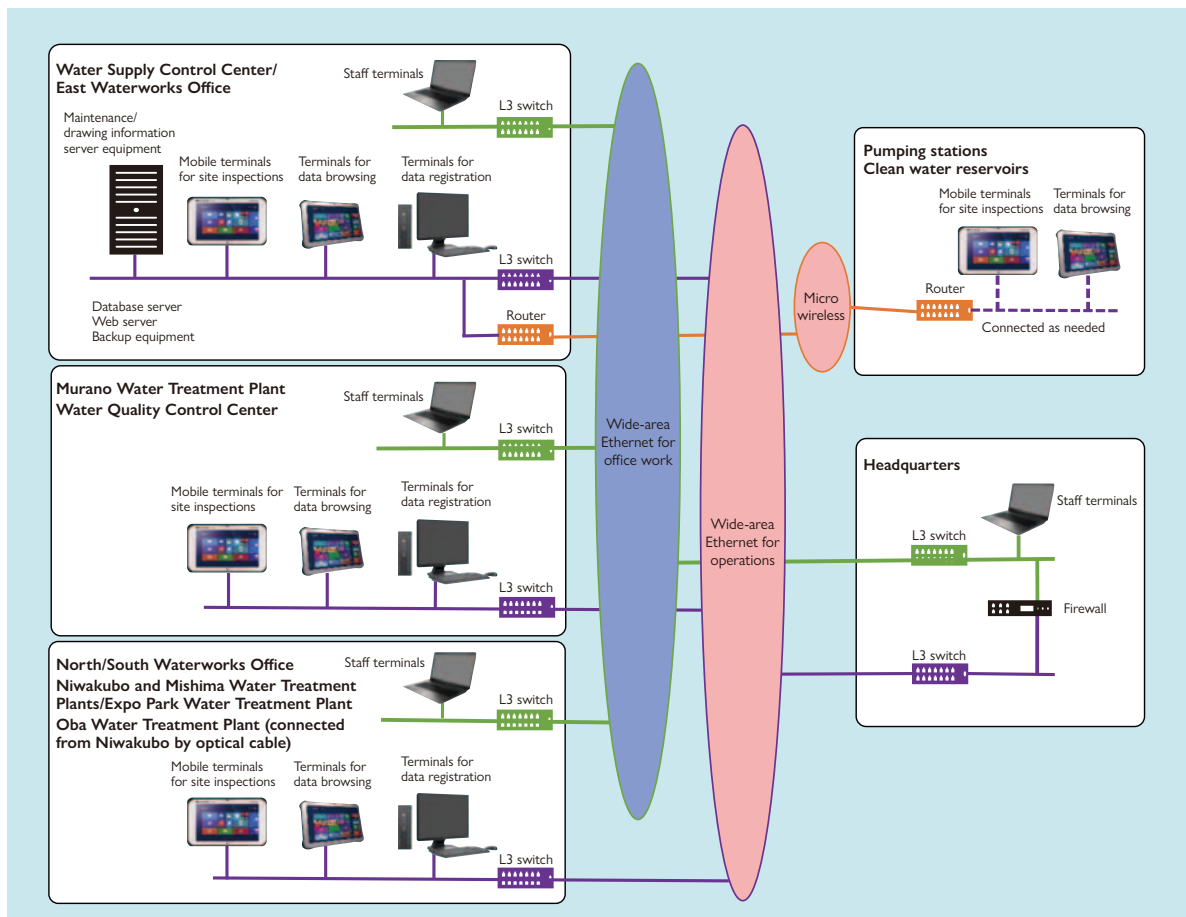


## 1 Water Distribution Control Center of Osaka Water Supply Authority Maintenance/Drawing Information System Update

The Osaka Water Supply Authority is in charge of the water resources of 42 municipalities in Osaka Prefecture. Seeking to enable the ongoing stable supply of good-quality water in a safe and secure manner, the Authority expends a lot of effort on keeping its facilities in good working order and extending their lives. As part of these efforts, it has recently updated the maintenance/drawing management system used by its Water Supply Control Center and seven other facilities. The update is designed to increase the efficiency of the maintenance, inspection, repair, and overhaul work done as needed at facilities in Osaka Prefecture. Its main features are as follows:

