CASE STUDY 1.0

Water Supply & Distribution System Optimization

Overview

The City of Guelph, Water Services Division was awarded a project under the Ontario Ministry of the Environment's (MOE) Showcasing Water Innovation (SWI) Program in February 2012. This program provided a matching funding through a competitive process up to $1 Million for projects that best exemplified the Provinces Program Objectives:

- Take an integrated and sustainable approach to solve water management challenges.
- Use new and innovative approaches and technologies.
- Produce results that can easily be used by other communities.
- Create partnerships that highlight the benefits of collaboration.

While there are many activities which have been undertaken through this project, the main goals of this project from the City’s perspective were as follows:

- Implementation of a permanent distribution operational tool, which provides operations an easy to use tool based on the City's hydraulic model and utilizes real-time data to optimize system performance. The tool's main benefit is to provide a 24 hour forecast based on real system conditions while also providing the operator with the option of completing what if scenarios on historical data.

- Optimized power consumption in the supply and distribution of potable water with a specific target of 10% reduction, which is an equivalent of 1.3 million kWHr annually, or 337,000 kg of CO₂ emissions. Depending on how much off-peak load shifting can be achieved in conjunction with this initiative, this will be the equivalent of $100K to $200K of annual operational savings.

- Reduction of water loss in the distribution of potable water to the end user of 2%. This works out to an annual volume of 325 ML/Yr, or 55,000 kg of CO₂ emissions. Perhaps more important than the financial savings this relates to in terms of reduced supply and distribution costs, this quantity represents “found water” and defers the need for capital intensive implementation of new water supplies. This becomes critical for a City such as Guelph which has adopted a policy to grow responsibly, relying on a limited number of future potential water supply solutions which are available locally.

The SWI project goals are being realized through an assessment of capital improvements and operational practices which are first demonstrated using the City’s well-calibrated hydraulic modelling software. Improvements are then implemented, and performance is measured. Field trials with respect to the main performance goals identified above are planned for 2014. The SWI project wraps up with final reporting in March of 2015.

We acknowledge our industry partners on this project, Sam Ziemann (CH2M Hill), City of Guelph, Chatham Kent Public Utilities, Hydrant Network Solutions Inc., Eramosa Engineering and the Township of Centre Wellington.
CASE STUDY 1.1

Water Supply and Distribution System Energy and Energy Cost Optimization

In order to facilitate modeling analysis of the ability to achieve power and power cost savings, the project team met with Guelph Hydro to establish the calculation protocol for power cost for each water supply and distribution facility within the City of Guelph. The calculation is a complex one which factors in elements such as the Hourly Ontario kW-Hr Energy Price (HOEP), the monthly 15 minute maximum instantaneous kW power consumption, Distribution Surcharges, time of use rates and others. These are integrated into the total cost differently depending on the size of the electrical service and averaged monthly maximum instantaneous power consumption for the service. The calculations are developed in e.RIS, Eramosa's Reporting and Information System. This software has direct links into the SCADA system database and pulls power consumption, real-time, from each site within the City of Guelph's water supply and distribution system. Automated reports provide daily and monthly site power consumption and cost metrics to the operations management team. These reports are used to establish the baseline operational condition and analyze the improved performance when changes are made.

Minute interval data files, with the power consumption and power cost data for each site are then compared with the City's hydraulic model and used to calibrate it with respect to power consumption and power cost. This enables the modeling team to then run off-line simulations of various operating scenarios versus the baseline condition, ensuring that changes are managed within safe operational guidelines maintaining fire storage, minimum system pressures, and water age.

This analysis has demonstrated the potential ability to operate the system safely and realize energy cost savings between 10 to 20% in the Guelph Water Supply and Distribution system depending on the type of day analyzed (typical day versus summer average day).

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CASE STUDY 1.2

District Metering Area (DMA) Implementation and Water Loss Reductions

Analysis completed through the SWI project reinforced the City’s decision to implement a City-Wide DMA program. Six (6) of twenty-six (26) planned DMAs were implemented through the SWI project with the following highlights:

- A standard approach to implementing DMAs and associated instrumentation was established and documented.

- Flow meter installations made use of wireless technology to transmit data to a central facility where it is integrated with SCADA and then pushed with other real-time SCADA data into the City’s hydraulic model for calibration and the establishment of boundary conditions for real-time modeling in IW Live.

- Economic justification of the use of development funding to build out the DMA program has been made through the deferral of capital costs associated with the development of new water supplies realized by reducing water loss. The internal rate of return on the investment made is projected to be between fourteen (14) and twenty-seven (27) per cent, with projected potential water loss savings of between three (3) and four (4) per cent.

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CASE STUDY 1.3

Water Supply and Distribution Real-Time Operational Tool

The SWI project is implementing Canada's first IWLive implementation. The IWLive software module is an add-on module to Innovyze's Infowater hydraulic modeling software. The add-on facilitates an operational level interaction with the hydraulic model while providing updated boundary conditions. The software enables data exchange with a SCADA system historical database, enabling on-line calibration analysis and setting of boundary conditions to facilitate a daily look forward at the impact of proposed operational changes. Staff can assess the impact of taking a supply and distribution element out of service various operational parameters such as operating pressure, water age, or storage levels.

We acknowledge the industry partners on this project, Sam Ziemann (CH2M Hill), City of Guelph and Eramosa Engineering.
CASE STUDY 1.4

Innovative Distribution System Monitoring Technologies

Patented pressure monitoring technology was proven through the SWI project. The technology makes use of a dry barrel hydrant retrofit and battery powered, wireless technology is used to transmit system pressures at previously unmonitored distribution locations back into a web-based reporting system, the owner’s reporting or SCADA system. The dry barrel hydrant application is particularly well-suited to cold weather applications where cap pressure monitors are not feasible. Completely hidden within the hydrant, the technology is less susceptible to damage from handling during a fire event or vandalism. The retrofit takes less than an hour, with all original parts saved for reuse, and the technology is mobile. The device can be moved from location to location and has proven to be very versatile and reliable. Extensive testing has demonstrated that the device does not impact fire flow capacity of the hydrant, and that the retrofit does not impact torque ratings of the hydrant.

The team is now embarking on a proof of concept project which will see the development and testing of a device added to the hydrant instrument to allow for leak listening and distance to leak estimation.

We acknowledge our industry partners on this project, Chatham Kent Public Utilities, City of Guelph, Eramosa Engineering, Township of Centre Wellington, Hydrant Network Solutions Inc.