

GLOBAL BEST TAP WATER

Arisu

Office of Waterworks Seoul Metropolitan Government



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- II Strict and Meticulous Water Quality Management
- III Supply Water without Interruption
- IV Sustainable Management and Overseas Business
- V Efforts to Improve Citizen Service and Awareness



I General Status

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Organization

Personnel (1,874 people)

- 1 headquarters(5 bureaus, 1 division), 8 water supply offices, 7 centers(6 water purification centers, 1 waterworks equipment management center), 1 research institute
- Headquarters(223), water supply offices(1,084), water purification centers(441), Waterworks Research Institute(93), waterworks equipment management center(33)

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Headquarters

Offices

Waterworks Research Institute

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)

Water supply office(8)

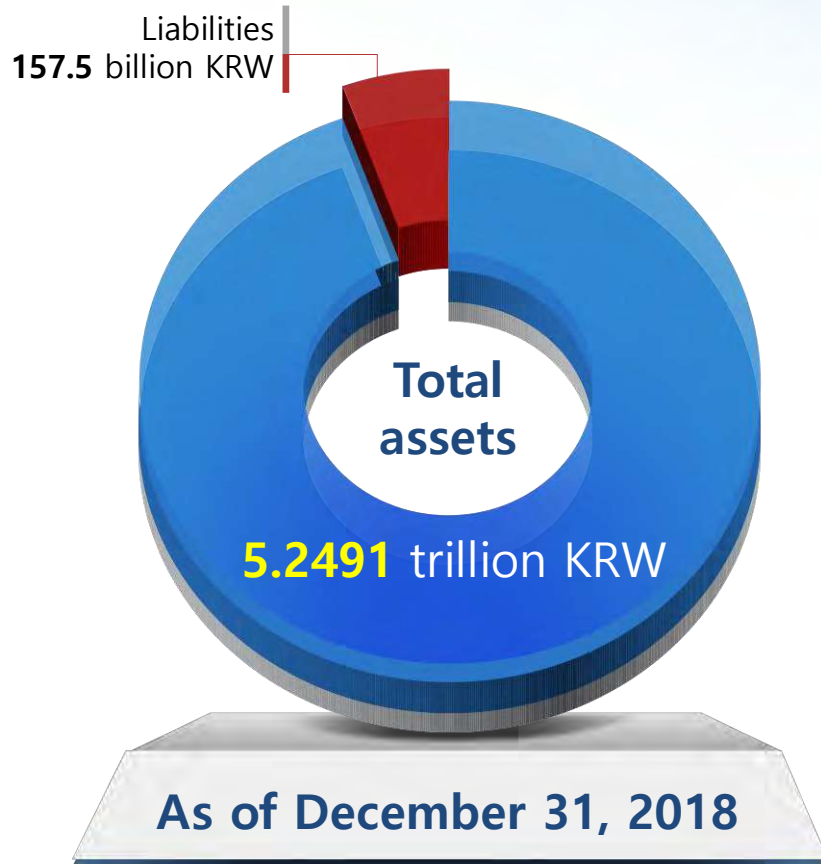
Arisu water purification center(6)

Waterworks equipment
management center

Water Quality Analysis Bureau
(5 departments)

Waterworks Research Bureau
(4 departments)

Future Strategy Research Center
(2 departments)



Production and Water Supply Facilities

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start
watering

- 1908, Dduk-do purification plant
- Start supplying tap water for 125,000 people



