A Brand-new Future of the Sewer System in Taipei

Department for the Promotion of Private Participation
Ministry of Finance

Sewerage Systems Office,
Public Works Department,
Taipei City Government

Speaker ： Chien-Hsien Lee, Director

2020.09.24

Outline

I. Sewer System of Taipei City – Current Situation

II. Sewer System of Taipei City – Planning

III. Sewer System of Taipei City – Vision

I. Sewer System of Taipei City - Current Situation

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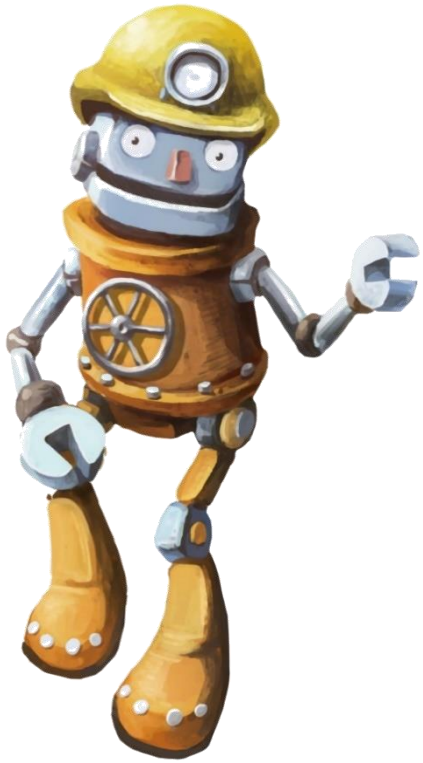
The major targets of sewer system in Taipei



- To ensure a clean and healthy living environment
- To improve and protect the river water quality
- To promote the reuse of water resources

Sewer System of Taipei City

Taipei City (July 2020)

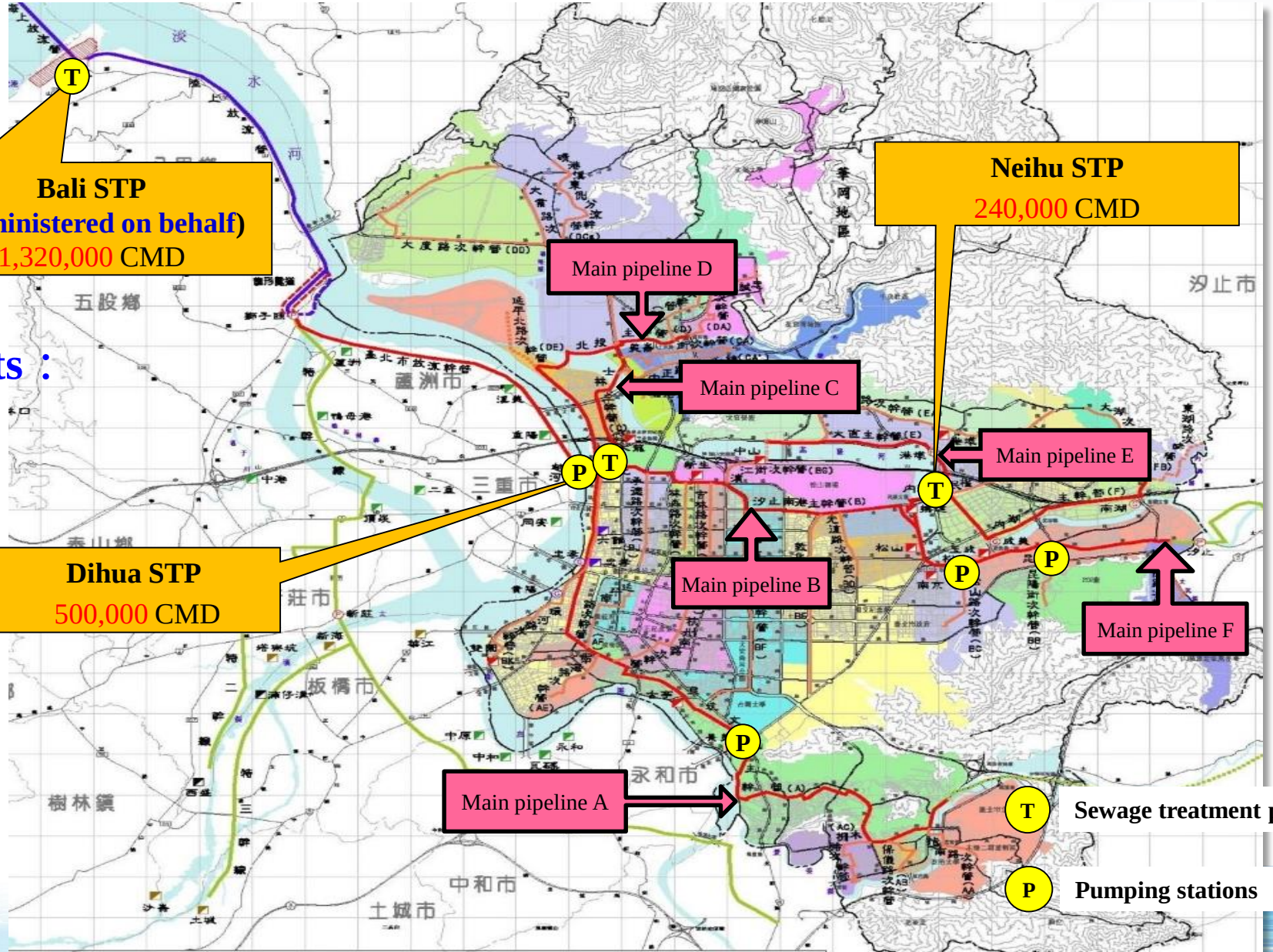
Area：271 km²

Population：2,620,037

Household：1,060,529

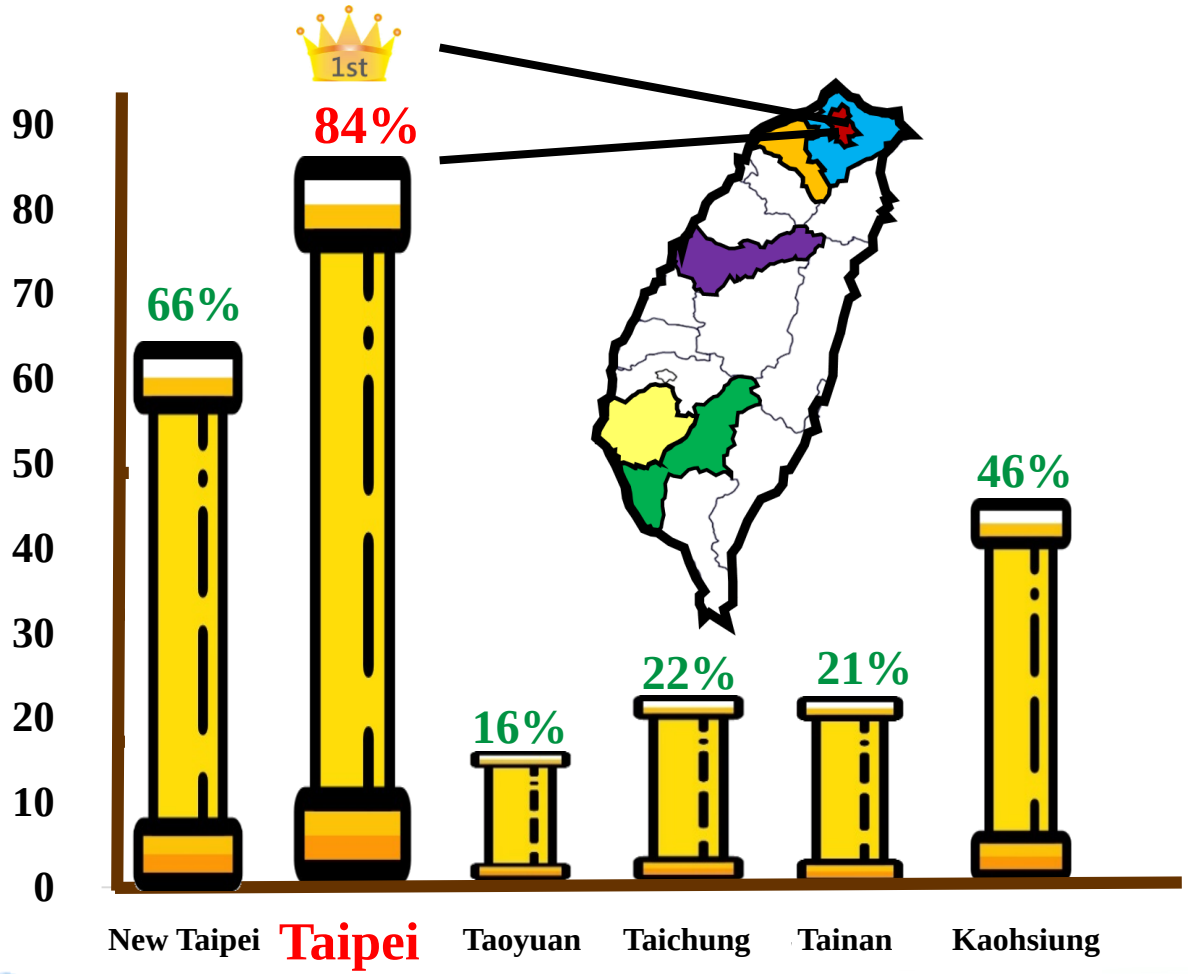
Sewer System

- **Wastewater treatment plants：**
  2+1 / 2.06 x 10^6 CMD
- **Pumping stations ：4**
- **Lifting stations：36**
- **Interception facilities：**
  14 / 676 x 10^3 CMD
- **Gravel treatment facilities：**
  5 / 64 x 10^3 CMD

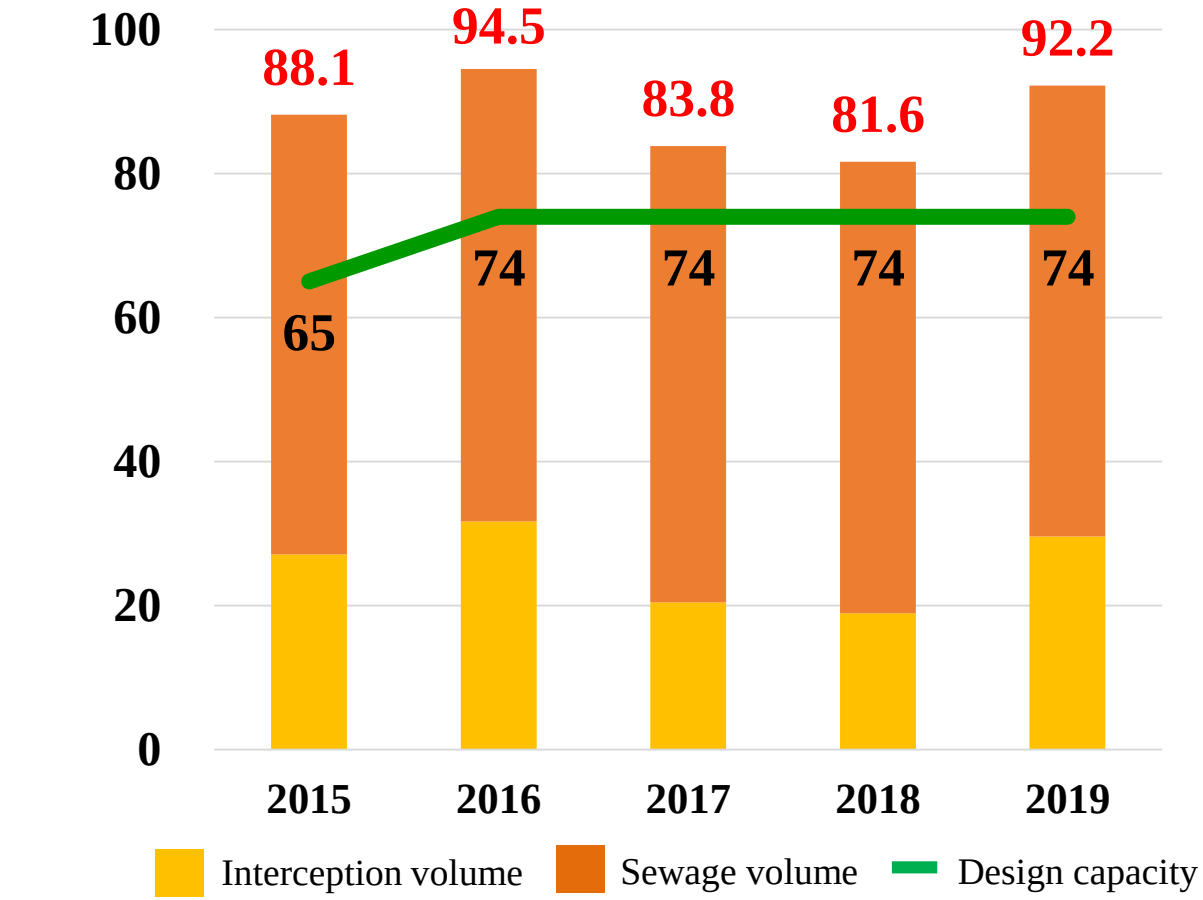


Household Connection Rate

- ***890,924 households*** having sewerage service and household connection rate is about ***84%*** (July 2020)



