

# Long-Term Plan for Reconstruction of Wastewater Treatment Plants(WWTPs)

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**1. Introduction**

**2. Basic Conditions and Considerations for Reconstruction of WWTPs**

**3. Project Cost Estimation for Stage 1**

**4. Conclusions**

# 1. Introduction

## Outline of the City of Yokohama

- ◆ The city with second largest population in Japan
- ◆ Population: about 3.77 million
- ◆ Area: 437 km<sup>2</sup>



Figure 1 Map of Japan

# 1. Introduction

## Outline of sewerage system in the City of Yokohama

- ◆ Penetration rate of sewage services : almost 100%
- ◆ Treatment method : Conventional activated sludge process, MLE process, A2/O process, ...etc
- ◆ Average amount of treated wastewater : 1.5 million m<sup>3</sup>/d
- ◆ Length of sewer: 11,900 km
- ◆ WWTPs: 11
- ◆ Sludge Treatment Plants: 2
- ◆ Pumping stations: 26

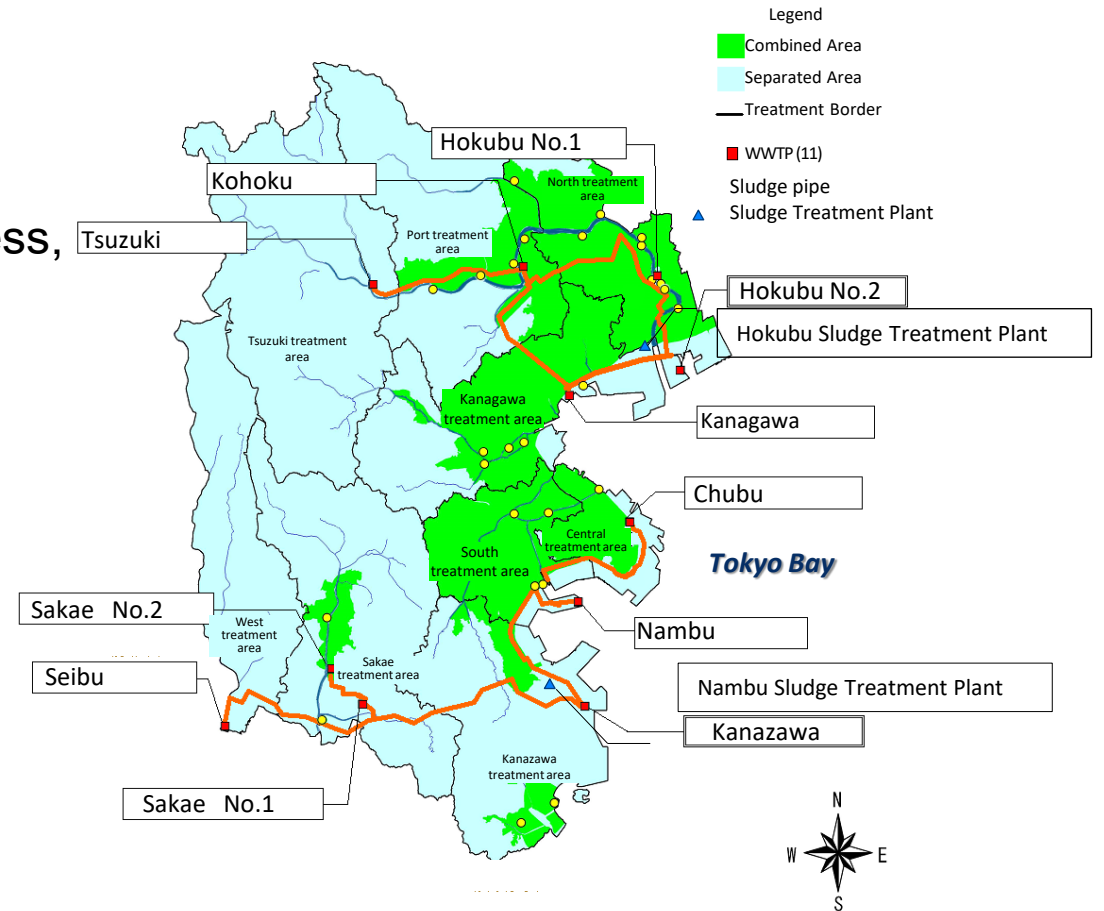


