

# **The introduction of Wastewater Reclamation in Taiwan**

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# Outline

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**Introduction**

**II**

**Development of Reclaimed Water**

**III**

**Demonstration Project**

**IV**

**Conclusion**

Public Sewer System



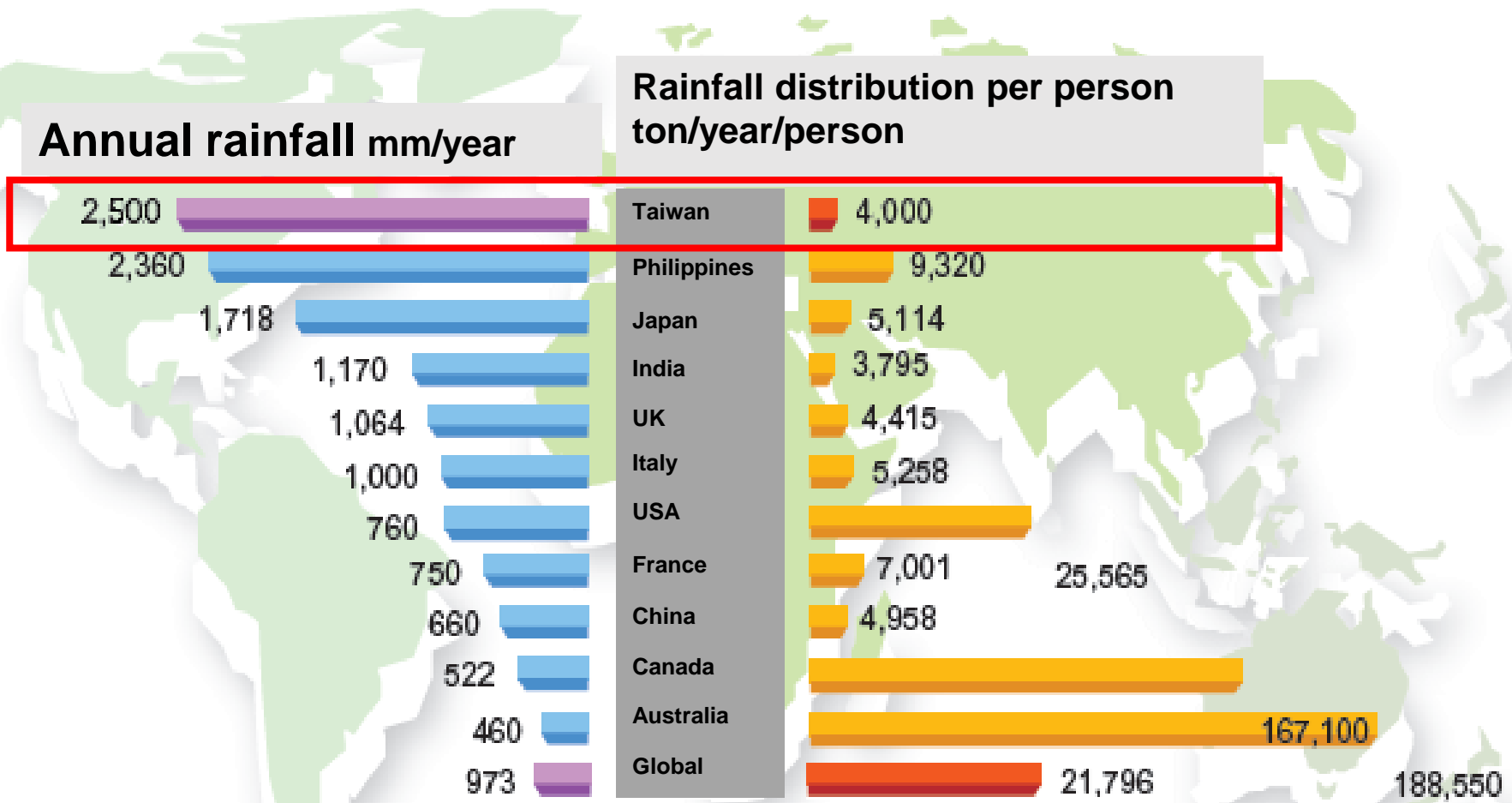
# I

# Introduction

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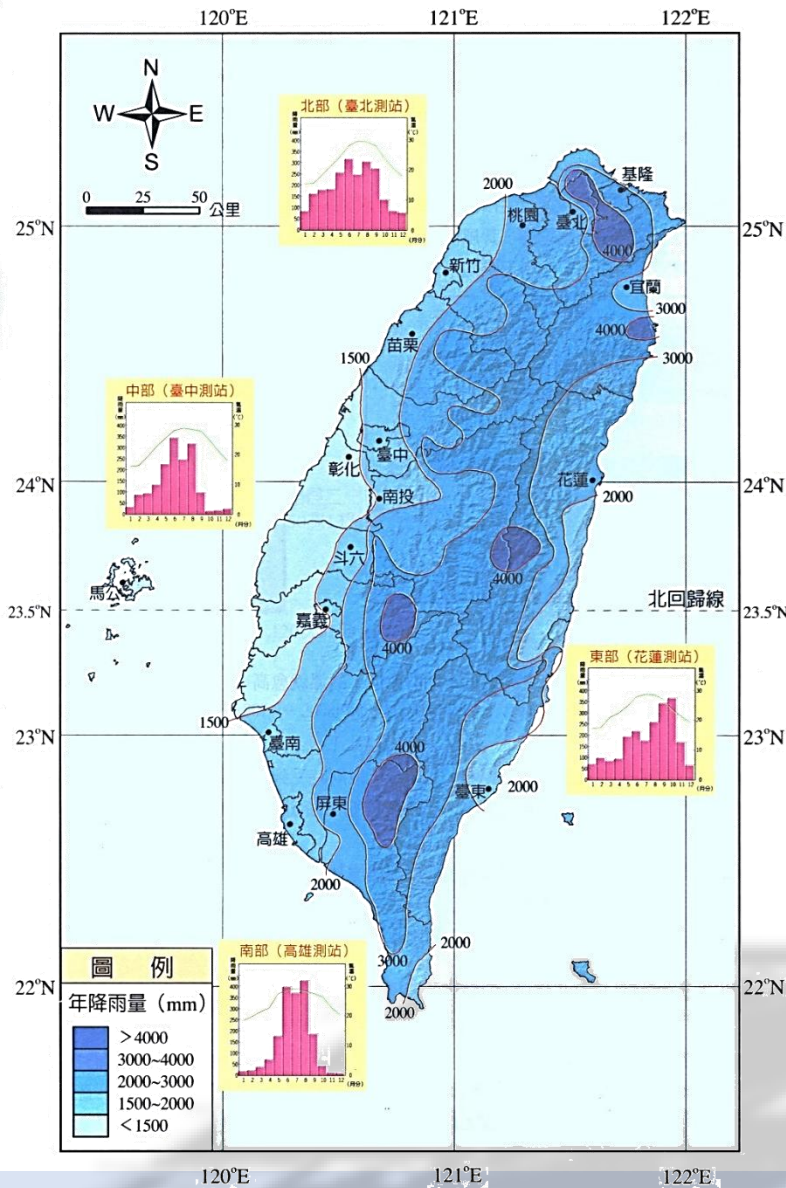


# Problems of Water Resources Management in Taiwan



- ❑ Annual rainfall : **3 times** of global average
- ❑ Per capita quantity of water : Less than **1/5** of global average
- ❑ The **18<sup>th</sup>** water scarcity country in the world