The Amount of Taipei's municipal wastewater



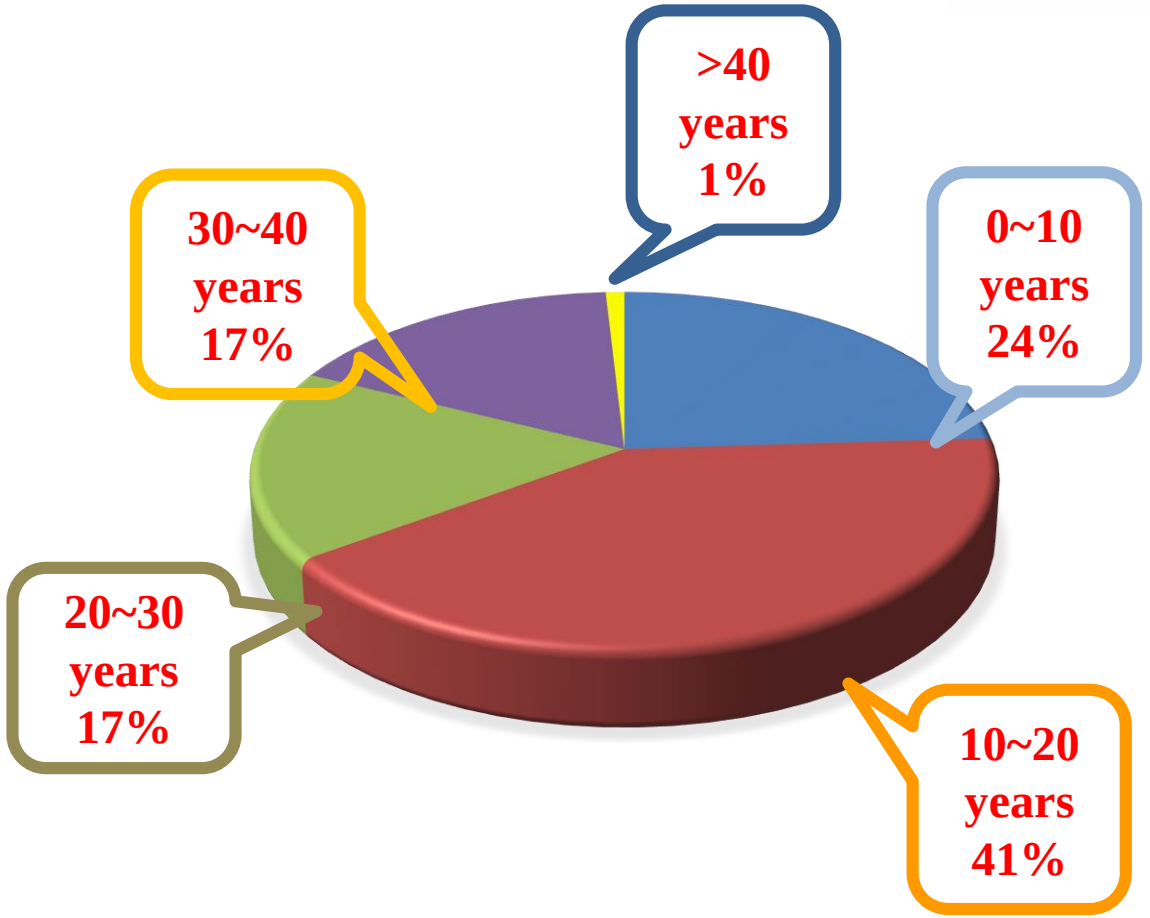
- About 300,000 CMD of excessive sewage is transported to Bali Plant for treatment.

Source: Construction and Planning Agency, Ministry of the Interior
Statistic Table of National Sanitary Sewer Piping Rate and Overall Sewage Treatment Rate(July 2020)

Current Status of Sewerage Pipeline System in Taipei

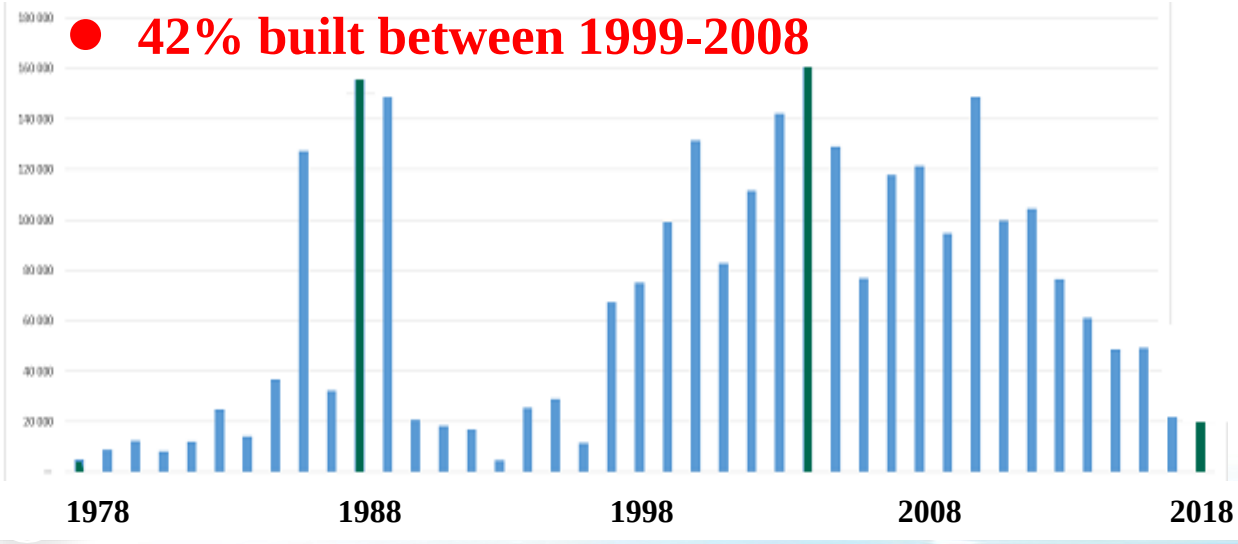
- Total length of sewerage pipeline 2,717.7 km (2019)

Age (year)	Built year	Length (m)
0~10	2010~2019	656,263
10~20	2000~2009	1,120,651
20~30	1990~1999	472,956
30~40	1980~1989	458,585
>40	Before 1979	24,677
Total		2,717,688

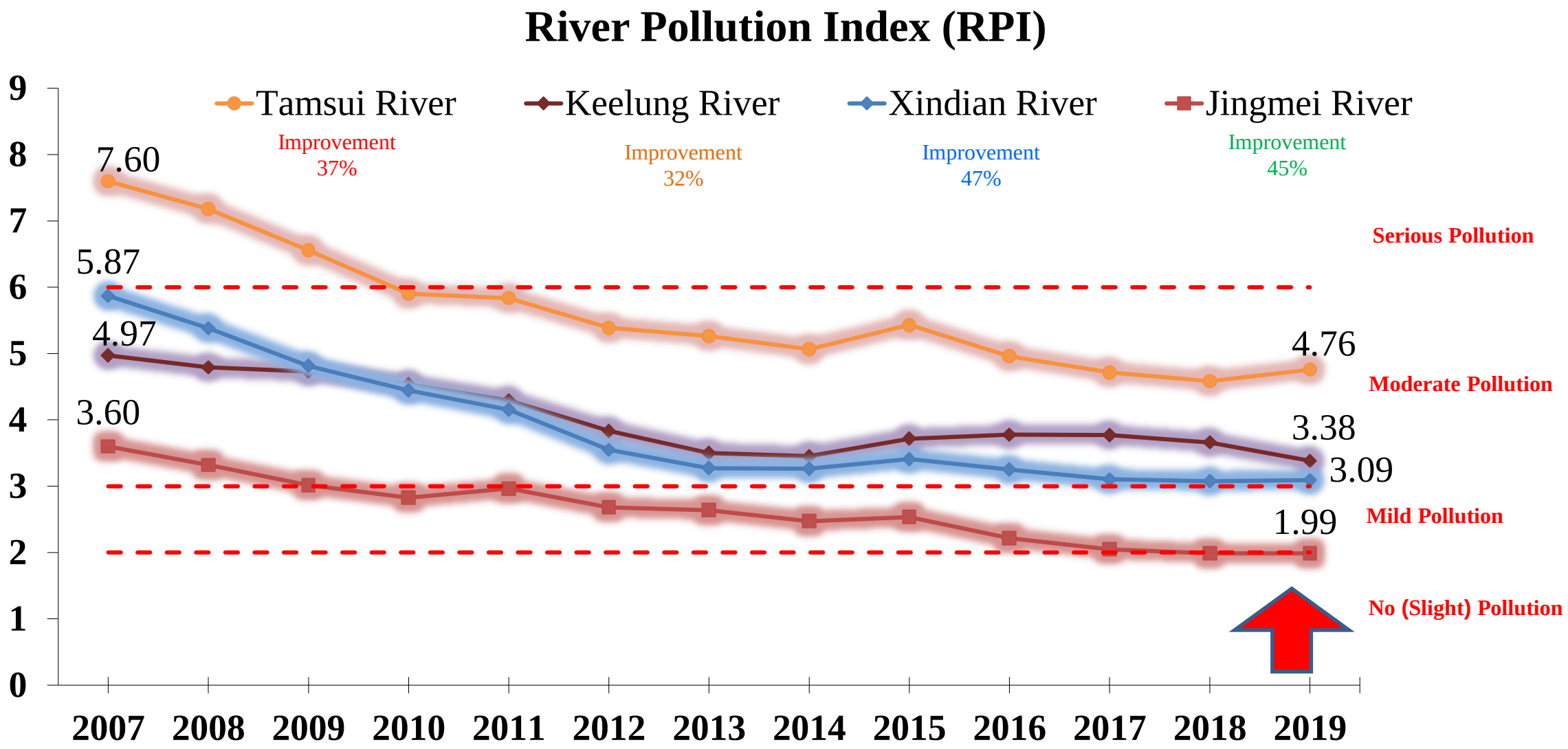


- Age profile of existing sewerage pipelines

- 42% built between 1999-2008



Water Quality Trends of Taipei Rivers Over the Last 12 Years



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III. Sewer System of Taipei City – Vision

