GLOBAL BEST TAP WATER

Arisu

Office of Waterworks, Seoul Metropolitan Government

CONTENTS


Arisu

01 100-year History of Arisu from Seoul's Waterworks

Office Of Waterworks Seoul Metropolitan Government

1908

Started the water flow in waterworks of Ddukdo Water Purification Plant for the first time

Low-speed filtering

1941: Completed the construction of Guui Water Purification Plant

1962~1969

Extended 3 water purification plans and additionally completed

High-speed filtering

1970~1990

Issued national bonds and introduced loans

Completed the construction of 3 water purification plans e.g. Gwangam

Designated the entire area of Seoul as water quality preservation zones for protecting the water quality of Han River

Launched the Office of Waterworks

Expanded the quantity growth

1990~2000

1991: Achieved the waterworks distribution of 100%

1998: Completed the construction of Gangbuk Water Purification Plant

Devised the 5-Year Plan for Clean Water Supply

Evaluated the water quality management per water purification plant

2000~2010

2004: Launched Arisu, Seoul's tap water brand

2009L Won the Grand Prize in the UN Public Administration Service Water Awards

Raised national competitiveness

2000~2010

Enhanced the qualitative supply

Introduced and completed the construction of advanced water treatment plants

171 water quality inspection items (adding smell and taste)

Before 1908~1990	1991~2000	After 2010
Extended water purification facilities	Replaced rundown pipes and direct-coupled water supply	Introduced and completed the construction of advanced water treatment plants
Clean tap water	Safe tap water	Tasty tap water

02 Organization and Personnel

Office Of Waterworks, Seoul Metropolitan Government

Organization

- 1 headquarters(5 bureaus, 1 division), 8 water supply offices, 7 centers(6 water purification centers, 1 waterworks equipment management center), 1 research institute

Personnel (1,841 people in total)

- Headquarters(224), water supply offices(1,051), water purification centers(441), Waterworks Research Institute(92), and waterworks equipment management center(33)

Office of Waterworks Seoul Metropolitan Government

Headquarters

- Management & Administration Bureau(6 departments)
- Revenue Management Bureau (4 departments)
- Production Bureau (4 departments)
- Water Supply Bureau (4 departments)
- Water Facility Safety Bureau (4 departments)
- Safety Management Division (1 division)

Offices

- Water supply office(8)
- Arisu water purification center(6)
- Waterworks equipment management center(1)

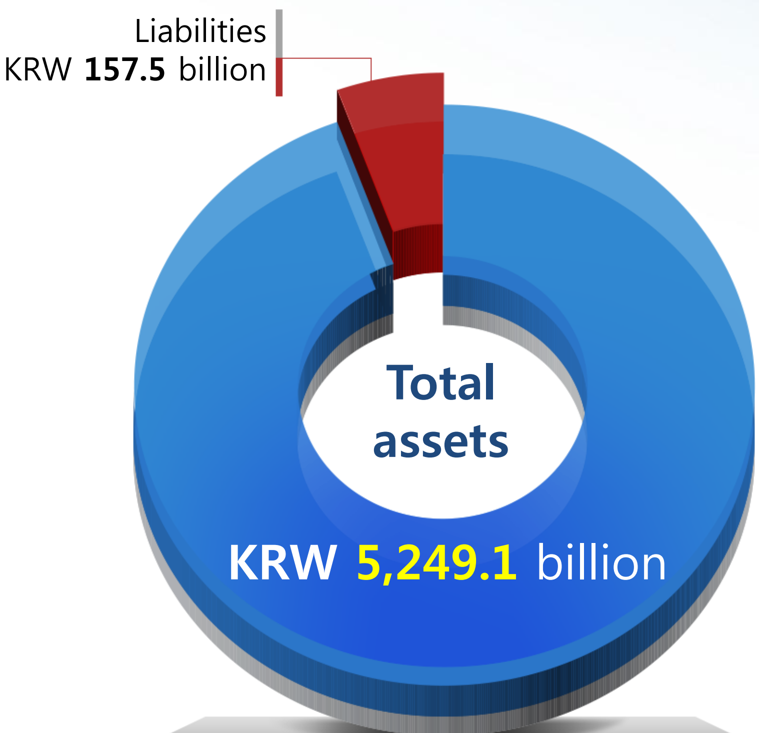
Waterworks Research Institute

- Water Quality Analysis Bureau (5 departments)
- Waterworks Research Bureau (4 departments)
- Future Strategy Research Center (2 departments)

03

Finance and Budget

Office Of Waterworks, Seoul Metropolitan Government



As of December 31, 2018

No government subsidies

Budget for revenues & expenditures in 2019

04 Water Production and Supply Facilities

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Starting Water supply

- 1908, Dduk-do Purification Plant
- Start supplying tap water for 125,000 people