Figure 2 WWTPs in the City of Yokohama

# 1. Introduction

## Aging WWTPs

### ◆ WWTPs in service for more than 50 years

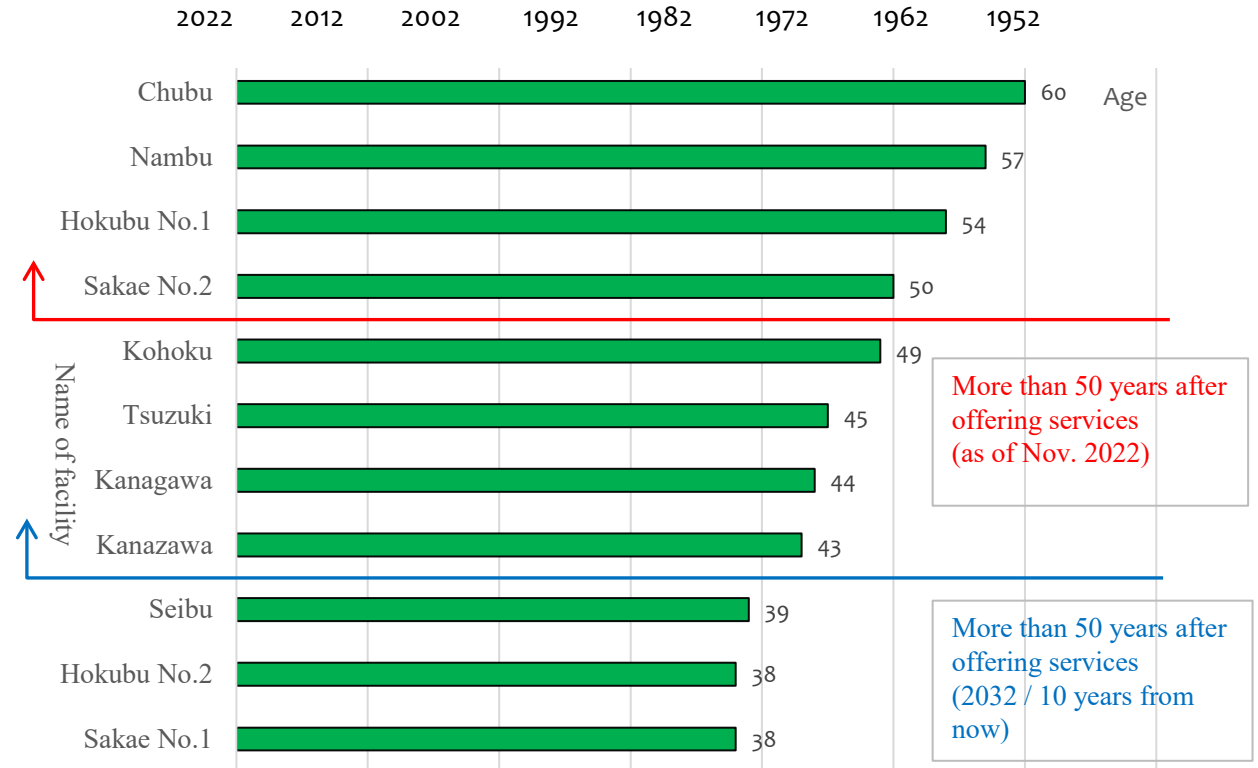
- Currently (as of Nov. 2022) : 4 plants
- In 10 years : 8 plants
- In 20 years : 11 plants (all the plants)

Long-Life Improvements



Reconstruction

Table 1 Number of WWTPs have been in operation



# 1. Introduction

Target of this initiative

- ◆ **Feasible method for reconstruction of each WWTP**
- ◆ **Total cost and Total term for reconstruction of 11 WWTPs**



1 Introduction

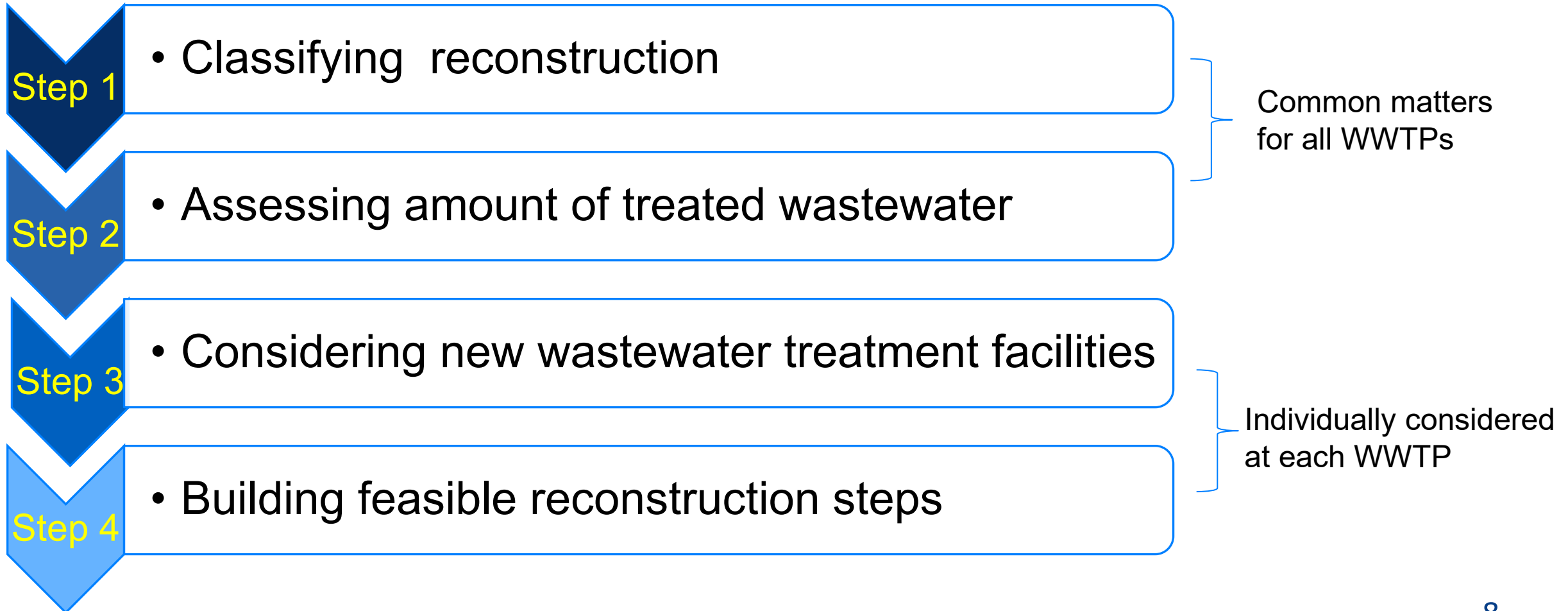
**2 Basic Conditions and Considerations for Reconstruction of WWTPs**

3 Project Cost Estimation for Stage 1

4 Conclusion

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

A long term plan for reconstruction



## 2 Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### (1) Classifying reconstruction

- ◆ Two stages for Reconstruction of WWTPs.