Climate Change

2020, Japan. Source：Associated Press

2019, India. Source：Reuters

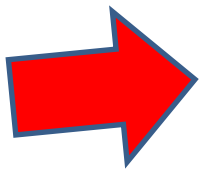
2020, Taiwan. Source：China TV

2016, Paris. Source：Associated Press

2015, California. Source：Tech News

2017, Taiwan . Source：China Times

International Trends and Indicators

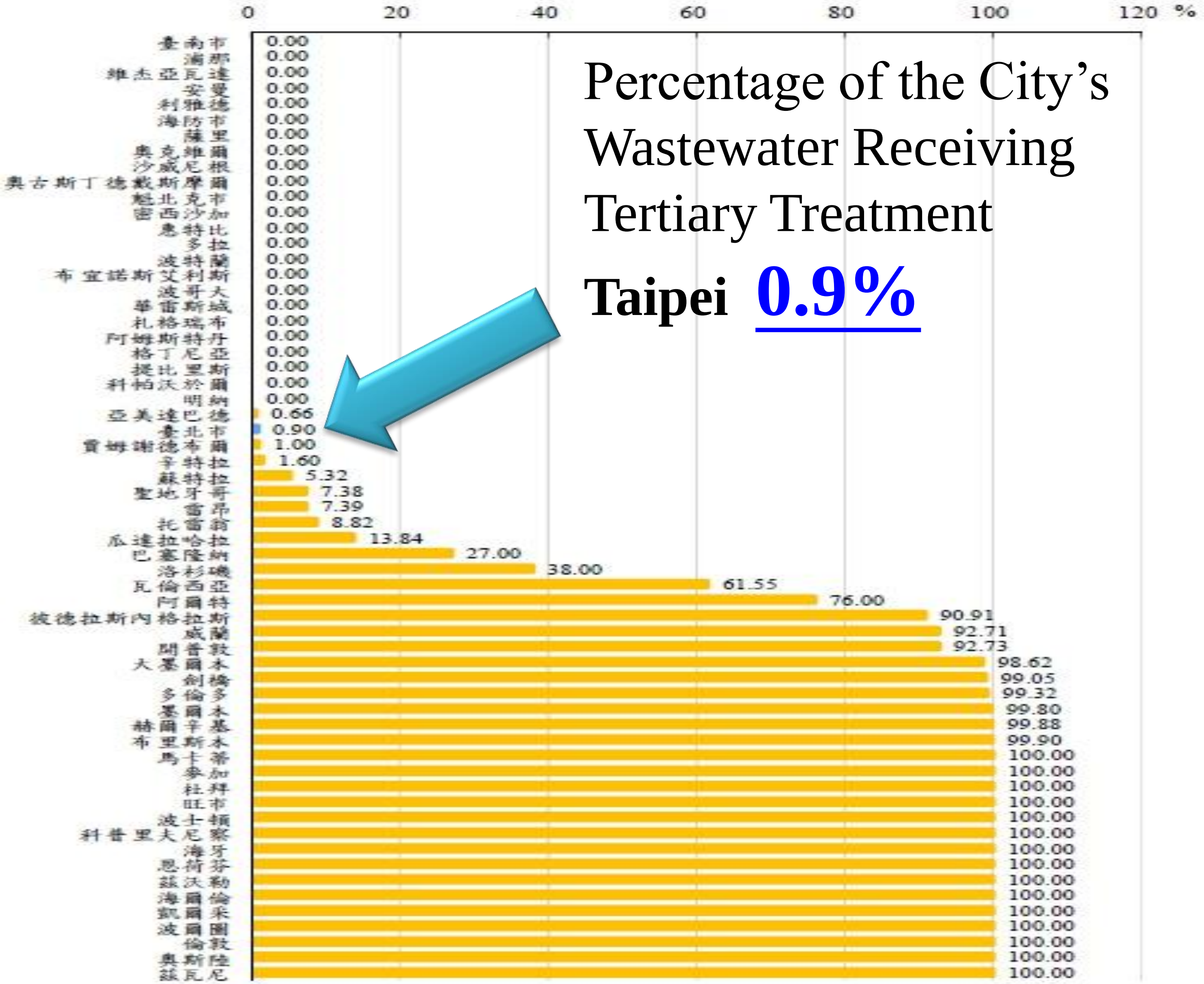


Sustainable Development Goals (SDGs)

Percentage of City Population Served by Wastewater Collection

Percentage of the City's Wastewater Receiving Tertiary Treatment

International Trends and Indicators



Percentage of the City's Wastewater Receiving Tertiary Treatment

Taipei 0.9%

Source：WCCD, 2018

WCCD

WASTEWATER

World Council on City Data (WCCD)
Percentage of City Population Served by Wastewater Collection
Percentage of the City's Wastewater that has Received No Treatment
Percentage of the City's Wastewater Receiving Primary Treatment
Percentage of the City's Wastewater Receiving Secondary Treatment
Percentage of the City's Wastewater Receiving Tertiary Treatment

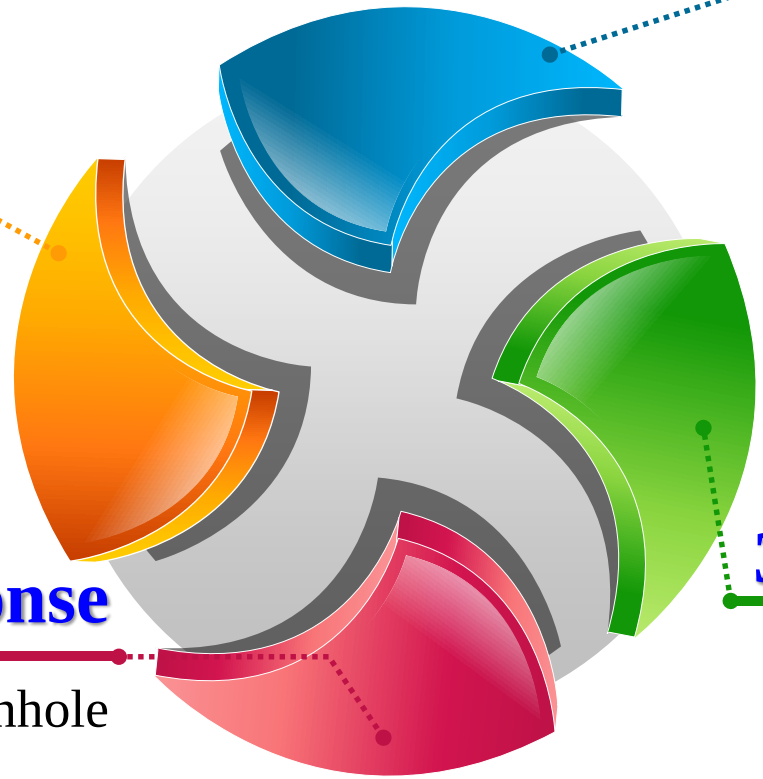
New Issues Facing of Sewer System in Taipei

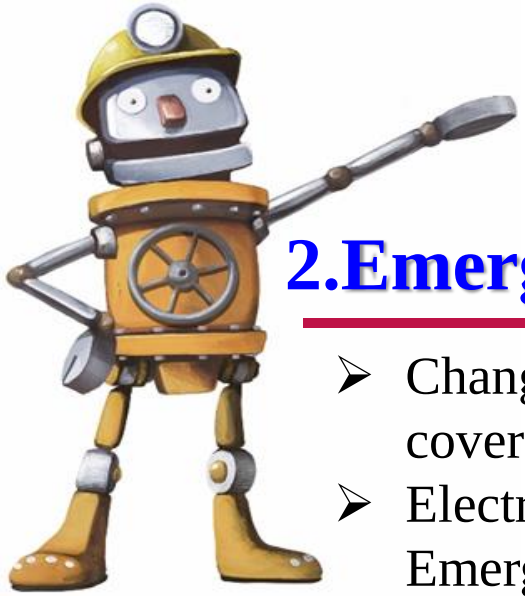
1. Wastewater Treatment

- Build a new generation water resource center
- Increase the production of reclaimed water

4. Household Connection

- Change in contracting method
- Rule amendment
- Adoption of new techniques





2.Emergency Response

- Change the form of manhole covers
- Electronic Early Warning and Emergency Response Platform
- Sewerage System Hydraulic Monitoring Center

