Water Utility Information (FY 2014)

Basics

Name of utility:	Chiba Prefectural Waterworks Bureau		Service type:	Water service provider
Administrative population:	3.5 million people		Start of service:	1936
Population served:	3 million people		Service area:	566.37 km²

Water supply volume

Average daily water supply:	870,000 m3/d	Breakdown	Household use	690,000 m³/d
			Commercial and institutional use:	120,000 m³/d
			Others:	50,000 m³/d
			From wholesale supplier	13,000 m³/d
Average daily water supply per capita:	292 L/person/d	Service coverage:		96.4 %
Effectiveness:	98.7 %	Revenue water:		94.7 %
NRW:	5.3 %	Water loss		1.6 %

Water rates

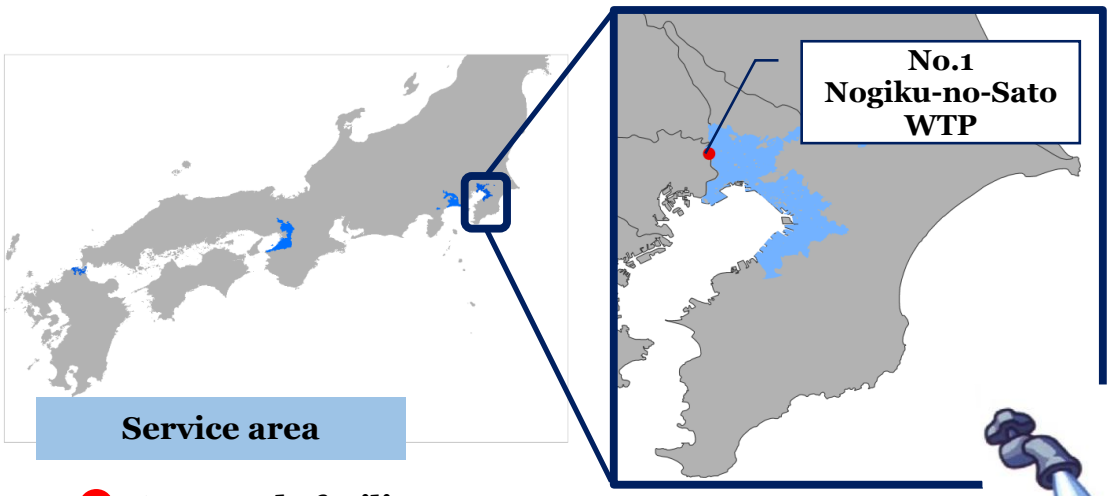
Water rates for 10m3/month:	1,020 yen (including taxes) *Calculation conditon: The service pipe has a 13-mm diameter. The fixed charge is 410.10 yen/month. The volumetric charge is 61.56 yen/m3 up to 10m3.
Water production cost: 181.85 yen/m³	Water supply cost: 202.39 yen/m³

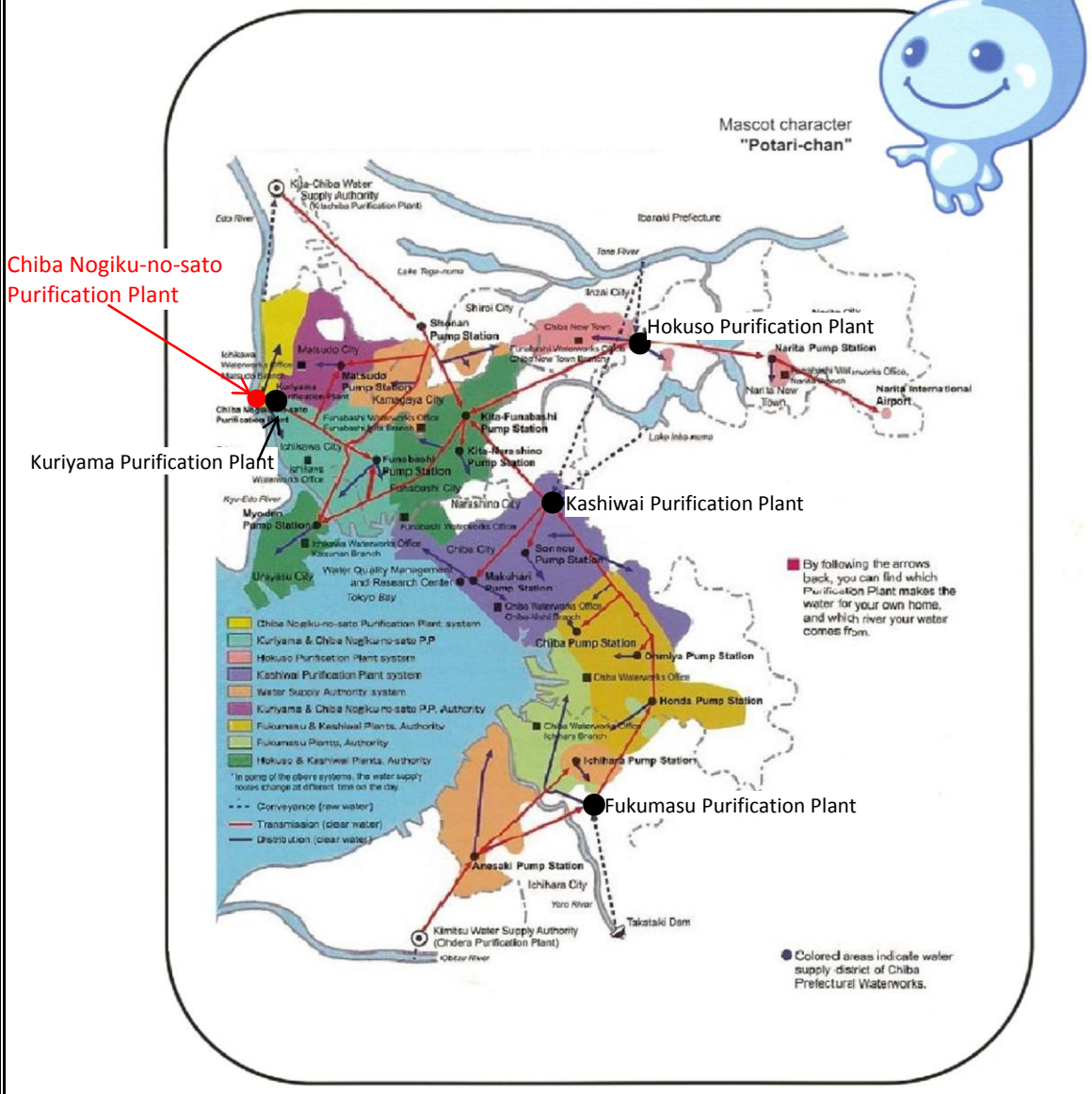
Facilities	Water Treatment Plant and Facilities (including water from wholesale supplier):	Name	Capacity	Water source	Treatment process
		Kuriyama WTP	186,000 m^3/d	Surface water (river)	Coagulation/Sedimentation + Rapid filtration + Chlorine disinfection
		Kashiwai WTP (west wing)	360,000 m^3/d	Surface water (river)	Coagulation/Sedimentation + Rapid filtration + Chlorine disinfection
		Kashiwai WTP (east wing)	170,000 m^3/d	Surface water (lake)	Coagulation/Sedimentation + Rapid filtration + Ozone + Powdered activated carbon + Chlorine disinfection
		Hokuso WTP	126,700 m^3/d	Surface water (river)	Coagulation/Sedimentation + Rapid filtration + Chlorine disinfection
		Fukumasu WTP	90,000 m^3/d	Surface water (lake)	Coagulation/Sedimentation + Pre-ozonation + Rapid filtration + Ozone + Biological activated carbon + Chlorine disinfection
		Chiba Nogiku-no-Sato WTP	60,000 m^3/d	Surface water (river)	Coagulation/Sedimentation + Ozone + Biological activated carbon + Rapid filtration + Chlorine disinfection
		Water for wholesale supplly	261,300 m^3/d	–	–
		Total	1,254,000 m^3/d		

Pipes	Pipieline length:	8,970 km	Conveyance:	70 km	Transmission:	170 km
			Distribution:	8,730 km	Others:	– km
	Type of material:	・Cast iron: 8,530 km ・Asbest cemento: 6.9 km ・Steel: 167 km				

Others	Other information:	・Number of employees: 875 ・Seismic reinforcement rate of pumping stations: 79.8% ・Seismic reinformcement rate of distribtuion reservoirs: 56.5% ・Maximum daily supply: 1 million m3 ・Maxiumum facility utilization rate: 82.8% (Maximum daily supply/treatment capacity) ・Facility utilization rate: 69.2% (Average daily water supply/treatment capacity)
	Remarsk:	・All the infromaiton above (except for the length of the lead service pipe) was cited from the Annual Report FY2014 of the Chiba Prefectural Waterworks Bureau. ・The length of the lead service pipe was cited from the Annual Report FY2013.

Water Utility Information (FY 2014)





Case Study Report (Chiba Nogiku-no-Sato Water Treatment Plant)

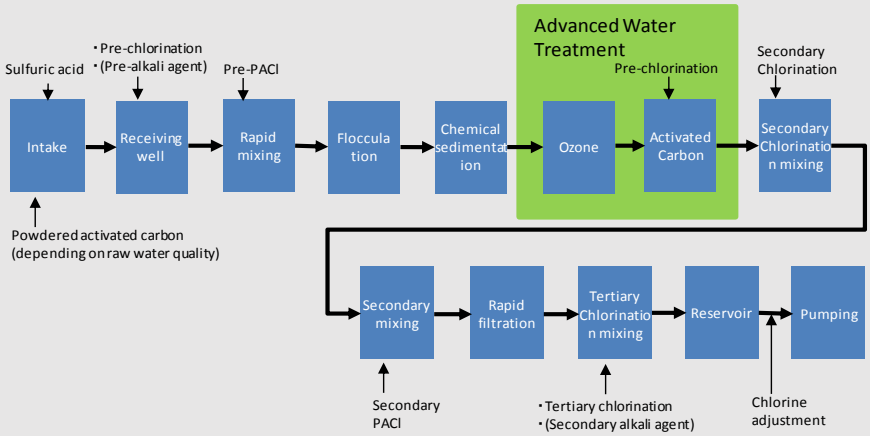
Water Treatment Process

Case #1: Chiba Nogiku-no-Sato Water Treatment Plant

Key word:	Advanced water treatment (ozone + biological activated carbon), Surface water (river), Odor control, Elimination and consolidation of facilities, Private sector involvement
Outline:	<Outline and characteristics> ● Purpose of construction The Chiba Nogiku-no-Sato Water Treatment Plant began operation in October 2007. It's a seismic resistant plant built to replace the old Kogasaki (1940) and Kuriyama (1958) Water Treatment Plants. Upon its completion, the Kogasaki was demolished in 2007. The Kuriyama will also be out of service in 2023, when the Chiba Nogiku-no-Sato will have completed an ongoing construction of a new water treatment facility that will fully replace the capacity of the Kuriyama. ● System features ・Safe and high quality water supply: Ozone + biological activated carbon (advanced water treatmetn) to control musty odor as well as bad smells from fish eggs ・Emergency preparedness: Seismic resistance reinforcement of water facilities and preparation of on-site water supply stations for residents in the event of an emergency ・Private sector involvement: Private Finance Initiative (PFI) for the construction and operation of its drainage facility. The operation contract is for 20 years. Among others, the contract provides for the use of surplus soil from on-site excavations as raw materials of improved soil for reclamed land. ・Environmental measures: Solar power generation system for clean energy ・Recreational area for the public: areas on the top of reservoirs is open to public access for recreational use. ・Barrier-free design: assures all the visitors a comfortable access to the buildings and facilities on the premises <Others> The service area includes portions of the Matsudo City, Ichikawa City, and Funabashi City in the Chiba Prefecture.
Address:	Kuriyama 478-1, Matsudo City, Chiba Prefecture
Land area:	125,000 m^2
Water treatment process:	Coagulation/Sedimentation + Ozone + Biological Activated Carbon + Rapid filtration + Chlorine disinfection
Capacity:	・Final capacity: 246,000 m3/d (to be complete in 2023) ・Current capacity: 60,000 m3/d ・Additional capacity under construction: 186,000 m3/d
Water source:	Surface water (Edo River of the Tone River System)

Case Study Report (Chiba Nogiku-no-Sato Water Treatment Plant)

Water Treatment Process

Raw water quality:	■ Affected by upstream river conditions because of the plant's downstream location ■ Frequent oil spills ■ Algae blooms tend to increase the pH and adversely affect the coagulation process ■ An issue of musty odor and fish eggs flowing from upstream <Average raw water quality in FY2014 (maximum)> ・Turbidity: 11 degrees (24 degrees) ・Hardness: 60mg/L (68mg/L) ・TOC: 1.5 mg/L (2.9 mg/L) ・pH: 7.7 (8.7) ・Color: 10 degrees (64 degrees) ・Geosmin: 0.002 μg/L (0.004 μg/L) ・2-MIB: <0.001 μg/L (0.005 μg/L) ・TON: 21 (40)
Chemical dose:	Sulfuric acid (pH adjustment), Sodium hydroxide (pH adjustment), Polyaluminum chloride (coagulation), Sodium hypochlorite (disinfection)
Start of operation	Oct-07
Layout:	Aerial view 
Treatment process flow diagram:	