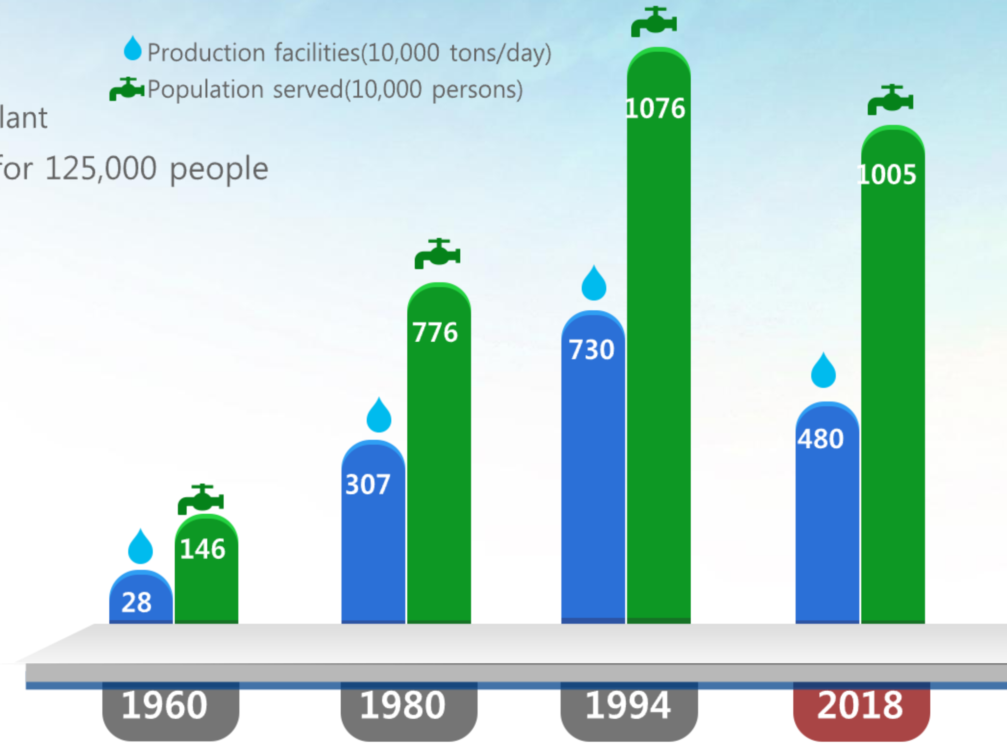
Population served

- 10,049,000 people(2018.12.31)
- 4,264,000 households, distribution rate 100%

Production facilities

- Production capacity : 4,800,000 tons/day (6 purification centers, 4 water intakes)
- Average production: 3,200,000 tons/day

Water supply facilities



Length of water pipes	Water reservoirs	Booster stations	Hydrants
13,571km	100 locations (2.42 million tons)	212 places	2,216,000 shatts

05 The World-renowned Water of Arisu

Office Of Waterworks, Seoul Metropolitan Government

Arisu

2000
- ISO14001 (Environmental Management)
  Environment-friendly management to minimize environmental pollution

2009
- Grand Prize in the UN Public Administration Service Water Awards

2010
- IWA(International Water Association), Project Innovation Award

2010
- International Business Awards

2016
- ISO22000 (Food Safety Management)
  Effective management of harmful elements in the entire process for production and manufacturing process

Arisu

Seoul's tap water Arisu that citizens trust and drink

Production of clean, mineral-rich Arisu

- Preemptive water quality management from a water source to A faucet
- Management of conditions for faucet disinfection in the optimal state
- Maintaining the ISO22000 for waterworks

Water supply without interruption throughout the year

- Maintenance of rust-prone waterworks pipes
- Expansion of reservoir for a stable water supply
- An interruption-free waterworks network even in a leak accident
- Improvement in accuracy f or GIS database for waterworks

Capacity buildup for sustainable growth

- The world's best revenue water ratio
- Construction of a intelligent water management system
- Expansion of renewable energy equipment
- Promotion of the international prestige of Seoul as an advanced city in water supply facilities

Improvement in social and psychological awareness of Arisu

- Financial support for rust-prone water pipe replacement in houses
- Conversion of water supply system into the direct connection type for high-rise apartments
- Installation of Arisu drinking fountains
- Improvement in awareness of Arisu through communication of the right information

Improvement in civic service with Arisu

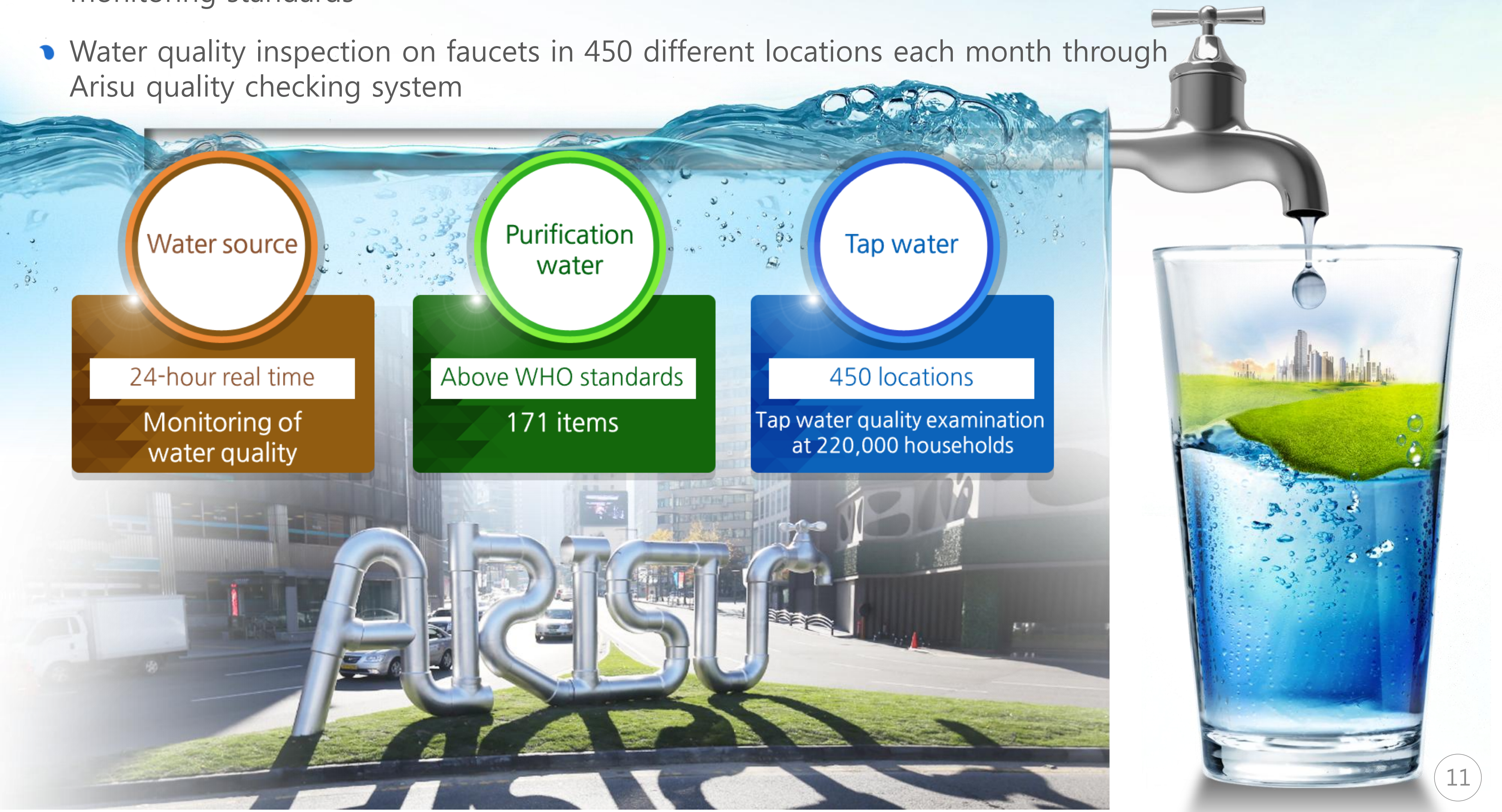
- Facilitation of the quality dentification system for Arisu
- Provision of service to identify one's house water quality and supply paths
- Utility bill notification service