3. Lifespan Extension Plan

- Sewage Treatment plant
- Pipeline Inspection & Repairing
- Water Quality Audit

Wastewater Treatment

-Build a New Generation Water Resource Center

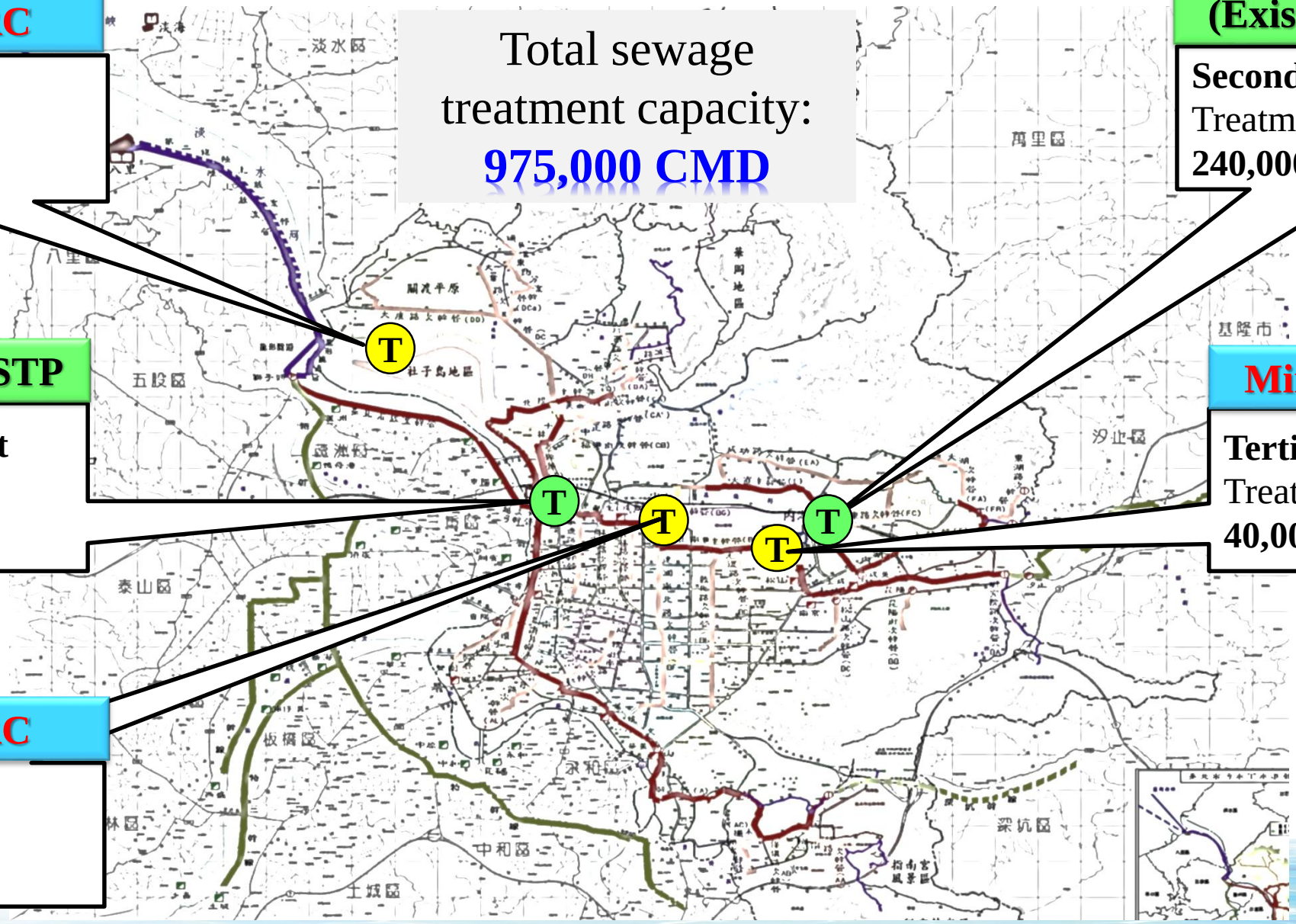
Shezidao WRRC

Tertiary treatment
Treatment capacity：
35,000CMD

(Existing) Neihu STP

Secondary treatment
Treatment capacity：
240,000CMD

Total sewage treatment capacity:
975,000 CMD



(Existing) Dihua STP

Secondary treatment
Treatment capacity：
500,000CMD

Mingsheng WRRC

Tertiary treatment
Treatment capacity：
40,000CMD

Binjiang WRRC

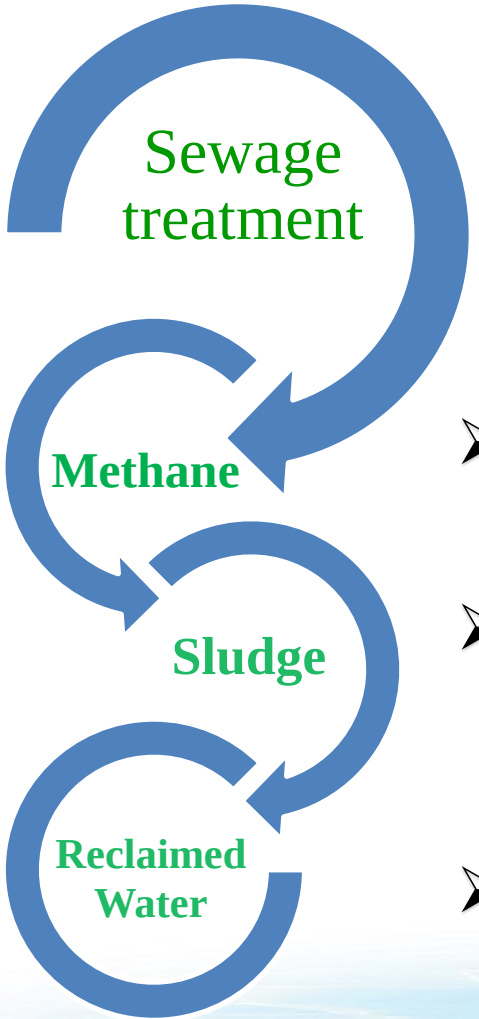
Tertiary treatment
Treatment capacity：
160,000CMD

Wastewater Treatment

-Build a New Generation Water Resource Center

✓ New **Generation** Water Resource Center

∞ **Circular Economy**



- **Methane is recovered for fuel or power generation.**
- **Dried sludge is manufactured into water permeable paving and flower containers.**
- **Reclaimed water is reused.**

✓ **Water quality requirements are far higher than discharge standards**

AO+MBR System			
Design Discharge Water Quality (mg/L)			
BOD	SS	TN	NH_3-N
10	4	15	5

Wastewater Treatment

-MingSheng Water Resource Reclaimed Center

- **Sewer Intelligent Operation Management Center**

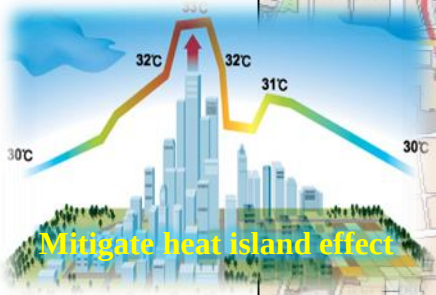
- **Sewer Environmental Education Center**

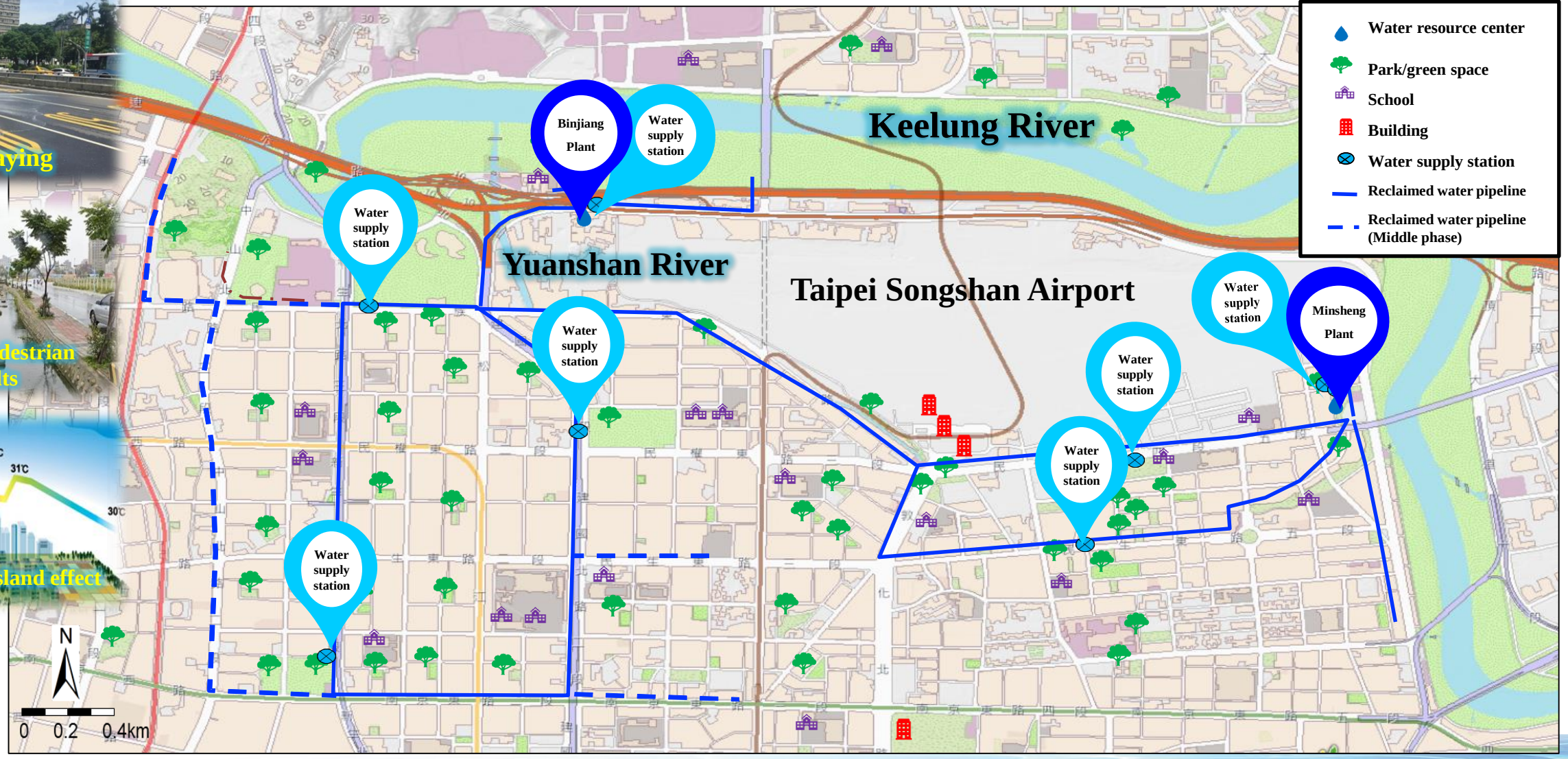
Wastewater Treatment

-Binjiang Water Resource Reclaimed Center

Wastewater Treatment

-Laying of Reclaimed Water Pipeline Network





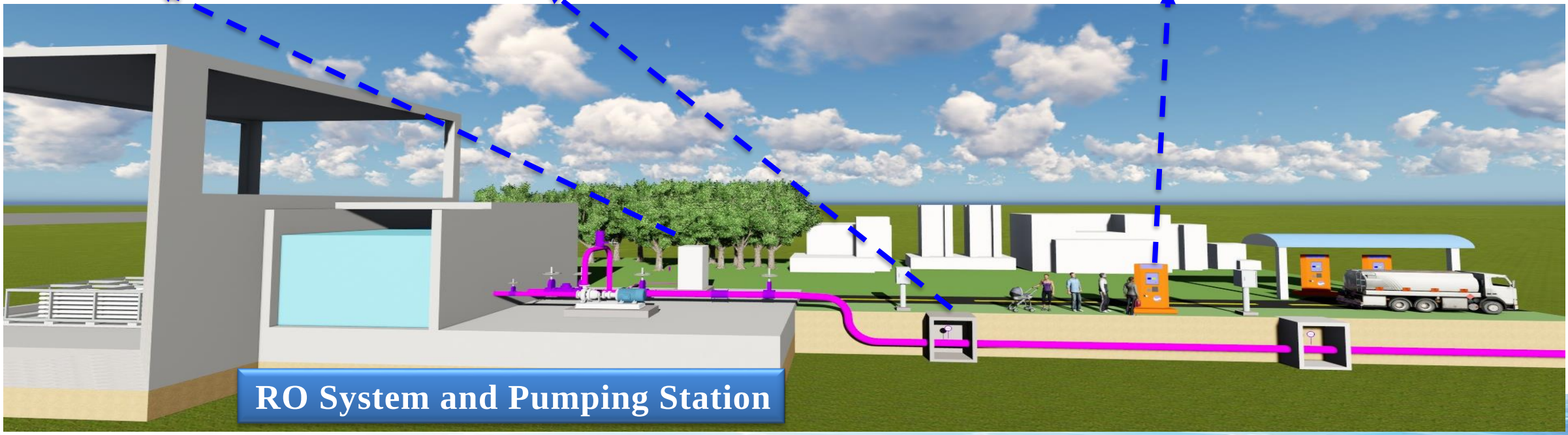
Wastewater Treatment

-Build Smart Online Water Intake System for Reclaimed Water

Online Quality Analysis

Monitoring Points

Smart Kiosk



RO System and Pumping Station

Emergency Response - Challenges and Difficulties

Extreme rainfall

↓

Water volume increased drastically in the sewerage system

↓

Air in the pipelines is compressed by the large volume of water and not vented in time