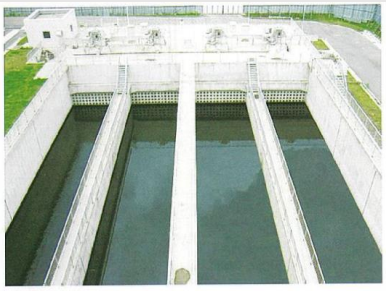
Case Study Report (Chiba Nogiku-no-Sato Water Treatment Plant)

Water Treatment Process

Pictures:

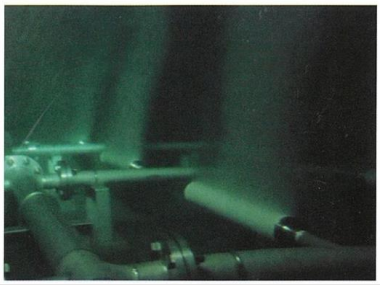
Instake point

Grit chamber

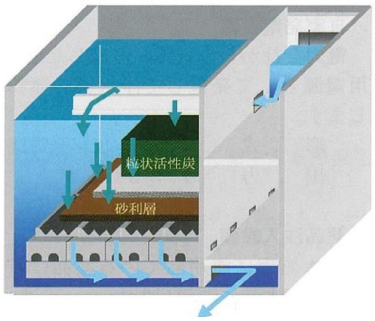


Sedimentation basin

Ozone diffusing pipe



Activated carbon adsorption basin



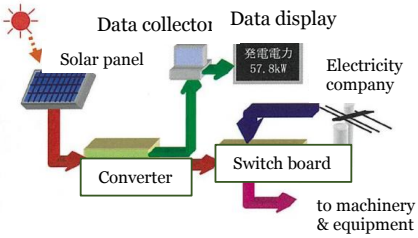
Rapid filtration basin

Case Study Report (Chiba Nogiku-no-Sato Water Treatment Plant)

Water Treatment Process

Other facilities:	●Solar Power Generation System for CO_2 reduction Maximum output: 57.8 kw (daily output varies depending on the weather) Installation area: 410 m2 (324 solar power generation modules) Usage: suppies power for ventilation fans in the central control building
Order/contract:	PFI (drainage facility)

Solar panel



Other information:

List of references (URL)

●Chiba Prefectural Waterworks Bureau. Annual Report FY2014.
http://www.pref.chiba.lg.jp/suidou/souki/toukeidata/h26zigyou-nenpou.html

●Chiba Prefectural Waterworks Bureau. Brochure of the Chiba Nogiku-no-Sato Water Treatment Plant (September 2012).

●Chiba Prefectural Waterworks Bureau. Chapter 8: Water Quality Management, the Environment Report FY2014.
https://www.pref.chiba.lg.jp/suidou/souki/zigyougaiyou/kankyoukaikei/houkokusho-h26.html

●Association of Water and Sewage Works Consultants Japan. Suikon 2015 Vol. 50.
http://www.suikon.or.jp/suikon/vol.50/suikon50_009.pdf

Water Utility Information (FY 2014)

Basics

Name of utility:	Public Enterprises Agency Kanagawa Prefectural Government		Service type:	Water service provider	
Administrative population:	3.03 million people		Start of service:	1933	
Population served:	2.8 million people		Service area:	808.59	km^2

Water supply volume

Average daily water supply:	880,000	m^3/d	Break down: Household use	664,000	m^3/d
			Commercial and Industrial use:	152,000	m^3/d
			Others:	42,000	m^3/d
			From wholesale supplier	25,000	m^3/d
Average daily water supply per capita:	292.6	L/person/d	Service coverage:	99.8	%
Effectiveness:	92.7	%	Revenue water:	88.5	%
NRW:	11.5	%	Water loss	6.7	%

Water rates

Water rate for 10m3/month:	1,043 yen (including taxes) **Calculation condition: The fixed charge is 1,420 yen/two months. The volumetric charge is 128 yen/m3 from 17 to 30 m3 = 1,932 yen x taxes x 1/2				
Water production cost:	164.14	yen/m^3	Water supply cost:	156.01	yen/m^3

Facilities

Water Treatment Plant and Facilities (including water from wholesale supplier):

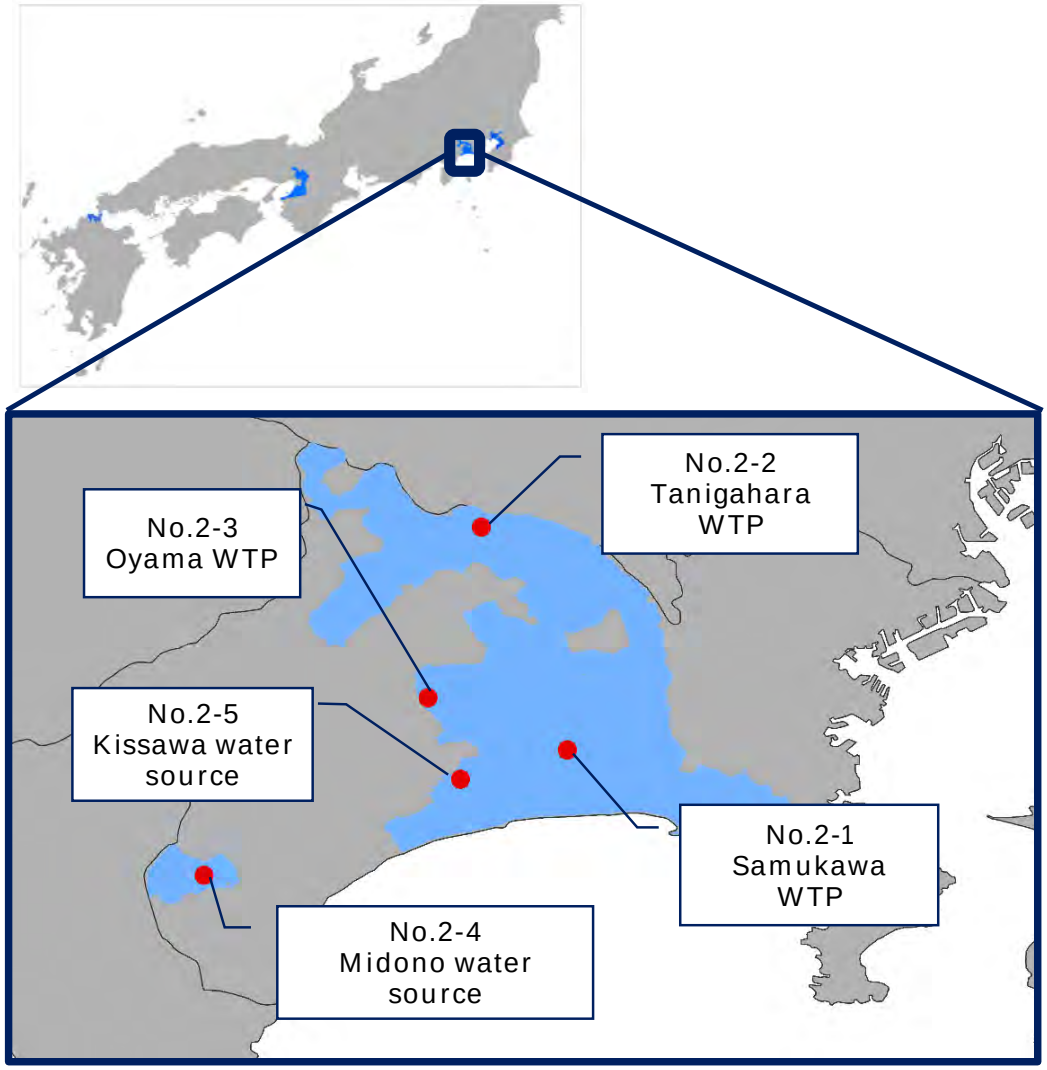
Name	Capacity	Water source	Treatment process
Samukawa WTP	750,000 m^3/d	Surface water	Coagulation/sedimentation + Rapid filtration + Chlorine disinfection
Tanigahara WTP	242,800 m^3/d	Subsoil water Surface water	Sedimentation + Slow filtration + Chlorine disinfection Coagulation/sedimentation + Rapid filtation + Chlorine disinfection
Kamasawa WTP	720 m^3/d	Surface water	Membrane filtration + Chlorine disinfection
Ochiai WTP	1,620 m^3/d	Surface water	Membrane filtration + Chlorine disinfection
Wada WTP	360 m^3/d	Surface water	Membrane filtration + Chlorine disinfection
Oyama WTP	1,100 m^3/d	Surface water	Membrane filtration + Chlorine disinfection
Sokozawa WTP	470 m^3/d	Surface water	Membrane filtration + Chlorine disinfection
Toya WTP	5,550 m^3/d	Subsoil water	Coagulation/sedimentation + Rapid filtration + Chlorine disinfection

		Nagano WTP	500 m^3/d	Subsoil water	Membrane filtration + Chlorine disinfection
		Itarih WTP	4,400 m^3/d	Spring water	Membrane filtration + Chlorine disinfection
		Shinanoki WTP	3,300 m^3/d	Spring water	Membrane filtration + Chlorine disinfection
		Midono water source	12,800 m^3/d	Spring water	UV treatment + Chlorine disinfection
		Others (Kissawa etc)	1,700 m^3/d	Ground water	Chlorine disinfection
		Water from wholesale supplier	669,400 m^3/d	–	–
		Total	1,694,720 m^3/d		

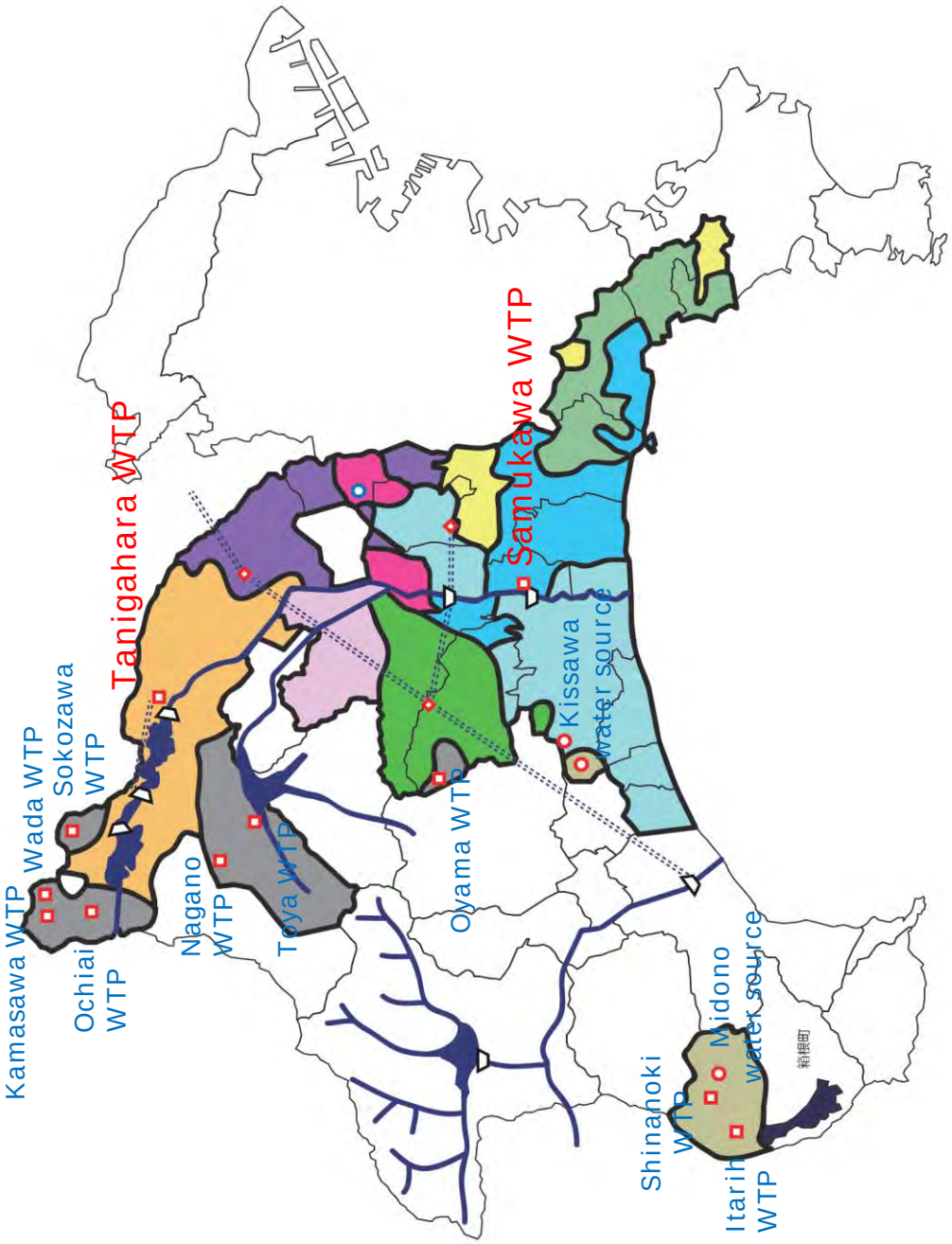
Pipes	Pipieline length:	9,217 km	Conveyance:	12 km	Transmission:	221 km
			Distribution:	8,984 km	Others:	– km
	Type of material:	・Cast iron: 6,381km ・Steel: 481km ・Stainless: 14km				
Others	Other information:	・Number of employees: 623 ・Seismic reinforcement rate of pumping stations: 4.8% ・Seismic reinformcement rate of distribtuion reservoirs: 21.6% ・Maximum daily supply: 1.04 million m3/day ・Maxiumum facility utilization rate: 68.5% (Maximum daily supply/treatment capacity) ・Facility utilization rate: 62.9% (Average daily water supply/treatment capacity)				
	Remarks:	・The informaiton in the Basics, Facilities and Pipes sections (except for the pipeline length, pipe material and ratio of lead service pipe) was cited from the Annual Statistics Report FY2014 of the Kanagawa Prefectural Government. http://www.pref.kanagawa.jp/uploaded/attachment/801189.pdf ・The pipeline length and pipe material is based on the registry of the fixed assets of the Kanagawa Prefectural Government. ・The information on the lead service pipe and the seismic reinforcement ratio (except for the one of primary mains) was cited from the PI guidelines for water supply services FY2014. http://www.pref.kanagawa.jp/uploaded/life/1005094_3294728_misc.pdf ・The seismic reinforment ratio of primary mains is based on the reference material below. http://www.pref.kanagawa.jp/uploaded/attachment/832973.pdf				

