WATER & TOKYO

Revised edition

Master Plan for Construction of Tokyo Waterworks Facilities

Outline

February 2016

Bureau of Waterworks, Tokyo Metropolitan Government

Supporting "Tokyo, a Leading City in the World," with Stable Supply of safe, potable delicious and high-quality water

Tokyo Waterworks faces various problems such as aging facilities, major earthquake/disaster threats and climate change that impact on water services.

For this reason, we have presented the middle- and long-term directions of facility development and formulated the "Master Plan for Construction of Tokyo Waterworks Facilities" that sets out the decadal targets and concrete measures to achieve them.

This time, we revised the plan to further enhance the crisis management, etc., including the covering of water purification facilities to be prepared for volcanic eruptions and terrorism, the seismic reinforcement measures for pipelines, etc.

By constructing facilities based on the Master Plan, we will ensure stable supply of safe, potable delicious and high-quality water over the future, including during the period of the 2020 Tokyo Olympic and Paralympic Games.

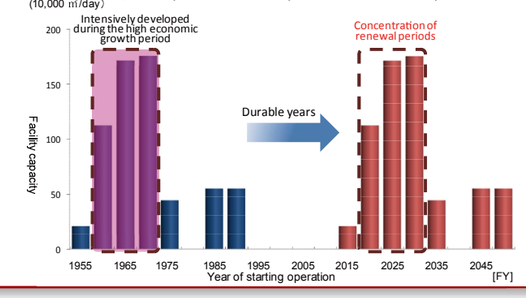
The period of the Plan is 10 years from FY 2016 to FY 2025.

Current Status of Tokyo Waterworks

Aging waterworks facilities and concentration of renewal periods

- ○ A number of water purification plants (WPPs) will be subject to renewal from approximately 2020 because almost 70% of all the WPPs were developed during the high economic growth period.
- ○ Some of the mains do not have secured backup pipelines, which makes replacement work difficult under existing conditions.

＜Capacity of WPPs by construction year＞



Threat of great earthquakes and disasters

- ○ It is expected that an Earthquake beneath Tokyo is highly likely to occur.
- ○ In recent years, damage has been done across Japan by flooding of waterworks facilities and long-term water outage associated with large typhoons and torrential rains.
- ○ The risk of volcanic eruptions, terrorism, etc. is increasing.

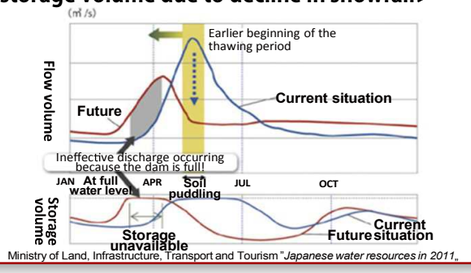
＜Damage to waterworks facilities caused by an earthquake disaster (Iwate Prefecture)＞

(Source: Ministry of Health, Labour and Welfare/ Japan Water Works Association)

Impacts of climate change

- ○ There is likelihood of severe drought due to significant decline in snowfall and early thaws caused by global warming.
- ○ Due to global warming, there are likelihood of abnormal proliferation of underwater organisms by rising water temperature and that of sudden deterioration of raw water quality by heavy rain, etc.

＜Changes in the river flow rate and the dam storage volume due to decline in snowfall＞



Ministry of Land, Infrastructure, Transport and Tourism "*Japanese water resources in 2011*„

Facility improvements in the Coming Decade

Ensuring stable water supply	Securing water resources	Project 1	Securing water resources
	Renewing water purification plants	Project 2	Renewing water purification plants and covering of water purification facilities
		Project 3	Renewing facility equipment
	Enhancement backup functions	Project 4	Duplexing of conveyance facilities
		Project 5	Duplexing and networking of transmission pipes
		Project 6	Establishing and expanding water supply stations
	Facility development in Tama area	Project 7	Restructuring small-scale water purification plants in Tama area
		Project 8	Restructuring the distribution areas in Tama area
Promoting earthquake countermeasures	Reinforcing earthquake-resistance of facilities	Project 9	Reinforcing quake resistance of reservoirs & water intake/conveyance facilities
		Project 10	Reinforcing quake resistance of water purification facilities
		Project 11	Reinforcing quake resistance of distribution reservoirs
	Reinforcing earthquake-resistance of pipelines	Project 12	Reinforcing quake resistance of distribution pipes
		Project 13	Reinforcing quake resistance of service pipes
	Promotion of autonomous power generation	Project 14	Reinforcing non-utility power generation facilities
	Flood damage prevention	Project 15	Flood damage prevention
Providing safe, potable delicious water	Responding to water quality issues	Project 16	Measures concerning water quality of the Tamagawa River system
		Project 17	Appropriate management of receiving tanks
	Shifting to the direct water supply system	Project 18	Promoting the shift to the direct water supply system

