



**Waterworks Office**  
Seoul Metropolitan Government




# Water for All

<http://arisu.seoul.go.kr>

**Kevin Young June Choi**

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- 3 Issues and Challenges
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**Waterworks works!!**

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**Waterworks works!!**

- ❖ **Only waterworks can do it!**
  - 5.4 mil. tons/day (Total capacity of Seoul)
  - 3.5 mil. tons produced and distributed daily
  - 433,750 trucks required distributed without waterworks systems (i.e., pipe lines)
- ❖ **Waterworks in the US**
  - 1907: 1<sup>st</sup> filtration facility
  - 1914: disinfection by chlorination
  - **Waterworks works!!**
    - 1900: 30 out of 100,000 died of typhoid fever
    - 1928: 5 out of 100,000 died of water-born disease

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## Waterworks in History

- ❖ Ancient time
  - Groundwater or surface water
- ❖ Roman Empire, BC 312 ~ BC 305
  - 578 km of aqueduct
    - Fountains, public bathhouse, other public buildings
- ❖ Europe
  - 6<sup>th</sup> century
    - Population growth in Paris and London
    - Waterworks systems to use the Thames and the Seine
  - 1830: Cholera outbreak (from contaminated drinking water)
  - 1852: Law of waterworks announced (London)



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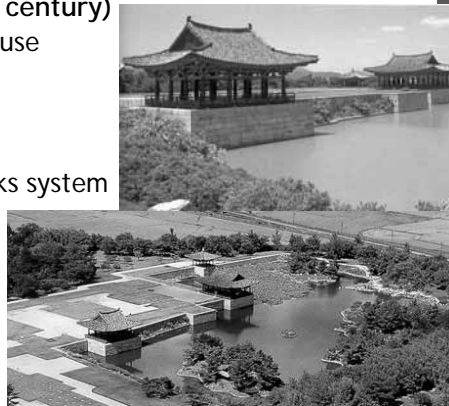
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## Waterworks in Korea

- ❖ Unified Shilla dynasty (7<sup>th</sup>~10<sup>th</sup> century)
  - Clay pipe network for water use
- ❖ Pusan, 1895
  - First treated water supply
- ❖ Seoul, September 1, 1908
  - First modern style waterworks system
  - Dduksum WTP
- ❖ Pyongyang, Pusan, and Daegu
- ❖ 1947 after WWII
  - 40,000 tons/day
  - 66 lpcd
- ❖ 1954 after Korean War
  - Rebuilding waterworks system with foreign funds
- ❖ Economic development plan (1962~1992)
  - The percentage of population served in 2004: 90.1%



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## Supply

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# Waterworks Service in Korea