Water Utility Information (FY 2014)

Service area



Overview of facilities



Case Study Report (Samukawa Water Treatment Plant)

Water treatment process

Case #2-1 Samukawa Water Treatment Plant

Key word:	Surface water (river), Rapid filtration
Outline:	<Characteristics> ●Features of the Samukawa Water Treatment Plant ・Reliable water supply: The Samukawa Water Treatment Plant has a distribution management system to monitor and control reservoirs and pumping stations in the utility's distribution network. On the premises there are two water treatment plants called No. 2 and No 3 WTPs (No. 1 WTP has been demolished). These two plants are responsible for an efficient and reliable distribution management based on demand forecasts as well as for mutual water transfers with other utilities. ・Environmental measures: Solar power generation system. Surplus soil from on-site excavations is recycled as raw materials of cement additives. ・Private sector involvement: A Private Finance Initiative (PFI) has been used for the construction and operation of the drainage facility. <Outline> ・The Samukawa Water Treatment Plant is situated in the Samukawa Town approximately 6.5 km upstream from the estuary of the Sagami River. The Samukawa intake weir located in the town abstracts water from the river. The water treatment process consists of a coagulation/sedimentation, filtartion and disinfection. ・Service area: 11 Cities and 4 Towns ・Capacity: 750,000 m3/d (No. 2 WTP: 210,000 m3/d + No. 3 WTP: 540,000 m3/d)
Address:	Miyagawa 4271, Samukawa Town, Kanagawa Prefecture
Land area:	487,229m^2
Water treatment process:	Coagulation/sedimentation + Rapid filtration + Chlorine disinfection
Capacity	750,000 m3/d
Water source:	Surface water (Sagami River)
Raw water quality:	■Since the raw water is taken from downstream of the Sagami River, it tends to be adversely affected by phytoplankton growth and aritificial contaminations in upstream river bodies and lakes. <Average raw water quality in FY2014 (maximum)> ・Turbidity: 9.1 degrees (51 degrees) ・Hardness: 59 mg/L (68mg/L) ・TOC: 0.8 mg/L (1.3 mg/L) ・p H: 7.8 (7.9) ・Color: 3.4 degrees (12 degrees) ・Geosmin: 0.002μg/L (0.004μg/L) ・2-MIB: <0.002 μg/L (0.007 μg/L) ・TON: 8 (17)
Chemical dose	Sulfuric acid (pH adjustment), Sodium hydroxide (alkalinity adjustment), Polyaluminum chloride (coagulation), Sodium hypochlorite (disinfection)
Start of operation:	Dec-63

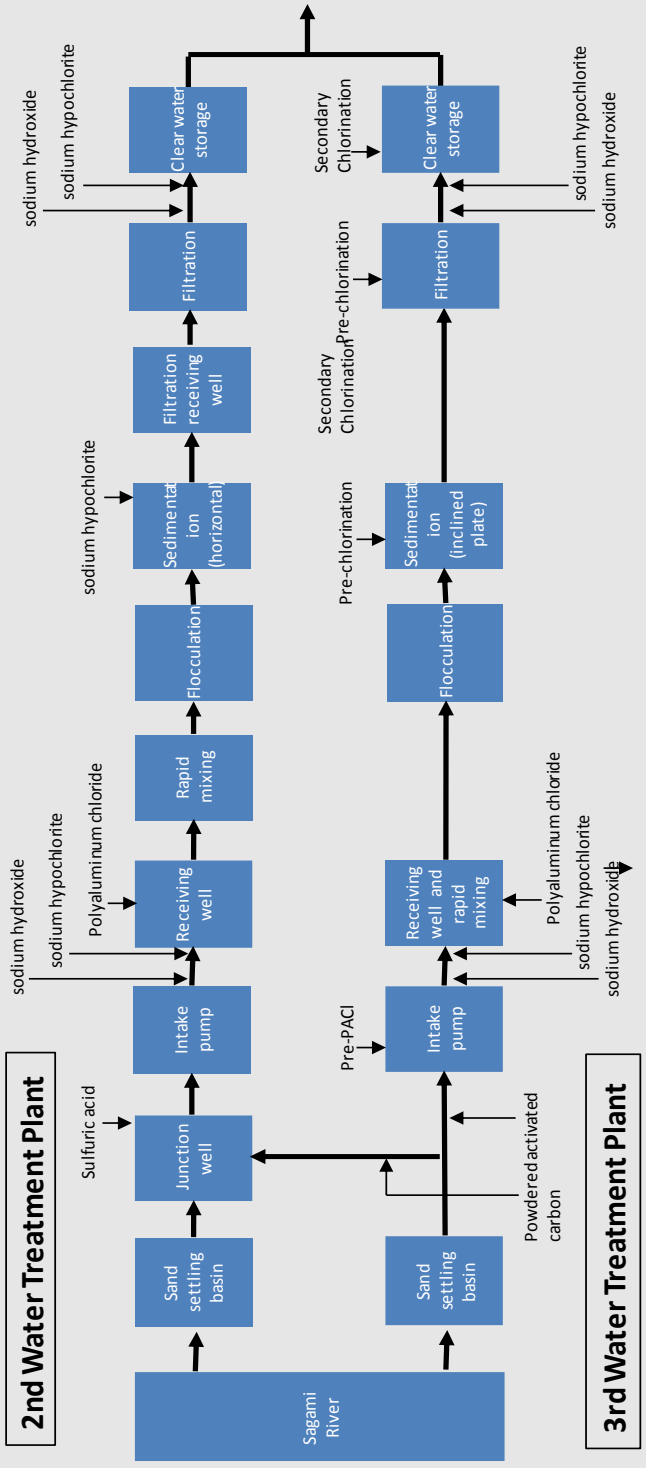
Case Study Report (Samukawa Water Treatment Plant)

Water treatment process

Layout:

● Arial view

Water treatment process



Case Study Report (Samukawa Water Treatment Plant)

water treatment process

Pictures:

● Intake point

● Sand settling basin

● Flocculation basin

● Sedimentation basin

● Rapid filtration basin

Other facilities:

● Solar Power Generation System for CO2 reduction
Maximum output: 120 kw (daily output varies depending on the weather)
Installation: Feb 2005
Location: on the top cover of filtration basins

● Backup Power Supply System
The backup power supply system enables the No. 2 and No. 3 water treatment plants to continue operation when a blackout cuts the commercial power supply from the Tokyo Electric Power Company.

Other information

- The Brochure of the Samukawa Water Treatment Plant (June 2015)
- The Water Quality Report of the Kanawaga Prefectural Government's Water Supply Service (Jan 2016)

Case Study Report (Tanigahara Water Treatment Plant)

water treatment process

Case #2-2 Tanigahara Water Treatment Plant

Key word:	Surface water (lake), Slow filtration
Outline:	<Characteristics> ・Efficient and Reliable water supply: The Tanigahara Water Treatment Plant has a monitoring and control system for not only on-site facilities but outside reservoirs and pumping stations of the utilty's distribtuion network, providing an efficient and reliable water supply. To improve the treated water quality, automated feeders of activated carbon were instlalled in 2010. ・Multiple water treament processes: the plant has two trains of water treament processes with the one using slow filtration and the other rapid filtration. The latter has three types of sedimentation methods: horizontal, inclined plate, and rapid ones. ・Environmental measures: Surplus soil from on-site excavations is recycled as raw materials of cement additives <Outline> ・Built in 1942 to address a rapid increse in water demand in the Sagamihara Region. ・Service area: 2 Cities and 1 Town ・Capacity: 242,800 m3/d (slow filtartion system: 32,800 m3/d + rapid filtration system: 210,000 m3/d)
Address:	Tanigahara 2-6-1, Midori-ku, Sagamihara City, Kanagawa Prefecture
Land area:	91,492m^2
Water treatment process:	1. Slow filtration system: Sedimetation + Slow filtration + Chlorine disinfection 2. Rapid filtration system: Coagulation/sedimentation + Rapid filtration + Chlorine disinfection
Capacity	242,800 m3/d
Water source:	Surface water, Subsoil water (Sagami River)
Raw water quality:	■ Mostly abstracted from the Sagami Lake, the raw water tends to contain a range of phytoplanktons including synedra (clogging filtration basin), mycrocystis (affecting filtrate turbidity) and anabaena (musty odor). <Average raw water quality in FY2014 (maximum)> ・Turbidity: 7.6 degrees (35 degrees) ・Hardness: 53 mg/L (61 mg/L) ・TOC: 0.8 mg/L (1.3 mg/ L) ・p H: 7.8 (8.5) ・Color: 6 degrees (22 degrees) ・Geosmin: 0.003μg/L (0.008μg/L) ・2-MIB: <0.001 μg/L (0.002 μg/L) ・TON: 3 (5)
Chemical dose:	Sulfuric acid (pH adjustment), Calcium hydroxide (alkalinity adjustment), Polyaluminum chloride (coagulation), Sodium hypochlorite (disinfection)
Start of opeation	Mar-40

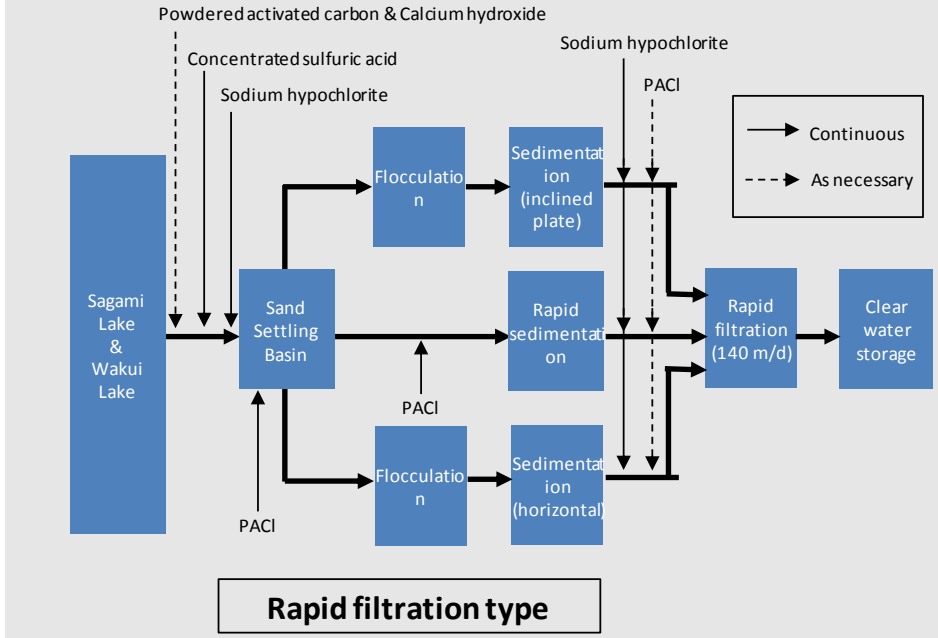
Case Study Report (Tanigahara Water Treatment Plant)

Water treatment process

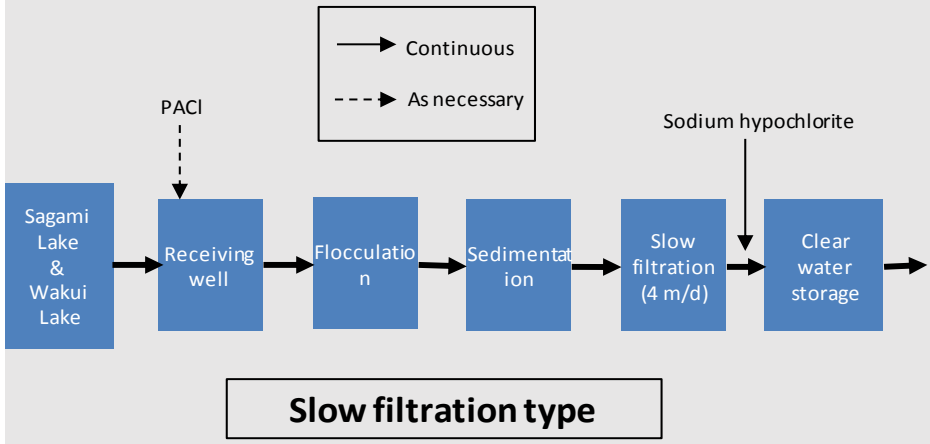
Layout

● Arial view

Water treatment process flow



Rapid filtration type



Slow filtration type

Water treatment process

Pictures

● Intake point

● Sedimentation basin
(slow filtration system)

● Coagulation/sedimentation basin
(rapid filtraion system - horizontal)

● Coagulation/sedimentation basin
(rapid filtraion system)

● Slow filtration basin

● Rapid filtration basin

Other facilities:

● Backup Power Supply System

In the event of a blackout cuts the commercial power supply, a backup power generator enables the operation for up to one fourth of the total plant capacity.

