

Workshop 4, Session 2  
Wastewater Management to Support River Basin Water Quality

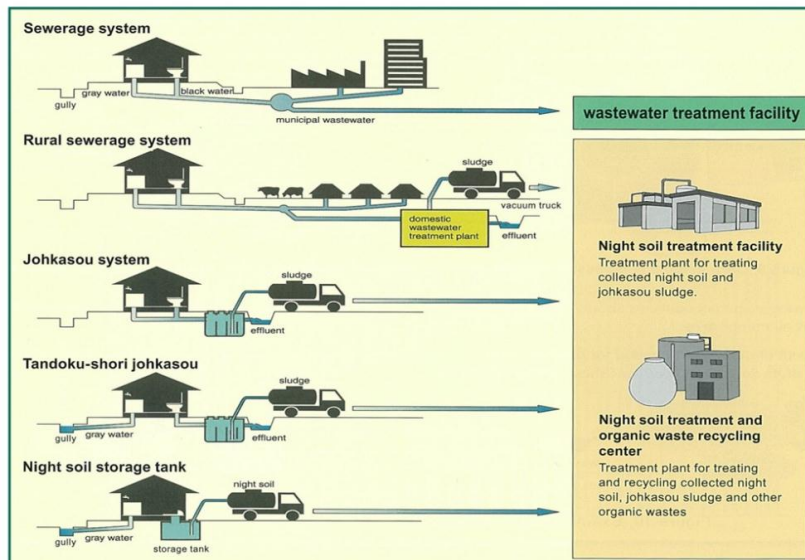
## POTENTIAL OF SMALL SCALE AND LARGE SCALE SOLUTIONS – COST AND QUALITY ASPECTS

