Developing a Water System Monitoring Program: Visioning and Assessing Stakeholder Needs

by

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Presentation Outline

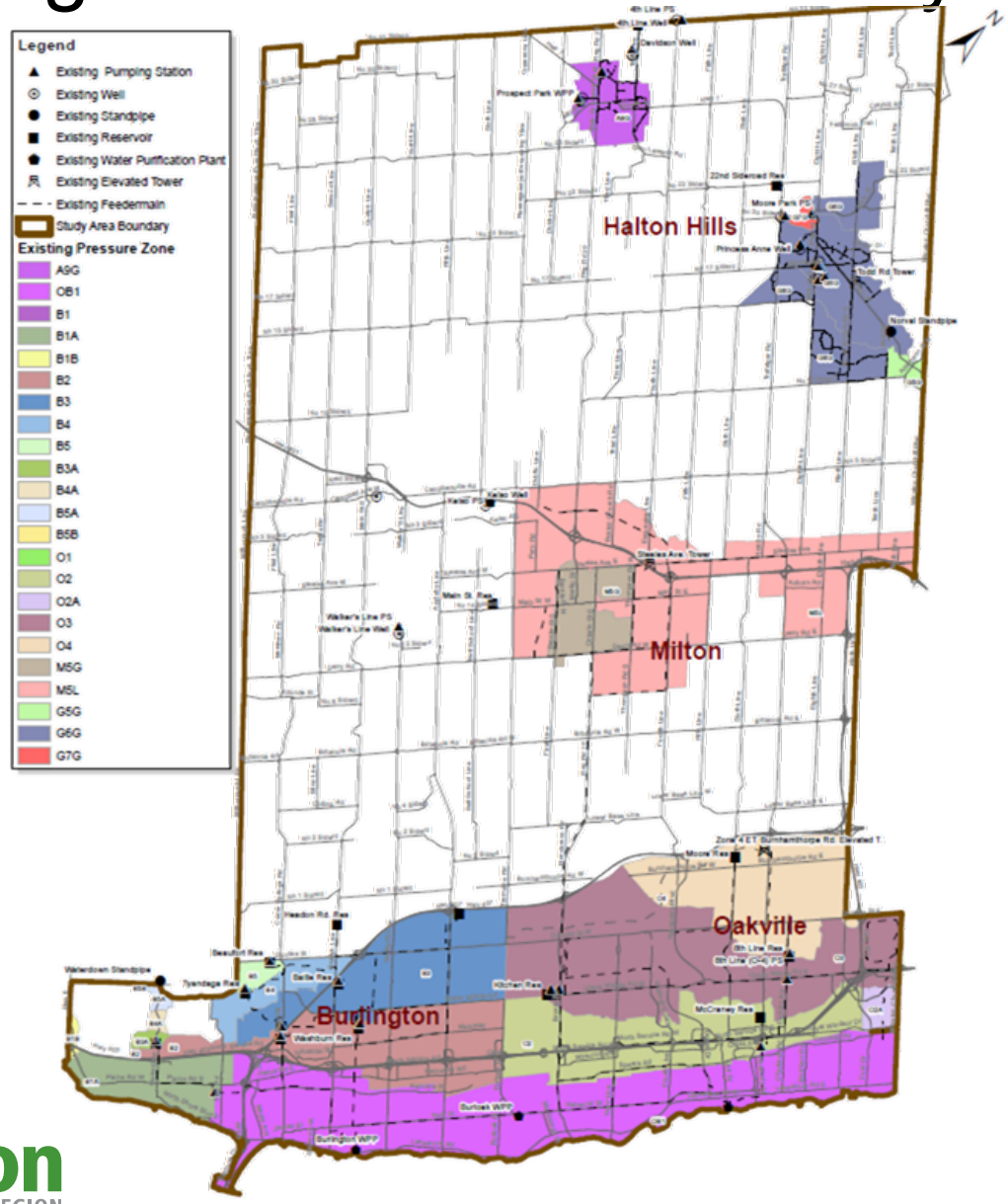
- Background
- Visioning and Stakeholders Needs Assessment
- Key Monitoring Parameters
- Existing Monitoring and Opportunities
- Ongoing Work

Background: Halton Water System

- South Halton is a lake-based system
  - Three (3) WPPs,
  - Three (3) booster pumping stations
  - Five (5) storage reservoirs
  - Nine (9) storage reservoirs and pumping stations
  - Two (2) elevated storage tanks
  - 1,563 km of trunk watermains
  - 193 km of distribution watermains
- Three (3) small groundwater supply systems
  - Milton, Georgetown and Acton

