



Project Summary

Organization:

Water Supply & Sanitation
Department

Project:

Crisis Management of Water Supply
in Developing Countries

Location:

Maharashtra, India

Solution:

Water and Wastewater

Be Inspired category:

WINNER in Innovation in Water,
Wastewater, and Stormwater
Networks

Project Objectives:

Re-engineering the water system,
so that 17 million people are able to
get water in a reasonable amount of
time after interruptions in service.

Products Used:

WaterGEMS and Bentley Water

Fast Facts

- Water supply to the region was cut off every Friday, affecting 17 million people in the Mumbai metropolitan area.
- Although service was restored on Saturdays, it took up to 30 hours for water to reach some areas, causing civil unrest.
- A hydraulic model was built and analyzed using Bentley Water and WaterGEMS to allow engineers to locate the problem and design a solution.

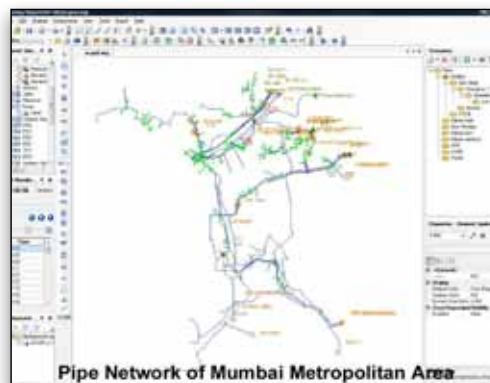
Crisis Management of Water Supply Systems

Use of Bentley Water and WaterGEMS helped MJP quickly re-engineer Mumbai Metropolitan Area's pipe network

Project Helped Safeguard the Public Health of 17 Million People

Distributing safe, potable water within densely populated regions of a developing country like India is always difficult. But "difficult" became "daunting" in India's Mumbai Metropolitan Area (MMA) when the water supply for the 17 million people living there was suddenly and dramatically reduced. A 2009 India Supreme Court decision regarding the interstate sharing of water from the Krishna River (as defined by the Krishna Water Disputes Tribunal) cut the annual flow of water into the westward rivers of the state to 1,206 million cubic meters. This led to a one-day-per-week interruption in MMA's water supply that, for some cities, turned into a 54-hour interruption. With the help of Bentley's information modeling software, this extended and potentially dangerous loss of water supply was remedied, millions Indian Rupees (INR) that would have been spent each week to truck water into the area were saved, and the reliability of the water infrastructure in the region was enhanced.

The solution was found with the help of Bentley Water, a desktop geospatial information system (GIS) for managing water utility assets, and Bentley's WaterGEMS water distribution analysis and modeling software. Both were used to help MJP quickly prepare a hydraulic model that would give MJP the knowledge it needed to re-engineer the region's pipe network and solve the problem.



Pipe Network of Mumbai Metropolitan Area

In WaterGEMS, engineers created three scenarios to simulate the crisis and identify probable strategies.

The Challenges

As a result of the India Supreme Court ruling, every Friday at 6 a.m., the water for cities supplied by Barvi Dam is turned off. When the pumping is restarted at 6 a.m. on Saturday, every city in the region is supposed to receive water immediately. However, in many cities it was taking 30 hours after the pumps had been restarted for water to begin flowing.

Residents in the six municipal corporations and 13 municipalities impacted by these extended water service interruptions organized municipal meetings and demonstrations in protest, and civil disorder often broke out. To calm the outcry, the chief minister of the state directed Maharashtra Jeevan Pradhikaran (MJP), the board responsible for managing the water supply, to take whatever measures were necessary to mitigate the crisis.

Analysis of the Problem and the Proposed Solution

MJP's study and analysis of the water system found that a long pipe network remained empty after the region's pumps had been restarted, and it took 14 hours to refill it. Moreover, because the level of the terrain was uneven, communities in low-lying areas were drawing water easily while those at the tail end of the network were getting water as much as 30 hours after resumption of the water supply.

The first step in assessing the problem and developing a solution was to acquire satellite images with 0.6 meter resolution. Next, pipeline and features such as properties and roads were digitized using Bentley Map® and Bentley Water. The data for various zones and sub-zones (called district metered areas or DMAs) was then stored in Bentley Water.

An intelligent model of MMA's entire water pipe network was created in Bentley Water and exported directly to WaterGEMS without data loss. This allowed the critical hydraulic modeling work to begin.

“Using Bentley’s technology on this project has not only saved money, but also enhanced the reliability of the water infrastructure in the region and helped safe-guard the public health of 17 million people.”