- (1) Using a web-based system enables data browsing and editing from staff terminals on the local area network (LAN) used for office work without installing a dedicated system.
- (2) Highly mobile and durable tablet PCs are used to increase the efficiency of the design work done for field surveys or similar operations needed during maintenance, overhauling or upgrading work for site inspections, troubleshooting, or the like.
- (3) The data input work done by the Authority staff has been made more efficient by providing functions that facilitate system loading of function lists, completed drawings, and repair and maintenance reports submitted by construction, repair, and maintenance contractors.



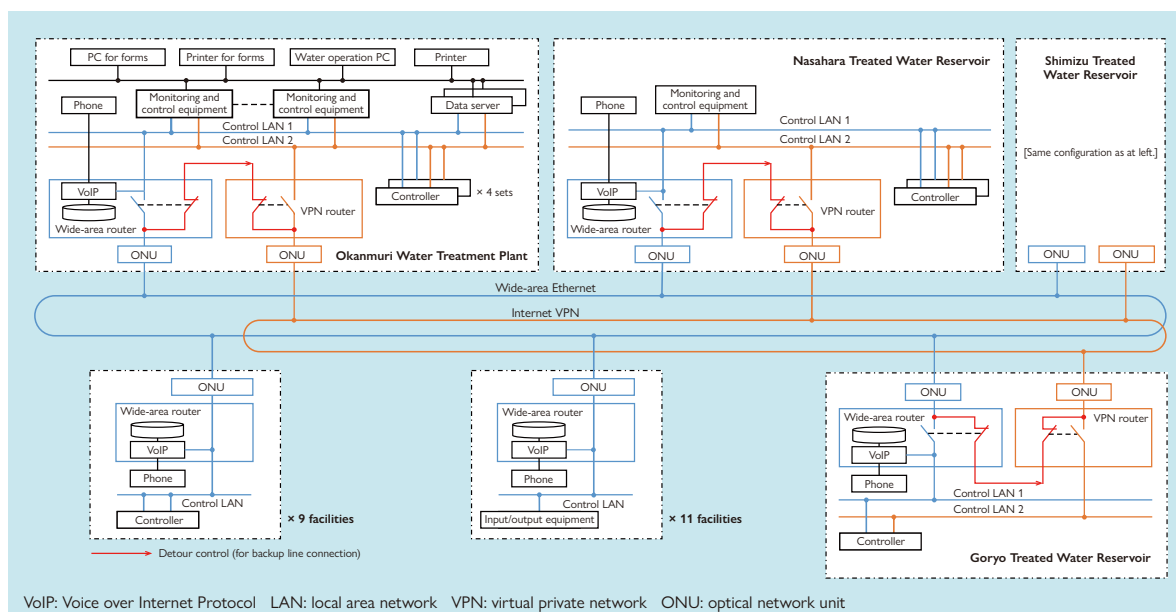
1 Maintenance/drawing information management system configuration

## Takatsuki Waterworks Okanmuri Water Treatment Plant Central Monitoring System

The city of Takatsuki's water supply comes from the Kashida and Kawakubo Water Treatment Plants (sourced from mountain river surface water), from the Nasahara, Shimizu, and Goryo Treated Water Reservoirs (sourced from Osaka Water Supply Authority water), and from the Okanmuri Water Treatment Plant (sourced from a mixture of local water from underground sources and Osaka Water Authority water). Monitoring and control equipment is located at the Okanmuri Water Treatment Plant and the Nasahara and Shimizu Treated Water Reservoirs, enabling backups covering the monitoring and control zones governed by each service reservoir.

