The Comprehensive Study of Additional Water Supply to Chao Phraya Basin from Nearby Basins

Estimation of Future Water Status through Water Balance Analysis

Contents

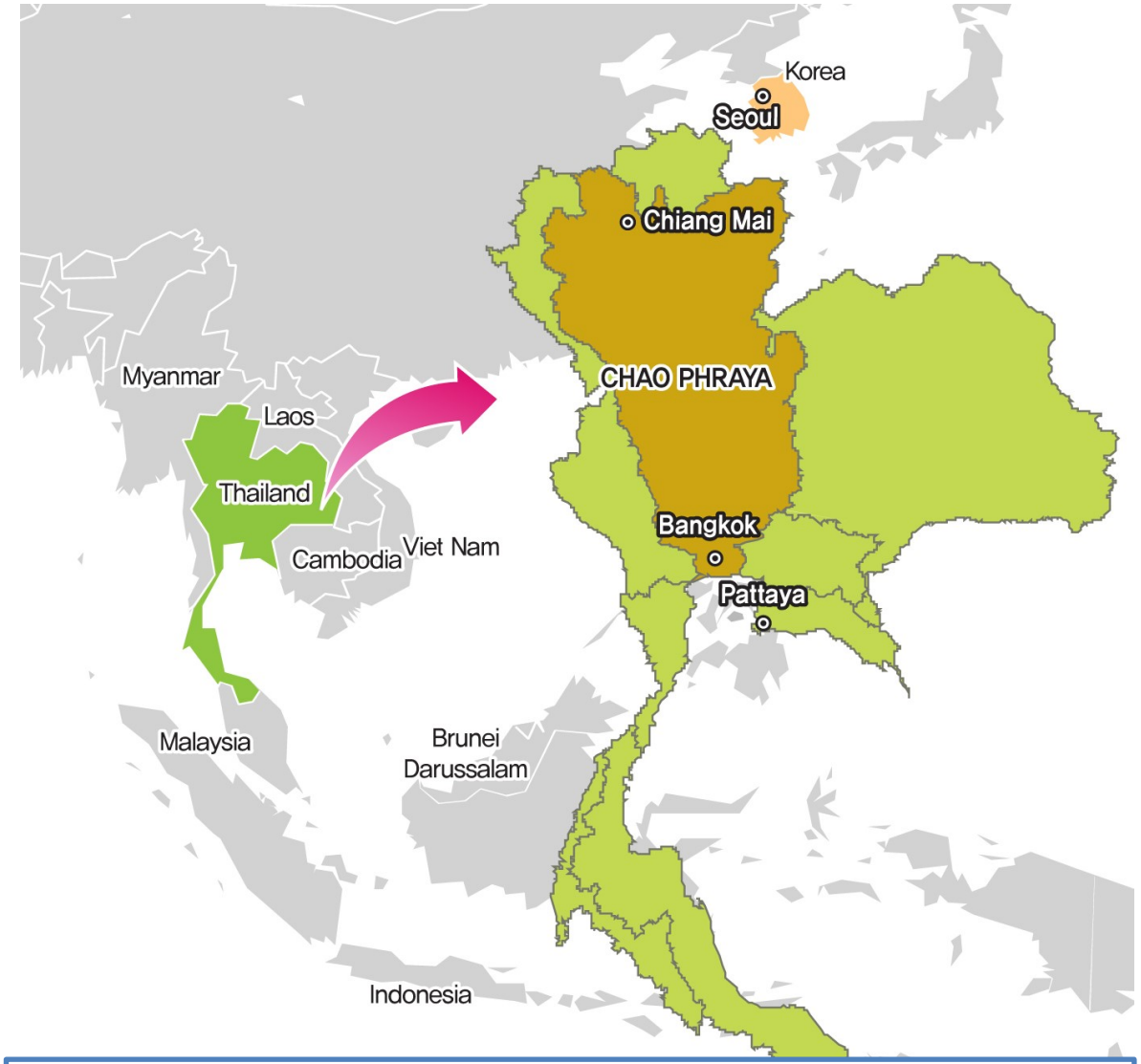
Ⅰ. Project Overview

1. Outline

2. Progress Status

01 Outline

Project Area



- Period: Jun. 2, 2016 - Feb. 26, 2017
- Project area: Chao Phraya Basin & Nearby basins

Purpose

Extreme water shortage in Chao Phraya Basin, Thailand

Establishing additional water supply plan & water resources development plan

Stable Water Supply	Solution for Water Scarcity	Promotion of Cooperation Relationship in Water Field

02 Progress Status

- Jun. 02, 2016 : Commencement of project
- Jun. 14, 2016 : Inception & 1st consultation workshop(Korea)
- Jun. 17, 2016 : Consultation meeting with RID(Thailand)
- Jul. 14, 2016 : Inception workshop(Thailand)
- Aug. 09, 2016 : Working group meeting(Thailand)
- Oct. 27, 2016 : Interim & 2nd consultation workshop(Korea)
- Dec. 08, 2016 : 1st interim workshop(Thailand)
- Feb. 06, 2017 : 2nd interim workshop(Thailand)
- Feb. 10, 2017 : 3rd consultation meeting(Korea)
- Feb. 23, 2017 : Final draft-meeting(Thailand)

Ⅱ. Status Survey

1. General

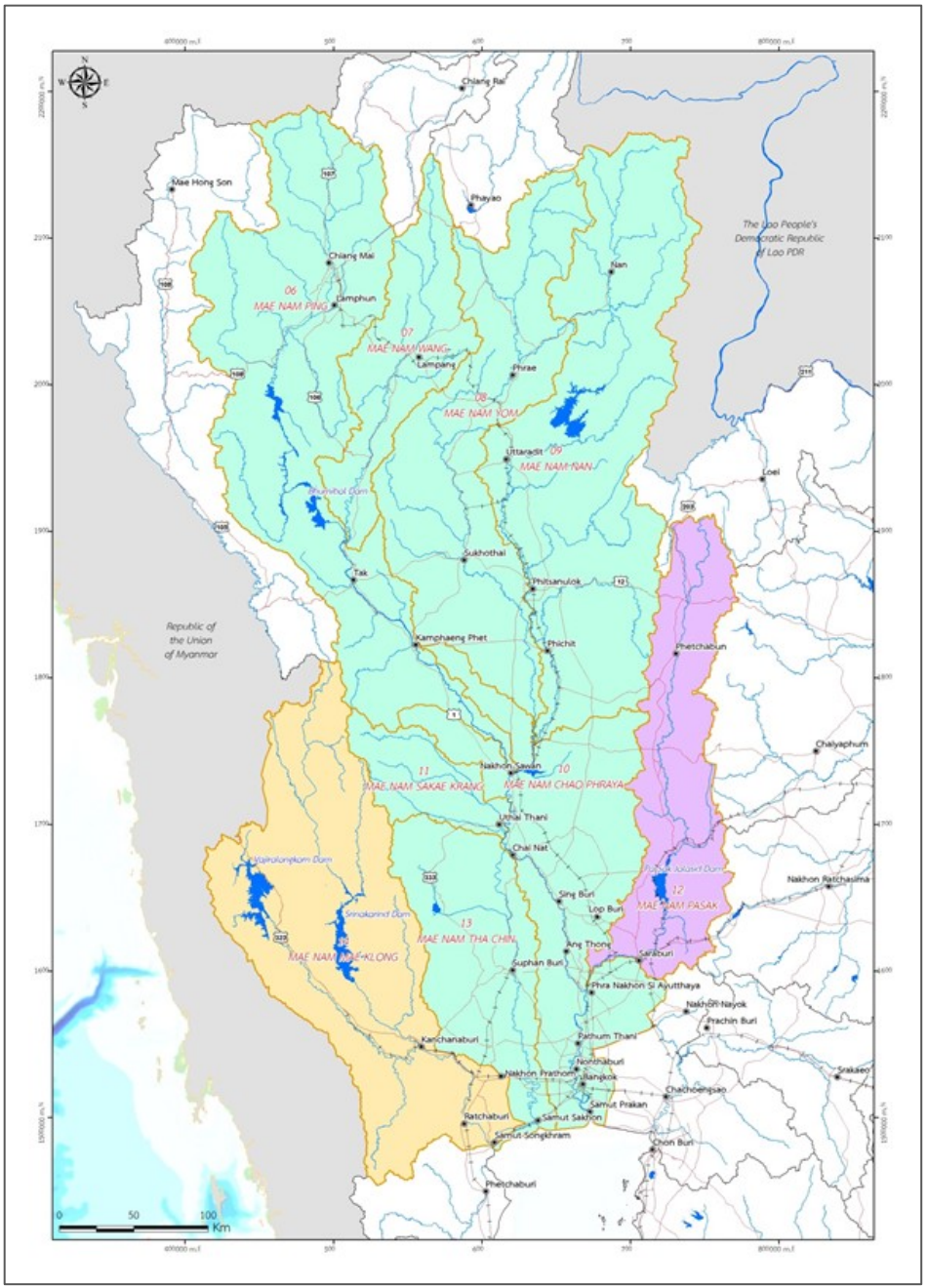
2. Climatology

01 General

General status of Thailand

Country	The Kingdom of Thailand
Location	Southeast Asia (5.6~20.7 degrees North Latitude, 97.3~105.7 degrees East Longitude)
Administrative division	1 capital city (Bangkok), 1 special governed city (Pattaya), 77 provinces
Area	513,000㎢ (some 2.3 times as large as the territorial area of the Korea peninsula)
Climate /Ann Prec.	Tropical monsoon
Capital	Bangkok
Population	68.25 million
Language	Thai
Religion	Buddhism (94.6%), Muslim (4.6%), Others (0.8%)

01 General



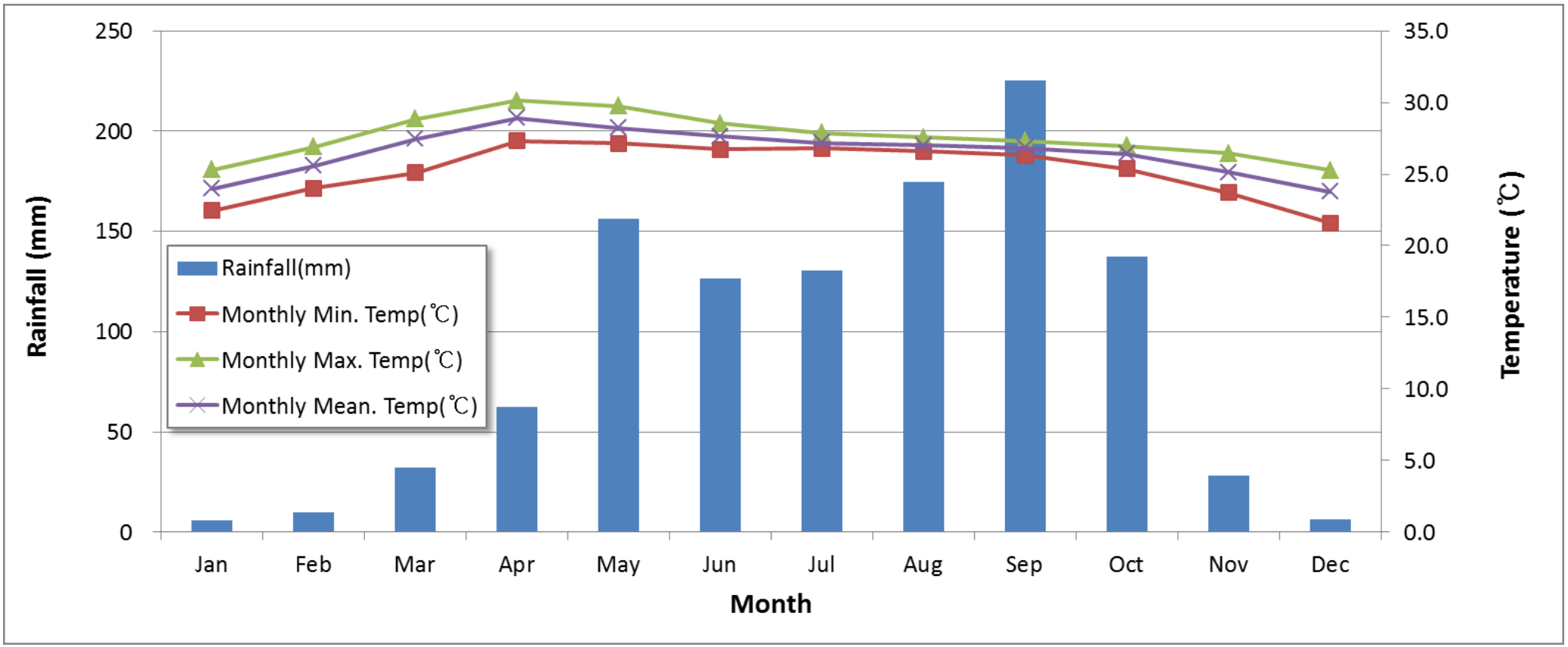
General status of Chaophraya basin

Basin	Chao Phraya river basin
Area	158,592 km ^{2}
Sub-basin	8 Sub-basins (Ping, Wang, Yom, Nan, Sakae-Krang Pasak, Thachin, Lower Chaophraya)
Landuse	Agriculture : 45.2 % Forest : 43.3 % Urban : 6.3% Others : 5.2%
Total Water resources	173,593 MCM (Yearly Rainfall : 1,088.1mm)
Annual Runoff	35,424 MCM
Runoff Rate	20.4 %

02 Climatology

Rainfall & Temperature

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Rainfall(mm)	6.2	10.9	33.3	64.2	156.5	124.3	130.0	174.2	220.8	134.2	27.4	6.3	1,088.1
Mean monthly temperature (℃)	24.0	25.6	27.5	28.9	28.2	27.6	27.2	27.0	26.8	26.4	25.1	23.8	26.5



- Tropical monsoon climate characteristic by high temperature and humidity
- 2 distinct season : the wet season (May to October) and the dry season (November to March)

Ⅲ. Analysis of Water Resources in Chao Phraya Basin

1. The Concept of Study
2. Available Water Resources
3. Water Balance Analysis
4. Strategy Setup for additional water supply

01 The Concept of Study

Basic Concept

01

Survey and evaluate the available water resources in Chao Phraya river basin

"How much water is available or needed in Chao Phraya river basin?"

➔ Water Balance Assessment : Analyzing water shortage in sub-basin

02

Formulate a comprehensive plan for additional water supply from the nearby basins

"If water shortage happened, How can we supply the additional water?"

➔ Planning Water diversion from Mae Klong , Pasak and Salawin river basin

03

Preliminary Feasibility Study considering the priority of countermeasure projects

"What is the best project for solving the issue?"

