- Ministry of the Environment, Conservation and Parks

Stormwater Monitoring Guidance

for Consolidated Linear Infrastructure Environmental Compliance Approvals

February 2023

Ontario

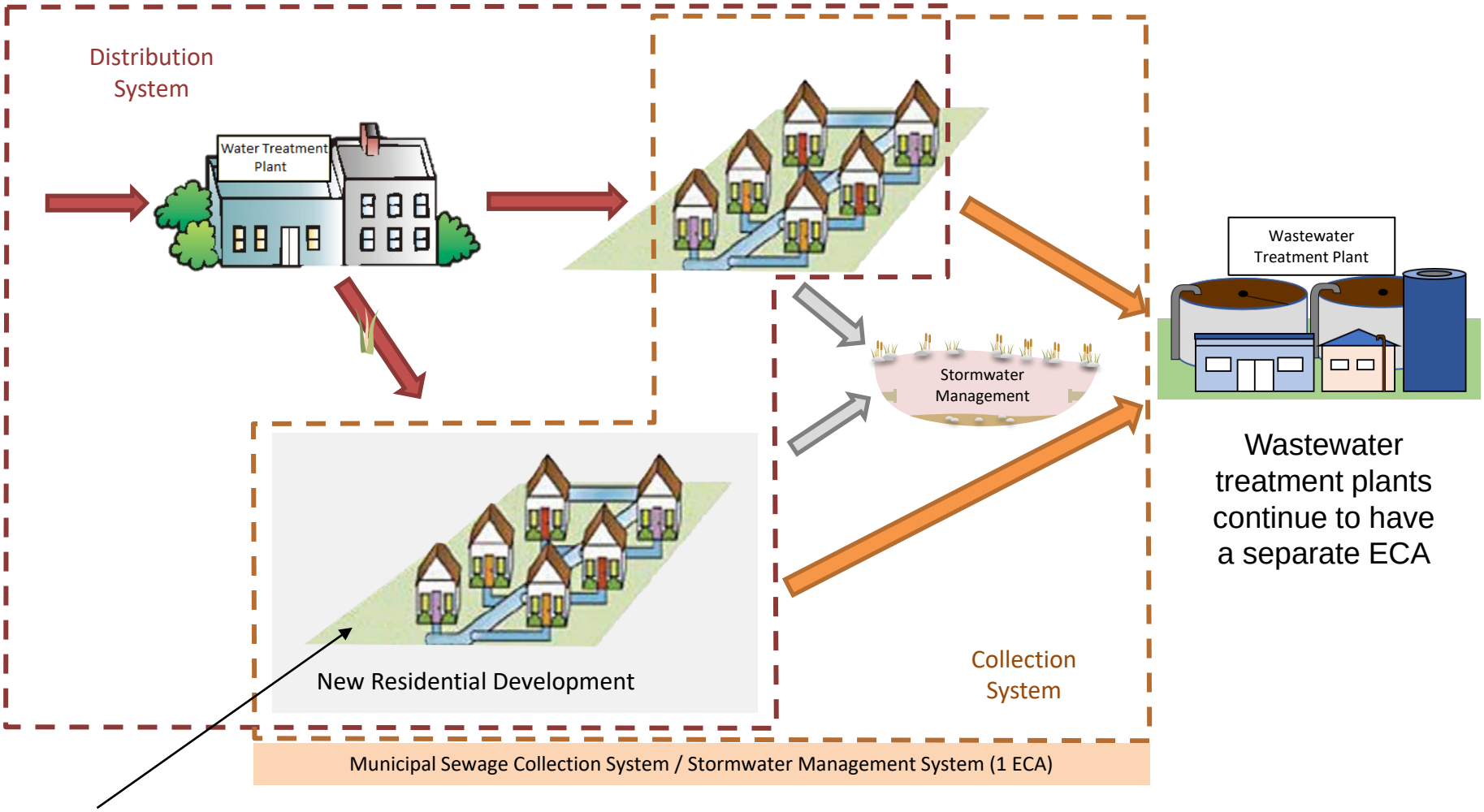
Background and Purpose

- Over 500 CLI ECAs have been issued in final or draft form
- Stormwater CLI ECAs require monitoring on the authorized system as a whole, as opposed to individual pieces of infrastructure such as ponds on previous ECAs
- Conditions in the CLI ECA anticipate the development of a future guidance document, which will assist municipalities in meeting the requirements of monitoring the authorized works as a system
- This presentation will describe in general, some of the considerations in the future guidance, to allow municipalities to begin early planning for these once the guidance becomes final
- The draft guidance document will be posted on ERO for comment, prior to implementation

The CLI Approach

- Consolidated Linear Infrastructure (CLI) Environmental Compliance Approvals (ECA) represent a modernized approach to low-risk municipal linear infrastructure permissions.
- Applies to sanitary sewage conveyance and stormwater management (e.g., sewers).
- Includes pre-authorization conditions similar in scope to municipal drinking water.
- Reduces burden on municipalities, developers and the ministry, while imposing a consistent set of conditions intended to improve environmental protection.

Consolidated Linear Infrastructure Permissions Approach



Wastewater treatment plants continue to have a separate ECA

E.g., similar scope of pre-authorization for extension to new residential developments in three permissions: drinking water, sanitary sewage collection and stormwater management.