Other information

- The Brochure of the Tanigahara Water Treatment Plant (March 201)
- The Water Quality of the Kanawaga Prefectural Government's Water Supply Service (Jan 2016)

Case Study Report (Oyama Water Treatment Plant)		
Water treatment plant	Case #2-3	Oyama Water Treatment Plant
	Key word:	Membrane filtration, surface water (river)
	Outline:	<Characteristics> ・Demand fluctuation management: Situated in a tourist zone, the Oyama Water Treatment Plant has relatively broad water demand fluctuations throughout the year but has been producing drinking water in a safe and reliable manner. <Outline> ・With a capacity of 740 m3/d, it abstracts water from the Oyama River and suppies about 270 households in the Oyama and Koyasu Districts. ・Service area: portions of 1 City
	Address:	Sakamoto 671, Oyama, Isehara City, Kanagawa Prefecture
	Land area:	592m^2
	Treatment process:	Sedimentation + Membrane filtration + Chlorine disinfection
	Capacity	1,000 m3/d
	Water source:	Surface water (Oyama River)
	Raw water quality:	■Abstracted from a mountaineous region, the raw water has a high quality with little artificial contaminations. <Average raw water quality in FY2014 (maximum)> ・Turbidity: 0.6 degrees (2.3 degrees) ・Hardness: 36 mg/L (38 mg/L) ・TOC: 0.5 mg/L (1.7 mg/L) ・p H: 7.6 (7.7) ・Color: 2.1 degrees (6.4 degrees) ・Geosmin: <0.001μg/L (-) ・2-MIB: <0.001 μg/L (-) ・TON: 3 (5)
	Chemical dose:	Sodium hypochlorite (disinfection)
	Start of operation:	April 1986 (membrane filtration since 1998)

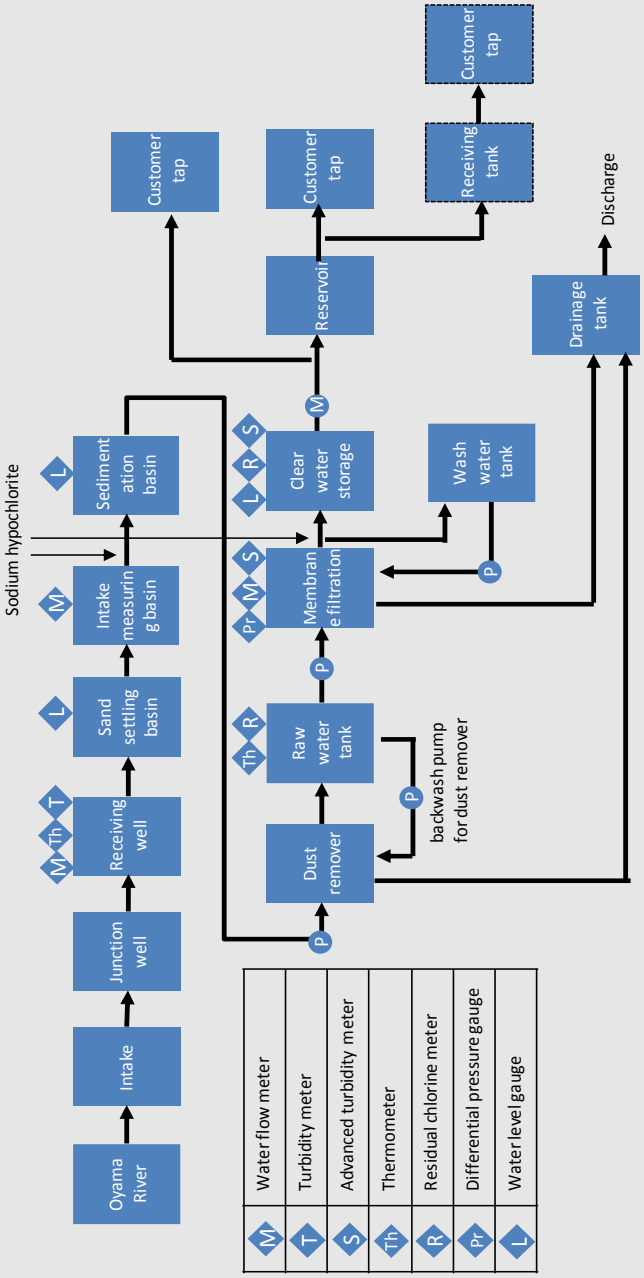
Case Study Report (Oyama Water Treatment Plant)

Water treatment process

Layout

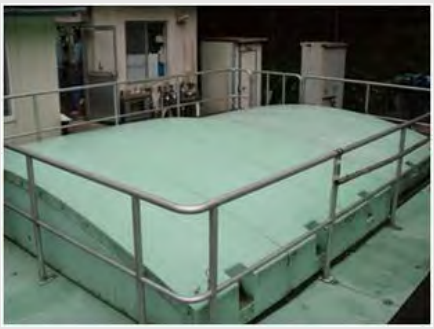
● Outside appearance

Treatment process flow diagram:



Case Study Report (Oyama Water Treatment Plant)

Water treatment plant

Pictures	● Intake point  ● Intake point  ● Settling basin, Sedimentation basin (when covered)  ● Settling basin, Sedimentation basin (when opened)  ● Membrane filtration system  ● Membrane filtration system 
Other facilities:	● Membrane module 12 m3 x 34 modules x 3 trains (102 modules in total) Filtration method: external pressure type dead-end filtration Filtration velocity: 1.0 m3/m2*d (maximum) Modle size: φ114×1,078 mm

Other information

- The Brochure of the Oyama Water Treatment Plant (June 2010)
- The Water Quality Report of the Kanawaga Prefectural Government's Water Supply Service (Jan 2016)

Case Study Report (Midono Water Source)

water treatment process

Case #2-4	Midono Water Source
Key word:	UV treatment system, Spring water
Outline:	<Chracteristics> ・Environmental measures: Because of a very high raw water quality throughout the year, a UV treatment system has been adopted, saving energy required for water treatment. ・Service area: portions of 1 Town ・Design capacity: 12,800 m3/d
Address:	Sengokuhara Daigatake 1277-2, Hakone Town, Kanagawa Prefecture (location of the UV treatment system)
Land area:	16,127m^2
Water treatment process:	UV treatment + Chlorine disinfection
Capacity:	12,800 m3/d
Water source:	Spring water
Raw water quality:	■Although influenced by volcanic soil, the raw water has a very high quality with little contaminations. <Average raw water quality in FY2014 (maximum)> ・Turbidity: <0.1 degrees (<0.1 degrees) ・Hardness: 110 mg/L (110 mg/L) ・TOC: <0.1 mg/L (0.1 mg/L) ・p H: 7.2 (7.2) ・Geosmin: <0.001μg/L (-) ・2-MIB: <0.001 μg/L (-) ・TON: <1 (<1)
Chemical dose:	Sodium hypochlorite (disinfection)
Start of operation:	Mar-68

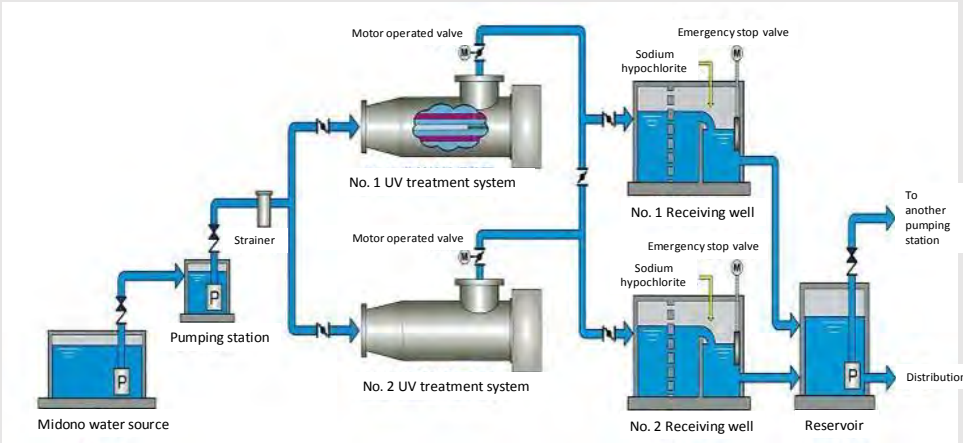
Case Study Report (Midono Water Source)

water treatment process

Layout

● Midono Water Source

Treatment process flow diagram:



Case Study Report (Midono Water Source)

water treatment process

Pictures:

● Intake facility

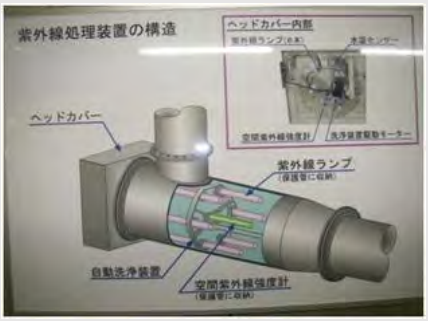
● Intake facility

● Spring water
(inside the intake facility)

● UV system (outside)

● UV system

● UV system structure



Other faciliteis:

● UV treatment system
Irradiation dose: over 10mJ/cm2
Size of irradiation tank: φ500 mm x 2400 mm
Number of UV lamps: 6 lamps/unit
Size of a UV lamp: φ19 mm x 1500 mm

Other information

- The Brochure of the Kanagawa Prefectural Government's Water Service in the Hakone Town (Apr 2014)
- The Water Quality Report of the Kanawaga Prefectural Government's Water Supply Service (Jan 2016)

Case Study Report (Kissawa Water Source)		
water treatment process	Case #2-5	Kissawa Water Source
	Key word:	Ground water, Chlorine disinfection only
	Outline:	<Characteristics> ・Safe and refreshing drinking water: the ground water has a very good quality throughout the year. <Outline> ・Service area: the ground water is used to suppliment reservoirs of other water treatment plants. ・Maximum capacity: 1,100 m3/d 1st well: φ75×60m 2nd well: φ125 x 12 m、φ100 x 48 m
	Address:	Tsuchiya 1760, Hiratsuka City, Kanagawa Prefecture
	Land area:	322m^2
	Water treatment process:	Chlorine disinfection
	Capacity:	1,100 m3/d
	Water source:	Ground water
	Raw water quality:	■The raw water has a very high quality with little contaminaions. <Average raw water quality in FY2014 (maximum)> ・Turbidity: <0.1 degrees (<0.1 degrees) ・Hardness: 140 mg/L (140 mg/L) ・TOC: 0.2 mg/L (0.3 mg/L) ・p H: 7.6 (7.9) ・Geosmin: <0.001μg/L (-) ・2-MIB: <0.001 μg/L (-)
	Chemical dose:	Sodium hypochlorite (disinfection)
	Start of operation:	Unknown

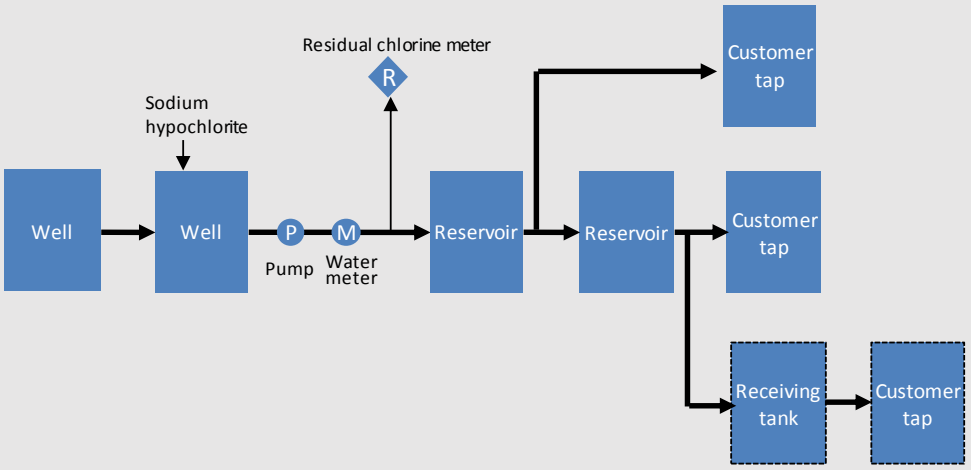
Case Study Report (Kissawa Water Source)

Water treatment process

Layout:

● Overview

Treatment process flow diagram:



Case Study Report (Kissawa Water Source)

Water treatment process

Pictures	●Well (outside)  ●Well (inside)  ●Intake facility  ●Pumping facility 
Other facilities:	–

Other information:

・The Water Quality Report of the Kanawaga Prefectural Government's Water Supply Service (Jan 2016)

Water Utility Information (FY 2014)

Basics

Name of utility:	Osaka Water Supply Authority		Service type:	Wholesale water supply	
Administrative population*1:	6.2 million people		Start of service*2:	2011	
Population served*1:	6.1 million people		Service area*3:	1100.46	km^2

Volume of water supply

Average daily water supply:	1.4 million	m^3/d	Breakdown: Household use	–	m^3/d
			Commercial and institutional use:	–	m^3/d
			Others:	–	m^3/d
			Wholesale water supply	1.4 million	m^3/d
Average daily water supply per person*4:	252.3	L/person/d	Service coverage:	–	%
Effectiveness:	100.0	%	Revenue water:	100.0	%
NRW:	0.0	%	Water loss	0.0	%

Note: as a wholesale supplier, service coverage is not applicable. NRW and water loss are both 0%.