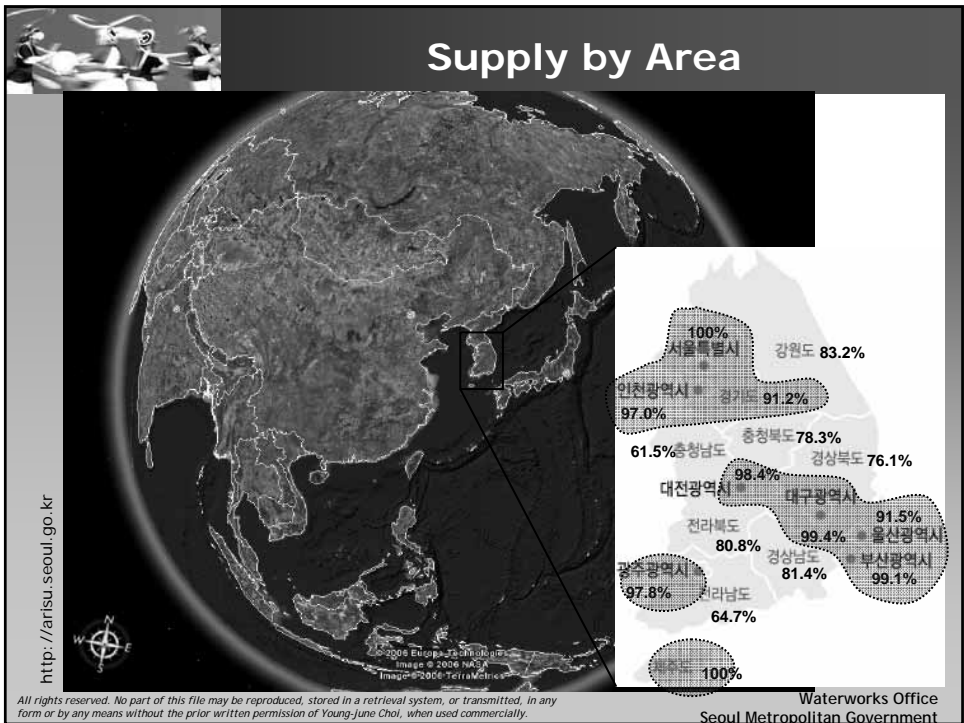
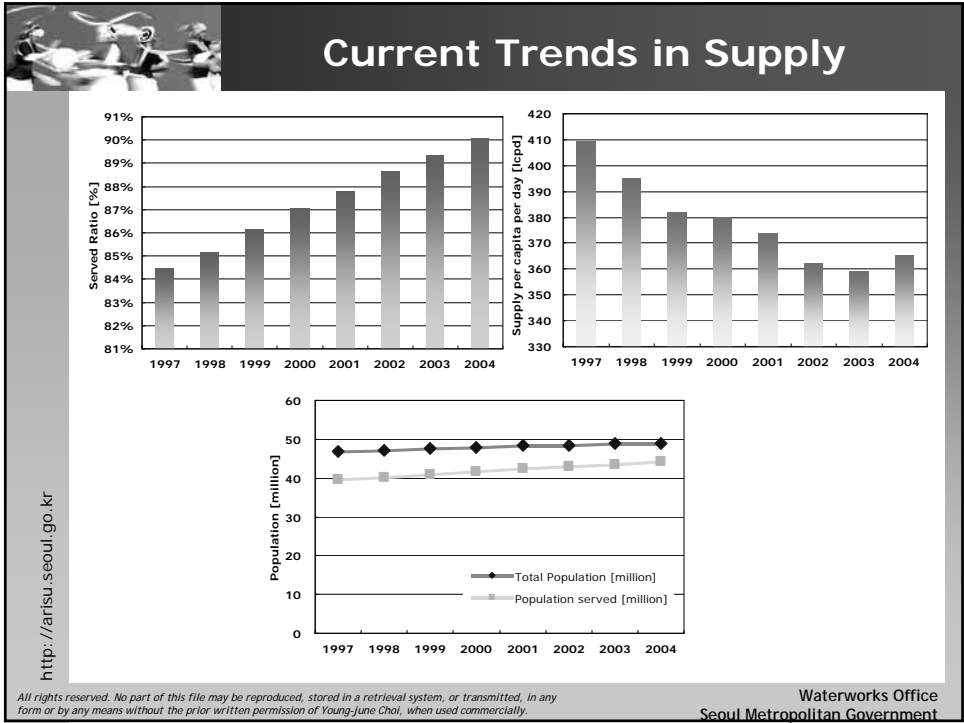
	Total Population (thousand)	Population served (thousand)	Percentage served (%)	Production capacity (1,000 tons/day)	Supplied City (1,000 tons/day)	Supplied City per capita per day (lpcd)
Nation-wide	49,053	44,187	90.1%	23,156	16,145	362
Special and Metro area cities	23,068	22,793	98.8%	14,930	8,153	358
Cities	16,618	16,166	97.3%	6,146	6,071	370
Eups	4,036	3,384	82.5%	1,347	1,255	317
Myuns	5,201	1,864	35.2%	733	666	287