Halton REGION

Background: Halton Water System



Background: WSMP Objective and Phasing

OBJECTIVE

- Provide consistent means to measure, monitor & record Water Distribution System performance parameters

PROPOSED PHASES

- **Phase 1: Develop Water System Monitoring Program**
- Phase 2: Implement Water System Monitoring Pilot Program
- Phase 3: Implement Water System Monitoring Region-wide Program

Background: WSMP Phase 1 Process

1. **Visioning and Needs Assessment**
2. Review current data collection, processing, storage protocols and propose standardized architecture and protocol
3. **Review current monitoring equipment deployment and assess gaps**
4. Undertake municipal survey for best practices
5. Undertake vendor survey
6. Develop pilot program

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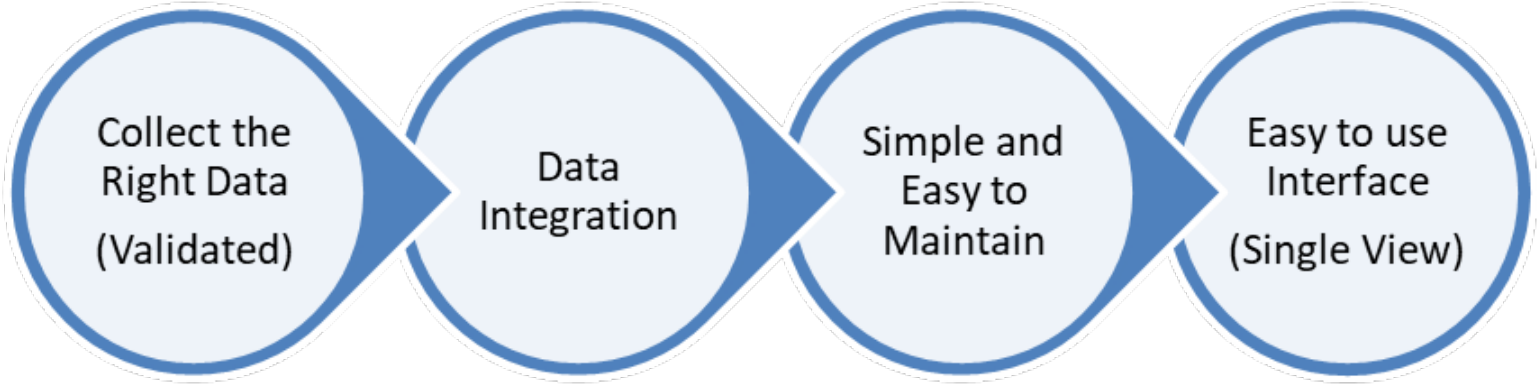
Visioning & Needs Assessment: Process Steps

1. Identify stakeholder groups across Region
2. High-level visioning and needs assessment workshop
3. Stakeholder-specific workshops to identify applications needs and associated parameters
4. Collate and compile information