➔ Support project implementation with structure-planning with economic analysis index

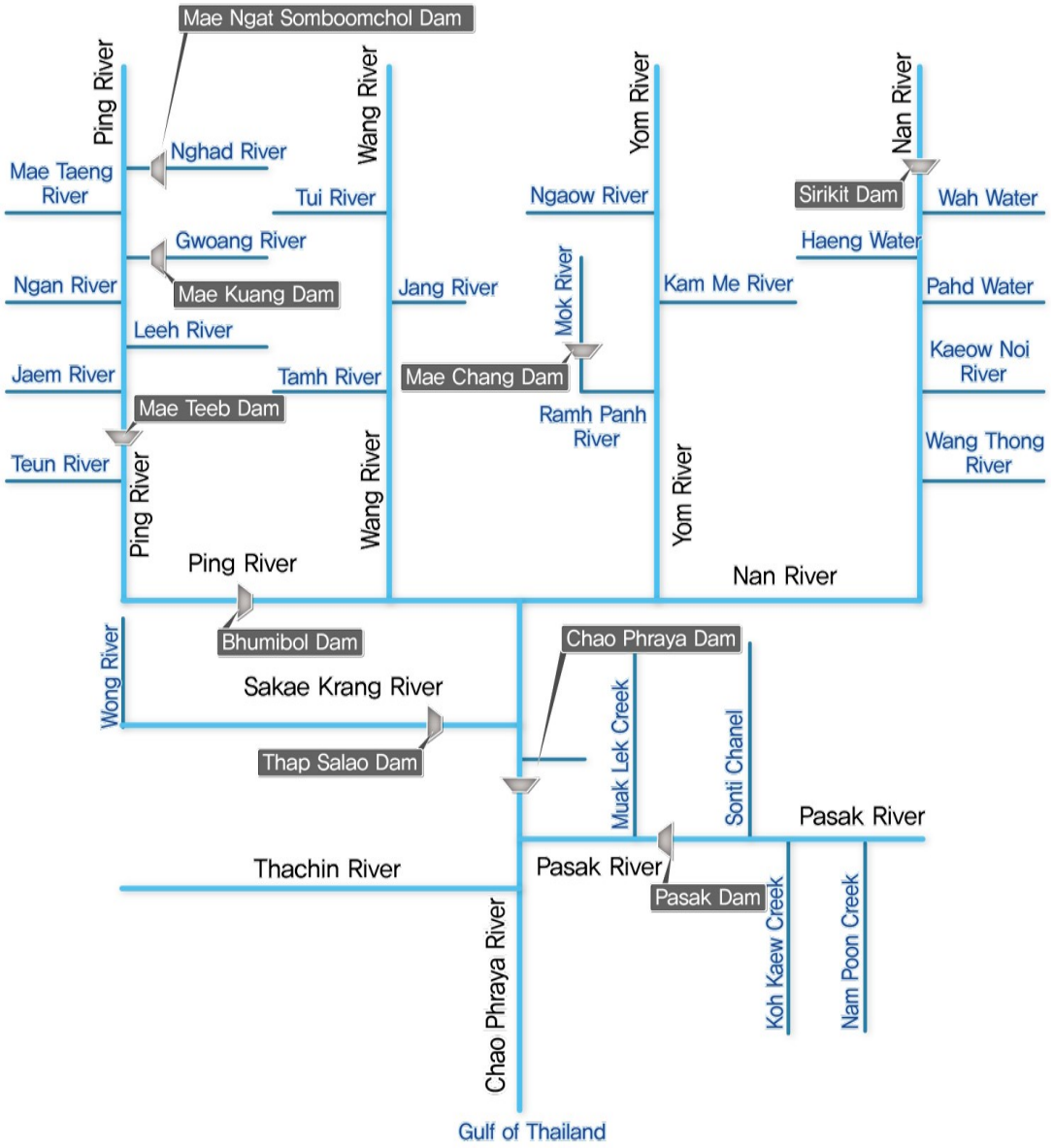
02 Available Water Resources

Available Water Resources in Chao Phraya Basin

Average annual precipitation & runoff (1986~2015yr)

Basin	Precipitation (mm)	Runoff (MCM)	Runoff Rate (%)
Ping	1,029.7	9,044	25.5
Wang	1,042.3	1,663	14.8
Yom	1,118.2	4,166	15.6
Nan	1,195.9	12,428	29.8
Sakae Krang	1,132.8	1,269	21.0
Pasak	1,117.0	2,921	22.2
Tha Chin	1,045.1	1,437	10.2
Chao Phraya	1,024.1	1,748	8.3
	(Avr.) 1,088.1	(Total) 35,424	20.4

- **Precipitation data:** Historical monthly rainfall records for the recent 30 years (218 stations)
- **Runoff data:** Historical monthly flow records for the recent 30 years (138 stations)



03 Water Balance Analysis

Water Demand of each sub-basin

Basin	Water Demand (MCM/yr)			
	Present	2020	2025	2035
Ping	3,692.7	3,786.0	3,879.1	4,261.8
Wang	320.3	392.0	463.4	477.4
Yom	2,128.2	2,394.0	2,661.1	2,774.1
Nan	3,807.8	4,259.0	4,710.8	4,930.6
L. Chao Phraya + Tha Chin	19,342.8	19,968.0	20,591.2	22,296.5
Sakae Krang	583.0	585.0	585.6	1,188.4
Pasak	1,388.3	1,456.0	1,524.6	1,720.5
Total	31,263.0	32,840.0	34,415.8	37,649.3

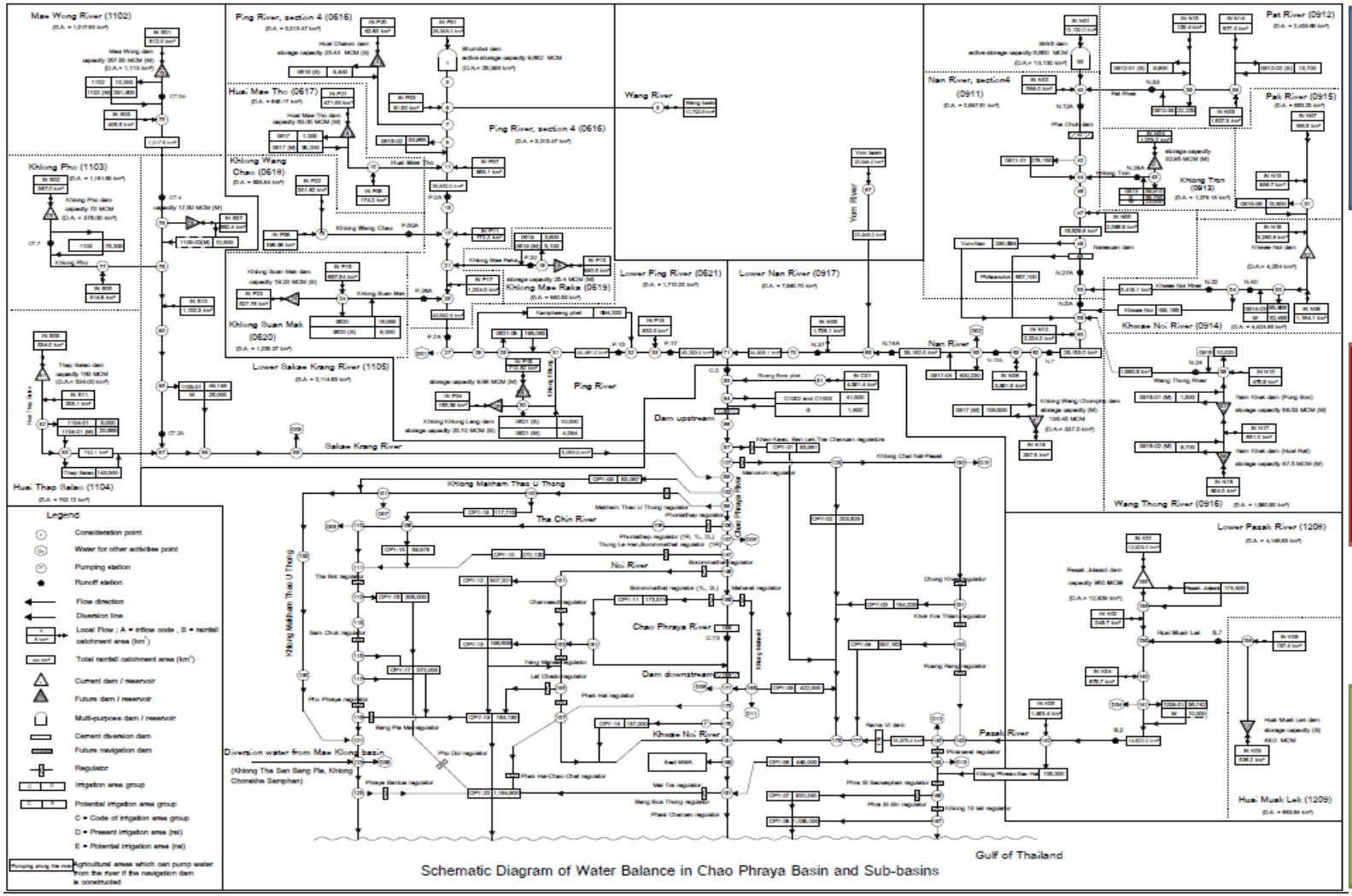
03 Water Balance Analysis

Water Demand of each water usage

Item	Present	2025	2035
Domestic (MCM/yr)	3,271.6	4,395.1	5,910.3
Industrial (MCM/yr)	2,371.1	2,589.3	2,827.6
Agricultural (MCM/yr)	25,305.3	27,057.6	28,419.5
Total (MCM/yr)	**30,948.0**	**34,042.0**	**37,157.4**
River maintenance flow (Station C2, ㎥/s)	175.0	175.0	175.0

03 Water Balance Analysis

WBA (Water Balance Analysis – K-MODSIM*)



Schematic Diagram of Water Balance in Chao Phraya Basin and Sub-basins

01 Build a model for water balance analysis for the Chao Phraya Basin (with K-MODSIM)

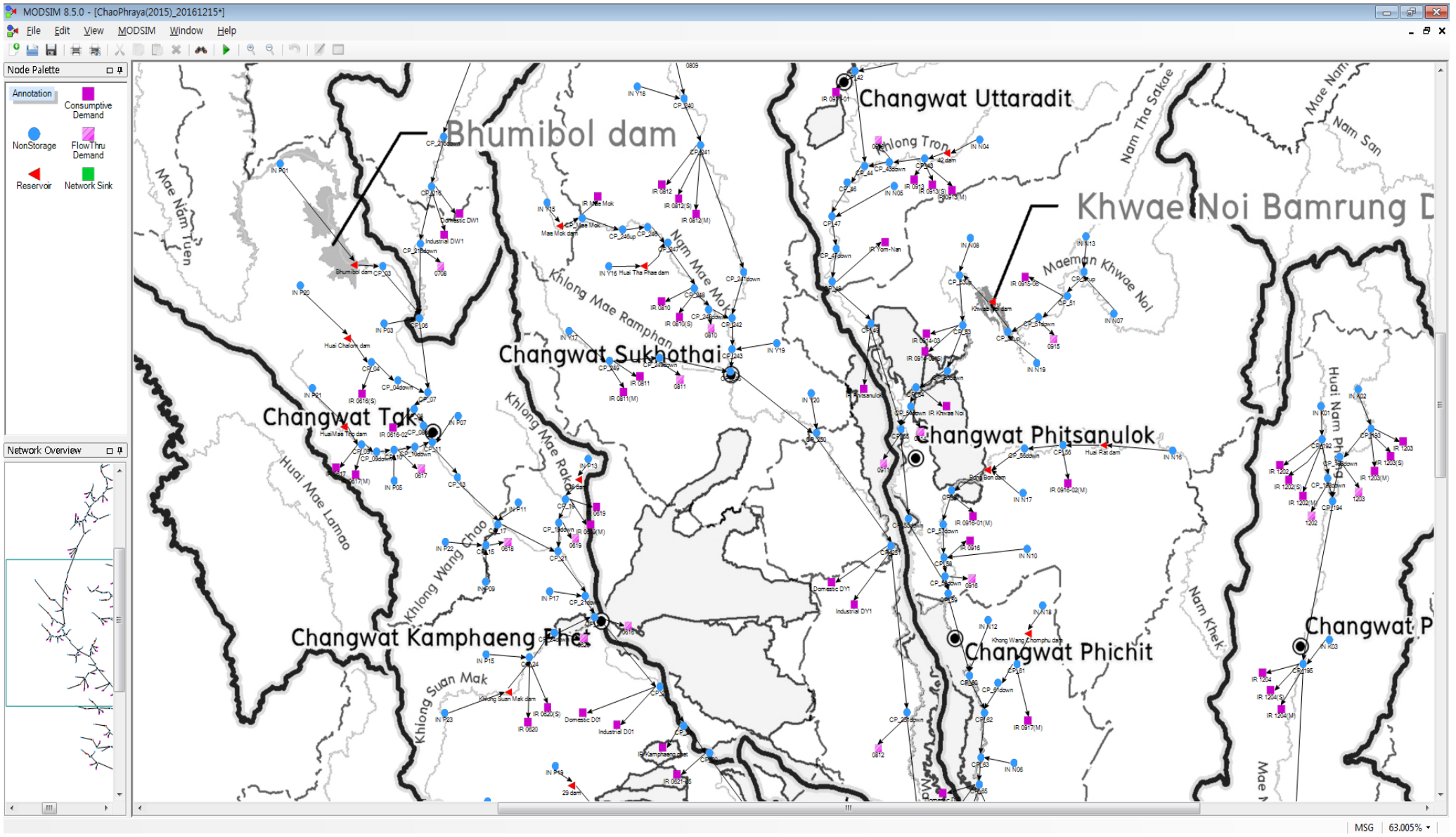
02 Agricultural (irrigation), domestic, industrial and ecological water demand and supply

03 Evaluate current (2015) and future (2025, 2035) water demand and supply

*** K-MODSIM : River and reservoir system operations simulation and optimization program, developed by Colorado State University and K-water**

03 Water Balance Analysis

Water Supply & Demand Analysis (K-MODSIM)



03 Water Balance Analysis

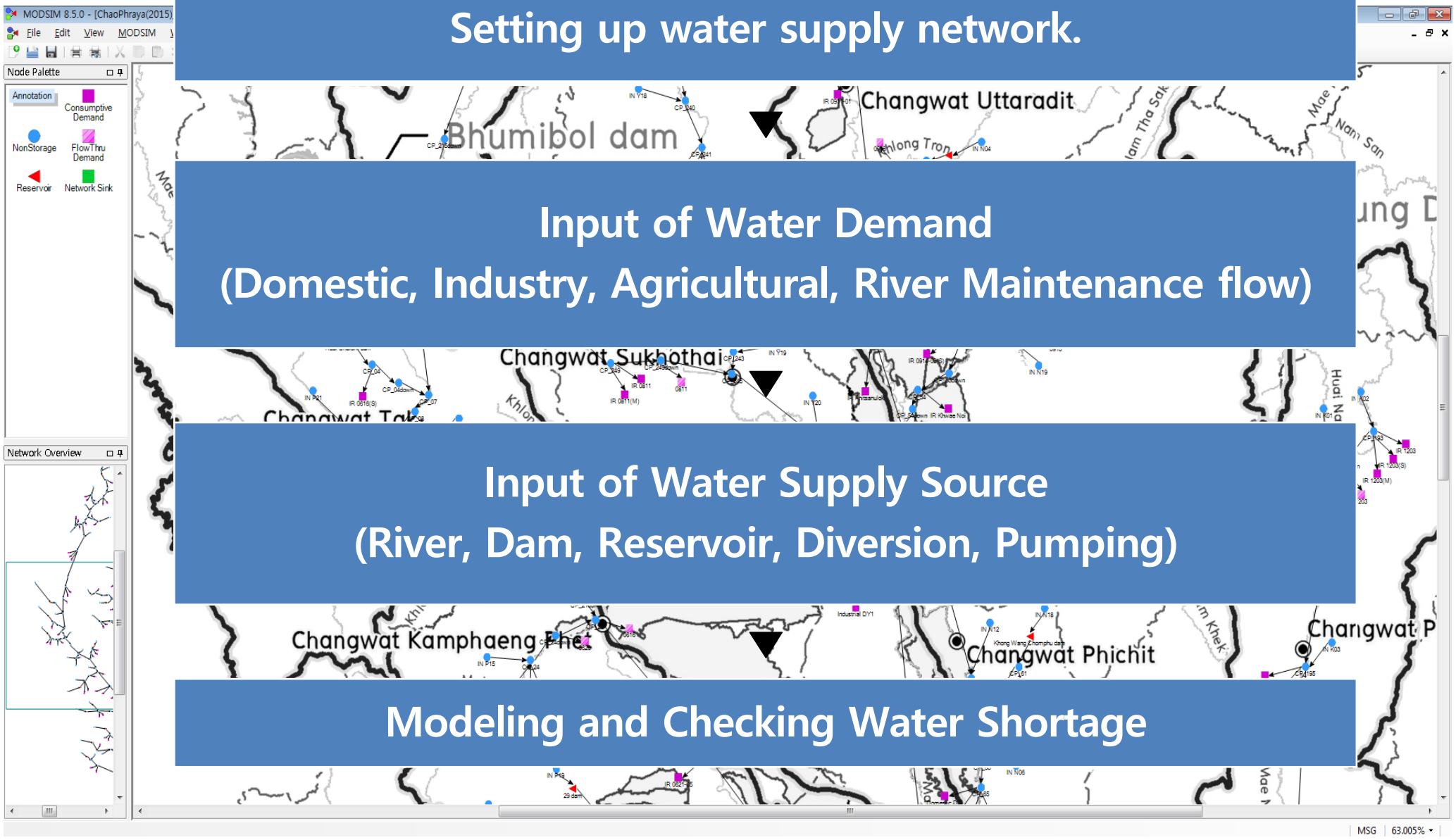
Water Supply & Demand Analysis (K-MODSIM)

Setting up water supply network.