Wednesday 23 November 2011

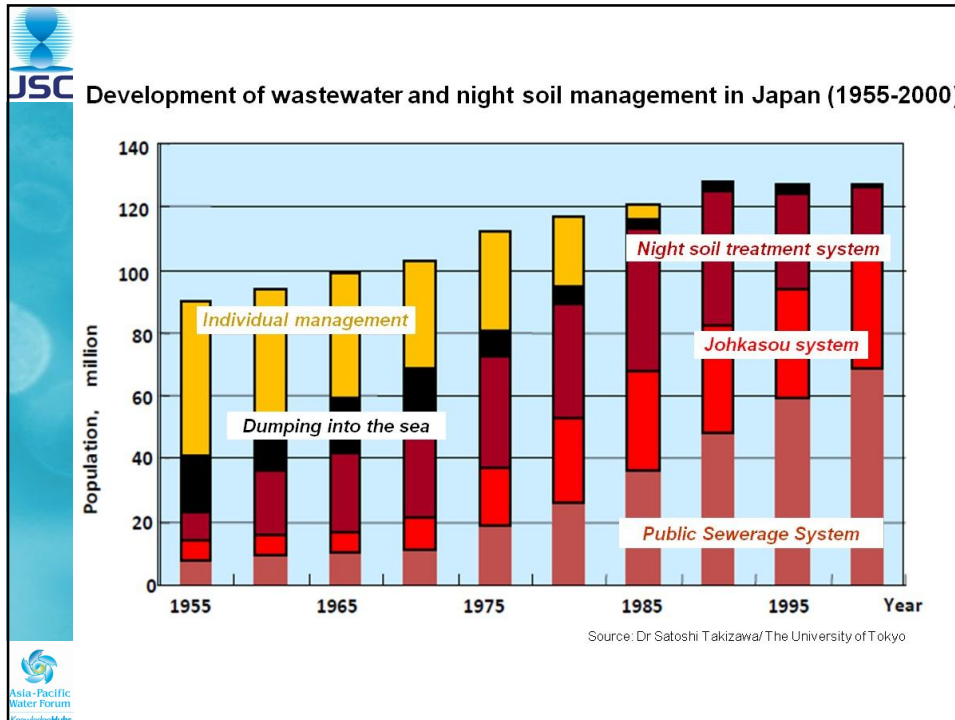
*Pierre Flamand*



### Major night soil and wastewater treatment systems in Japan



Source: Japan Education Center of Environmental Sanitation

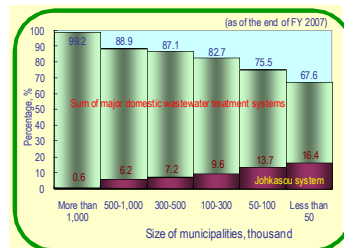


### CHARACTERISTICS OF THE MAJOR WASTEWATER TREATMENT SYSTEMS IN JAPAN

Category & type of system	Sewerage system Centralized System	Rural sewerage system Centralized system (small-scale)	Johkasou system Decentralized system
Purpose	-Treat industrial, miscellaneous domestic WWT & stormwater -Prevent inundation -Maintain quality of water resources -Protect public health	-Treat miscellaneous domestic WWT & stormwater -Prevent inundation -Maintain quality of water resources -Protect public health	-Treat domestic & miscellaneous WWT -Maintain quality of water resources -Protect public health
Suitable areas	Mainly urban, peri-urban areas	Agricultural villages within selected areas where agriculture is promoted	Peri-urban, rural areas where sewerage system is not planned
Administrator for installation, O&M	Municipalities	Municipalities and selected areas where agriculture is promoted	Individuals, communities and municipalities
Applicable population	10,000 people or more	Up to 1,000 people	<u>Small-scale</u> = 5 to 50 people (less than 10 m <sup>3</sup> /day) <u>Medium-scale</u> = 51 to 500 people (less than 100 m <sup>3</sup> /day) <u>Large-scale</u> = more than 500 people (more than 100 m <sup>3</sup> /day)
Life cycle	Legal	Treatment plants: 23 years Piping system: 50 years	- -
	Past results	Treatment plant: 15-70 years Piping system: 50-120 years	- -
Construction period	Approx. 5 years	3-5 years	Approx. 1 week to 1 year
Served population (as of 2009)	93.6 million (73.7%)	3.79 million (3.0%)	11.24 million (8.8%)

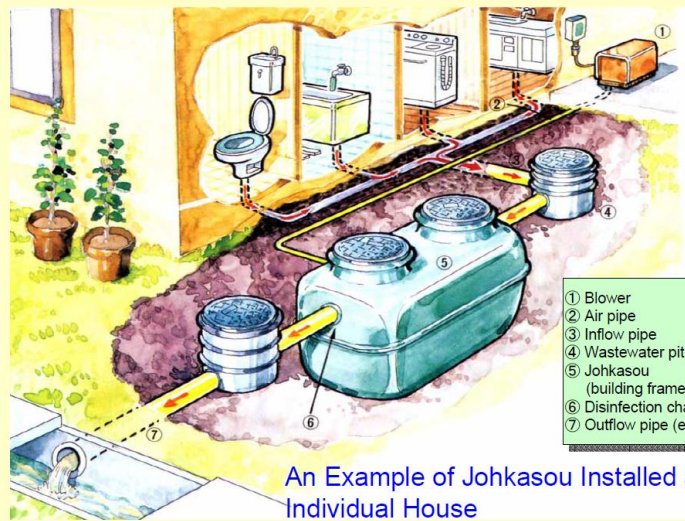
## ADVANTAGES AND SPECIFICITIES OF JOHKASOU

- Flexible system that can cope with population decrease
- Less vulnerable to earthquakes and other disasters
- Cheaper and quicker to put in service after disaster occurrence
- Low initial investment cost, high treatment performance
  - Little topographic limitation, short installation time and quick results
  - Invaluable contribution to maintaining sufficient water in small rivers and aquatic environments near inhabited areas
  - Treated effluent and sludge are easy to reuse



*decentralized system*

## What is Johkasou?



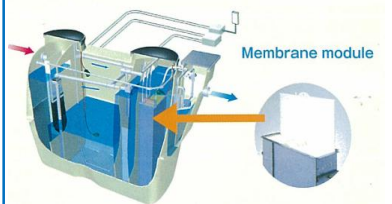
- ① Blower
- ② Air pipe
- ③ Inflow pipe
- ④ Wastewater pit
- ⑤ Johkasou (building frame)
- ⑥ Disinfection chamber
- ⑦ Outflow pipe (effluent)

An Example of Johkasou Installed at Individual House

**SMALL-SCALE JOHKASOU (FRP)**

Capacity = 5 to 50 users

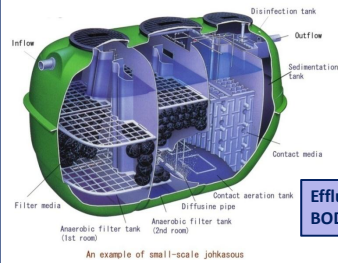
**Membrane johkasou**



A small-scale membrane johkasou (FRP-made)