#### Stage 1

Targets: **Facilities Before 1980**

Objective: **Reconstruction by 2050**

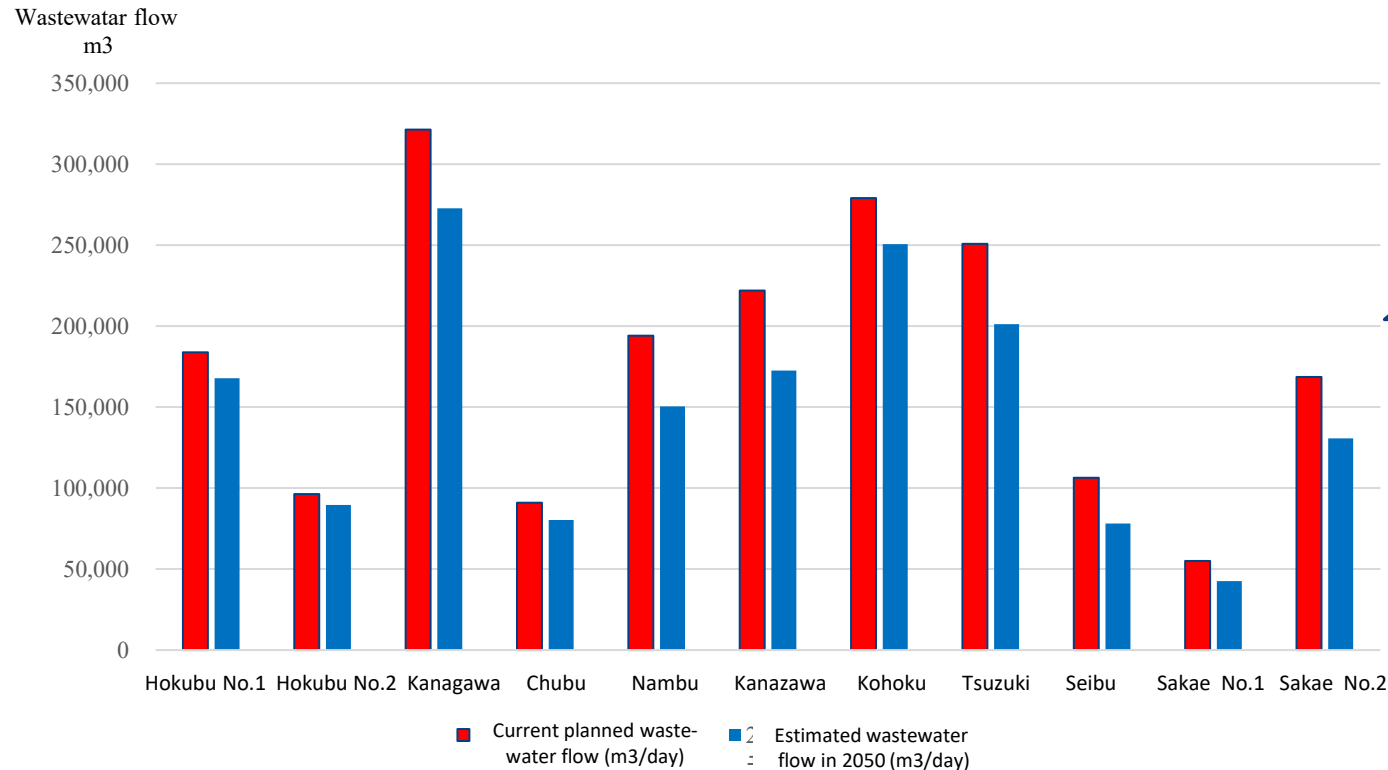
#### Stage 2

Targets: **Facilities not included in Stage 1**

Objective : **Start after 2050**

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### (2) Assessing amount of treated wastewater



Population  
decline in 2050  
↓  
23% decrease in  
average

Figure 3 A comparison of current planned wastewater flow and estimated wastewater flow in 2050

Stage 1 of Reconstruction: **current planned wastewater flow.**

Stage 2 of Reconstruction: **wastewater flow in 2050**

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### (3) Considering wastewater treatment facilities