Input of Water Demand
(Domestic, Industry, Agricultural, River Maintenance flow)

Input of Water Supply Source
(River, Dam, Reservoir, Diversion, Pumping)

Modeling and Checking Water Shortage



03 Water Balance Analysis

Water Supply & Demand Analysis (K-MODSIM)

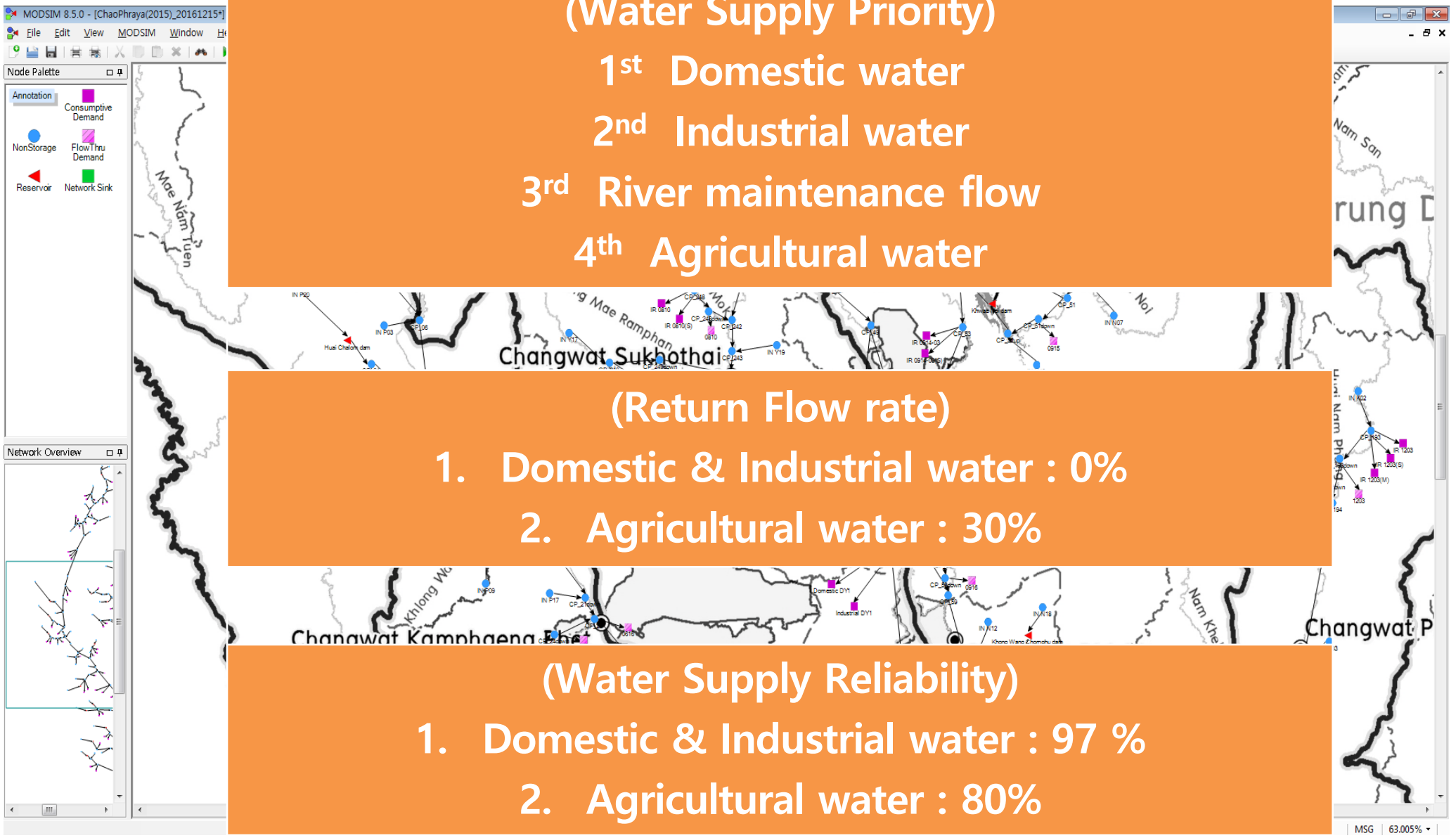
(Water Supply Priority)

1st Domestic water

2nd Industrial water

3rd River maintenance flow

4th Agricultural water



(Return Flow rate)

1. Domestic & Industrial water : 0%
2. Agricultural water : 30%

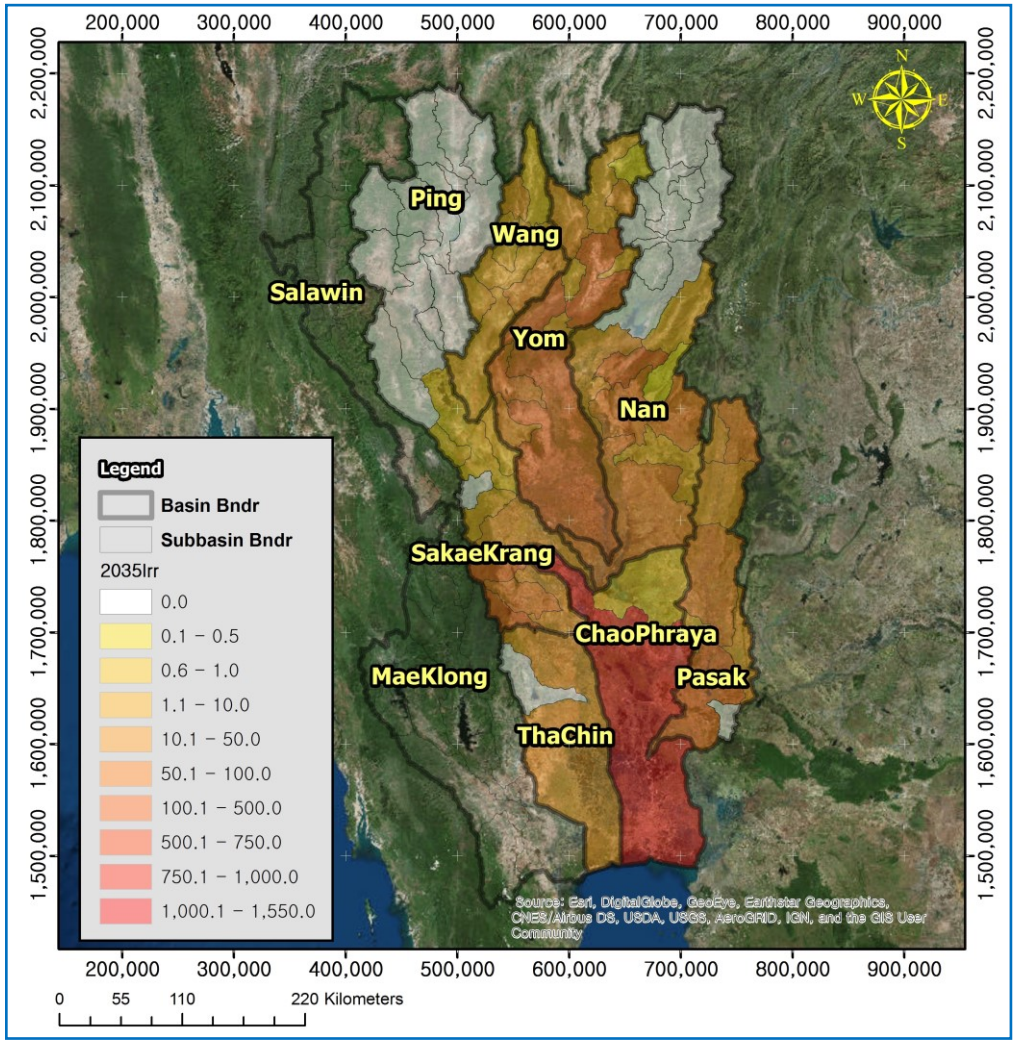
(Water Supply Reliability)

1. Domestic & Industrial water : 97 %
2. Agricultural water : 80%

03 Water Balance Analysis

Result of Water Balance Analysis

Irrigation water



Basin	Water shortage (MCM/yr)			
	Present	2020	2025	2035
Ping	4.4	7.0	9.6	29.1
Wang	48.5	54.1	59.6	106.5
Yom	328.1	549.3	770.4	1,061.9
Nan	201.3	252.6	303.8	474.9
L. Chao Phraya + Tha Chin	1,682.2 (57.0%)	1,732.8 (52.4%)	1,783.3 (48.8%)	1,794.0 (41.0%)
Sakae Krang	397.2	397.7	398.1	543.2
Pasak	290.9	310.4	329.9	370.7
Total	2,952.6	3,303.9	3,654.7	4,380.3

- Calculate water shortage from the Thailand criteria

1. Count water shortage in case the monthly demand at point is 20% excessive than the supply each year

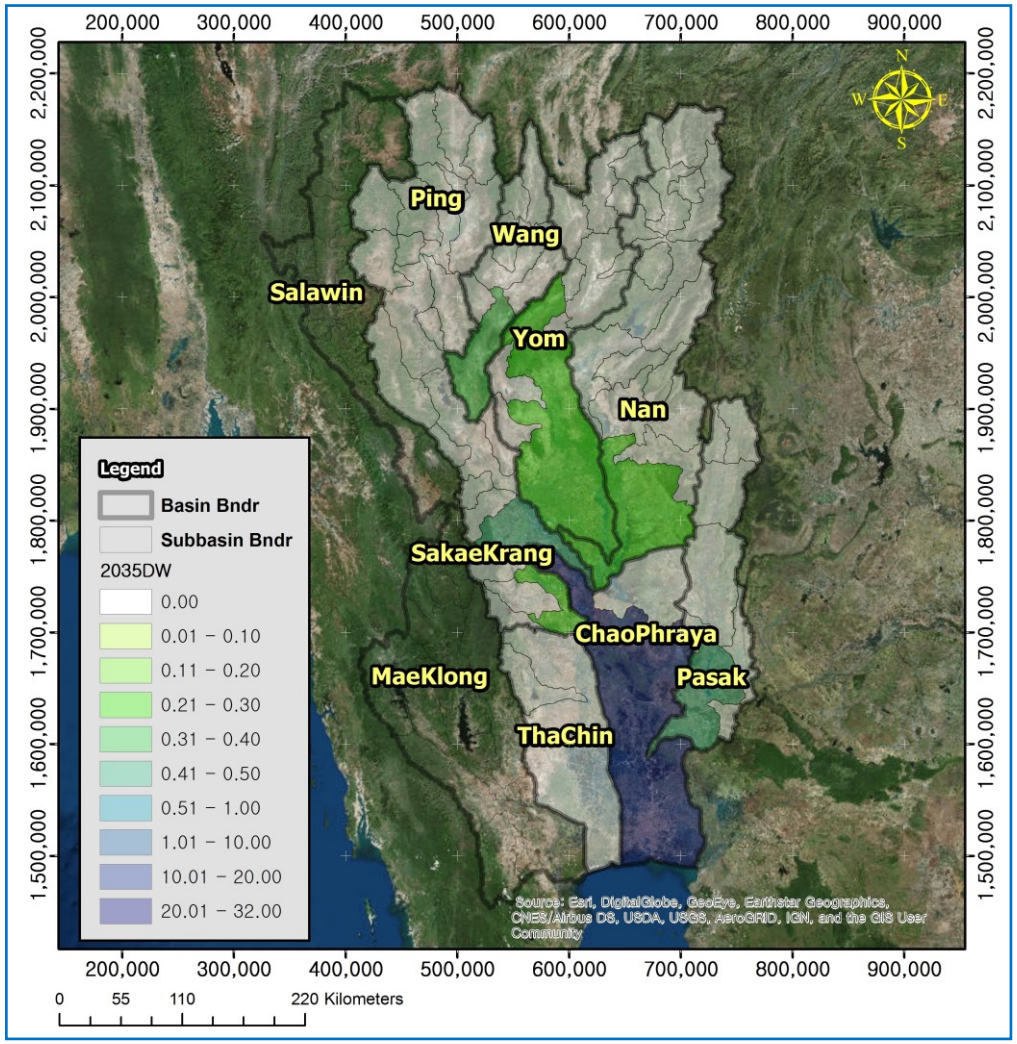
2. Average yearly water shortage for the entire analysis period (30 years)

- Irrigation water shortage is found to be most serious in Chao Phraya Basin.
- More than 40% of future irrigation water shortage is expected to occur in the Lower Chao Phraya & Tha Chin river basin.

03 Water Balance Analysis

Result of Water Balance Analysis

Domestic water



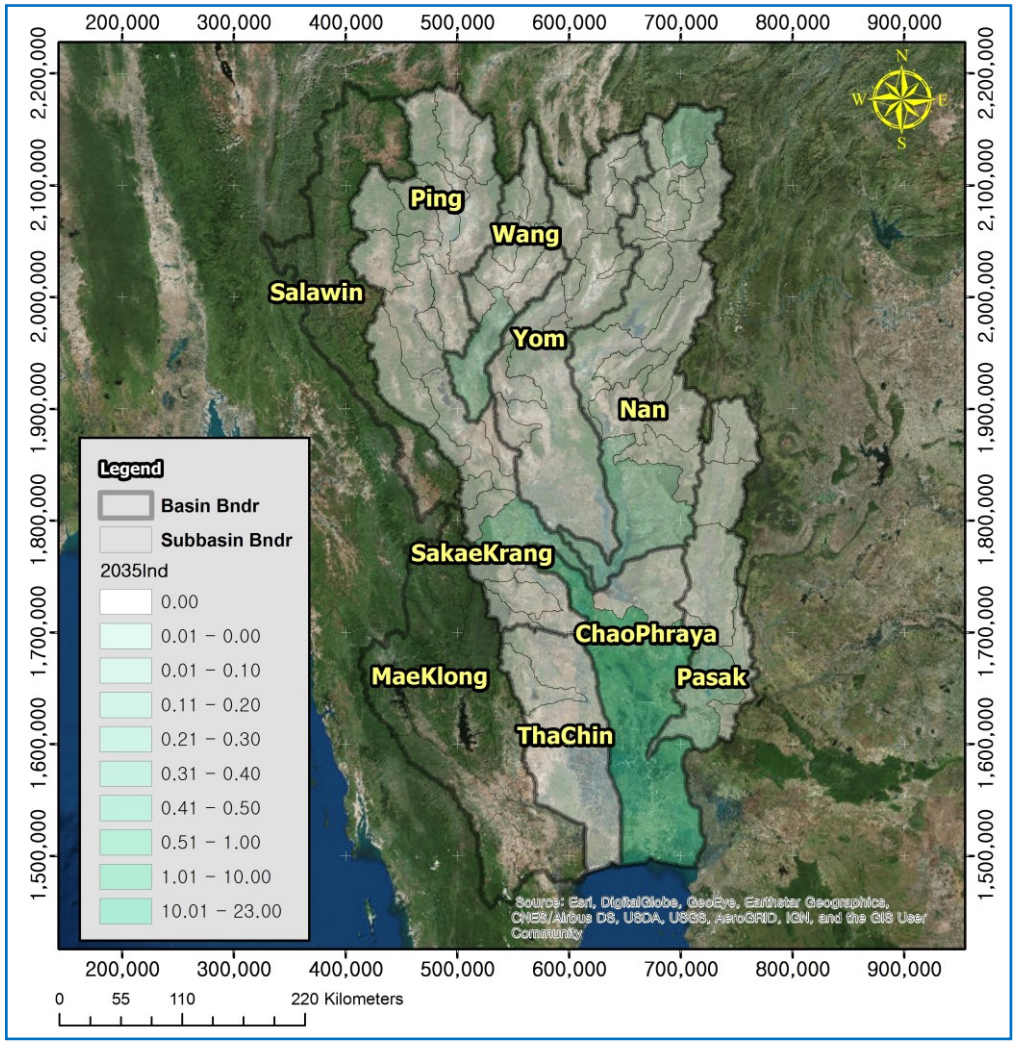
Basin	Water shortage (MCM/yr)			
	Present	2020	2025	2035
Ping	–	–	–	–
Wang	–	–	–	–
Yom	–	–	–	–
Nan	–	–	–	–
L. Chao Phraya + Tha Chin	21.8 (100.0%)	27.3 (100.0%)	32.8 (100.0%)	70.9 (99.4%)
Sakae Krang	–	–	–	–
Pasak	–	–	–	0.4
Total	21.8	27.3	32.8	71.3

- Domestic water shortage is found in Lower Chao Phraya & Tha Chin river basin.