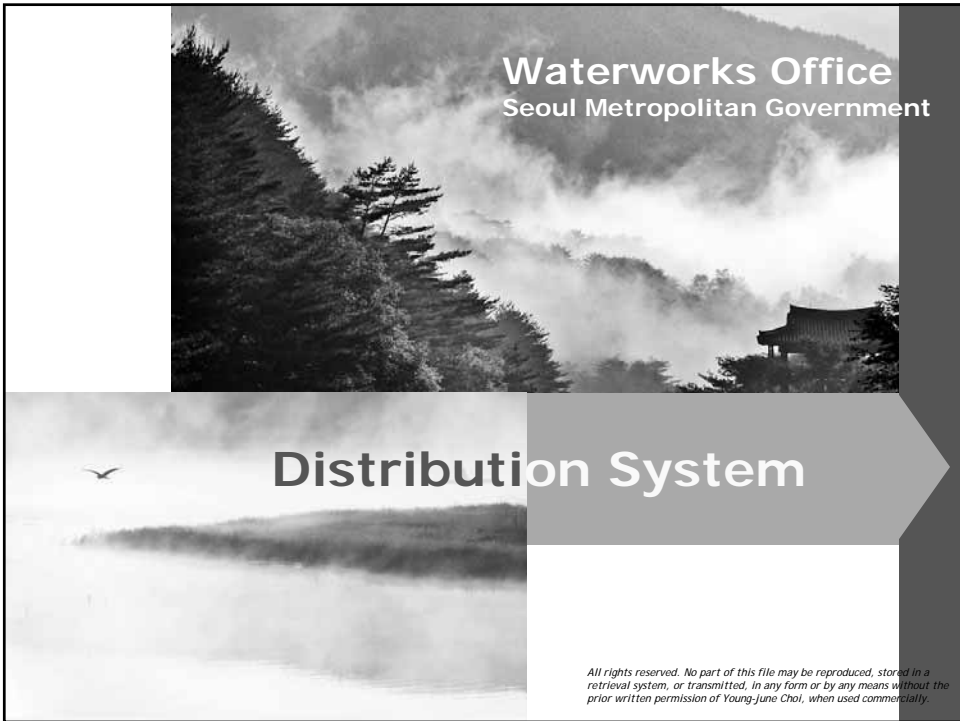
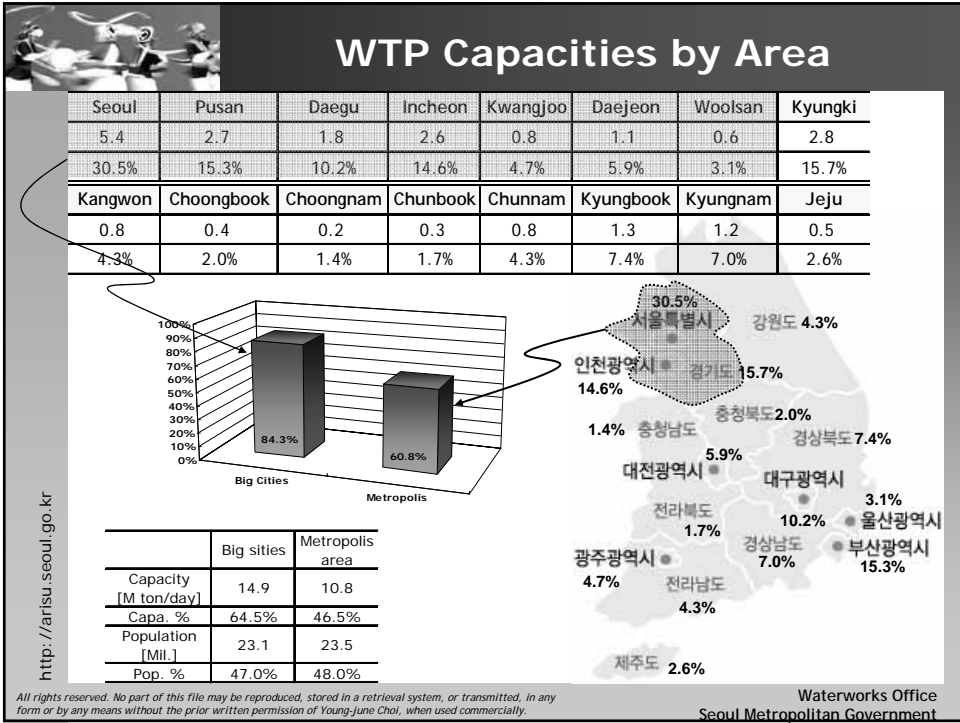
- ❖ Population served
  - 49 million people (90.1%)
    - US 85%, Japan 96%
- ❖ Unbalanced service ratio
  - High service ratio in cities: Enhanced social infra-structure for urbanization
  - 84 cities (97.3%; Special city and large area city 98.9%) and 212 Eups (82.5%)
  - 719 Myuns (35.2%)
  - Need to extend waterworks service in rural and island areas

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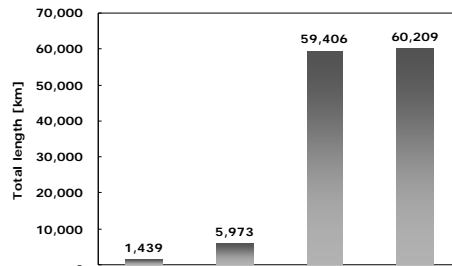




## Length of Pipe Line

❖ Length of pipe line for drinking water distribution:  
Total length: 127,027 km

- Intake~WTP: 1,439 km (1.1%)
- WTP~Distribution point: 5,973 km (4.7%)
- Reservoir~Pumping station: 59,406 km (46.8%)
- Pumping station~Tap: 60,209 km (47.4%)



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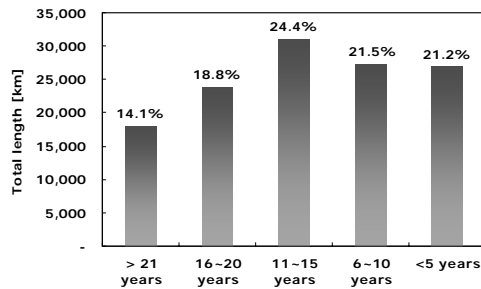
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## Old Pipe Line

