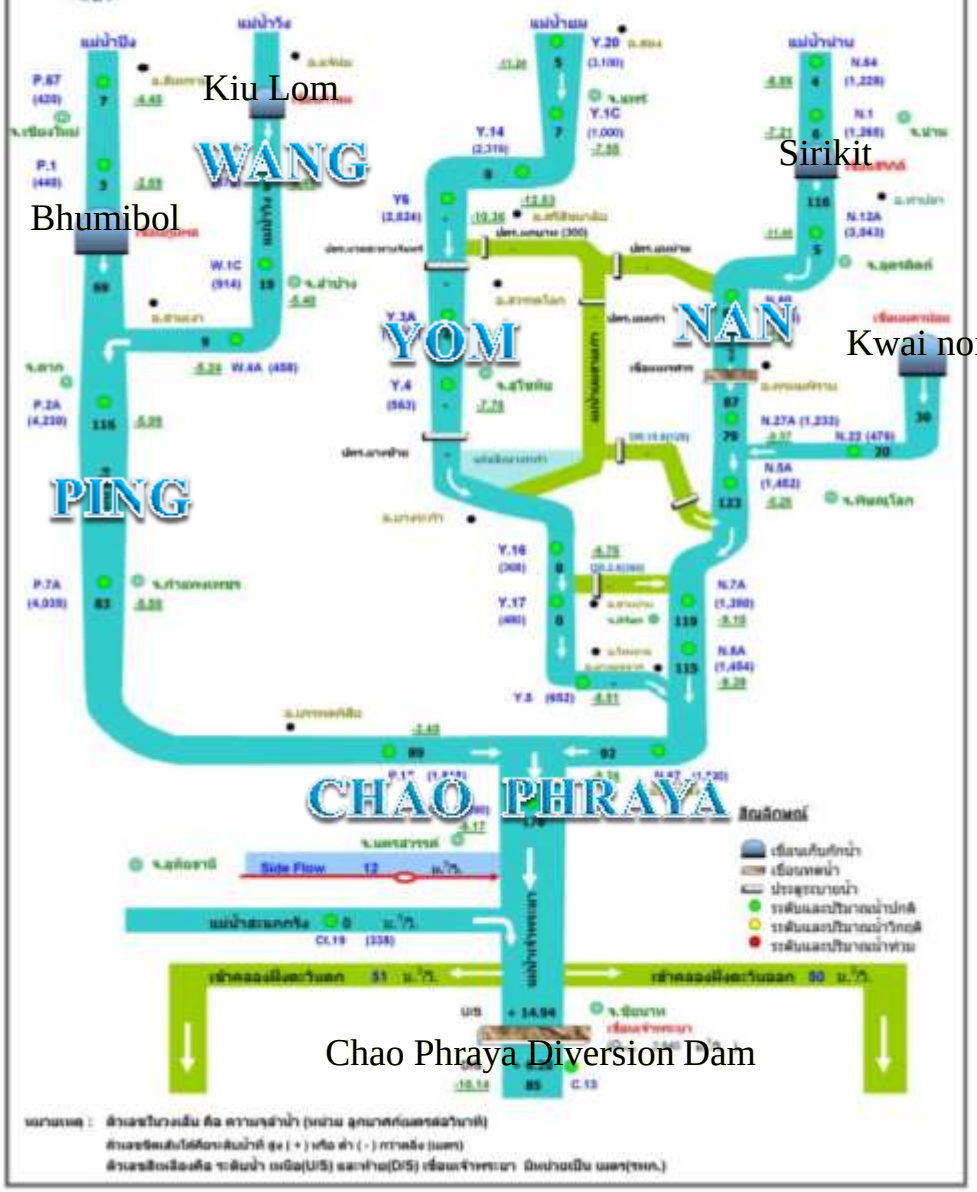


	Watershed Area (km^2)	Annual Rainfall (mm)	Rainfall (MCM)	Runoff (MCM)	%rainfall-runoff	% Watershed Area
Gulf of Thailand	282,000	1,560	440,000	118,000	27	55
Khong	190,000	1,470	280,000	56,000	20	35
Andaman	40,000	2,000	80,000	24,000	30	10
Total	512,000	1,560	800,000	200,000	25	100