03 Water Balance Analysis

Result of Water Balance Analysis

Industrial water

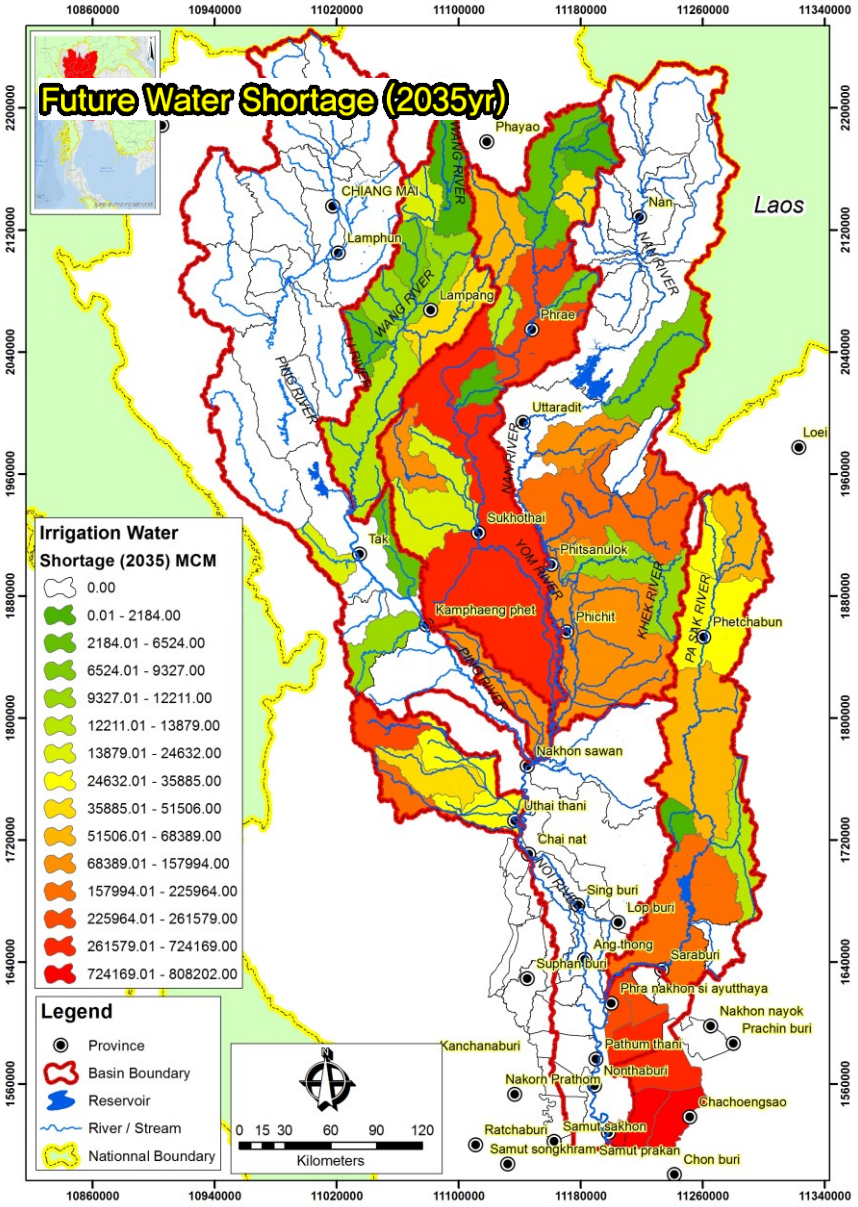


Basin	Water shortage (MCM/yr)			
	Present	2020	2025	2035
Ping	–	–	–	–
Wang	–	–	–	–
Yom	–	–	–	–
Nan	–	–	–	–
L. Chao Phraya + Tha Chin	40.6 (100.0%)	44.6 (100.0%)	48.6 (100.0%)	74.5 (99.9%)
Sakae Krang	–	–	–	–
Pasak	–	–	–	0.1
Total	40.6	44.6	48.6	74.5

- Industrial water shortage is found mainly in Chao Phraya & Tha Chin river basin

03 Water Balance Analysis

Result of Water Balance Analysis



Water Demand

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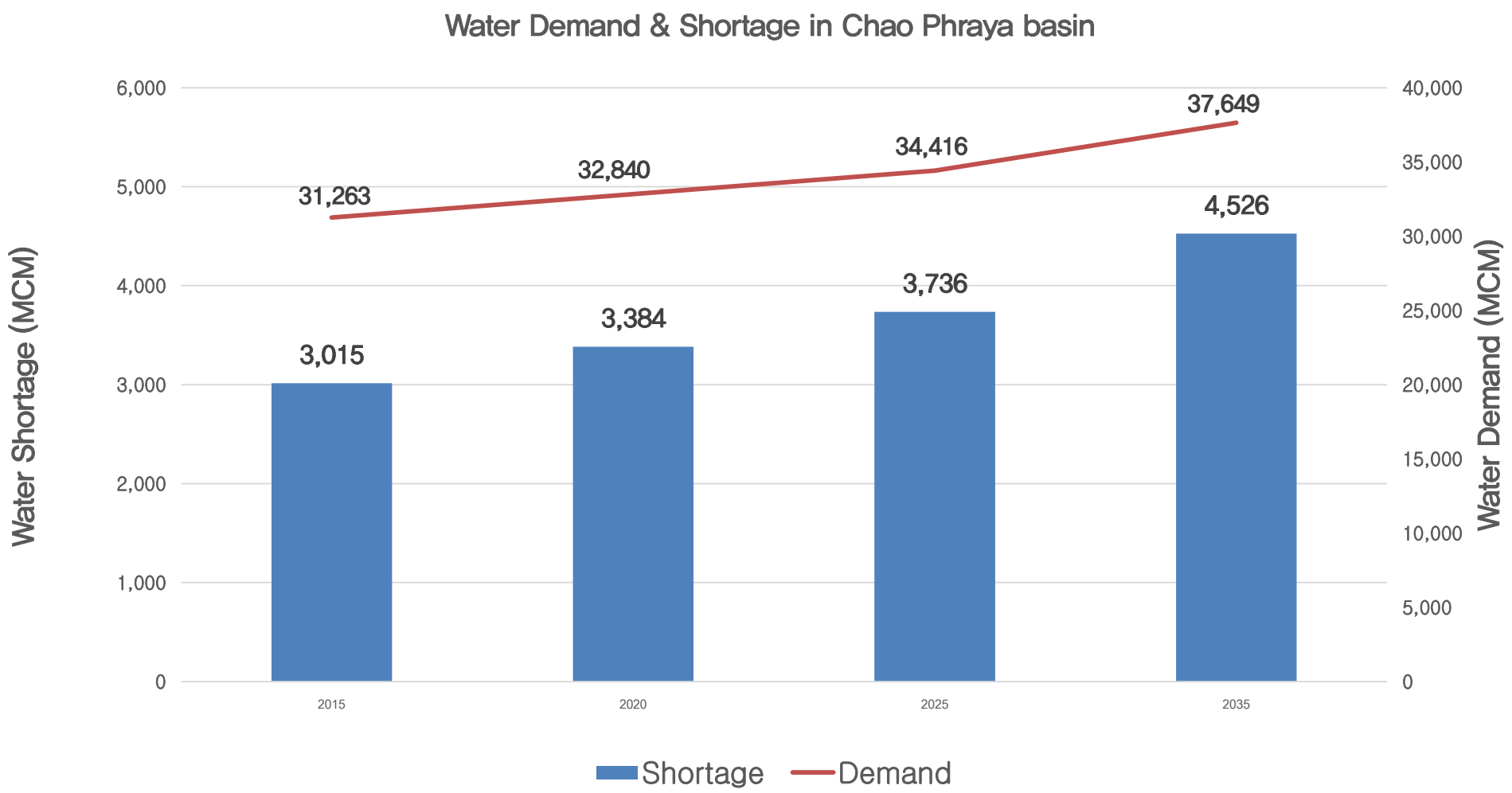
Total	31,263.0	32,840.0	34,415.8	37,649.3

Water Shortage

Basin	Water Shortage (MCM/yr)			
	Present	2020	2025	2035
Ping	4	7	10	29
Wang	49	54	60	107
Yom	328	549	770	1,062
Nan	201	253	304	475
L. Chao Phraya + Tha Chin	1,744	1,810	1,877	1,900
Sakae Krang	397	398	398	543
Pasak	291	310	330	371
Total	3,015	3,384	3,736	4,526

03 Water Balance Analysis

Result of Water Balance Analysis



04 Strategy Setup for additional water supply

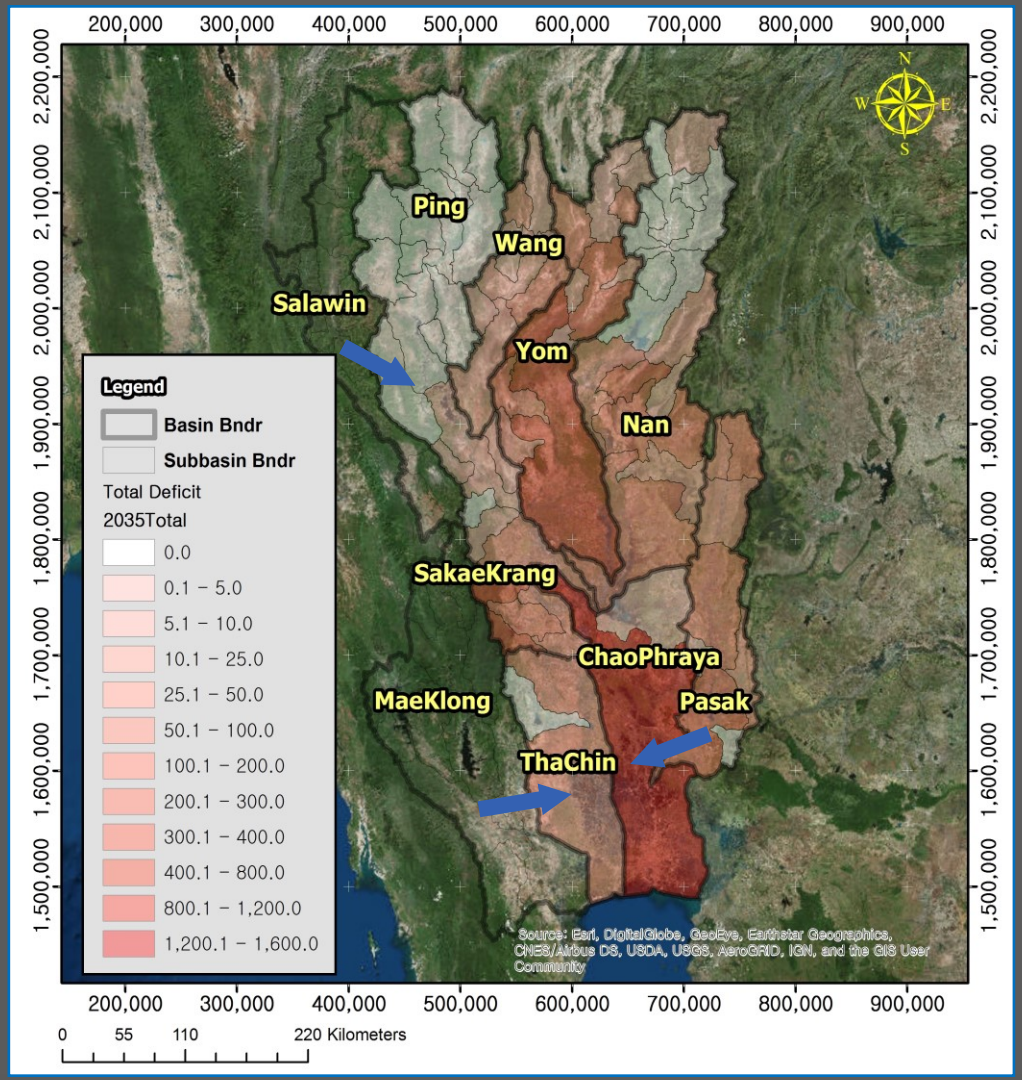
Result of Water Balance Analysis : Considering Thai Gov. plan (By RID)

Basin	Water Shortage (MCM)		Gov. Plan (MCM)		Expected Shortage (MCM)	
	2025	2035	2025	2035	2025	2035
Ping	10	29	170	350	0	0
Wang	60	107	18	19	42	88
Yom	770	1,062	193	252	577	810
Nan	304	475	909	1,276	0	0
L. Chao Phraya + Tha Chin	1,877	1,900	36	113	1,841	1,787
Sakae Krang	398	543	70	346	328	198
Pasak	330	371	0	0	330	371
Total	**3,749**	**4,487**	**1,396**	**2,356**	**3,118**	**3,253**

- Considering Thai Gov. reservoir plan in the future, the water shortage was re-estimated
  - (2025) Water shortage was expected to 3,118 MCM - (2035) Water shortage was expected to 3,253 MCM
- Even though considering existing Thai Gov.' s plan of water resources, water shortage is to be expected more than 3 bil.m^3

04 Strategy Setup for additional water supply

Strategy to solve the water shortage in Chao Phraya river basin



1	In the future, water shortage is to be expected about 3 bil.m3 in Chao Phraya river basin
2	Limitation of developing water resources in its basin
3	This study focuses on developing additional water resources nearby Chao Phraya river basin – Maeklong river – Pasak river – Salawin river etc.