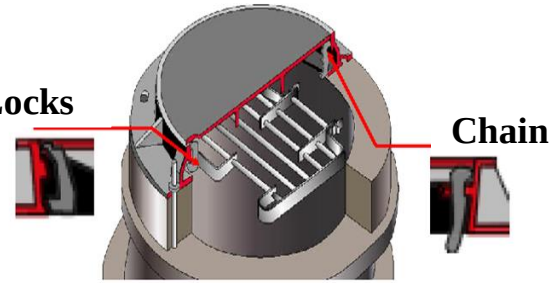
↓

Manhole cover explosion

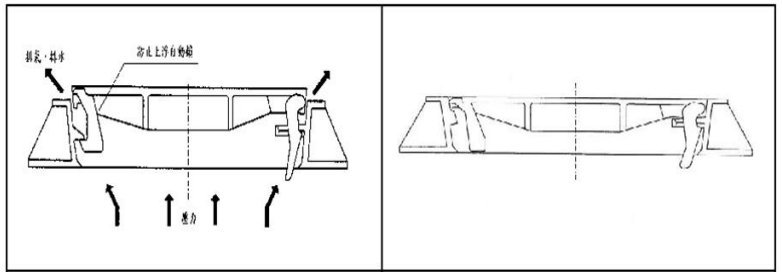
Source：TVBS

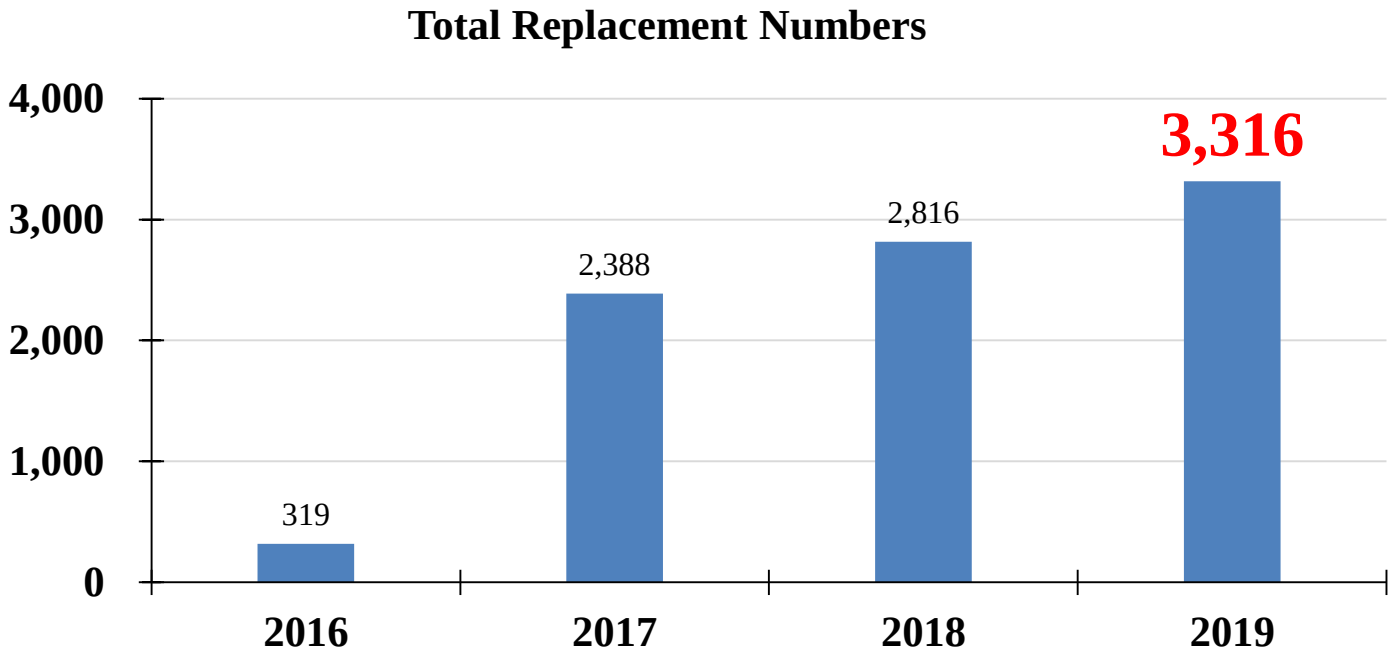
Source ：CNA

Emergency Response - Replacing Manhole Cover



Pressure-resistant Manhole Cover





Before

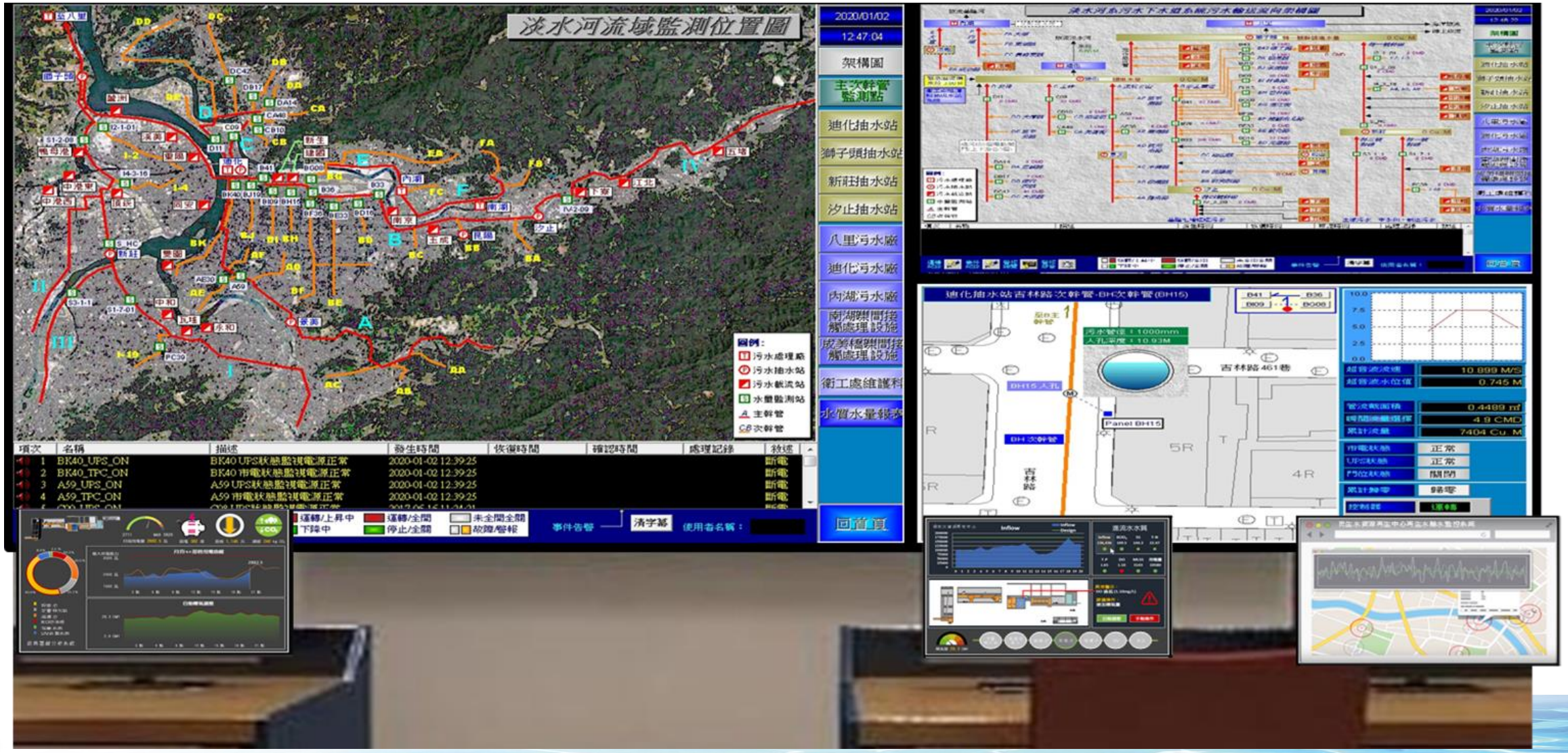
After

Emergency Response

- Existing Sewerage System Hydraulic Monitoring Center

Plant Operation Situation

Water Level and Flow Monitoring



Emergency Response

-Early Warning and Emergency Response Platform

AI deep learning and system water volume forecast

2 sets of servers and system platform

Water level station
71 sites

Key facilities

Hydraulic model calibration and verification

SWMM hydraulic modeling

Parameter configuration for auxiliary management system

- Weather forecast
- Hydro information
- Real-time rainfall
- Real-time monitoring
- Computer-assisted operations system
- GIS potential overflow zones
- Integrated app information
- **Early warning and emergency response platform**

Integration and interfacing of existing real-time surveillance systems and information

Establishment of early warning and emergency response system

Upgrade to the existing computer-assisted operations management system

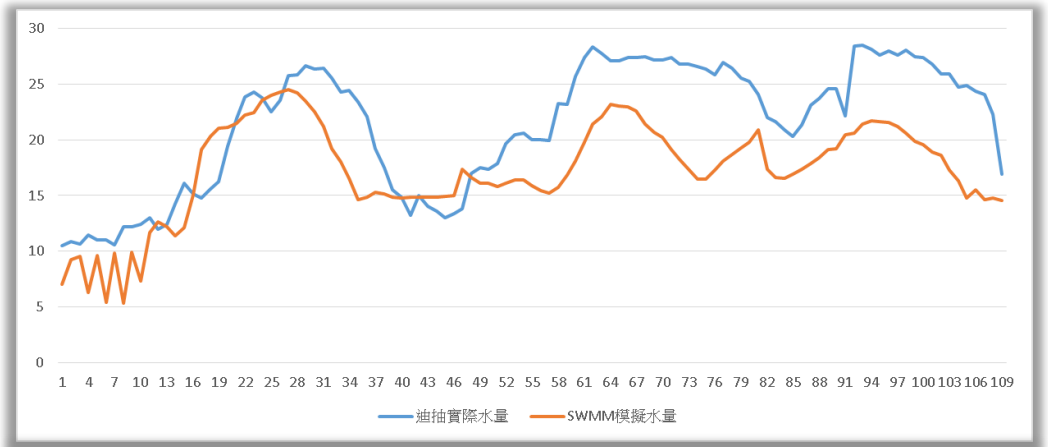
Early warning modeling and verification

Emergency Response

-Early Warning and Emergency Response Platform

- SWMM model simulation for Dihau WWTP inflow during Storm water event

109/5/28



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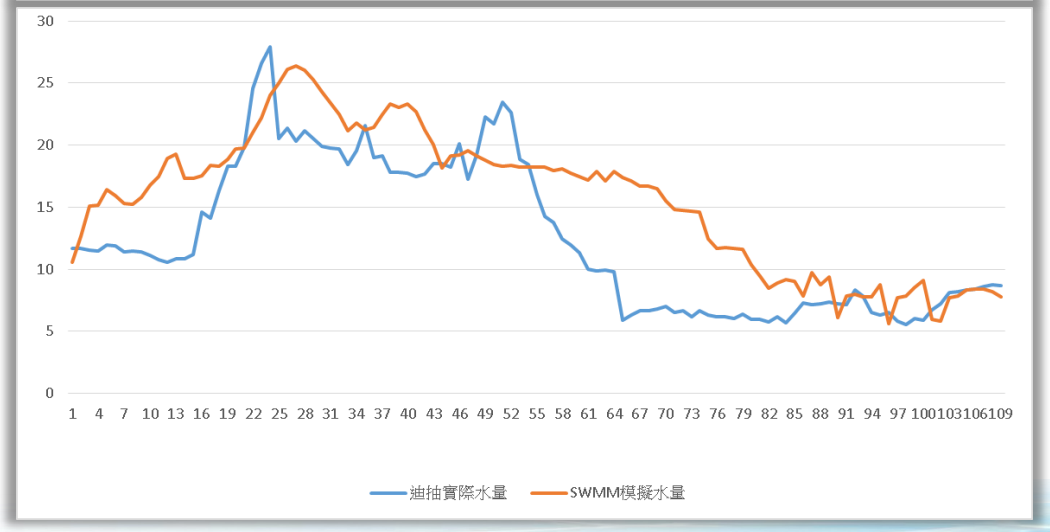

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Emergency Response

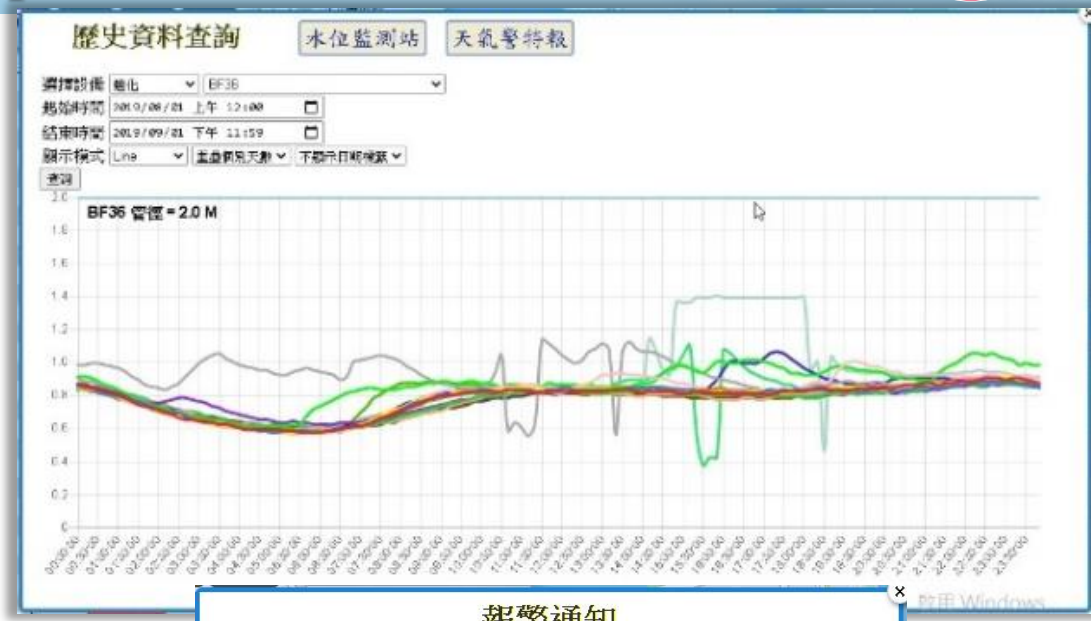
-Early Warning and Emergency Response Platform