Arisu

01 Strict Management of Water Quality

Office Of Waterworks, Seoul Metropolitan Government

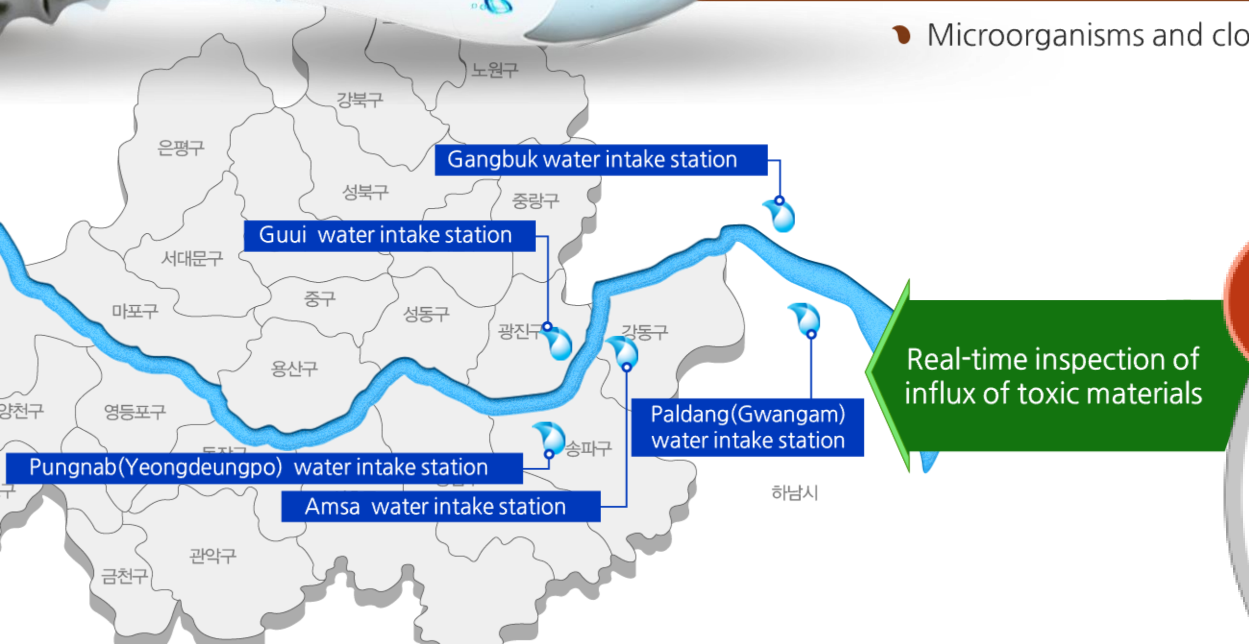
- 32 branches conducting water quality inspection and automatic monitoring of source water quality, and operating the biological warning system
- Conducting water quality inspection for 171 items, that is, 60 water quality standards and 111 self-monitoring standards
- Water quality inspection on faucets in 450 different locations each month through Arisu quality checking system

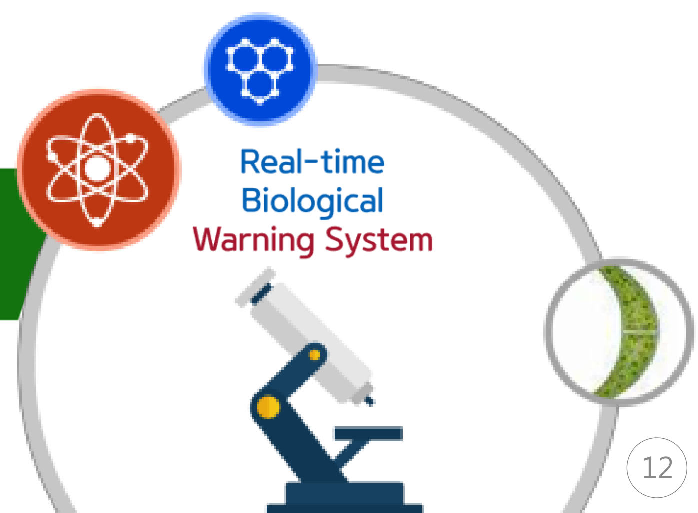


02 24-hour Monitoring of Water Source

Office Of Waterworks, Seoul Metropolitan Government

- Use of the surface water of Han River as source water
- Installation of automated water quality measuring equipment at waterintake plants to detect the presence of algae and phenols 24 hours a day
- Reinforcement of monitoring of new microbial elements and securing of safe source water
- Operation of the Biological-Warning System using the Food Chain Index
  - Microorganisms and closterium