# Problems of Water Resources Management in Taiwan



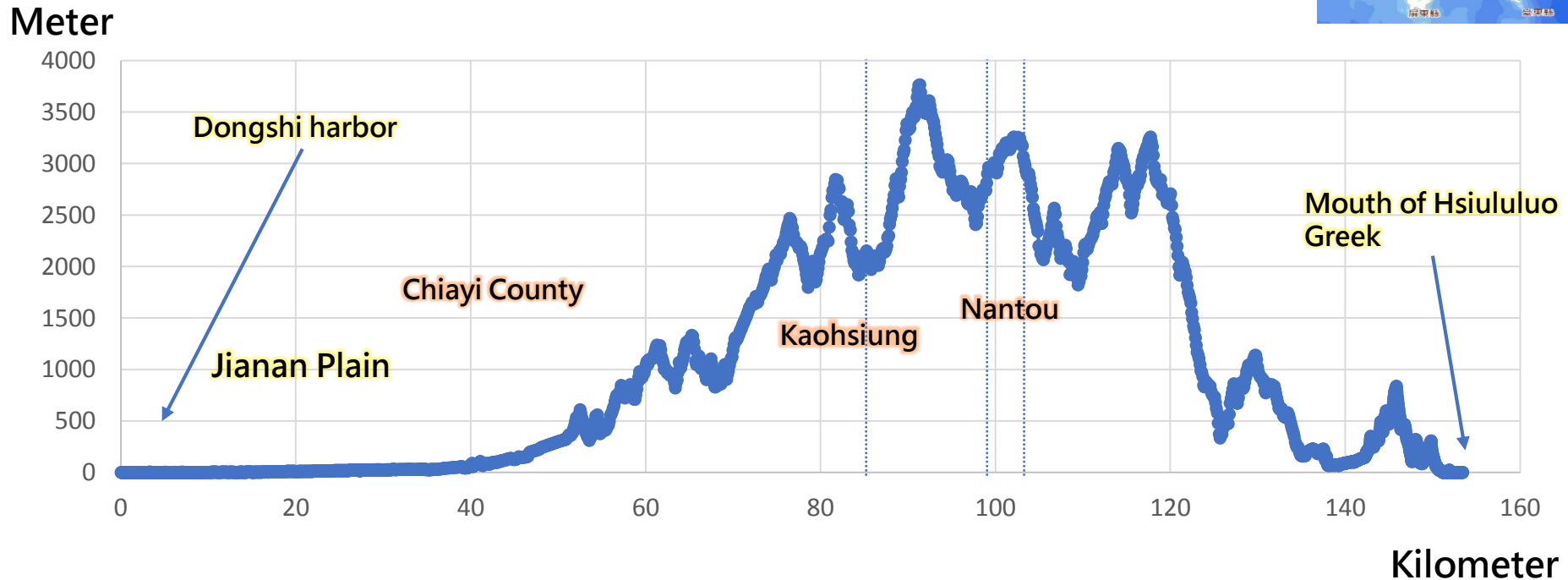
## Problems:

- ❑ Rainfall is **abundant**
- ❑ Unevenly distributed in **space** and **time**
  - ✓ Mountain area **> 8000mm**
  - ✓ Plain area **< 1200mm**
  - ✓ Example : In **south area**, the rainfall in wet season is **9 times** of dry season

# Problems of Water Resources Management in Taiwan

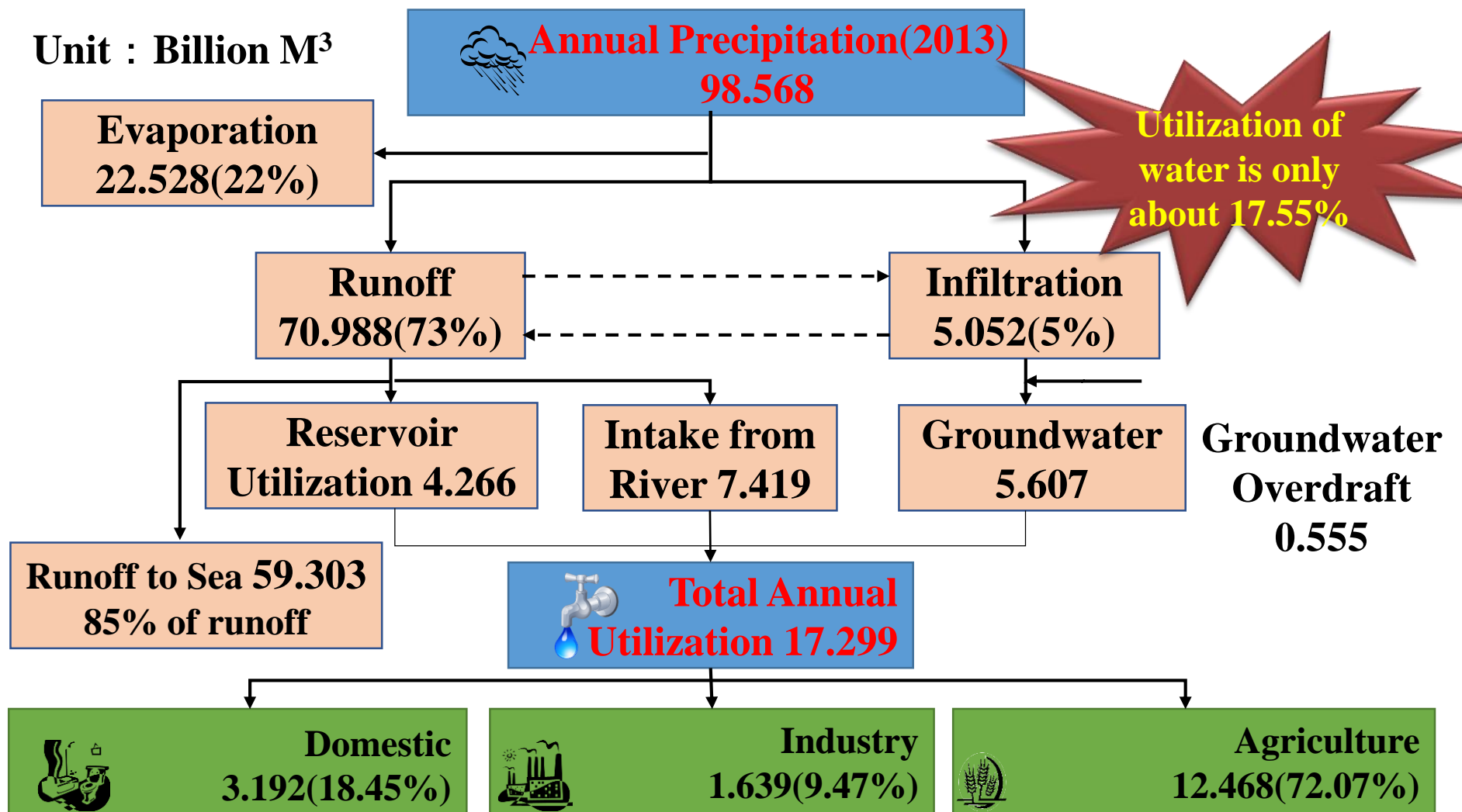
## Problems:

- ❑ Disadvantage of **landscape**
- ❑ Elevation drops **3900m** in distance of **90 kilometer**
- ❑ **Gradient** of river is **steep**