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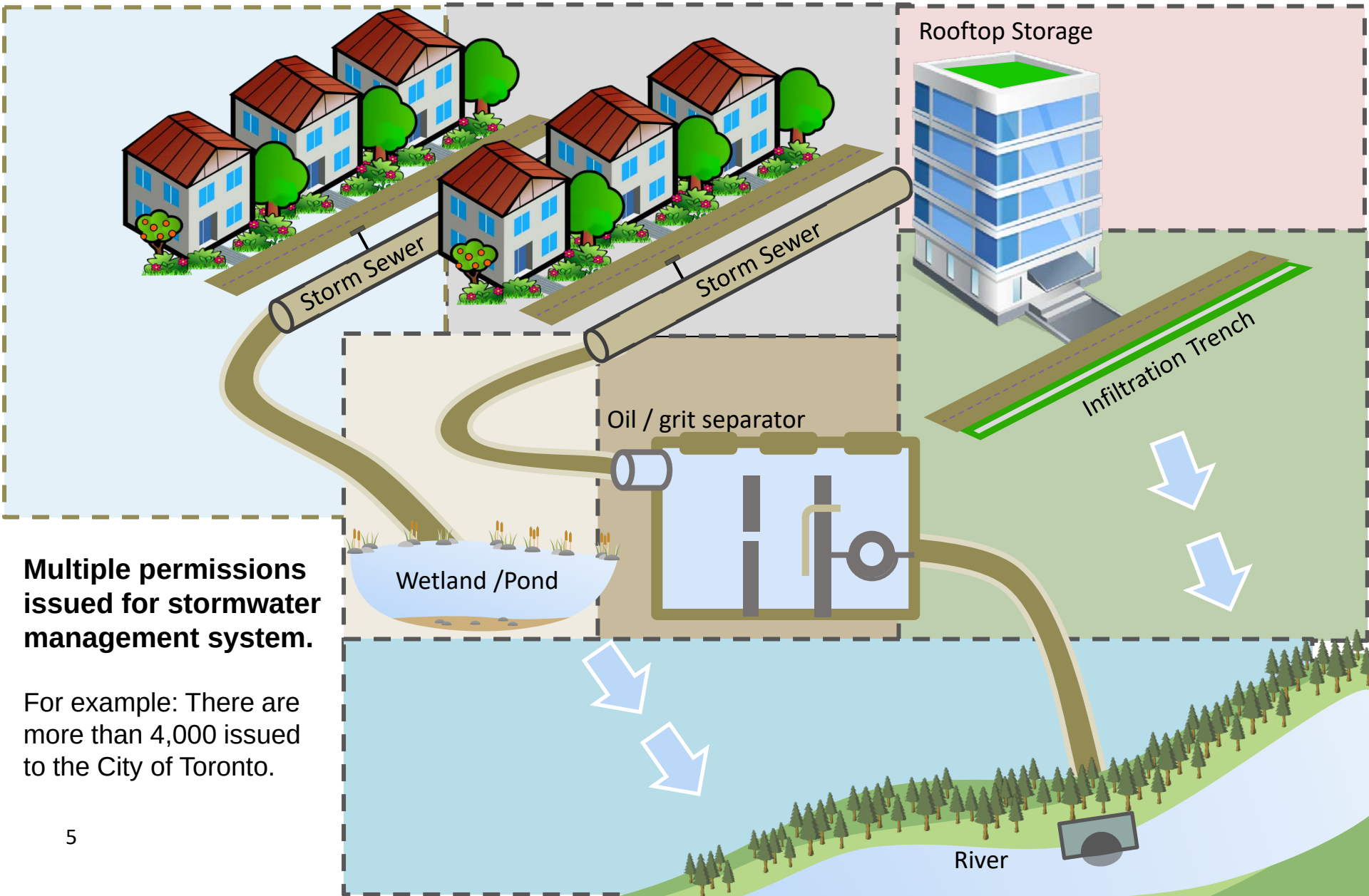
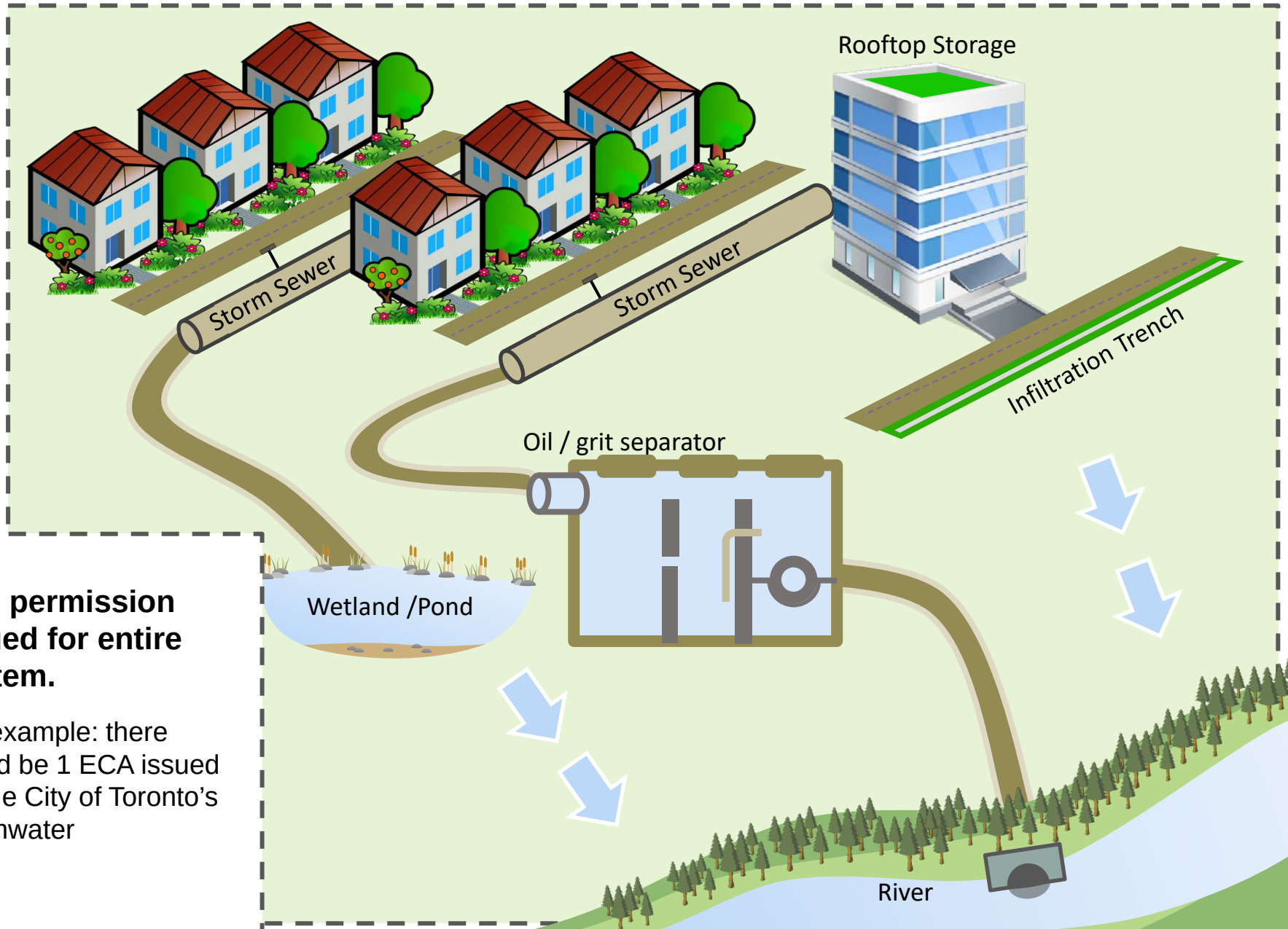
Approvals for Stormwater Management - Current State



Multiple permissions issued for stormwater management system.

For example: There are more than 4,000 issued to the City of Toronto.

Approvals for Stormwater Management - Future State



One permission issued for entire system.

For example: there would be 1 ECA issued for the City of Toronto's stormwater

Consolidated Linear Infrastructure Permissions

Three Key Components

New ECA Templates

- Introduce a standard format and standard conditions
- Include new preauthorization conditions

New Design Criteria

- When followed, enables alteration to the works without a separate approval
- For sanitary and some types of storm collection systems
- Includes clear design specifications, including post installation checks

Prescribed Persons Regulation O. Reg. 208/19

- Enables developers to make alterations to a municipality's sewage system without a separate approval, if the works will be transferred to municipal ownership under a development agreement

Monitoring Guidance

- Provides guidance on development and implementation of monitoring program as required in conditions of a CLI-ECA
- Describes specific considerations such as siting of monitoring locations, key parameters and methods.
- Intent is to build upon existing studies/plans/programs or monitoring that may already be in place.
- Not “one size fits all”, scalable and flexible.

Conditions in the CLI-ECA

Schedule E – Condition 4

4.0 Monitoring Plan

4.1 On or before <DATE > or within twenty-four (24) months of the date of the publication of the Ministry's monitoring guidance, whichever is later, the Owner shall develop and implement a monitoring plan for the Authorized System. The monitoring plan shall be:

4.1.1 Signed and approved by management with the authority delegated by the Owner to do so;

4.1.2 Peer-reviewed by a third-party Qualified Person (QP), external to the development of the Monitoring Plan, to verify the adequacy of the Monitoring Plan in complying with conditions 4.4 and 4.5 of Schedule E. The results of the peer review shall include:

a) Written confirmation from the QP that they have the experience and qualifications to carry out the work; and

b) Written confirmation from the QP of the adequacy of the Monitoring Plan.

High Level Overview

- System wide (municipal wide) ECA
- Focus on overall system performance and receiver monitoring
- Monitoring for overall system performance, not point-in-time compliance
  - Cannot create adverse impact on the environment.
- Align with pre-authorization and longer term planning

Overall intent is to provide a scalable and flexible framework for monitoring that can be tailored to the individual system in a manner that is meaningful, practical and cost effective.

Objectives of the Monitoring Plan

1. Verify that the operational performance of the municipal stormwater system infrastructure is as designed/planned;

2. Assess the environmental impact of the municipal stormwater management system on the receiver;

3. Develop and implement a process to address performance deficiencies or environmental impacts through adaptive management.