Production
facilities

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



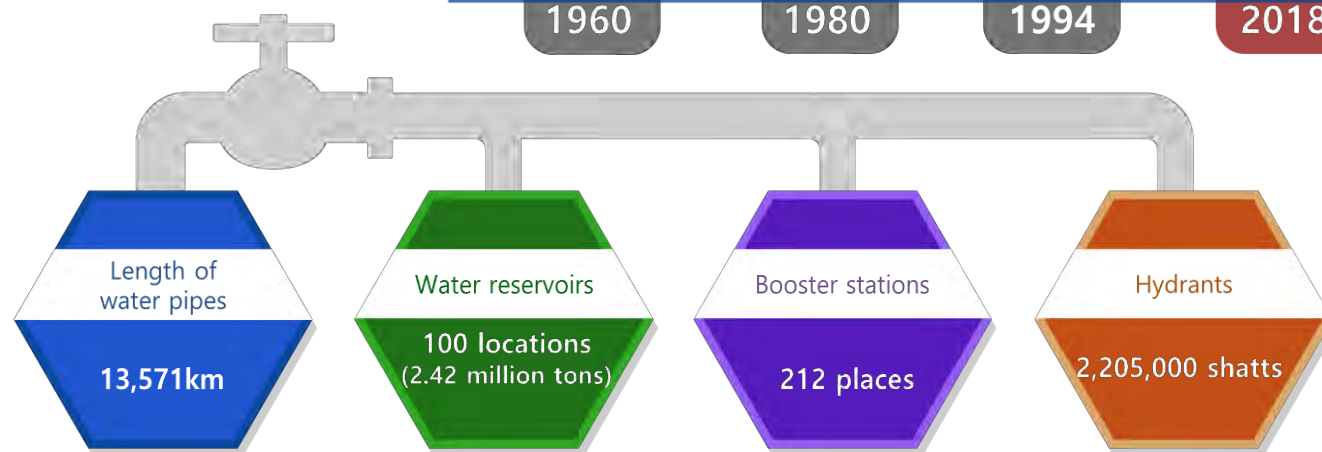
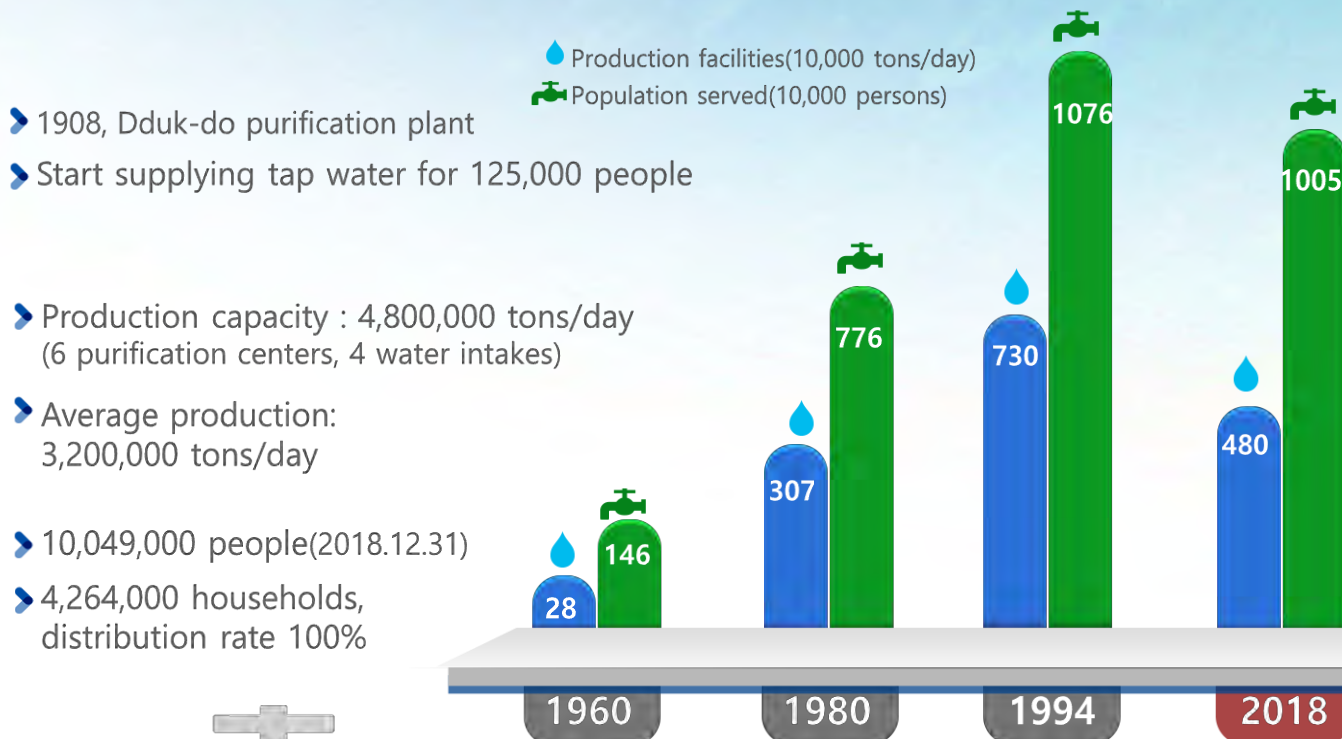
Population
served

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



Water supply
facilities

Production facilities(10,000 tons/day)
Population served(10,000 persons)





Seoul's tap water Arisu that **citizens trust and drink**





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- 33 branch water quality inspection, Automatic monitoring of source water quality, Biological warning system
- 60 water quality standards + 111 self-monitoring standards, Total 171 items water quality inspection
- Water quality inspection on faucets at 450 different location through Arisu quality checking system

Water source

24-hour real time

Monitoring of
water quality

Purification
water

Above WHO standards

171 items

Tap water

450 locations

Tap water quality examination
at 220,000 households



24-Hour monitoring of water source

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Use the surface water of the Han River as source water

Installation of automated water quality measuring equipment at water intake plants to detect the presence of algae and phenols 24 hours a day

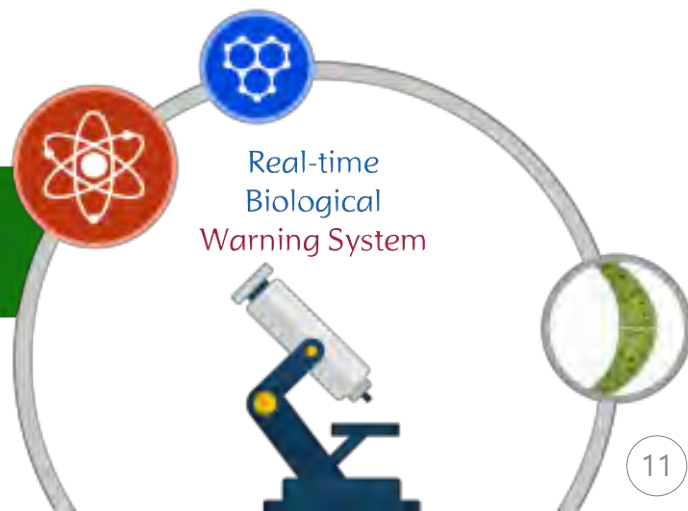
Reinforcement of monitoring of new microbial elements and secure safe source water