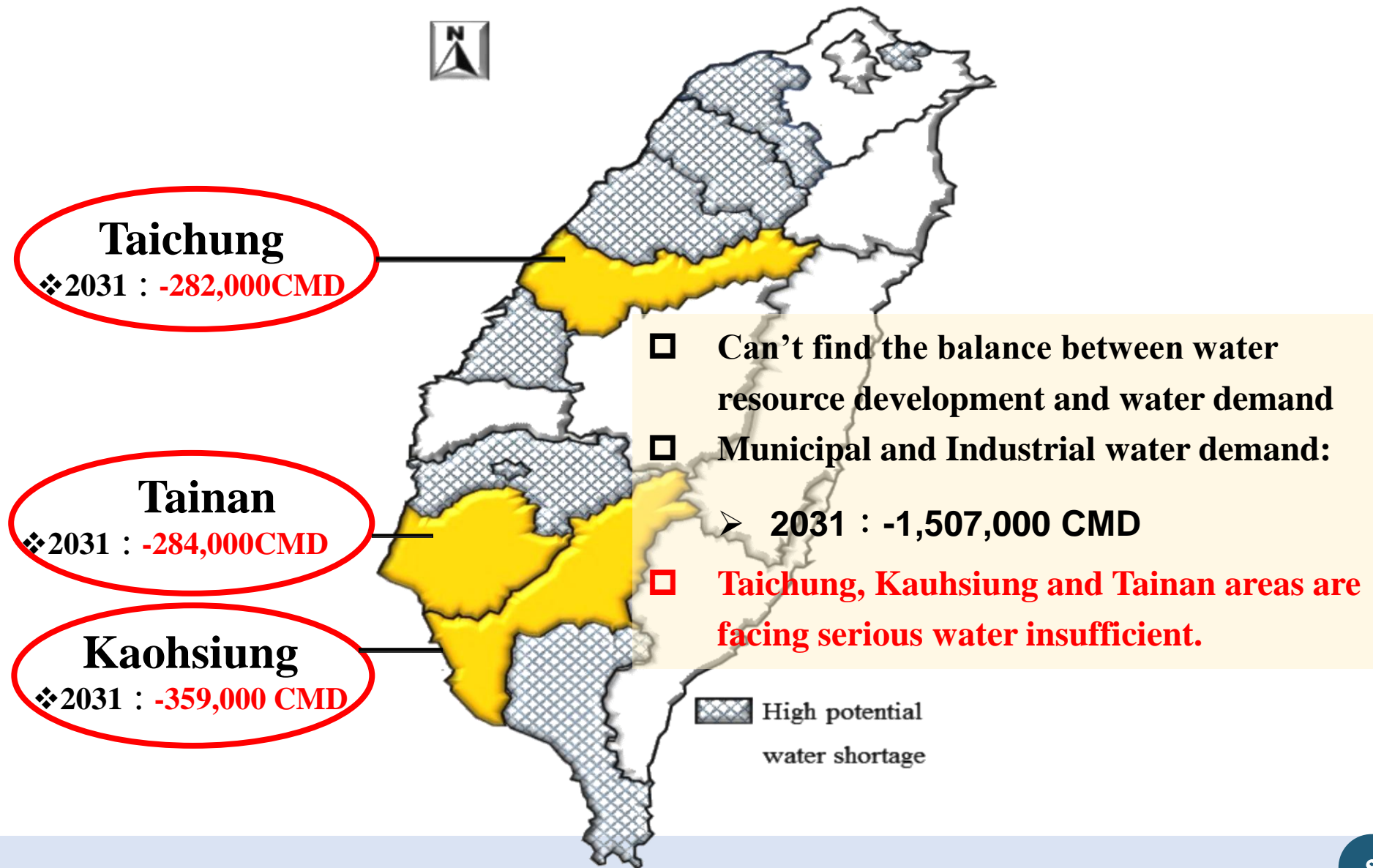
# Characteristics of Water Resources in Taiwan

Unit : Billion M<sup>3</sup>





# Water scarcity areas in Taiwan





# Future Development of Water Resources in Taiwan

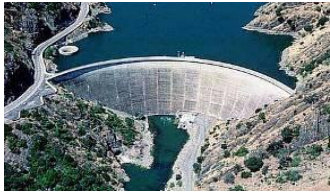
**Reclaimed water will become an important part of the future water resources**

**Sustainable Approach**

**Uneven distribution  
Controversial**

**High power consumption**

**Stable quantity  
Stable quality**



**Water Storage**



**Desalination**



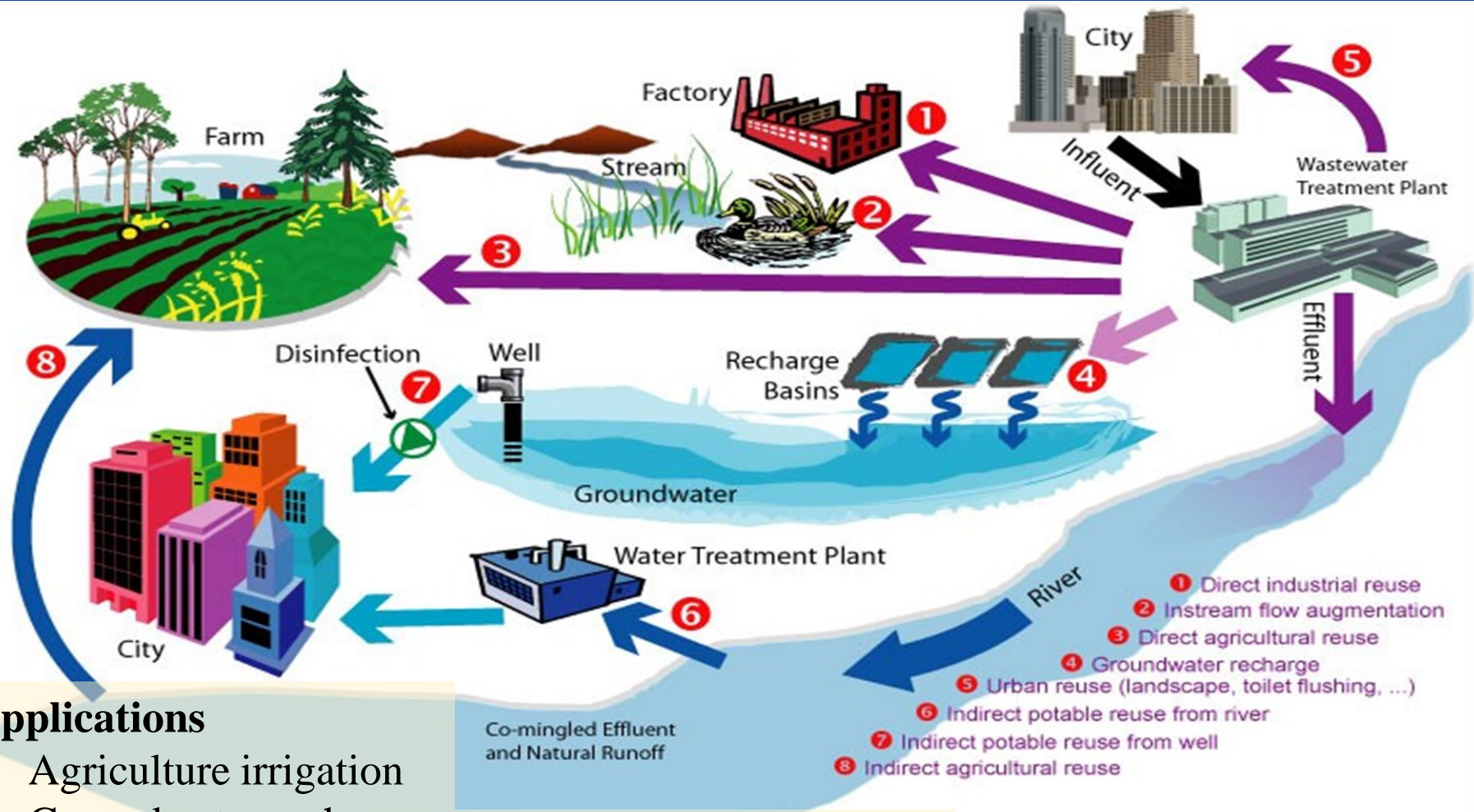
**Wastewater  
Recycle**

**Traditional Water Sources**



**Dam: 65 unit  
Desalination : 17 plants  
WWTP : 61**

# Applications of Reclaimed wastewater



## Applications

- Agriculture irrigation
- Groundwater recharge
- Potable Reuse
- ✓ Industry reuse