Water rates

Water rates for 10m3/month:			– yen		(including taxes)
Water production cost:	64.35	yen/m^3	Water supply cost:	75	yen/m^3

Water Utility Information (FY 2014)

Facilities

	Name	Capacity	Water source	Treatment process
Water Treatment Plants:	Murano WTP	1,797,000 m^3/d	Surface water	Coagulation/sedimentation + Rapid filtration + Ozone + Granular activated carbon + Chlorine disinfection
	Niwakubo WTP	203,000 m^3/d	Surface water	Coagulation/sedimentation (only in the event of high turbidity events) + Biological treatment (contact filtration) + 2nd coagulation + Rapid filtration + Ozone + Granular activated carbon + Chlorine disinfection
	Mishima WTP	330,000 m^3/d	Surface water	Biological treatment (honeycomb tube) + Coagulation/sedimentation + Rapid filtration + Ozone + Granular activated carbon + Chlorine disinfection
	Total	2,330,000 m^3/d		

Pipes

Pipeline length:	573.19 km	Conveyance:	16.698	km	Transmission:	549.363	km
		Distribution:	0	km	Others:	7.129	km
Type of material:	・Cast iron 35.560 km ・Ductile iron 435.630 km ・Steel 101.999 km ・Stainless 0.025 km						

Others

Other information:

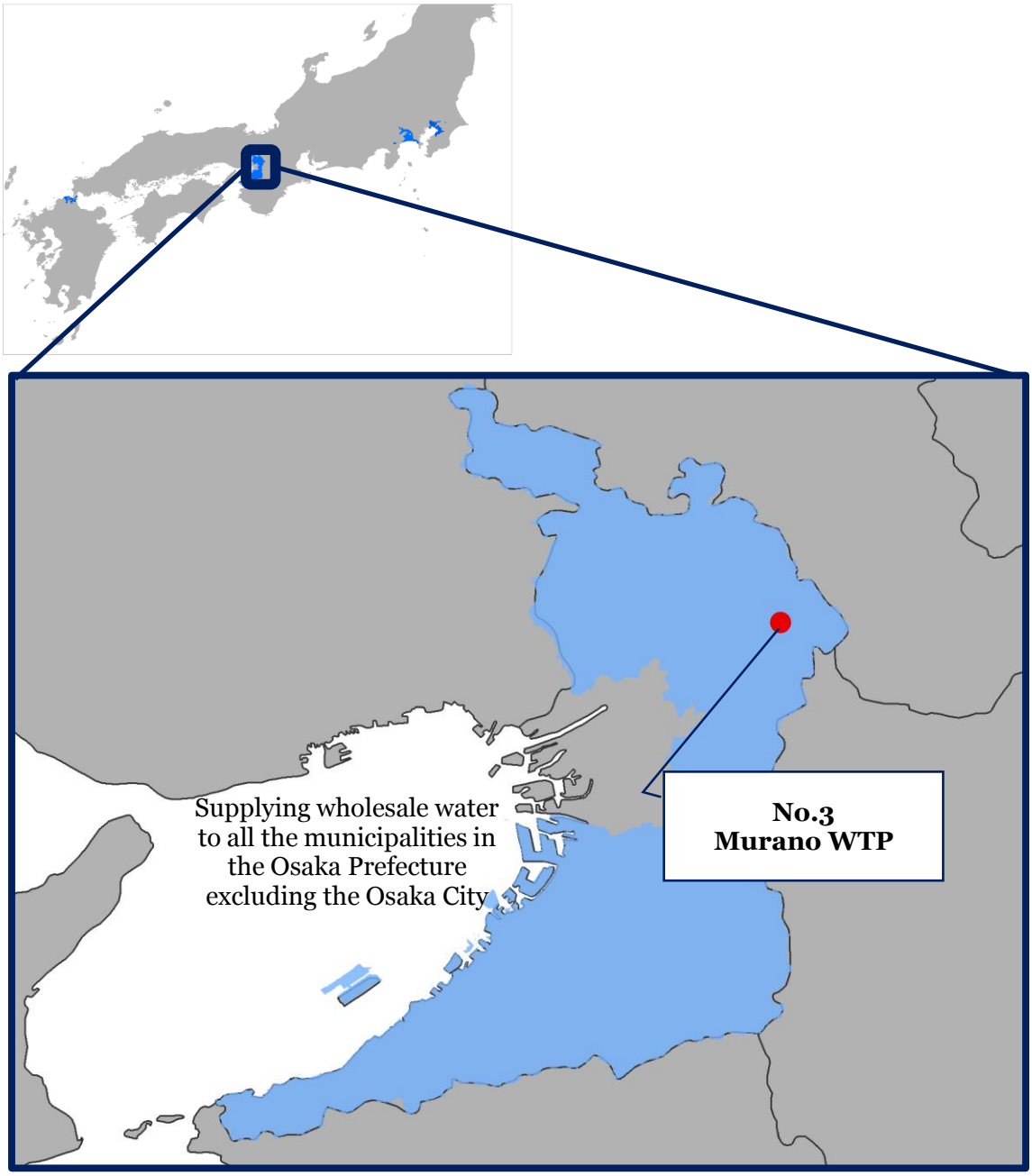
・Number of employees: 376
・Seismic reinforcement rate of pumping stations: 100%
・Seismic reinforcement rate of distribtuion reservoirs: 10.4%
・Maximum daily supply: 1.56 million m3
・Maxiumum facility utilization rate: 66.9% (Maximum daily supply/treatment capacity)
・Facility utilization rate: 60.7% (Average daily water supply/treatment capacity)

Remarks:

●Primary reference materials
・Osaka Prefectural Government. Water Supply Service in the Osaka Prefecture in FY2014. http://www.pref.osaka.lg.jp/kankyoeisei/suido/genkyo-26.html
・Osaka Water Supply Authority. Water Suply Statistics Annual Report FY2014. http://www.wsa-osaka.jp/siryoushu/toukei-nepo/26toukei_index.html
*1 The administrative population and the population served are those of the 42 municipalities in the Osaka Prefecture (excluding the Osaka City) in FY2014.
*2 The water supply department of the Osake Prefectural Government (the predecessor of the Osaka Wate Supply Authority) was created in 1940 and began water supply in 1951.
*3 Of the 42 municipalities in the Osaka Prefecture (excluding the Osaka City) in FY2013.
*4 Of the 42 municipalities in the Osaka Prefecture (excluding the Osaka City) in FY2012.
*5 The water treatment plants for industrial users are not listed here.

Water Utility Information (FY 2014)

Service area



Case Study Report (Murano Water Treatment Plant)

Water Treatment Process

Case #3	Murano Water Treatment Plant
Key word:	Advanced water treatment (ozone + granular activated carbon), Multi-story water treatment facility, Water pressure differential power generation, Surface water (river)
Outline:	<Outline> ・The Murano Water Treatment Plant is responsible for approximately 80% of the utility's water production. ・Ozonation and granular acivated carbon (GAC) treatment was installed in 1998 to address issues of musty odor and trihalomethane. <Characteristics> ・One of the largest water treatment plants in Japan in terms of capacity ・One of the first water treatment plants in Japan that adopted ozone and GAC ・A very rare, multi-story water treatment facility <Multi-story water treatment facility> ・The multi-story water treatment facility contains the equipments for sedimentation, filtration, ozonation, GAC treatment etc. These equipments are located on the multiple stories of two connected buildings. Each building has a capacity of 275,000 m3/d. The operation started in July 1980. (The advanced water treatment process was installed in 1994 in the multi-story water treatment facility.) ・When a water demand increase in the 1970s required an enhancement of the utility's water supply capacity, there was not enough available area on the premises to build a new facility. The utility thought it better, however, if a new facility could use some of the existing Murano facilities so they wouldn't have to build new ones. Their answer was the multi-story water treatment facility that requires much smaller site space and thus allows for more efficient daily inspections and repair work of the equipments. ・The facility has a pressure differential power generation system. Using a 10-meter difference in water levels among basins, it provides a maximum electricity of 240 kw. The accumulated electricity in 2014 was 1.41 million kWh.
Address:	Murano Takamidai 7-2, Hirakata City, Osaka Prefecture
Land area:	317,756 m^2
Water treatment process:	Coagulation/sedimentation + Rapid filtration + Ozone + GAC + Chlorine disinfection
Capacity:	1,797,000 m3/d
Water source:	Surface water (Yodo River)
Raw water quality:	■Since the plant abstracts water from the downstream of the Yodo River, the raw water is affected by the use in the upstream side of the river. It used to contain much ammonia nitrogen but its concentration has decreased to a non-significant level in recent years due to a development of sewage infrastructure. ■Because of an influence from the Lake Biwa situated upstream of the Yodo River, the raw water tends to be adversely affected by musty odor, picoplankton growth, and algae growth during summer that increase the pH. <Average raw water quality in FY2014 (maximum)> ・Turbidity: 8 degrees (62 degrees) ・Hardness: 42.6 mg/L (45.1 mg/L) ・TOC: 1.8 mg/L (2.4 mg/L) ・p H: 7.4 (7.8) ・Color: 20 degrees (190 degrees) ・Geosmin: 0.001 μg/L (0.004 μg/L) ・2-MIB: 0.004 μg/L (0.014 μg/L) ・TON: 24 (30)
Chemical dose:	Sulfuric acid (pH adjustment), Sodium hydroxide (pH adjustment), Polyaluminum chloride (coagulation), Sodium hypochlorite (disinfection)
Start of service	1963/7/1

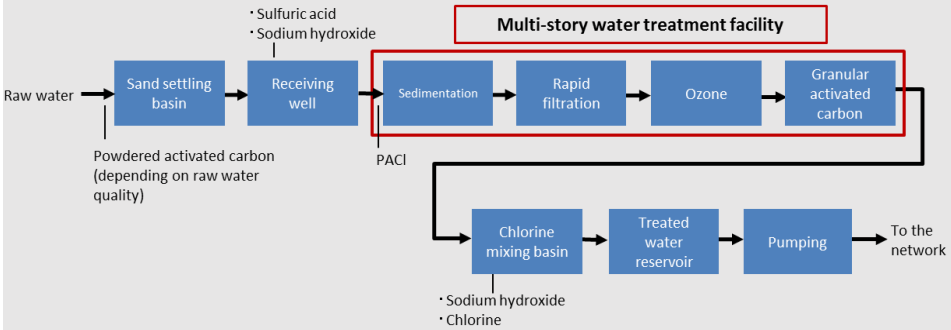
Case Study Report (Murano Water Treatment Plant)

Water Treatment Process

Layout

●Aerial view

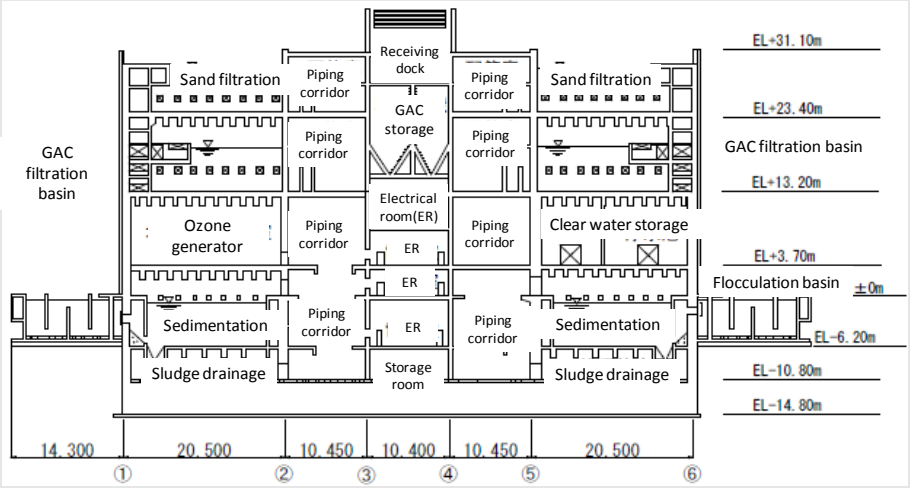
Treatment process flow diagram:



Pictures

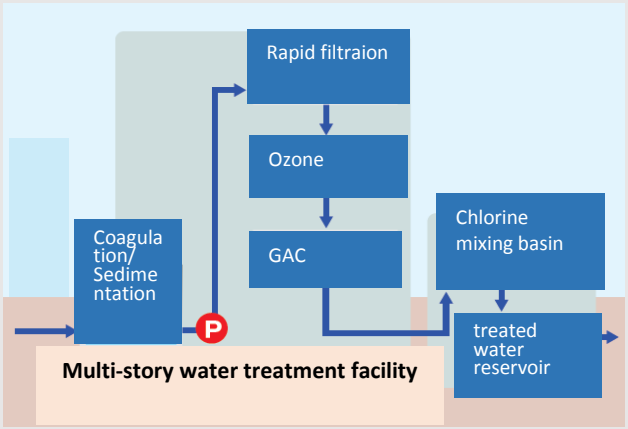
●The multi-strory water treatment facility has 72.3 m in length, 88.8 m in depth and 31.1 m in height.