Operation of Biological-Warning System using the Food Chain Index

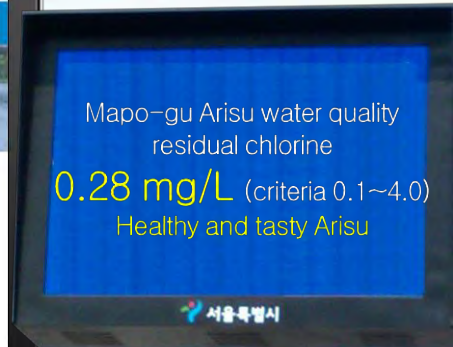
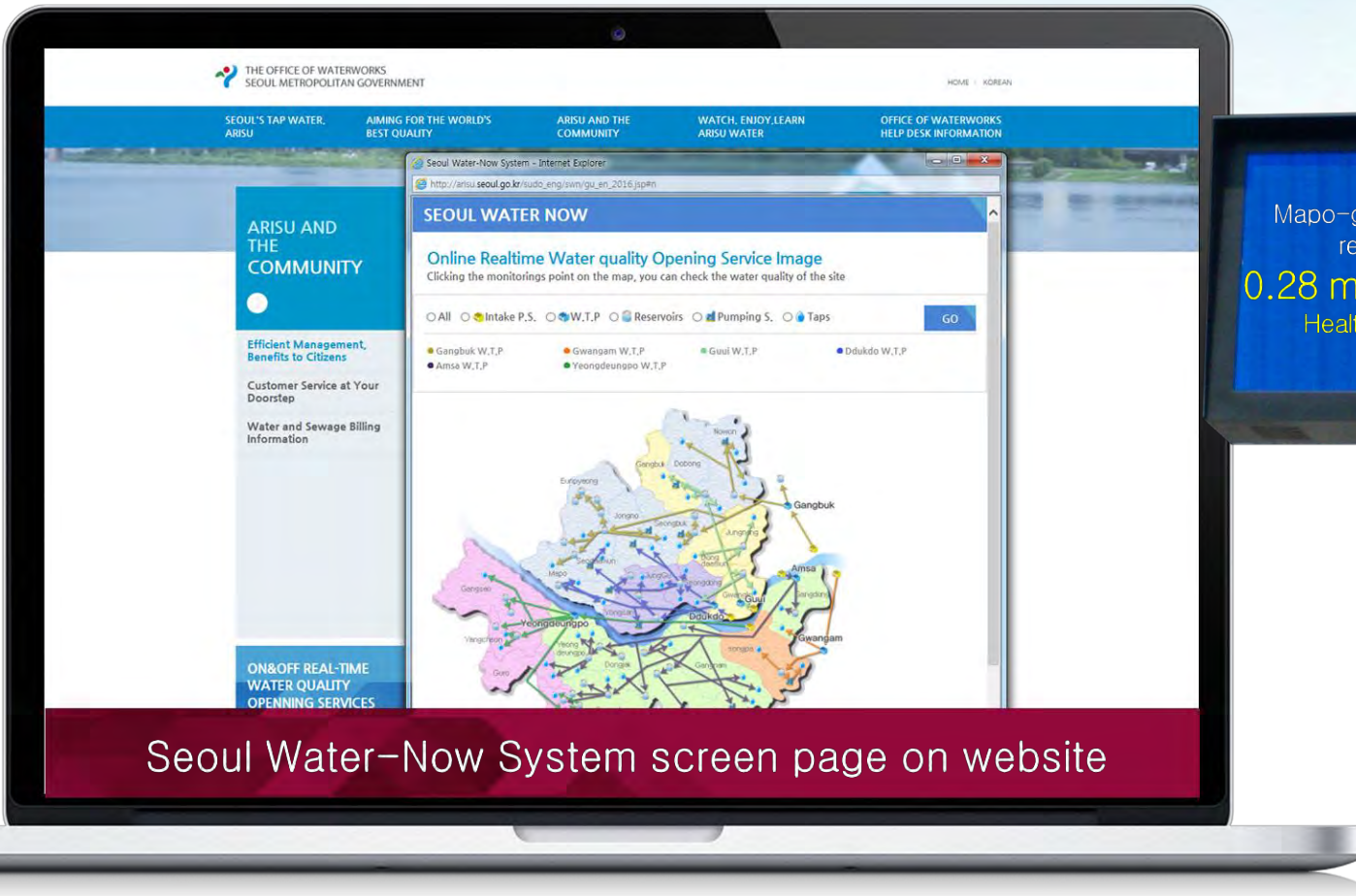
Microorganisms, algae, fish



Real-time inspection of influx of toxic materials



- Publication real-time water quality from Source water to faucet **208 spots**
- Water quality information available on Seoul City atmospheric environment electronic bulletin board **12 locations**