## Problems

- Public health concern

# II

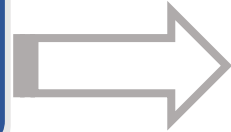
## Development of Reclaimed Water

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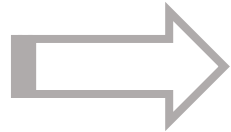
# Strategies of Promoting Reclaimed wastewater

**Provide  
Incentive**



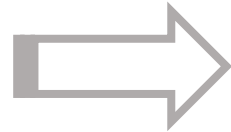
- Reclamation plant and water pipeline are regarded as infrastructure
- Reduce price of reclaimed water

**Add  
Value**



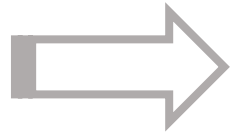
- ◆ Encourage industry to use reclaimed water
- ◆ With high value of production

**Eliminate  
Interface**



- Combine sewage system and reclaimed water system
- Run by the same operation contractor

**Legalization**



- ✓ Reclaimed Water Resource Development Act
- ✓ Water-scarce areas are obligated to use reclaimed water



# Six Demonstration Wastewater Reclamation Plants

- **6 demonstration plants**
- **Total reclaimed water 280,000CMD**
- **Total budget 500 million USD**
- **Period:2013~2020**

## **Putain (1)**

(Running)

**130,000CMD (Secondary process)**

User : Taichung Harbor Industry Park

## **Anping (2)**

(Running)

**60,000CMD**

User : Southern Taiwan Science Industry park

## **Fengshanshi (3)**

(Running)

**45,000CMD**

User : Linhei Industry Park

## **Fengyuan (5)**

(Under construction)

**20,000CMD**

User :Central Taiwan Science Industry Park

## **Yongkan (6)**

(Under construction)

**15,000CMD**

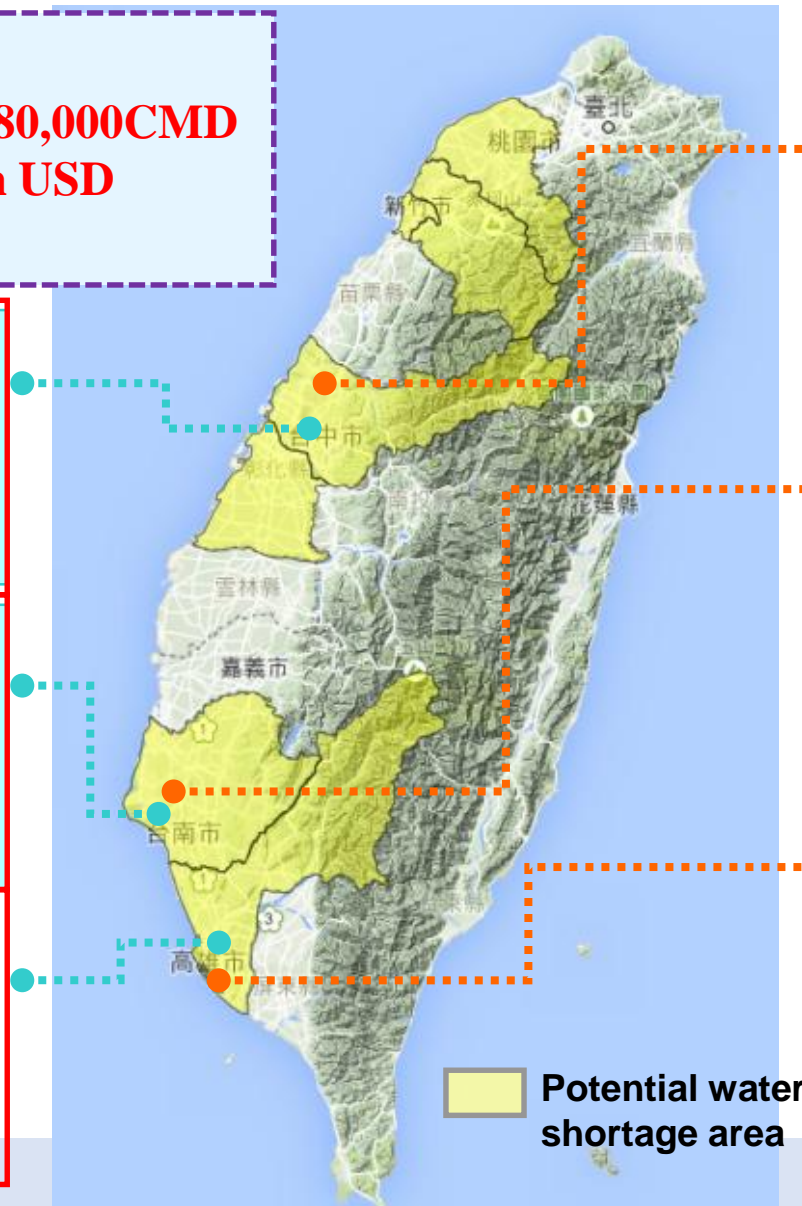
User: Southern Taiwan Science industry Park

## **Linhei (4)**

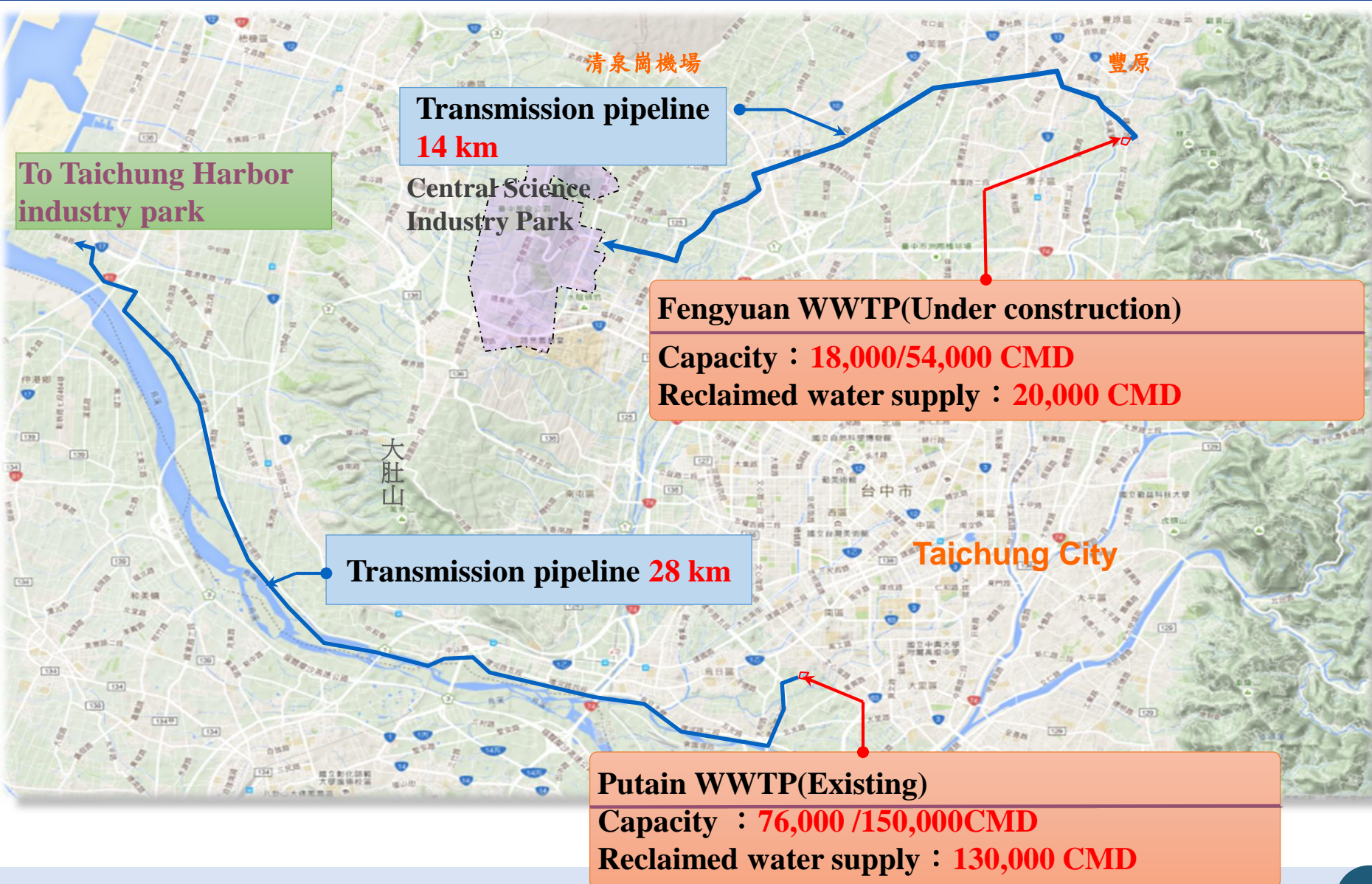
(Under construction)