Effluent quality  
BOD <= 5 mg/l  
T-N <=10 mg/l

**Conventional johkasou (FRP-made)**



Effluent quality  
BOD <=20 mg/l

An example of small-scale johkasous

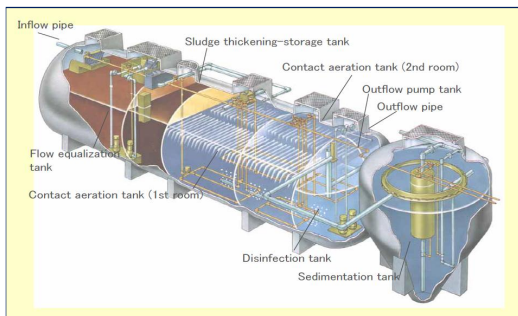
**Johkasou for BOD, N&P Removal**



Effluent quality  
BOD <=10 mg/l  
T-N <=10 mg/l  
T-P <= 1 mg/l

**MEDIUM-SCALE JOHKASOU (FRP-made)**

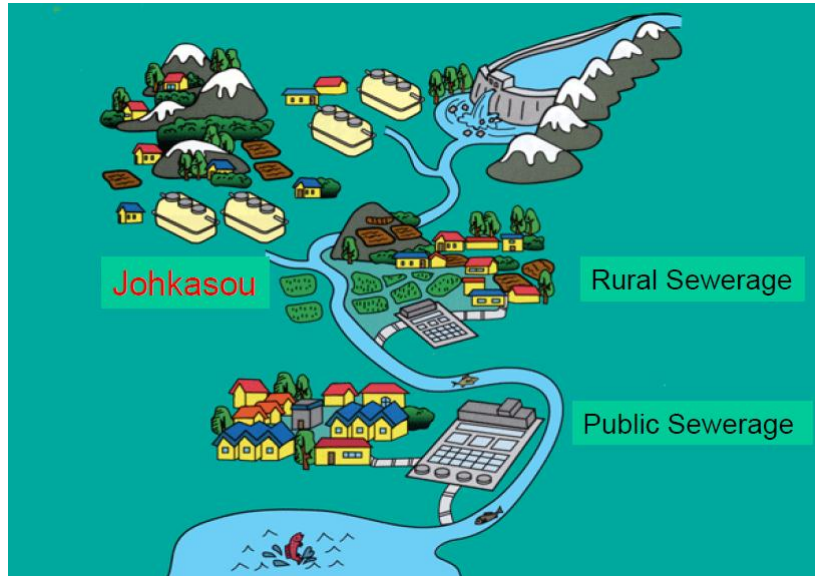
Capacity = 51 to 500 users



**LARGE-SCALE JOHKASOU (RC-made)**

Capacity = more than 500 users

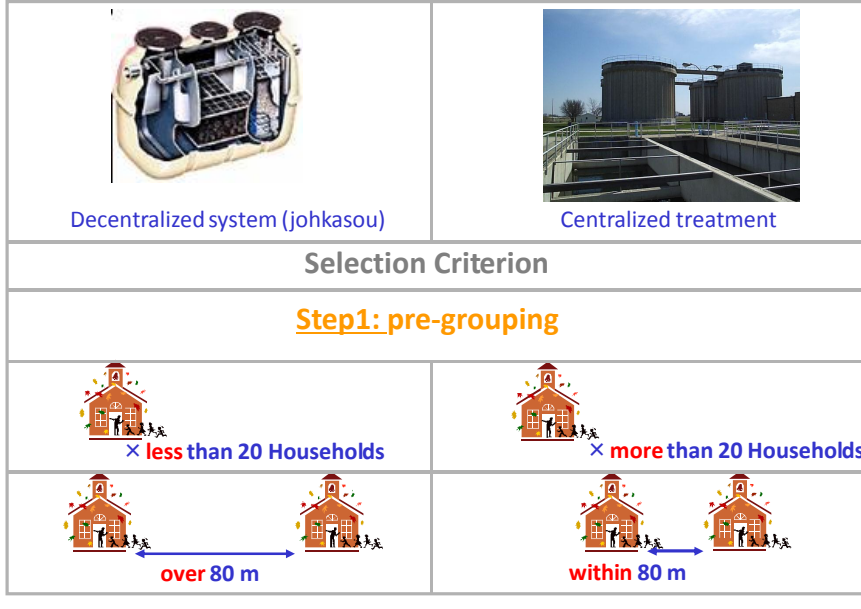
## MAIN SYSTEMS FOR WASTEWATER TREATMENT



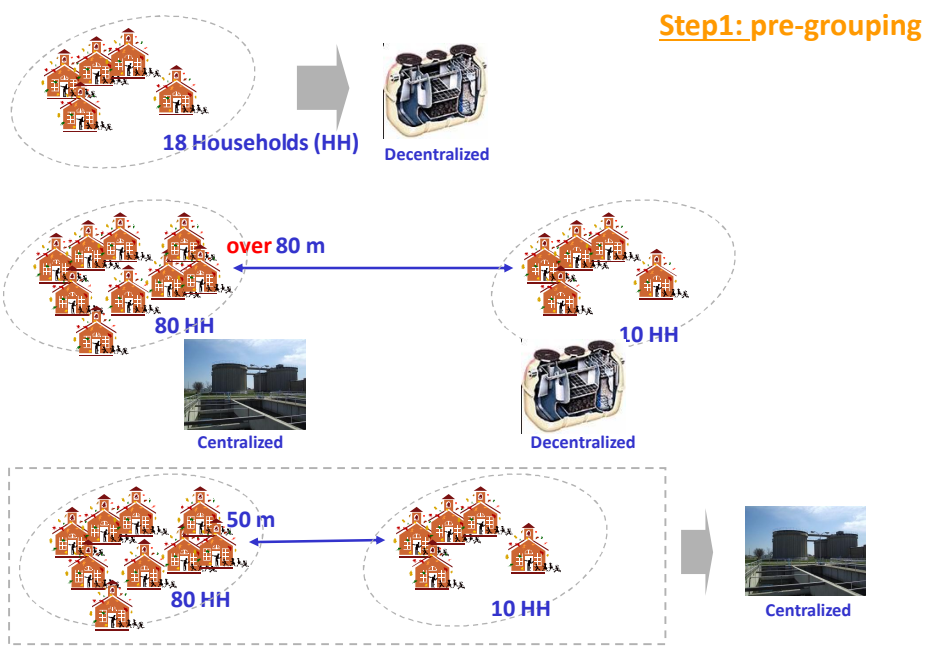