Seoul Water-Now System screen page on website

Advanced Water Purification System

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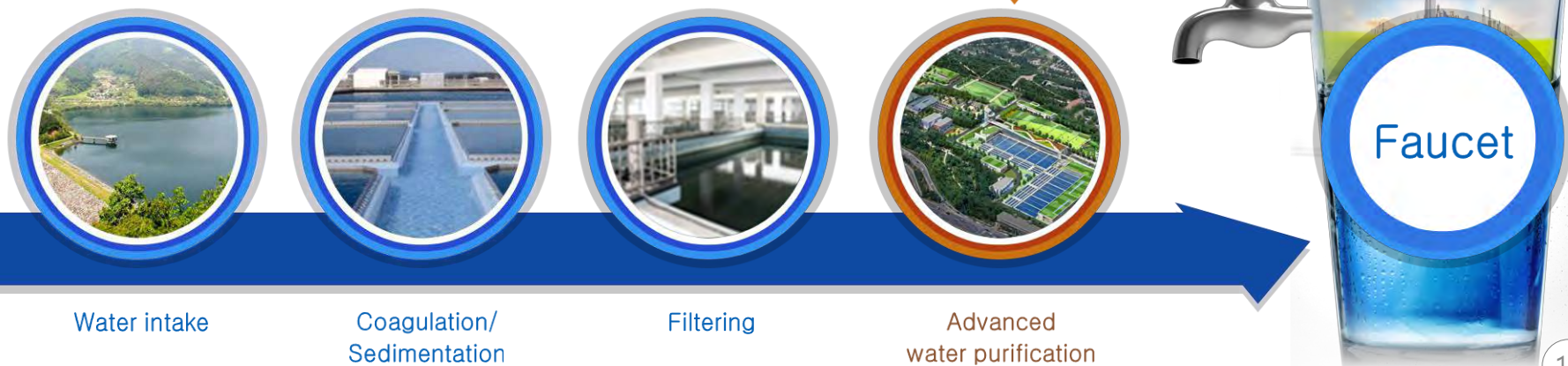
Process

- Ozone and Granular Activated Carbon particle treatments added to process

➔ Production of healthy and tasty tap water

Installation and Operator

- all Water Purification plants(3,570,000 tons/day)



Effect Advanced water treatment



Safe from green algae

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



Safe from pesticides

- Eight insecticide components detected in eggs **were not Detected in Arisu**



Safe from micro-plastics

- **Microplastic was not detected in Arisu**



Safe from radioactive material

- Total of 12 Management Items Artificial radioactive elements(5), natural radioactive element(6), radiation(1)
- Provision of radioactive element removal plan during water purification & creation of response manual

➡ I-131 100% remove, Cs-134, Cs-137 80% remove



Residual chlorine equalization across the entire area

the amount of residual chlorine in water at the faucet



Past

Now

Chlorine injection limited to center

- Local chlorine odor complaints
- Long-distance residual chlorine targets not met

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 Chlorine Disperse Injection System

- 15 reservoirs (Nakseongdae, Daebang and others)



Maintaining ISO22000 International Certification

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Certification date

• 2016.10.27.

Certification scope

• 6 water purification center systems from water intake to faucet (including bottled tap water)

Certification agency

• BSI
(British Standards Institution)



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)

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

Strengthening hygiene management for all visitors

**Effective management of
harmful elements in
production and
manufacturing process**



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Repairing weak, old water pipes to create
an environment to supply safe, clean tap water

Business scope • 13,571km(13,396km repaired, 98.7% completed)

Business period • 1984~present

Total business expenses • 3,512.3 billion KRW(invested cost from 1984 to 2018: 3,338.4 billion KRW)

Galvanized
steel pipes

Stainless
steel pipes

Built before 1983
Rust often generates

Replacement of corrosion
resistance pipes

Gray cast
iron pipes

Ductile cast
iron pipes

Newly construct or expand reservoir to establish a stable water supply system without a shutoff even during waterworks construction, leakage accidents, etc.

Newly construct or expand reservoirs

- 11 locations, capacity of 66,000 m³
(40,000 m³ of new construction(7), 26,000 m³ of expansion(4))

Reservoirs status

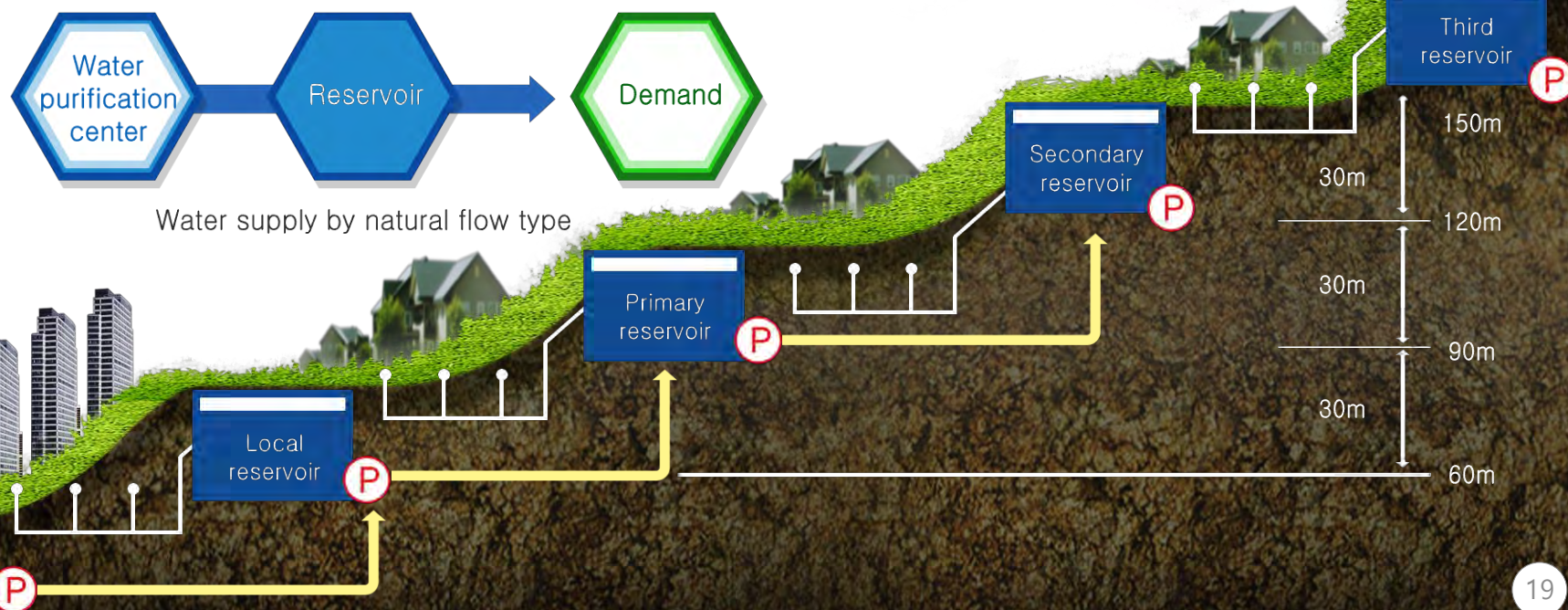
- total 100 locations, 2.42million tons, 2018.12.31