**10,000CMD**

User: Linhei Industry Park

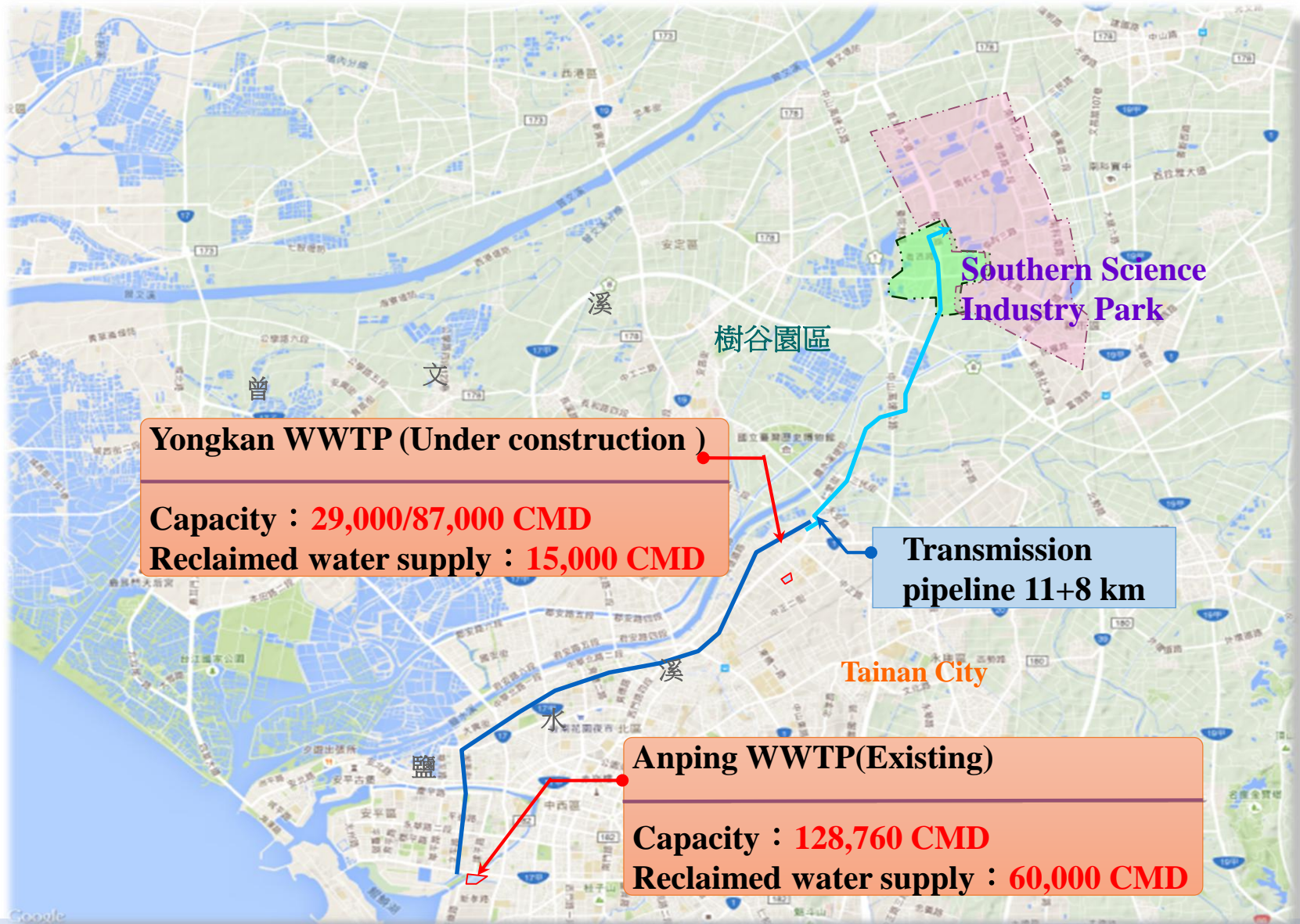


# Putain WWTP and Fengyuan WWTP





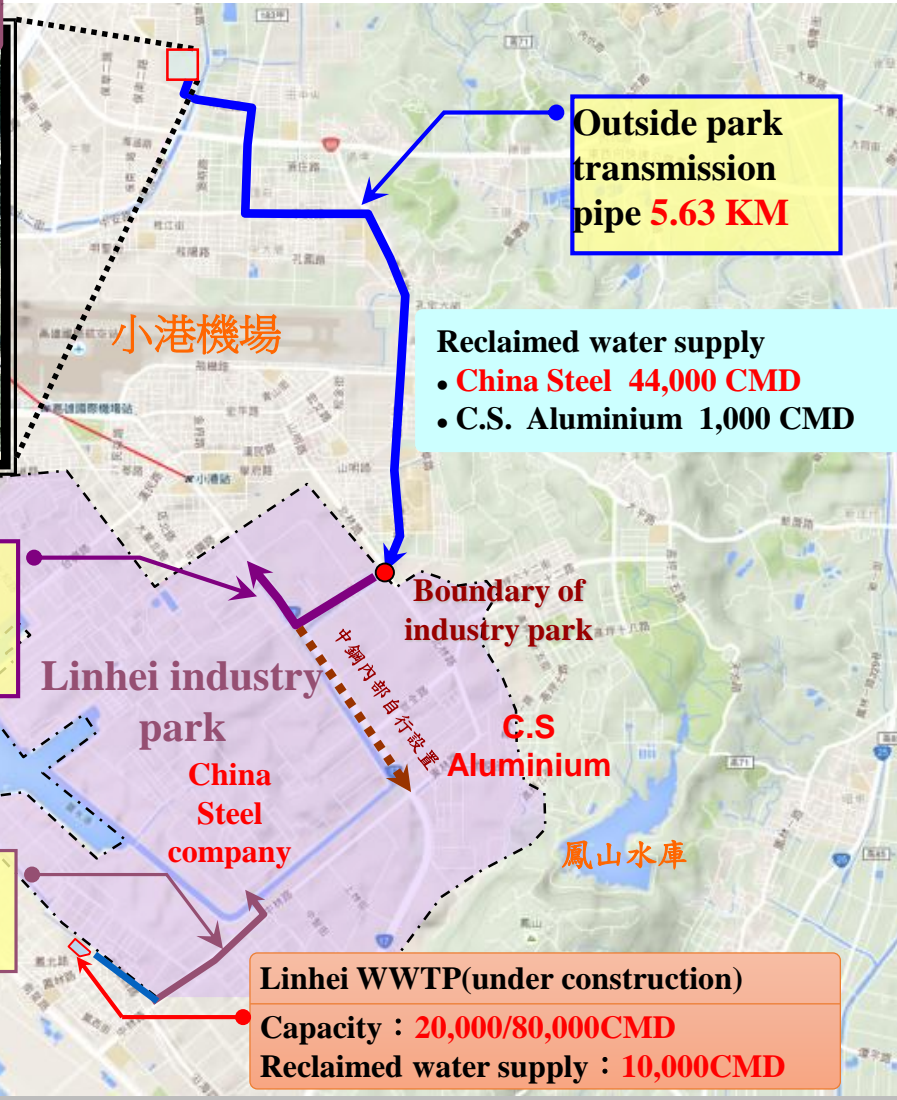
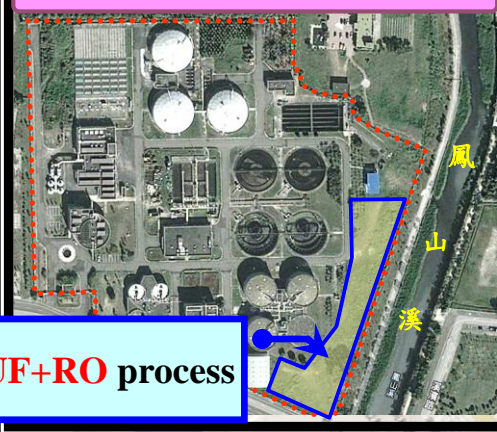
# Yongkan WWTP and Anping WWTP