❖ Length of old pipe line

- Over 21 years: 17,953 km (14.1%)
- 16~20 years: 23,918 km (18.8%)
- 11~15 years: 30,988 km (24.4%)
- 6~10 years: 27,255 km (21.5%)
- Less than 5 years: 26,912 km (21.2%)



	Length [km]	Ratio [%]
> 21 years	17,953	14.1%
16~20 years	23,918	18.8%
11~15 years	30,988	24.4%
6~10 years	27,255	21.5%
<5 years	26,912	21.2%

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**Source Water and Treatment**

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**Source Water and Treatment**

Source Water

	Q'ty [1,000 m <sup>3</sup> ]	Percent [%]
Surface water	13,133	65.3%
Underflow water	1,889	9.4%
Lake water	4,527	22.5%
Groundwater	554	2.8%

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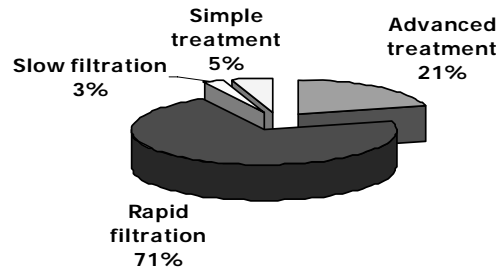




# Source Water and Treatment

## Treatment Technology

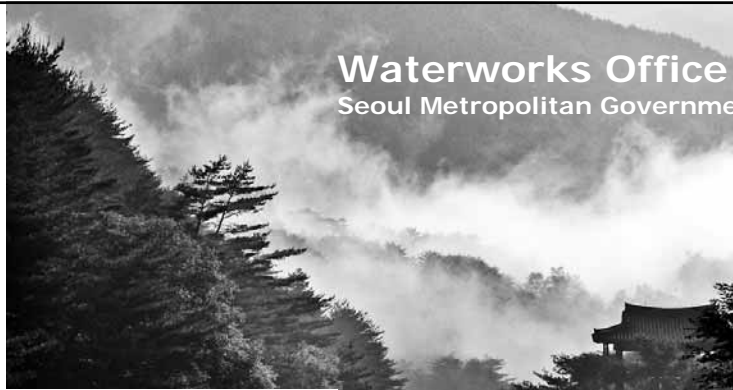
	Q'ty [1,000 ton/day]	Percent [%]
Advanced treatment	4,913	21.2%
Rapid filtration	16,478	71.2%
Slow filtration	636	2.7%
Simple treatment	1,129	4.9%



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## Production

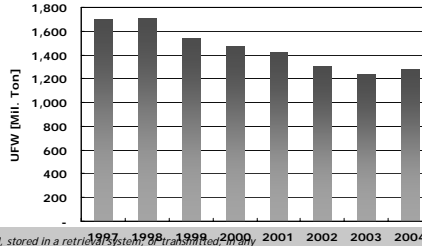
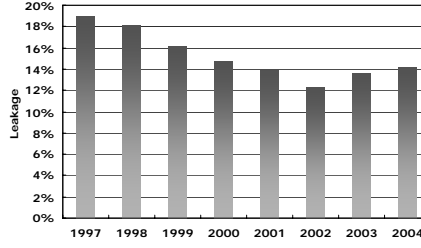
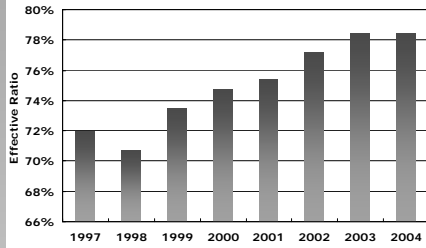


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# Production

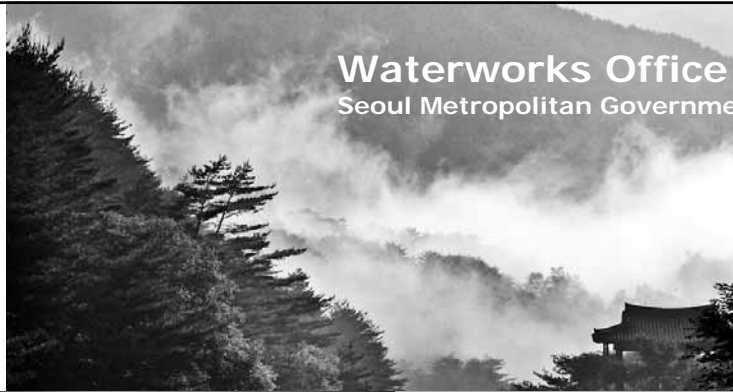
	1997	1998	1999	2000	2001	2002	2003	2004
Produced [Mil. Ton]	6,039	5,840	5,798	5,812	5,791	5,696	5,723	5,909
Supplied [Mil. Ton]	4,344	4,129	4,258	4,342	4,367	4,395	4,489	4,633
Effective Ratio [%]	71.9%	70.7%	73.4%	74.7%	75.4%	77.2%	78.4%	78.4%
UFW [Mil. Ton]	1,695	1,711	1,540	1,470	1,424	1,301	1,234	1,276
Leaked [Mil. Ton]	1,145	1,056	934	859	804	700	781	839
Leakage [%]	19.0%	18.1%	16.1%	14.8%	13.9%	12.3%	13.6%	14.2%