Qualified Professional Requirements

- **A monitoring plan can be developed by:**

1. The Municipality (owner of the system identified on the CLI-ECA)
2. Multiple municipalities in the same watershed (e.g., upper and lower tier)
3. Qualified Person under the supervision of the municipality(ies), such as consultants, conservation authorities or academic institutions.

-

A **Qualified Person** is defined as persons who have obtained the relevant education and training and have demonstrated experience and expertise in the areas relating to the work required to be carried out.

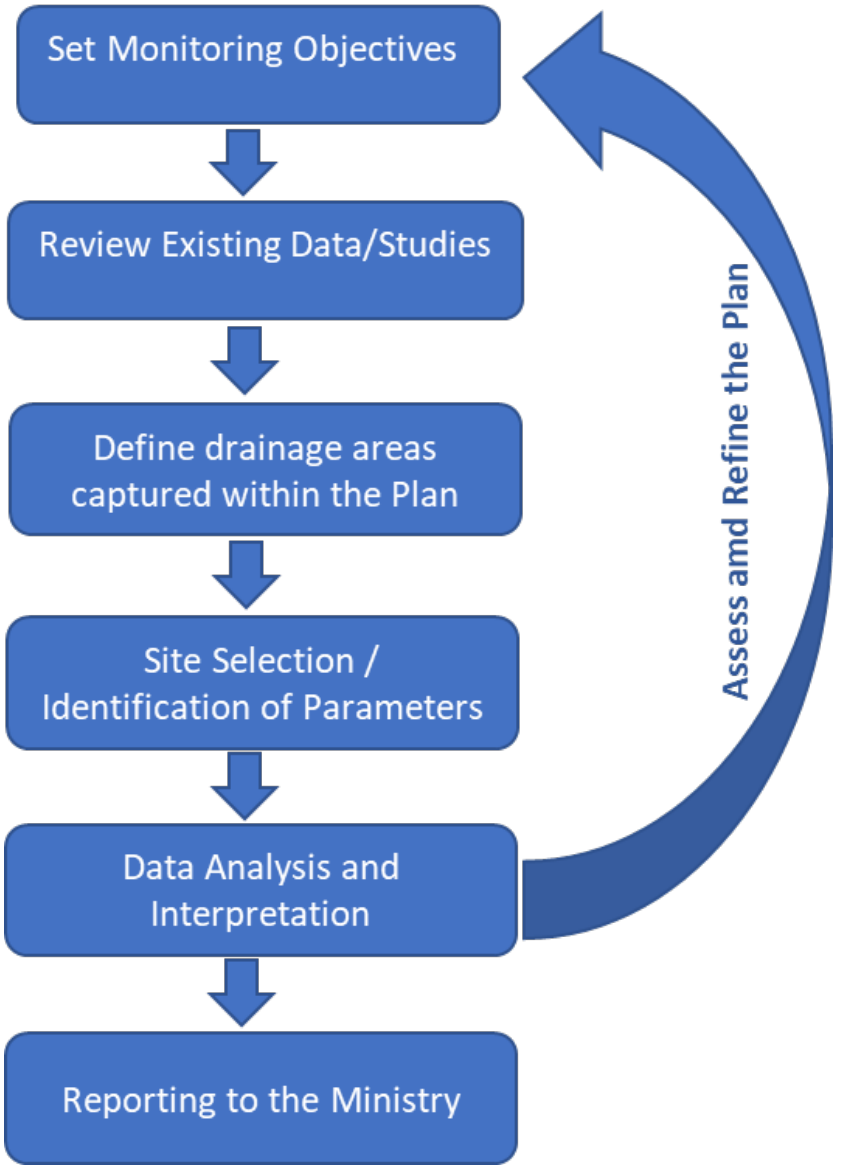
- **The Qualified Person is permitted to perform the following:**

1. Develop and/or assist with the monitoring plan under the supervision of the municipality(ies);
2. Peer-review the monitoring plan under the supervision of the municipality(ies);
3. Carry out the monitoring plan tasks under the supervision of the municipality(ies)

Qualified Professional Requirements

- **A Qualified Person should have experience and knowledge on the following topics:**
  - Principles and challenges of stormwater monitoring for receiving waters;
  - Performance monitoring of different types of stormwater management infrastructure;
  - Factors that impact stormwater run-off quality and quantity and impacts on groundwater, surface water and stormwater use;
  - Local water quality and quantity issues;
  - Stormwater monitoring procedures, sample collection and handling practices including sample processing techniques;
  - Owner's Environmental Compliance (ECA) as it relates to stormwater monitoring and reporting;
  - QA/QC procedures for sampling and analysis and interpretation of collected monitoring data;
  - Relevant acts and regulations including but not limited to Ontario Water Resources Act (OWRA), Environmental Protection Act (EPA), Environmental Assessment Act (EAA), Species At Risk Act (SAR), Fisheries Act, Nutrient Management Act (NMA).

Developing a Monitoring Plan



Ontario

Watercourse and SWM System Monitoring

- **Overall**

- Continued proactive implementation of a municipal SWM O&M guide/manual to ensure SWM infrastructure is functioning as designed is the foundation of the ECA monitoring plan.
    - ❖ Instances where a municipality does not have one, one should be prepared and put into effect as per Condition 3.0, Schedule E of the SWM CLI ECA template.
- Monitoring recommendations should be considered as amendments to the an O&M program where applicable.
- Monitoring must be representative of dry weather, wet weather, and snowmelt flow regimes of selected outfalls and watercourses.
- In some instances, localized monitoring (e.g. level) of one or more SWM technologies may need to be conducted to evaluate performance if not already part of an SWM O&M program.
- Decision making information to be used for ambient and long-term trend observations of receiving waters and/or to evaluate the effectiveness of SWM maintenance activities. Data will streamline adaptive management strategies to rectify and manage the issues identified.

Monitoring Attributes: Water Quantity

Attribute and Target	Notes	Data Use
Water Level	Used to observe timing and duration of runoff in/out of watercourses and SWM systems (runoff intensity/duration, draw down times, overflows, flooding, etc..) and in the development of stage-discharge relationships.	Decision making, reporting, QAQC
Velocity/Flow	Used to observe rates and volume of runoff in/out of watercourses and SWM systems, a necessity to calculate loading, and in development of stage-discharge relationships.	Decision making, reporting, QAQC
Precipitation	Used to observe precipitation event and runoff dates, duration, intensity, input volume, flooding documentation, and for QAQC when assessing flow regimes.	Decision making, reporting, QAQC
Snowmelt Observation (for grab sample classification)	Used to observe infrequent flow conditions during winter months when SWM systems are affected by ice, snow, and/or precipitation at any given time. This attribute is typically observed in conjunction with air temperature, precipitation, and observable snow on the ground.	Decision making, Metadata
Dry Weather Observation (for grab sample classification)	Used to observe the most common condition of any SWM system. It is helpful in establishing baseline conditions of both the natural and sewershed systems. In addition, depict potential short circuits, clogged outlets, sediment accumulation, or excessive groundwater input within an active system.	Decision making, Metadata

NOTE:

- **Multiple options are available to monitor level, flow and precipitation. Methods can range from manual measurements to automating the process.**
- **Station design/method to be planned by the QP with the municipality and considering its resources.**
- **If using automated device(s), the equipment can be moved across jurisdiction to maximize resources available and timelines**

Monitoring Attributes: Water Quality

Attribute and Target	Notes	Data Use
Grab Samples	• Representative grab samples of dry weather, wet weather, and snowmelt conditions as defined by the QP which will include selected outfalls and watercourses. • Used for ambient and long term trend observations of a municipal SWM system to receiving waters and can be used to evaluate the effectiveness of SWM maintenance activities.	Decision making, reporting
Spot Measurement (pH, Water Temp)	Water temperature and pH can be measured manually directly from the grab sample bottle using a thermometer and pH strips.	Decision making, reporting

NOTE: Autosamplers or sondes may be used if preferred and can be setup for more robust sampling activities as needed.