Sectioned diagram of the multi-stroy water treatment facility



Case Study Report (Murano Water Treatment Plant)

Water Treatment Process

Other facilities:	● A solar power generation system: installed on the top cover of sedimentation basins. The cover also helps prevent algae growth. The maximum output is 360 kW. ● A pressure differential power generation system: the multi-story water treatment facility generates power by utilizing the difference in water pressure between the chlorine mixiging basin and the treated water reservoir.   Pressure differential power generation system ●Organic compound sensors in the intake station continuously monitor volatile organic compounds in the raw water. ●Carp Sensor is also installed in the intake station for continuous monitoring of the raw water quality.
Order/contract:	–
Expenses:	Unknown

Other information

Reference:
Osaka Water Supply Authority. Commemorative Publication for the Establishement of the Osaka Water Supply Authority. http://www.wsa-osaka.jp/event-pr/pamphlet/

Water Utility Information (FY 2014)

Basics

Name of utility:	Water and Sewer Bureau of the City of Kitakyushu		Service type:	Wholesale and retail water supply	
Administrative population:	957,000		Start of service:	1907	
Population served:	995,000		Service area:	270.16	km^2

Water supply volume

Average daily water supply:	310,000	m^3/d	Break down	Household use	213	m^3/d
				Commercial and institutional use:	61	m^3/d
				Others:	1.3	m^3/d
				Wholesale water supply	12	m^3/d
Average daily water supply per capita:	311	L/person/d	Service coverage:		99.6	%
Effectiveness:	93.11	%	Revenue water:		90.4	%
NRW:	2.69	%	Water loss		6.66	%

Water rates

Water rates for 10m^3/month:	842 / 780 yen (including taxes/excluding) *Calculation condition: The fixed charge is 680 yen. The volumetric charge is 10 yen/m^3. In case of service pipe of 13-mm diameter.		
Water production cost: 145.21 yen/m^3	Water supply cost: 144.65 yen/m^3		

Facilities

Water Treatment Plant and Facilities (including water for wholesale supply):

Name	Capacity	Water source	Treatment process
Ideura WTP	255,200 m^3/d	Dam, subsoil water, surface water	Coagulation/sedimentation + Rapid filtration
Dobaru WTP	7,800 m^3/d	Dam	Slow filtration
Hata WTP	24,000 m^3/d	Dam	Coagulation/sedimentation + Rapid filtration
Ano WTP	300,000 m^3/d	Dam, surface water	Biological contact filtration + Coagulation/sedimentation + Rapid filtration
Honjo WTP	141,000 m^3/d	Dam, surface water	Biological contact filtration + Coagulation/sedimentation + Rapid filtration
Total	728,000 m^3/d		

Pipes

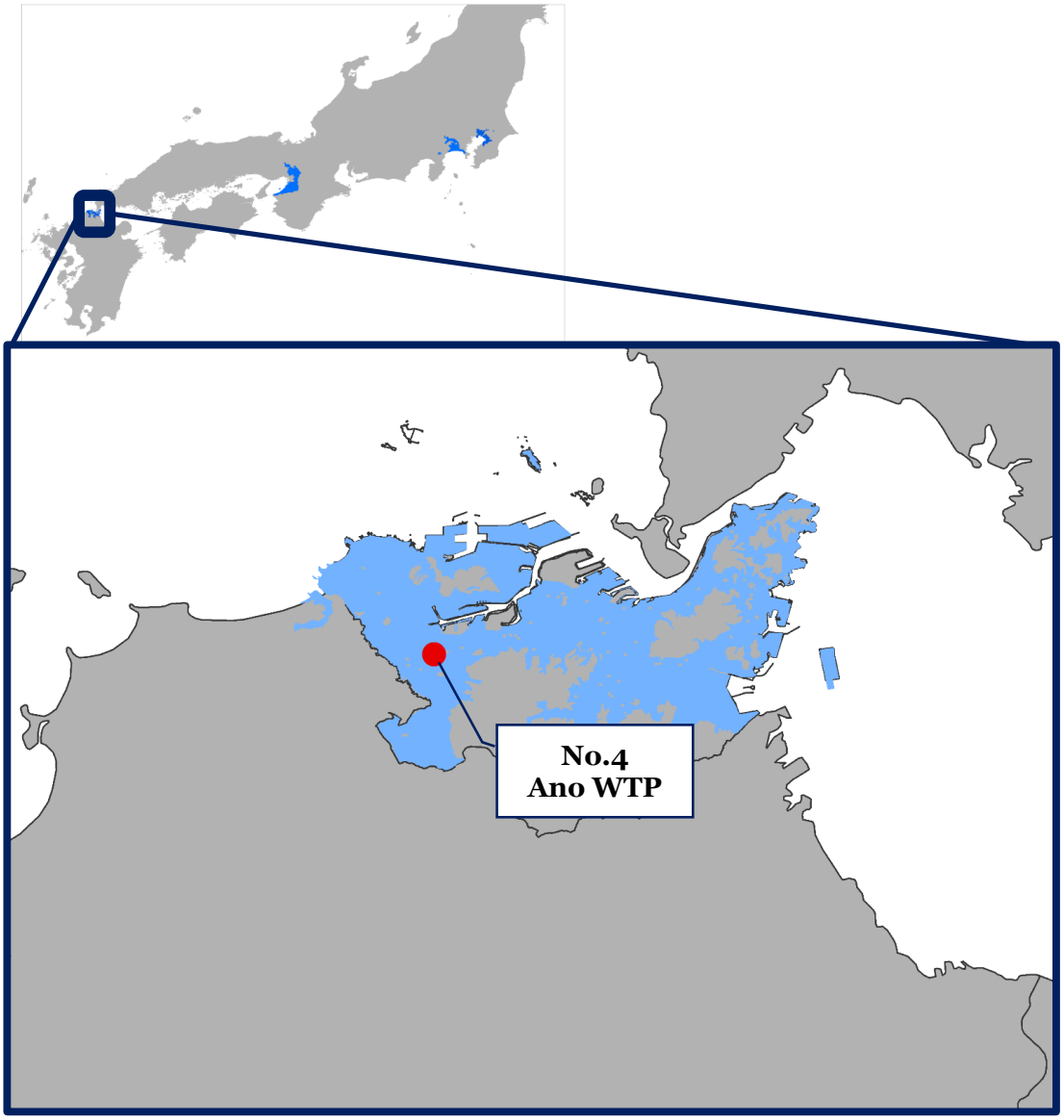
Pipieline length:	4,518.2 km	Conveyance:	188.6 km	Transmission:	230.8 km		
		Distribution:	4,098.6 km	Others:	– km		
Type of material:	・Ductile iron 3950.6 km ・Cast iron 265.7 km ・Steel 98.8 km ・Others (GP, VLP, etc) 156.4 km						

Others

Other information:	・Number of employees: 379 ・Maximum daily supply: 340,000 m^3 ・Maxiumum facility utilization rate: 44.4% (Maximum daily supply/treatment capacity) ・Facility utilization rate: 40.2% (Average daily water supply/treatment capacity)
Remarks:	●Kitakyushu City Water and Sewer Bureau. Outline of the Water and Sewer Services: https://www.city.kitakyushu.lg.jp/suidou/s00101009.html

Water Utility Information (FY 2014)

Service area



Case Study Report

Water treatment process

Case #4

Ano Water Treatment Plant (Upward Biological Contact Filtration: U-BCF)

Key word:	Advanced water treatment, Upward Biological Contact Filtration,Taste and Odor, Surface water (dam)

Outline:

<Characteristics>

1. Features of U-BCF

The Upward Biological Contact Filtration (U-BCF) system can remove ammonia nitrogen, dissolved manganese, and musty odor causing substances like geosmin efficiently. Using the U-BCF helped reduce the chemical dose at the Ano Water Treatment Plant.

2. U-BCF in other countries

The *Haiphong Water Supply One Member Company Limited* , the water utility in Haiphong City in Vietnam, has installed a U-BCF system in their Vinh Bao Water Treatment Plant.

<Outline>

・As the utility's primary water treatment plant, the Ano Water Treatment Plant has the capacity of 300,000 m3/d (39% of the total production).

・The U-BCF was developed by the utility itself. It was first installed in 2003.

<Characteristics of U-BCF>

・The core function of the U-BCF is to artificially reproduce a natural environment in which aquatic microorganisms decompose micropollutants in a more efficient manner.

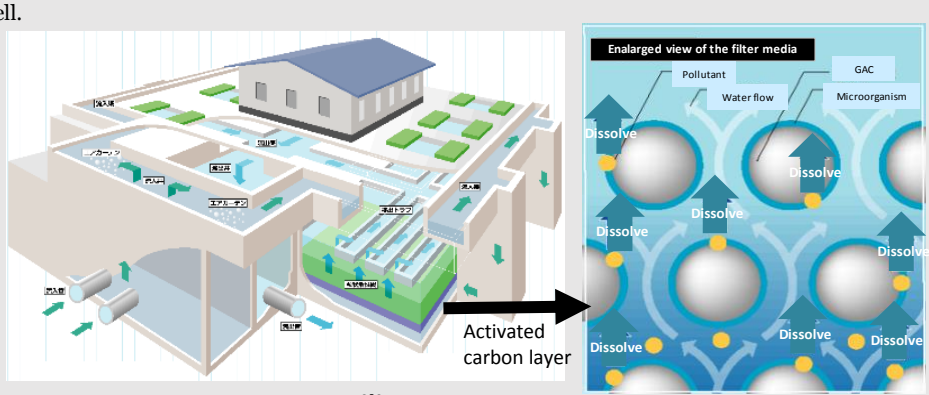
・The filter mediaum is granular activated carbon.

・Due to its porus, rugged, uneven surfaces, the granular activated carbon provides a much better environment than, for example pebbles in a riverbed for microorganizams to live in.

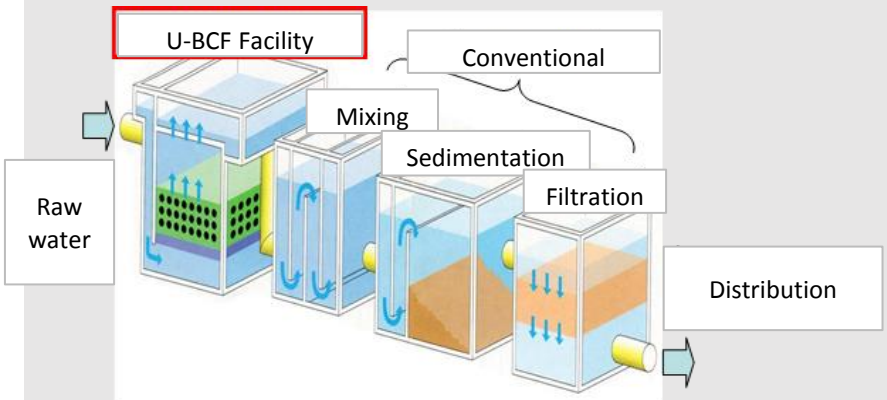
・An upward water flow through the activated carbon layers makes the raw water contact with microorganisms.

・The upward water flow stirs the granuler activated carbon, contributing to an improved biological contact.

・When the U-BCF was installed at the Ano Water Treatment Plant, it was placed before the receiving well.

