

City Sanitation Strategies: Wastewater Management Planning in Japan

How City Sanitation has progressed

In-Country Workshop for Developing Sanitation Strategy
Promoting Innovation Wastewater Management (ADB)

15-16 July 2013, Hanoi, Vietnam

Mitsuo Kitagawa
Japan Sanitation Consortium

I. BASIC FRAMEWORK for CSS

- I-1. Legal System for Sanitation Systems
- I-2. Technology Options for Drainage and Treatment of Wastewater
- I-3. Institutional and Management Arrangements
- I-4. Financial System for Sewerage Systems

II. NECESSARY CONSIDERATION for CSS

II-1. Project Planning

- II-1-1. Comprehensive Basin-wide Planning
- II-1-2. Concept of Cost Comparison between Off-site and On-site
- II-1-3. Prefectural Plan for Appropriate Wastewater Treatment
- II-1-4. Formulation of Project Plan
- II-1-5. Technology Options; Technology Evaluation and Design Manual

II-2. Operation and Maintenance

- II-2-1. Institutional and Management Arrangements
(Human Resource Development, Capacity Development, R&D)
- II-2-2. Financial System for Sanitation
(Willingness To Pay, Public Awareness, Public Relation)
- II-2-3. Management of Sanitation Systems

III. CONCLUSION

Objectives of CSS; City Sanitation Strategy

- (1) Improvement of Living Condition
- (2) Improvement of Public Health
- (3) Preservation of Water Quality in Public Water Bodies

I. BASIC FRAMEWORK for CSS

- (1) Legal System: Basic Law for Environmental Protection
 - Water Quality Control Law
 - City Planning Law
 - Sewerage Law, Johkasou Law
- (2) Technology Options for Drainage and Treatment of Wastewater
 - Off-site Treatment, On-site Treatment
- (3) Institutional and Management Arrangements
 - Role of Central Government and Municipality
 - Project Implementation Organization , JS: Japan Sewage Works Agency
 - Private Sector Participation, Public Private Partnership
- (4) Finance System for Sanitation
 - Establishment of Construction and O&M Cost Sharing Principles
 - Construction Cost: Subsidy, Local Bond, User Charge
 - O&M Cost : User Charge, Public Sector Cost Burden

I. BASIC FRAMEWORK for CSS

I-1. Legal System for Sanitation Systems

1. Basic Law for Environmental Protection

(1) Sets up the Environmental Quality Standards

Items on Protection of Human Health

Items on Conservation of living Environment

(Classified based on Water Usage)

(2) Stipulates to Take Countermeasures for Pollution Control

2. Water Pollution Control Law

(1) Sets the Effluent Wastewater Standards from Factories and Places of Business. (Specific Place of Business)

National Standards

(2) Prefecture Government Can Set Several Effluent Standards Wastewater Treatment plant; Specific Place of Business

I. BASIC FRAMEWORK for CSS

I-1. Legal System for Sanitation Systems

3. City Planning law

Sewerage System is defined as Urban Facility

4. Sewerage Law

(1) Purpose of Sewerage

- Prevention of Flood
- Improving the Surrounding Environment
- Switching Flushing Toilet
- Prevention of Water Quality in Public Water Bodies

(2) Comprehensive Basin -wide Sewerage Development Program

- Basic Policy for the Development of Sewerage Systems
- Areas for the Development of Sewerage Systems
- Location, Structure and Capacity of Basic Sewerage Facilities
- Stage Planning for the Execution of Sewerage Construction Projects

I. BASIC FRAMEWORK for CSS

I-1. Legal System for Sanitation Systems

4. Sewerage Law

(3) Administration of Sewage works

The installation, improvement, repair, maintenance and other works required for controlling public sewerage shall be executed by the municipality concerned.

- **Municipalities**; in charge of **Public sewerage**
- **Prefectures** ; in charge of **Regional sewerage system**
(More than 2 Cities)

(4) Procedures for Development of Sewerage Systems

- Approval of Sewerage Project Program by Ministry of Land Infrastructure and Transport

(5) Use of Sewer Systems

- Obligation for house Connection
- Switching to Flush Toilets
- Users Charge

I. BASIC FRAMEWORK for CSS

I-2. Technology Options for Drainage and Treatment of Wastewater

Off-site Treatment; Sewerage Systems (Night Soil Treatment in Japan)

On-site Treatment; Johkasou,

Table 1: Technology Options for Wastewater Treatment

	Type of System	Population Rate (%) FY 2011	Project Program	Wastewater		
				Human Waste	Gray Water	
Night Soil Treatment	Off-site	12.4	Night Soil Treatment Facility (MOE)	Vault Toilet	Discharge Without Treatment	
				Collection (Vacuum Truck)		
	On-site		(Tandoku-shori Johkasou*)	Flush Toilet On-site Treatment	Discharge Without Treatment	
Wastewater Treatment	On-site	8.8	(Gappei-shori) Johkasou (MOE)	Flush Toilet	Gray Water	
				On-site Treatment		
Wastewater Treated Population Rate = 87.6 (8.8+78.8)	Off-site	78.8	Sewerage System	Flush Toilet	Gray Water	
			Public Sewerage System (MLIT)	Collection (Sewer Network)		
			Rural Sewerage System (MAFF) Community Plant (MOE)	Wastewater Treatment Plant (Off-site)		

Note: MLIT: Ministry Land Infrastructure and Transfer, MAFF: Ministry of Agriculture, Forestry and Fisheries
MOE: Ministry of Environment *new installations are legally prohibited