Sample Conditions:
• Dry weather: 3-5 days after precipitation or snowmelt.
• Wet weather: timed with rainfall during and shortly after rain has stopped.
• Snowmelt: presence of snow on ground (trace amounts not included), air temperature above or near freezing, decrease in snow depth on ground, or rain on snow event where runoff is observed.

Water Quality Suite:
Total Suspended Solids (TSS), Total Phosphorous (TP), Chloride, Potentially Others TBD

Grab samples need a minimum representation of:
• Baseflow condition: 1 sample/station/season.
• Rainfall event flows: 2 samples/station/season representing late spring, summer, and fall.
• Snowmelt event flows: 1-2 sample(s)/station/during winter/early spring.

Monitoring Attributes: Other

Attribute and Target	Notes	Data Use
Air Temperature	Useful parameter to measure that can assist with decision making and data QAQC. Some of which include: help determine the timing of snowmelt events and classify grab sample type (e.g. wet weather vs. snowmelt).	Decision making, QAQC, Metadata
Identification of New Development or Erosion Sediment Controls	Tracking of major construction activities in a drainage area can help identify sources of poor water quality. It can also determine if issues within a drainage area are acute or chronic.	Decision making, Reporting, Metadata
Sediment Accumulation	As per Condition 3.2, Schedule E of the CLI SWM ECA, inspection of sediment accumulation must be conducted as per the Municipality's O&M guide/manual, as appropriate.	Decision making, Reporting

NOTE:

- **Document the number of major developments in a jurisdiction where there are ESC plans and/or runoff discharging to a watercourse. Only basic information is needed which includes: location of development or ESC plan, receiving watercourse, start/end of development activities.**

- **The method used to measure sediment accumulation will differ with the type of SWM technology being assessed (e.g. pond, OGS, tank, catch basins, etc..). Commonly used options:**
  - ❖ Visual inspection
  - ❖ Sediment coring and probes
  - ❖ Survey method (disc mounted to bottom of survey rod) and running transects
  - ❖ Bathymetric survey (using surface device such as ADCP)
  - ❖ Desk-top forecasting (will need some field measurements)

Monitoring Locations

Attribute and Target	Duration	Notes
Major Watercourse Quality/Quantity	Long term (ambient)	All major watercourses and confluences within or crossing a municipalities jurisdiction including: where a major watercourse(s) starts/enters and ends/leaves its jurisdiction and upstream and downstream of major watercourse confluences to isolate the watercourse into natural subcatchments. It's not expected that every tributary be monitored, but strategically chosen by the QP to represent the overall natural system that captures the outfall(s) of a municipalities SWM system. This is typically with stream orders 2 or greater (ref: Strahler).
SWM Major Sewershed Outfall Quality/Quantity	Long/short term (ambient)	Only major outfalls within a municipalities jurisdiction that enters a watercourse and fall between an upstream and downstream ambient monitoring station. It is not expected that every outfall be monitored, but strategically chosen by the QP to assist with decision making and represent major SWM systems on a short or long term basis.
SWM Technology	Short term, typically for performance evaluation (as needed)	Focus should be on water quantity and sediment accumulation within the local sewershed of one or more SWM technologies. Location emphasis may include local sewershed, inlet(s), outlet(s), and detention area as needed. Water quality can also be used if deemed necessary.
Precipitation	Long term (recommended)	One precipitation gauge or third party source per municipality is acceptable. Due to the variability of precipitation, additional gauges can be installed or used to develop a precipitation average for the jurisdiction.
Air Temperature:	Long term (recommended)	One temperature gauge or third party source per municipality is acceptable.
Snow Pack	As needed (for grab sample classification)	Observations of snow pack presence can be taken from any large open spaces with natural infiltration such as a field, lawn, or park. It should not include high traffic areas such as parking lots since snow depths are influenced by plowing, de-icing, and other activities.
New Development and Erosion and Sediment Control	Long term (recommended)	Identifying major construction activities can help identify sources of poor water quality. It can also determine if issues within a drainage area are acute or chronic.

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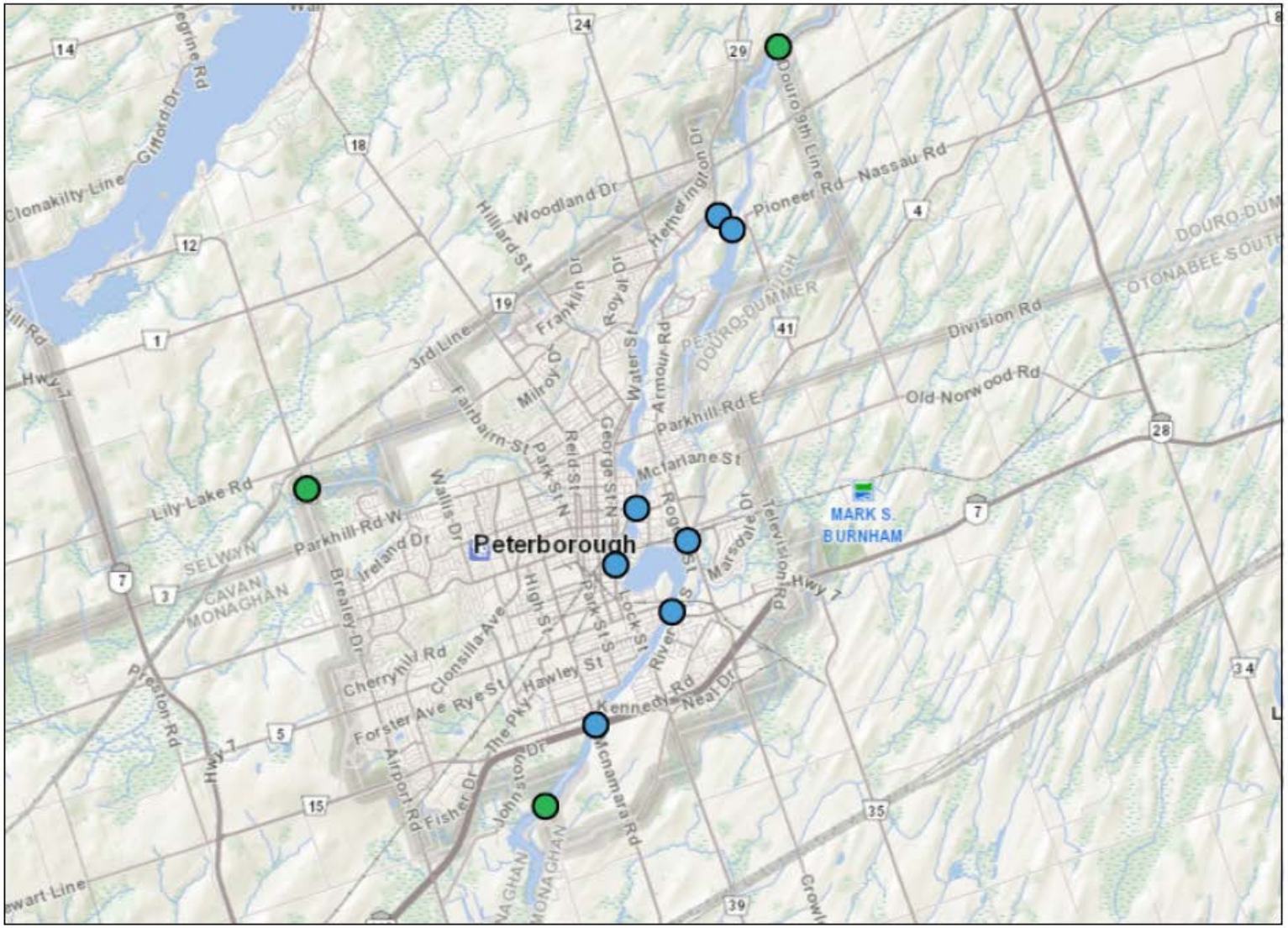
Ontario