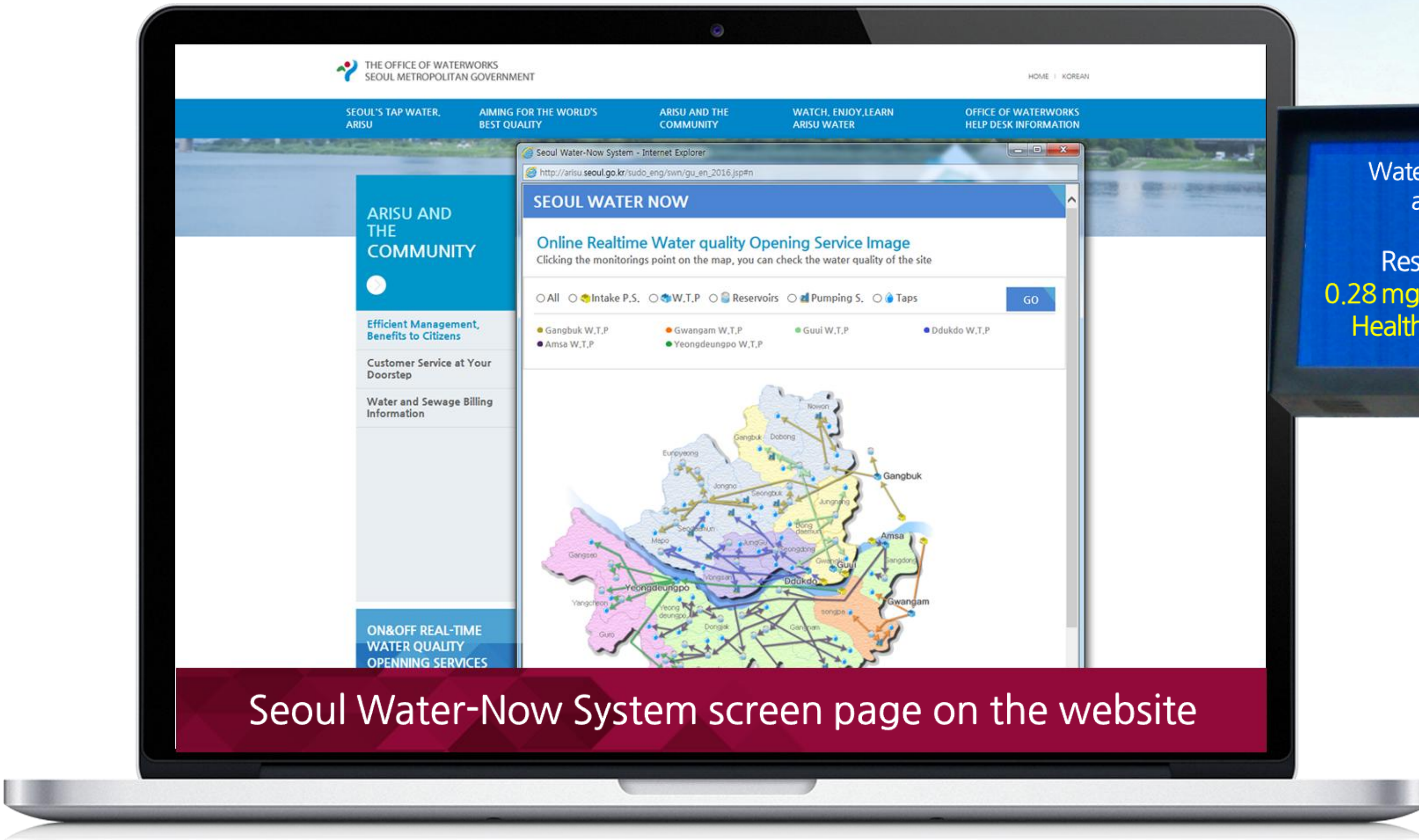




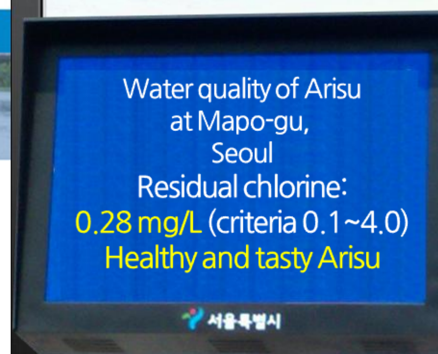
03 Seoul Water-Now System

Office Of Waterworks, Seoul Metropolitan Government

- Disclosure of real-time water quality from source water to faucet **214 spots**
- Publicizing of water quality information available on the bulletin board for Seoul's air environment **12 locations**



Seoul Water-Now System screen page on the website



04 Advanced Water Purification System

Office Of Waterworks, Seoul Metropolitan Government

Process

- Adding the process for ozone and granular activated carbon particles in the standard water purification treatment process

➔ Production of healthy and tasty tap water

Installation and Operation

- All water purification plants(3,570,000 tons/day)

Adhesion capacity of active carbon

Oxidation capacity of ozone

Water intake

Coagulation/ Sedimentation

Filtering

Advanced water purification

Faucet

Effects of Advanced Water Treatment

Safe from green algae

- **Completely removing** odor-causing substances such as soil(geosmin) and mold(2-MIB) induced by algae

Safe from pesticides

- Eight insecticide components detected in eggs **not being detected in Arisu**

Safe from micro-plastics

- **Microplastics not detected in Arisu**

Safe from radioactive material

- **Management of 12 items in total: Artificial radioactive elements(5), natural radioactive element(6), radiation(1)**
- Provision of radioactive element removal plans during water purification And documentation of a response manual

→ I-131 removed 100% even Cs-134 and Cs-137 by up to 80%(adjusting the turbidity 80NTU)

05 Chlorine Dispersal & Injection System

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Levelizing the amount of residual chlorine across the entire area

Optimized system (chlorine of 0.1~0.3mg/L)

Water purification center: Chlorine injection → Reservoir: Chlorine re-injection → Households

Past

Chlorine injection limited to the purification plant

- Complaints on nearby chlorine odor
- Not complying with the standard for residual chlorine in tap water over a long distance

Now

Decentralized injections in water purification center and reservoir

- Reduction of chlorine odor
- Supply of tasty water (0.1~0.3mg/l of chlorine)

Construction of the Chlorine Disperse Injection System

- 15 reservoirs(Nakseongdae, Daebang and others)

06 Maintaining ISO22000(Food Safety Management) International Certification

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Certification date
- Oct. 27, 2016

Certification scope
- 6 water purification center systems from water intake to faucet (including bottled Arisu)

Certification agency
- BSI (British Standards Institution)

Effective management of harmful elements in production and manufacturing process

Introducing a hygiene concept and managing a facility (Hazard Analysis and Critical Control Points)

Establishing a safe tap water production system (2 manual and 17 procedures)

Seting up safety goals and operation plans (6 goals and 15 tasks)

Strengthening hygiene management for all visitors

01 Repairing of Rust-prone Water Pipes

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Repairing rust-prone water pipes to create an environment to supply safe and clean tap water

- **Business scope**: 13,571km(13,396km repaired, 98.7% completed)
- **Business period**: 1984~2020
- **Total project cost**: KRW 3,517.3 billion (invested cost from 1984 to 2018: KRW 3,338.4 billion)

