

# Block Distribution System for Equitable, Efficient and Resilient Distribution: Yokohama City and Fukuoka City



**Model of block distribution system  
(Fukuoka City Waterworks Bureau)**

**No. C4 Ver. 1**

# Contents

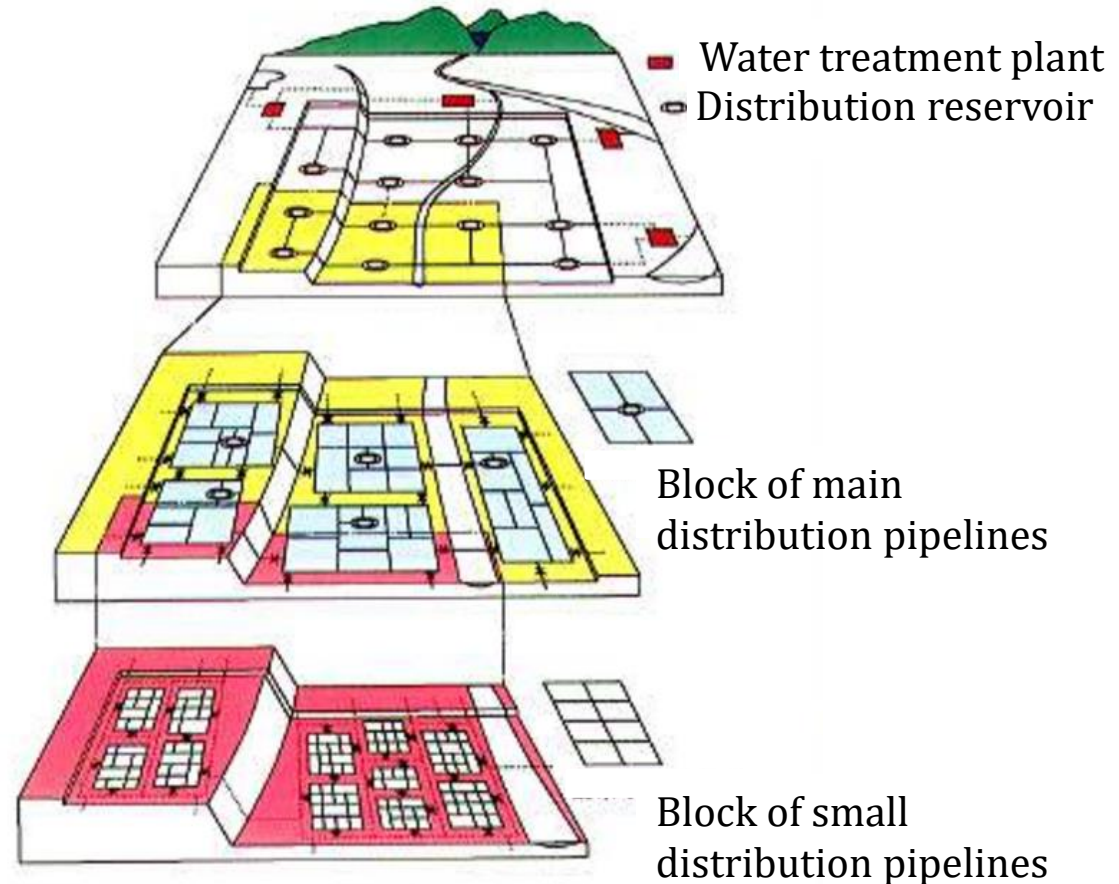
- 1. Introduction**
- 2. Block Distribution System in Japan**
- 3. Case 1 : Yokohama City**
- 4. Case 2 : Fukuoka City**
- 5. Lessons Learned**

# 1. Introduction

**Treated water transmission pipeline networks**

**Main distribution pipeline networks**

**Small branch distribution pipeline networks**



## Concept of treated water transmission and distribution system

Source: Bureau of Waterworks Tokyo Metropolitan Government,  
<https://www.waterworks.metro.tokyo.jp/suido/jigyo/torikumi/kadai/step21/05.html>

