Hydraulic Modeling for Citywide Water Distribution System

THE PROJECT

A municipal utility in Northern California, serving over 17,500 customers, wanted to optimize its water distribution system to reduce the amount of energy used while serving its customers. Their multi-zone distribution system included 215 miles of water mains, a 20 million gallon (mg) reservoir, a 32 million-gallon-per-day (mgd) water treatment plant, and various pump stations. The pressures between the multiple hydraulic zones were balanced by use of pressure-reducing valves (PRVs). Lincus reviewed the city's EPANET hydraulic model and converted it to a more dynamic water distribution system model designed specifically by Lincus' engineers. Use of this improved city-wide hydraulic model allowed observation of operations in "real time", integrating findings with data from the city's geographic information system. The process actively discovered opportunities for operational energy reduction daily, monthly, and seasonally, and Lincus was able to simulate the complete operation of the water distribution system and measure the impact of alternative operational controls, equipment upgrades, and the integration of the storage facilities. When reconciled with the past few years of utility billing data, the city was provided the information needed to create a baseline for overall performance, resulting in a significant savings of energy and operational costs. Use of a similar evaluation process outside of Lincus' model would have been manually intensive, requiring a great deal of additional engineering analysis at a much higher cost.

THE SOLUTION

By reconfiguring the water system's characteristics in the custom simulation model, Lincus' engineers developed an new operating option that allowed the water demand to be met directly by the water treatment plant through a gravity feed rather than excessive use of pressure-reducing valves between different service zones. This alternative resulted in a savings of more than 760,000 kWh and $112,000 in annual operating costs. With an additional $104,000 in utility incentives, the city's utility payback was 6.7 years.

Figure 1 depicts pressure distribution under maximum flow conditions. The proposed scenario resulted in very little change in this pressure distribution.

Figure 1: Pressure Map Under Maximum Demand Conditions

Figure 2 represents the pumps' energy savings per day as a result of implementation of the measures identified.

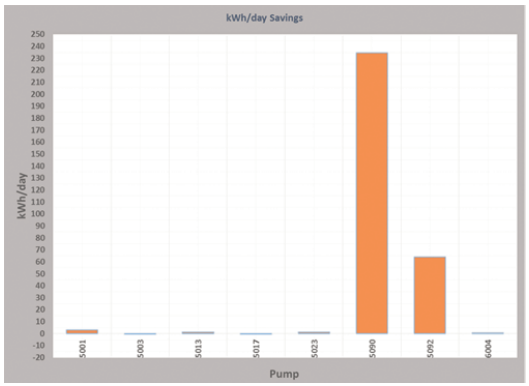

Figure 2: Energy Savings/Day

WHY HYDRAULIC MODELING IS CRITICAL

The use of hydraulic modeling allows for review of the impact made as water demands change, pipes fail, if there is excessive use of pressure-reducing valves, the proper placement of storage facilities, and ultimately the overall control and optimization of a water system' operation. Lincus' hydraulic model is capable of identifying pipes that are in need of critical care, as well as the location of pressure issues prior to failures.

WATER INFRASTRUCTURE AND SYSTEM EFFICIENCY (WISE™) PROGRAM

The Lincus WISE program is a comprehensive, turnkey solution for municipalities which offers no-cost engineering services, project support, and cash incentives. Lincus uses a holistic approach, combining existing pump tests and hydraulic modeling to provide a detailed analysis of how water agencies pumping systems can be optimized. For this specific project, Lincus completed its review of the system and analysis in two phases:

PHASE 1: Provide an onsite assessment of overall system's operations, and develop a savings analysis showing the payback based on making system-wide pump improvements.

PHASE 2: Develop a comprehensive, custom hydraulic model that is calibrated to actual water production, delivery, and demands required by each pumping station zone.

For more information, please call:
(949) 244-6528

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