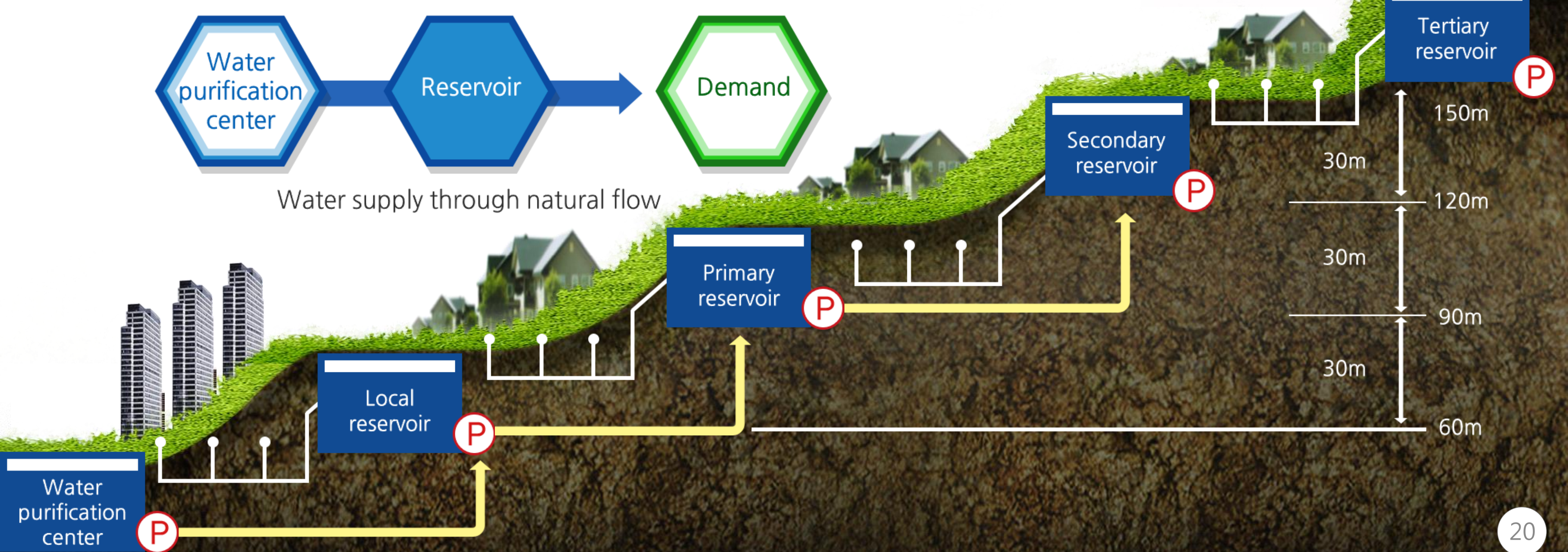
Expanding Reservoirs for a Stable Water Supply System

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Constructing or expanding reservoirs to establish a stable water supply system without a shutoff even during waterworks construction, leakage accidents, etc.

- **Constructing or expanding reservoirs**: 11 locations, a capacity of 66,000㎥
  (40,000㎥ for construction(7), 26,000㎥ for expansion(4))
- **Reservoirs status**: A total of 100 locations, 2.42million tons (Dec. 31, 2018)
- **Business period**: 2015 - 2030
- **Total business expenses**: KRW 108.2 billion



Building an Uninterrupted Water Supply System

Office Of Waterworks, Seoul Metropolitan Government

Arisu

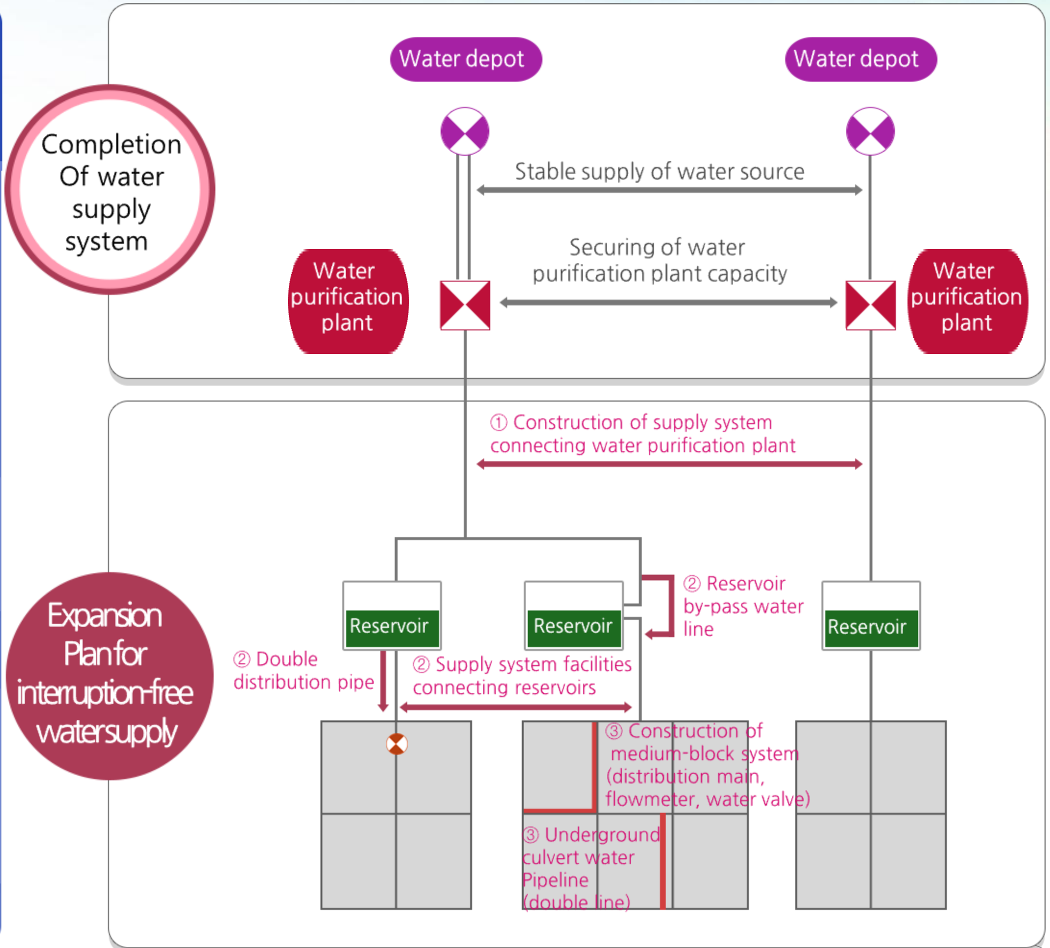
Build a system that can supply tap water under any circumstances(2018~2030)

A need for fundamental measures against large-scale water supply interruption caused by leakage