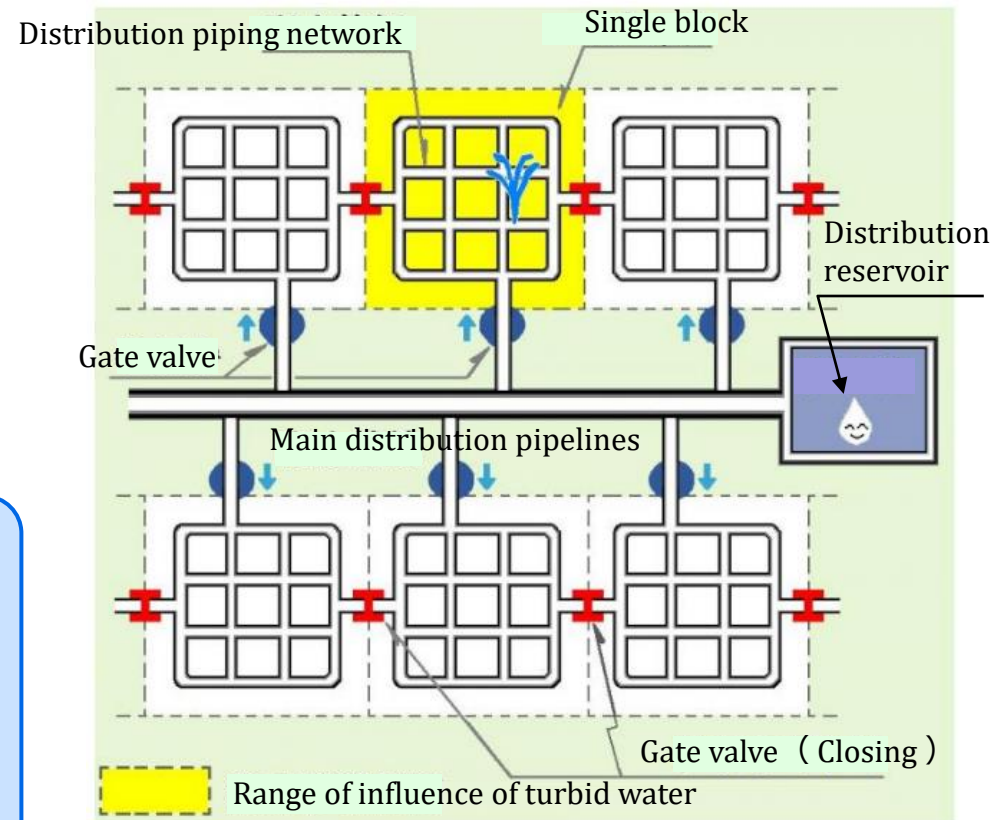
## 2. Block Distribution System in Japan

### (1) General Features

Both **District Metered Area (DMA)** and **Block Distribution System (BDS)** can be defined as a discrete area of a water distribution network.

While the aim of **DMA** is to reduce and control leakage, **BDS** has been developed and utilized in Japan for the following purposes :

- Optimization of water pressure
- Flow measurement in smaller blocks and quick adjustment of supply route
- Isolation of water mains and alternation of supply route
- Early detection of leakage



**Overview of block distribution system**

Source : Sapporo City

# 2. Block Distribution System in Japan

## (2) Background and History

**Yokohama**

The first water utility to use a block distribution system

Unorganized & intricate piping



Failure to manage distribution



Organize pipelines and make block a distribution system

**Fukuoka**



Prolonged serious drought  
→ Advanced water resource management and water supply operation

Source : Fukuoka City Waterworks Bureau  
[http://www.city.fukuoka.lg.jp/mizu/keikaku/machi/0060\\_3\\_2\\_3.html](http://www.city.fukuoka.lg.jp/mizu/keikaku/machi/0060_3_2_3.html)