I. BASIC FRAMEWORK for CSS

I-3. Institutional and Management Arrangement

Role of Central Government and Municipality

Table : Project Implementation Organizations

Type of System	Project Program	Project Implementation Organization
Off-site	Night Soil Treatment Facility (MOE)	Municipality
On-site	Johkasou (MOE)	Individuals or Municipality
Off-site	Sewerage System Public Sewerage System (MLIT) Rural Sewerage System (MAFF) Community Plant (MOE)	Municipality [JS: Japan Sewage Works Agency]

Note; Project Implementation (construction, O&M, and renewal)

The responsible Ministry in each program

Key and fundamental organization for

nationwide budget, establishment of technical standards, project evaluation, enactment of laws and regulations basic frameworks, and long and middle-term plans

I. BASIC FRAMEWORK for CSS

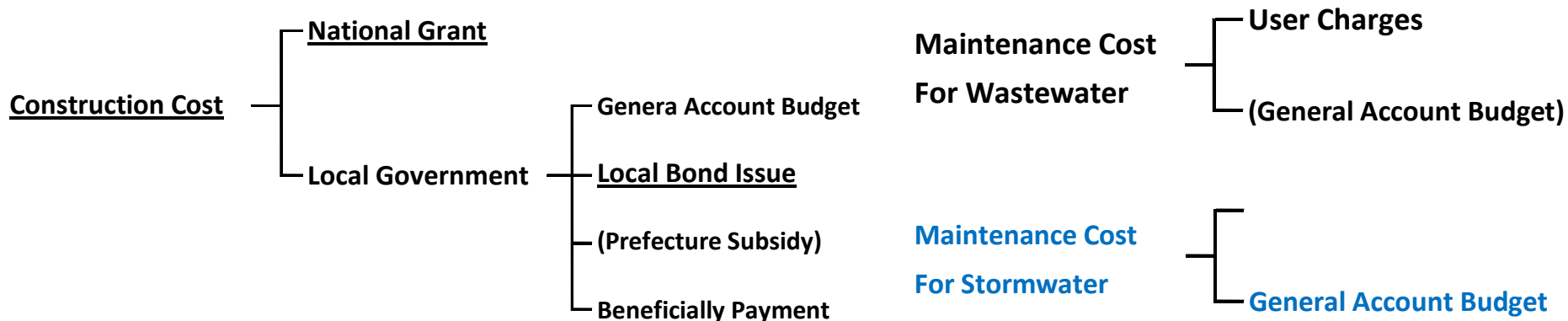
I-4. Finance System for Sewerage Systems

Table : National Subsidy Ratio

Classification		Ratio of National Subsidy	Cost Sharing Ratio of Local Governments
Sewer Pipes	Granted Project	1/2	1/2
	Unsubsidized Project		10/10
Wastewater Treatment Plants	Granted Project	5.5/10	4.5/10
	Unsubsidized Project		10/10

Note : All of the costs shared by local governments are covered by local bonds

Table: Financial Sources of Sewage Works



Establishment of Construction and O&M Cost Sharing Principles
“Stormwater at public burden and Wastewater at private burden”

II. NECESSARY CONSIDERATION for CSS

Establishment of Project Planning and O&M Concept for City Sanitation(Drainage and Treatment of Wastewater)

II-1 Project Planning

II-1-1. Comprehensive Basin-wide Planning

If rivers and other public water bodies or coastal areas, to which the **'environmental water quality standards'** is applied to maintain a sound living environment in relation to water pollution as provided for in the Basic Environmental Law,

each prefecture shall set forth a comprehensive basic plan for the installation or development of sewerage systems ('comprehensive basin-wide planning of sewerage system')

for the respective public water bodies or coastal areas

in order to bring the environmental conditions of the subject area to environmental water quality standards

Environmental quality standards for conservation of the living environment

Lakes (natural lakes and artificial reservoirs with 10 million m³ of water or above)

Items Category	Standard values				
	pH	Chemical Oxygen Demand	Suspended Solids (SS)	Dissolved Oxygen (DO)	Number of coliform groups
AA	6.5-8.5	≤1mg/L	≤1mg/L	≥7.5mg/L	≤50MPN/100mL
A	6.5-8.5	≤3mg/L	≤5mg/L	≥7.5mg/L	≤1,000MPN/100mL
B	6.5-8.5	≤5mg/L	≤15mg/L	≥5mg/L	
C	6.0 -8.5	≤8mg/L	Floating matter such as garbage should not be observed	≥2mg/L	

Category	Items Purpose of water use	Standard values	
		Total Nitrogen	Total Phosphorus
I	Conservation of natural environment	≤0.1mg/L	≤ 0.005 mg/L
II	Water supply. Fishery type 1. Bathing	≤0.2 mg/L	≤0.01mg/L
III	Water supply class 3 (special types)	≤0.4 mg/L	≤0.03mg/L
IV	Fishery type 2	≤0.6 mg/L	≤0.05mg/L
V	Fishery type 3. Industrial water.	≤1 mg/L	≤0.1mg/L
	Agricultural water. Conservation of the living environment		

AA: Water supply, class 1; Fishery, class 1 ; Conservation of natural environment.

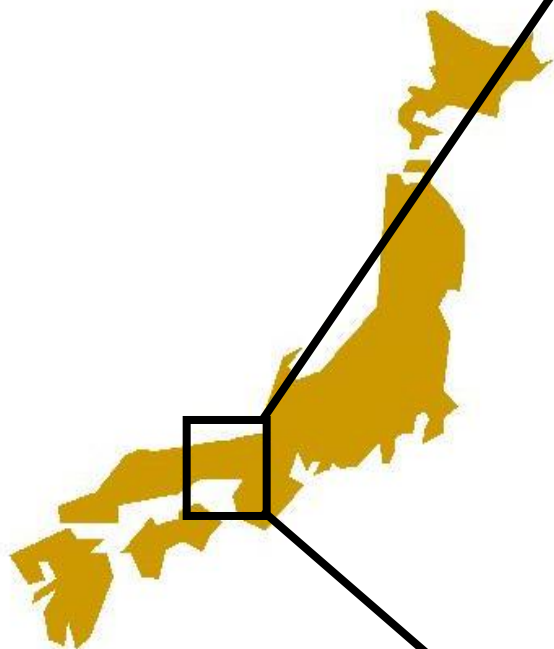
A : Water supply, class 2 and 3 ; Fishery, class 2 ; Bathing.