Find out about Bentley at: www.bentley.com

Contact Bentley
1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Global Office Listings
www.bentley.com/contact

In WaterGEMS, engineers created three scenarios to simulate the crisis and identify probable strategies:

- The first scenario simulated normal water supply conditions, where water from the water treatment plant (at an elevation of 107 meters) upstream of Ulhas-Nagar gravitates to a tank at Shil (at an elevation of 63 meters). From there, water is conveyed by gravity to tanks in all MMA cities.
- The second scenario added dynamic controls in the WaterGEMS model to simulate a problem with the opening and closing of the valve, which occurred after a one-day water interruption. The team ran the water model as an extended period simulation (EPS) over 36 hours and compared the results with the real situation. The findings showed that the required water level in MBR at Shil was not attained because low-lying areas such as Mumbra and Diva were drawing too much water. Moreover, because there wasn't an adequate level of water in MBR at Shil, water did not flow at all to a number of cities, including Mira-Bhayander, Thane, and Navi Mumbai.
- The third scenario tried to resolve the problem. Based on findings in the second scenario, engineers analyzed different alternatives to control the flows by setting the valves at low-level areas to avoid excessive withdrawal. Consequently, the hydraulic grade line was elevated and the required level in MBR at Shil was attained. Using advanced programmable controls in WaterGEMS, the flow from valves at low-level areas was set to 10 million liters per day (MLD), which solved the entire problem without compromising the water needs of these areas. The analysis also showed that with this solution, water would start filling the network within an hour of the valve opening, which was also confirmed by field engineers.

Project Benefits

Clearly, had this same exercise been done in the field without a water model, scenarios would have been carried out randomly and alternatives would not have been tested to make sure they actually worked. This could have caused more problems than it solved.

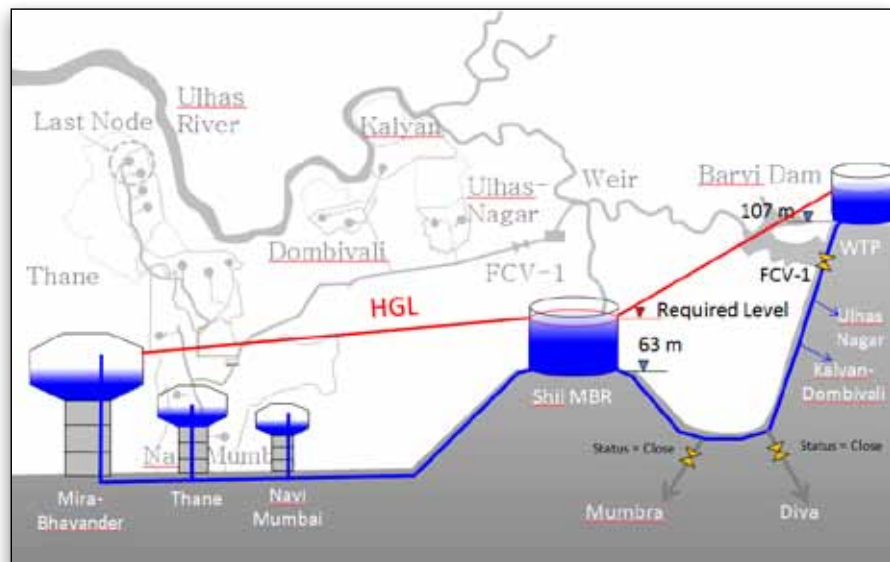
Once the modeled solution was implemented and the system re-engineered, 17 million people were able to get water in a reasonable amount of time after the planned interruption in service. This solved the law and order problems that accompanied the civil protests and mitigated the disaster. These efforts were greatly appreciated by the local municipal bodies as well as the government of Maharashtra.

The proposed solution eliminated the need for the thousands of water tanker trucks that would have been required each week to deliver water to the affected cities in the absence of a functional pipe network. Since 20 liters of water are required for the daily sustenance of a single person and the volume of one tanker is 10,000 liters, servicing the water needs of the entire population affected by the extended service interruption would have required a weekly caravan of 26,000 tankers (assuming 25 percent of the population gets water from local sources). Hence, 182 million INR would have been spent each week on these deliveries or 4.7 billion INR over a six-month period.

Community and Environmental Impacts

Using Bentley's technology on this project has not only saved money, but also enhanced the reliability of the water infrastructure in the region. Moreover, it helped safe-guard the public health of 17 million people.

Lastly, this project also reduced the effects of human activity on the environment. Not having to transport water by tanker trucks through the MMA prevented the damaging effects of increased traffic congestion and air pollution.



All pipelines are full and the hydraulic grade line is attained.