Systematic promotion of the renewal of WPPs

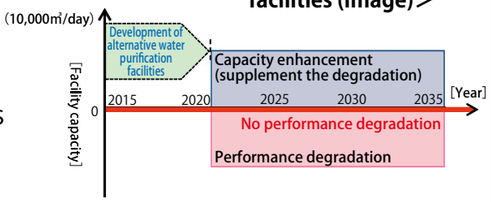
We will launch the renewal project of water purification plants (WPPs) while ensuring stable water supply, following the prior development of alternative facilities.

In constructing alternative purification facilities and renewing WPPs, we will cover water purification facilities as well.

Major projects

- Reconstruction of Sakai WPP: to be completed in FY 2021
  (Alternative facility for renewal of Higashimurayama WPP)
- Reinforcing of Misato WPP: to be completed in FY 2023
  (Alternative facility for renewal of Kanamachi WPP)
- Renewal of Higashimurayama WPP: to be launched In FY 2022
- Renewal of Kanamachi WPP: to be launched in FY 2024

<Effects of developing alternative facilities (image)>



<Covered water purification plant (image)>

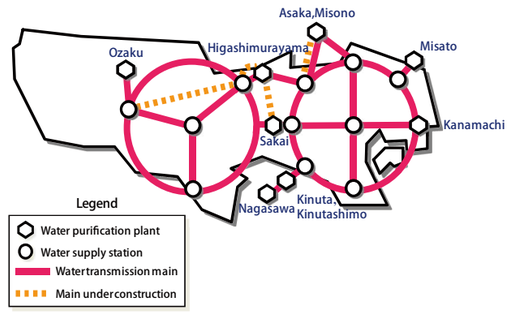
Enhancement of backup functions

We will promote the construction of a wide-area network of transmission pipes and the introduction of the dual system of water transmission to water supply stations, as well as the introduction of double pipelines for water conveyance facilities.

Major projects

- Improving the 2nd Raw Water Connecting Pipe (tentative) : to be completed in FY 2018
- Improving Tama North South Mains(tentative): to be completed in FY 2018
- Improving 2nd Asaka-Kamiigusa Mines(tentative): to be completed in FY 2020

<Network of water transmission pipes (image)>



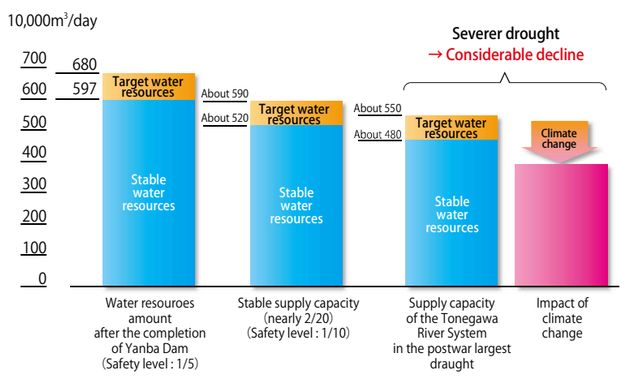
Securing of water resources

In light of the future climate change impacts, we will make efforts to secure stable water resources in order to ensure water supply even in a severe drought.