# Fengshanshi WWTP and Linhei WWTP

Fengshanshi WWTP(Existing)

Capacity : **48,000CMD**





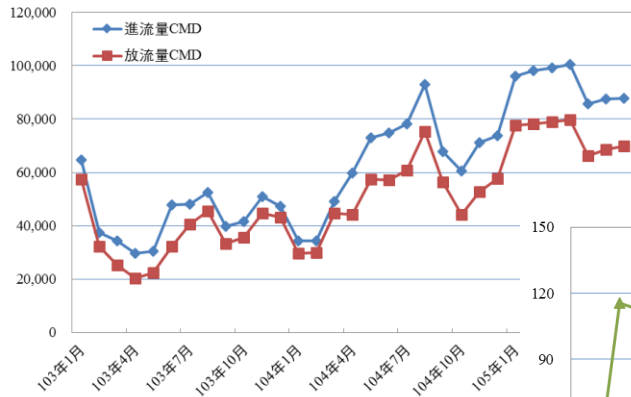
# III

## Demonstration Project



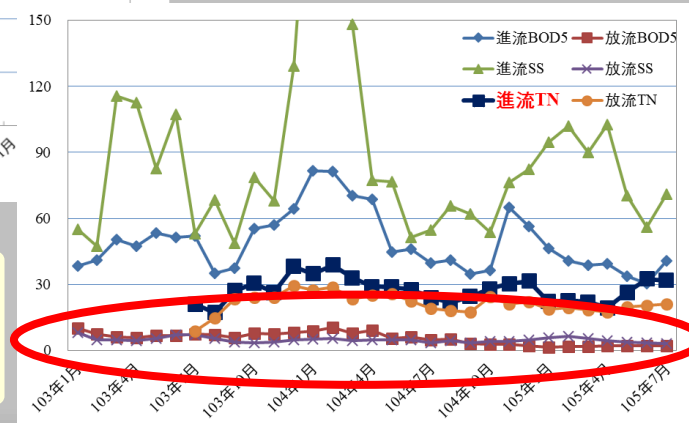
# Fengshanshi wastewater reclamation plant

## Wastewater Treatment Plant



- Stable **quantity**  
**60,000CMD**

- Stable **quality**
- **SS, BOD < 10mg/L**



- Has **extra**  
**space**



- Stable **quality** and **quantity**
- Has **extra space**
- Implemented by **BTO** and **Concession is 17 years**

Scheduled capacity of  
reclamation water plant  
( CMD )

2018	2018~2031
25,000	45,000

# Fengshanxi wastewater reclamation plant Treatment Process

WWTP Effluent

Pre-filter

UF

RO

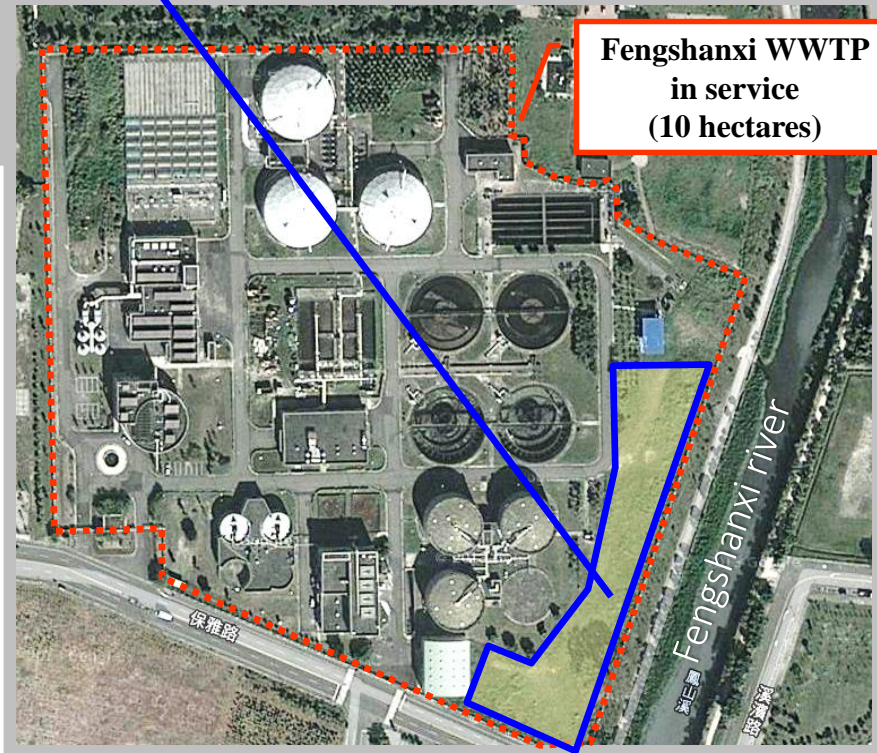
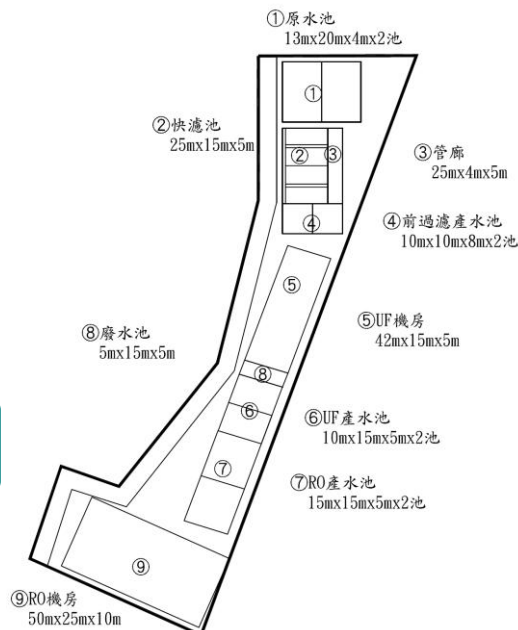
Chlorination