Business period

- 2015 – 2030

Total business expenses

- 108.2 billion KRW



03 Build an uninterrupted water supply system

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

Fundamental measures against
Large-scale water supply interruption
Caused by leakage

01

Establishment of supply system
between Arisu water purification centers

02

Stable supply of tap water through
Double line of main water line

03

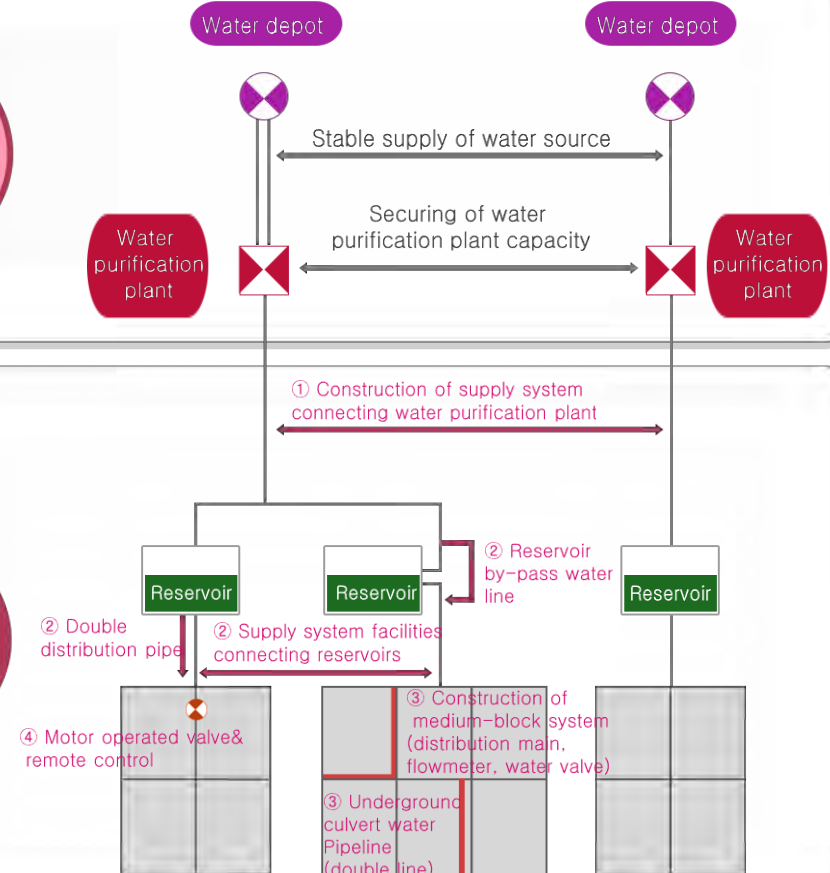
Establishment of efficient block system

04

The main valve of the water supply pipe
Was electronicized for remote control

Completion
Of water
supply
system

Expansion
plan



Close examination of facilities' location, depth and data and construction of tap water GIS database

Project objective

- Establish Construction of water pipeline (9,647km / more than 80mm diameter)

Progress report

- Completed 72.6% (7,003km) as of December 2018

Project period

- 2005 – 2022(Cost: 87.8 billion KRW)

Project detail

- Close examination of facilities' location and specifications
- Measurement of coordinates using state-of-the-art equipment such as Global Navigation Satellite System(GNSS) & editing of database

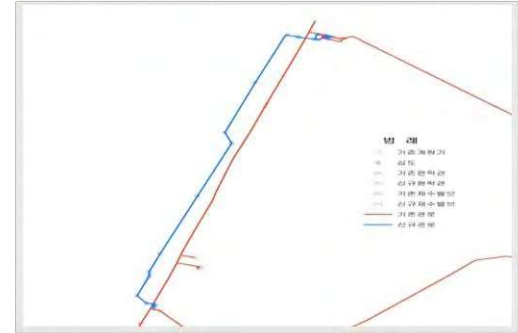
Tap water facilities research and inspection



Precise(Coordinate) measurement



Modification/editing of database





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Replacement of old facilities