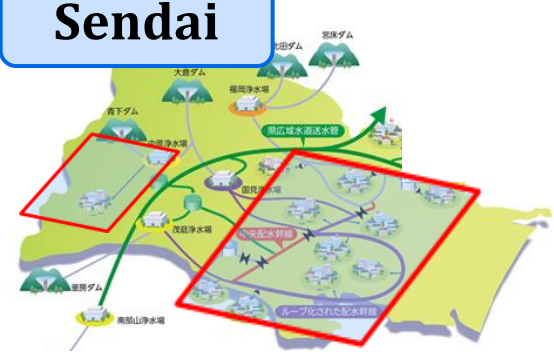
**Niigata**



Liquefaction caused by earthquakes  
→ Localized suspension of the water service

Source : Niigata City  
[http://www.city.niigata.lg.jp/shisei/koho/kohoshi/shiho/backnumber/h26/shiho140511/1\\_01.html](http://www.city.niigata.lg.jp/shisei/koho/kohoshi/shiho/backnumber/h26/shiho140511/1_01.html)

**Sendai**



Large difference in height in water supply districts  
→ Equalization of water pressure

Source : Sendai City Waterworks Bureau  
[https://www.suidou.city.sendai.jp/03\\_suisitu/16.html](https://www.suidou.city.sendai.jp/03_suisitu/16.html)