Reclaimed Water  
Storage Tank

Pipeline

Linhai Industrial  
Park

**Fengshanxi  
reclamation plant  
( 0.8 hectares )**

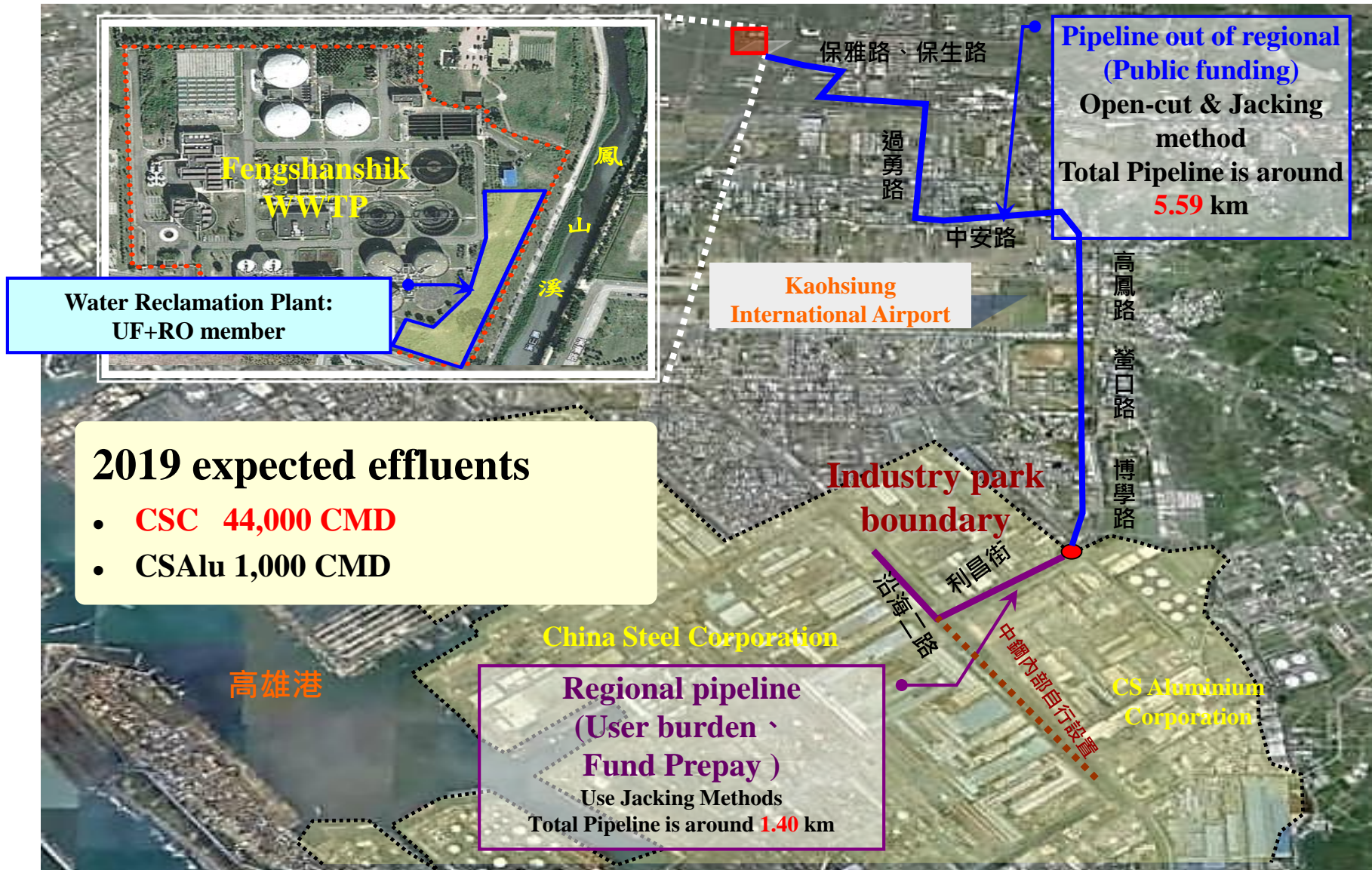


- The water quality of reclaimed water is based on the user's intent.



# Fengshanshi wastewater reclamation plant

## Transmission system





# Fengshanshi wastewater reclamation plant

## Transmission system

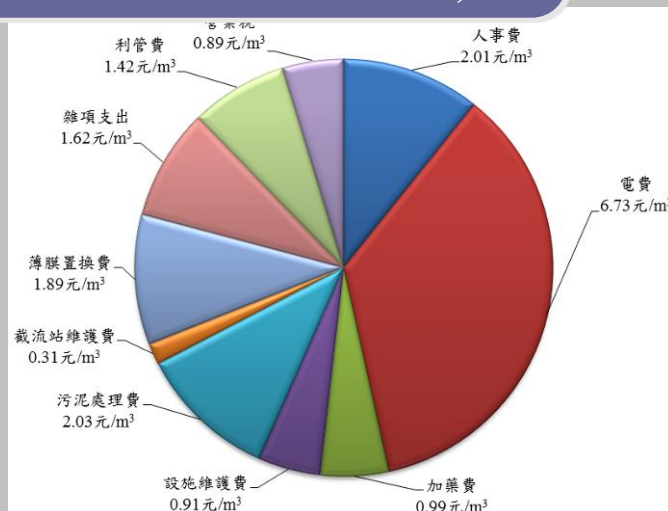
Item	First phase	Second phase	Note
Wastewater reclamation plant	31	18	Quantity of first phase : 25,000CMD Second phase : 45,000CMD
Transmission system	14	-	
Management cost	5.4	2.2	(Wastewater reclamation plant fee + Transmission pipe) X 12%
Indirect cost	8.9	3.2	
Subtotal	59.3	23.4	
Total		82.7	Unit: million USD

User pay the cost of reclaimed water will be **1.29 USD/m<sup>3</sup>**.

### Price of Reclaimed Water(exclude construction cost)

#### User Pay

- WWTP operating cost
- M&O of wastewater reclamation plant and transmission system



### Price of Reclaimed water USD/CMD

Personnel	0.07
Electricity	0.22
Chemical	0.03
Maintenance	0.03
Sludge disposal	0.07
Pipe maintenance	0.01
Membrane replacement	0.06
Miscellaneous	0.05
Management	0.05
Tax	0.03
Total	0.61