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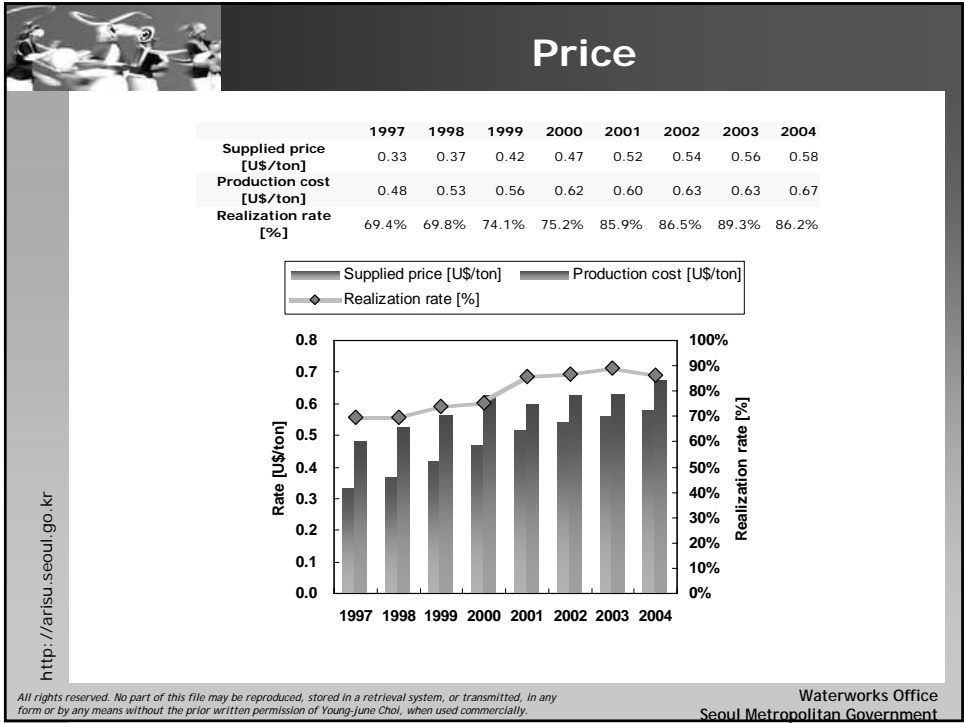


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# Price & Personnel



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- ## Price by Area
- ❖ Local self-governing bodies
    - Young-wol, Kangwon-Do: 1.12 U\$/m<sup>3</sup>
      - Mountainous area
    - Kwa-chun, Kyungki-Do: 0.29 U\$/m<sup>3</sup>
      - Suburb area of Seoul
      - Government offices, Green city
  - ❖ Cities and Provinces
    - Daegu Large-area city: 0.46 U\$/m<sup>3</sup>
    - Woosan Large-area city: 0.81 U\$/m<sup>3</sup>
    - Seoul Metropolis: 0.54 U\$/m<sup>3</sup>
  - ❖ Difference in price
    - Supply by large area drinking water distribution system
    - Source water development
    - Distance between source water and consumers
    - Size of WTP
    - Cost to produce drinking water
    - Administrative and financial conditions of water authority
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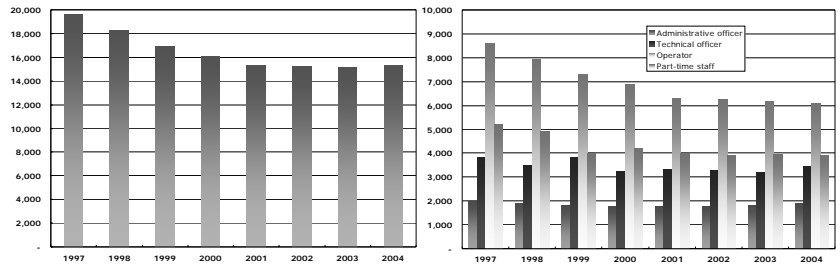


# Personnel

## ❖ As of December 2004

- Total 15,365 officers
  - Administrative officer: 1,887 (12.3%)
  - Technical officer: 3,440 (22.4%)
  - Operator: 6,107 (39.7%)
  - Part-time staff: 3,931 (25.6%)