設施	管徑	水深比	趨勢
A59	2.4	48 %	↑
AE30	1	52 %	↑
B33	3	40 %	↑
B36	3.4	88 %	↑
B41	3.6	49 %	↑
BD16	1.35	24 %	↑
BE33	2	17 %	↑
BF36	2	41 %	↑
BG08	1.8	31 %	↑
BH15	1	45 %	↑
BI09	1.35	38 %	↑
BJ19	1.2	54 %	↑
BK40	1.65	47 %	↑
C09	1.65	86 %	↑
CA48	1.2	57 %	↑
CB10	1.2	30 %	↑
D11	2	77 %	↑
DA14	1	28 %	↑
DB17	1.2	29 %	↑
DC42	1.8	4 %	↑
B43	3.8	48 %	↑
1286	2.2	100 %	↑
1453	0.3	0 %	-
1454	1.5	100 %	↑
1456	1.5	100 %	↑
1587	2	0 %	-
1460	1.65	0 %	-
1461	0.8	0 %	-
1466	1	100 %	↑
1467	1	0 %	-
1468	1.8	100 %	↑
1469	1.8	0 %	-
1471	2	0 %	-

Emergency Response

-Early Warning and Emergency Response Platform

溢流潛勢模擬



Emergency Response

-Early Warning and Emergency Response Platform

污水抽水站

設備	狀態
迪化抽水站	
進流閘門	開 關
撈污機	1 2 3 4 5
抽水機 (CMS: 3.1)	1 2 3 4 5 6 7 8 9
B43抽水機	1 2 3 4
濕井液位計(超音波)	-10.49 M
濕井液位計(氣泡式)	1.40 M
南放流閘門	關
南越淡閘門	關
北放流閘門	關
北越淡閘門	關
獅子頭抽水站	
進流閘門	關 關
撈污機	1 2 3 4 5 6 7 8
抽水機	1 2 3 4 5 6 7 8
省陰井液位計	0.00 M
市陰井液位計	0.00 M
疏流蝶閥	開
龍形隧道進口閘刀閥	關 關 關 關 關
龍形隧道出口閘刀閥	關 關 關 開 開
龍形隧道繞流閘門	開 開 開 關 關
新莊抽水站	
匯流閘門	開
匯流液位計	未完工
進流閘門	開
撈污機	1 2
抽水機	1 2 3 4
濕井液位計	0.00 M
汐止抽水站	
進流閘門	關
撈污機	1 2
抽水機	1 2 3 4 5
濕井液位計	

污水處理廠

設備	狀態
迪化污水處理廠	
進流蝶閥	關 開
進流瞬間流量	0.00 CMM
放流抽水機	1 2 3 4
放流瞬間流量	0.00 CMM
內湖污水處理廠	
1號工作井1800mm閘門	開
1號工作井2800mm閘門	開
廠內G14閘門	關
濕井水位計1	471.86 cm
濕井水位計2	482.73 cm
進流抽水機	1 2 3 4 5
紓流抽水機	1 2
放流抽水機	1 2 3 4
八里污水處理廠	
撈污機	1 2 3 4
前處理繞流閘門	關 關
海放站抽水機	1 2 3 4
海放站壓差計	0.40 0.27 1.23 0.60
海放站放流流量	0.00 62.10 0.00 0.00

繞紓流設施

設備	狀態
迪化緊急進流抽水站	
進流閘門	關
蝶閥	關 關 關
抽水機	1 2 3
迪化緊急紓流抽水站	
進流閘門	開
放流管蝶閥	關
蝶閥	關 關
抽水機	1 2
忠孝紓流站	
抽水機	1 2
士林紓流站	
抽水機	1 2 3
松信紓流站	
抽水機	1 2 3
新建紓流站	
抽水機	1 2
木柵紓流站	
抽水機	1 2
電動閥A(往揚水站)	關
電動閥B(往景美溪)	關

雨量觀測站

雨量站	時雨量強度	趨勢	更新時間
北投國小	0 mm	-	2020/08/14 09:25
陽明高中	0 mm	-	2020/08/14 09:25
太平國小	0 mm	-	2020/08/14 09:25
雙園	0 mm	-	2020/08/14 09:25
中和	2 mm	-	2020/08/14 09:25
板橋	0 mm	-	2020/08/14 09:25

礫間處理設施

設施	進流流量(CMD)	放流流量(CMD)	抽水機
南湖	111.20	66.00	1 2
成美	0.00	0.00	1 2
忠孝			1 2 3 4
貴陽	1.40		1 2 3
景美	10238.40		1 2 3

揚水站

揚水站	抽水機狀態	浮球液位
巨蛋	1 2 3	低
大道路	1 2 3 4 5	
松信	1 2 3	低
師大	1 2	低
忠孝1號	1 2	
忠孝2號	1 2	中
懷生	1 2	
中正	1 2 3 4 5 6 7	2
重慶	1 2	低
天成飯店	1 2 3	
天津	1 2	低
愛國東	1 2	低
中山北	1 2	低
大湖國小	1 2	中

液位監測站

設施	管徑	水深比	趨勢
A59	2.4	48 %	↑
AE30	1	52 %	↑
B33	3	40 %	↑
B36	3.4	88 %	↑
B41	3.6	49 %	↑
BD16	1.35	24 %	↑
BE33	2	17 %	↑
BF36	2	41 %	↑
BG08	1.8	31 %	↑
BH15	1	45 %	↑
BI09	1.35	38 %	↑
BJ19	1.2	54 %	↑
BK40	1.65	47 %	↑
C09	1.65	86 %	↑
CA48	1.2	57 %	↑
CB10	1.2	30 %	↑

截流站

截流站	進流閘門	出流閘門
瓦塔截流站	■	
永和截流站	■	
中和截流站	■	
中原截流站	■	
同安截流站	■	
重陽截流站	■	
溪美截流站	■	
蘆洲截流站	■	
二重截流井	■	
頂崁截流站	■	
中港截流站	■	
中港截流站	■	
鴨母港截流站	■	
玉成截流站	■	■
南京截流站	■	■
松山截流站	■	■
撫遠截流站	■	■
中山截流站	■	
大龍截流站	■	
新生截流站	■	
建國截流站	■	■
景美截流站	■	

河川水位站

河川水位站	水位	趨勢	更新時間
南湖大橋	0.07	-	2020/08/14 09:25
臺北橋	0.14	-	2020/08/14 09:25
新海橋	0.4	-	2020/08/14 09:25
秀朗橋	2.02	-	2020/08/14 09:25

Emergency Response

-Early Warning and Emergency Response Platform

- APP Functions:

1. Real time rainfall
2. River water level
3. Pumping stations
4. Intercetors
5. Manhole water level
6. Gate Operation of WWTP

Lifespan Extension Plan - Wastewater Treatment plants

WWTP	Equipment upgrade Duration	Budget (NTD)
Dihua	2018-2022	711,500
Neihu	2018-2021	209,000
Bali	2016-2021	701,000