## 3. Case 1 : Yokohama City

### (1) Background and Purpose

Water intake from the Kanagawa Water Supply Authority to meet the increasing demand was decided in 1964.

To prepare the project it was necessary to;

- Know the capacity of existing distribution pipelines
- Decide where to locate new distribution pipelines

However, existing distribution systems at that time were not well organized due to financial difficulty.

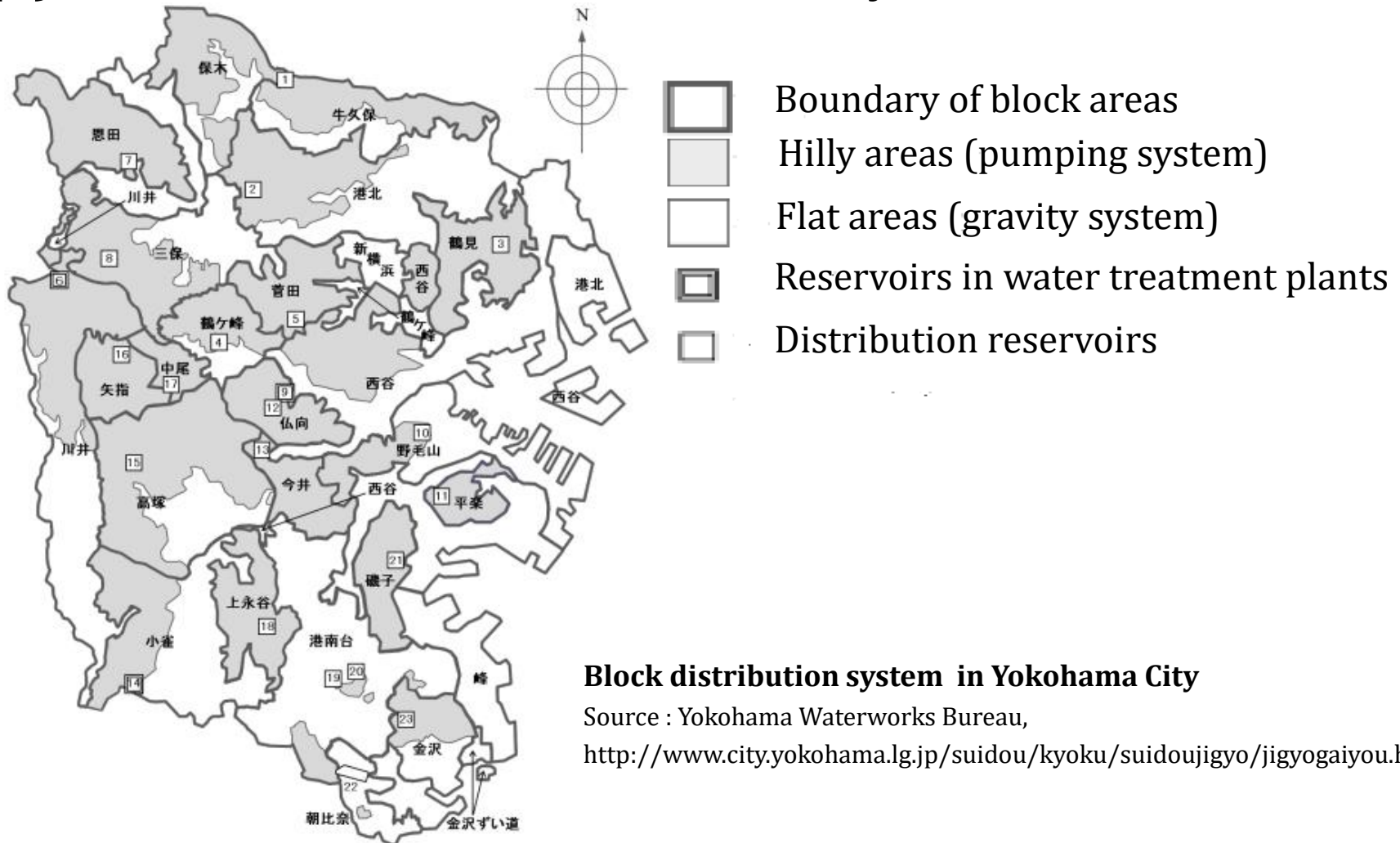
Simultaneous study for water consumption and water supply conditions in each town was implemented.