B : Fishery, class 3 ; Industrial water, class 1 ; Agricultural water.

C : Industrial water, class 2 ; Conservation of environment.

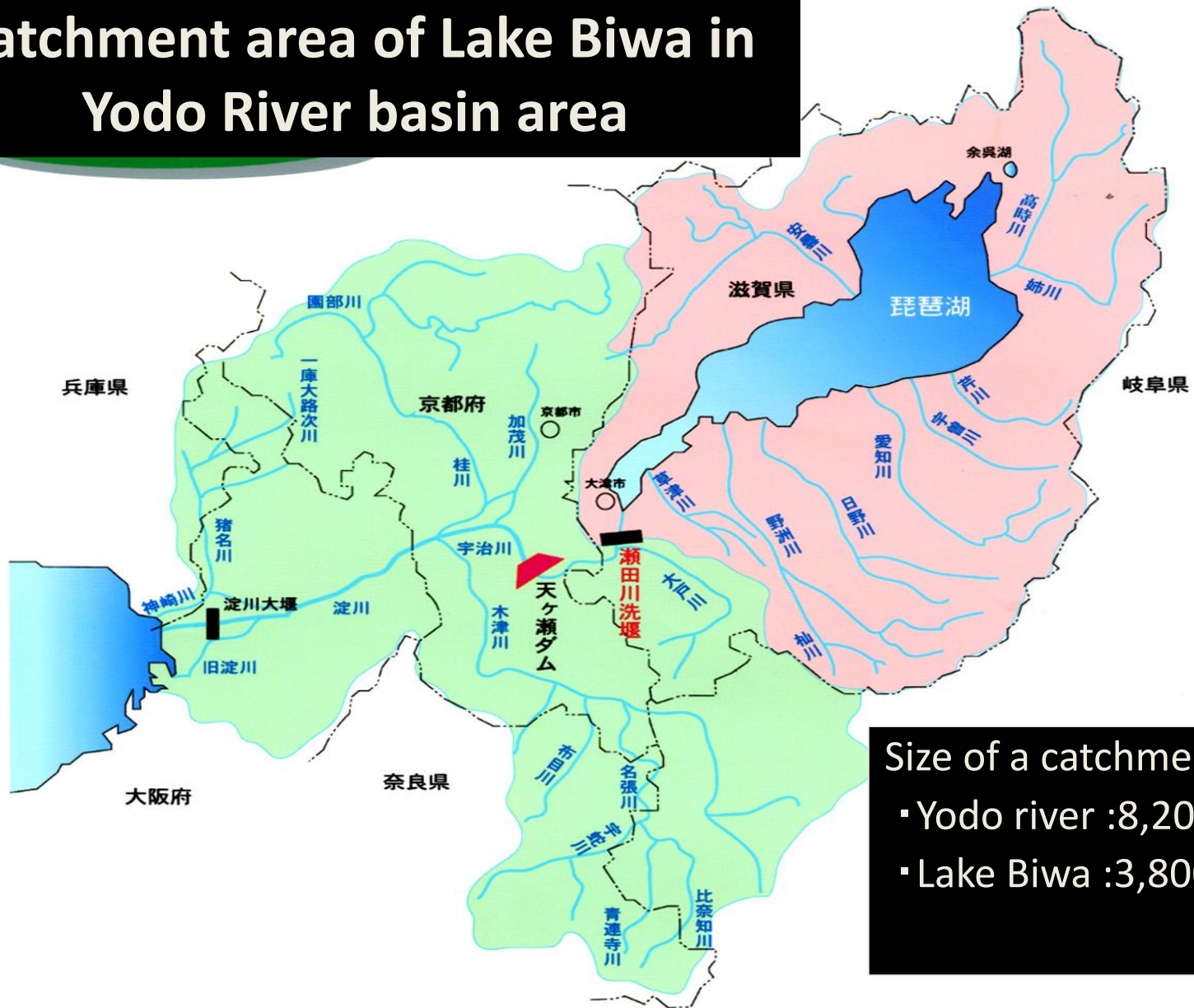
II-1-1. Comprehensive Basin-wide Planning

Location of Lake Biwa and Yodo River basin area



II-1-1. Comprehensive Basin-wide Planning

Catchment area of Lake Biwa in Yodo River basin area



Size of a catchment area

- Yodo river :8,200km²
- Lake Biwa :3,800km²

II. NECESSARY CONSIDERATION for CSS

II-1-1. Comprehensive Basin-wide Planning

To meet the Environment Standards, allocation of pollution load reduction in accordance with Pollution Source is necessary

Calculation and Allocation of Pollution Load in the River Basin

Present Pollutant Loads

Allowable Pollutant Load

Domestic Wastewater		
Industrial Wastewater		Domestic Wastewater
Live Stock		Industrial Wastewater
Others		Live Stock
Non Point Source		Others
		Non Point Source

Measures

Sewerage System
On-site Systems

Regulation

Treatment Facility

II. NECESSARY CONSIDERATION for CSS

II-1-1. Comprehensive Basin-wide Planning

Planning for Drainage and Treatment of Domestic Wastewater to meet the Water Quality Standards