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## Cooperation

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## Cooperation with Regulator and Operator

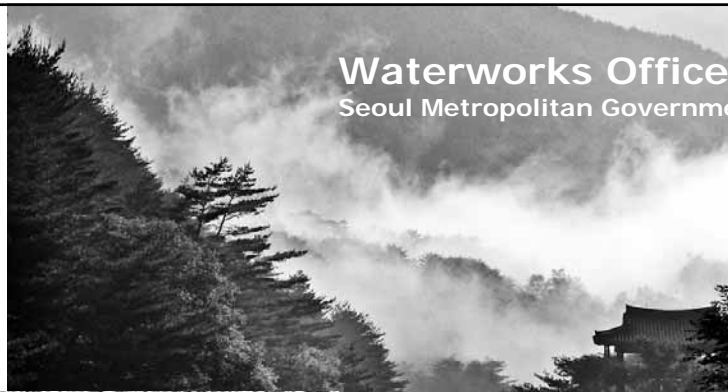
### ❖ Regular communication with the regulator

- Ministry of Environments
  - Regulations related with drinking water quality
- Ministry of Construction and Transportation
  - Regulations related with construction of water utilities and facilities
- Having no regular meeting but discussing on the issues through many channels

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Utility Specific Issues

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## Arisu: Drinking Water for Seoulites

'Ari' means 'Big' or 'Large'.

'Su' stands for 'Water' or 'River'.



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Arisu was the name of the Han River in ancient time, flowing through the very middle of Seoul.

The Waterworks Office of Seoul Metropolitan Government have been providing the citizens with the bottled tap water with the brand name of "Arisu" since April 2004.

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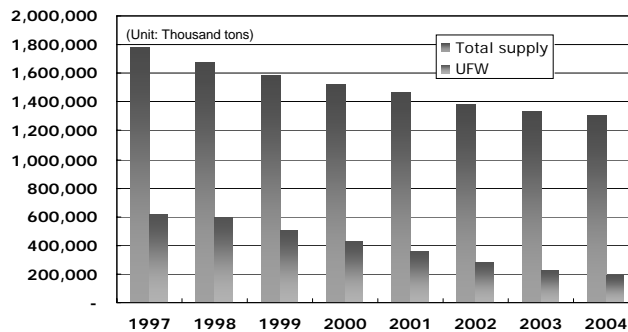
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## Unaccounted-for Water (UFW)

(Unit: Thousand tons)

	1997	1998	1999	2000	2001	2002	2003	2004
Total supply	1,785,452	1,673,817	1,579,119	1,523,246	1,470,516	1,379,340	1,334,913	1,310,538
Effective supply	1,170,863	1,073,865	1,077,055	1,097,402	1,106,127	1,092,993	1,104,368	1,117,554
UFW	614,589	599,952	502,064	425,844	364,389	286,347	230,545	192,984



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## Future Development Plan

- ❖ **Water Quality Improvement**
  - Water quality monitoring - 145 items recommended by WHO
  - Source water with the best quality
  - Application of advanced water treatment technologies
  - AOP, BAC, GAC, Ozone, Membrane filtration
- ❖ **Stabilization of Production/Supply System**
  - Increasing reservoirs to distribute treated water
  - Supply system without suspension in any case
- ❖ **Improving Administrative Conditions**
  - Effective supply system (metered water ratio: 90%)
  - Effective administrative system (EIS and dataware house)
- ❖ **Customer Satisfaction**
  - One-stop solution for customer complaint
  - Arisu quality control system
  - Improving PR for Arisu

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## Summary of Standards

- ❖ **Treated Water Quality Standards**
  - Turbidity: <0.3 NTU
  - N-NO<sub>3</sub>: <10 mg/L
  - Fe: <0.3 mg/L
  - Hardness: <300 mg/L as CaCO<sub>3</sub>
  - THM: <0.1 µg/L
  - pH: 5.8~8.5
- ❖ **Source Water with the Best Quality**

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## Overview of Water Demand Management

### ❖ Upgrading WTP Facilities

- To replace and repair old facilities
  - Inefficient, high cost WTP → Application of Advanced Treatment Technologies
  - Continuous maintenance of facilities
  - Youngdeunpo WTP (600,000 m<sup>3</sup>/day)
    - Old facility of 300,000 m<sup>3</sup>/day → Ozone and GAC
  - Kangbook WTP (1,700,000 m<sup>3</sup>/day)
    - Extending capacity of 700,000 m<sup>3</sup>/day

### ❖ Expanding Service Reservoirs

- Pressure stabilization/equalization
- Control the quantity for distribution

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## Overview of Water Demand Management