04 Strategy Setup for additional water supply

Overview of additional water supply plan

After analysis of potential water resources, the plans have studied as for structural and non-structural countermeasures in nearby Chao Phraya river basin

Basin	Structural Plan	Non-Structural Plan
Maeklong river	1) New Diversion Weir and Canal or 2) Estuary Weir and Canal	1) Using existing canal 2) Integrated dam operation (SND, VJK) 3) Using inactive storage for extreme drought (700 mil.m3)
Pasak river	1) New Reservoir construction 2) Heightening Pasak Dam	-
Salawin	* Existing plan is on going by Thai Gov. (Bhumibol dam water resources increasing project by diversion from Salawin basin)	

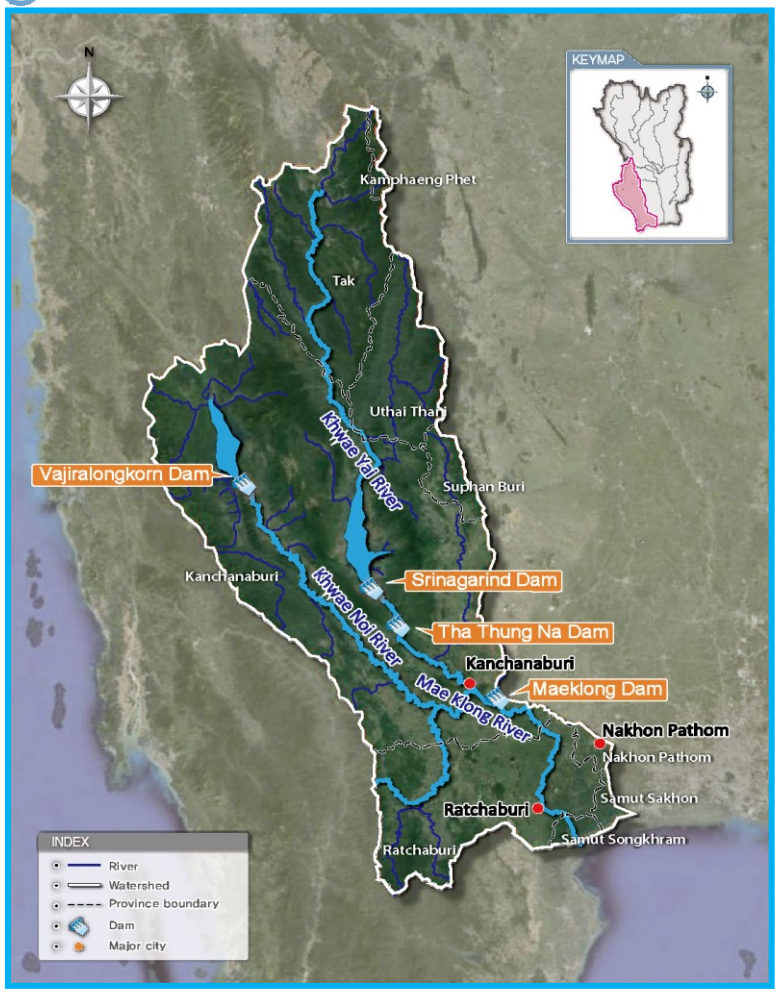
Ⅳ. Additional Water Supply Plan

1. Development of Water Resources in Mae Klong Basin
2. Conclusion

01 Development of Water Resources in Mae Klong Basin

Water Resources in Mae Klong Basin

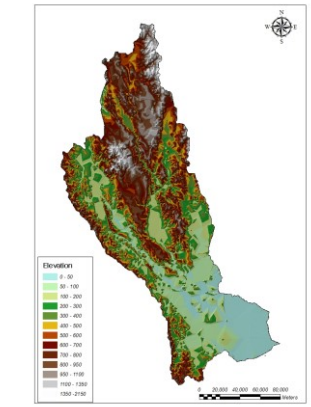
Basin Status & Annual Runoff



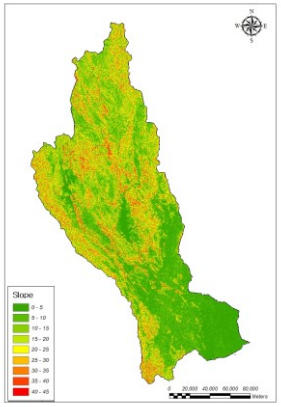
- Location: West of Chao Phraya Basin in Thailand
- Population: 2.25 million (population density: 73 person/km^2)
- Land use: Forest – 69%, Agricultural land – 22%, Others – 9%

※ Except for downstream plains, the runoff rate is expected to be somewhat higher.

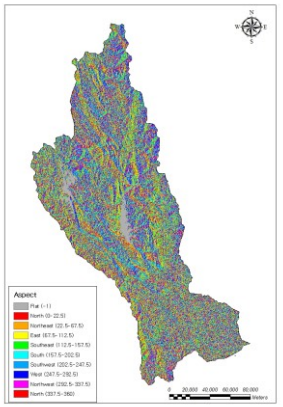
- Amount of Water Resources : 42,922 MCM
  (Annual average Rainfall : 1,422.6 mm)
- Annual average Runoff : 18,158 MCM
  (Wet season : 12,786 MCM, Dry season : 5,372 MCM)



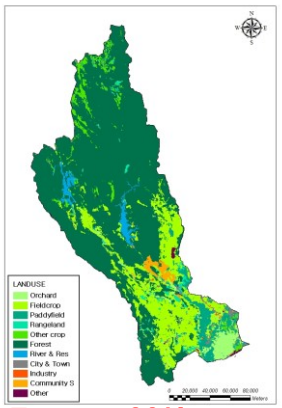
Mean: 442.0m MSL



Mean: 12.0%



Southern: 36.5%



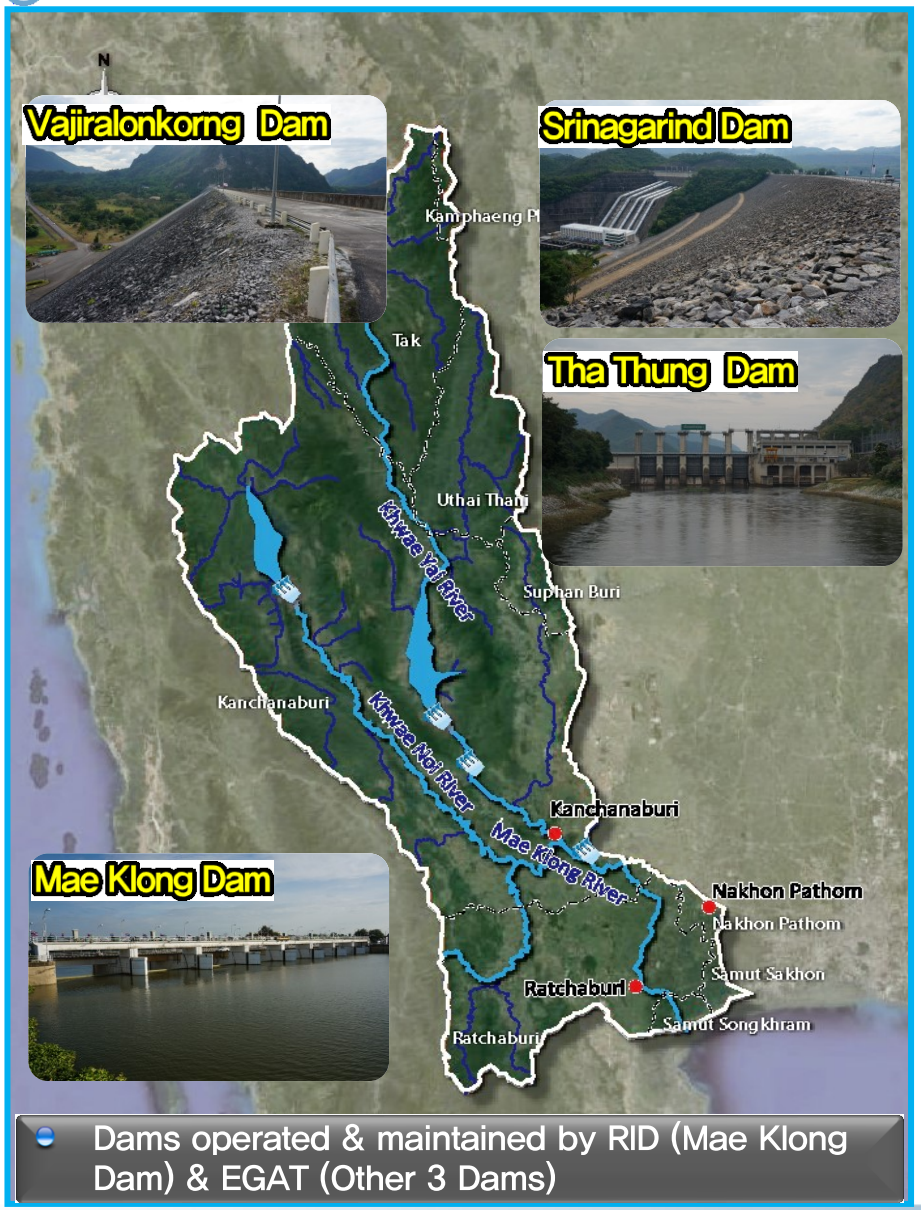
Forest: 69%
Agriculture: 22%

- Mae Klong Basin is High in the north side and low in the south side in terms of topography, and its river runoff originates in the upper mountainous area and flows into the Gulf of Thailand through lower plains.
- Runoff from the northern mountains areas has been stored in the four dams and it is used to supply required water to downstream plains and Chao Phraya Basin.

01 Development of Water Resources in Mae Klong Basin

Additional Water Resource Development Plans (Mae Klong Basin)

Present Status of Dams



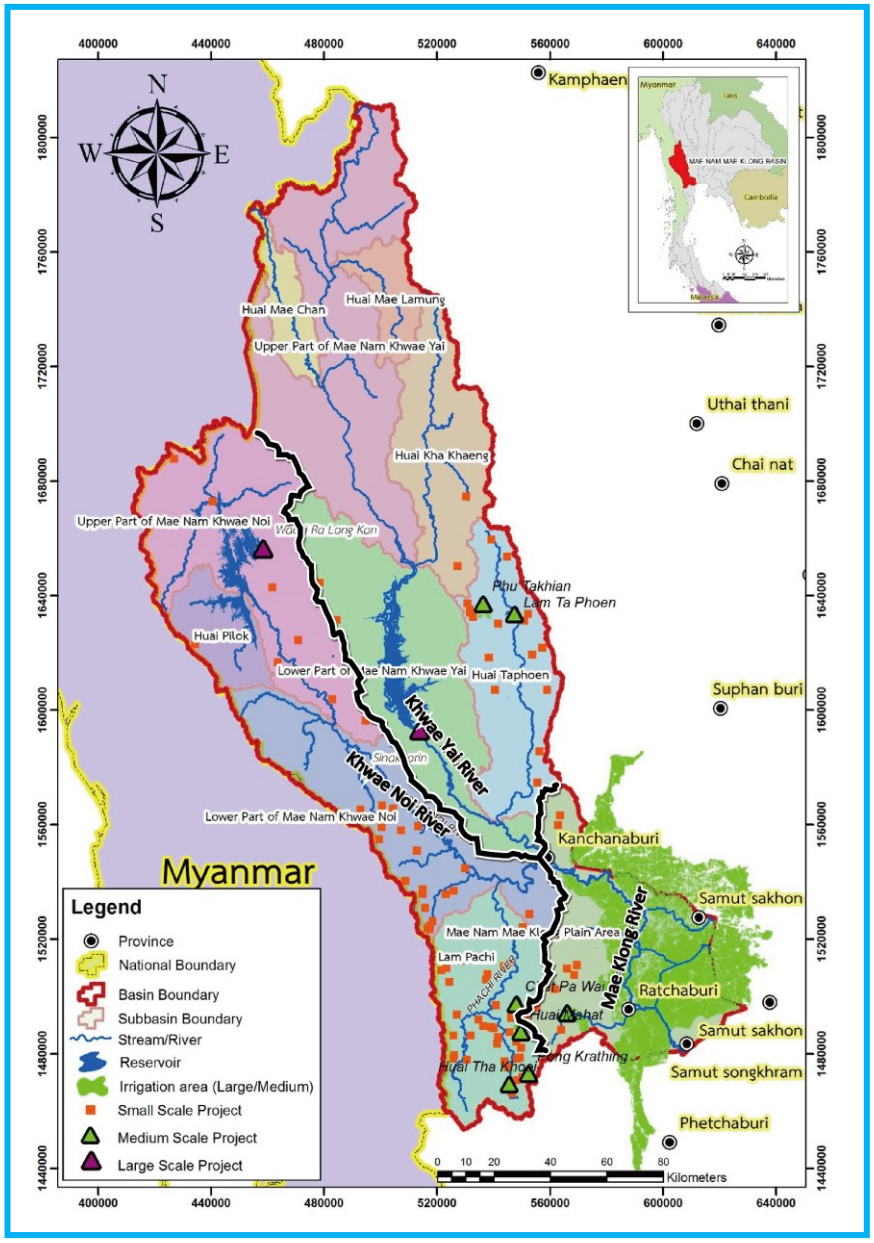
Dams operated & maintained by RID (Mae Klong Dam) & EGAT (Other 3 Dams)

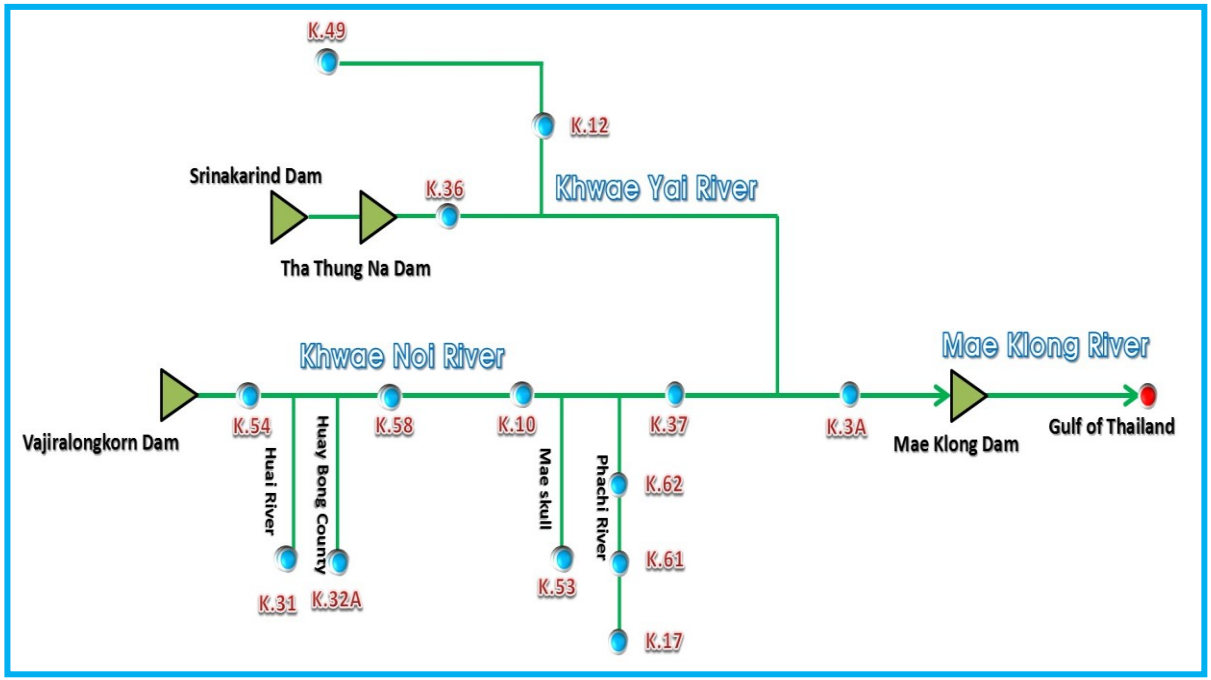
Item	Unit	Vajiralongkorn Dam	Srinagarind Dam
Location	–	Khawe Noi River (270km northwest of Bangkok)	Khawe Yai River (150km northwest of Bangkok)
Catchment area	km^2	3,720	10,880
Annual Inflow	MCM	5,500 (5,491*)	4,400 (4,605*)
Dam type	–	CFRD	ECRD
Dam height x Length	m	92 x 1,019	140 x 610
Dam crest	m MSL	163.0	185.0
Flood Water Level	m MSL	160.4	182.4
High Water Level	m MSL	155.0	180.0
Lower Water Level	m MSL	135.0	159.0
Total storage	MCM	8.860	17,745 (19,825 *)
Effective storage	MCM	5,848	7,470 (7,327 *)
Inactive storage	MCM	3,012	10,275 (10,418 *)