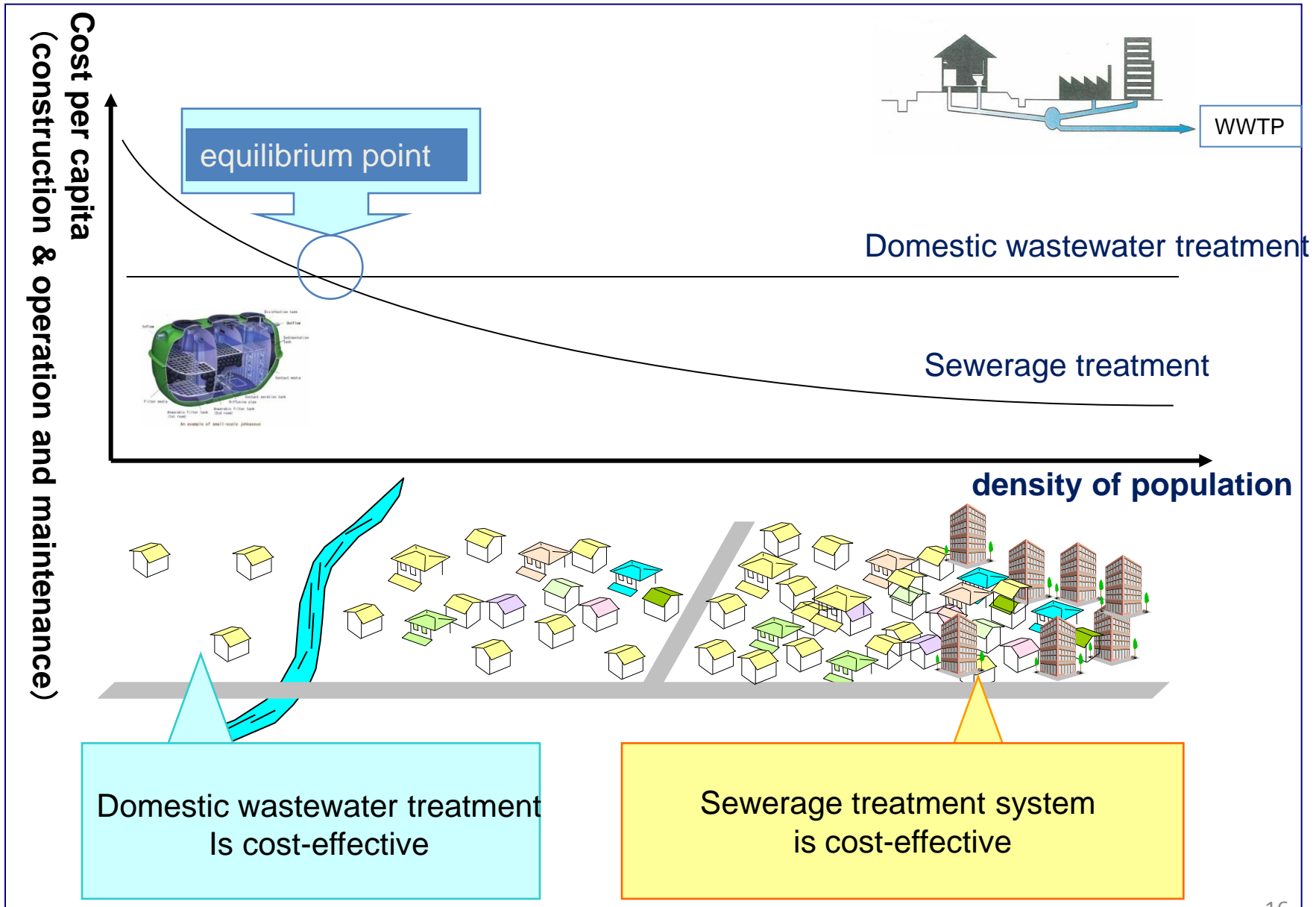
CONTENTS

- Target Area, Coverage Area
 - Area-wide Sewerage System (more than 2 cities)
 - Number and Location of WWTPs in Administrative Area
 - Main Pipe Route, Number and Location of Pumping Stations
 - On-site Treatment Area
- Wastewater Inflow Quantity and Quality
- Required Treated Water Quality and Treatment Processes