MINISTRY OF NATURAL RESOURCES AND FORESTRY

Ontario Watershed Information Tool

EXAMPLE ONLY



Legend

- Assessment Parcel
- Secondary Watershed
- Tertiary Watershed
- Quaternary Watershed
- Great Lakes - St. Lawrence Basin
- Hudson - James Bay Basin
- Nelson River Basin
- Diversions
- Waterbody Outlet
- Conservation Authority Dam
- Provincial Dam
- Federal Dam
- OPG Dam
- Other Dam
- Virtual Flow Segment

Land Cover Compilation

- Other
- Cloud/Shadow
- Clear Open Water
- Turbid Water
- Shoreline
- Mudflats
- Marsh
- Swamp
- Fen
- Bog
- Heath
- Sparse Treed
- Treed Upland
- Deciduous Treed
- Mixed Treed
- Coniferous Treed
- Plantations - Treed Cultivated
- Hedge Rows
- Disturbance
- Open Cliff and Talus
- Alvar
- Sand Barren and Dune
- Open Tallgrass Prairie
- Tallgrass Savannah
- Tallgrass Woodland
- Sand/Gravel/Mine Tailings/Extraction
- Bedrock
- Community/Infrastructure
- Agriculture and Undifferentiated Rural Land Use

5.3 0 km 2.63 5.3

Scale: 1 : 103,357

Projection: Web Mercator

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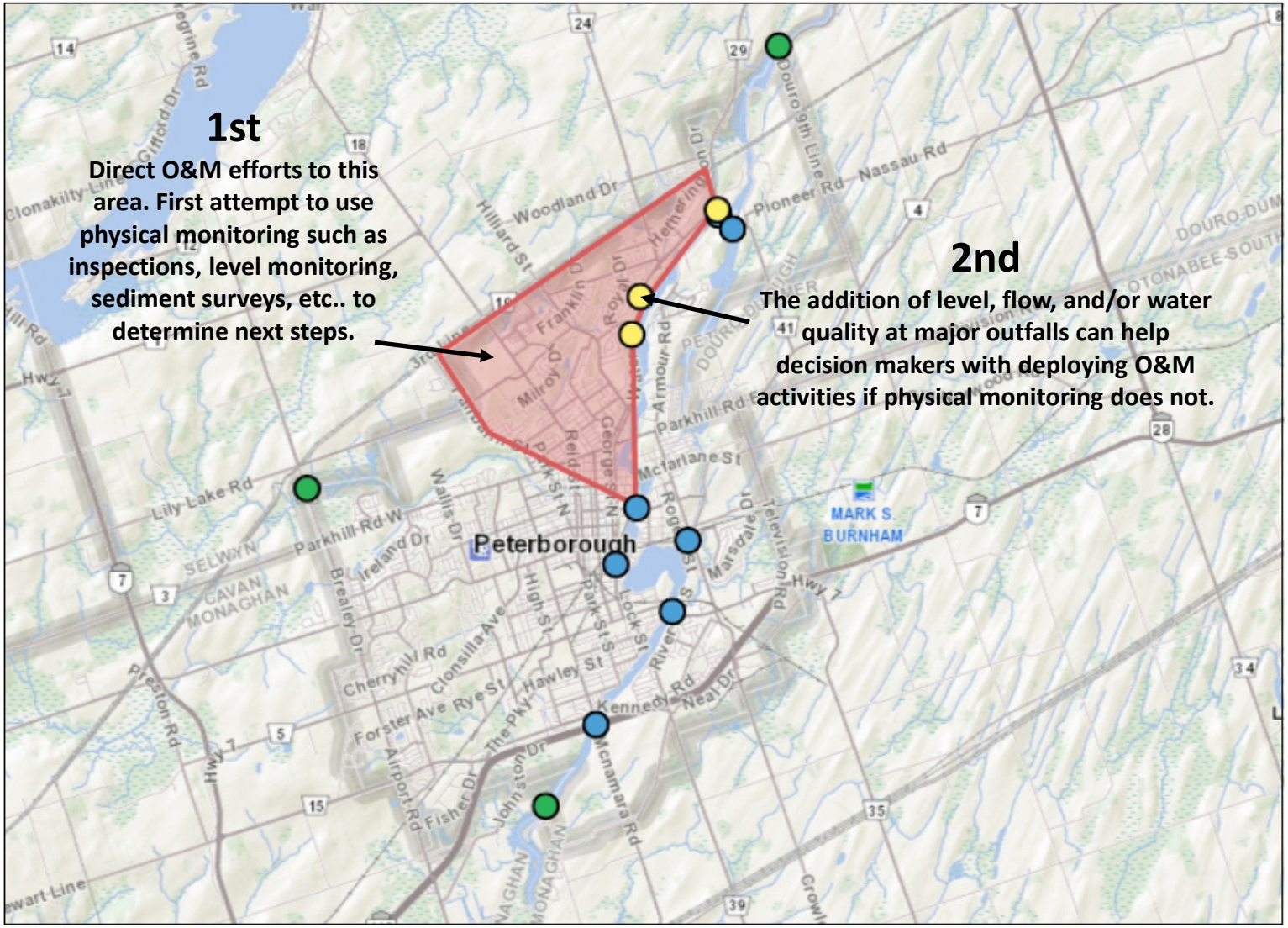