Major project

- Yanba Dam construction project: to be completed in FY 2019
  (Project by the Ministry of Land,Infrastructure, Transport and Tourism)

<Evaluation of water supply capacity of water resources (image)>



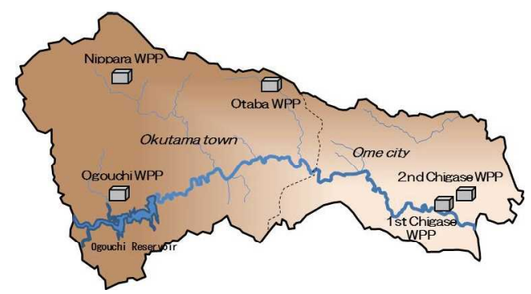
Promotion of facility improvement in Tama area

In renewing facilities, we will introduce appropriate and effective water purification methods accommodating the current raw water quality,etc.

Major projects

- Renewal of 2nd Chigase WPP: to be completed in 2018
- Renewal of 1st Chigase WPP: to be completed in 2021

<Renewing WPPs in Tama area(image)>



Promotion of 18 Projects Based on the Directions of Three Major Projects: "Securing of Stable Water Supply," " Promotion of Seismic Strengthening Measures," and "Safe, Potable delicious Water"

Promotion of seismic strengthening of facilities

We will promote reinforcement of reservoir bodies and seismic strengthening of WPPs and water supply stations based on the concept of the latest seismic strengthening construction.

Major projects

- Reinforcing the body of Murayamakami Reservoir: to be completed in FY 2023
- Seismic strengthening of Kanamachi WPP: to be completed in FY 2023
- Seismic strengthening of Nerima Water Supply Station: to be completed in FY 2017

<Example of seismic strengthening of a sedimentation basin>

Before seismic strengthening work

After seismic strengthening work

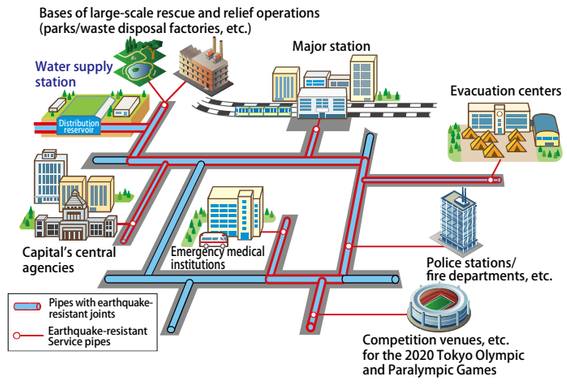
Promotion of seismic strengthening of pipelines

We will improve the rate of earthquake-resistant-joint pipes up to 61% and shorten the prospect of recovery period from 27 days (as of the end of FY 2014) to 16 days by FY 2025.

Major projects

- Introduction of distribution pipes with earthquake-resistant joints: about 5,000 km in the coming decade
- Introduction of earthquake-resistant-joint pipes for the supply routes to important facilities Capital's central agencies/emergency medical institutions, etc. : to be completed in FY 2019 Major station : to be completed in FY 2022

<Use of earthquake-resistant joint pipes for the supply routes to important facilities (image)>



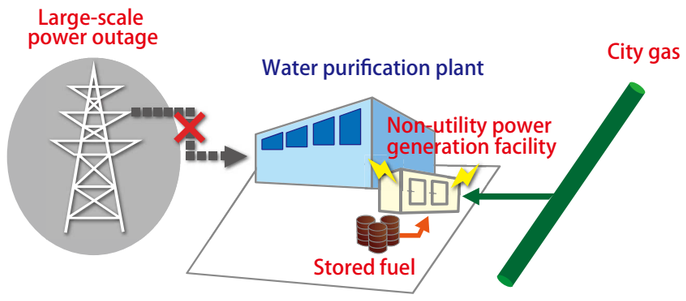
Promotion of autonomous power generation

We will achieve the water supply capacity of 100% even in a large-scale power outage in FY 2021 by developing non-utility power generation facilities.

Major projects

- Kanamachi WPP: to be completed in FY 2019
- Wadabori Water Supply Station: to be completed in FY 2021

<Autonomous power generation at WPPs (image)>



Note: Non-utility power generation facilities are operated by city gas or stored fuel.

Implementing measures against floods

We will implement measures against floods (e.g. raising of facilities) to prevent impacts of floods on facility equipment.