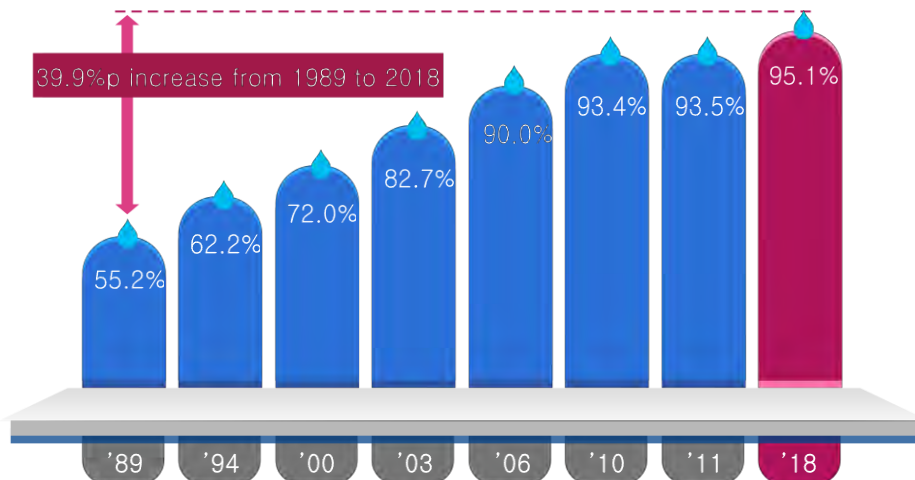
- Systematic management of waterworks facilities
Removal of disused pipes, Preemptive leak detection

Revenue
water rate
95.1%
(2018)

Scientific management
of water supply quantity

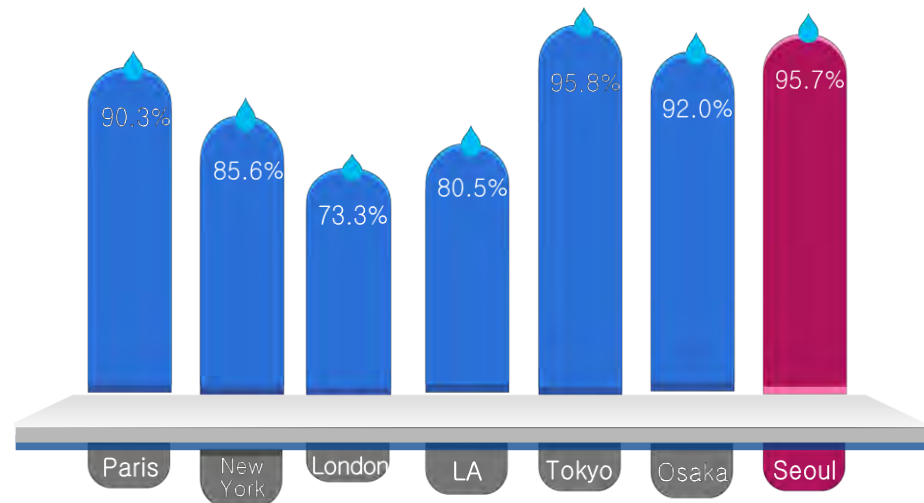
- Water intake and flow meter management,
booster area management, flow management
block by block

Producing savings 500 million tons per year



Trend in revenue water rate changes

World's Second highest revenue water rate



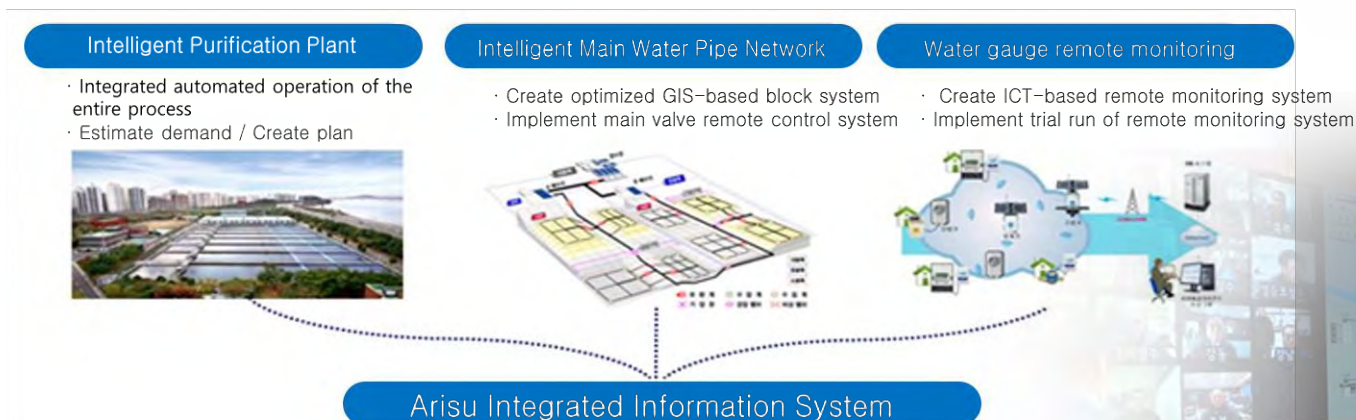
Comparison to major cities in developed countries(2017)

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 in the event of an emergency

Smart Water Greed

What is the Smart Water Grid?