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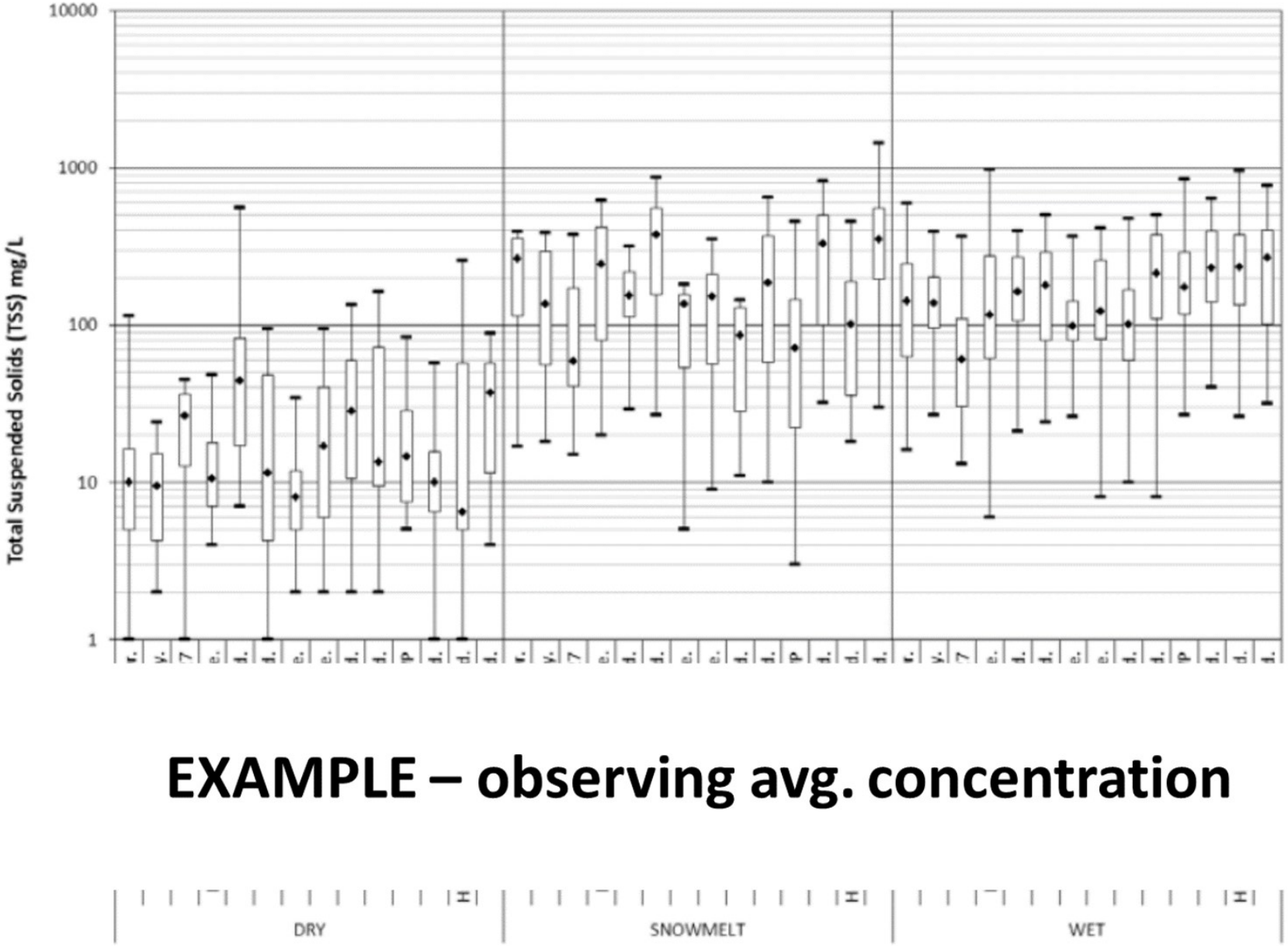
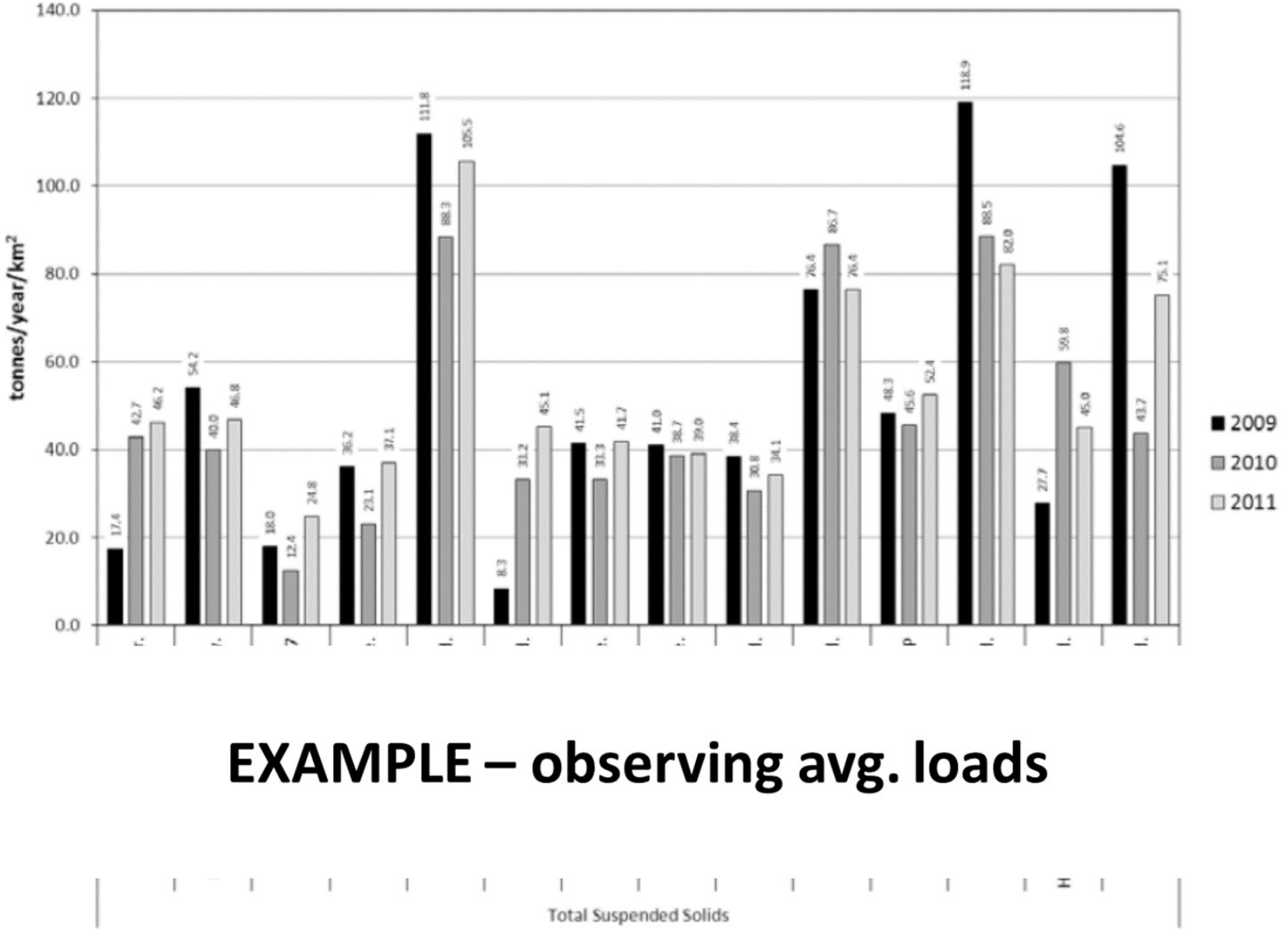


EXAMPLE – observing avg. concentration

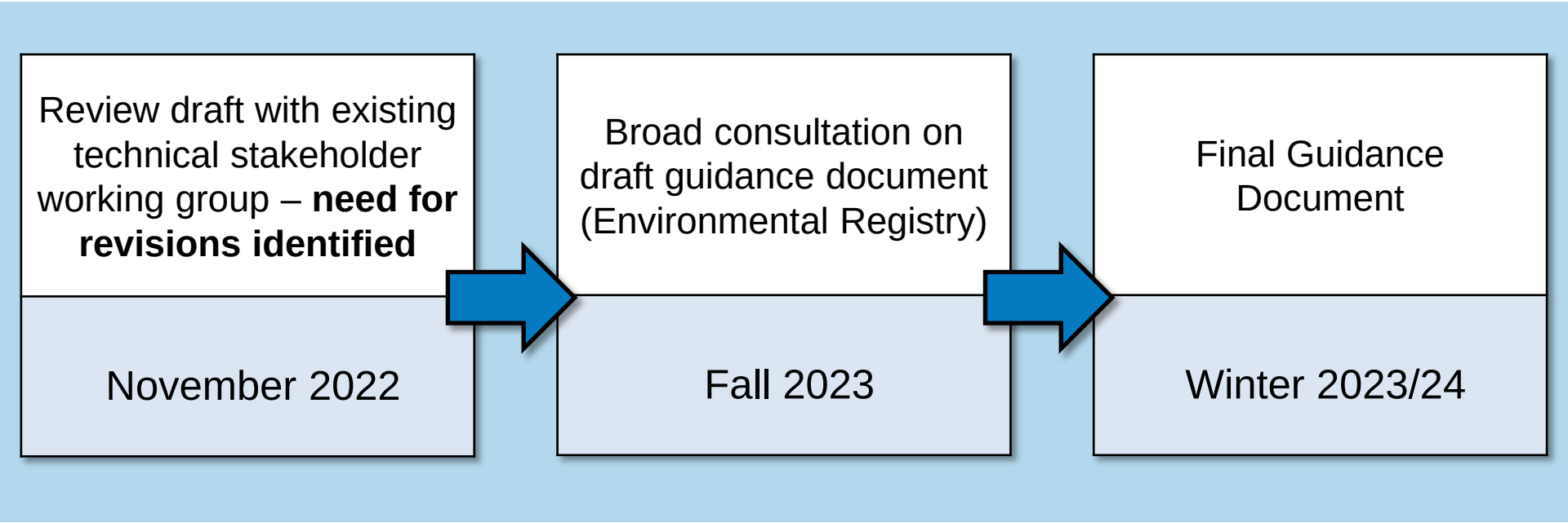


EXAMPLE – observing avg. loads

Additional Topics Covered in Guidance

- **Sampling, Analysis and Record Keeping**
  - Details on what should be considered in relation to the methods, data summaries, and record keeping.
- **Construction and Sediment Control**
  - Construction activities are a leading cause of increased total suspended solids and the CLI ECA requires development and implementation of erosion and sediment control plans.
- **Reporting Requirements**
  - Details on what should be included in annual performance reports provided to the Director.
- **Case Studies**
  - Case studies will be included that provide example implementations of monitoring strategies.