#### Existing characteristics

Wastewater treatment method

Effluent quality

Surplus land

Feasibility of networking

...etc



#### Items for consideration

Wastewater treatment method

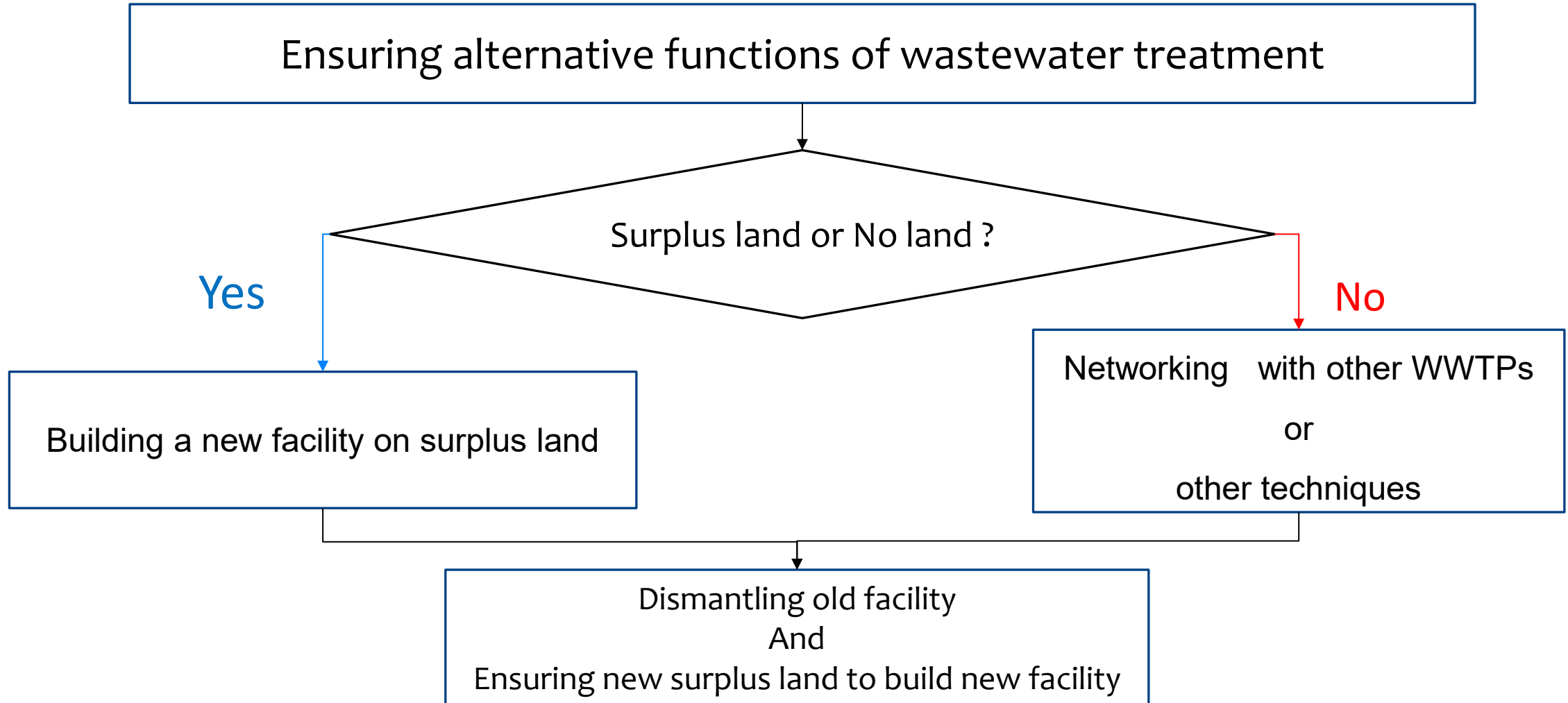
General scale

The method of minimizing footprint

- Multilayering primary sedimentation tanks
- Deepening reactors

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### (4) Building reconstruction steps



## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### Characteristics of Chubu WWTP

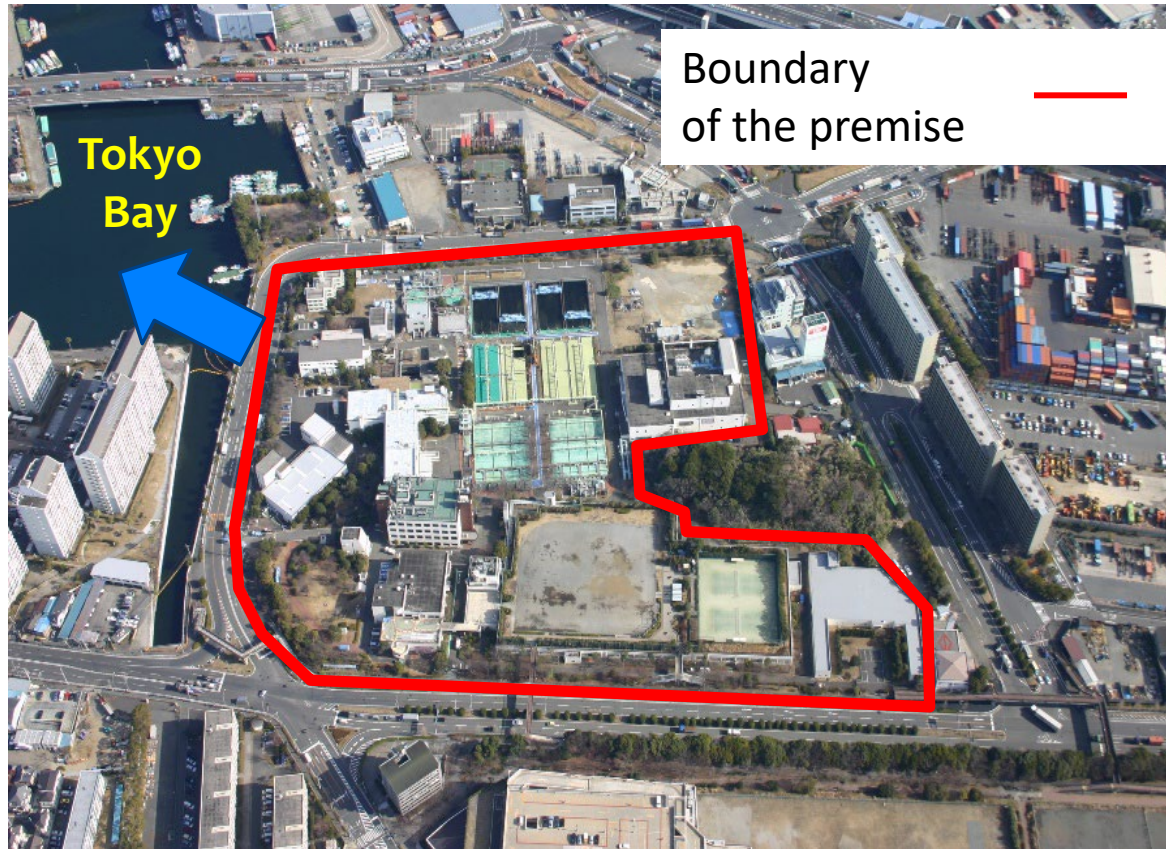


Figure 4 Chubu WWTP

	Existing wastewater treatment method	Wastewater treatment capacity (m <sup>3</sup> / day)
Train A	Conventional activated sludge process	44,650
Train B	Conventional activated sludge process	46,250
	total	90,900

- ◆ Effluent standards : **High** (Tokyo bay)
- ◆ Possibility of networking: **No**
- ◆ Surplus land: **No**

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### Classifying of Chubu WWTP