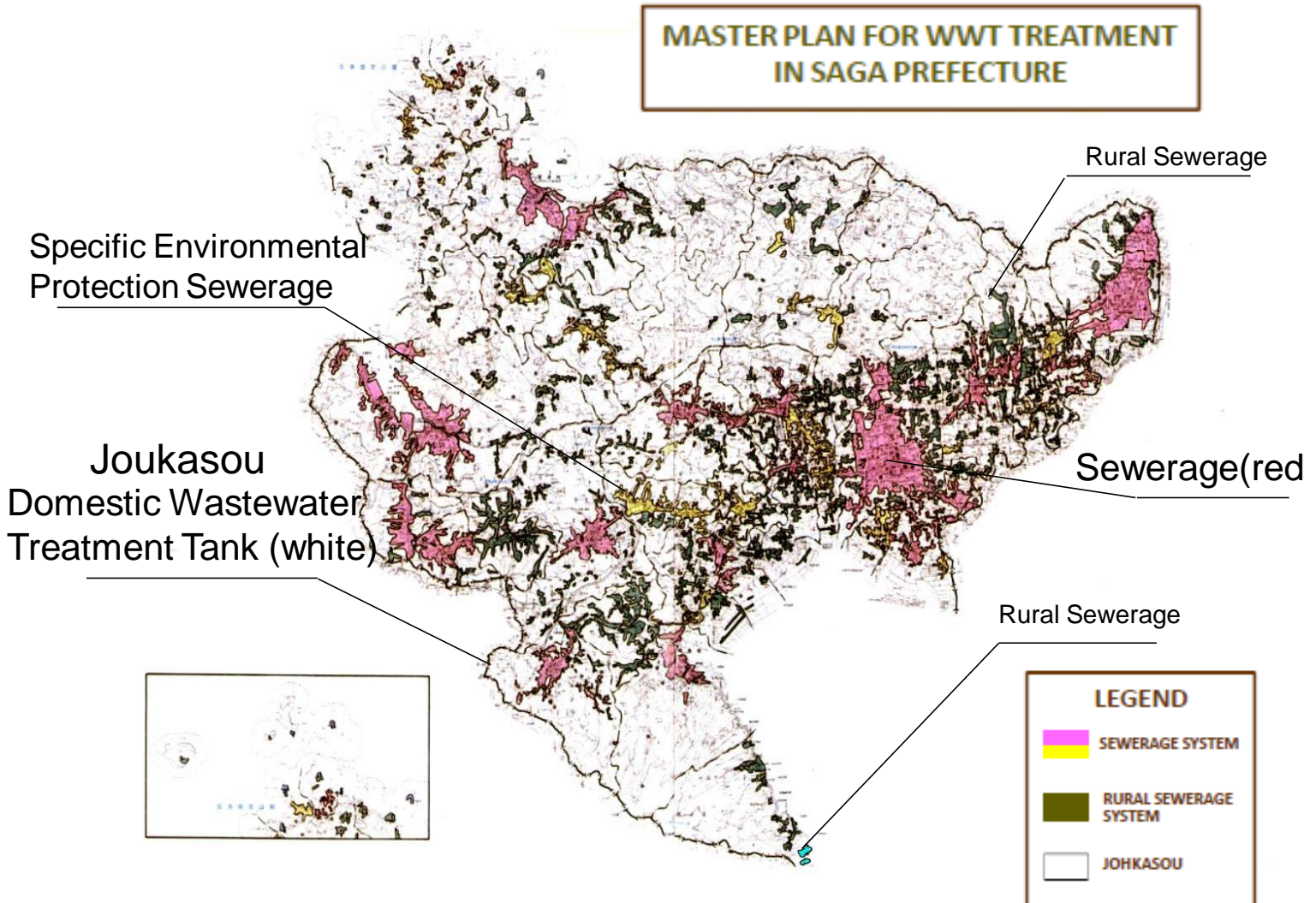
II. NECESSARY CONSIDERATION for CSS

II-1-2. Concept of Cost Comparison between Off-site and On-site



II. NECESSARY CONSIDERATION for CSS

II-1-3. Prefectural Plan for Appropriate Wastewater Treatment



II. NECESSARY CONSIDERATION for CSS

II-1-4. Formulation of Project Plan

Sewerage Law (Article 4)

The official in charge of managing public sewerage systems (general manager of public sewerage systems) shall formulate **a project plan**, as specified by Cabinet Order, when he wishes to implement a public sewerage system.

The general manager of public sewerage systems shall confer with the prefectural governor (or the Minister of Land Infrastructure, Transport and Tourism in the case of a planning specified by Cabinet Order) when he formulates a project plan.

A project plan shall **be suited to a comprehensive basin-wide sewerage plan** which has been initiated in the area of the project.

II. NECESSARY CONSIDERATION for CSS

II-1-4. Formulation of Project Planning

Sewerage Law (Article 5)

Matters to be set forth in the Project Planning

In the project planning, each of the following matters shall be defined.

1. **Layout, structure and capacity** of the sewer system (including auxiliary facilities), and planned disposal areas.
2. **Layout, structure and capacity** of the sewage treatment plant of the location where it joins the regional sewerage system.
3. In installing treatment plants (including auxiliary facilities), other than the sewage treatment, layout, structure and capacity of such facilities shall be specified.
4. **Scheduled date of initiating and completing the work**

II. NECESSARY CONSIDERATION for CSS

II-1-4. Formulation of Project Planning

Standard of Approval, Sewerage Law (Article 6)

1. The location and capacity of the public sewerage system are properly set up in consideration of precipitation, population, and other factors that may influence the amount and the water quality (including water temperature and other conditions of water), of sewage in the area, topography, land utility and situations of the area where the effluent is to be discharged.
2. The structure of the public sewerage system meets the technical standards specified in the Sewerage Law.
3. The planned disposal area is suitable for the location and capacity of the sewer system and sewage treatment plant.
4. The working plan shall be suited to the comprehensive basin sewerage plan which has been initiated for the area.

II. NECESSARY CONSIDERATION for CSS

II-1-5. Technology Options

Technical Standards for Wastewater Treatment Processes (Off-site)

Item	Planning Final Effluent Water Quality(mg/l)			Typical Wastewater Treatment Process	Additional Treatment			
	BOD	T-N	T-P		Rapid Filtration	Addition of Caogulant	Addition of Organic Matter	
1	>10	>10	>0.5	Anaerobic-Anoxic-Oxic Process	○	○	○	
2			0.5-1	Recycled Nitrification / Denitrification Process	○	○	○	
3			1-3	Anaerobic-Anoxic-Oxic Process	○		○	
4			—	Recycled Nitrification / Denitrification Process	○		○	
5		10-20	>1	Recycled Nitrification / Denitrification Process	○	○		
6				1-3	Anaerobic-Anoxic-Oxic Process	○		
7			—	Recycled Nitrification / Denitrification Process	○			
8			—	>1	Anaerobic-Oxic Activated Sludge Process	○	○	
9			—	1-3	Anaerobic-Oxic Activated Sludge Process	○		
10			—	—	Conventional Activated Sludge Process	○		
11		10-15	>20	>3	Anaerobic-Anoxic-Oxic Process			
12				—	Recycled Nitrification / Denitrification Process			
13			—	>3	Anaerobic-Oxic Activated Sludge Process			
14			—	—	Conventional Activated Sludge Process			
Same Level of Conventional Activated Sludge Process: OD, SBR, BAF, etc								