## DECENTRALIZED & CENTRALIZED WASTEWATER TREATMENT SYSTEMS: ADVANTAGES / DISADVANTAGES AND IMPACTS

Items	Advantages of decentralized systems	Advantages of centralized systems
Number of HH	small	big
Distance between HH (in meters)	Long	short
Soil undulation and number of water bodies	big	small

## DETERMINATION OF CENTRALIZED AND DECENTRALIZED AREAS



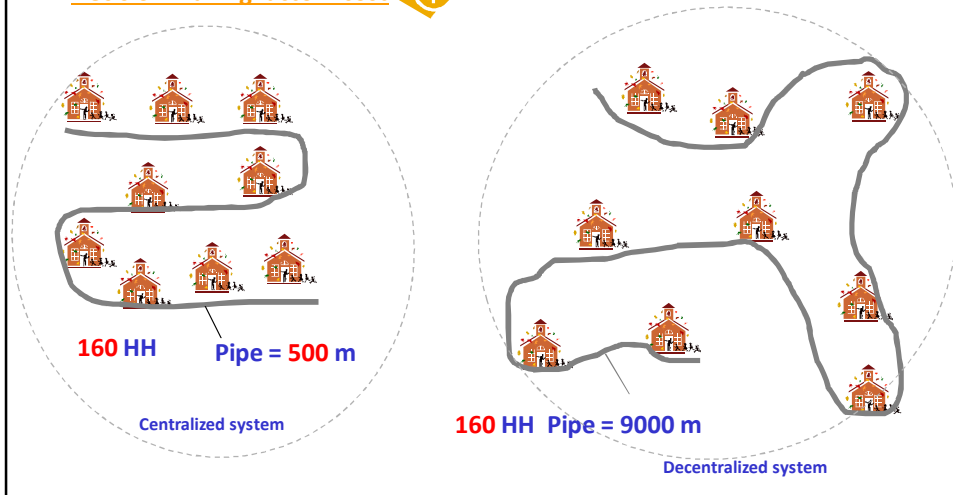
## DETERMINATION OF CENTRALIZED AND DECENTRALIZED AREAS



## Step 2: Selection for centralized & decentralized systems

Example: 160 Households,  
 Total pipe Length > 8513m → decentralized  
 Total of pipe Length < 8513m → centralized