01 Establishment of a supply system between Arisu water purification centers

02 Stable supply of tap water through doubling of the main water line

03 Establishment of an efficient block system through optimized maintenance of waterworks



04 Improving Accuracy of the Geographic Information system(GIS) Database(DB) for Waterworks

Office Of Waterworks, Seoul Metropolitan Government

Arisu

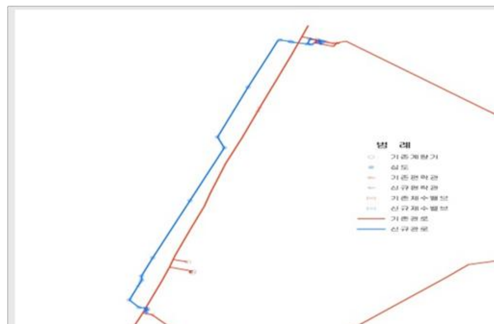
Setting up a GIS DB for close examination of facilities' location, depth and specification

Project objective	Construction of a water pipeline (9,647km / more than 80mm in diameter)
Progress report	7,003km(72.6%) completed (as of December-end 2018)
Project period	2005 - 2022(KRW 87.8 billion in cost)
Project details	Close examination of facilities' location and specifications Measurement of coordinates using state-of-the-art equipment such as Global Navigation Satellite System(GNSS) and editing of database

Research and inspection of tap water facilities

Precise(Coordinate) measurement

Modification/editing of database



Ⅰ General Status

Ⅱ Strict and Thorough Management of Water Quality

Ⅲ Water Supply without Interruption

Ⅳ Sustainable Management and Overseas Business

Ⅴ Improvement in Civic Service and Public Awareness

01 The World's Best Management of the Revenue Water Rati

Office Of Waterworks, Seoul Metropolitan Government

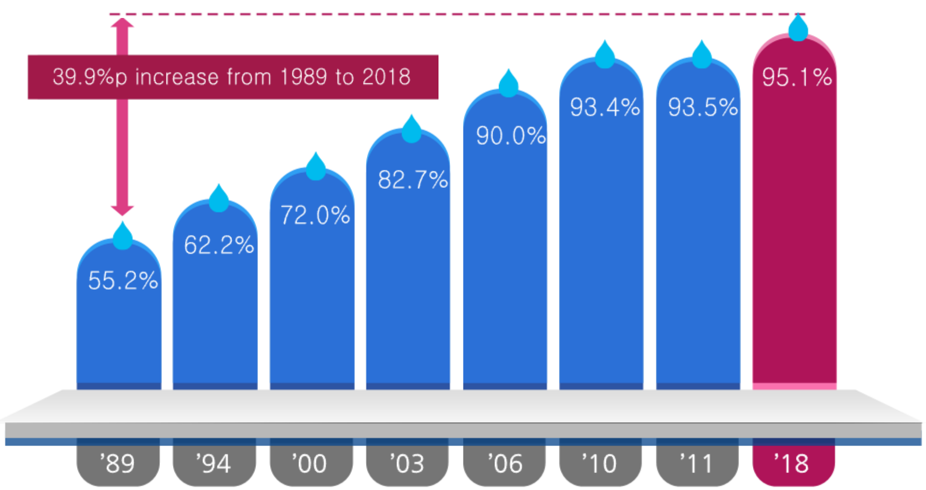
Facility maintenance and leakage prevention

Revenue water ratio
95.1%
(2018)

Scientific management of water supply quantity

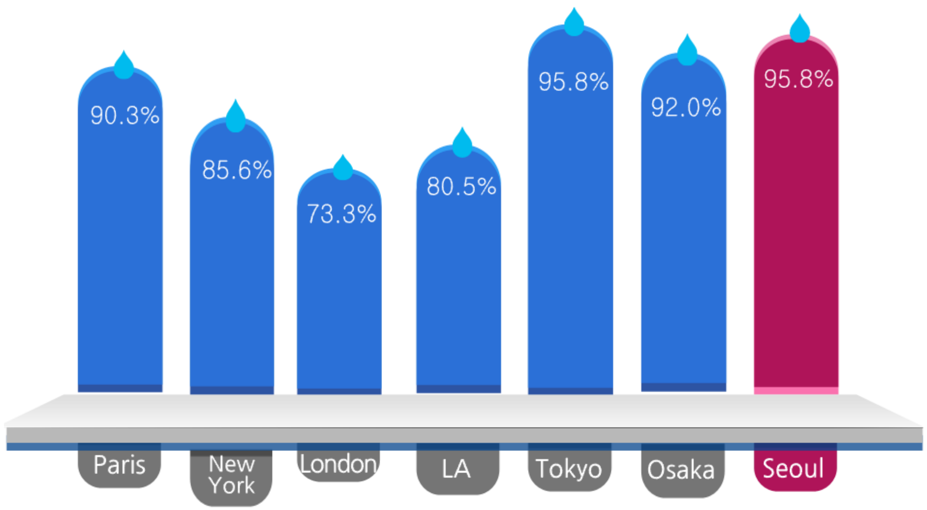
- Systematic management of waterworks facilities, removal of disused pipes and preemptive leak detection
- Water intake and flow meter management, booster area management, and block-based flow management

Producing savings of 11.5 billion tons in total



Trend in the revenue water ratio

World-class high revenue water ratio(2017)



Comparison with major cities in developed countries

02 Arisu Integrated Information System

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Information on the supply and distribution of tap water is collected in real time via the Smart Water Grid and holistically managed in order to improve management efficiency and ensure a prompt response to an emergency

Smart Water Greed

What is the Smart Water Grid?

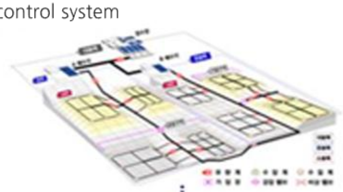
- A next-generation water control system combined with state-of-the-art IT to enhance management efficiency in water resources, supply and drainage

Intelligent Purification Plant

- Integrated automated operation of the entire process
- Estimating demands/Devising plans

Intelligent Main Water Pipe Network

- Creating an optimized GIS-based block system
- Implementing the main valve remote control system



Water gauge remote monitoring

- Creating an ICT-based remote monitoring system
- Implementing trial runs of remote monitoring system

Arisu Integrated Information System

Implementing roles of the water pipeline integrated control tower

03 Eco-friendly Energy, Recycling Facilities

Office Of Waterworks, Seoul Metropolitan Government

Production of renewable energies

Solar power | Geothermal | Small hydro

- Produced 18,448 mwh/year, reduced manufacturing cost of 599 million KRW (2018)

Eco-friendly usage of sludge originating from water purification process

- Construction using prototype water-permeable soil concrete and water-permeable blocks at 3 water purification centers to reduce the waste processing cost