II. NECESSARY CONSIDERATION for CSS

II-1-5. Technology Options

Based on the Technology Evaluation and Design and O&M Manual

Types of Wastewater Treatment Processes in Japan (in 2008)

Process	Maximum Daily Flow (× 1000?/day)						
	<	5~10	10~50	50~100	100~500	500<	Total
1. Secondary Treatment	5						
Activated Sludge Processes							
a) Conventional Activated Sludge Process (Step Aeration Process)	41 0	53 0	325 1	119 2	126 2	12 0	676 5
b) Oxidation Ditch Process	804	93	33	0	0	0	930
c) Sequencing Batch Reactor	61	9	2	0	0	0	72
d) Extended Aeration Process	36	7	3	0	0	0	46
e) Pure Oxygen Activated Sludge Process	1	2	3	2	2	0	10
Fixed-film processes							
a) Aerobic Biofilter (Biological Anaerobic-Aerobic Filter)	24 42	5 2	0	0	0	0	29 44
b) Contact Aeration	12	0	1	0	0	0	13
c) Soil Covering-type Gravel Contactor	29	0	0	0	0	0	29
2. Advanced Treatment							
a) Recycled Nitrification/Denitrification Process	5	4	11	1	7	0	28
b) Nitrification/Endogenous Denitrification Process	1	0	1	0	0	0	2
c) Step-feed Multistage Nitrification/Denitrification Process	2	2	9	4	6	0	23
d) Anaerobic-oxic Activated Sludge Process	14	0	5	3	10	0	32
e) Anaerobic-anoxic-oxic Activated Sludge Process	0	4	7	9	15	1	36
f) Advanced Treatment Oxidation Ditch Process	47	10	0	0	0	0	57
3. Others							
a) Rotating Biological Contractor	10	6	1	1	0	0	18
b) High-rate Trickling Filter (Trickling Filter)	0 0	2 0	2 0	0 1	0 0	0 0	4 1
c) Primary Treatment (Sedimentation)	1	0	1	0	0	0	2
d) Others	32	9	12	2	8	0	63
TOTAL	1,162	208	417	144	176	13	2,120

II-1-5. Technology Options

Technical Standards for Wastewater Treatment Processes (On-site)

Class	Type of treatment	Treatment process	Number of users for design						BOD removal rate	Treatment performance			
										Effluent quality (mg/ℓ)			
			5	50	100	200	500	2000		5000	BOD	COD	T-N
1	Combined domestic wastewater treatment	Separation-contact aeration process							90% or more	20 or less	—	—	—
		Anaerobic filter-contact aeration process											
		Denitrification type anaerobic filter-contact aeration process											
4	Flush toilet wastewater treatment	Septic tank process							55% or more	120 or less	—	—	—
5		Land infiltration process							SS: 55% or more	SS: 250 or less	—	—	—
6	Combined domestic wastewater treatment	Rotating biological contactor process							90% or more	20 or less	30 or less	—	—
		Contact aeration process											
		Trickling filter process											
		Extended aeration process											
		Conventional activated sludge process											
7	Combined domestic wastewater treatment	Contact aeration and trickling filter process							—	10 or less	15 or less	—	—
		Coagulation separation process							—	10 or less	10 or less	—	—
8	Combined domestic wastewater treatment	Contact aeration and activated carbon absorption process							—	10 or less	10 or less	—	—
		Coagulation separation and activated carbon absorption process							—	10 or less	10 or less	—	—
9	Combined domestic wastewater treatment	Nitrified water recirculation type activated sludge process							—	10 or less	15 or less	20 or less	1 or less
		Tertiary treatment type denitrification dephosphorization process											
10	Combined domestic wastewater treatment	Nitrified water recirculation type activated sludge process							—	10 or less	15 or less	15 or less	1 or less
		Tertiary treatment type denitrification dephosphorization process											
11	Combined domestic wastewater treatment	Nitrified water recirculation type activated sludge process							—	10 or less	15 or less	10 or less	—
		Tertiary treatment type denitrification dephosphorization process											
12	Emission standard under the Water Pollution Control Law	Class: 6 -11 COD (mg/ℓ): 60 SS (mg/ℓ): 70 n-Hex (mg/ℓ): 20 pH: 5.8-8.6 Total coliforms (N/mℓ): 3,000 or less 6 -11 45 60 20 5.8-8.6 3,000 or less 6 -11 30 50 20 5.8-8.6 3,000 or less 7 -11 15 15 20 5.8-8.6 3,000 or less 8 10 15 20 5.8-8.6 3,000 or less											

II. NECESSARY CONSIDERATION for CSS

II-2. Operation and Maintenance

II-2-1 Institutional and Management Arrangements

- **Role of Central Government and Municipality**
- **Project Implementation Organization**(Project Responsible Organization)

- **Private Sector Participation,**
- **Public Private Partnership** (Share of Responsibilities, Risk management)
(Service Contract, Managing Contract, Lease, Concession, Privatization, etc.)