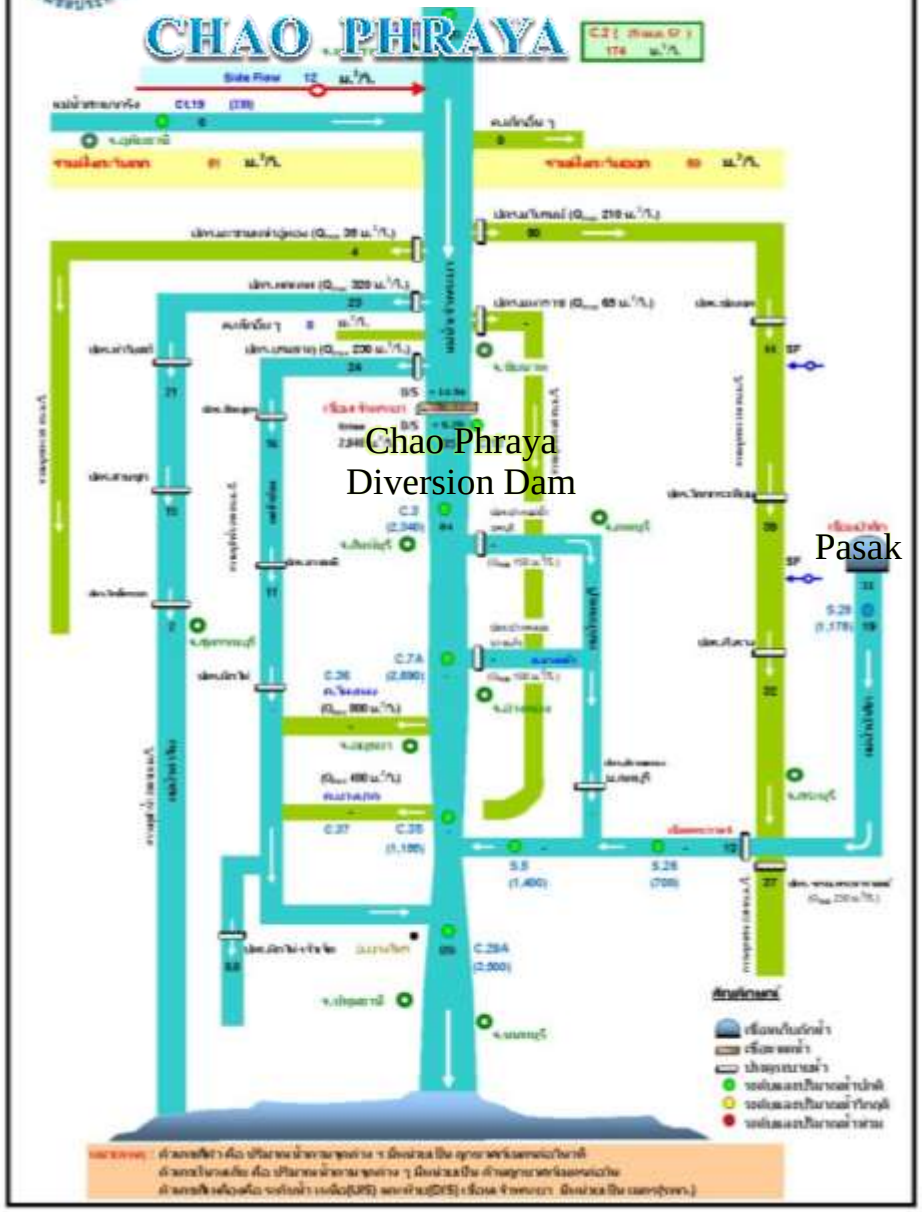
Chao Phraya Basin



Upper Chao Phraya



Lower Chao Phraya



(1) Flood Management since 1980

1980: Flooded because of 4 days of more than 200 mm. rain.

1980: His Majesty King Bhumipol proposed 5 methods for resolving the problem

1983: Flooded for 3-5 months because of several cyclones

1 Oct 1987: RID transferred pumping stations along Chao Phraya river to BMA because of Decentralization Policy

1994-1999: Pasak Jolasid Dam initiated by His Majesty the king

1995: Flooded. The rapid growth of Bangkok city, green belt area decreased.

(1) Flood Management since 1980

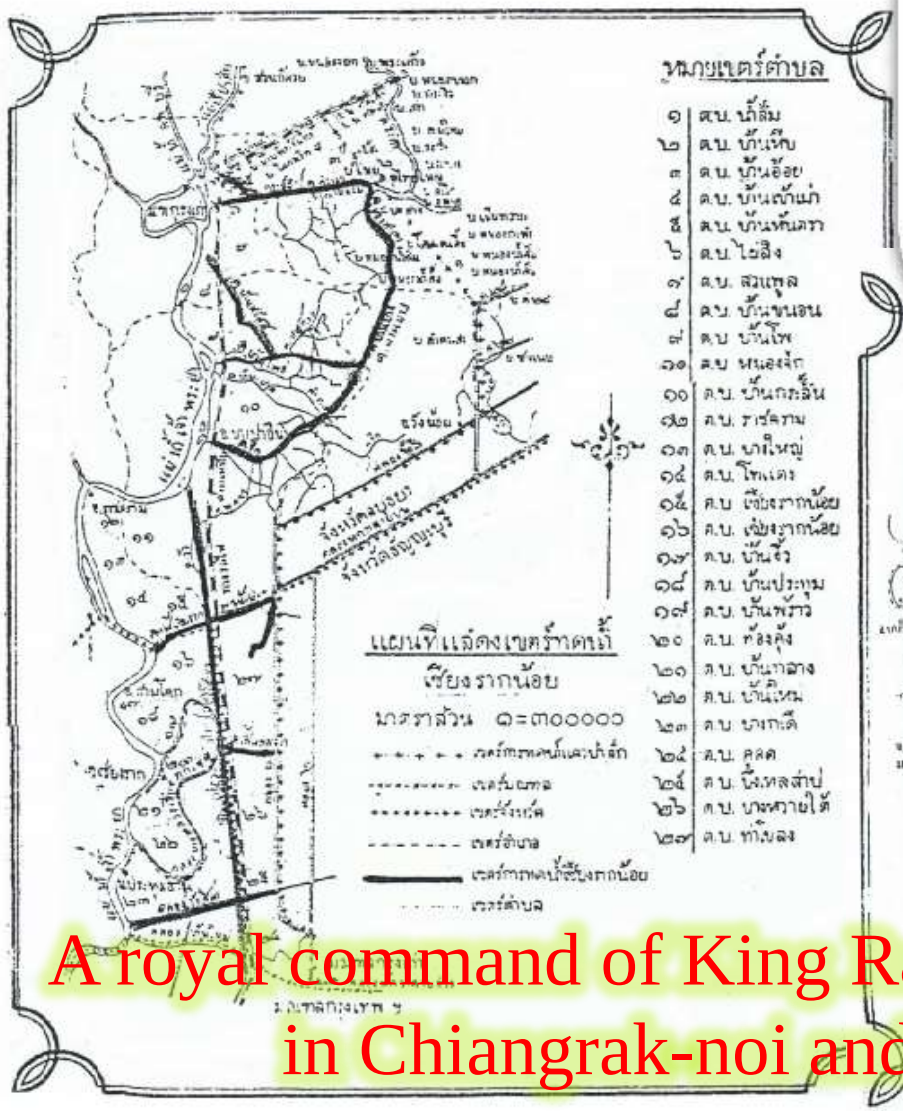
2002: The Khlong Lat Pho Floodgate Project initiated by His Majesty the king

2004: Drainage Project for Suvarnabhumi Airport

10 November 2004: Because of Civil Service Reform, RID transferred pumping stations and flood gates of King Dike to BMA following the instruction of Bureau of the Budget

2006: Flood in Bangkok, Pumping stations and flood gates did not operate functionally.