Design of **block distribution system**



# 3. Case 1 : Block Distribution System in Yokohama

## (2) The Effect of Block Distribution System



### 3. Case 1 : Block Distribution System in Yokohama

#### (2) The Effect of Block Distribution System (Cont'd)

- Introduction of **the block distribution system**
- **Pipeline information** database
- Network information using **computerized system** and **advanced mapping system**



- **Easy pressure control** by utilization of elevation
- **Easy distribution volume control** by valves in the network
- **Reduction of water service suspension time** for repairs and maintenance
- **Improvement of pipeline system**
- **Easy maintenance** in daily operation



## 4. Case 2 : Fukuoka City

### (1) Background and Purpose

#### **【 Drought in 1978 】**

- Water restrictions up to 287 days
- Drought was so severe that emergency water was brought from a distance using ships and trains.

**Water-saving  
urban  
development**



**Parched Dam during Period of Abnormally Low Rainfall in 1978**



**Water Trucks Dispatched during the Severe Drought**

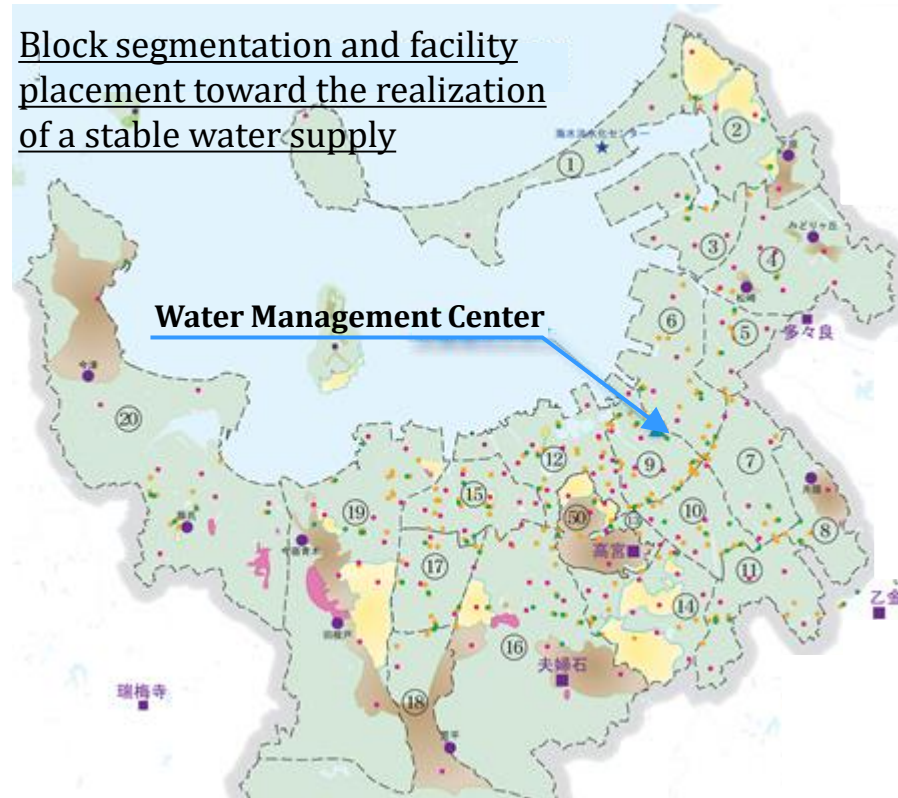
## 4. Case 2 : Fukuoka City

1978 Serious drought

- Reduction of **downtime** in **daily** water supply
- Reduction of supply **restrictions** during **drought** by multiple water sources
- **Uniform distribution** throughout the city
- **Detection of water leakage** through advanced monitoring

1981 Establishment of the **Water Management Center** and **21 distribution blocks**

Block segmentation and facility placement toward the realization of a stable water supply



**21 distribution blocks in Fukuoka City**

## 4. Case 2 : Fukuoka City

### Function of the Water Management Center

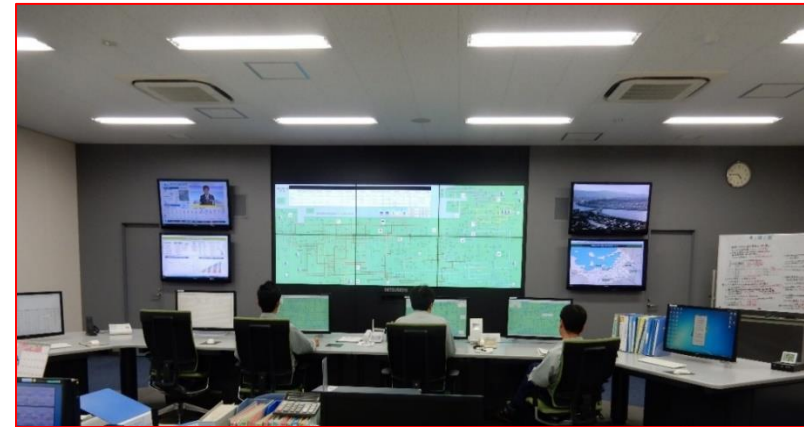
**Adjustment of flow rate and allocation** from different water treatment plants