* : Operation Data

01 Development of Water Resources in Mae Klong Basin

Basin Diagram & Characteristics

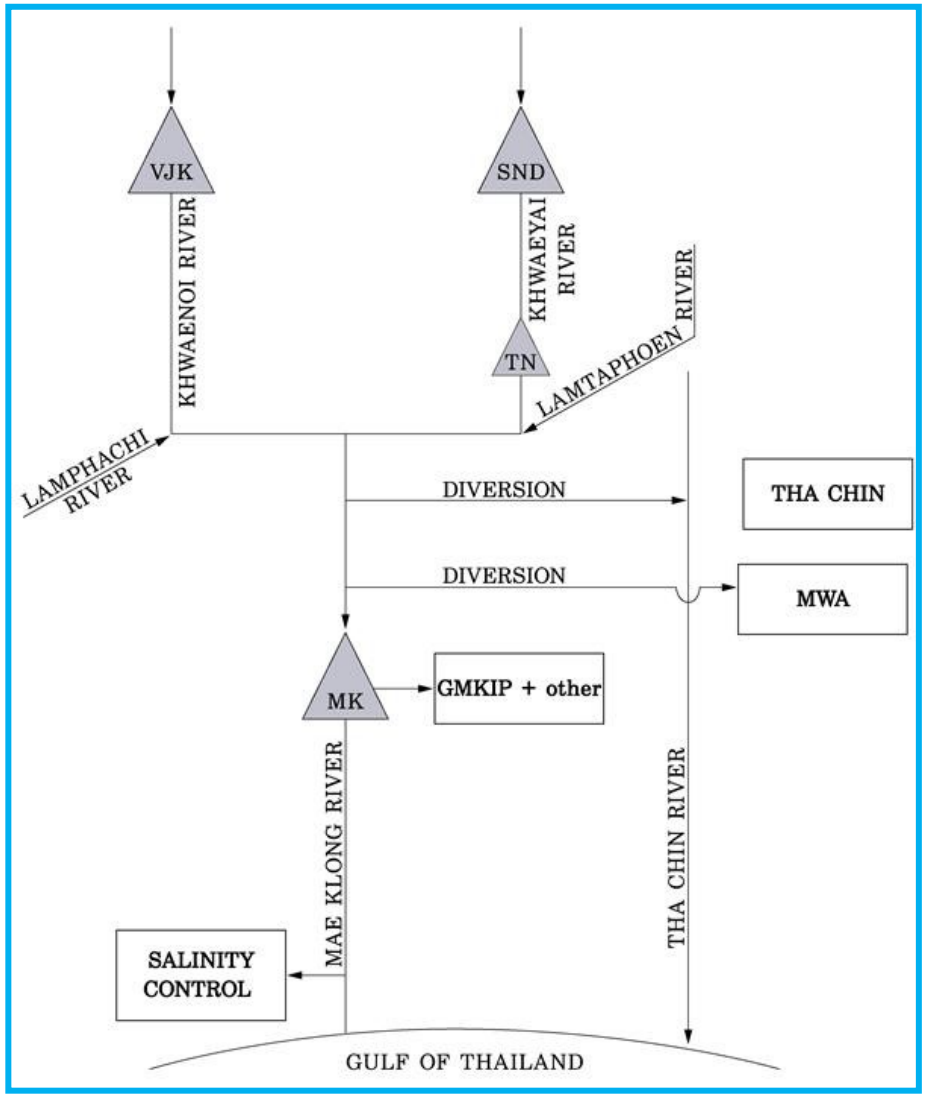




River	Catchment area (km^2)	Channel length (km)	Mean width of basin (A/L, km)	Shape factor of basin (A/L^2)
Khwae Noi	9,256	379	24.4	0.064
Khwae Yai	15,267	449	34.0	0.076
Mae Klong	30,171	589	51.2	0.087

01 Development of Water Resources in Mae Klong Basin

- Status of Water Supply



Diversion of Mae Klong Dam

Dam Name	Catchment area (km^2)	Width (m)	Length (m)	ED* (m)	Max. Q (m^3/s)	Max. water level (m MSL)
Mae Klong	25,590	10.0	117.50	10.00	3,100	24.36

* ED: Elevation difference* between upstream & downstream of the dam

Water use of Mae Klong Dam

Item	Water Use (MCM/yr)	Remark
Total	9,800	
Irrigation + Other	5,700	Wet Season : 2,500 Dry Season : 3,200
Tha Chin River	1,500	Chao Phraya basins
MWA	600 (Max. 1,500)	Water Treatment Plant
River Maintenance	2,000	Ecology + Salinity Control

* Source : http://irrigation.rid.go.th/om13
* MWA : Bangkok Metropolitan Water Work Authority

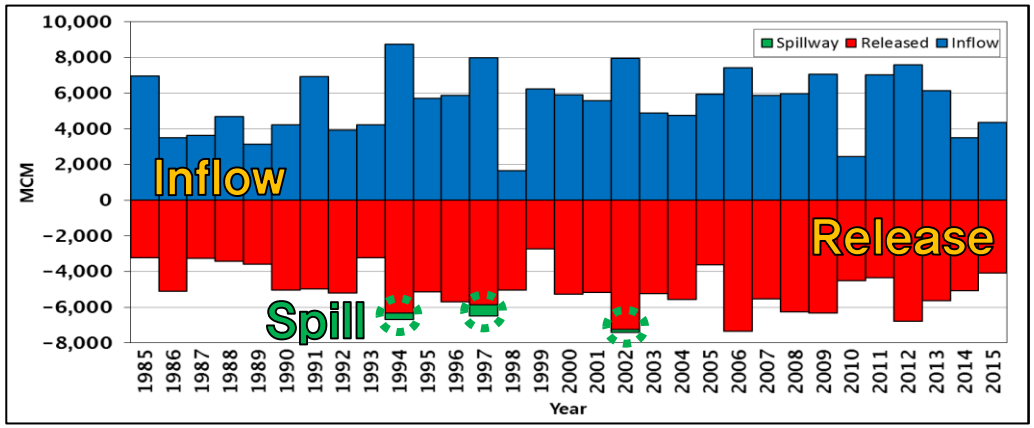
- Maeklong dam supplys water to GMKIP, Thachin river, MWA and river mainternance, by the flow of upper river and released discharge of two dams

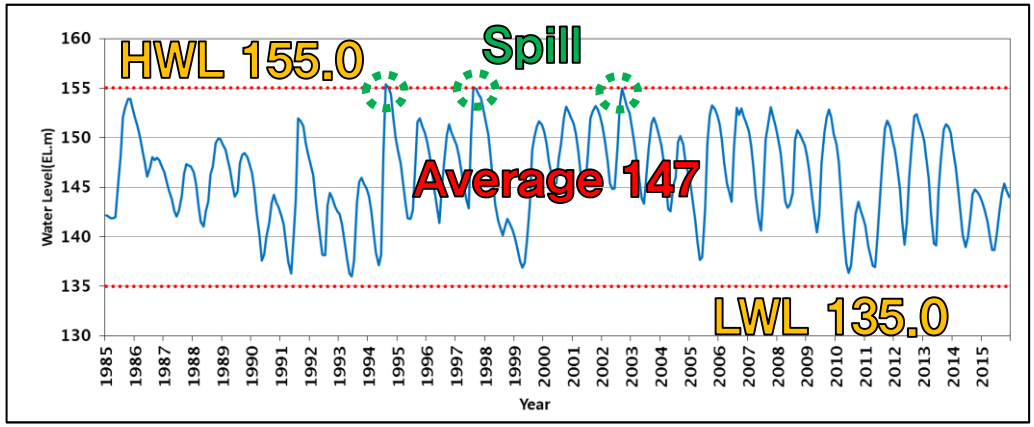
01 Development of Water Resources in Mae Klong Basin

Operation Associated With Existing Dams

- Vajiralongkorn Dam(Operation Data, 1985~2015)

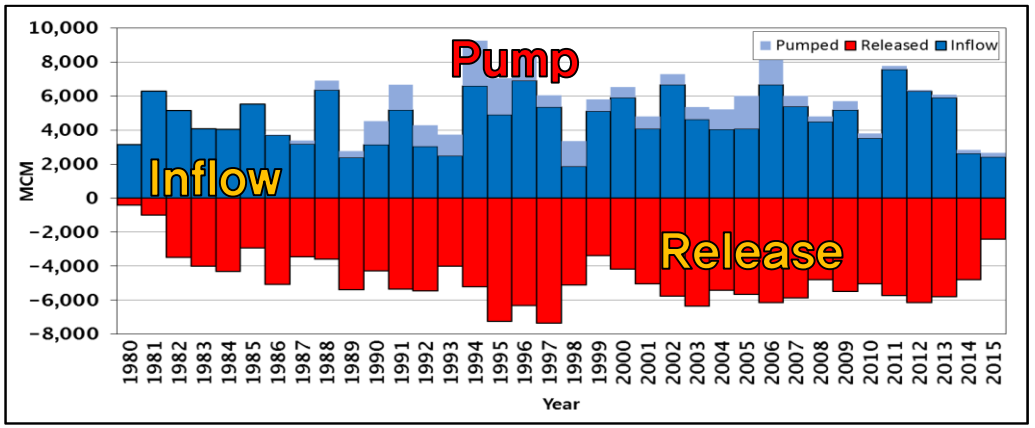
- Average Inflow : 5,815 MCM/yr
- Average Water supply : 5,231 MCM/yr

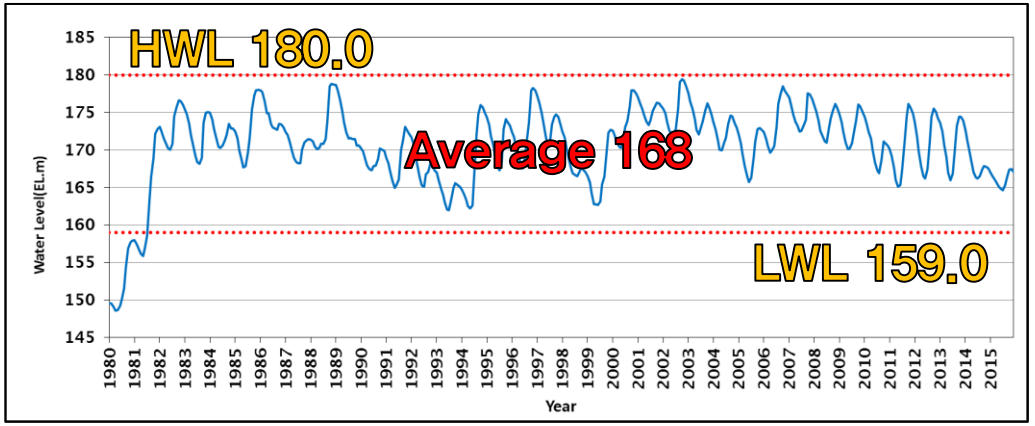




- Srinagarind Dam(Operation Data, 1980~2015)

- Average Inflow : 4,824 MCM/yr
- Average Water supply : 5,081 MCM/yr



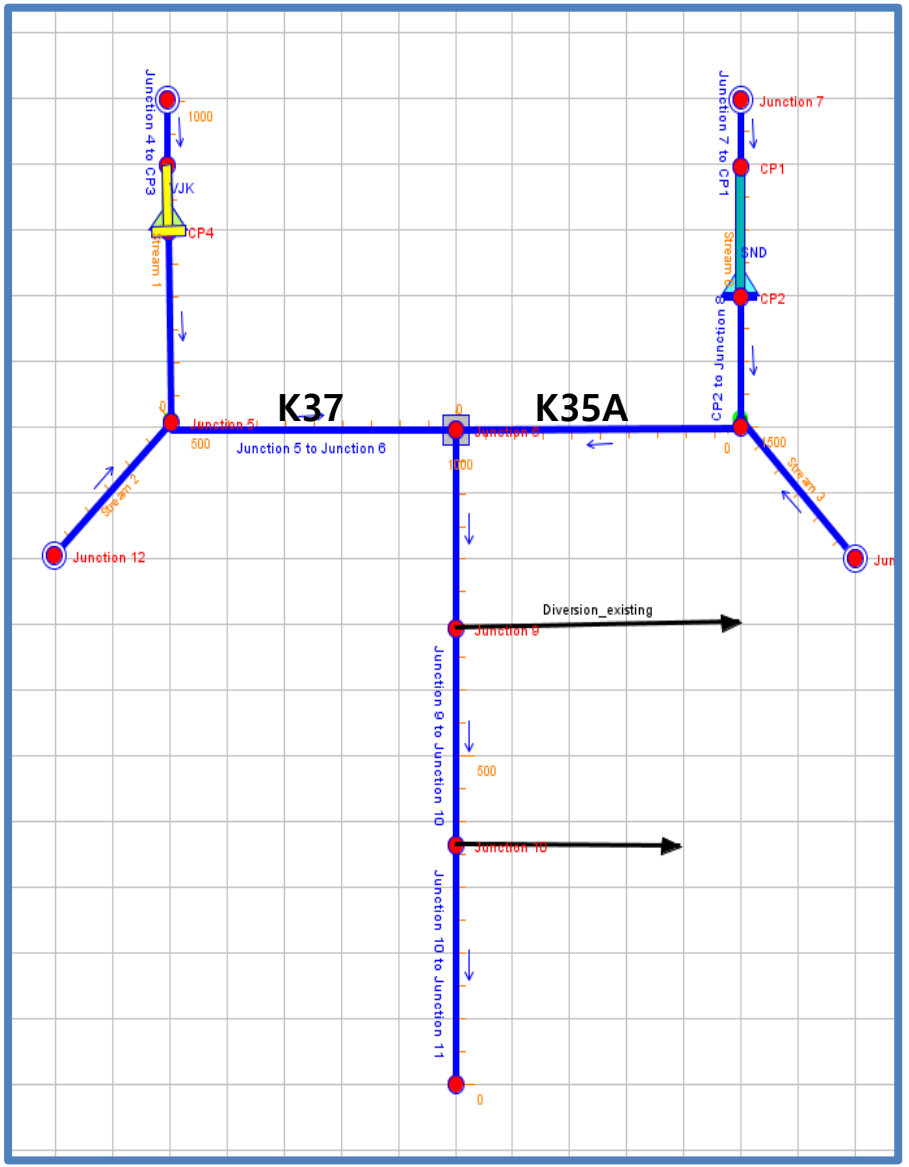


- VJR Dam : Annual Water Level 147m MSL, Spillway overflow 3 times.
- SND Dam : Annual Water Level 168m MSL, Spillway overflow 0 times, Inflow through pumping at downstream

01 Development of Water Resources in Mae Klong Basin

Coordinate Operation Study between VJK & SND Dams

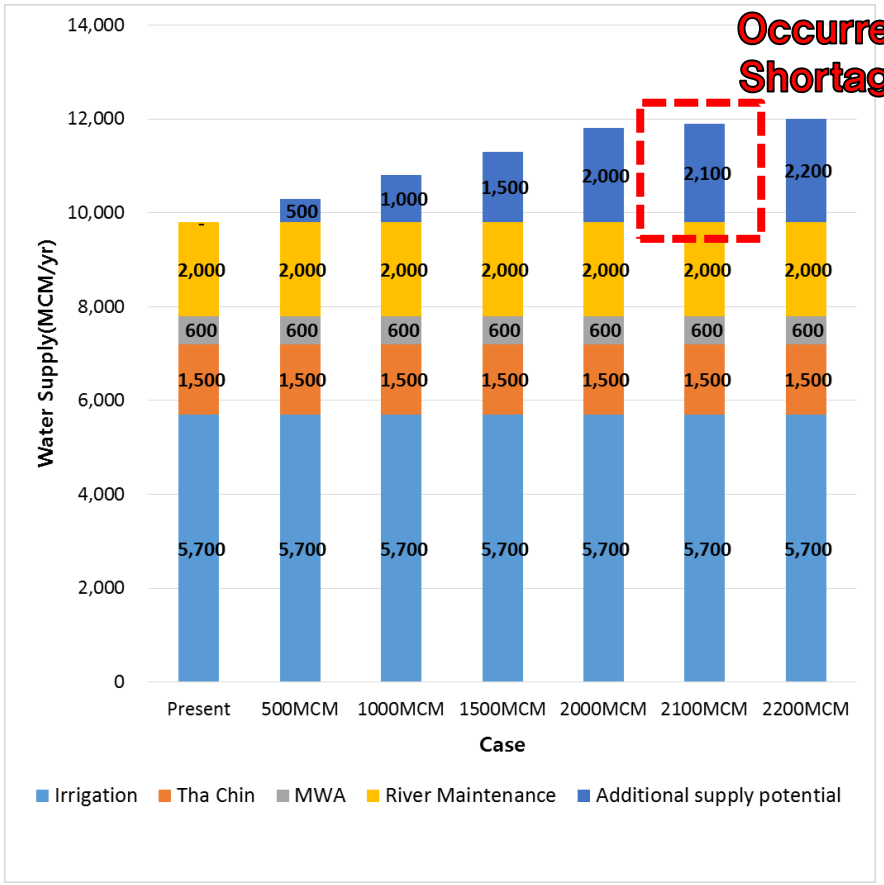
Input data		**Dam data(from EAGT site)** – Inflow, WL & storage, rule curve – generation capacity, tailwater **Tributary inflow(from RID)** – (VJK) K37 – dam outflow – (SND) K35A – dam outflow
Simulation condition		**Period : '02.Jan.1 ~ 15.dec.31(14yrs)** **Operation rule curve** – existing rule curve – changing rule curve (upper : HWL, lowest : LWL) **Control point operation condition** – existing water supply : 9,800MCM – additional water supply potential : + α
Additional water supply potential		**Simulate for maximum additional water supply potential** – review of water shortage – evaluation of additional supply potential