- ◆ Train A : stage 1
- ◆ Train B : stage 2



Figure 5 Classifying of Chubu WWTP

## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

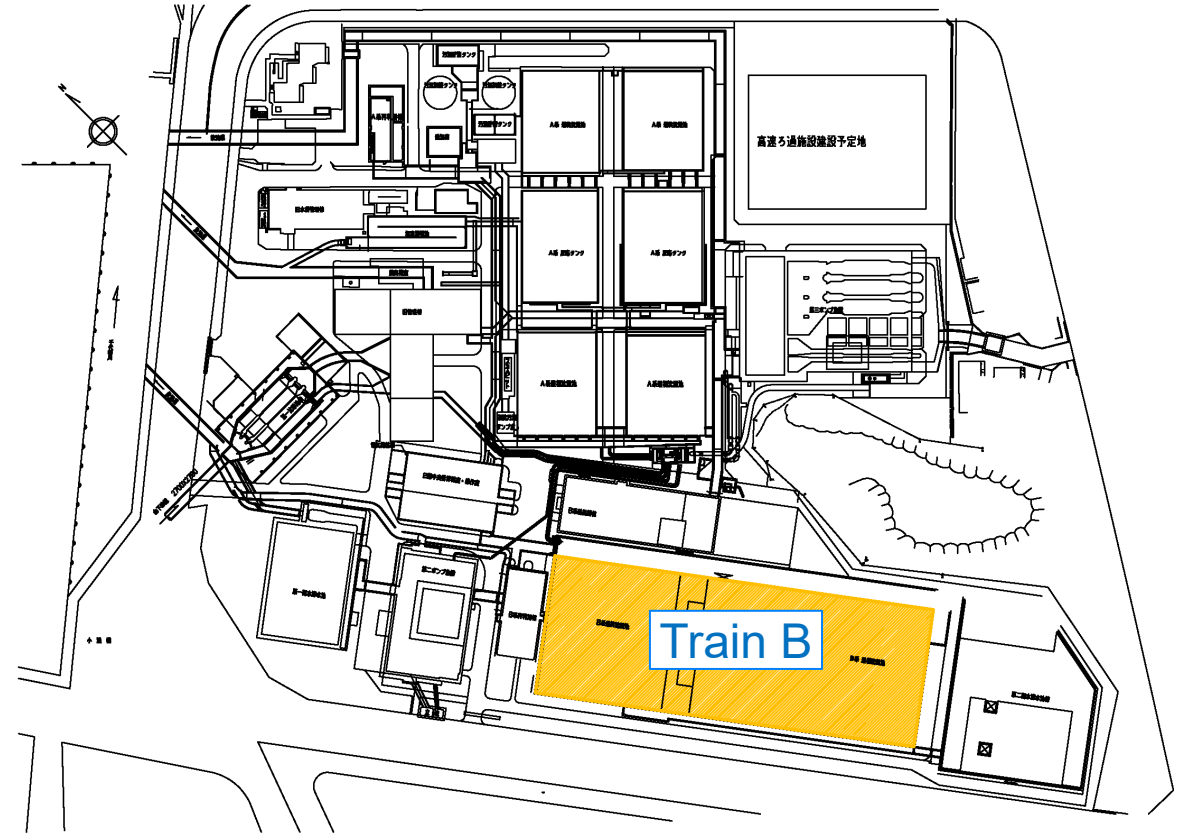
### Step 1 Increase of Train B capacity

◆ Wastewater treatment process (New train B) : Carrier-added activated sludge process

◆ Wastewater treatment capacity of Train B :

46,250 m<sup>3</sup> / day → 69,375 m<sup>3</sup>/day

1.5 times more



## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

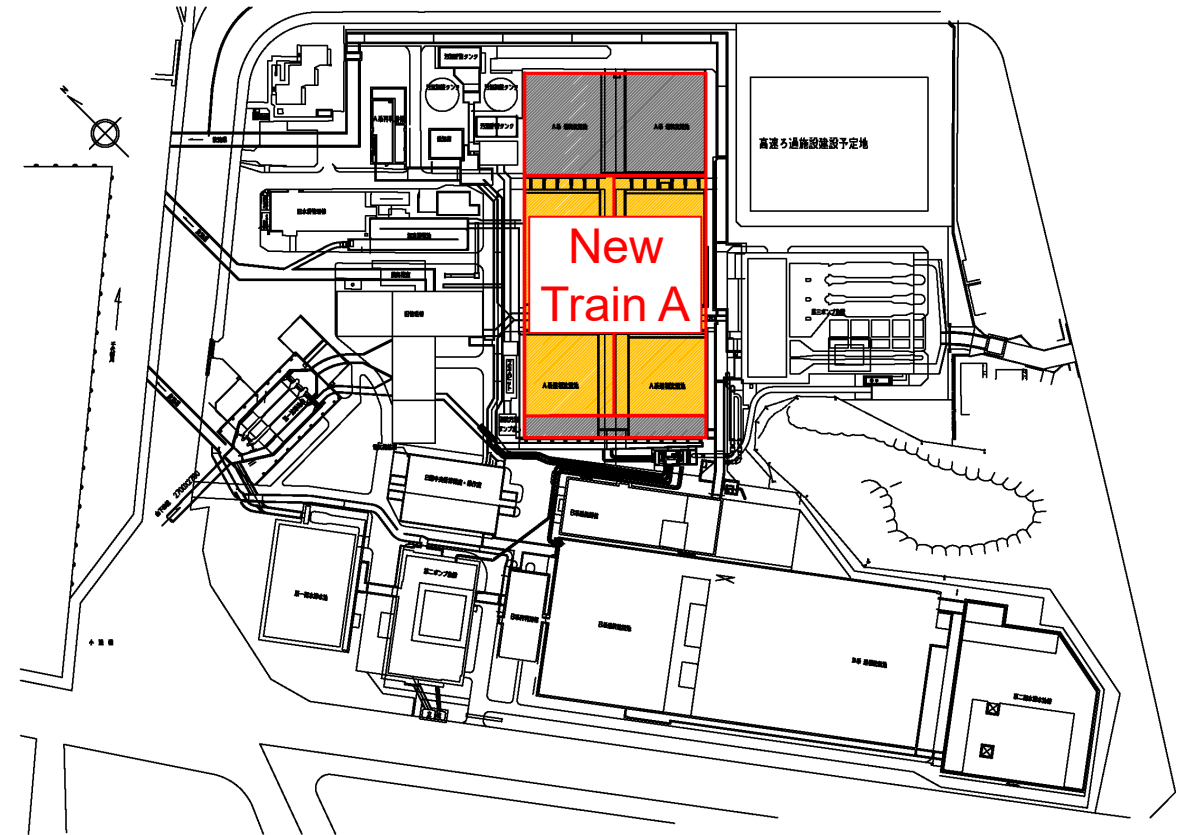
### Step 2 Reconstruct Train A

#### ◆ Reconstruct Train A half by half

While Train A is operated		Wastewater treatment capacity (m <sup>3</sup> / day)
	Train A (half)	22,325
	Train B	69,375
	Total	91,700
Required wastewater treatment capacity		90,900