2009: The great flood; 2 main courses are failure pumping station and flood gates operation, and political issues

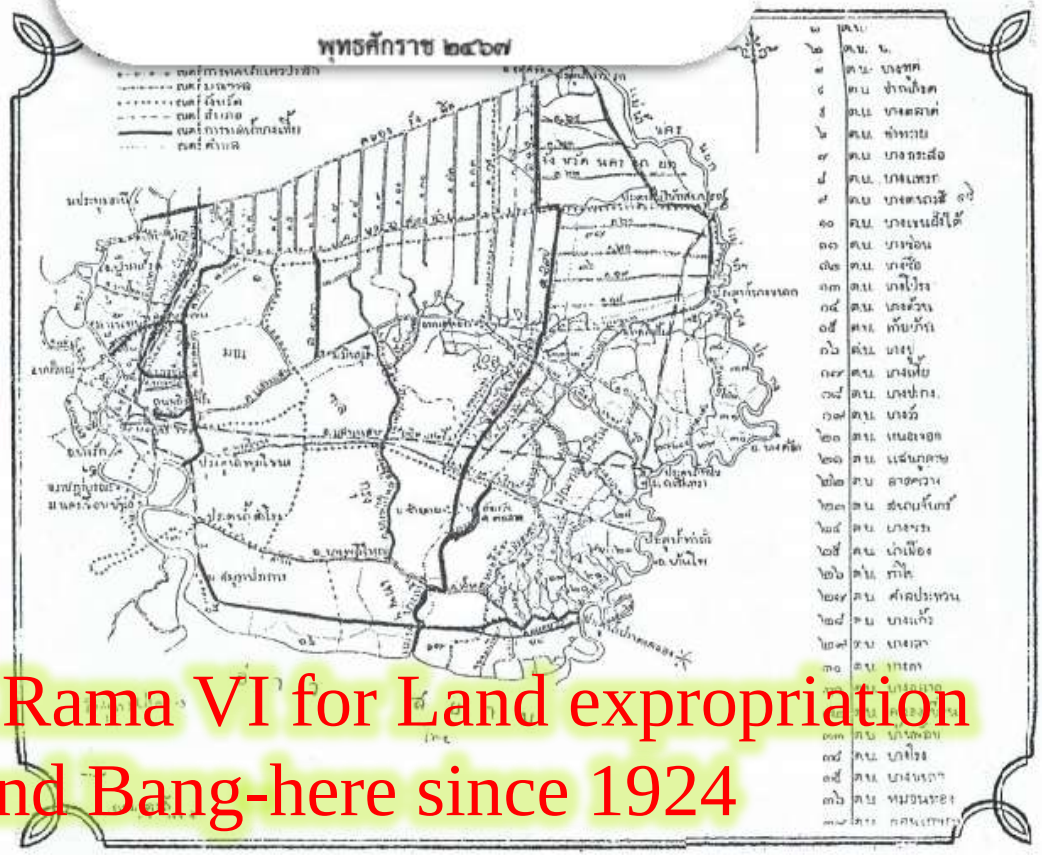


ประกาศกระแสร์พระบรมราชโองการ

เรื่องขยายการหวงห้าม และจัดซื้อที่ดิน

สำหรับสร้างการทดน้ำไขน้ำในบริเวณเชียงรากน้อยและบางเหี้ย

พุทธศักราช ๒๔๖๗



A royal command of King Rama VI for Land expropriation in Chiangrak-noi and Bang-here since 1924

(1) Flood Management since 1980

HMK studies maps of Bangkok with BMA officials during 1980 heavy Flooding in Bangkok

After serious flooding in Bangkok in 1980, His Majesty King Bhumipol proposed 5 methods for resolving the problem.

1. Accelerate water drainage to the sea through canals at the eastern part of Bangkok;
2. Allocate green belt areas to prevent the expansion of the city, and use these areas for drainage routes during high run-off periods;
3. Set up flood protection systems;
4. Construct retention basins ("Monkey Cheek") in various locations in the city to support the flood prevention programs;
5. Enlarge and/or clear the waterways where the highways and railways pass through

(1) Flood Management since 1980

1980: After His Majesty King Bhumipol proposed 5 methods for resolving the problem, the government was unable to implemented because of budget.

1983: Flooded in Bangkok again, the government determined to implement flood protection methods following His Majesty King Bhumipol initiation.

(1) Flood Management since 1980

The 1983 flood caused 400 million baht of damage to farmland and orchards in Bangkok and 462 million baht damage to the city's roads, as demonstrated by this shot of the Central Lat Phrao shopping mall on Phahon Yothin Road.

The 1983 flood cost the Thai economy 6.6 billion baht, including damages to this Bangkok bus factory.

Fifty-five Bangkok residents died and 200,000 homes in the eastern sub-urbans alone were damaged by the 1983 flood.

http://www.bangkokpost.com/multimedia/photo/262533/splash-from-the-past

(1) Flood Management since 1980

1983: Flood Prevention and Mitigation for Bangkok Metropolitan Region Committee was appointed;