- **Human Resource Development:** On-the-Job Training, Training Program
- **Capacity Development** **(JS Training Center)**

- **Research and Technology Development** **(JS R&D Division)**

- **Technical Support to Middle-Small Scale Municipalities**
(JS: Japan Sewage Works Agency)

II. NECESSARY CONSIDERATION for CSS

II-2-2 Financial System for Sanitation

- **Establishment of Construction and O&M Cost Sharing Principles**

Construction Cost: Subsidy, Local Bond, User Charge

O&M Cost : User Charge, Public Sector Cost Burden

Collection of User Charge (Sustainability) greatly depends on
User's Willingness To Pay, (Affordability to pay)

In respect of

- (1) The need for a water supply and sewerage system
- (2) Awareness and understanding of residents for paying for the facilities
- (3) A suitable payment system

II. NECESSARY CONSIDERATION for CSS

II-2-2 Financial System for Sanitation

- **Willingness to pay greatly depends on how citizens are aware of and evaluate the benefits of sanitation systems** (Importance of Awareness and Understanding of Sanitation Systems Benefits)

1) Improvement of Surrounding Environments

Examples of benefits;

hygiene status, eradication of mesquites, flies,

People's comfort, use of flush toilet, elimination of odor problems, etc.

Reduction of Waterborne Diseases

2) Water Quality Preservation in Public Water Bodies

- (1) Improvement of the value of water environment for citizens
- (2) Cost reduction to uptake the water for drinking, industrial use, agricultural use, etc.
- (3) Damage cost of agriculture by discharging of untreated wastewater
- (4) Damage cost of fishery by discharging of untreated wastewater
- (5) Alternative method for dredging (without sewage works, dredging is required)

Necessary Viewpoints for Public Relation, Public Education

II. NECESSARY CONSIDERATION for CSS

II-2-3 Management of Sewerage Systems

Necessary Aspects for Rational Management of Sewerage Systems

- **Appropriate cost sharing** between public and private financial resources
- **Long-term basis forecast of income and expenditures** considering the lifespan of the facilities and the increased percentage of users
- **Appropriate economic management** based on tangible business objectives, precise business analysis and future business prospects
- **Disclosure of management information to the citizens** as tax payers and users who bear user charge

Currently, Kyoto City, Yokosuka City, and other cities disclose management information including Medium-range management planning, Balance of payment of sewage works, and PI (Performance Indicators) proposed by the Japan Sewage Works Association.

CONCLUSION

Objectives of CSS; City Sanitation Strategy

- (1) Improvement of Living Condition
- (2) Improvement of Public Health
- (3) Preservation of Water Quality in Public Water Bodies

I. BASIC FRAMEWORK for CSS

(1) Legal System: Basic Law for Environmental Protection

Water Quality Control Law

City Planning Law

Sewerage Law, Johkasou Law

(2) Technology Options for Drainage and Treatment of Wastewater

Off-site Treatment, On-site Treatment

(3) Institutional and Management Arrangements

Role of Central Government and Municipality

Project Implementation Organization

Private Sector Participation, Public Private Partnership

(4) Financial System for Sanitation

Establishment of Construction and O&M Cost Sharing Principles

Construction Cost: Subsidy, Local Bond, User Charge

O&M Cost : User Charge, Public Sector Cost Burden

CONCLUSION

II. NECESSARY CONSIDERATION for CSS

II-1. Project Planning

II-1-1. Comprehensive Basin-wide Planning

Basic Concept for CSS

II-1-2. Concept of Cost Comparison between Off-site and On-site

Design Criteria for Selection of Off-site and On-site System

II-1-3. Prefectural Plan for Appropriate Wastewater treatment

Fundamental Plan for CSS Based on II-1-1 & II-1-2

II-1-4. Formulation of Project Plan

Location and Capacity of Sanitation Systems considering several aspects (in Japan formulated in the Sewerage Law)

II-1-5. Technology Options

Technology Evaluation and Establishment of Design Manuals

Objectives of CSS; City Sanitation Strategy

- (1) Improvement of Living Conditions**
- (2) Improvement of Public Health**
- (3) Preservation of Water Quality in Public Water Bodies**

CONCLUSION

II. NECESSARY CONSIDERATION for CSS

II-2. Operation and Maintenance

II-2-1. Institutional and Management Arrangements (HRD, CD)

Role of Central Government and Municipalities,
Project Implementation Organization,
Private Sector Participation,
Human Resource Development: OJT, Training Program
Capacity Development (JS Training Center)
Research and Technology Development (JS R&D Division)
Technical Support to Middle-Small Scale Municipalities

II-2-2. Financial System for Sanitation (WTP, Public Awareness)

Establishment of Construction and O&M Cost Sharing Principles

Construction Cost: Subsidy, Local Bond, User Charge

O&M Cost : User Charge, Public Sector Cost Burden

Willingness to pay greatly depends on how citizens are aware of
and evaluate the benefits of sanitation systems