#### ◆ Wastewater treatment process

(New Train A): MBR

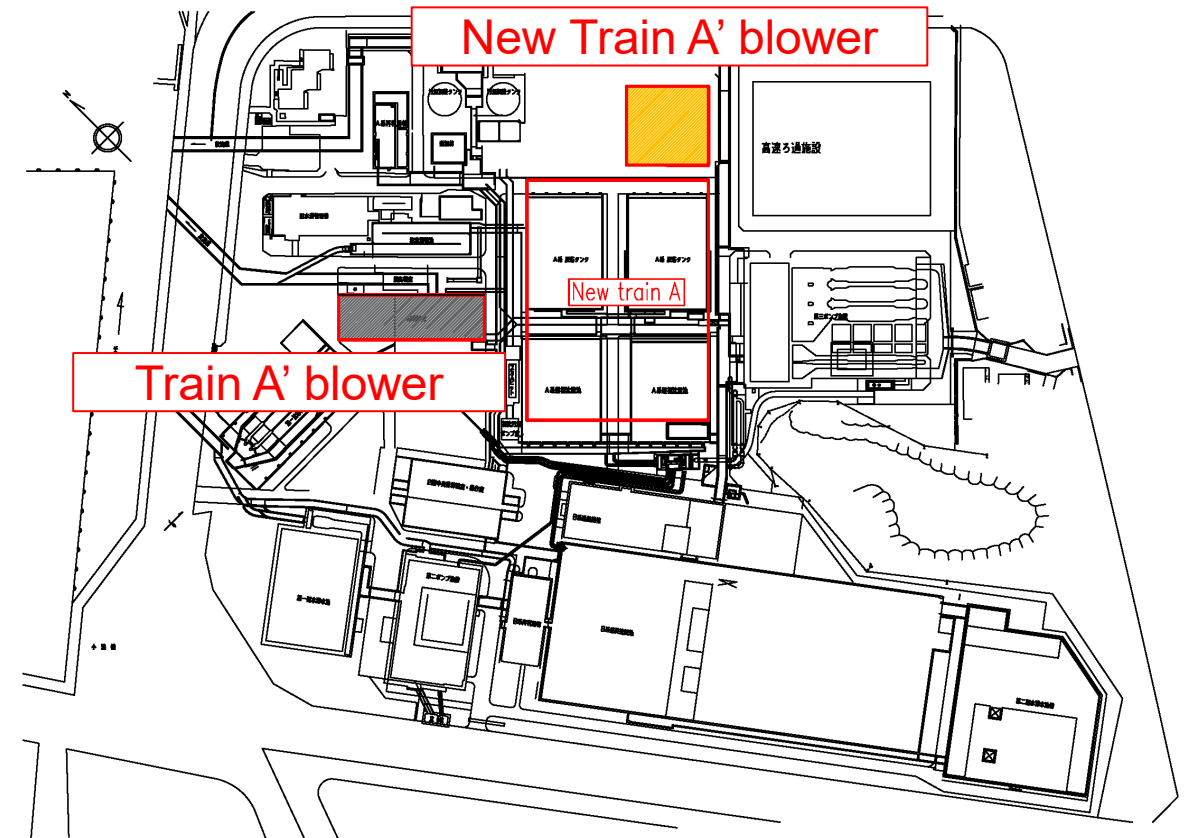


## 2. Basic Conditions and Matters of Consideration for Reconstruction of WWTPs

### Step 3 Reconstruct blower

- ◆ Build new blower
- ◆ Dismantle old blower
- ◆ The surplus capacity of 34,875m<sup>3</sup>/day will be utilized in Stage 2

Stage 1 of reconstruction is completed		Wastewater treatment capacity (m <sup>3</sup> / day)
	Train A (half)	56,400
	Train B	69,375
	Total	125,775
Required wastewater treatment capacity		90,900