Lifespan Extension Plan

-Purchase Wastewater Treatment Services and Equipment Upgrades

Procurement Contract

- Purchase long term wastewater treatment service
- ROT concept

Purpose

- Efficiency improving
- Reducing interface conflict

Service Fee

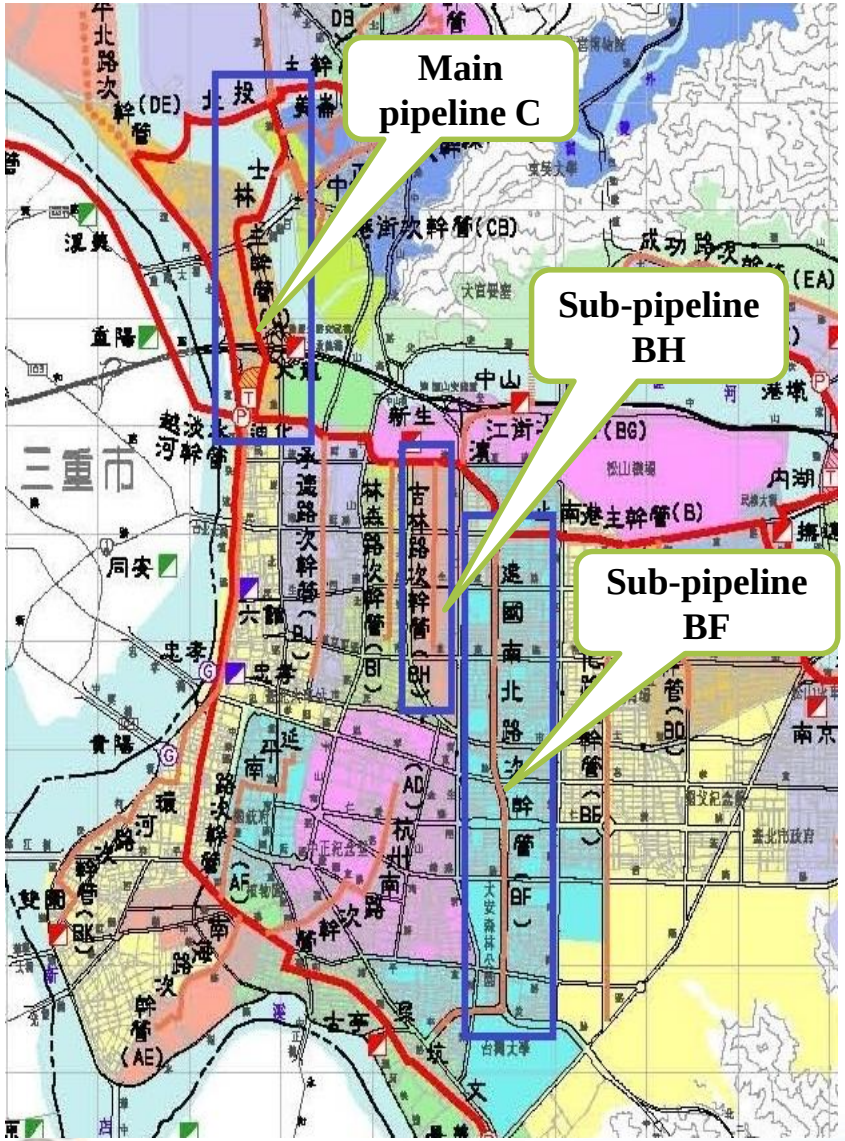
- Base on the amounts of wastewater

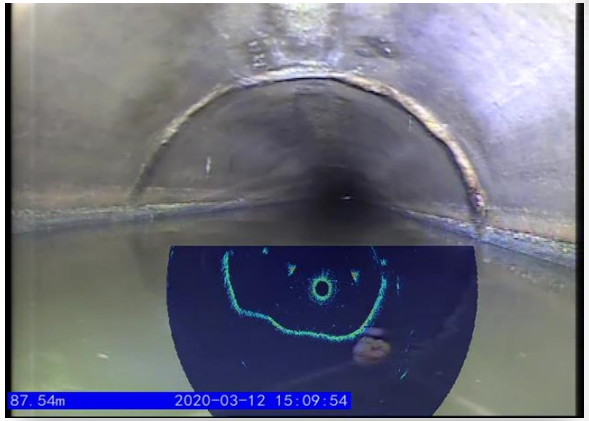
Quality Assurance

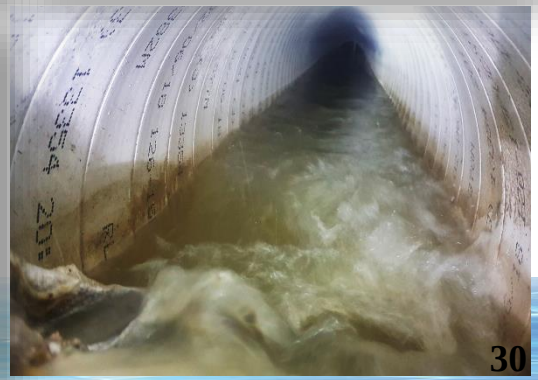
- Accountability and Strict audit

- Stable
- Reliable
- Responsible

Lifespan Extension Plan - Pipeline Inspection and Repairing







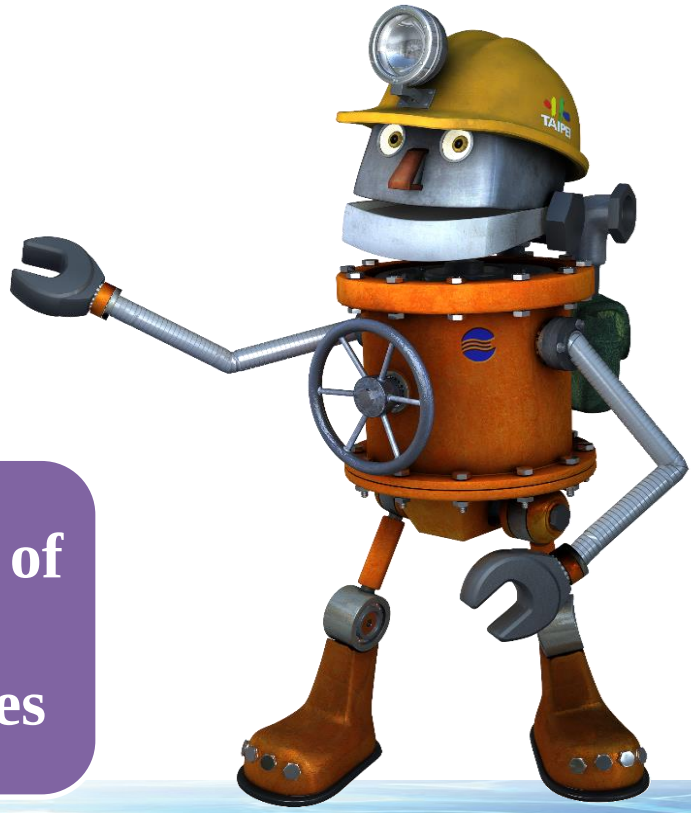
Household Connection Upgrade

Change in contracting method

Improve household connection rate

Rule amendment

Adoption of new techniques



Household Connection - Change of Work paths

Turkey Contract

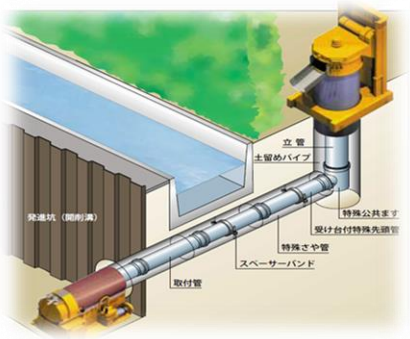
Traditional procurement

- Design
- Construction

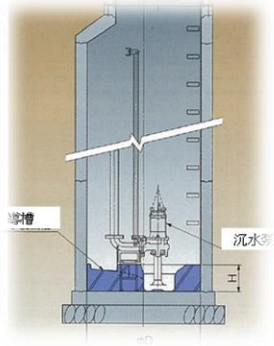
1. Efficiency improvement
2. Milestones

TurnKey — **Design + Construction**

New Techniques



Vertical and horizontal boring for small-diameter piping



Small pumping manholes

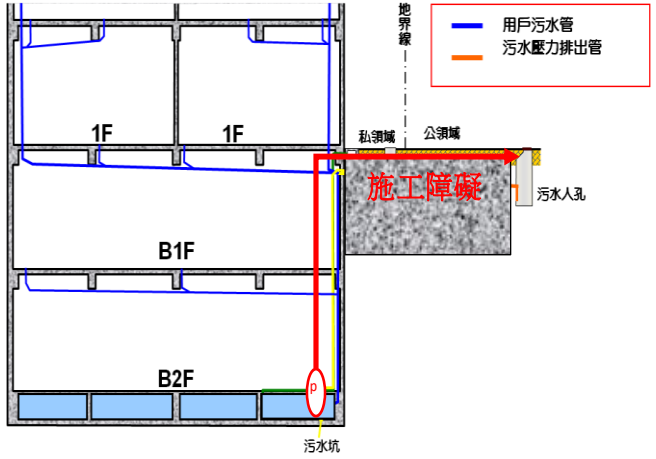
Vacuum sewerage

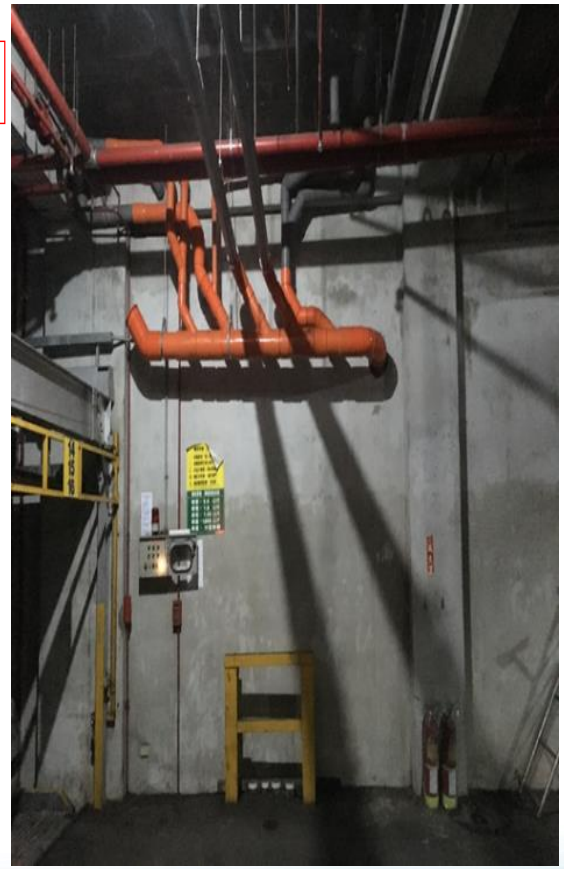
Straight pipe connection well model

Household Connection - Rule Amendment

Incentives

- **Subsidizing policy adapt**





- ✓ Scope expansion
- ✓ Scale increase

Penalties

- **Inspection enforcement**

- ✓ Announcement of penalties for households not connected to existing sewerage systems with deadlines for improvement.

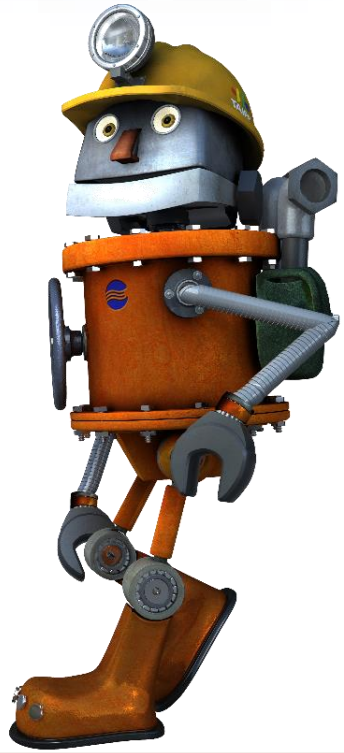
User-pay

- **Water pollution prevention fee**

- ✓ Announcement of water pollution levy for households not connected to existing sewerage systems.

I. Sewer System of Taipei City – Current Situation

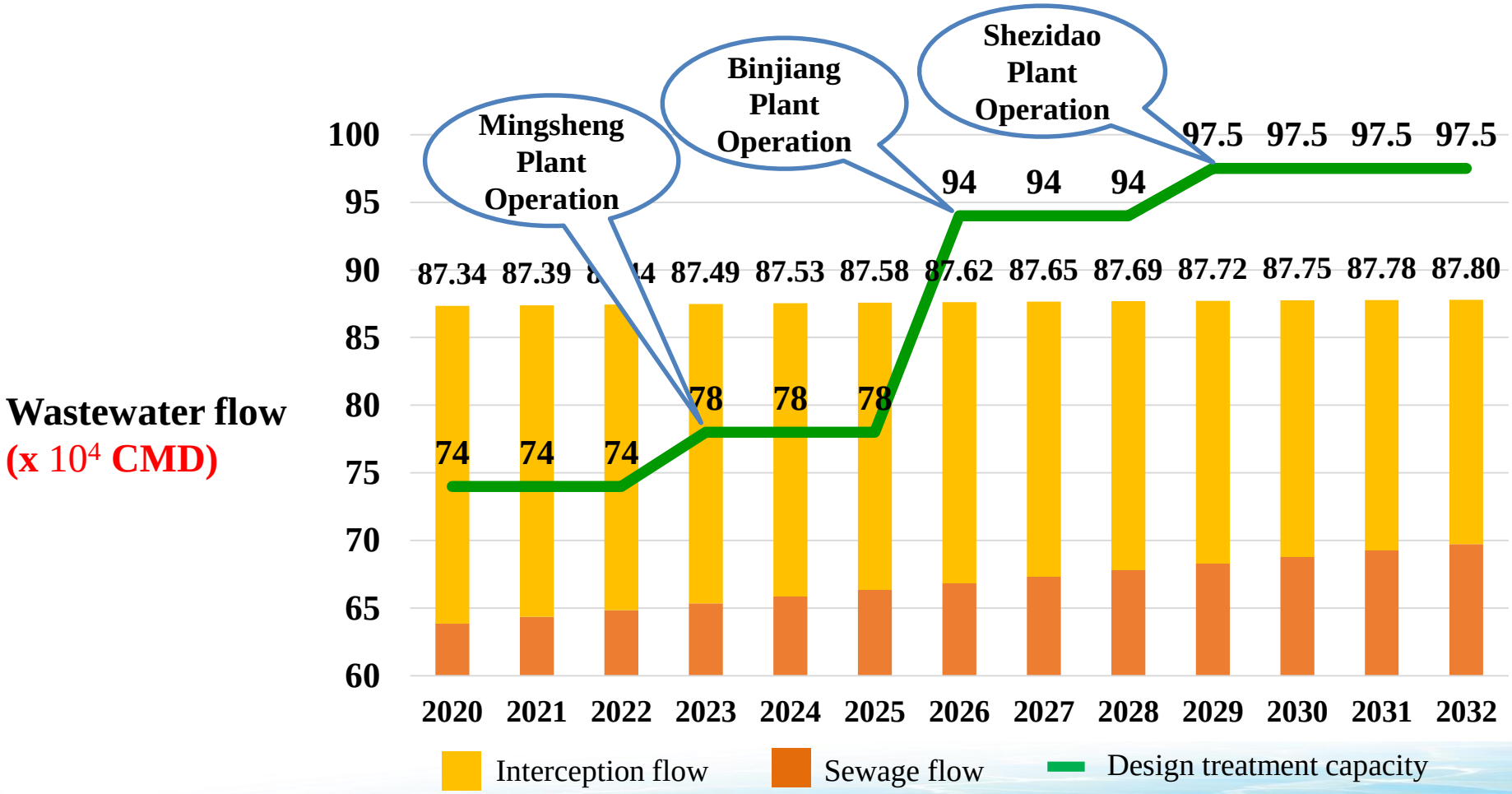
II. Sewer System of Taipei City – Planning



III. Sewer System of Taipei City – Vision

Visions for Taipei City sewer system

- **2030 –Wastewater Treatment self-sufficiency**
- **2032 –90% household connection rate**