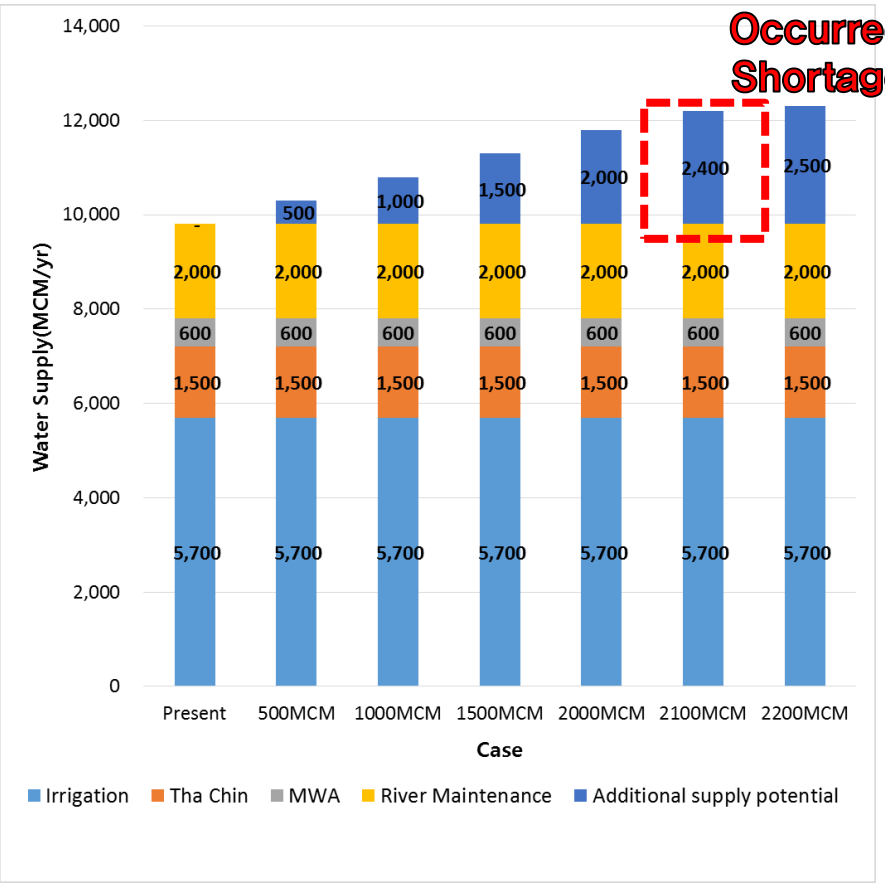
01 Development of Water Resources in Mae Klong Basin

Review of Additional Water supply Potentinal

Existing Rule Curve



Changing Rule Curve

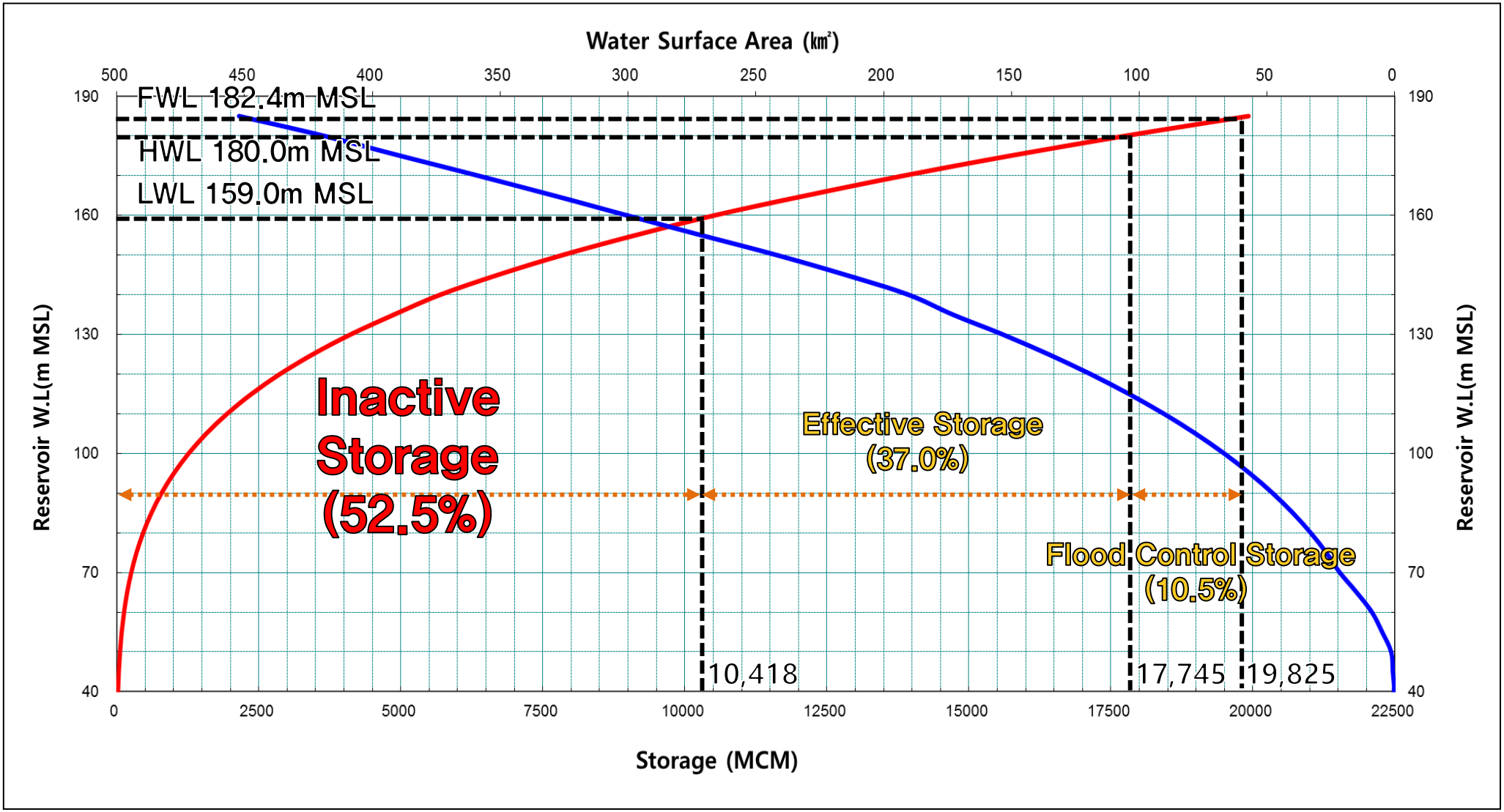


- The additional water supply potential in the Mae Klong Basin was reviewed to be 2,100 ~ 2,400 MCM. (Using the recent 14–year data)

01 Development of Water Resources in Mae Klong Basin

Storage Allocation of Srinagarind Dam

- Inactive storage is 10,418 MCM accounting for approx. 52.5% of total storage capacity 19,825 MCM.
  ➔ The water level of Srinagarind dam has operated to maximize generation highly



01 Development of Water Resources in Mae Klong Basin

Securing Additional Storage of Srinagarind Dam

- In the emergency such as extreme drought, Additional capacity can be secured through LWL is lower.
  (LWL : 159m MSL → 157m MSL, Additional Storage : 789 MCM)
- Power generation loss is about 2%.(LWL : 159m MSL, 722GWh → 157m MSL, 710GWh).

※ Tha objective of dams should be reviewed to find a best solution of Trade off between water and energy

Item	Additional Storage (MCM)			Remark
	159m MSL(Current)	157m MSL(-2m)	155m MSL(-4m)	
Total storage(FWL)	19,825	19,825	19,825	FWL 182.4m MSL
Total storage(HWL)	17,745	17,745	17,745	HWL 180.0m MSL
Effective storage	7,327	8,116	8,612	
Additional storage	–	789*	1,285	* Power generation loss 2%
Inactive storage	10,418	9,629	9,133	Dead storage + Emergency storage

01 Development of Water Resources in Mae Klong Basin

Results

- Potential Water Supply were examined ➔ As a results, the potential water supply to be secured additionally at the Mae Klong Basin is reviewed to be 2,100 ~ 2,400MCM
- Water Supply Requirement of Chaophraya Basin : 1,100 MCM
- New Diversion Dam ➔ Additional water availability : 400 MCM
  Using Existing Canal ➔ Additional water availability : 700 MCM
- In the emergency such as extreme drought, Additional capacity can be secured through LWL is lower.
  (LWL : 159m MSL → 157m MSL, Additional Storage : 789 MCM)
- Power generation loss is about 2%.(LWL : 159m MSL, 722GWh → 157m MSL, 710GWh).

Lowering of Reservoir Level(Srinagarind Dam)

Item	Additional Storage (MCM)		Remark
	159m MSL (Current)	157m MSL (-2m)	
Total storage(FWL)	19,825	19,825	FWL 182.4m MSL
Total storage(HWL)	17,745	17,745	HWL 180.0m MSL
Effective storage	7,327	8,116	
Additional storage	–	789	
Inactive storage	10,418	9,629	

Facilities Plan(New Diversion Dam)

Item	Specification	Remark
Dam height (m)	13.0	
Dam length (m)	157.0	
Width of diversion channel (m)	18.0	
Length of diversion channel (km)	71.0	
Design water Diversion (m^3/s)	12.7	400MCM

01 Development of Water Resources in Mae Klong Basin

Facilities Plan

- Options for securing additional water availability(Comparison Route)

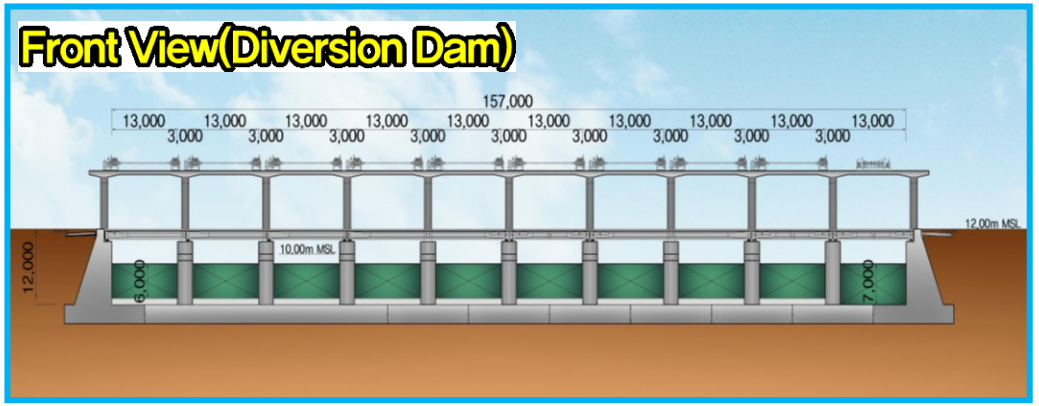
Item	Dam	Gate			Diversion Channel	Remark
	Width (m)	No.	Width (m)	Height (m)	Length (km)	
Diversion Dam	157	10	13.0	6.0	71	Connect to the Mahawawat WTP
Estuary Weir	600	38	13.0	6.0	75	Connect to the Chao Phraya River

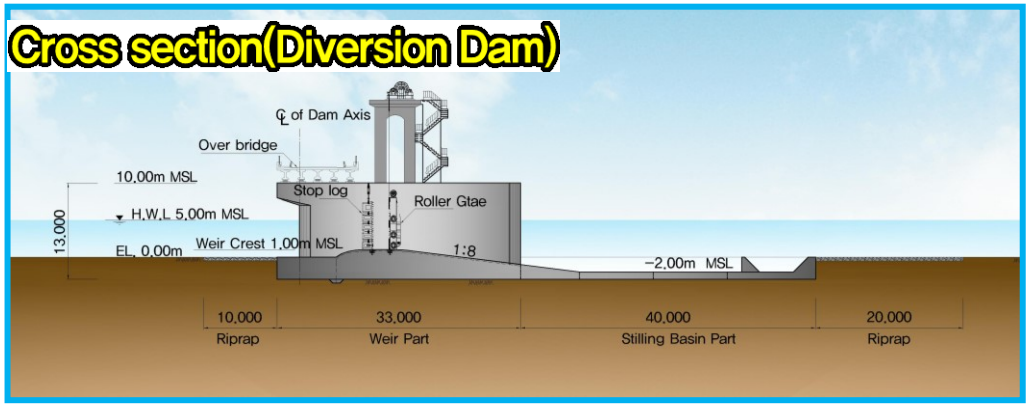
01 Development of Water Resources in Mae Klong Basin

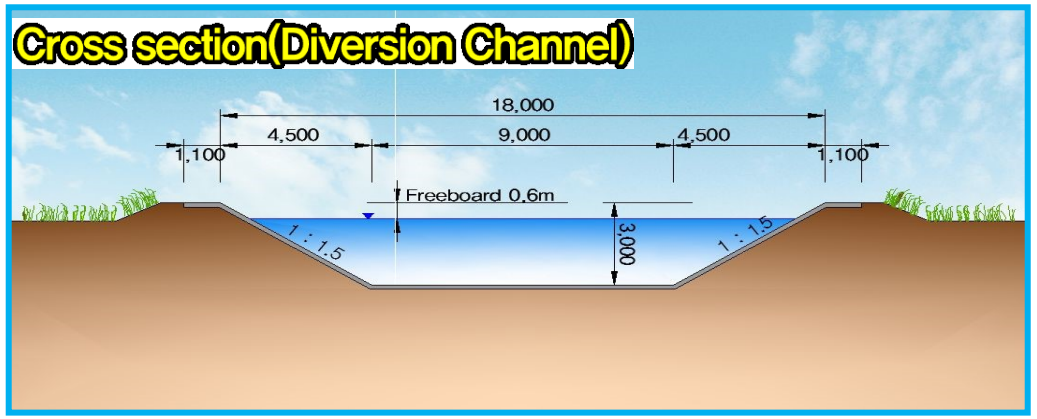
Facilities Plan

- Design specification of diversion systems

Item			Specification	Remark
New Diversion Dam	Flood Water Level(m MSL)		10.0	
	High Water Level(m MSL)		5.0	
	Low Water Level(m MSL)		2.0	
	Gate	No.(EA)	9	Roller gate
		Width(m)	13.0	
		Height(m)	6.0	
	Navigation Lock		22x6, 2EA	
Diversion System	Design water diversion(m^3/s)		12.7	
	Inlet elevation(m MSL)		5.0	
	Outlet elevation(m MSL)		1.0	
	Diversion Channel Gate		2x3, 4EA	Roller gate
	Diversion channel	Length(km)	71.0	Tha Pha ~ WTP
		Slope(%)	0.0001	

