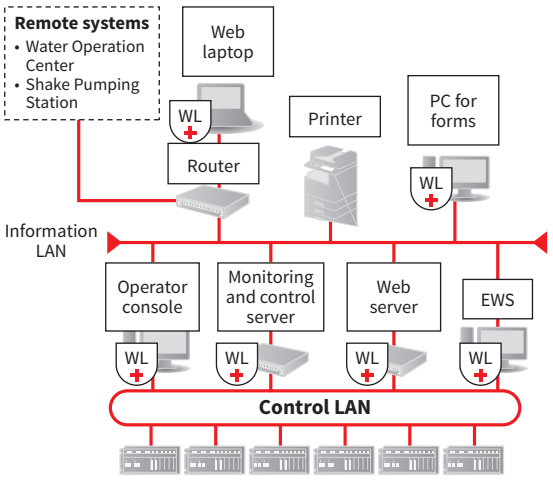
Water

1 Kanagawa Water Supply Authority Ayase Water Purification Plant Monitoring and Control System

The Ayase Water Purification Plant is a large facility that forms the core of the Kanagawa Water Supply Authority. It has a site area of 234,495 m^2 and a water supply capacity of 500,000 m^3 per day. The facility commenced operation in 1998. Recently, during its 17th year of operation, its central monitoring and control equipment was given a complete overhaul to improve system reliability and make operation monitoring work more efficient.

The overhaul involved constructing a web monitoring system controlled by mobile PCs installed in electrical rooms. System security measures were also provided. The web monitoring system was provided by creating a local area network (LAN) in the facility. The system lets users bring laptops into electrical rooms to do the same monitoring work they do from the central monitoring room, which is effective for maintenance, management and servicing during accidents, maintenance, and trial operation. The security measures include using a white list method for the first time instead of the common black list method, which has high load and could potentially reduce the monitoring and control system's response time. The constructed security system disables unknown malware while reducing load.



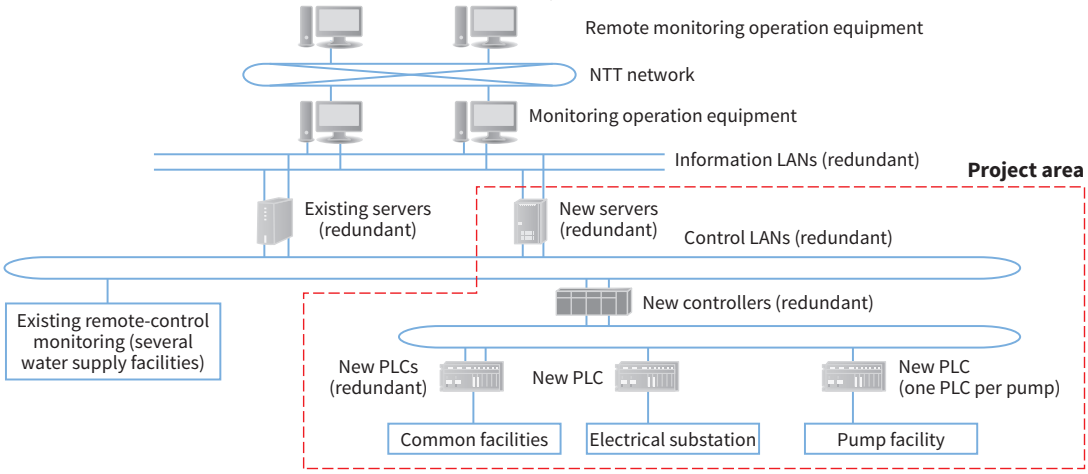
EWS: engineering work station WL: white list

1 Schematic diagram showing white list being applied to the monitoring and control system (top) and Ayase Water Purification Plant's monitoring and control room (bottom)

2 Tokyo Metropolitan Government Bureau of Waterworks Jindaiji Water Purification Plant Monitoring and Control System

The Jindaiji Water Purification Plant commenced operation in May 1965 as the third facility of its type in the city of Chofu (Tokyo)*. The plant supplies water pumped from wells in Chofu and from the Higashi-Murayama Water Purification Plant to meet the city's water needs. The Jindaiji Water Purification Plant's monitoring and control system is used to remotely monitor operations for multiple water supply facilities as well as for the plant itself.

A recent project to provide facilities such as service reservoirs has required an upgrade to an electrical substation, pump facility, and some areas of the monitoring and control system. Since the hardware, operating system, and software of the existing system were from the early 2000s, Hitachi was prepared for major hardware and software renovations to be needed even for



NTT: Nippon Telegraph and Telephone Corporation TM: telemeter PLC: programmable logic controller

2 Configuration of the monitoring and control system at Jindaiji Water Purification Plant

a partial upgrade. Continued operation of the existing system was made possible by making the existing system software compatible with new hardware and a new operating system.