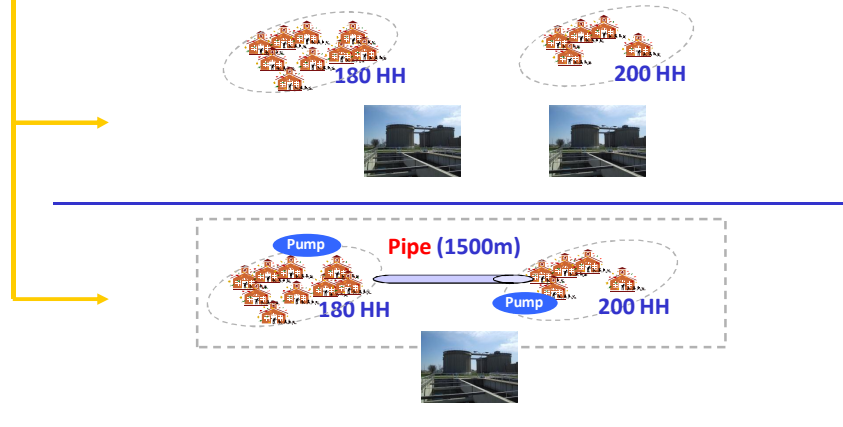
Decision making factor : cost 



## Step3: Connection of Off-site treatment districts



Decision making factor : cost 



## COST COMPARISON FOR SELECTION OF WASTEWATER TREATMENT SYSTEM

**GENERAL CONDITIONS:** Number of households (HH) in targeted area → 110  
Targeted population → 418 people

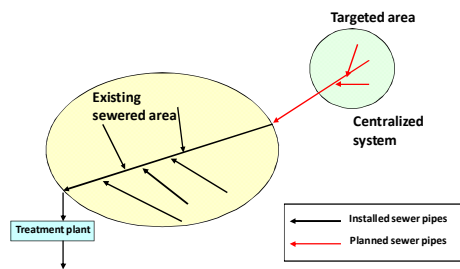
**TYPE 1:** sewerage system  
(Utilization of existing treatment plant)

Specific Conditions:

Extension of sewer network Length = 3,000 m  
Manholes/pumps Number = 2

(when connecting to already existing sewer area)

Cost for 34 years = 1,050 million yen  
- Revenue in 34 years = 421 million yen  
**= Total cost in 34 years = 629 million yen**



## COST COMPARISON FOR SELECTION OF WASTEWATER TREATMENT SYSTEM

**GENERAL CONDITIONS:** Number of households (HH) in targeted area → 110  
Targeted population → 418 people

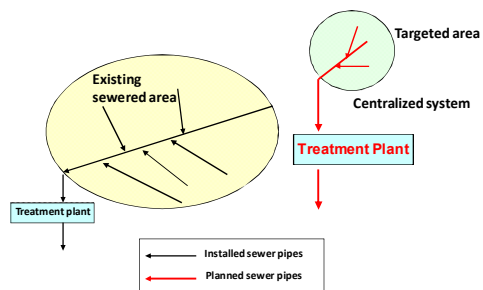
**TYPE 2:** sewerage system  
(Construction of a new treatment plant)

Specific Conditions:

Extension of sewer network Length = 2,500 m  
Manholes/pumps Number = 2  
WWT Treatment Plant Number = 1

(when not connecting to already existing sewer area)

Cost for 34 years = 1,082 million yen  
- Revenue in 34 years = 377 million yen  
**= Total cost in 34 years = 705 million yen**