**Leakage reduction** by controlling water pressure

**Reduction of labor** for valve exercising during droughts

**Early detection** of abnormal conditions and quick measures by remote control

**Efficient operation** based on **information collection and analysis**

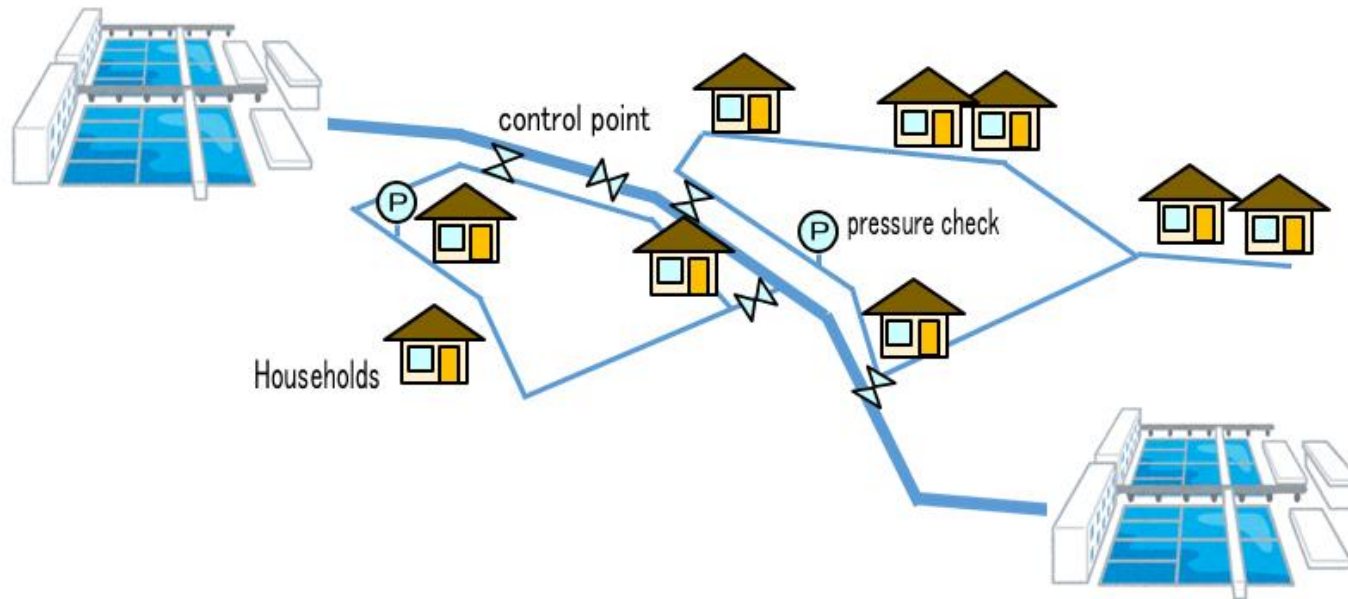


**The Water Management Center,  
Fukuoka City Waterworks Bureau**

- Opening and closing of 180 electric valves
- Manual remote operation from the Water Management Center

## 4. Case 2 : Fukuoka City

### (2) The Effect of Block Distribution System



#### Reduction of Leakage

- Reduced leakage **volume**  
4,000-5,000 m<sup>3</sup>/day
- Lowered leakage **incidents**  
30%

#### Minimization of service suspension

- **Mutual back up between treatment plants** when distribution is disrupted by accidents, construction, or repair at a certain point

## 5. Lessons Learned (1)

- **(Block Distribution System)** The system is used by most Japanese water utilities. It is very effective in **reducing leakage** and maintaining **stable supply** by: (1) **optimizing water pressure** in distribution pipelines, (2) measuring flows in small areas to allow **early detection of abnormal conditions**, (3) **identifying the location of broken pipes** quickly, and (4) allowing operators to **make immediate adjustments** to the distribution route and switch to a **backup** supply.
- **(Large and Small Blocks)** **Large blocks** allow switching between water sources and water treatment plants. **Small blocks** are **discrete areas within a large block** for switching distribution route during maintenance of the network.
- **(Yokohama System)** The block distribution system in **Yokohama City** drastically modified the disorganized water supply network and improved operation and maintenance by introducing a computerized system. The system makes it easier to identify broken distribution mains and provide a backup supply to minimize suspension of service.

## 5. Lessons Learned (2)

- **(Fukuoka System)** The block distribution system in **Fukuoka City** established to deal with severe droughts is characterized by the advanced linkage between water sources and distribution reservoirs, switching of water sources by remote control of valve operation, and reduction of leakage in block units. The block system together with the Water Management Center and advanced mapping system is very effective in leakage reduction.
- **(Topographic Considerations)** The implementation of **block distribution systems based on topographical characteristics** (including the location of water sources and treatment plants) contributes to efficient water supply operations.