### ❖ Supply System without Suspension

- Maintenance of WTP's (US\$ 24.4 Mil.)
  - From 5.4 Mil. m<sup>3</sup>/day in 2005 to 5.1 Mil. m<sup>3</sup>/day in 2008
  - Optimization of WTP's facilities

### ❖ Improving Revenue Water Ratio

- From 85.3% in 2004 to 90.5% in 2007

### ❖ Application of IT on Waterworks Administration

- Seoul Water Now system
- Real time water quality monitoring system
- Will be integrated with the other databases of pressure and quantity of delivered drinking water

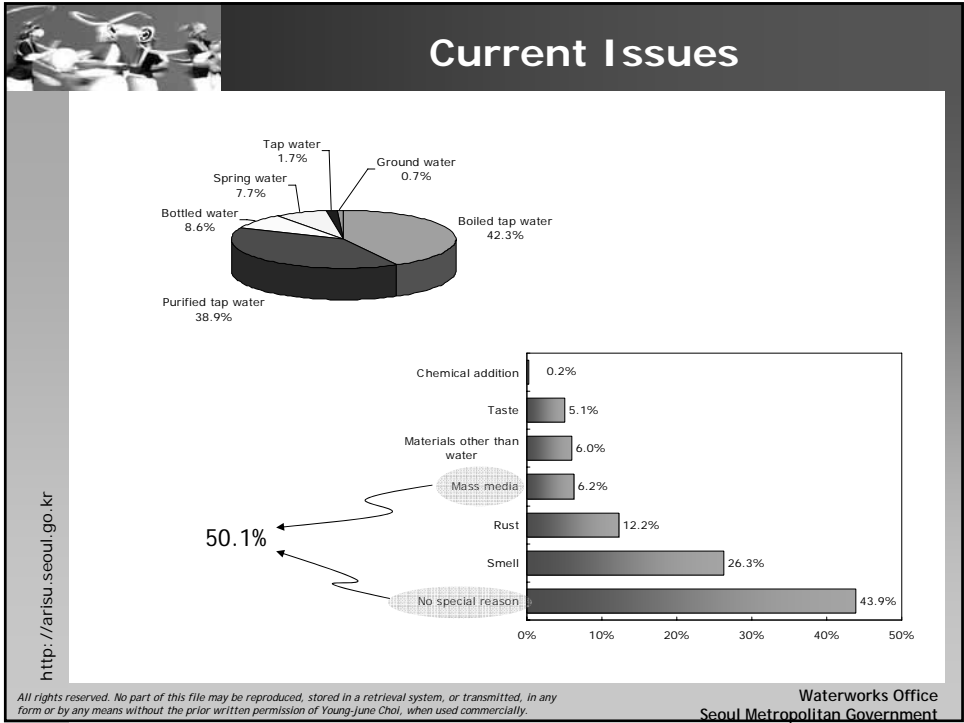
### ❖ Integrating GIS, MIS, and Water quality and quantity monitoring system

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- ## Key Recommendations
- ❖ Education of kids, parents and teachers
  - ❖ Open administration and management
  - ❖ Share information on water quality and supply with the citizens or the customers
  - ❖ Emphasize that "Water for All"
  - ❖ Increasing governance with citizens
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**Water Operators Partnership**

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**International Solidarity**

- ❖ Exchanging technical information, data, knowledge, and experience
- ❖ The first stage by Seoul Metropolitan Government
  - America: US, Canada, Mexico
  - Asia: China, Japan, Mongolia, Myanmar, Pakistan, Vietnam, and so on
  - Europe: Netherlands, Denmark and so on.
- ❖ UN's support
  - Role as an organizer and mediator for the solidarity
  - Keep the connection not in uni- or bi-directional relationship but in systematic networks

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## Domestic Partnership

- ❖ Council of Waterworks Research Institutes of Korea
  - Led by WRI of Seoul Metropolitan Government
  - Have regular meeting every six months
  - Reporting progresses in technical aspects
    - Improving existing technologies
    - Applying new technologies
  - Discuss hot issues related with water industry
    - Regulations on standards, tariff, application of new technologies
    - Organizing nation-wide conferences
  - No private sector allowed to participate
  - Current issues
    - Uni-directional flow of information and experience
    - Different financial structure and condition

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## More To Go

- ❖ Council of Waterworks Research Institutes of Korea
- ❖ KOWACO (public corporation for water service)
  - technical partnership with Vietnam, Peru, Iraq, and Pakistan through KOICA
  - in some countries, they had difficulties to get what they wanted through the partnership
- ❖ Contacting Washington DC and Philadelphia for technical level partnership
- ❖ Attending Capacity building workshop

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## Waterworks Service in Korea