Major projects

- Kanamachi WPP: to be completed in FY 2016
- Asaka WPP: to be completed in FY 2016
- Kinuta WPP: to be completed in FY 2016

<Examples of measures against floods>

(Source: Expert panel for the Central Disaster Management Council)

Raising

Water-stop weir

Promotion of water quality improvement

In the Tamagawa River System that faces new problems, we will conduct a study on the introduction of the most suitable water purification method in order to supply of safe, potable delicious water without musty odors.

Major projects

- Improving the upstream area WPP (tentative): to be launched in FY 2021

<Example of water treatment experiment to remove musty odors>

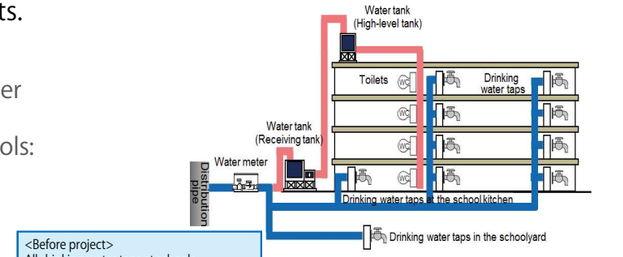
Promotion of the transition to the direct water supply system

We will promote the transition of the water tank supply system to the direct water supply one in order to deliver the safe, potable delicious water directly to customers' faucets.

Major projects

- Model project to introduce the direct water supply system for drinking water at elementary schools and junior high schools: to be completed in FY 2020

<Model project to introduce the direct water supply system for drinking water at elementary schools and junior high schools (image)>



<Before project>
All drinking water taps at schools provide water via water tanks

<After project (see illustration on the right)>
All drinking water taps at schools directly provide water

Basic concepts for facility development

We have a host of issues that we need to tackle, e.g. concentrated schedule for renewal of water purification plants (WPPs) and preparation for the Earthquake beneath Tokyo. The following are our basic concepts of facility development for responding appropriately to the abovementioned issues.

Water use (water demand)

○We have estimated that the water demand in the coming 25 years, by which time the first WPP renewal work will be completed, will peak in a decade after 2018 with about 6 million m^3 per day.

○We will ensure constant facility development in order to deliver tap water of 6 million m^3 per day – our current estimate – to customers.

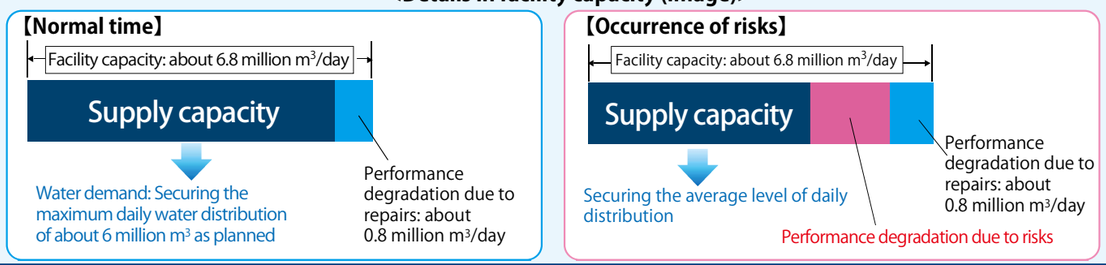
Capacity of providing tap water (facility capacity)

○Due to repair work of aging facilities, their original capacity of 6.86 million m^3 per day has currently dropped to about 6 million m^3 per day. This is almost the same as the present water demand, which suggests that the situation is tight.

○We will ensure the facility capacity of about 6.8 million m^3 that includes water demand and the decreased amount due to repair,etc.

○We will keep the average level of daily water distribution of the past decade even if the risk of emergency stop of the largest water purification plant occurs.

<Details in facility capacity (image)>



Responses to aging WPPs (renewal of WPPs)

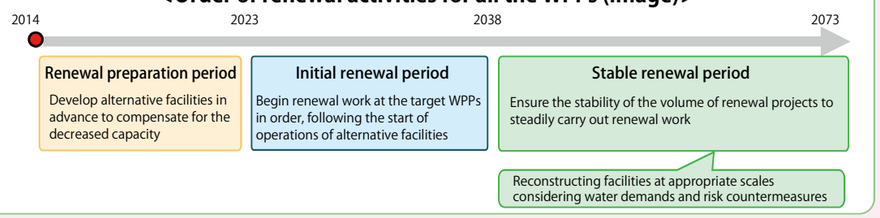
○In order to avoid significant capacity degradation due to renewal work, we will launch the work based on prior development of an alternative water purification facility of the equivalent capacity.