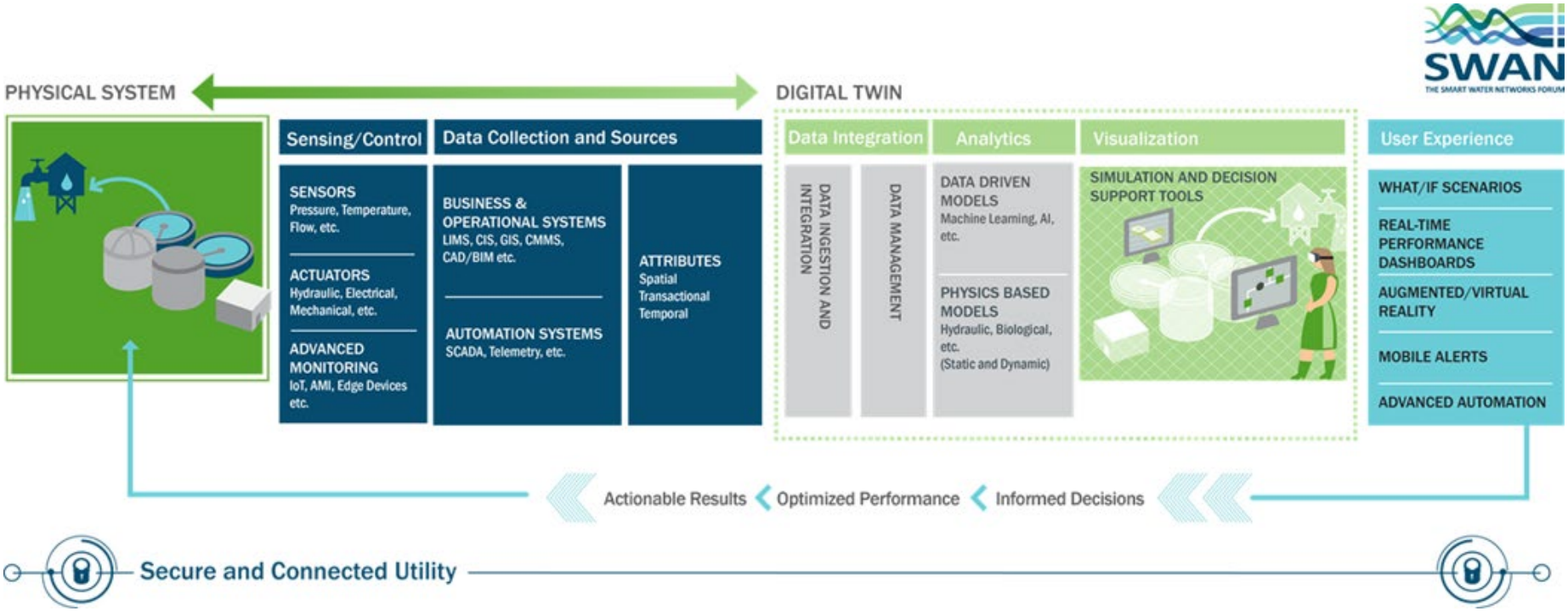
Stakeholder Groups

- Systems Services
  - System Design and Performance
  - Asset Condition and Planning
- System Operations
  - Pump Stations
  - Linear Systems
- Hydraulic Modelling
- SCADA Group

High Level Workshop
WSMP Vision: Guiding Principles



High Level Workshop
Long Term WSMP Vision: Digital Twin



High Level Workshop
Practical WSMP Applications

Short-term goals

- Confirm level of service (LOS) requirements and guide system operation related to LOS
- Monitor flow between pressure zones
- Support compliance reporting

Long-term goals

- Real time alerts: pressures, transients, water quality parameters
- Spatial depiction of data
- Real-time pump performance monitoring
- Predict water demands

High Level Workshop
WSMP Concerns

- QA/QC of the data collected
- Resources required
  - People and Cost
- Data management
  - Retention
  - Storage (currently decentralized)
  - Access
- Cyber security

Individual Workshop Results

Systems Services

- Zone diagnostics
- System optimization
- Pump testing
- Water loss management and leak detection

Individual Workshop Results

System Operations

- Improve zone pressure visibility and management
  - Zone pressure
  - Intra-zonal transfers at PRVs
- Enhanced data capture:
  - Water quality
  - Flushing optimization
  - Hydrant capacity
  - Leak detection
- Allow for “What-if” scenario analysis
  - Digital twin is a long-term goal