Anticipated Next Steps & Timelines



Note: the CLI-ECA allows the system owner (Municipality) up to two years from the date of publication of the guidance document to ***develop*** and ***implement*** a monitoring plan that meets the requirements in the ECA.

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Thank You

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CLI ECA Receiver Monitoring:

Lake Simcoe Watershed Pilot

Source To Stream

March 22, 2023

David Lembcke, Manager, Environmental Science and Monitoring

Lake Simcoe Region conservation authority

Lake Simcoe Watershed Urban Areas

- Medium to smaller urban areas
  - Approximately 455 stormwater ponds in the watershed
  - Approximately 195 LID features

Schedule E – 4.0 Monitoring Plan

- Monitoring Plan requirements:
  - **4.4.1** Verify that the operational performance of the Municipal Stormwater Management System is as designed/planned;
  - **4.4.2** Assess the environmental impact of the Municipal Stormwater Management System; and
  - **4.4.3** Inform any corrective action that may be required to address any performance deficiencies or environmental impacts identified from above 4.4.1 or 4.4.2.

Monitoring Plan Implementation

- Robust O&M program first line of defence in identifying performance issues.
- 4.4.1 and 4.4.3
  - Annual inspections (general condition minor / major failure)
  - Sediment accumulation assessments
  - Water level monitoring (hydraulic function + following flooding event)

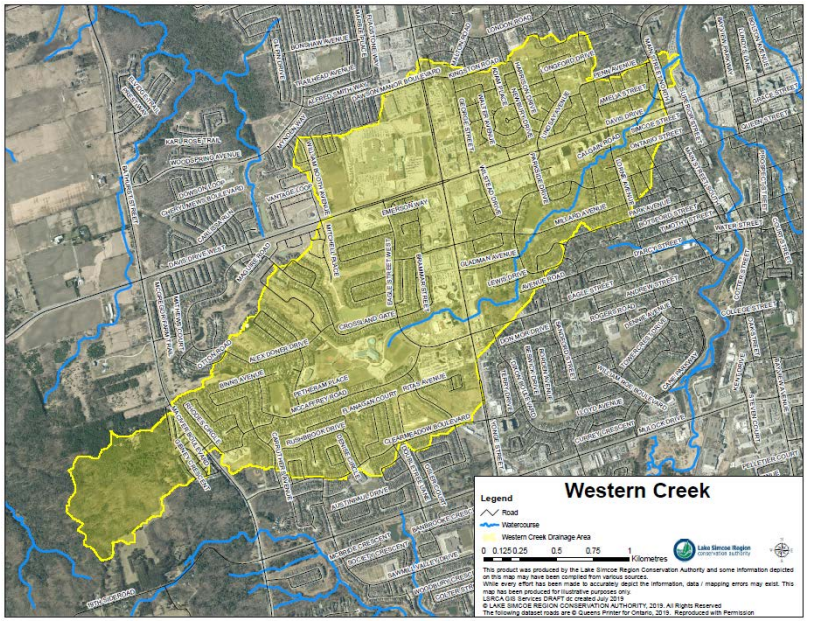
Monitoring Environmental Impacts (4.4.2)

Receiver Monitoring

- **Meaningful data**
- Informs SWP management and demonstrates value of maintaining SWP assets
- Respond to stormwater infrastructure
- **Cost effective**

Monitoring Plan Implementation

- Receiver monitoring of “Sentinel Catchments”. In most cases its not possible to capture entire jurisdiction.
  - Low stream order
  - High density of stormwater infrastructure
  - Maintenance of infrastructure could be expected to elicit a response in stream characteristics
  - Prioritize parameters most affected by stormwater infrastructure (stream flow TSS)
  - Pace of maintenance and required monitoring data = long term monitoring required



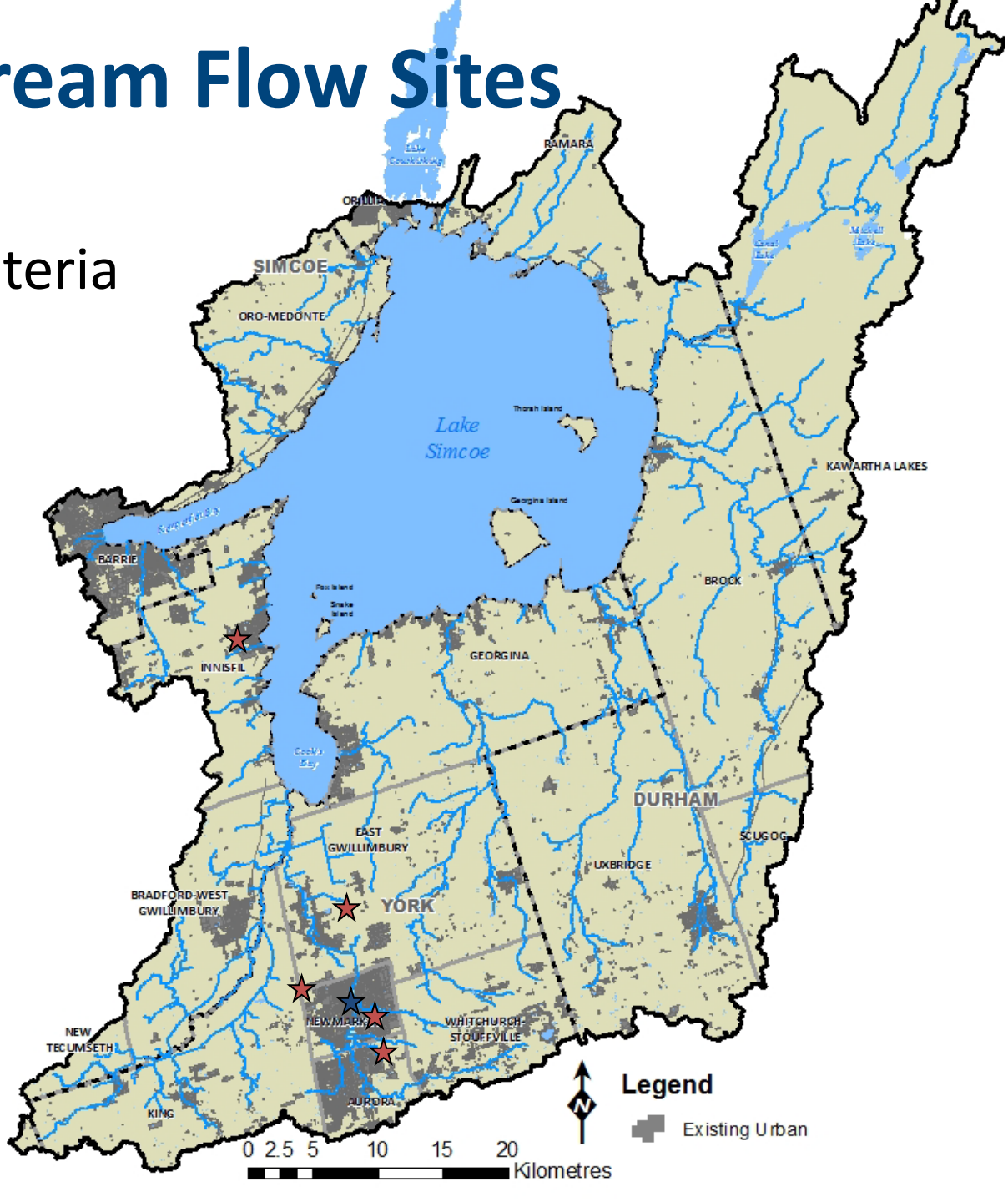
Primary Goal – See receiver improve over time with improved SWM controls.