Sludge Sediment deposits from the water purification process

Reduction of the **cost of generating** tap water, **reduction of waste management fees, improvement of productivity**

Solar power (17 locations, 12,346 kW)

Geothermal (6 locations, 3,246 kW)

Small hydro (Noryangjin, 300kW)

04 The Lowest Water Fees in the World

Office Of Waterworks, Seoul Metropolitan Government

Arisu

「Minimizing fees through sensible management」

Comparison of tap water fees

Tap water fees(USD/㎥)
Applied exchange rate: KRW 1,066.30/dollar

*City of Seoul froze the cost after an increase in March 2012

Water usage cost in Seoul is 5.7 and 6.4 times lower than those of Copenhagen and New York, respectively(as of January 2018)

Overseas Advancement for Global Promotion

Office Of Waterworks, Seoul Metropolitan Government

Arisu

Acquired an order for the infrastructure development consulting project of PMB Island, Brunei

- Dispatching supervising personnel, Apr. 2016 - Apr. 2020

Completed the waterworks system improvement project in Chanchamayo City, Peru

- San Ramon, La merced and Pichanaki(2012~2018, KRW 2.5billion)

Completed a water facility improvement project for regions in Vietnam

- Huê, Vietnam, Jan. 2016 - Feb 2016

Conduct training for representatives from target capital cities(2~3 times per year)

- Dispatching professional personnel(Ninh Binh and Hai Duong, Vietnam)

Operating private-government council for overseas advancement of waterworks

- Operation of subcommittees for consulting, design, construction, water quality, and equipment

06 International Waterworks Project

Office Of Waterworks, Seoul Metropolitan Government

Arisu

ODA for the International Waterworks Project

- Completed the project for improving the intake & water treatment facilities and water supply system in Chanchamayo City, Peru from 2013 to 2018

Bidding as a Private and Public Consortium for the International Waterworks Project

- Contracted an infrastructure consulting service project worth KRW 13.5 billion for PMB Island, Brunei (Apr. 2016~Apr. 2020)

07 Foundation for International Waterworks Projects

Office Of Waterworks, Seoul Metropolitan Government

Arisu

MOU for Promoting the Cooperation Projects of Waterworks with Foreign Cities

- 11 cities and institutions in Brazil, Thailand, Papua New Guinea and others

Training Camp for Foreign High Officials Involved in Waterworks

- Instructed 40 high level officials each year from ASEAN and Latin America
  250 people from 81 cities in 36 countries over 20 occasions

Arisu

01 Replacement of Old Indoor Water Pipes

Office Of Waterworks, Seoul Metropolitan Government

Arisu

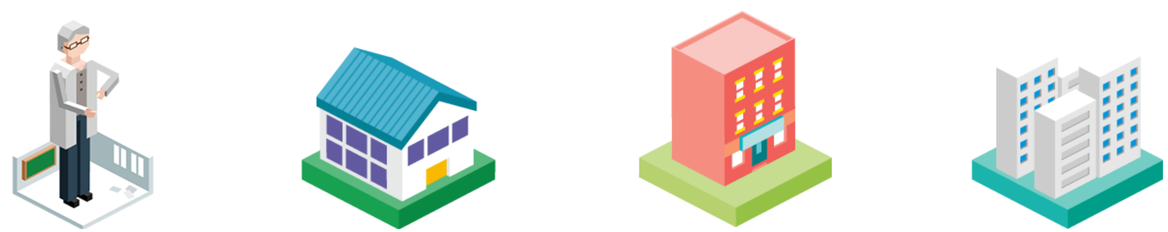
Old pipes in houses causing deteriorated water quality!
Preventing the discharge of rusty water and improving the water quality through financial support for pipe replacement projects

Plans for Support (2007-2022)

- 565,000 households , KRW 255 billion

Details

- 389,000 households, KRW 147.5 billion KRW(69%)
(Setting the maximum amount for support by housing type)



Classification	Social welfare facilities and beneficiary of basic livelihood security aid	Single house	Multi-family house	Apartment house
Replacement construction : within 80% Restoration construction : within 80%	Entire construction cost	Max. KRW 1.5 million	Max. KRW 2.5 million	Max. 1.2 million (KRW 400,000 for common water pipes)

02 Implementation of a Water Supply System of Direct Connection for High-rise Apartments

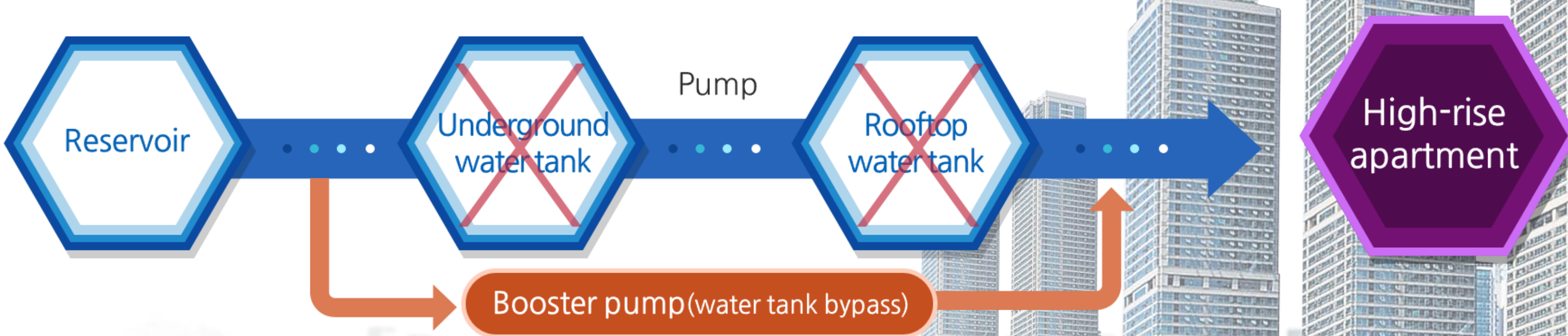
Office Of Waterworks, Seoul Metropolitan Government

Arisu

Improved from water tank supply to pressurized water supply of direct connection, supplying clean Arisu to faucets to improve the drinking rate

- Converting the existing water supply of direct connection for existing apartments
  - Targets: 1,325 complexes(39% of 3,359 apartment complexes that have 6 floors or more)
  - Results: 265 complexes completed from 2014 to 2018

- Attaching conditions for direct-connection water supply upon agreeing on water supply of new apartments with construction permission(178 complexes completed)