Necessary Viewpoints for Public Relation, Public Education

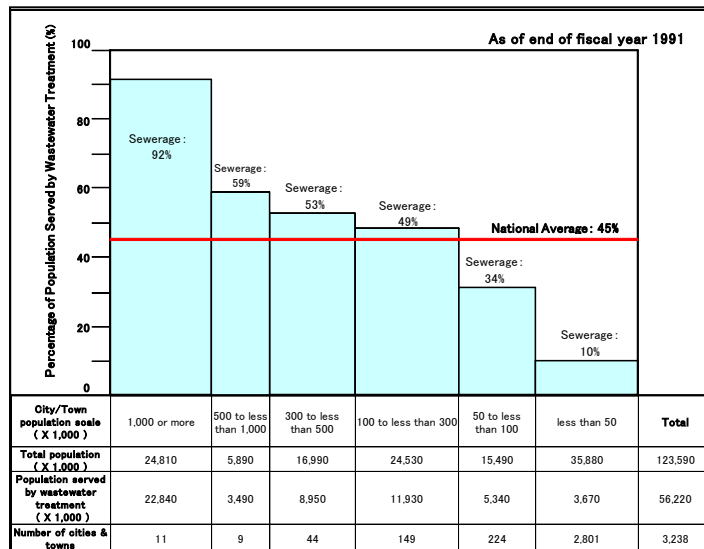
CONCLUSION

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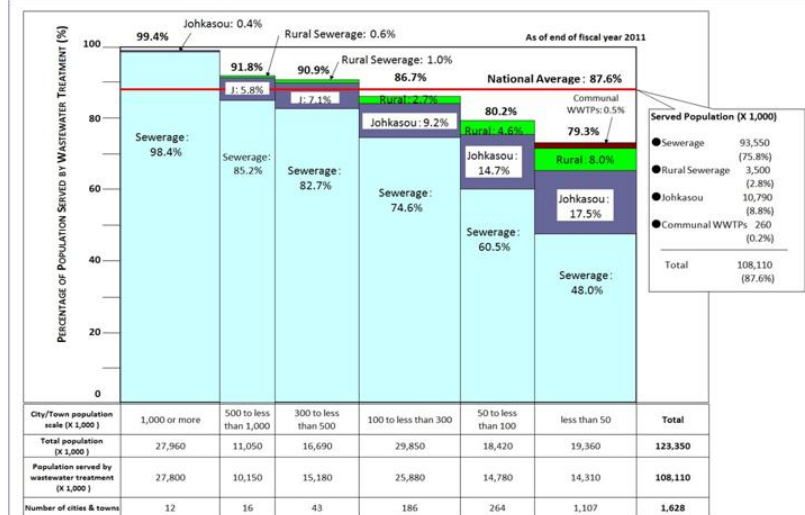
II-2. Operation and Maintenance

II-2-3. Management of Sanitation Systems

- Appropriate cost sharing between public and private finance resources
- Long-term basis forecast of income and expenditures
- Appropriate economic management
- Disclosure of management information to the citizens as tax payers and users who bear user charge



45%: Sewered Population Rate in 1991



88%: Wastewater Treated Population Rate in 2011

CONCLUSION; SOLUTION for City Sanitation

I. BASIC FRAMEWORK for CSS

- I-1. Legal System for Sanitation Systems**
- I-2. Technology Options for Drainage and Treatment of Wastewater**
- I-3. Institutional and Management Arrangements**
- I-4. Financial System for Sewerage Systems**

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II-2. Operation and Maintenance

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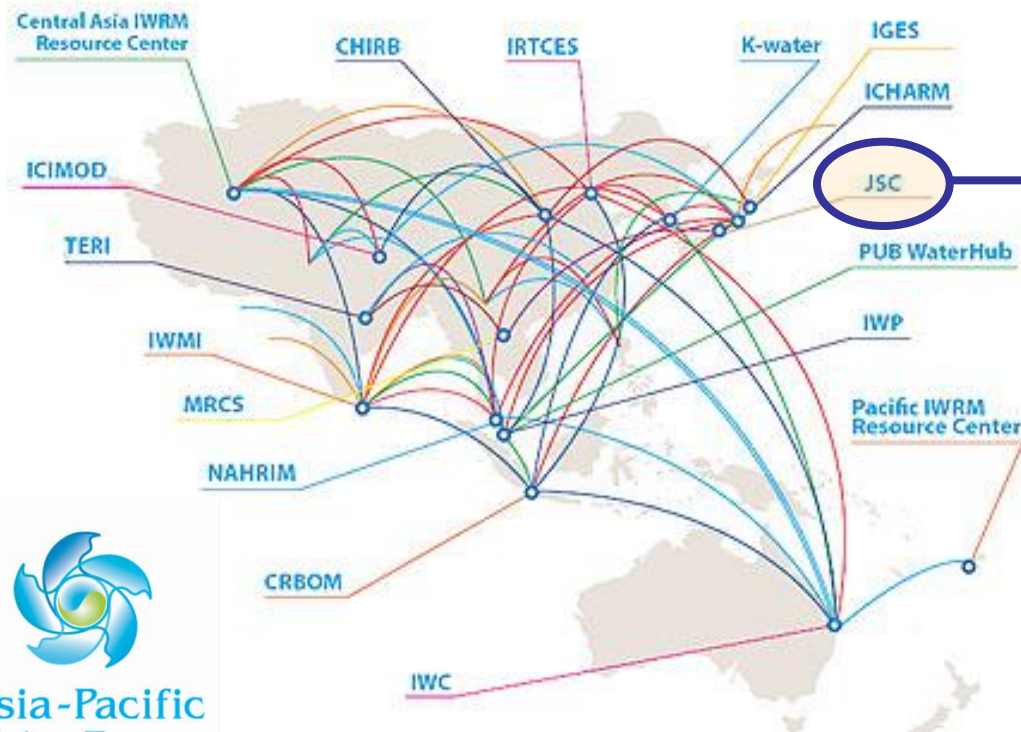
For Formulation of City Sanitation Strategy

The Japan Sanitation Consortium (JSC) was launched on 16 October 2009

JSC Objectives

- ❑ Promote access to sanitation and sustainable improvement in the Asia-Pacific region
- ❑ Promote sanitation policies, legal and institutional frameworks, and financing strategies
- ❑ Develop human resource capacity and sanitation and hygiene awareness

Thank you for your attention



JSC MEMBER ORGANIZATIONS

■ OFF-SITE SANITATION

1. Sewerage Business Management Centre



2. Japan Sewage Works Association



3. Japan Sewage Works Agency



■ ON-SITE SANITATION

4. Japan Environmental Sanitation Center



5. Japan Education Center of Environmental Sanitation



Asia-Pacific Water Forum

KnowledgeHubs