• Gen. Prachuab Soontrangkul (Deputy Prime Minister) as the chairman

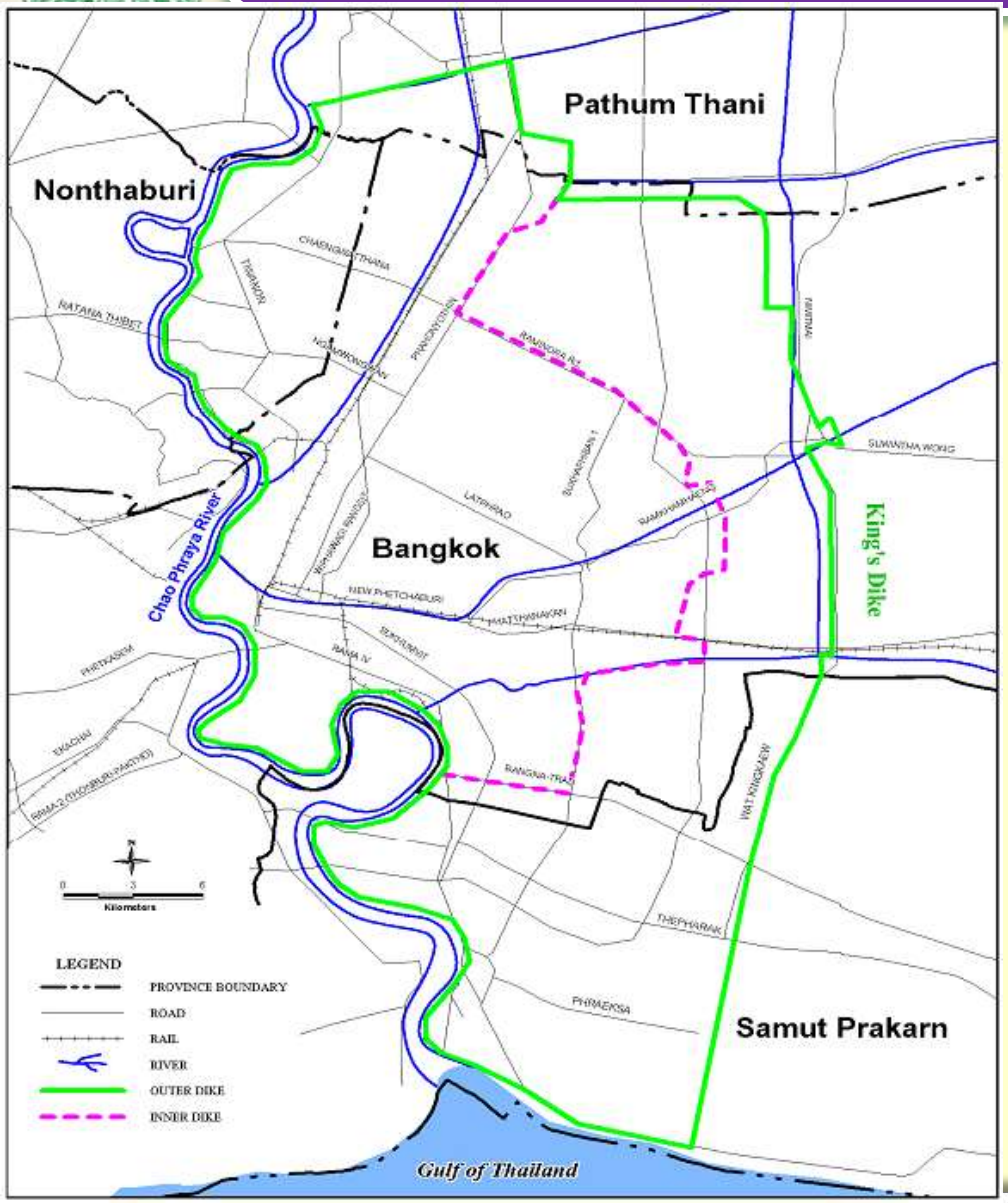
Dr.Anat Apapirom as the chairman of Technical Sub-committee. At that time, he was the president TDRI.

(1) Flood Management since 1980

Technical Sub-committee included all relevant agencies in Bangkok Metropolitan Region

- Royal Irrigation Department
- Department of Highway
- Department of Drainage and Sewerage, BMA
- State Railway of Thailand
- Department of Public Works
- Samut Prakan Province
- Etc.

(1) Flood Management since 1980



After 1983 flood in the Bangkok City due to heavy rainfalls resulted in severe flooding for 4 months in Rangsit irrigation areas (the north and east of Bangkok). The King recommended the King's Dike since 1980 in the northern and eastern boundaries of Bangkok to protect the rain waters from flowing into the city. The Government began constructing in 1983.

(1) Flood Management since 1980

1994-1999: Pasak Jolasid Dam initiated by His Majesty the king

(1) Flood Management since 1980

In 1995 Bangkok witnessed the worst flooding in the city's history with water levels reaching 2.27m. The flood lasted from October to November with an estimated 2.6 million people affected in the city.

Parked Daewoo meter-taxis are half-submerged near an office in Charan Sanitwong in 1995. Flood damages across the country ran into billions of baht.

A man inspects a drain in front of Government House in1995. Many flood victims complained about a lack of assistance from government agencies. Residents of Bangkok Noi reported that their MPs disappeared during the crisis.

http://www.bangkokpost.com/multimedia/photo/262533/splash-from-the-past

Flood Mitigation Measures

Royal Intention Project Committee under the Crown Property Bureau has done a research on a master plan for water resource management, development and coordination among the relevant agencies in Chao Phraya river basin since 2000

Flood Mitigation Measures

Urban Polder

Reservoir Operation

Short Term in 5 year

Reservoir

Chao Phraya Delta Retention

Medium Term in 15 years

Reservoir Construction

Upstream Retention

Long Term in 25 years

Crown Property Bureau, 2000

(1) Flood Management since 1980

2006-2010 The Khlong Lat Pho Floodgate Project initiated by His Majesty the king

Chao Phraya River flowed to the sea over an 18-km distance through the area of Bang Krajao, with the water's journey taking about five hours. Klong Lad Pho sluice gate, helped shorten the journey to only 10 minutes over a 600-metre distance

Drought Management by RID

Missions of RID consist of:

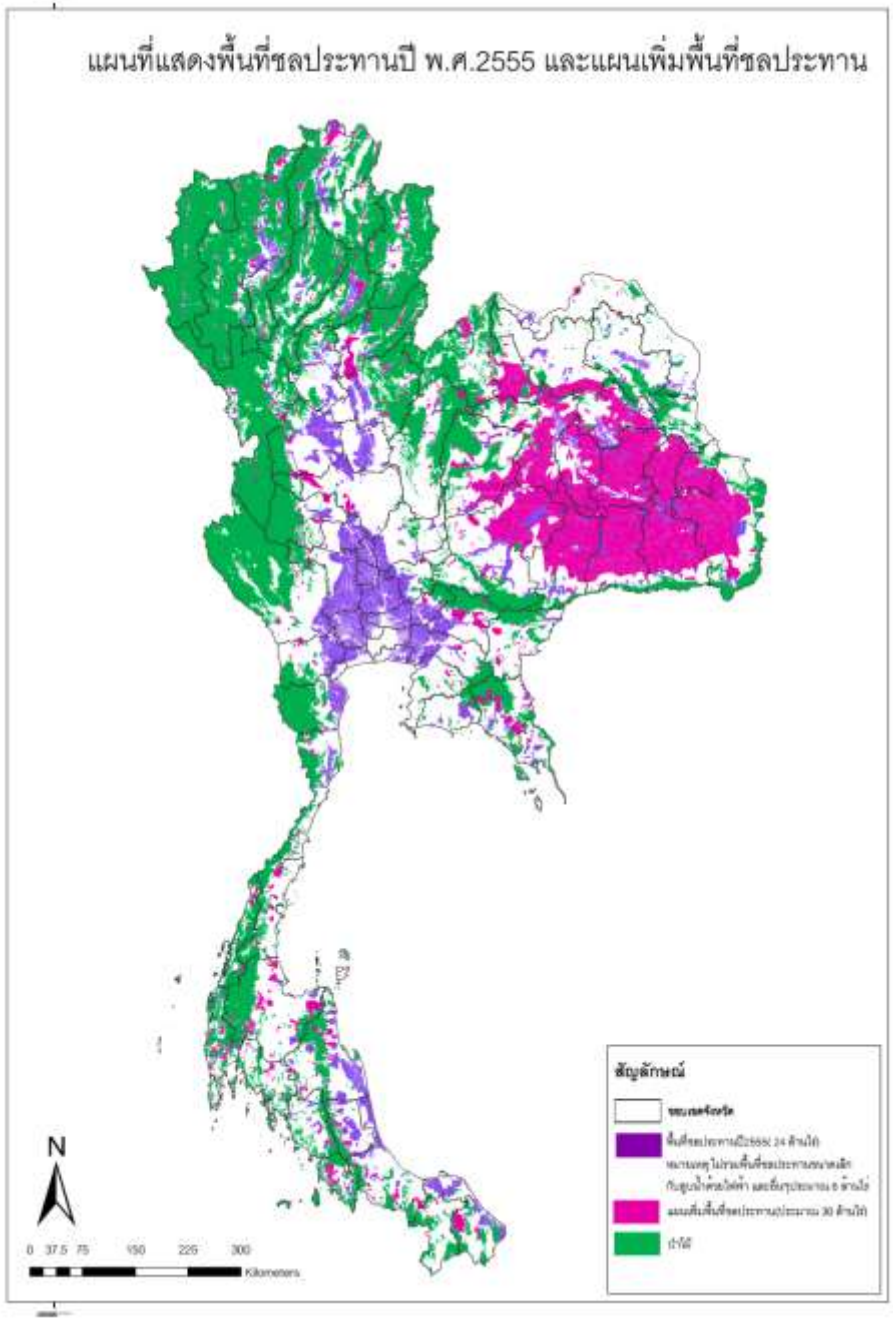
1) To develop water resources and increase irrigation areas according to their potential and natural balance.
2) To manage water allocation in equitable and sustainable manners.
3) To prevent and mitigate water hazards. (Agriculture Area)
4) To encourage people participation in water resources management and development at all levels and in comprehensive manners.