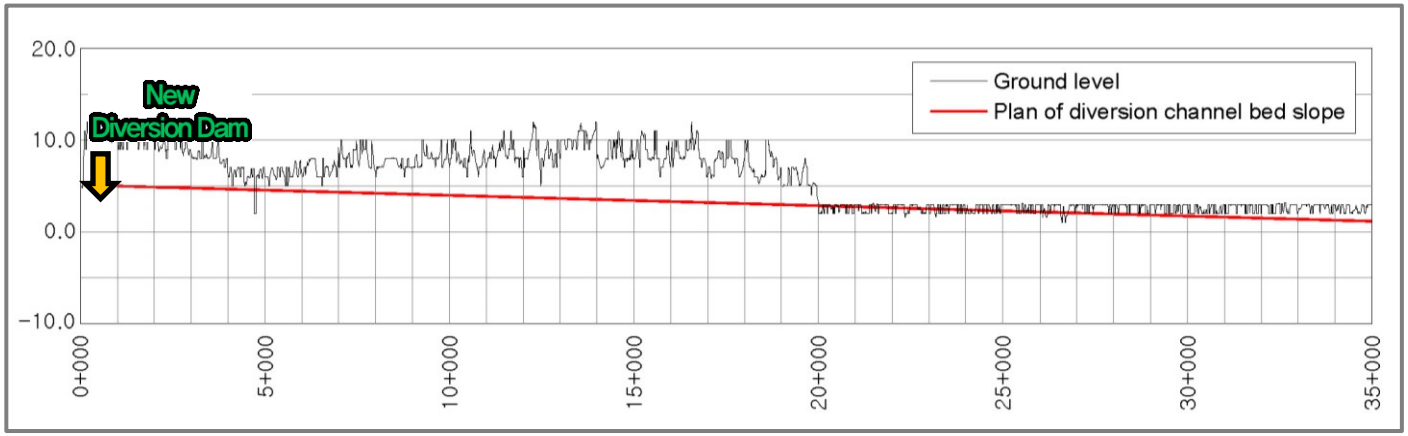




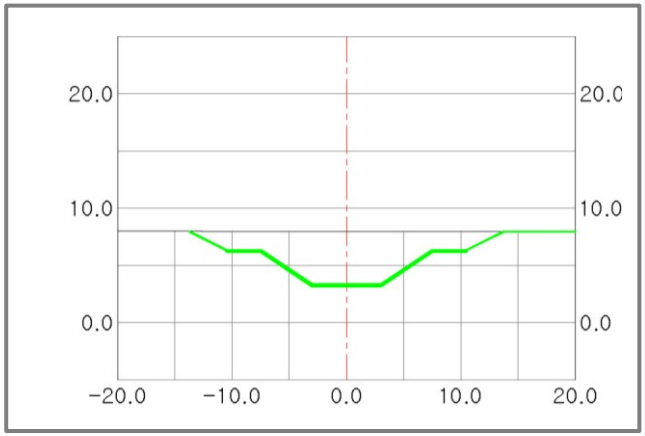


Profile of Diversion Route

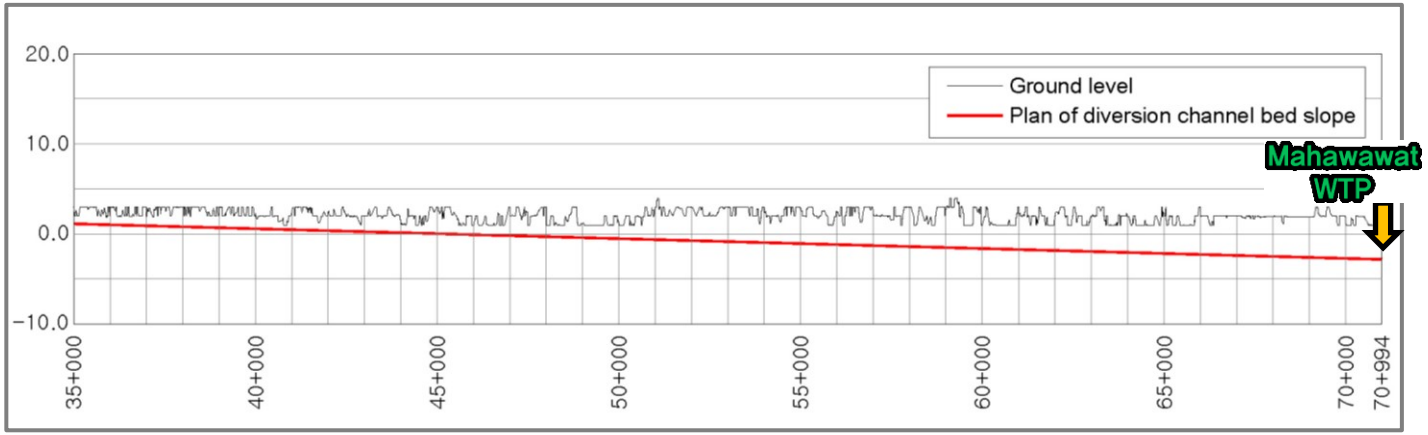
Diversion Route (0+000~35+000)



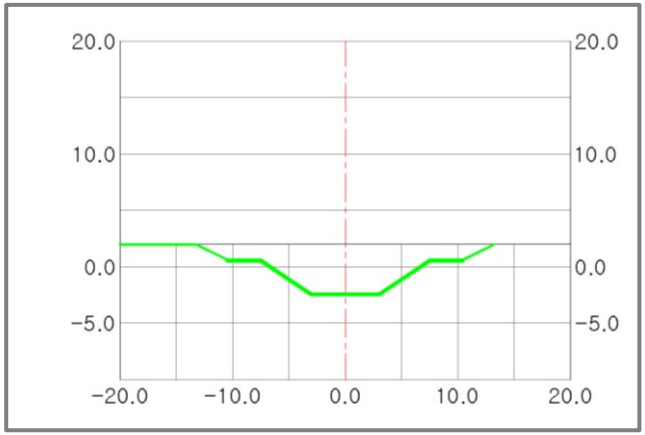
Cross Section (15+000)



Diversion Route (35+000~70+994)



Cross Section (67+000)

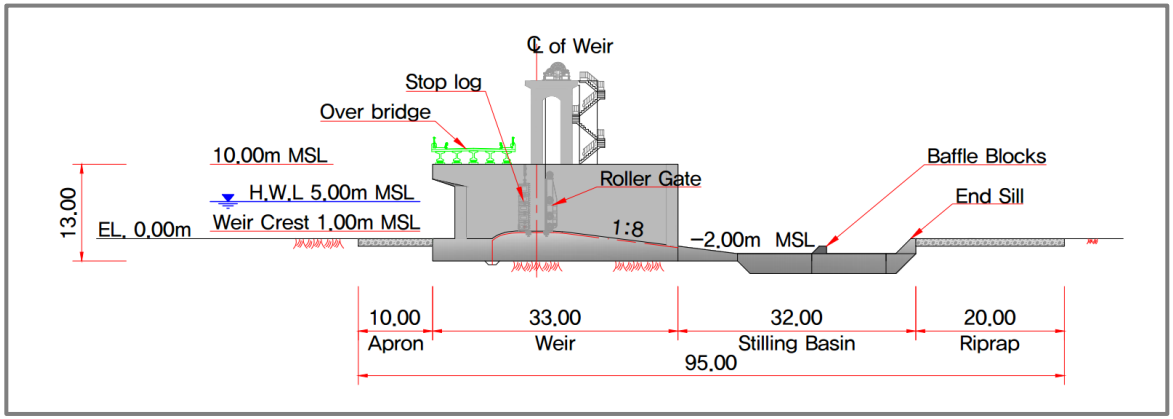


- Establishing plan of channel bed slope considered ground elevation of the Mahasawat WTP and diversion dam
- Establishing plan of channel section considered channel capacity and freeboard

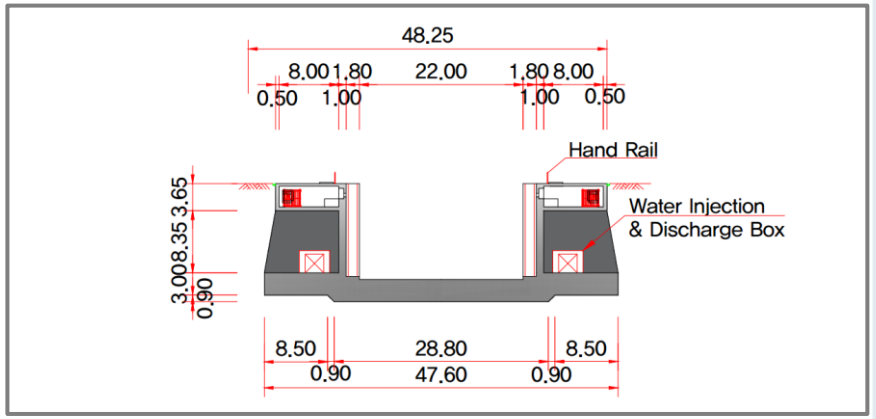
01 Development of Water Resources in Mae Klong Basin

Section of Diversion Dam

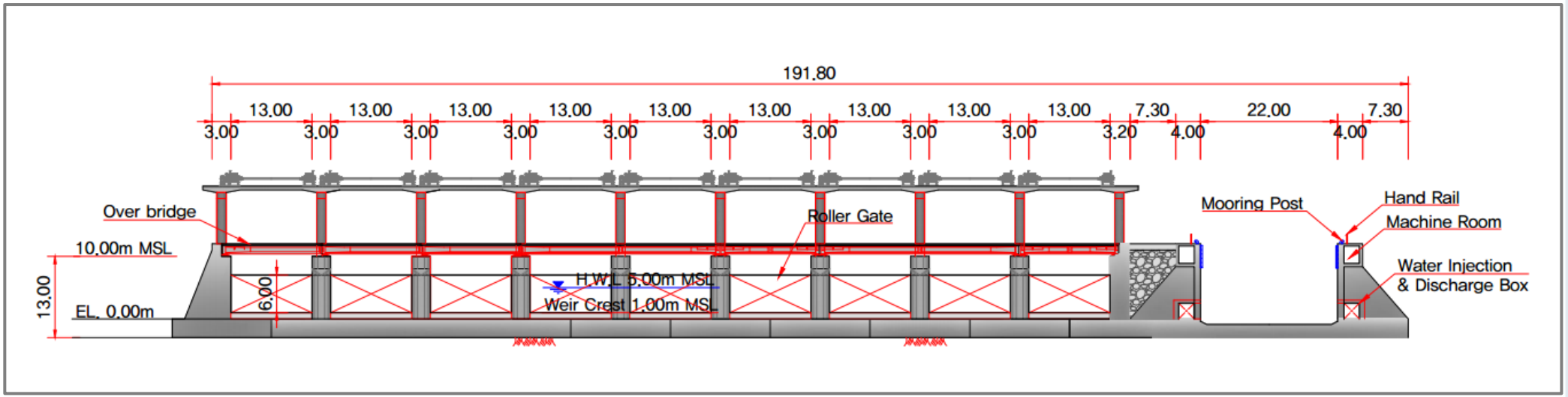
Section A - A



Section C - C



Section B - B



- Priority project facilities : Diversion dam & channel, head regulator
- Project cost : 15,436 Mil.Baht B/C = 1.33 NPV=5,028 Mil.Bhat

02 Conclusion

Additional water supply plan

WANG	WATER (MCM)
Shortage	(–) 107
RID Plan	(+) 19
Exp. Shortage	(–) 88

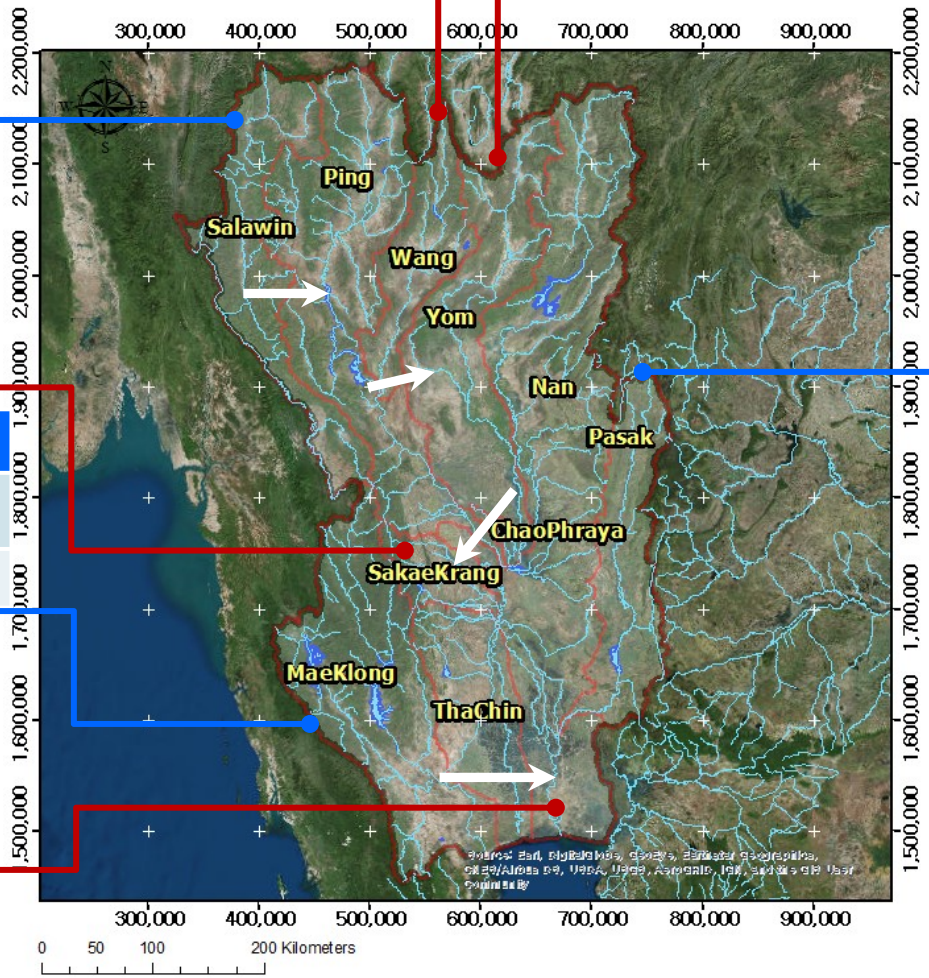
YOM	WATER (MCM)
Shortage	(–) 1,062
RID Plan	(+) 252
Exp. Shortage	(–) 810

SALAWIN	WATER (MCM)
RID Plan	(+) 1,700

SAKAE KRANG	WATER (MCM)
Shortage	(–) 543
RID Plan	(+) 346
Exp. Shortage	(–) 198

MAE KLONG	WATER (MCM)	Note
Water Supply Plan	(+) 1,100	New Plan
Surplus Water	(+) 1,100	

L.C + T.C	WATER (MCM)
Shortage	(–) 1,900
RID Plan	(+) 113
Exp. Shortage	(–) 1,787



PASAK	WATER (MCM)
Shortage	(–) 371
RID Plan	–
Exp. Shortage	(–) 371
Water Supply Plan	(+) 476
Surplus Water	(+) 105

BASIN	WATER (MCM)
SALAWIN	(+) 1,700
WANG	(–) 88
YOM	(–) 810
SAKAE KRANG	(–) 198
Sub TOTAL	(+) 604
MAE KLONG	(+) 1,100
PASAK	(+) 105
Sub TOTAL	(+) 2,009
L. C + T. C	(–) 1,787
TOTAL	(+) 22

02 Conclusion

Future Water Shortage

- **Result of Water Balance Analysis**

  - Expected water shortage in Chao Phraya basin (2035yr) : 3,253 MCM

  - T.C+L.C water shortage :1,787 MCM (54.9%)

Additional water supply plan

- **Mae Klong basin ➔ Total 1,100MCM (Coordination operation VJK&SND)**

  - Structural Plan

  New diversion dam ➔ Additional water availability : 400 MCM

  - Non-Structural Plan

  Using Existing Canal ➔ Additional water availability : 700 MCM

  Measure of adjusting the L.W.L of Srinagarind dam ➔ Emergency Storage : 789 MCM

- **Salawin basin (Plan of water supply by RID) ➔ Total 1,700 MCM**

  - Plan of additional water supply : 1,700 MCM (Salawin to Ping basin)

02 Conclusion

Additional water supply plan

- **Selection of Priority**
  - Structural Plan : 1st New Diversion Dam in Mae Klong basin, 2nd Rising the Pasak dam
  - Nonstructural Plan : Utilization of inactive storage in Srinagarind dam
    Using Exixsting Canal(PaPa Canal)

➔ **Considering the possibility of securing water resources and connectivity with new project,** ***construction of a new diversion dam is suggested for priority project*****.**

-

Item			Specification	Remark
New Diversion Dam	Roller Gate		W13.0 x H6.0 x 9EA	
	Navigation Lock		B22.0 x L252.6	
Diversion System	Design water diversion(m^3/s)		12.7	
	Diversion Channel Gate		W2.0 x H3.0 x 4EA	
	Diversion channel	Length(km)	71.0	Tha Pha ~ WTP
		Slope(%)	0.001	

- **Project cost : 15,436 Mil.Baht (B/C = 1.33 , NPV = 5,028 Mil.Baht)**


ขอบคุณ
Thank You