1 Introduction

2 Basic Conditions and Considerations for Reconstruction of WWTPs

**3 Project Cost Estimation for Stage 1**

4 Conclusions

# 3 Project Costs estimation for Stage 1

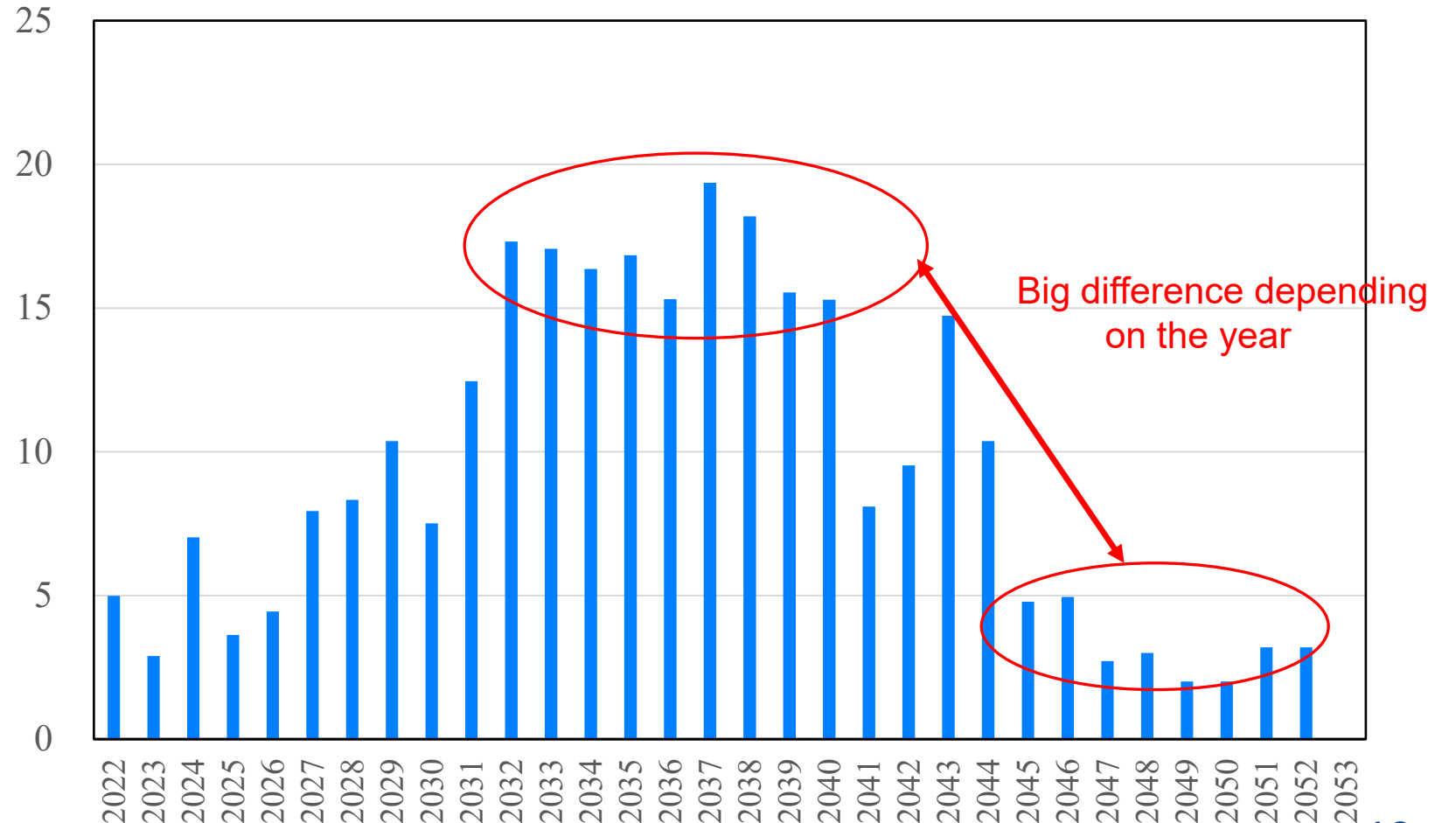
◆ Project period  
: 31 years

◆ Total approximate  
project cost  
: 270 billion yen

◆ Project cost/yaer  
: 8.7 billion yen/ year

Yearly cost  
billion yen

Yearly transition chart of estimated project costs for reconstruction



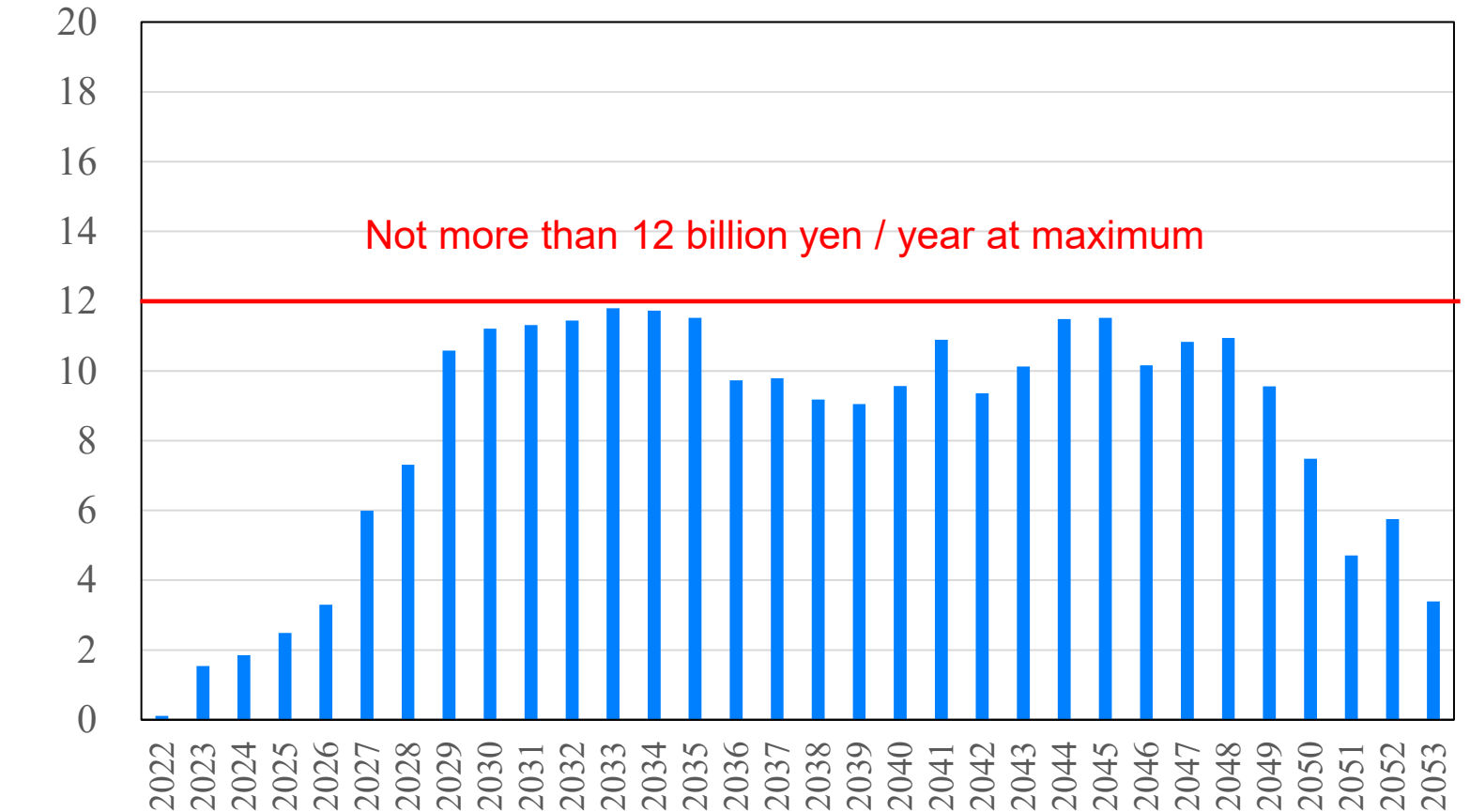
# 3 Project Costs estimation for Stage 1

Averaging out

◆ Revision to reduce the processes in 2030s

◆ Securing financial stability and sustainability

Yearly transition chart of estimated project costs for reconstruction (After leveling out)





1 Introduction

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**4 Conclusions**

## 4. Conclusions

- In Yokohama, aging of WWTPs is getting a serious issue.
- decision of WWTPs' reconstruction
- Classification of WWTPs' facilities into Two stages and setting up of the amount of treated wastewater and the target year for development for each stage
- Establish of the specific reconstruction steps, cost, and term of Stage 1. based on the existing characteristic of each WWTP
- Summarizing the estimated cost and term for Stage1 of 11 WWTPs
- Averaging out the estimated cost for securing budget



Thank you for your attention.