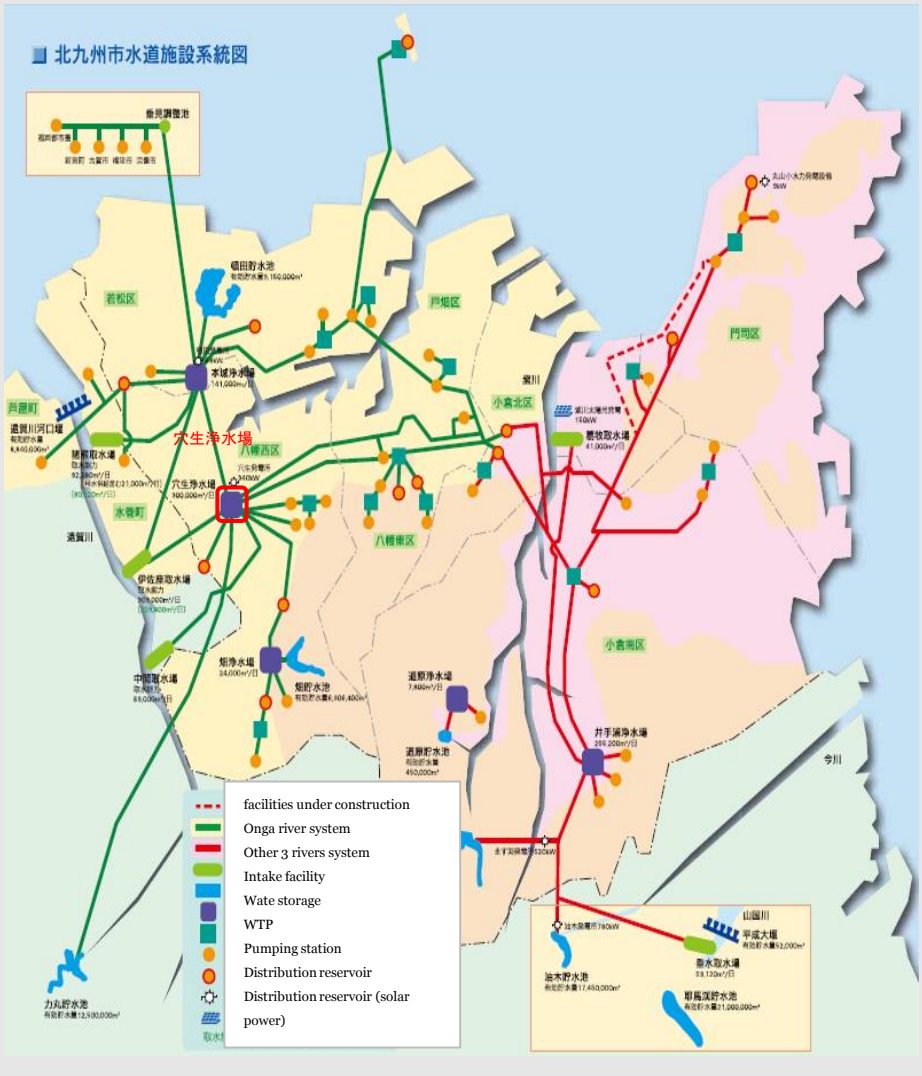


U-BCF Facility



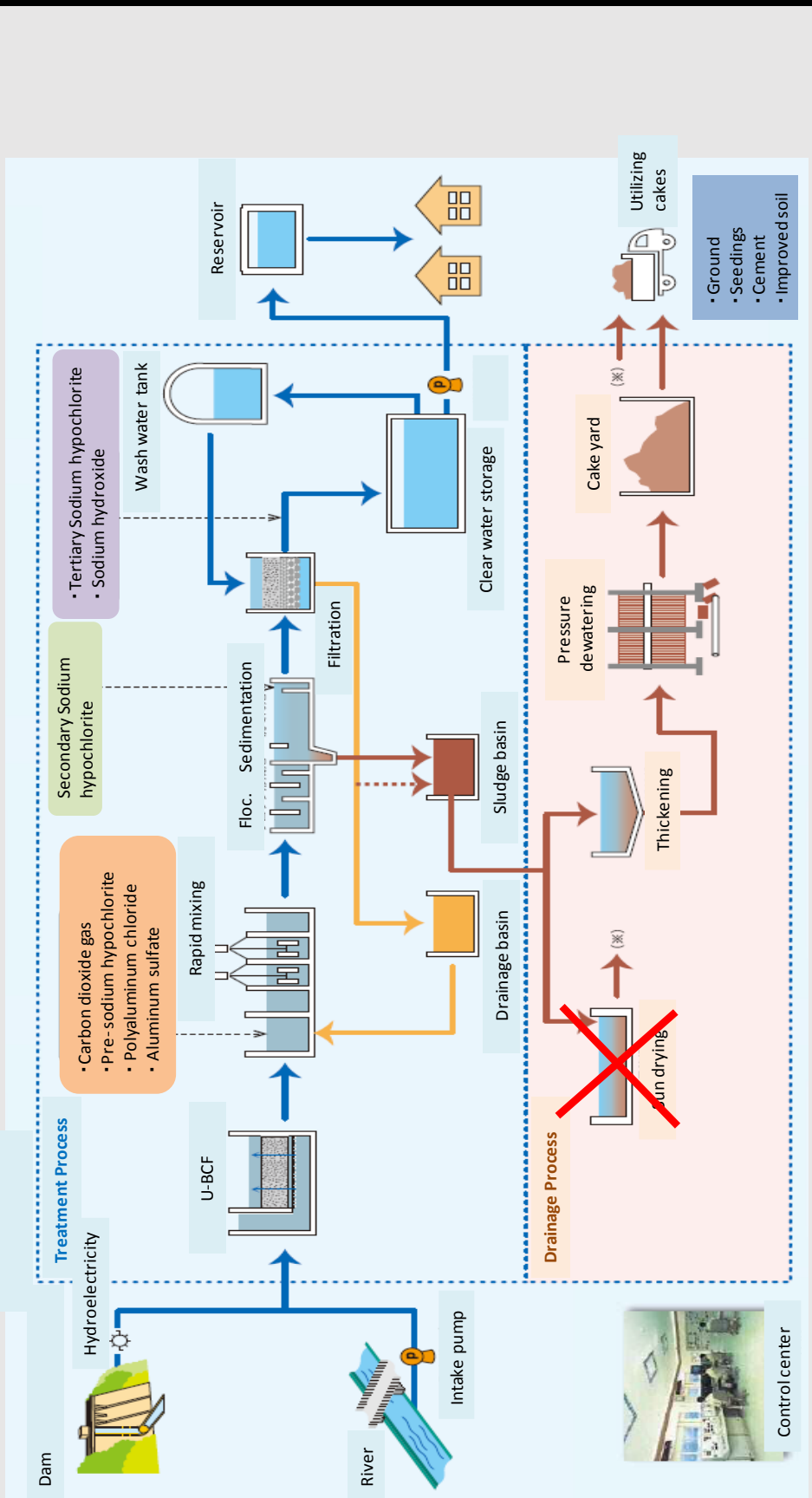
Case Study Report

Water treatment process

Address:	Takanosu 3-10-16, Yahata-Nishi Ku, Kita-Kyushu City, Fukuoka Prefecture
Land area:	84,150m^2
Water treatment process:	U-BCF + Coagulation/sedimentation + Rapid filtration
Water source:	Surface wtaer (river/dam)
Raw water quality:	■The raw water contains much musty odor substances, ammonia nitrogen and manganeze. <Average raw water quality in FY2014 (maximum)> ・Turbidity: 14 degrees (44 degrees) ・Color: 16 degrees (48 degrees) ・pH: 7.6 (7.8) ・Hardness: 66 mg/L (102 mg/L) ・TOC: 1.8 mg/L (2.7 mg/L) ・Ammonia nitrogen: 0.02 mg/L (0.09 mg/L) ・Dissolved manganeze: 0.007 mg/L (0.033 mg/L) ・Geosmin: 0.002 μg/L (0.006 μg/L) ・2-Methylisoborneol (2-MIB): 0.001 μg/L (0.002 μg/L)
Chemical dose:	As for the U-BCF, it requires no chemical dose.
Capacity:	171,000 m^3/d
Start of operation:	The U-BCF started operation in 2003 in the Ano Water Treatment Plant (in 2000 in the Honjo Water Treatment Plant).
Water supply network, City of Kitakyushu	

Water treatment process

Treatment process flow diagram:



Case Study Report

Water treatment process

Pictures	  Ano Water Treatment Plant — Upward Biological Contact Filtration (U-BCF)
Other facilities:	Small-size hydropower generation system
Order/ contract:	Tendering
Expenses:	Unknown
Other information:	–

Water Utility Information (as of 2016)

Basics

Name of utility:		Bureau of Waterworks Tokyo Metropolitan Government		Service type:		Wholesale + Retail water supply	
Administrative population:		13.74 million people		Start of service:		1898	
Population served:		9.37.5 million people		Service area:		626.79	km^2
Volume of water supply							
	Average daily water supply:	4.11 million	m^3/d	Break down	Household	2.96 million	m^3/d
					Industrial	37,000	m^3/d
					Urban	1.11 million	m^3/d
	Average daily water supply per person:	-	L/person/d	Service coverage:		100	%
	Effectiveness:	96.7	%	Revenue water:		96.0	%
	NRW:	4.0	%	Water loss		3.1	%
Water rates							
	Water rates for 10 m^3/month:			1,047/970 yen (with taxes/without taxes)			
				**Calculation condition: the fixed charge is 860 yen and the volumetric charge is 0 yen for 13 mm at 1-5 m^3 use and 22 yen/m^3 at 6-10 m^3 use.			
	Water production cost:	208.95	yen/m^3	Water supply cost:		211.61	yen/m^3

Water Utility Information (as of 2016)

Facilities

Water Treatment Plants: (including the water received for wholesale supply)

Name	Capacity		Water source	Treatment process
Kanamachi WTP	1,500,000	m³/d	Tone River・Arakawa River	Rapid filtration・Advanced water treatment (applied entirely)
Misato WTP	1,100,000	m³/d	Tone River・Arakawa River	Rapid filtration・Advanced water treatment (applied entirely)
Asaka WTP	1,700,000	m³/d	Tone River・Arakawa River	Rapid filtration・Advanced water treatment (applied entirely)
Mikuni WTP	300,000	m³/d	Tone River・Arakawa River	Rapid filtration・Advanced water treatment (applied entirely)
Higashimurayama WTP	1,265,000	m³/d	Tone River・Arakawa River・Tamagawa River	Rapid filtration・Advanced water treatment (applied partially for 880,000 m³/d of Tone River・Arakawa River waters)
Ozaku WTP	280,000	m³/d	Tamagawa River	Rapid filtration
Sakai WTP	315,000	m³/d	Tamagawa River	Slow filtration
Kinuta WTP	114,500	m³/d	Tamagawa River	Membrane filtration・Slow filtration
Kinutashimo WTP	70,000	m³/d	Tamagawa River	Membrane filtration・Slow filtration
Tamagawa WTP	(152,500)	m³/d	Tamagawa River	Slow filtration・Rapid filtration *operation suspended due to raw water degradation
Nagasawa WTP	200,000	m³/d	Sagamihara water	Rapid filtration
Suginami WTP	15,000	m³/d	Ground water	Disinfection only
Total	6,859,500	m³/d		

Pipes

Pipeline length:	27,792 km	Conveyance:	- km	Transmission:	- km
		Distribution:	27,038 km	Others:	- km

Type of material:
- Cast iron
- Steel
- Others

Others

Other information:
- Number of employees: 3,800 (as of August 1 2017)
- Maximum daily supply: 4.51 million m³/d
- Facility utilization rate: 78.6% (maximum daily supply/facility capacity)

Remarks:
- "Overview of the Water Services." Bureau of Waterworks Tokyo Metropolitan Government. https://www.waterworks.metro.tokyo.jp/

Case Study Report (Asaka Water Treatment Plant)

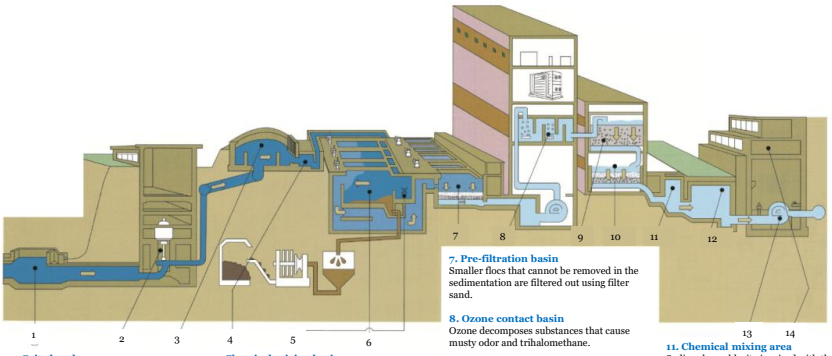
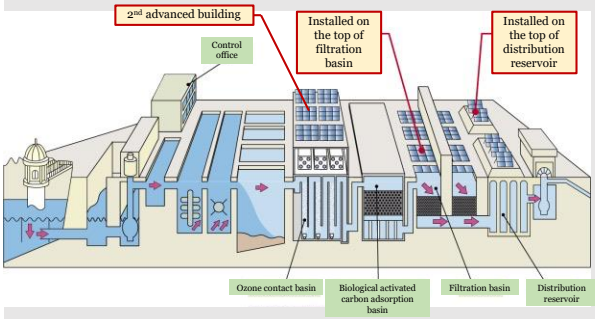
Water Treatment Process