03 Quality Identification System for Arisu

Office Of Waterworks, Seoul Metropolitan Government

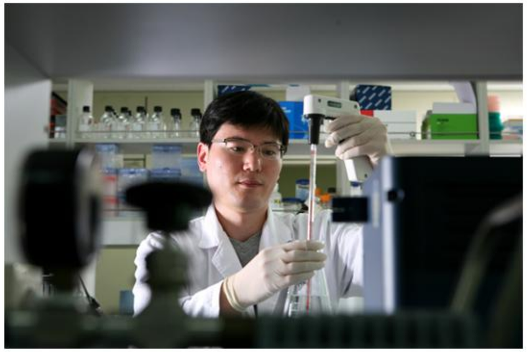
Arisu

Free water quality testing service provided for water faucets through home visits

Testing items	5 items (residual chlorine, Turbidity, pH, iron and copper)
Objective	220,000 households by 2019(2008~2018: 5,320,000 households)
Methods	Immediate inspection through water sampling at faucets

Additional precision testing for 7 items upon a failure in the testing results

Testing items	Typical germs, Total E. coli groups, E. coli, Ammoniacal nitrogen, Chlorine ion, Zinc, and Manganese



Free customized consulting e.g. guidance on replacing old pipes

04 Installing Arisu Drinking Fountains

Office Of Waterworks, Seoul Metropolitan Government

Creating an environment where drinking water can be enjoyed by installing Arisu drinking fountains in places with many citizens, e.g. schools, kindergartens

Project Details

- 1,361 elementary, middle and high schools (20,465 fountains installed in 1,298 schools)
- Installing Arisu outdoor drinking fountains in parks and Dulle-gil(paths), and those with characters attached for public/national kindergartens

Total Cost

- KRW 90.8 billion

Maintenance

- Outsourced

Elementary School (Larva)

Kindergarten (Tayo the Little Bus)

05 Service for Identifying the Supply Path for 'My House'

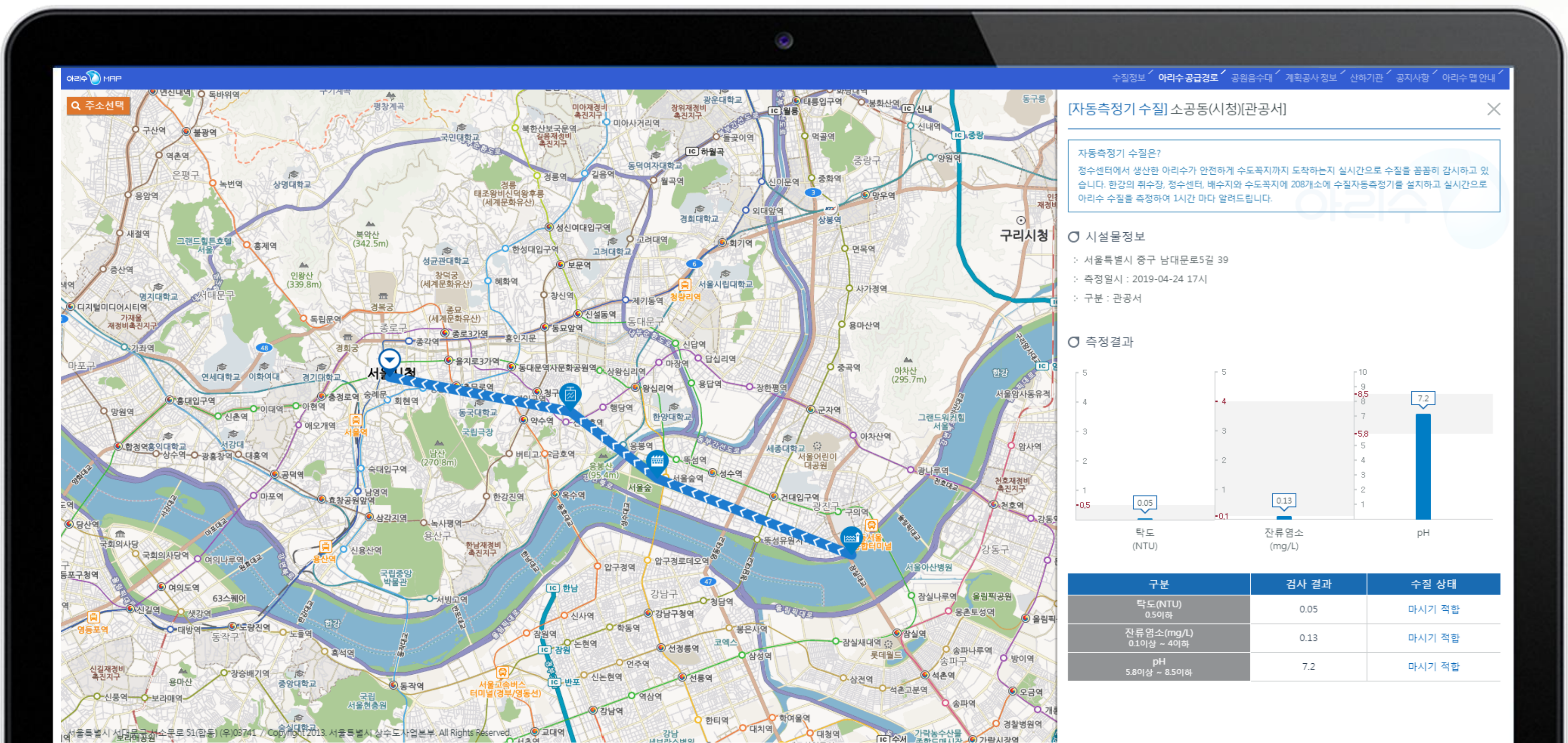
Arisu

Office Of Waterworks, Seoul Metropolitan Government

Securing information on tap water by identifying water quality information in each house in real time

Project Details

- Setting up seamless water quality inspection systems by installing automatic water quality meters in over one place for each mid-size bloc by installing an automatic water quality meter
- Identifying the supply path of Arisu for each house and the water quality per route on the map



구분	검사 결과	수질 상태
탁도(NTU) 0.5이하	0.05	마시기 적합
잔류염소(mg/L) 0.1이상 ~ 4이하	0.13	마시기 적합
pH 5.8이상 ~ 8.5이하	7.2	마시기 적합

[Thank you]

Office of Waterworks
Seoul Metropolitan Government

Healthy and Tasty
Globally Expanding
Arisu