The main features are as follows:

(1) Continued operation was enabled by making the existing system software compatible with new hardware and a new operating system.

(2) Reliability was ensured by making the new controllers redundant.

* Chofu's waterworks was integrated into the Tokyo Metropolitan Government in April 2000.

3 Sewerage Bureau of the City of Hiroshima, Ujina Pump Station Remote Monitoring System

To increase pump operation work efficiency at pump stations, Sewerage Bureau of the City of Hiroshima has installed a centralized monitoring and control system for its manned base pump stations and the unmanned pump stations under its control. The manned pump stations are the Ujina Pump Station (on the Asahimachi Water Resources Reclamation Center grid) and the Yoshijima Pump Station (on the Eba Water Resources Reclamation Center grid).

3 Remote monitoring system at Ujina Pump Station, Sewerage Bureau of the City of Hiroshima

The main features are as follows:

(1) Redundancy between base pump stations has been created by using the terminal server (TS) method to connect the six pump stations under the Bureau's control on a virtual private network (VPN) line, and performing dual-base communication from each pump station's controller along with the base pump station of each grid (Ujina Pump Station/Yoshijima Pump Station).

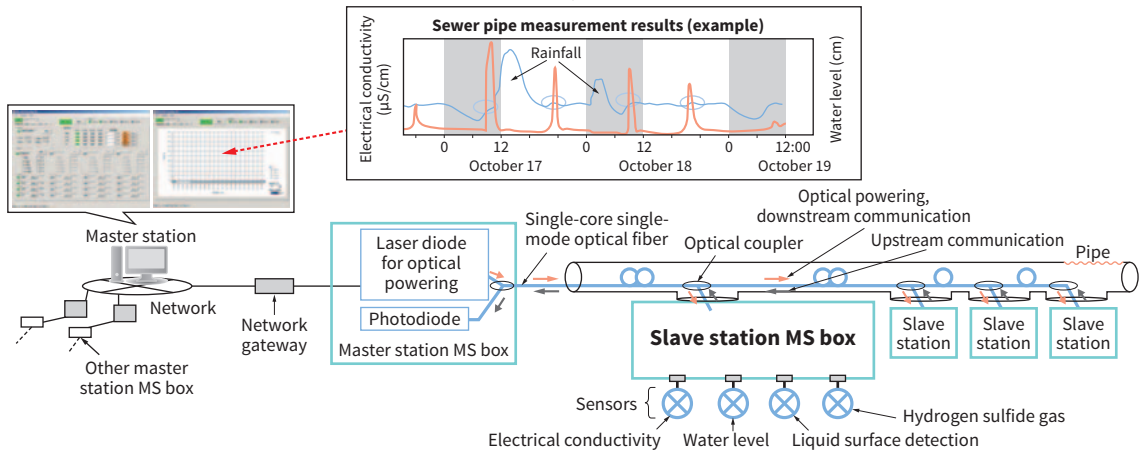
(2) Management system reliability has been improved by enabling monitoring operations on the pump stations under the Bureau's control from both of the base pump stations.

(3) The controllers have been made redundant to make automatic control more reliable.

(4) Automatic control of sewage pumps and rainwater pumps at pump stations under the Bureau's control has been unified for more efficient monitoring and control work.

4 Optical Fiber Multi-sensing System

Hitachi has partnered with Tokyo Metropolitan Sewerage Service Corporation and the Japan Sewer Optical Fiber Technological Association to develop a new multi-sensing system driven by optical fibers in sewer pipes.



4 Overview of optical fiber multi-sensing system

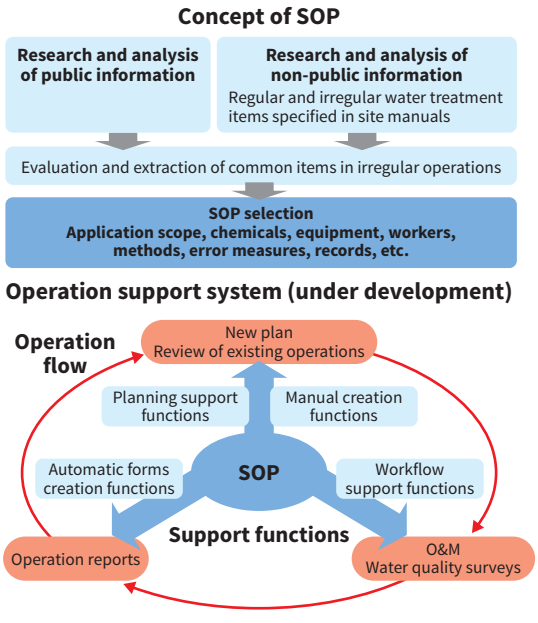
This technology connects up to four types of sensors in multi sensing (MS) boxes installed in sewer pipes at intervals of several kilometers. It can power the sensors and provide two-way communication using only the energy of light passing through a single-core, single-mode optical fiber. The system enables several types of remote monitoring of multiple locations in sewer pipes without power supplies. Demonstrations in actual sewer pipes have identified issues such as water quality variations and the generation of hydrogen sulfide gas resulting from unaccounted-for water. Analyzing the measurement information obtained will help maintenance and management problem-solving by assisting with measures to deal with unaccounted-for water, improved merging, dealing with aging facilities, and the like.