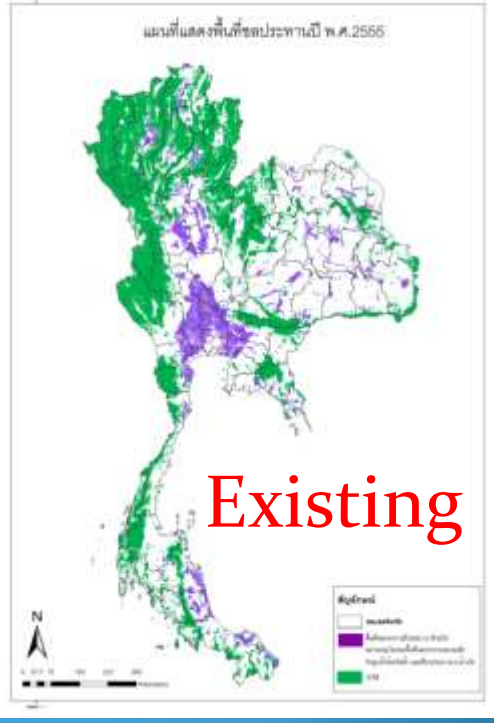
As the role of the development of water resources, RID has *a master plan for an expansion of irrigated area for 30 million rais* that reach a full potential. This expansion will be *included the existing area 30 million rais.* Totally, the future plan aims to have potentially irrigated area of ***60 million rais.***

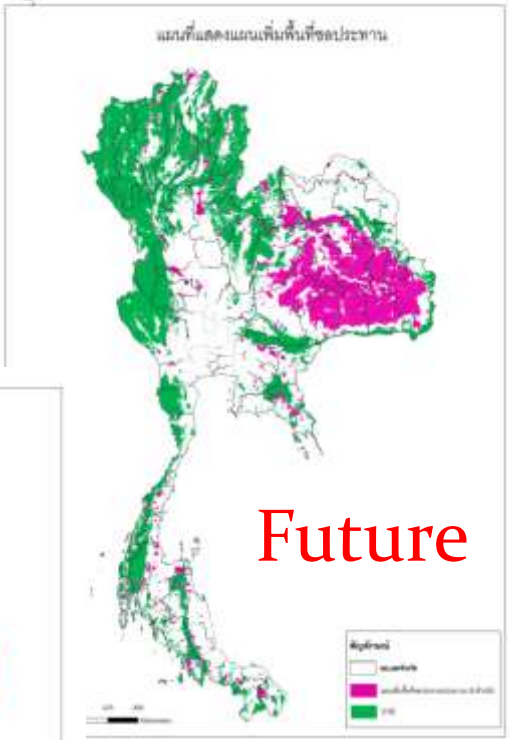
Particularly, the large scale resources will play a significant role to store a big volume of water in rainy season. This leads to alleviate inundation at downstream area. Additionally, such stored water would be utilized in a dry season and even in a dry spell in the next rainy season.