With the city's monitoring and control system having deteriorated, it has recently been completely updated with features such as digital communication lines to improve system reliability and increase the efficiency of operation monitoring work. The update's main features are as follows:

- (1) Reliability and responsiveness have been improved by installing controllers at service reservoirs, relay pumping stations, and major distribution reservoirs, and performing two-site communication for the Okanmuri Water Treatment Plant and related treated water reservoirs.
- (2) Reliability has been improved at the Okanmuri Water Treatment Plant and service reservoirs by using an Internet LAN virtual private network (VPN) as a backup line for detour control during wide-area router failures.
- (3) Site-to-site voice communication independent of specific routers has been enabled by using routers with the Voice over Internet Protocol (VoIP) at each site and registering a phonebook directly in each router.
- (4) The controllers governing the distribution reservoirs can now detect leakage sooner by performing a leakage detection calculation from the previous day's flow rate and the distribution reservoir water level.
- (5) An auxiliary function for water operation planning creates water operation plans with result data that does not reflect sudden usage increases from school swimming pool water supplies.
- (6) At the Kashida and Kawakubo Water Treatment Plants with surface water intake, an automatic intake control system that responds to changes in surface water turbidity has been created, reducing turbidity response work that often fluctuates with the weather.
- (7) Industrial television (ITV) images and control/telephone information have been integrated by a band control system, reducing communication costs.
- (8) Identification of leakage and water quality trends has been enabled by creating screens to display the same measurement items as one or eight weeks' worth of superimposed trend graphs.

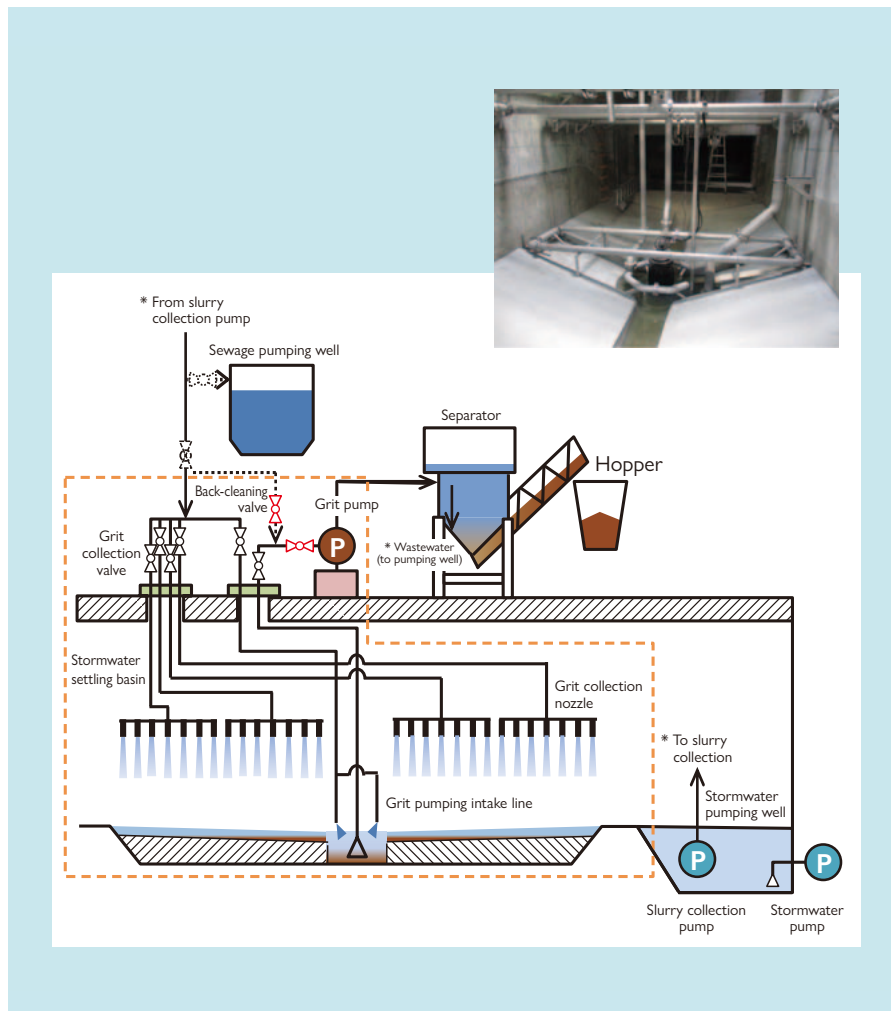


2 Overview of central monitoring system of Takatsuki Waterworks Okanmuri Water Treatment Plant

### 3 Low-pressure Silt Trap for Stormwater Settling Basin

Reconstruction of settling basin facilities at sewage treatment plants has recently been taking place in response to aging facilities. Settling basin facilities have previously used bucket equipment for grit collecting and lifting, and conveyor equipment for grit transport in most cases. But facilities are increasingly replacing this equipment with grit pumping equipment to meet demands for reducing bad smell from residual water, improving increasingly complex equipment layouts, and enabling dry settling basins.