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



Implement role of water pipeline integrated control tower



Production of renewable energy

Solar
power

Geothermal

Small
hydro

- Produced 18,448 mwh/year,
reduced manufacturing cost of 640 million
KRW (2018)



Environmentally 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

SludgeSediment deposits from the water purification
process

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



Solar power



Geothermal



Small hydro

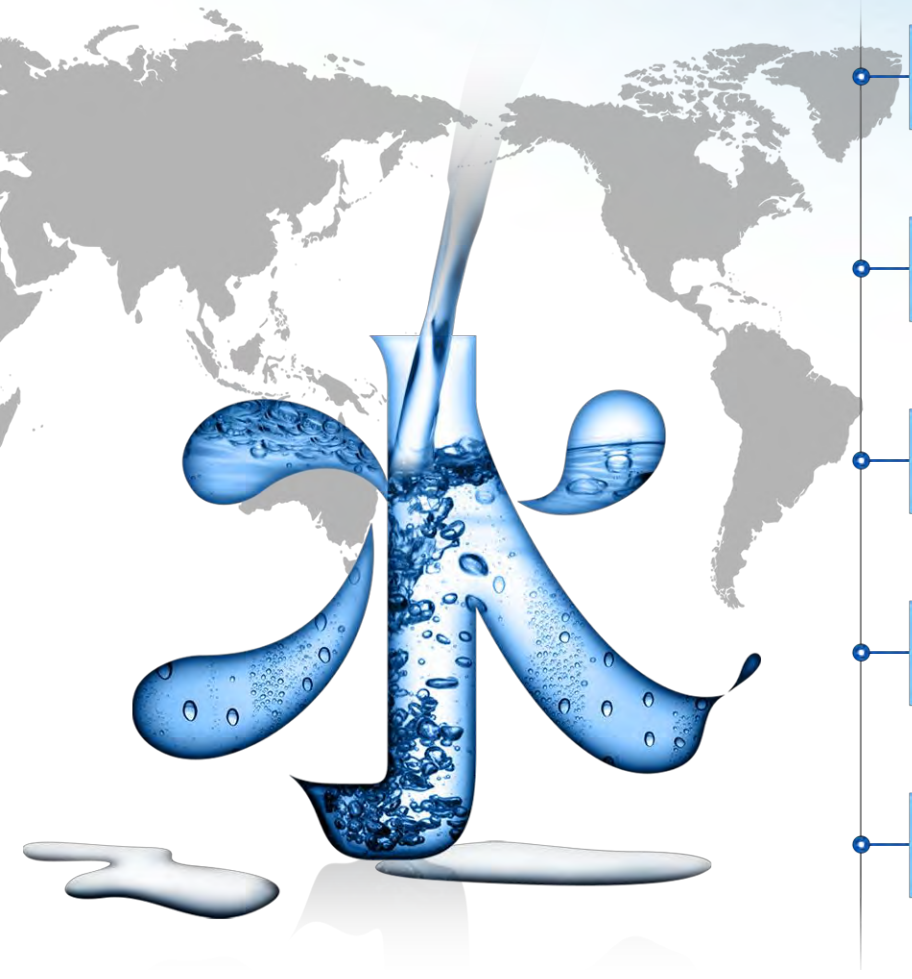


Minimizing fees through sensible management

Comparison of tap water fees



Water usage costs in Seoul are 5.7 and 6.4 times lower than Copenhagen and New York respectively(as of January 2018)



Participated in infrastructure development consulting project of PMB Island, Brunei

- ▶ Dispatch supervising personnel, 2016.04 – 2020.04

Pursuit of waterworks system improvement project in Chanchamayo city, Peru

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

Completed water facility improvement project for regions in Vietnam

- ▶ Huê, Vietnam, 2016.01 – 2016.02

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

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

Operate private-government council for overseas advancement of waterworks

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

ODA for the International Waterworks Project

- ODA 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 of PMB Island, Brunei (2016. 4. ~ 2020. 4.)



MOU for Promoting the Cooperation Projects of Waterworks with Foreign Cities

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



Training Camp for Foreign Waterworks High Officials

- Instructed 40 high level officials each year from ASEAN and Latin America
223 people from 34 countries participated in 18 events held from 2012 to 2018





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Since old indoor pipes become a reason for deteriorated water quality, **replacement construction cost is supported to prevent the release of rust and improve the water quality**

Implementation performance

- 565,000 households , 255 billion KRW (2007 – 2022)

Details

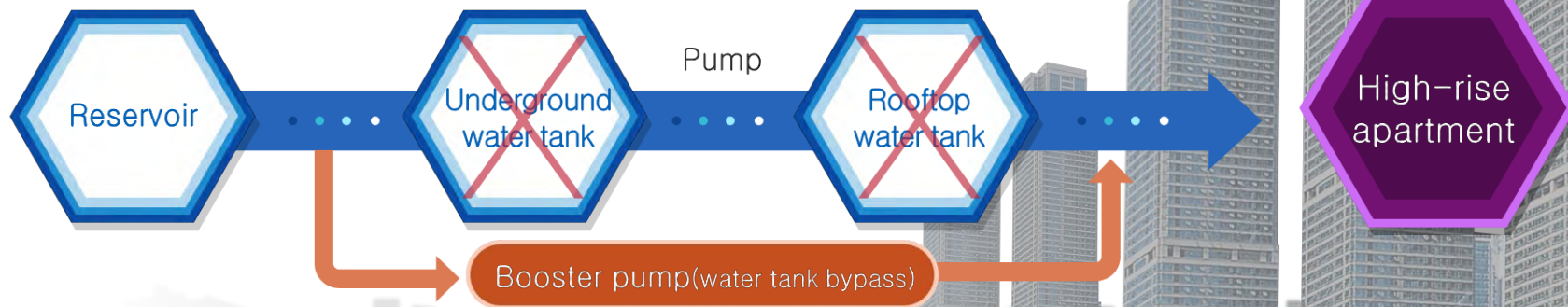
- 389,000 households, 147 billion KRW(69%)
(Supporting up to 80% of the cost within the upper limit for each housing type)



Classification	Social welfare facilities and beneficiary of basic livelihood security aid	Single house	Multi-household house	Apartment houses
Replacement construction : within 80%	Entire construction cost	1,500,000 KRW max	2,500,000 KRW max	1,200,000 KRW max (400,000 KRW common water pipes)
Restoration construction : within 80%				