Irrigated Area

60 million rias





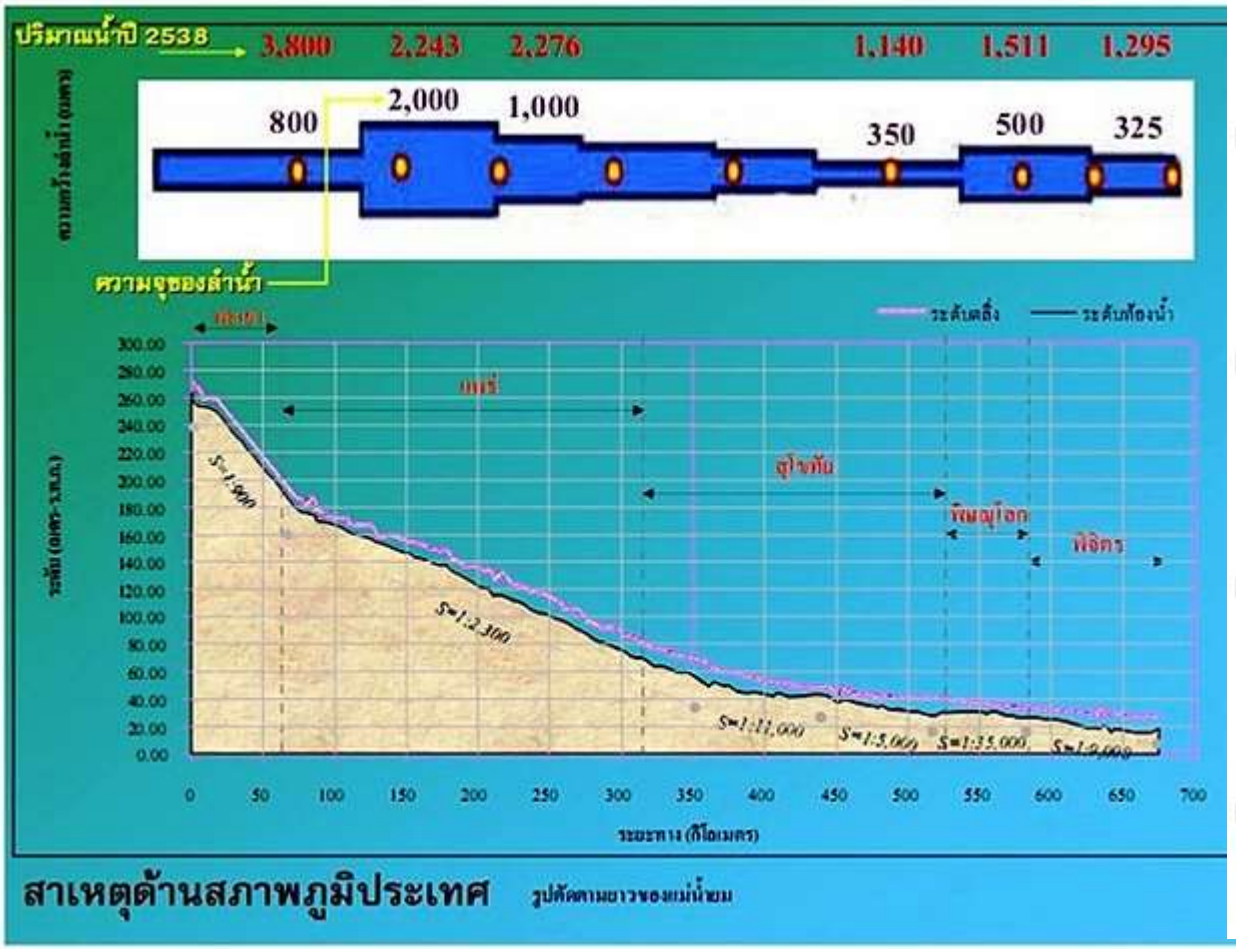


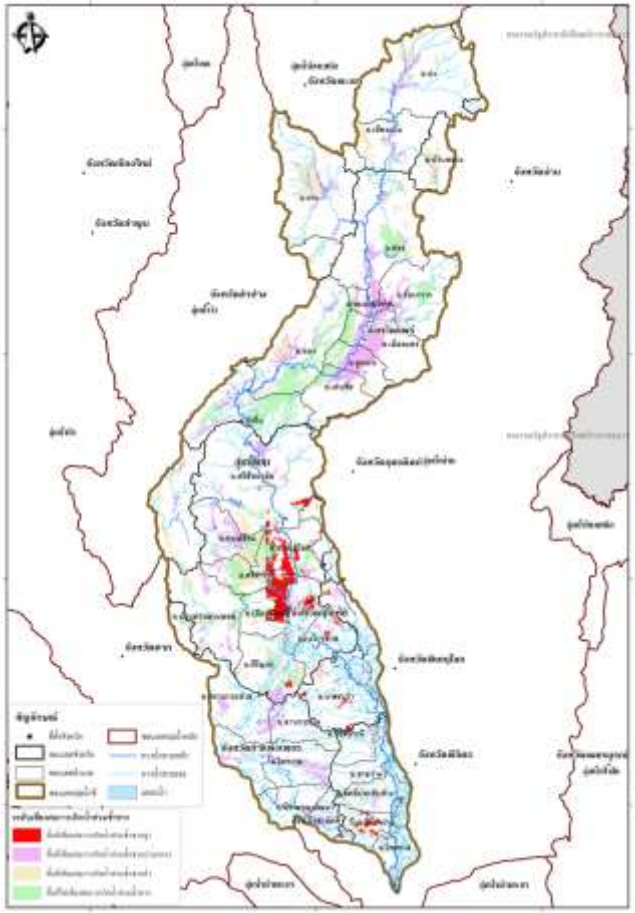
Drought Management by RID

The development of water resources has not been reach a goal as planned because of two factors – *acceleration and retardation*.

Acceleration	Retardation
1. Increase of water demand • a gigantic inundation as occurred in 2011, numerous irrigation structures and dikes were damaged because of old tools, the less potential of infrastructures.	1. Insufficient budget • a budget is significant for infrastructure development, government who formulate policy have to prioritize projects appropriately.
2. Climate variability • To make a decision for more appropriate water management, past inundation and drought events are therefore included to analyze. Accordingly, it seems that RID concentrates to protect for flood or tackle water shortage year by year.	2. Conflict between development and conservation • To tackle the conflict, conformity among community; local, region, and nation, is needed under a basis of variation on topographical, sociological, and knowledge-based conditions in each community, local, and region