The grit pump method uses pressurized water to collect the grit and a pump to lift it. The grit is transported through lines, improving the work environment through benefits such as reduced odor dispersion. But since components such as grit collection nozzles are placed in the sedimentation basin, improving maintenance and management has been a challenge. Hitachi has overcome this challenge by creating a system that enables easy maintenance and management, and has installed it at the Arai Higashi Pumping Station in Sendai City. The system uses a water-saving large-aperture nozzle that enables use of a pumping well and is installed on top of the settling basin.



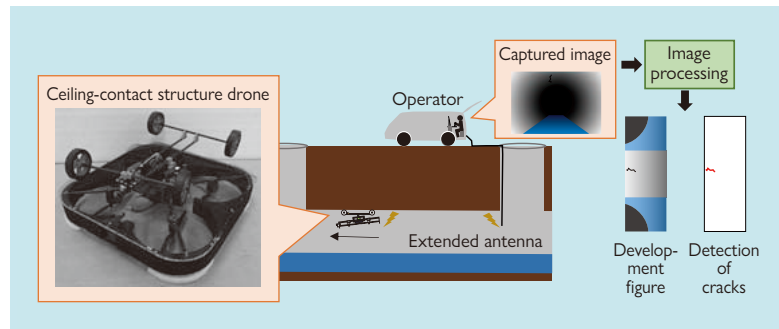
3 Equipment delivered to Sendai City (using submerged pump; top), and overall configuration flow (using a self-priming pump; bottom)

## 4 Sewer-pipe Inspection Support Technology Using Drone

The number of aging sewer-pipes that were installed during the period of high economic growth have been increasing every year. These sewer-pipes have previously been inspected by workers and/or remote control vehicles, but the hazards of pipes with high flow rates and high water levels have made inspection difficult.

To solve this problem, Hitachi is developing a sewer-pipe inspection technology that uses a drone, and is aiming to release it in 2019. Its main features are a drone that flies in contact with the ceiling, and image processing technology. The drone can fly stably without being affected by turbulence in narrow sewer-pipes that do not allow for Global Positioning System (GPS) use. The image processing technology can detect cracks and crack positions by transforming captured images into distortion-free development figures.

The technology eliminates the need for workers to enter the sewer-pipe. A ground operator remotely controls the drone while watching the live image obtained by the drone. Images inside the sewer-pipe can be captured safely and efficiently, and deteriorating locations can be identified efficiently in the captured images. The technology's features will realize safe and highly efficient sewer-pipe inspection work.