Sustainable River Water Quality Improvement

(Existing) Bali Plant

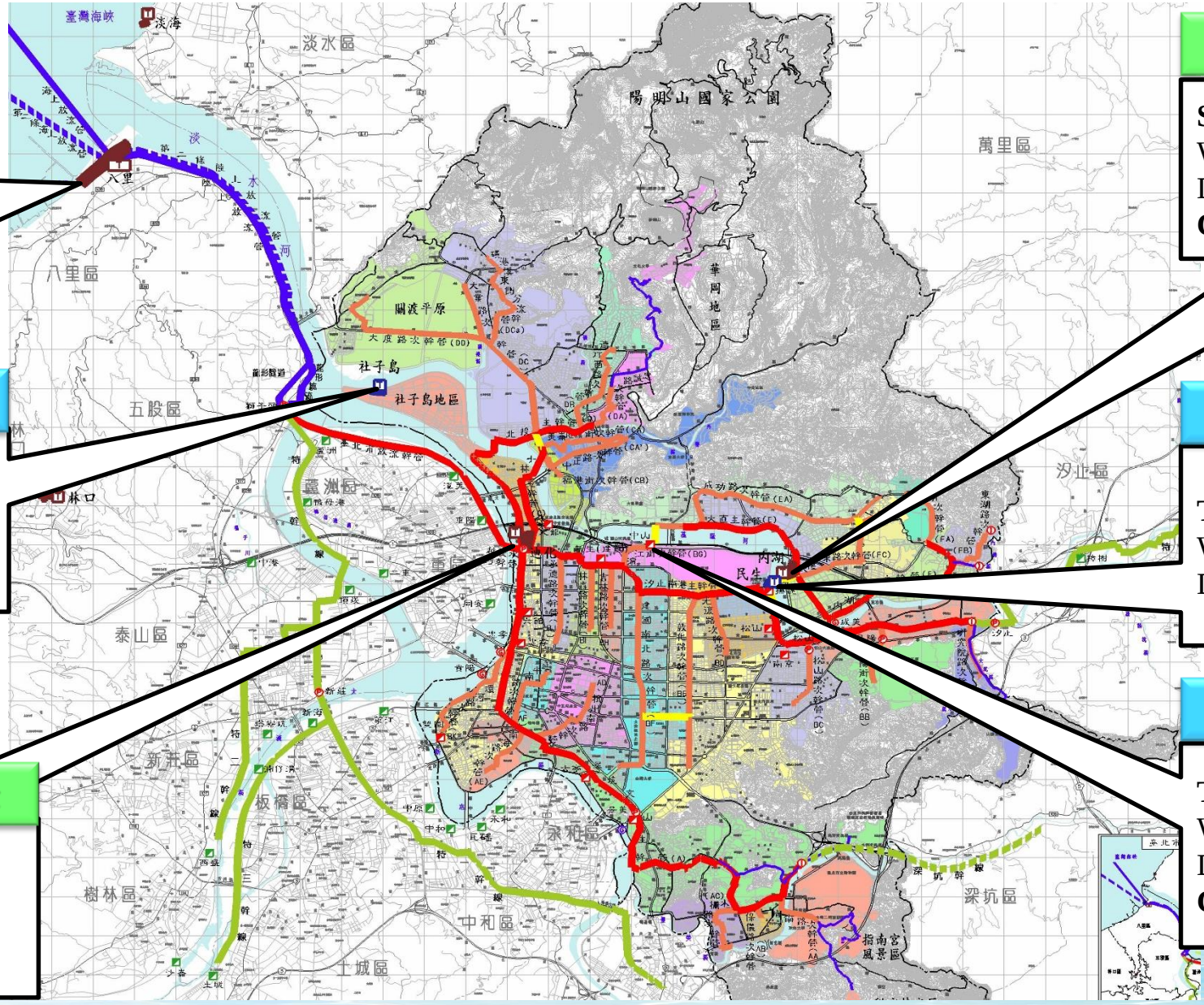
Primary Treatment
Suburban sewage transport through Taipei City:
70,000 ~ 80,000 CMD

Shezidao Plant

Tertiary treatment
Wet season: **35,000 CMD**
Dry season: **35,000 CMD**

(Existing) Dihua Plant

Secondary treatment
Wet season: ≦ **450,000 CMD**
Dry season: **500,000 ~ 550,000 CMD**



(Existing) Neihu Plant

Secondary treatment
Wet season: **< 240,000 CMD**
Dry season: **140,000 ~ 160,000 CMD**

Minsheng Plant

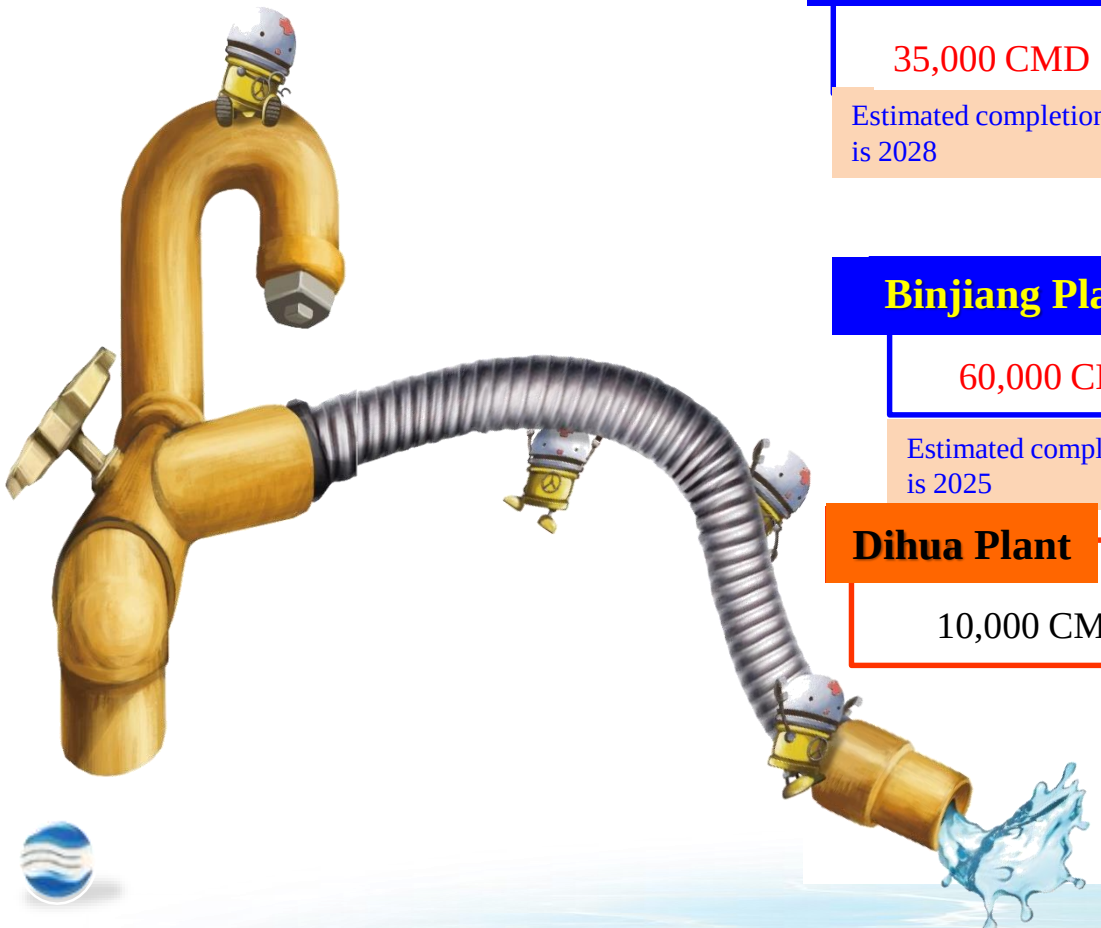
Tertiary treatment
Wet season: **40,000 CMD**
Dry season: **40,000 CMD**

Binjiang Plant

Tertiary treatment
Wet season: **160,000 CMD**
Dry season: **110,000 ~ 160,000 CMD**

Reclaimed Water in 2030

Total reclaimed water up to 145,000 CMD



Shezidao Plant

35,000 CMD

Estimated completion time is 2028

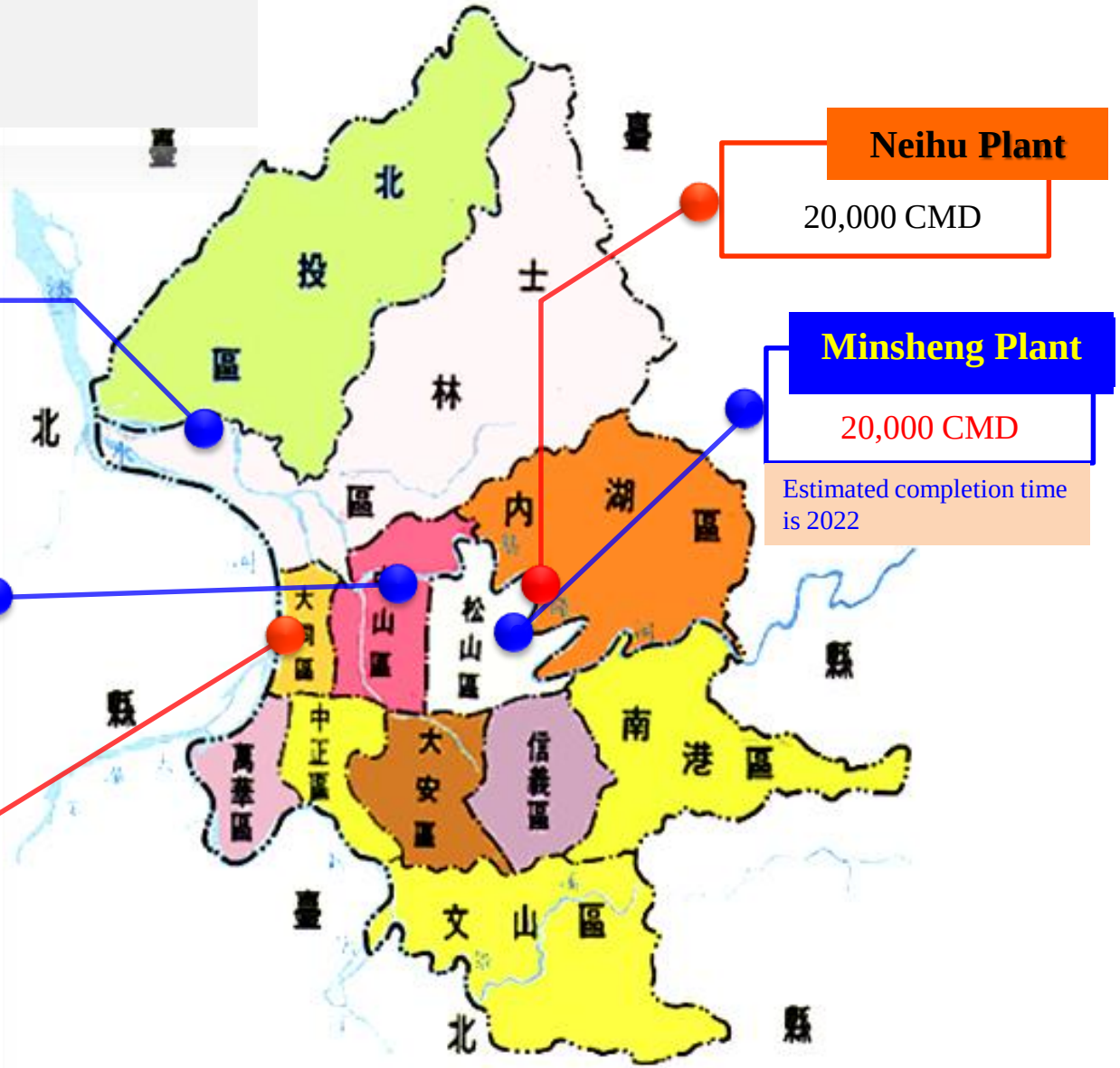
Binjiang Plant

60,000 CMD

Estimated completion time is 2025

Dihua Plant

10,000 CMD



Neihu Plant

20,000 CMD

Minsheng Plant

20,000 CMD

Estimated completion time is 2022

Visions for Taipei City

- Habitable
- Recyclable
- Sustainable

TAIPEI

Thank for your attention

Sewerage Systems Office,
Public Works Department,
Taipei City Government