	Total Population [thousand]	Population served [thousand]	Percentage served [%]	Production capacity [1,000 tons/day]	Supplied Qty [1,000 tons/day]	Supplied Qty per capita per day [lcpd]
Nation wide	49,053	44,187	90.1%	23,156	16,145	365
Special and Wide area cities	23,068	22,793	98.8%	14,930	8,153	358
Cities	16,618	16,166	97.3%	6,146	6,071	376
Eup	4,076	3,364	82.5%	1,347	1,255	373
Myun	5,291	1,864	35.2%	733	666	357

Special city: Seoul

Wide-area cities: Self-governing large cities with direct relationship with the central government. 6 cities (Pusan, Daegu, Incheon, Gwangju, Daejeon, Woosan)

Cities: Administrative unit. Population over 50,000.

Eup: Population over 20,000

Myun: Population less than 20,000

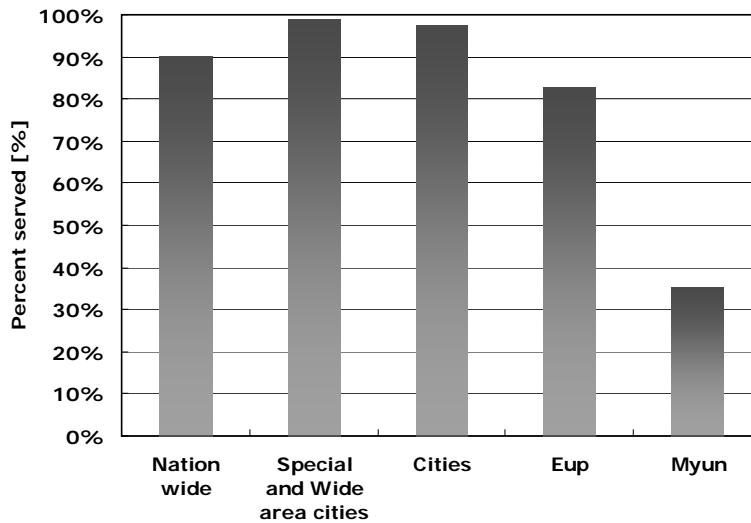
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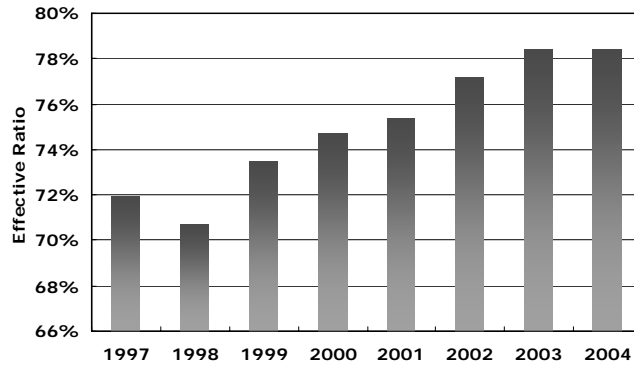
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## Revenue Water Ratio



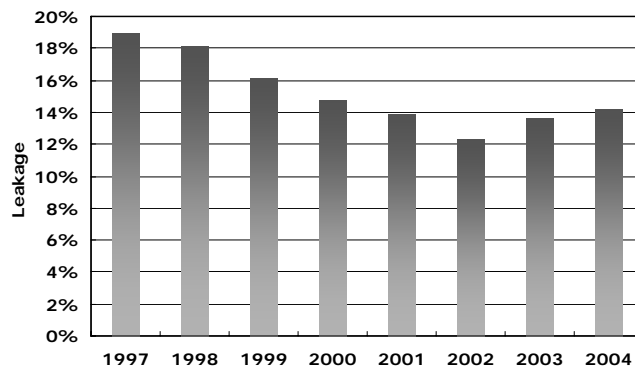
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## Percent Leakage



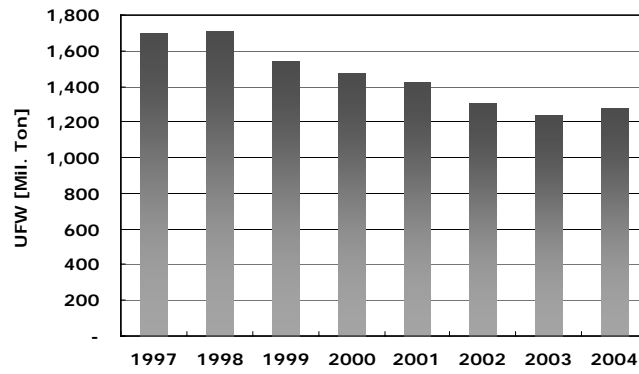
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Waterworks Office  
Seoul Metropolitan Government



# UFW



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