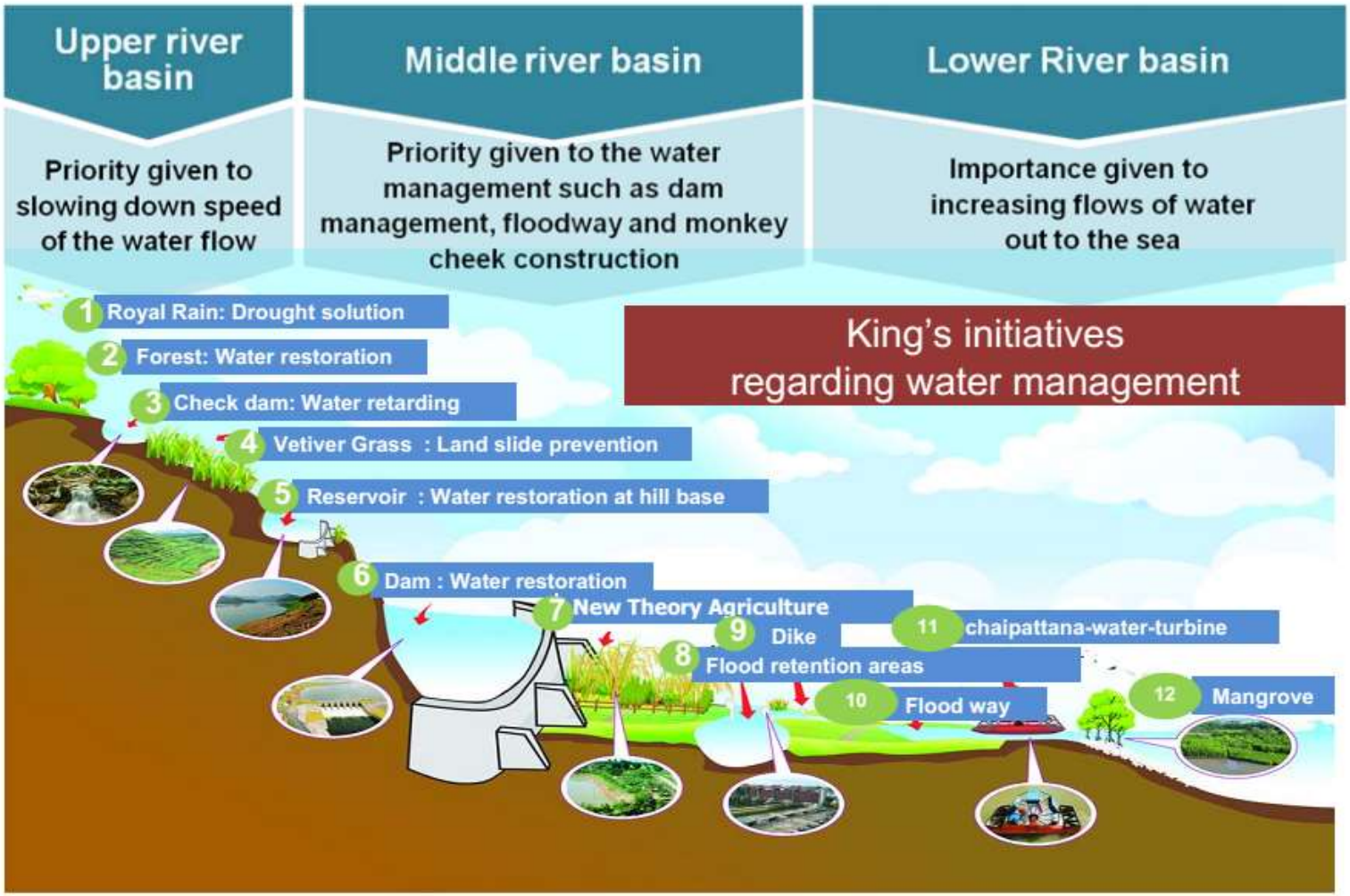
Yom Basin





Longitudinal profile of Yom river

Flood Management by RID in the past VS The Water and Flood Management Commission



Drought Management by RID

RID has strong and weak points for this mission as follows:

Strong	Weak
1. A clear vision: RID supports the cultivation with less water use but more economical value rather than supporting a dry season rice. A renew cropping calendar – one crop in rainy season and one crop in dry season is implemented in Chao Phraya River basin. Because of Rice Subsidies scheme (Government Policy), the famers cultivate 3 crops/year .	A lack of responsible staff responsible for monitoring, operating, and controlling water use corresponding to the amount of allocated water in each sector. The water stored for utilizing at the onset of the rainy season is therefore released for the demands in this dry season instead. Such problem will be more severer if the occurrence of the rainy-season onset is delay or less amount. This difficulty was happened in the rainy season of 2010. A crop growing was shifted to next two months in the Chao Phraya River basin. Only a request for cooperation from water users was done in this situation
2. A clear regulation (1) To allocate water for the water sectors, RID plans for the allocation based on an engineering principle (2) Prioritization on water allocation in diverse water users is another important issue (3) A productive cooperation among related government agencies, ie, RID, EGAT, MoAC, DOAE, etc	

Flood Management by RID in the past VS The Water and Flood Management Commission

Flood Management by RID in the past

- **Agriculture area in The Bangkok Metropolitan Region as the natural detention area and Green Belt.**
- **King Dike**
- **Revision of Reservoir Operation Rule Curves**
- **Set up warning criteria, i.e. flow rate 3,500 cms at Bangsai will affect to Bangkok**

Flood Management by RID in the past VS The Water and Flood Management Commission

Flood Management by Water and Flood Management Commission (9 Modules)

- **Module A1: Construction of suitable and sustainable reservoirs in Ping, Yom, Nan, Sakae Krang and Pasak river basins**
- **Module A2: Land use mapping, Land utilization plan and construction of flood protection measures for communities and major economic areas in the Chao Phraya river basin**
- **Module A3: Temporary flood retention areas**
- **Module A4: Improvement of main waterways and prevention of erosion along the river banks in the Yom, Nan and Cha Phraya river**
- **Module A5: The construction of flood diversion channel**
- **Module A6 & B4: National data center**
- **Module B1: Construction of suitable and sustainable reservoirs in the areas of 17 river basins**
- **Module B2: Land use mapping, Land utilization plan and construction of flood protection measures for communities and areas of economics importance in 17 drainage basins**
- **Module B3: Improvement of main waterways and prevention of erosion along the river banks in the areas of 17 drainage basins**

Flood Management by RID in the past VS The Water and Flood Management Commission

Flood Management by Water and Flood Management Commission (9 Modules)

There are no any significant differences from the past, both of structural and non-structural measures. The differences are the classification of the program / project, selection method of consultant companies, and implementation as soon as possible. This is a weakness; lack of participatory approach, transparency. Finally, the relevant departments will be responsible for the construction work and operate, while the Water and Flood Management Commission is the only an organizer. The only a strong point is that it is rapidly respond to the targets.

Flood Management by RID in the past VS The Water and Flood Management Commission

Design and Built

Design and built, initially, the project owner has only a Project Brief, which identifies the key requirements of the project. The Design-Builders will submit a proposal to provide both design and construction detail. Differently, Design – Bid – Built, the project owner must finish detail design and bid later.