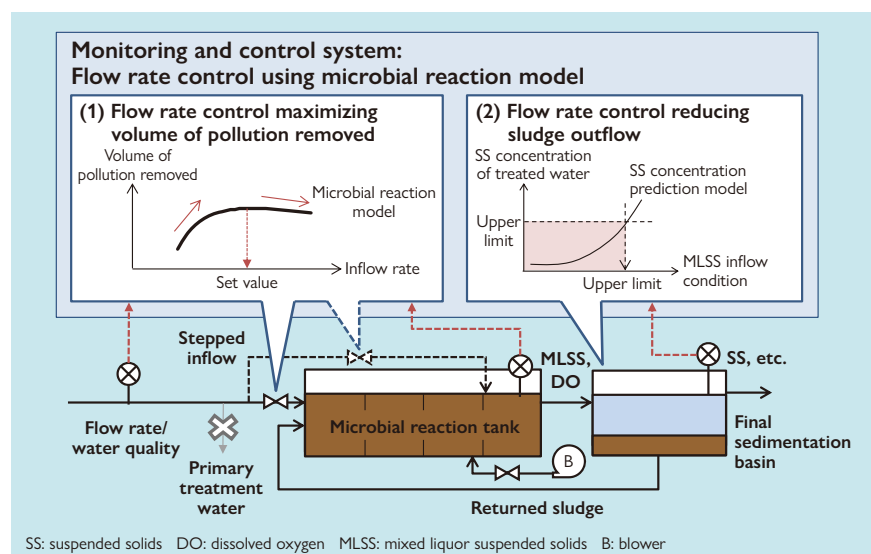


4 Overview of sewer-pipe inspection support technology using drone

## 5 Risk Control Technology for Stormwater (Flooding/Overflow)

In combined sewer systems that eliminate stormwater and sewage from the same line, sudden increases in inflow rates during rainy weather such as localized storms can actualize the risk of exceeding pumping station or water treatment facility processing capacities. To handle this risk, Hitachi is developing a monitoring and control technology that can avoid or mitigate flooding or conditions of sewage overflowing into rivers without being adequately treated. To cope with the risk of flooding, a pump operation control technology is being developed. It uses pumping station dynamic simulations to evaluate the continuously changing inflow states and set the startup timing and discharge rates of pumps enabling reductions in sewage service area flooding risk or pumping station immersion risk. To cope with the risk of overflow, a microbial reaction model is being developed that draws on theoretical metabolic/adsorption principles for activated sludge during sewage treatment. The model is being used to evaluate the limits of treatment flow rates and develop a sewage treatment control technology that can maximize the volume of pollution removed.

Hitachi will continue to augment these types of software-based solutions for mitigating stormwater risks.

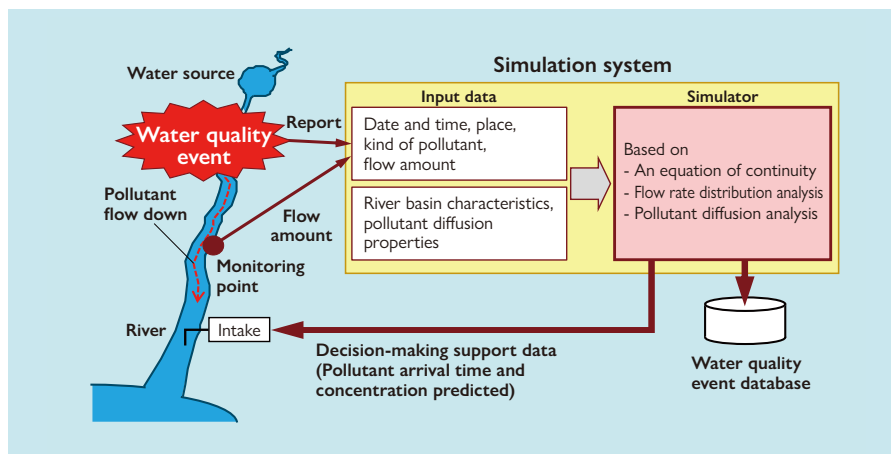


5 Sewage treatment control technology for use during rainy weather

Technical Committee 224 of the International Organization for Standardization (ISO) is working on developing international standards for water utility management and services. As of January 2019, the Committee has published 10 international standards since its formation in 2001.

Since 2012, one of the Committee's working groups (Working Group 9) has been developing an international standard to be codified as ISO 24522 (Event detection process). The standard will assist the decision-making process used when abnormal events are detected in water utilities. Hitachi has been working with related domestic Japanese organizations to assist in developing the standard by presenting good practices illustrating configurations and approaches used for water utility systems. These systems provide functions such as predicting the arrival time of pollutant at a water intake port when water quality events occur in the upper reaches of a catchment or river, and predicting rainwater inflow amount to a sewerage system during storms. The draft of the international standard containing these good practices was completed in 2018, and the standard is now on its way to being published.

Seeking to help provide solutions to the world's water problems, Japan is taking part in a wide range of international water utility standardization work through public-private sector collaborations. Hitachi will continue to contribute to this work in collaboration with related organizations.



6 System predicting arrival time of pollutant at a water intake port (an example presented in ISO 24522)