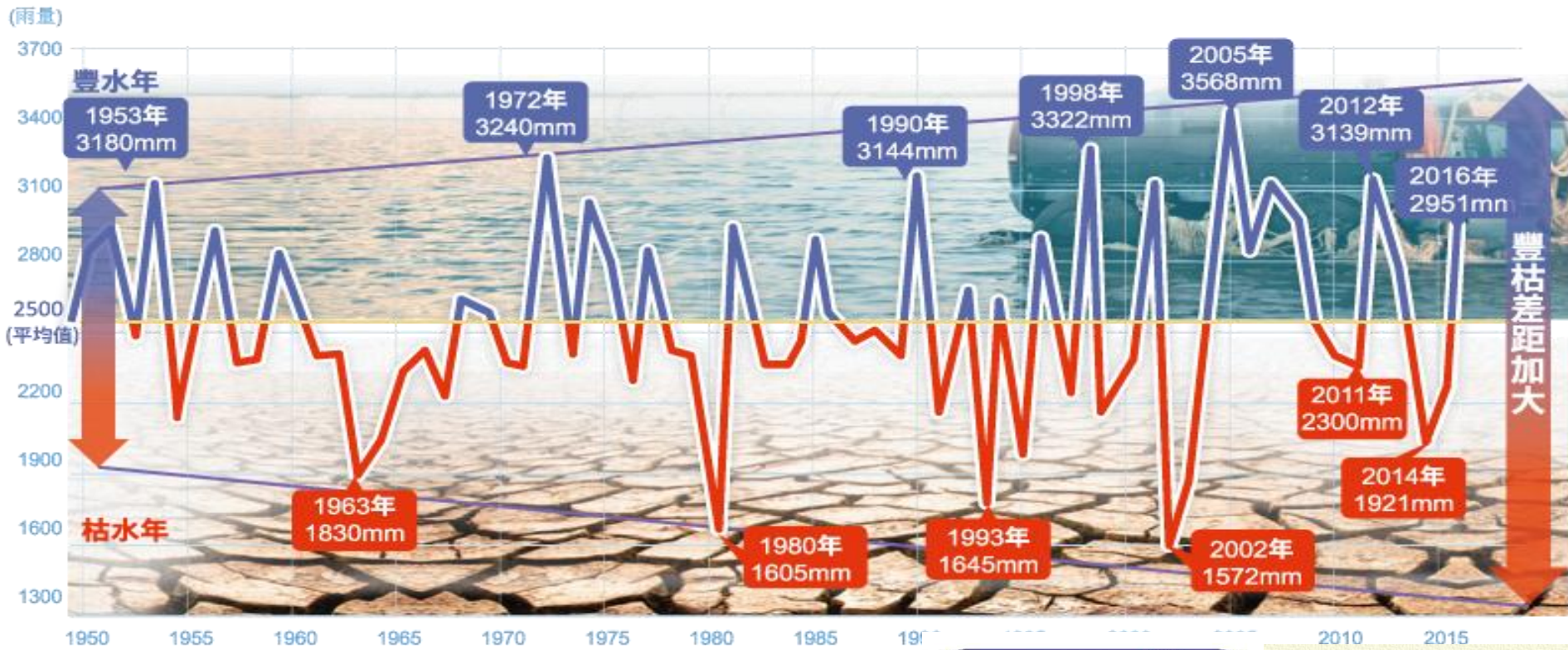
# IV

## Conclusion

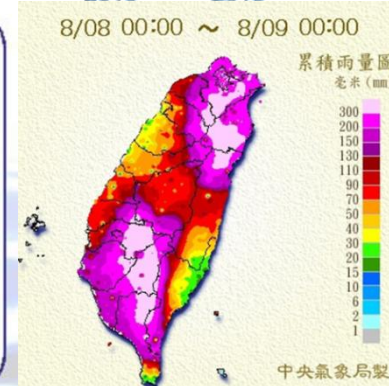
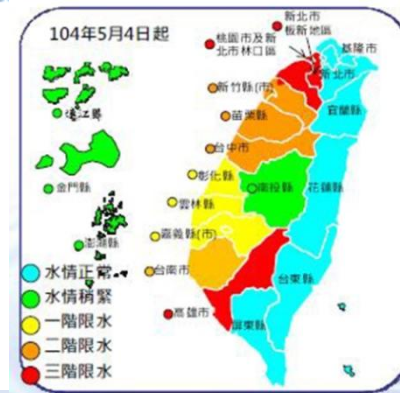
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# Importance of Reclaimed water in Taiwan



- ❑ The difference between **wet** and **drought** become **larger** (from 1300mm to 2000mm)
- ❑ The period between **wet** and **drought** become **shorter** (10 years to 3 years)



# The Future We Want



**RIO+20**  
United Nations  
Conference on  
Sustainable  
Development

<https://sustainabledevelopment.un.org/rio20.html>

## Sustainable Development Goals



<https://sustainabledevelopment.un.org/index.php?menu=1300>





# *Public Sewer System*

*clean water and sanitation*

*Thanks for  
Listening*



# Fengshanshi wastewater reclamation plant

## Architecture Design Concept

### 「Ocean」 Urban Image

Eliminating the oppression of large-scale buildings and creating a lively space with the use of water-related animals - whales as a building theme

Whales - the echo of images and the environment



Whales-Belly stripe features  
Roof molding  
metal plate

Curve metal plate

Arc Hall

Whale Shape Diagram



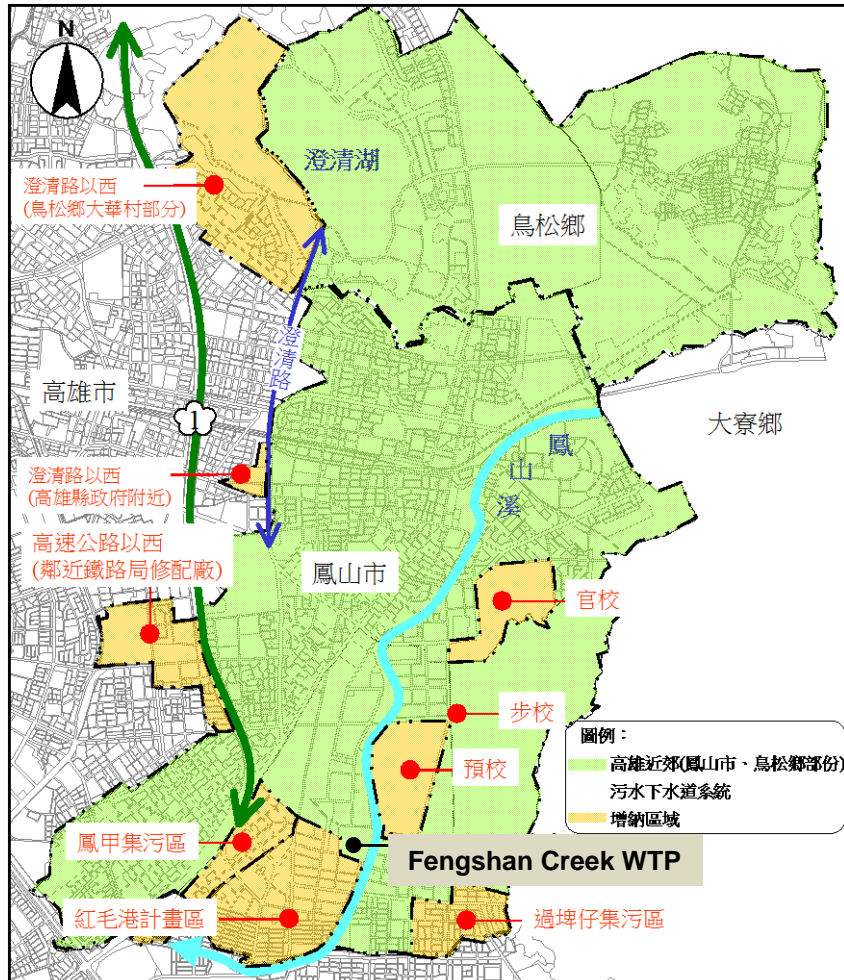
A gesture of whale swimming in the water



# Fengshanshi wastewater reclamation plant

## Sewerage System

### Public sewage system & WTP



### Sewerage catchment area :

- Area : 4,531 ha
- Pipeline: **170 km** (2013)
- Number of households : **50,000**

### Water Treatment Plant :

- Secondary processing unit : **trickling filter/solids contact** , since 2005.
- Treatment scale : **109,600 CMD**
- Daily average capacity: **98,000 CMD** (2016 Jan~Apr), about 20,000 CMD of effluents inject to wetlands and parks, and 78,000 CMD flow to Fengshan Creek.
- Expected to 2028, Daily capacity included interception can reach design scale.
- Daily average capacity **87,000 CMD** (2016 July)