## COST COMPARISON FOR SELECTION OF WASTEWATER TREATMENT SYSTEM

**GENERAL CONDITIONS:** Number of households (HH) in targeted area → 110  
 Targeted population → 418 people

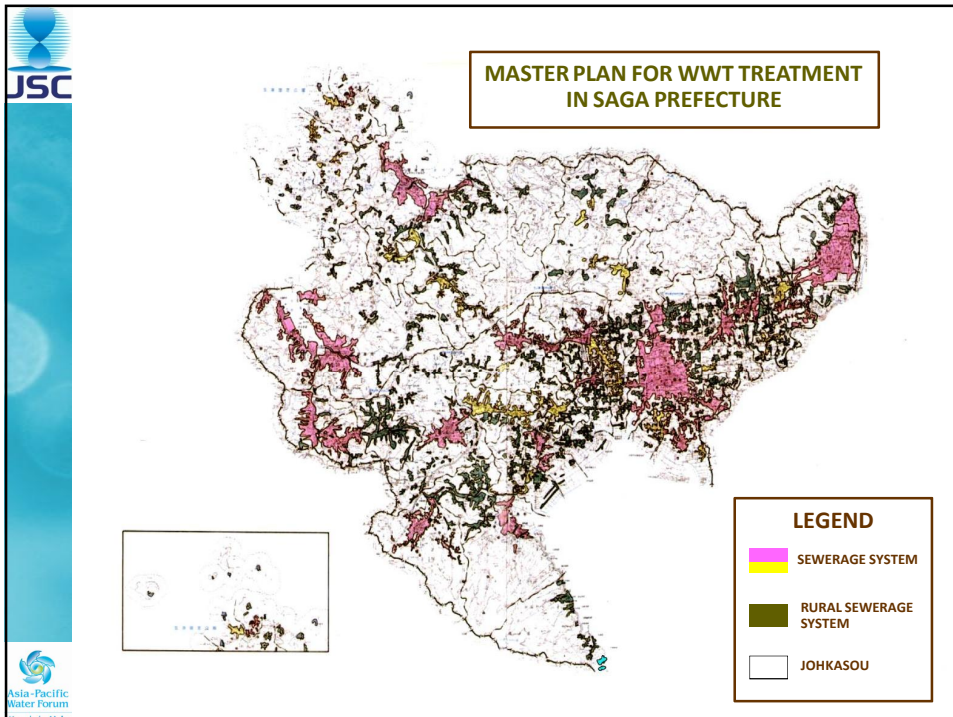
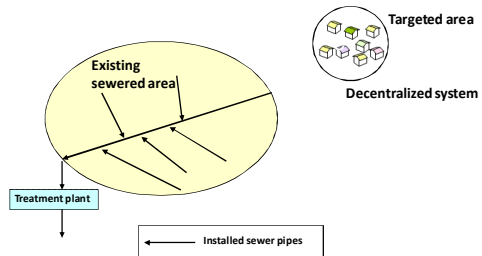
**TYPE 3:** Implementation of johkasou by municipalities

Specific Conditions:  
 Johkasou units = 110

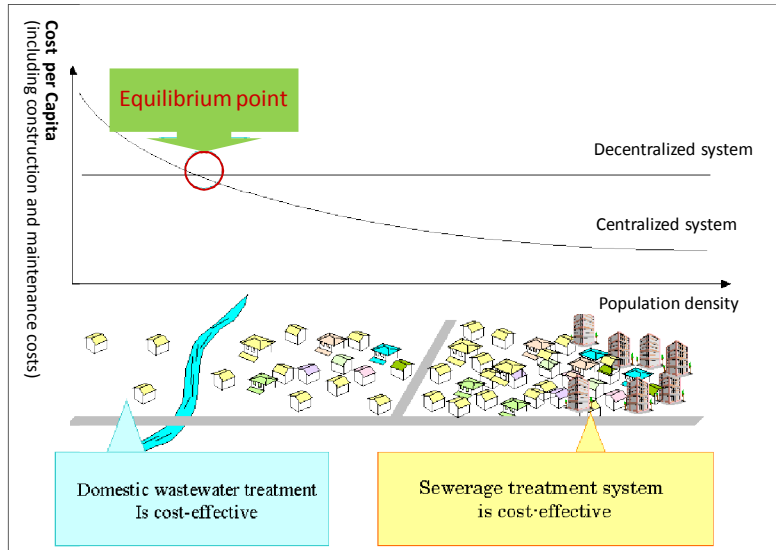
(when not connecting to already existing sewerage area)