Individual Workshop Results

Hydraulic Modelling

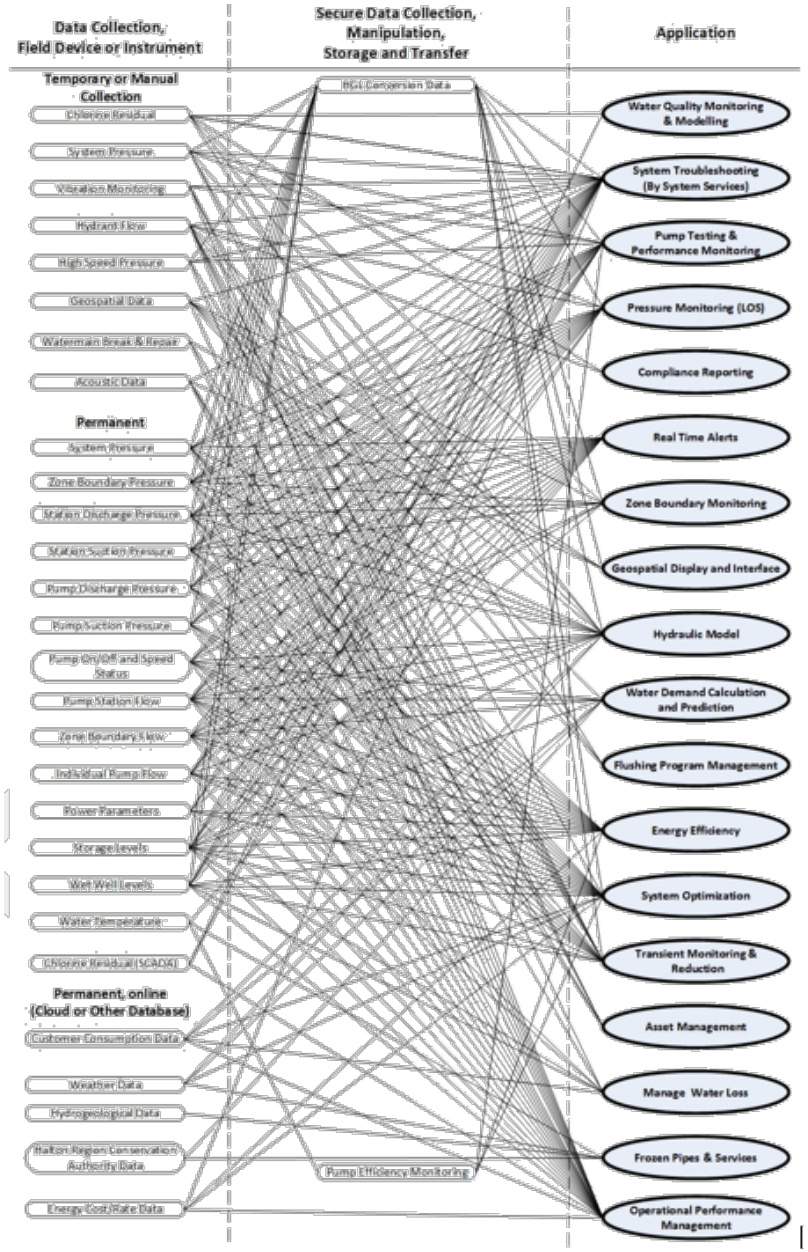
- Connect the hydraulic model to SCADA
  - Calibration and validation
  - Set boundary conditions
  - 5-minute data deemed appropriate to start
- Import asset data (e.g. elevation) to convert pressure to hydraulic grade line (HGL)
- Improve low-flow measurement accuracy
- Allow model to access manually entered PM data:
  - Flushing and hydrant testing
  - Work orders
- Use AMR/AMI data to understand demand patterns

Individual Workshop Results

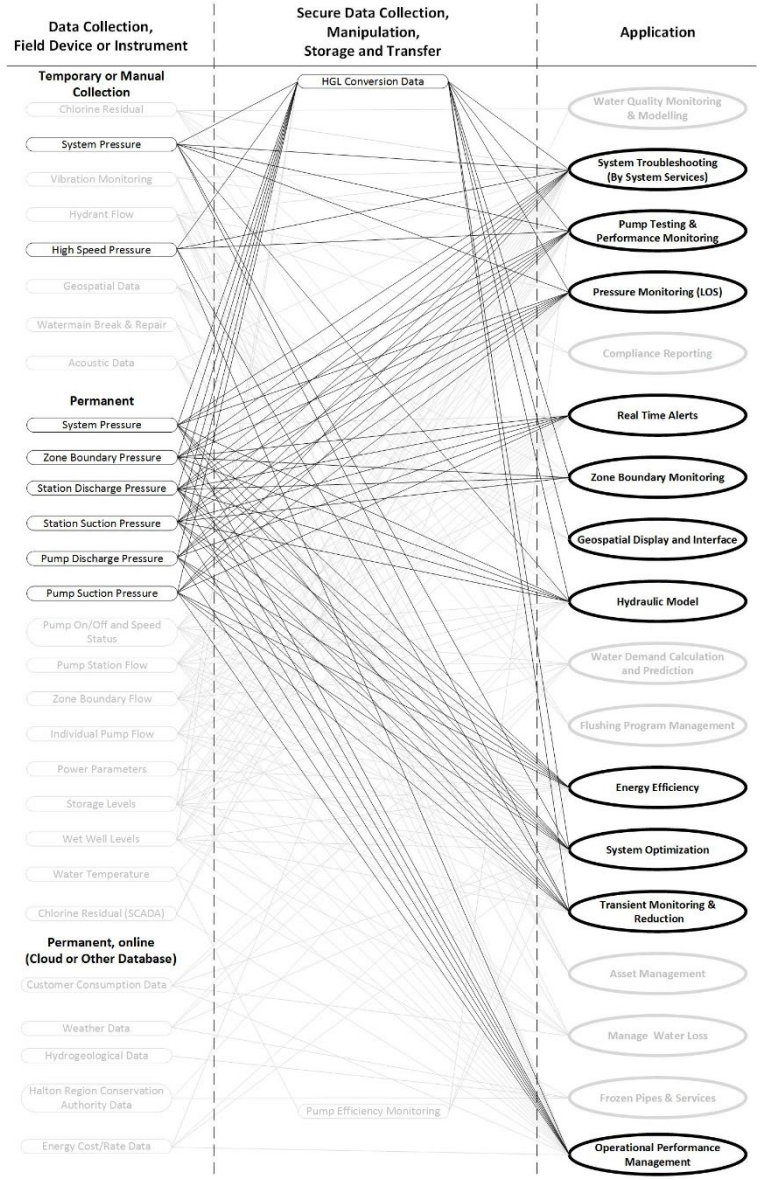
SCADA Group

- Centralize data storage and access
- Compatible with standard issue Microsoft products
- Compliance with latest network infrastructure and cyber security standards
- SCADA team can manage additional WSMP workload