○This will allow us to promote systematic renewal work over 60 years while producing tap water in a stable manner.

○We will proceed with the long-term renewal of WPPs in a phased manner considering the future estimates of water demand, the emergence of new risks,etc. We will reconstruct facilities at appropriate scales by reviewing their capacities as required.

○In renewing facilities, we will cover water purification facilities to take all possible measures to ensure preparation for a crisis such as foreign matter contamination.

<Order of renewal activities for all the WPPs (image)>



Targets

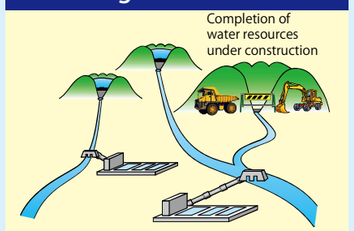
We will steadily promote facility development in accordance with the 21 indexes.

(Unit : %)

Index				FY2014 (Result)	FY2025 (Target)
Stable supply of water	Water resource availability for steady water supply at drought expected to happen once in every 10 years			93	100 【FY2020】
	Rate of the water supply in an accident			78	89
	Rate of renewal of the water purification plant			0	19
Countermeasures of earthquake disaster	Rate of earthquake-resistant facilities of principal structures of water purification facilities			51	100 【FY2024】
	Rate of earthquake-resistant filter basin			76	100 【FY2018】
	Rate of earthquake-resistant distribution reservoirs			70	99
	Rate of the replacement of early ductile iron pipes			53	100 【FY2021】
	Rate of earthquake-resistant pipeline joints			37	61
	Rate of earthquake-resistant-joint pipes used in supply routes serving important facilities	Capital's central agencies/emergency medical institutions, etc.		77	100 【FY2019】
		Evacuation centers	Junior high schools	36	100 【FY2019】
			Elementary schools	38	100 【FY2022】
			Colleges, high schools, community centers, etc.	36	100
		Major stations	Number of boarding passengers per day: over 200,000	41	100 【FY2019】
			Number of boarding passengers per day: over 100,000 and below 200,000	44	100 【FY2022】
		Bases of large-scale rescue and relief operations, etc.		43	100 【FY2019】
		Competition venues, etc. for the 2020 Tokyo Olympic and Paralympic Games		60	100 【FY2019】
	Rate of earthquake-resistant service pipes supplying evacuation centers and major stations			44	100 【FY2019】
	Rate of earthquake-resistant service pipes installed in private roads			38	85
	Rate of water supply available during massive power outage			61	100 【FY2021】
Safe, Potable delicious water	Achievement rate of residual chlorine decrease			85	100 【FY2016】
	Rate of direct water supply from distribution mains			70	75

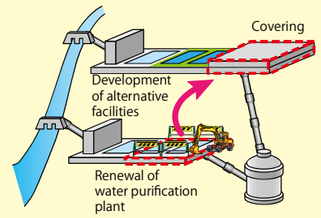
This is what Tokyo Waterworks will be in 10 years' time!

Securing water resources



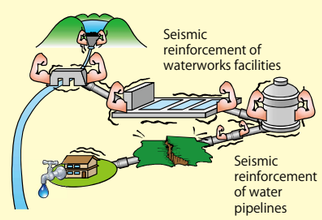
We have achieved 100 % of "water acquisition that responds to a drought that occurs once in a decade."

Renewal of WPPs



We have completed the development of alternative facilities for Sakai and Misato WPP and launched the renewal work for Higashimurayama WPP, etc.

Seismic reinforcement of waterworks facilities



We have achieved 100 % of the rate of earthquake-resistant facilities of principal structures of water purification facilities.
We have achieved 61 % of the rate of pipelines with earthquake-resistant joints.

Bureau of Waterworks, Tokyo Metropolitan Government