Case #5 Asaka Water Treatment Plant

Key word:	Advanced water treatment; raw water accommodation pipeline; solar power generation
Outline:	<Characteristics> 1. Installation of advanced water treatment process Following the Kanamachi Water Treatment Plant (WTP) and the Misato WTP, the Bureau installed an advanced water treatment using ozonation and biological activated carbon process at the Asaka WTP in November 2004. Together with the second-phase facilities completed in March 2014, the advanced treatment now accounts for Asaka's entire water treatment of 1.7 million m^3/d. This also means that all the water abstracted from the Tone River and its tributaries are now being treated through the advanced treatment at various WTPs of the Bureau including the Asaka. 2. Mutual accommodation of raw water The Asaka WTP has been connected with the Higashimurayama WTP by a raw water accommodation pipeline. This allows the Asaka to use the Tama River's water when needed, in addition to the water from the Tone River and the Arakawa River. 3. Use of PFI (public finance initiative) Since April 2005, the Asaka has operated its power generation facility and sodium hypochlorite production facility under PFI scheme. <Advanced Water Treatment Process> • The advanced water treatment process consists of an ozonation and a biological activated carbon absorption. It aims to reliably and efficiently remove substances that cannot be adequately removed by the conventional water treatment processes such as rapid filtration. • The ozonation oxidizes and decomposes substances that can produce musty odor and trihalomethanes. • The biological activated carbon (BAC) adsorption removes pollutants through activated carbon adsorption and decomposition by microorganisms that grow on the carbon. • The Bureau has installed an "ozonation + BAC" before filtration so it comes in as the final treatment process, as it can trap and remove microorganisms that may leak from the BAC layer. This decision was made based on the research and experiments conducted for six years from 1983. • In addition, the Asaka WTP also uses filtration before "ozone + BAC" in order to reduce trihalomethane precursors efficiently and to reduce the power consumption required for ozone injection. ＜Raw water accommodation pipe> • The utility has installed a "raw water accommodation pipe" that allows raw water from different river systems to be mutually accommodated for efficient use of raw water. • Asaka normally abstracts from the Tone River system, but sending some of its water to the Higashimurayama water treatment plant helps keep enough water stored all the time from the Tama River system, including at the Ogouchi reservoir. • In the event of drought or water quality incidents in the Tone River system, raw water from the Tama River system is used by receiving its water from the Higashimurayama water treatment plant.
Land area:	228,206 m^2 (excluding water drainage facility)
Water treatment process:	coagulation + sedimentation + ozonation + granular activated carbon + chlorine disinfection
Water source:	Surface water (rivers)

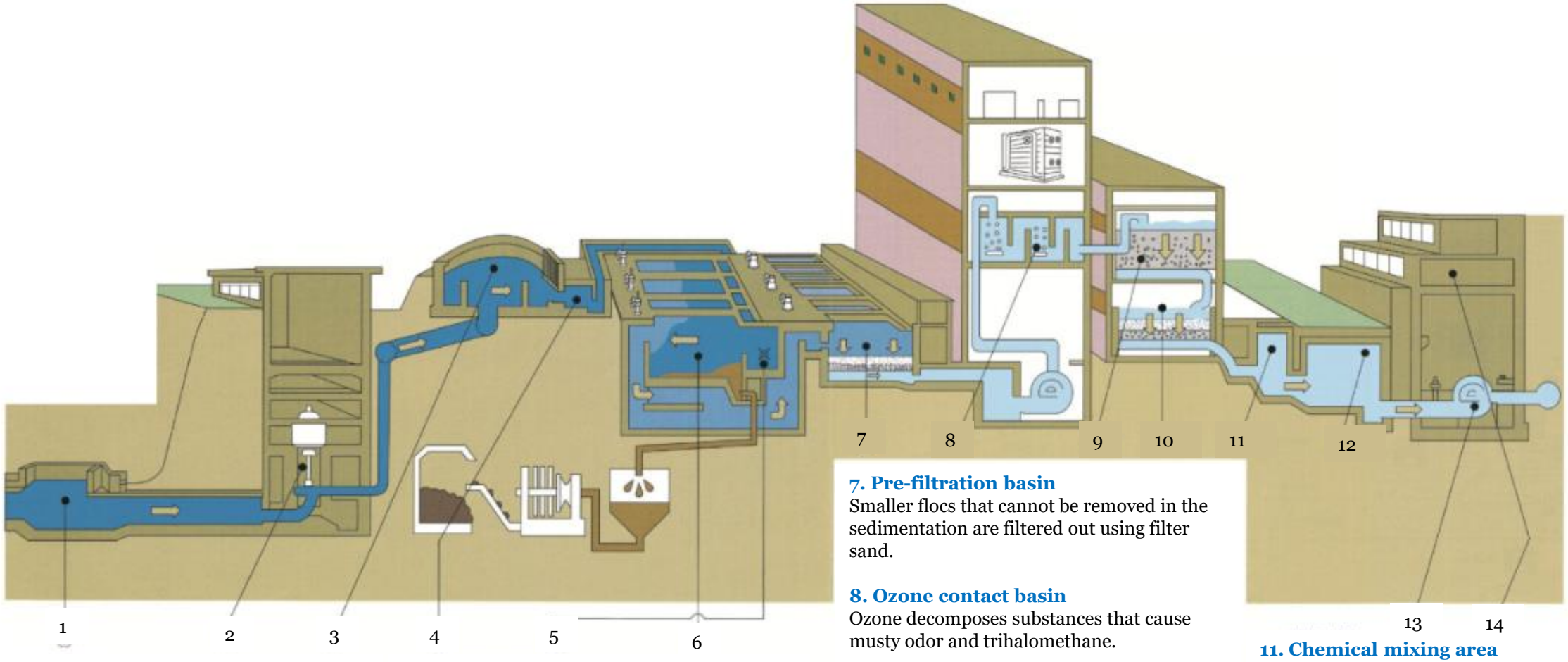
Raw water quality:	• Because the intake point is located in the lower reaches of the Arakawa River, the concentration is relatively high of water quality parameters that could affect the treatment process, such as organic matters and ammonia nitrogen. • In recent years, the concentration of substances that can cause musty odor has been relatively high due to the effects of algae attached to stones on the riverbed. • When the amount of water is short for distribution due to drought and other reasons, water is temporarily taken from the Arakawa Reservoir located right in front of the intake point. This water is susceptible to the water quality within the Arakawa Reservoir (especially the substances that can cause musty odor). <Average raw water quality in FY2018 (maximum)> Turbidity: 12 degrees (740 degrees) Color: 7 degrees (26 degrees) TOC: 1.7 mg/L (2.5 mg/L) Potassium permanganate consumption: 6.0 mg/L (34 mg/L) Ammonia nitrogen: 0.10 mg/L (0.43 mg/L) Iron: 0.43 mg/L (1.0 mg/L) Manganese: 0.076 mg/L (0.099 mg/L) Geosmin: 2 μg/L (20 μg/L) 2-MIB: 6μg/L (170 μg/L)
Chemical dose:	sulfuric acid (pH adjustment), caustic soda (pH adjustment), polyaluminum chloride (flocculation), sodium hypochlorite (disinfection), powdered activated carbon (odor removal)
Capacity:	1,700,000 m^3/d
Start of service	October 1966

Case Study Report (Asaka Water Treatment Plant)

Treatment flow diagram:	 **1. Grit chamber** Sand and soils mixed in the abstracted water are settled. **2. Water pump** Water is pumped into the receiving well. **3. Receiving well** Water pumped up by the water pump is led to the flocculation basin. **4. Chemical mixing basin** Polyaluminum chloride (flocculant) is added to collect and settle fine sand and soil mixed in the water. **5. Flocculation basin** Fine sand and soil mixed in the water are made into flocs that are easy to settle. **6. Sedimentation basin** While the water is slowly flowing, the flocs in the water settle to the bottom to make the water cleaner. **7. Pre-filtration basin** Smaller flocs that cannot be removed in the sedimentation are filtered out using filter sand. **8. Ozone contact basin** Ozone decomposes substances that cause musty odor and trihalomethane. **9. Biological activated carbon adsorption basin** Activated carbon removes the substances decomposed by ozone. Also, the microorganisms grown on the activated carbon decompose ammonia and other substances. **10. Post-filtration basin** The water is filtered again to make it safe and tasty to drink. **11. Chemical mixing area** Sodium hypochlorite is mixed with the filtered water for disinfection. **12. Water distribution reservoir** Clear water is stored. **13. Transmission and distribution pump** The water stored in the distribution reservoir is sent out for distribution. **14. Control room** The room is used to monitor the dosage of various chemicals and water quality.
Other facilities:	<Solar power generation system> Solar panels installed on the top of the filtration basin. Capacity: 1,200 kW Solar panels installed on the roof of the second-phase building and on the top of distribution reservoirs. Capacity: 500kW   
Order/ contract:	-
Expenses:	Unknown

Other information

https://www.waterworks.metro.tokyo.jp/suidojigyo/gaiyou/shisetsu.html



1. Grit chamber
Sand and soils mixed in the abstracted water are settled.

2. Water pump
Water is pumped into the receiving well.

3. Receiving well
Water pumped up by the water pump is led to the flocculation basin.

4. Chemical mixing basin
Polyaluminum chloride (flocculant) is added to collect and settle fine sand and soil mixed in the water.

5. Flocculation basin
Fine sand and soil mixed in the water are made into flocs that are easy to settle.

6. Sedimentation basin
While the water is slowly flowing, the flocs in the water settle to the bottom to make the water cleaner.

7. Pre-filtration basin
Smaller flocs that cannot be removed in the sedimentation are filtered out using filter sand.

8. Ozone contact basin
Ozone decomposes substances that cause musty odor and trihalomethane.

9. Biological activated carbon adsorption basin
Activated carbon removes the substances decomposed by ozone. Also, the microorganisms grown on the activated carbon decompose ammonia and other substances.

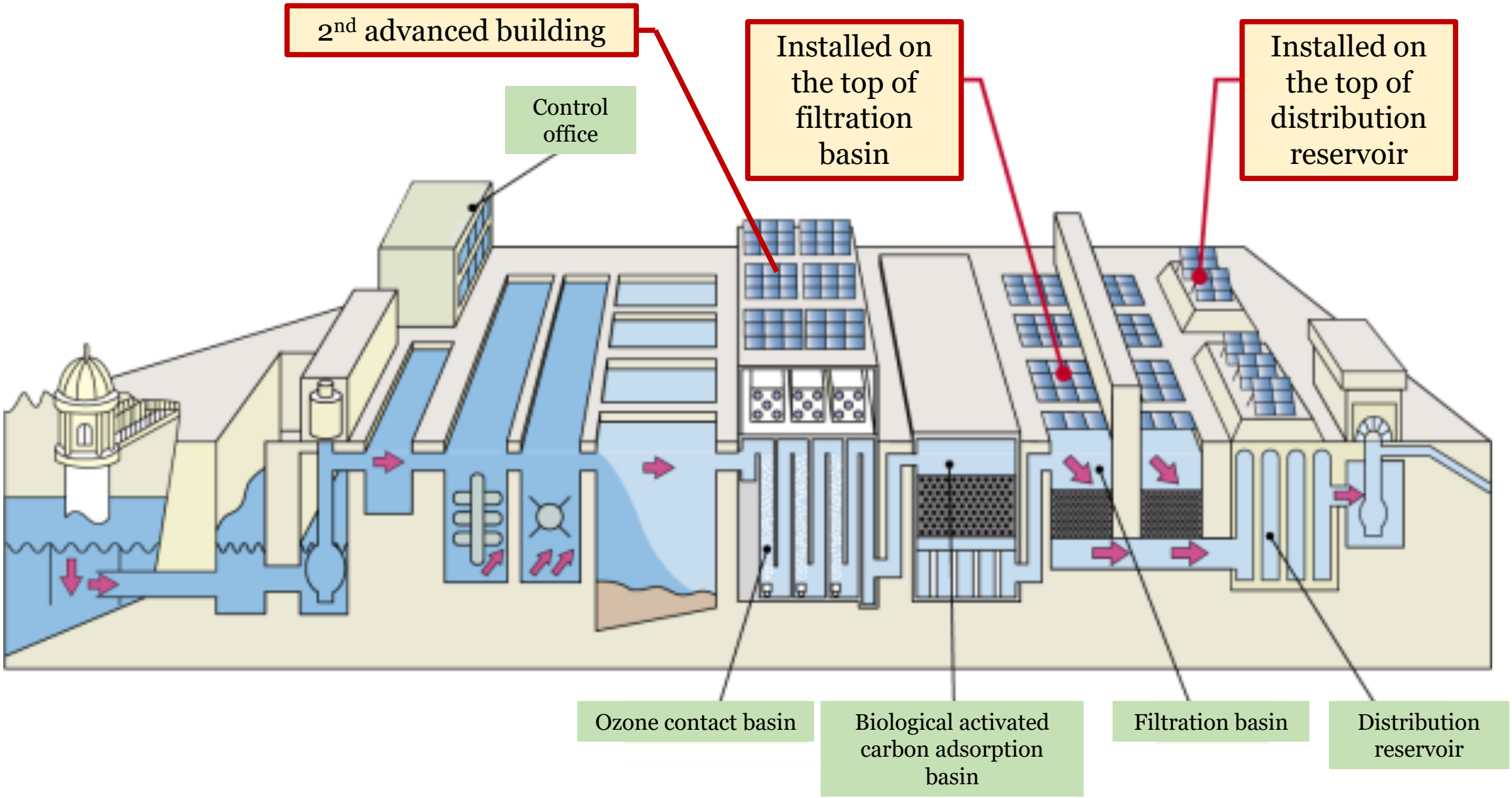
10. Post-filtration basin
The water is filtered again to make it safe and tasty to drink.

11. Chemical mixing area
Sodium hypochlorite is mixed with the filtered water for disinfection.

12. Water distribution reservoir
Clear water is stored.

13. Transmission and distribution pump
The water stored in the distribution reservoir is sent out for distribution.

14. Control room
The room is used to monitor the dosage of various chemicals and water quality.


2nd advanced building
Control office
Installed on the top of filtration basin
Installed on the top of distribution reservoir
Ozone contact basin
Biological activated carbon adsorption basin
Filtration basin
Distribution reservoir