Municipal Smart Water Systems: The Promise and Limitations

Dr. Mary Trudeau, P.Eng.
Basis for Presentation

• Municipal water infrastructure: drinking water, wastewater, stormwater systems
  – Experience as a manager of municipal water operations
  – K-Water & IWRA - *Smart Water Management Case Study Report*
    • Paris, France – Integrated network for improved real-time water quality in sanitation (wastewater)
    • Toronto, Canada – Stormwater SmartGrid real-time rainwater collection and monitoring for household stormwater management
What is Smart Water Management?

• K-Water & IWRA Case Study Report, SWM is:
  Use of Information and Communication Technology (ICT) to provide real-time, automated data in resolving water challenges
  – Integrated water resources management (IWRM)
  – Planning and operational purposes – multiple scales of time and space

• Key assertions of SWM: real-time data and automation will improve efficiency of services; water management will become more reliable; decision-making will be more inclusive; knowledge-sharing and collaboration will improve

  These benefits are not automatic with SWM!
Potable Water Infrastructure Automation is not only for modern/new systems

Fleet Street Pumping Station
- Ottawa’s First Water Distribution Infrastructure
- Built in 1874 for Fire Supply
- Six turbines run by water diverted from the Ottawa River
- Fleet Street still used for ‘free’ pumping energy
- The turbines drive 6 pumps that pressurize drinking water
- Operators present 24/7 to full automation (~1998)
Paris Integrated Smart Water Management

• Sanitation System in the Greater Paris Region: *Case Study*
  – Jean-Pierre Tabuchi, Béatrice Blanchet, Vincent Rocher of the Syndicat Interdépartemental pour l’Assainissement de l’Agglomération Parisienne (SIAAP)

• The public utility’s collection area:
  – 1800 km² with 9 million people in 284 municipalities

• Greatest challenge for the sanitation system: water quality recovery of the Seine and Marne rivers

• Treatment capacity, technical performance, combined sewer overflows

Diagram: Case Study in IWRA & K-Water Report
Paris Integrated Smart Water Management (2)
Vision and continuous improvement

• System evolution:
  – Real-time control system began with a 1997 sanitation master plan study
  – Infrastructure built to store and pump wastewater to treatment plants with available capacity, based on weather (i.e. precipitation) data and modelling
  – Control and forecast system with hydraulic & hydrologic numeric models fed by continuous monitoring of sewage network and weather radar images
  – Non-real time mode for scenarios, learning from past conditions, training

• Success factors:
  – Shared vision; integrating not merging the various systems; leadership committed to the vision; development of a common technical culture
  – Overcame slight resistance of operators to perceived loss of autonomy; access to information beyond their management scope; regular meetings of plant and network operators

• Future plans: preparing the transition from a system based on flow management to a system which also takes into account pollutant loads
Toronto Stormwater SmartGrid

- Community-based Stormwater Smartgrids: Distributed Artificial Intelligence/Internet of Things (AI/IoT) Rain Harvesting Networks for Flood and Drought Resilience
  – Kevin Mercer, Cristina Cholkan, RainGrid Inc. Toronto, Canada

- Real-time weather intelligence determines rainfall runoff from household roofs given predicted rainfall and rooftop area.

- Water available for household and garden or timed discharge into the sewerage system with automated valves

Smart Water Management Implementation Type:
- Combination of individual and institutional users
  - Private property systems – rain barrels and associated technologies
  - Public property system – municipal stormwater infrastructure
- Challenge: not the technology but the business model and achieving economies of scale to gain participating households
Lessons and Limitations

- Smart Water Systems do not begin with technology
  - Vision and planning
  - Long-term commitment (including budgets), building through continuous improvement, flexibility
  - Human resources are essential – engagement, capacity development, training, acceptance, relationships, knowledge sharing
  - Context – natural conditions (e.g. water quality and quantity) and governance (e.g. policy drivers); infrastructure conditions

- Technology will only get us so far when it comes to managing water resources
  - Technology will not create water
  - Watershed and aquifer management; IWRM
  - Match quality to use; greater emphasis on circular economy
  - Climate change - need to respect the water cycle and acknowledge that it is changing (attitudinal shift)
Thank you!

The IWRA & K-Water Smart Water Case Study Report can be found at:
https://www.iwra.org/swmreport/