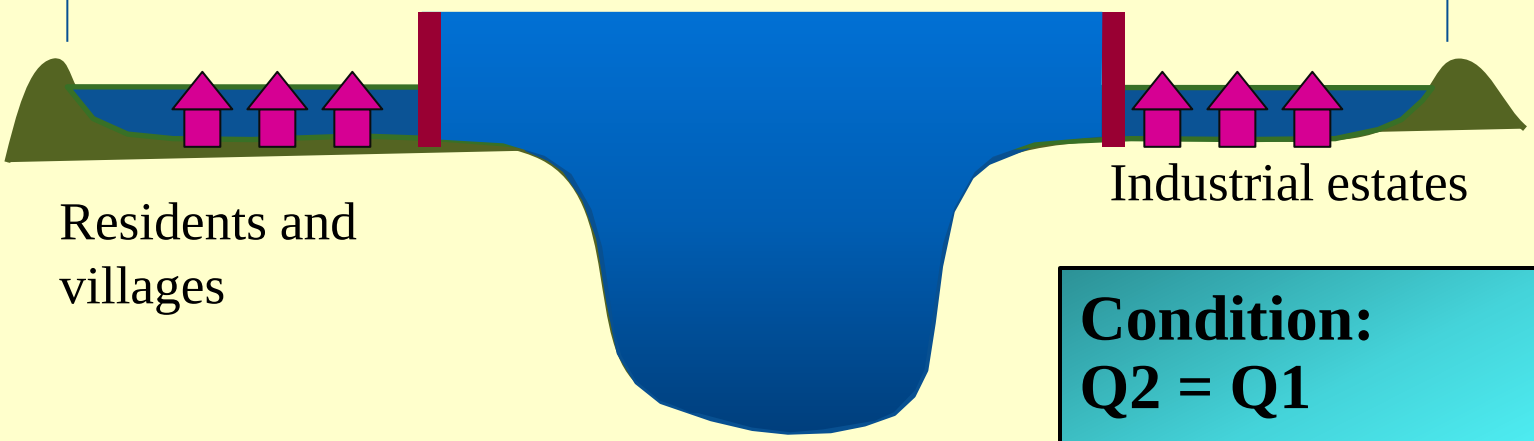
Advantages : design–build relies on a single point of responsibility contract and is used to minimize risks for the project owner and to reduce the delivery schedule by overlapping the design phase and construction phase of a project.

Disadvantages : Loss of Control of Project Design; if the Owner has specific needs or requirements, it should accept the risk that it will have to pay extra to get what it wants via the change order process. There will be hidden faults of construction.

Decreasing of Water Room

$$Q_1 = A_1V_1$$

$$Q_2 = A_2V_2$$



Condition:
Q2 = Q1
V2 >V1

Failure of Irrigation Structures

Bang Chomsri sluice gate in Sing Buri

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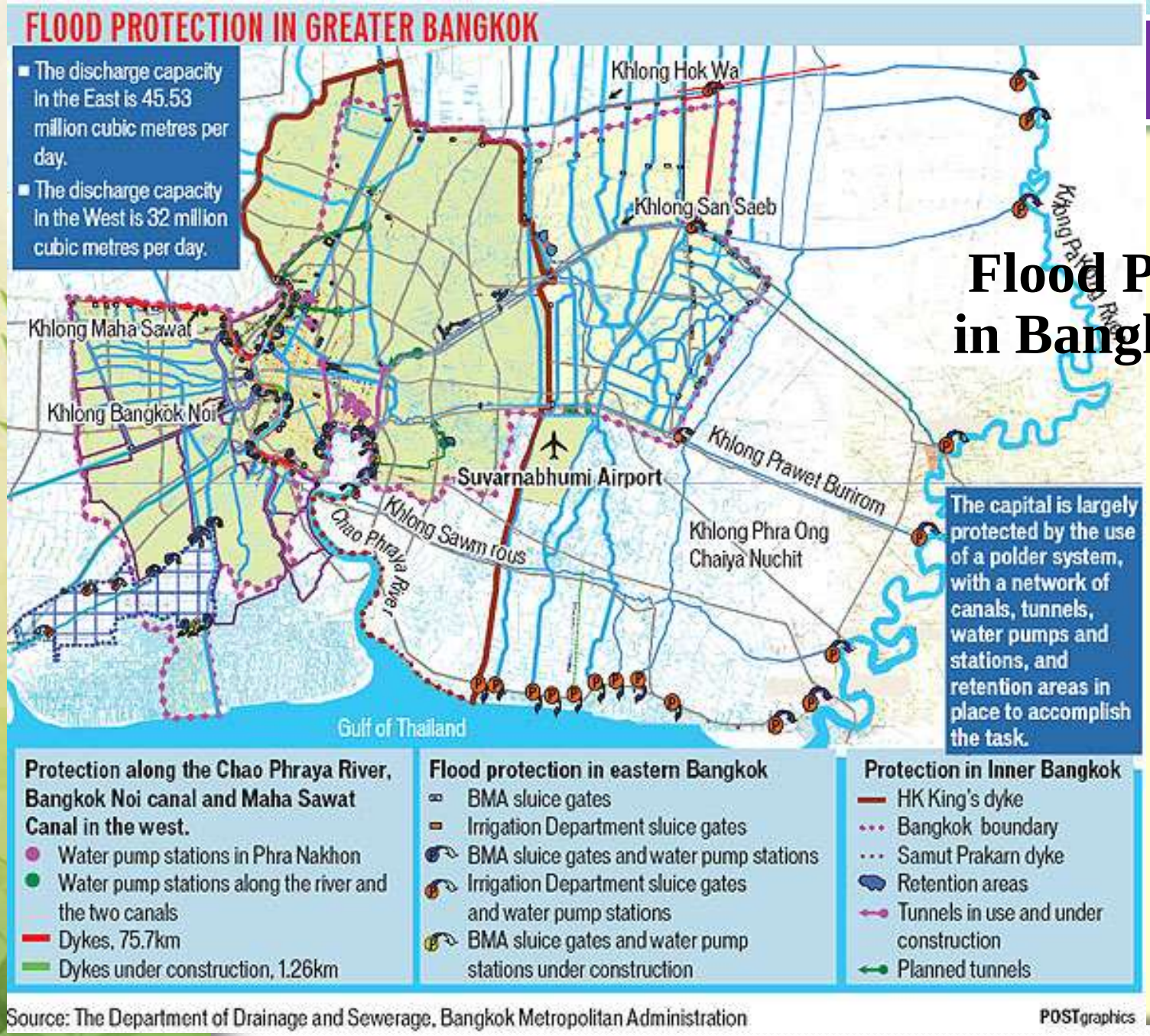
Flood Protection in Bangkok, 2011