5 Operation Support Technology for Water Supply Area Expansion and Operations Standardization

Aging water supply infrastructure combined with declining numbers of engineers are creating a need for efficient maintenance and management of water supply facilities. Small- and medium-sized organizations require urgent measures to address the issue of technology transfer. To do so, water suppliers will need to rapidly work on standardizing their operations while expanding their service areas by unifying management and sharing facilities.

To solve these issues, Hitachi is developing operation support technology designed to help water suppliers expand their service areas and standardize their operations. The technology standardizes the operations performed when maintaining and managing water supply facilities by creating standard operating procedures (SOPs) that are stored in a database. The SOPs are displayed to workers in the form of operation flows when they need to maintain or manage water supply facilities, thereby reducing errors and making it easier to evaluate conditions. The technology also facilitates data transparency and management indicator uniformity.

Hitachi will continue working on this technology to help grow water supply services and facilitate problem-solving for the maintenance and management of water supply facilities.



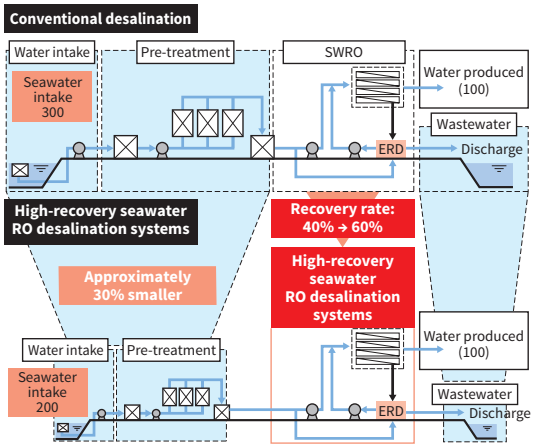
O&M: operation and maintenance

5 Overview of operation support tools being developed

6 High-recovery Seawater RO Desalination System

Seawater desalination technologies are being developed to meet rising global demand for water. Hitachi has responded by developing a high-recovery seawater reverse osmosis (RO) desalination system. Performance testing for use in the Middle East has been conducted on a prototype (with a capacity of about 500 m^3/day).

While conventional seawater RO desalination systems have a water recovery rate of about 40%, Hitachi's high-recovery system improves this figure to 60%. This higher recovery rate reduces the seawater intake volume, which enables the capacity of the pre-treatment and post-treatment equipment to be reduced by about 30% and reduces the equipment's overall energy consumption by about 15%. These benefits reduce the environmental impact by conserving the source seawater and reducing the amount of pre-treatment chemicals used.



SWRO: sea water reverse osmosis ERD: energy recovery device

6 Comparison of Equipment Used in Conventional and Hitachi's High-recovery Seawater RO Desalination Systems (top) and photo of the prototype (bottom)

By combining this system with specialized RO membranes, Hitachi expects to be able to meet the diverse requirements of different industries and regions by further improving energy efficiency and offering a wide variety of water production systems.

7 Training Program for Young South African Engineers

Since FY2009, Hitachi has provided a training program for young engineers from Republic of South Africa who are invited to Japan every year. The program is organized in collaboration with the South African government's Department of Science and Technology (DST), and is one example of Hitachi's corporate social responsibility (CSR) activities. Around five young engineers working in areas related to water treatment and water management at organizations such as local governments and waterworks have been invited annually since FY2015. They are trained for two months in Japan through a collaboration among Hitachi Group companies, outside partner institutions, waterworks, and similar organizations.

Six trainees were invited in FY2017. They attended lectures and received technical training in areas such as monitoring and control technology, and water treatment technology. They were also able to observe Japanese waterworks facilities, desalination plants, and manufacturing plants for water infrastructure products.

The human resources education provided by this program lets the Hitachi Group help solve a variety of issues related to water and the environment.

7 Trainees learning about wastewater treatment technology using helpful bacteria immobilized on carriers