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

- Existing apartments **converting to direct-connection water supply method**
 - For : 1,325 complexes(39% of 3,359 apartment complexes that have 6 floors or more)
 - Results : 443 complexes completed from 2014 to 2018
- Assigned conditions for direct-connection water supply after agreeing on water supply of new apartments with construction permission(178 complexes completed)



Water quality testing service provided for water faucets in every household

Testing items	Residual chlorine, Turbidity, pH, iron, copper
Objective	300,000 households each year (220,000 households from 2019)
Methods	Immediate inspection at faucet



When inadequate, an additional seven items are thoroughly checked and an improvement plan is formulated

Testing items	Typical germs, Total E. coli groups, E. coli, Ammoniacal nitrogen, Chlorine ion, Zinc, Manganese
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Diagnosis of general condition of in-house water pipe and tank performed free of charge



Creating an environment where drinking water can be enjoyed by Installing Arisu drinking fountain at places where there are many citizens, Such as schools, kindergartens

Policy Information

- Elementary School and Middle School 1,353(1,290School 20,400units completed)
- Installing Arisu drinking fountain in Park, Circumference, National and Public kindergarten

Expense • 86.6 billion KRW

Maintenance • Outsourcing



Elementary School



Kindergarten



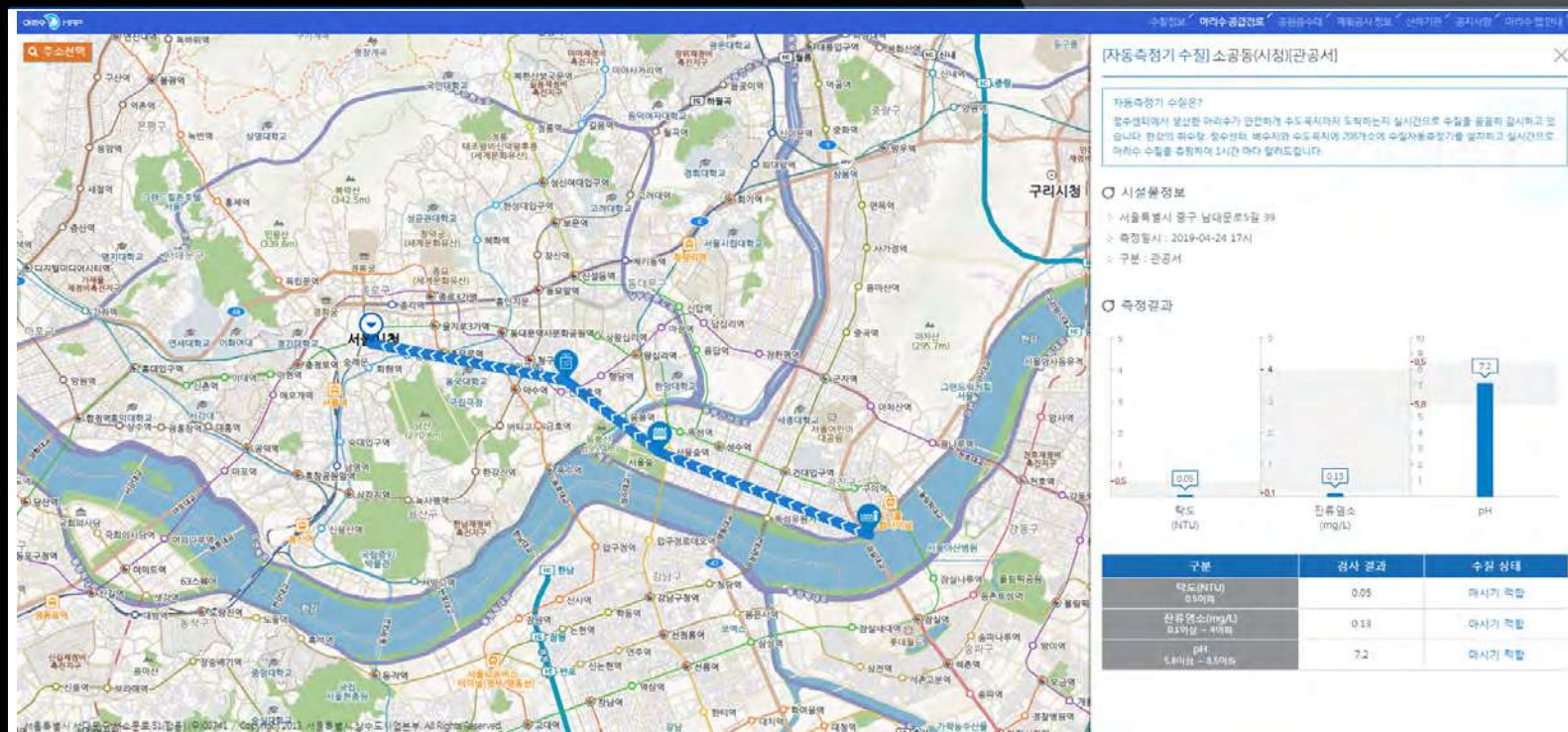
Confirmation service of our home supply path

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Information of home water quality, Secure tap water through real-time confirmation

Policy Information

- Tight monitoring system by Installing an automatic water quality meter
- Map-based verification of household Arisu supply route & water quality per route



[Thank you]

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Seoul Metropolitan Government

Healthy and tasty

Globally expanding

Arisu