Complex Connectivity of Applications Vs Parameters



Application of Pressure Monitoring Data



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Key Parameters: Steady State Pressure

Collecting the right data

- Better system coverage: **pressure zone boundaries and areas with limited coverage**
- **Temporary monitoring will guide permanent monitoring**
- Meta data to convert to HGL

Data integration

- Provide two data tags: gauge pressure and HGL
- Alternative data storage for temporary instruments, possibly cloud-based

Data application

- Pressure management as an integral part of system optimization as a long-term goal
- Visual representation of HGL across the network

Key Parameters: Flow

Collecting the right data

- Monitoring to be bi-directional with +ve defined
- **Reservoirs, pumping stations and chambers**

Data integration

- Instantaneous and cumulative flow recorded

Data application

- Potential to **replace virtual flow** calculations
- District metering areas (**DMAs**) a long-term feature
  - Utilize AMR/AMI data
  - Zone boundary flow useful in creating ad hoc DMAs

Key Parameters: Free Chlorine Residual

Collecting the right data

- Analyzed at most stations, **more coverage** desired
- Manual/handheld data will not be included in the WSMP
- Longer-term permanent monitoring **issues with freezing and waste disposal**

Data integration

- Centralized data storage an objective
  - Regulatory results stored in LIMS
  - Flushing data stored in Infor PS

Data application

- Visual representation to inform operations

Existing SCADA Monitoring: Sample Example

SCADA Connected Monitoring at Vertical Infrastructure in Burlington

Facility Name	Distribution System	Pressure Zone	Suction Pressure	Discharge Pressure	Flow	Level	Temperature	Free Chlorine
Appleby Line PS and Res.	Burlington	Between B2 & B3	x	x	x	x		x
Bailie	Burlington	Between B2 & B4		x	x	x		x
Beaufort	Burlington	B4	x	x	x	x		x
Brant	Burlington	B1		x		x		x
Headon	Burlington	B3				x		x
Kingsway	Burlington	B1	x	x	x			x
Mt. Forest	Burlington	Between B1 & B2		x		x		x
Tyandaga Reservoir	Burlington	Between B3 & B4	x	x	x	x		x
Washburn	Burlington	Between B1, B2 & B3		x	x	x		x
Waterdown	Burlington	B1		x		x		x

Existing SCADA Monitoring at Chambers

Facility Name	Distribution System	Pressure Zone	Suction Pressure	Discharge Pressure	Flow
Bronte X	Burlington/Oakville Connection	Between B1 and O1	x	x	x
300 mm watermain along Lakeshore (from Mississauga Street to Bronte Road	Burlington/Oakville Connection	Between B1 and O1	No current measurement	No current measurement	No current measurement
Dundas X	Burlington/Oakville Connection	Between B3 & O3	x	x	x
Burnhamthorpe PRV	Milton-Oakville	M4 to O4	x	x	
North Park PRV	Milton-Oakville	M4 to O4	x	x	
Settlers Road PRV	Milton-Oakville	M4 to O4	x	x	
Trafalgar PRV	Milton-Oakville	M4 to O4	x	x	
Hazel McCleary PRV	Oakville	O3 to O2A	x	x	
Joshua Creek PRV	Oakville	O3 to O2	x	x	
Prince John Circle PRV	Oakville	O3 to O2A	x	x	
Royal Windsor PRV	Oakville	O2A to O1	x	x	
White Oaks PRV	Oakville	O3 to O2			

Monitoring Gaps / Opportunities

- Mine existing data for use in the hydraulic model
- Prioritize and address data gaps at permanent facilities
- Install flow meters at storage facilities
- Examine in chamber free-chlorine residual monitors
- Identify additional permanent monitoring locations
- Heat mapping to identify trouble spots

Ongoing Work

- Municipal partner survey to confirm best management practices
- Vendor survey to confirm cost and deployment details
- Prioritize short (1 year), medium (2-5 year) and long-term (>= 5 years) goals
- Develop and conduct a pilot to validate the overall plan

QUESTIONS?

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