Cost for 34 years = 833 million yen  
 - Revenue in 34 years = 292 million yen  
**= Total cost in 34 years = 541 million yen**

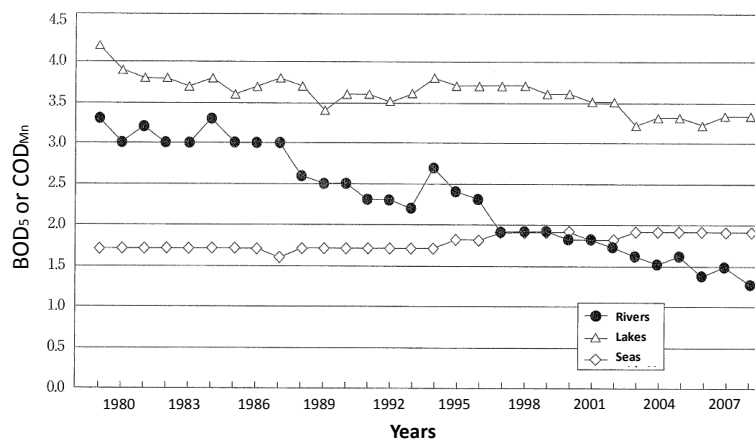
↑  
 Cost-effective & best solution



## COST COMPARISON BETWEEN CENTRALIZED SYSTEMS AND DECENTRALIZED SYSTEMS



## WATER QUALITY IN WATER BODIES IN JAPAN



Note: Rivers = BOD; Lakes and seas = COD



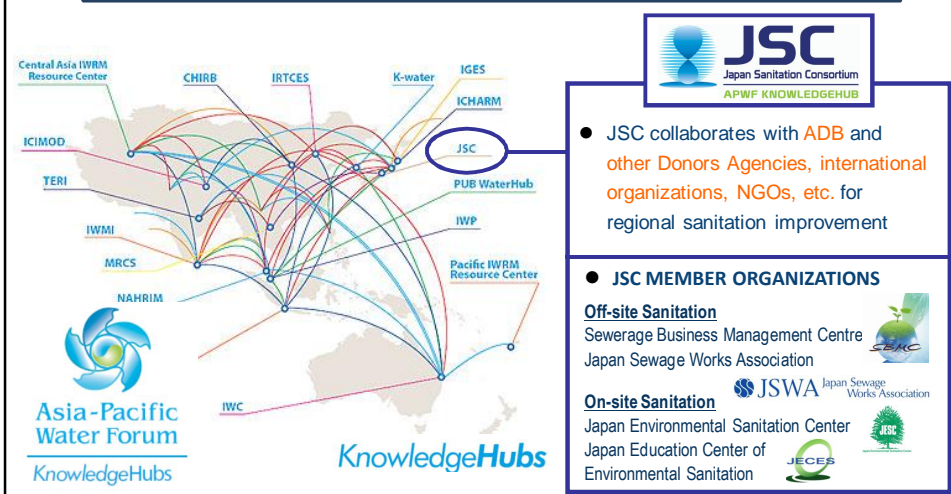
## CONCLUSION

*In the case of Japan,*

- To improve water quality, centralized and decentralized systems were developed to achieve equivalent wastewater treatment quality
- A combination of both systems proved to be cost-effective and the best way to increase sanitation coverage in a relatively short period of time



- The Japan Sanitation Consortium (JSC) was launched on 16 October 2009
- JSC consists of the 4 main national agencies managing on-site and off-site sanitation in Japan
- JSC aims to utilize Japan's advanced experience in sanitation and successful models from other countries to solve related issues in the region





**JSC Sanitation KnowledgeHub, Japan**  
Regional Water Knowledge Hub for Sanitation

■ **JSC Expertise**

- Member of a regional network of water specialists, committed for sanitation development in the Asia-Pacific region
- On-site and off-site sanitation specialized organization

■ **JSC Services**

- Networking, Information Gathering & Sharing, Knowledge Dissemination, Support to International Donor Organizations

■ **JSC Partners**

- ADB, JICA, Japan Water Forum, UNICEF, etc.



*Thank you for your attention*

e-mail: [info@jsanic.org](mailto:info@jsanic.org)  
[www.jsanic.org](http://www.jsanic.org)

Knowledge Networking for Water Security in the 21st Century