# Reference

## (2) Planned amount of wastewater to be treated

We reviewed the adequacy of the current planned amount of wastewater to be treated (predicted value for 2024)

### ◆ Forecasted population

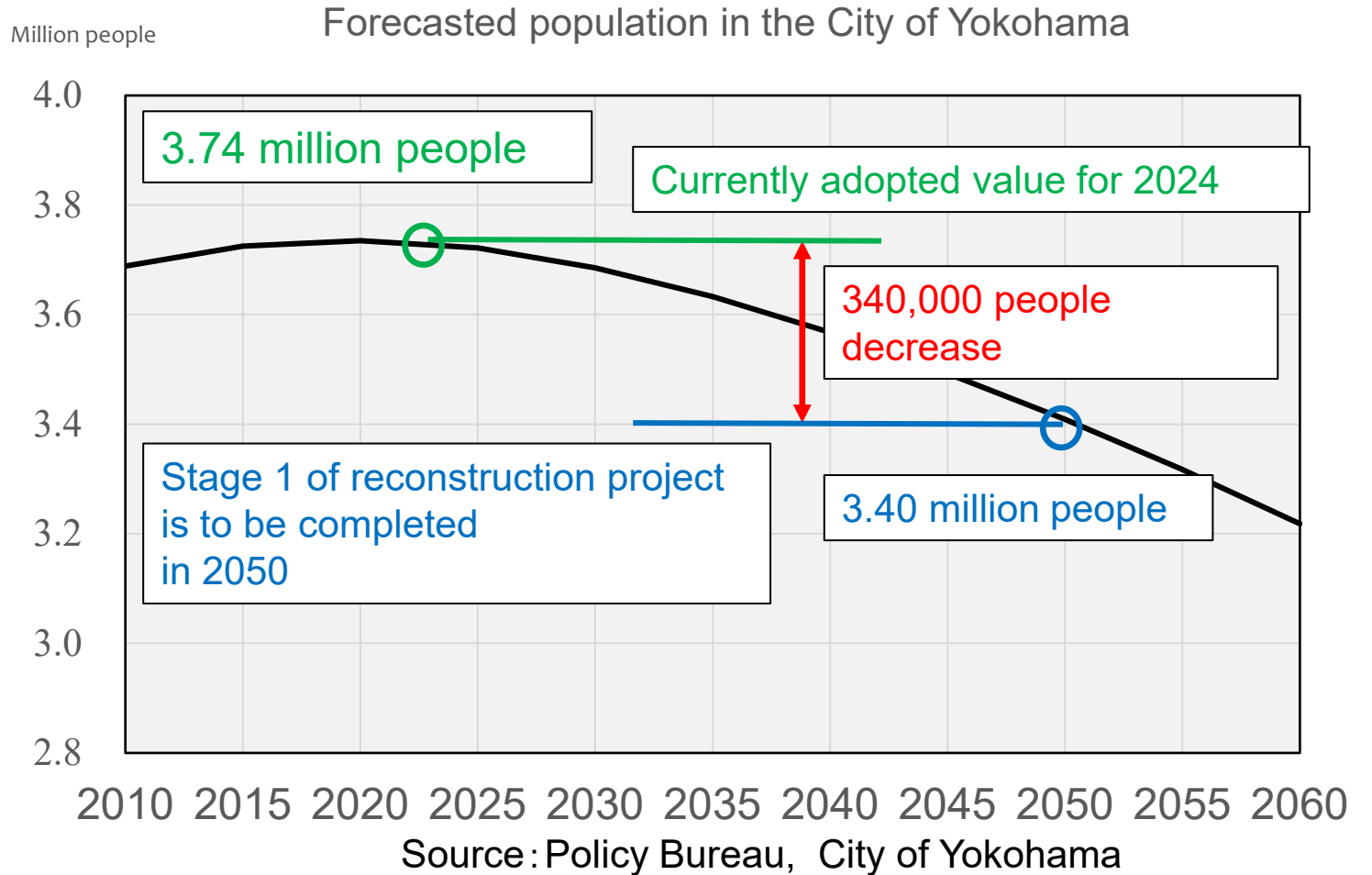
Currently adopted value for 2024:

3.74 million people

Estimated value for 2050: 3.40 million

people

→ 340,000 people decrease



## Categorization of Stage 1 of Reconstruction and Stage 2 of Reconstruction

\*Reasons why the facilities were categorized into the ones developed prior to 1980 and others

### (1) Revision of Anti-seismic Design Code

- Japan Sewage Works Association published guidelines on anti-seismic measures for sewage facilities (1981)
- Anti-seismic design specifications for highway bridges were issued (1980)
- New Anti-seismic Design Code was incorporated into the Building Standards Act (1981)

### (2) Regulation on materials

- National regulations were drawn up regarding the salinity of concrete materials (1978)

Based on those facts, the facilities were categorized into the ones developed prior to 1980 and others.

# Reference

Other factors changed in accordance with consideration of planned amount of wastewater to be treated

- Sanitary sewage amount

It will be determined based on the prediction for water demand (Source : Waterworks Bureau, City of Yokohama).

- Commercial water volume / business wastewater flow

The current planned volume will be compared with the current state, and be adjusted to suit the current state.

# Reference

## Current status of Train A in Chubu Wastewater Treatment Plant



# Reference

## A model of a building frame

- Height 46m × width 13m × depth 6.5m
- The amount of reinforcing steels was estimated as 105kg/m<sup>3</sup> based on past cases
- Steel sheet piles were used as a temporary earth-retaining method
- Stake foundation