Sentinel Catchment Scenarios

1. Catchment that may see change due to improved O&M
   - Reduction in peak flows
   - Reduction in flood magnitude,
   - Change to flow regime or flow duration curve
2. Catchment seeing retrofitting of uncontrolled areas
   - Change to flow regime or flow duration curve
   - Comparison to a reference system
3. Catchment seeing new development
   - Maintain the existing flow regime

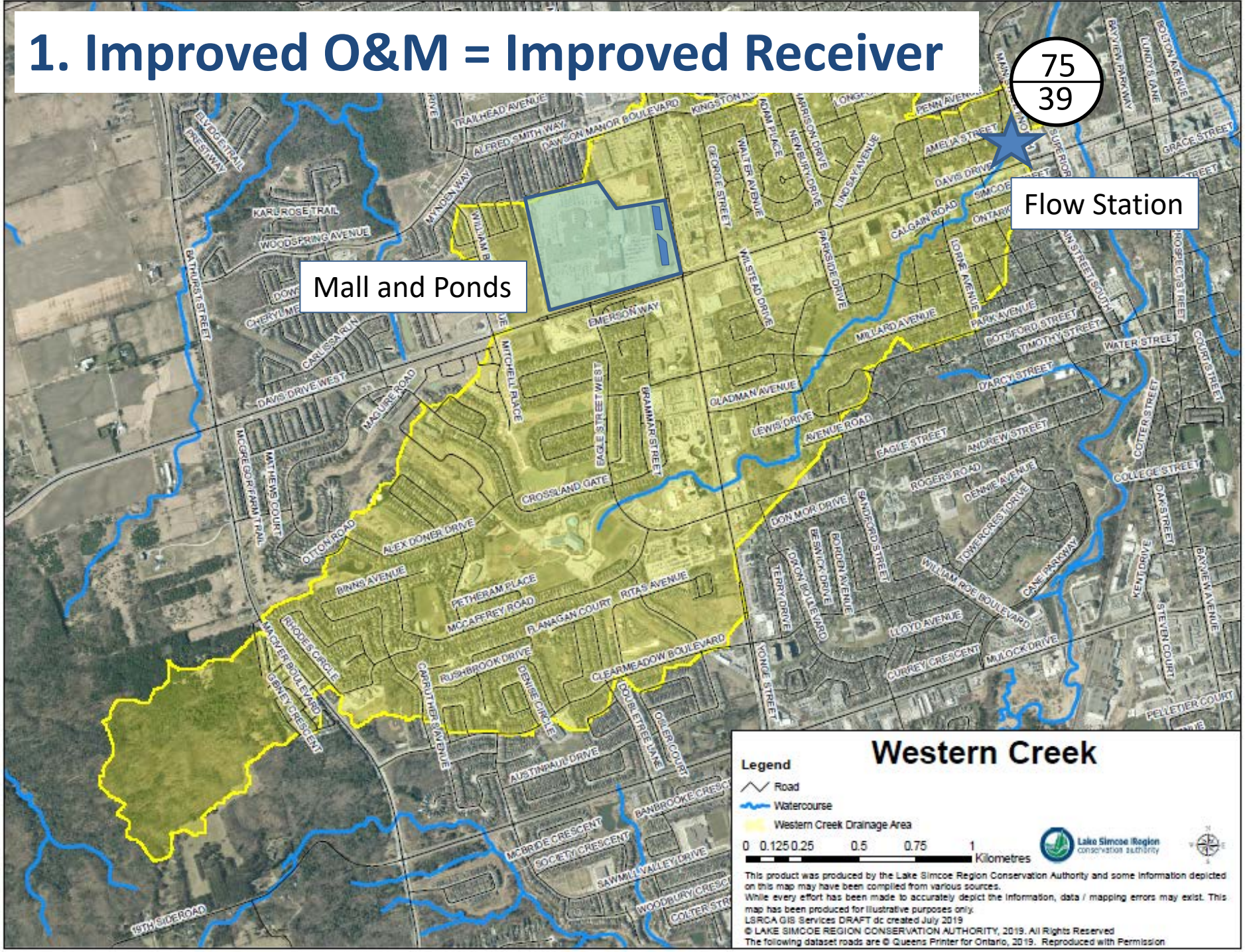
Short listed Stream Flow Sites

- ★5 sites met initial criteria
- ★1 site slated for intensive retrofitting
- 0 sites identified as future growth*



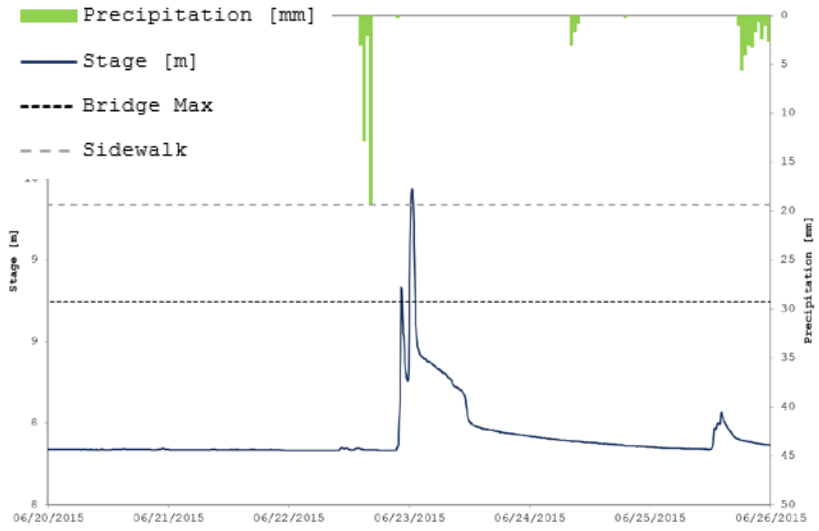
Potential Sentinel Location in Aurora

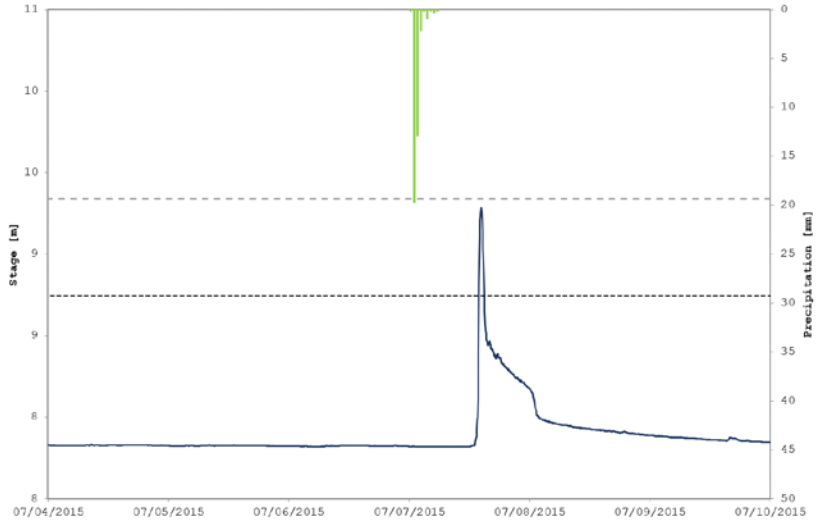
1. Improved O&M = Improved Receiver



1. Pond Maintenance = Peak Flow Reduction

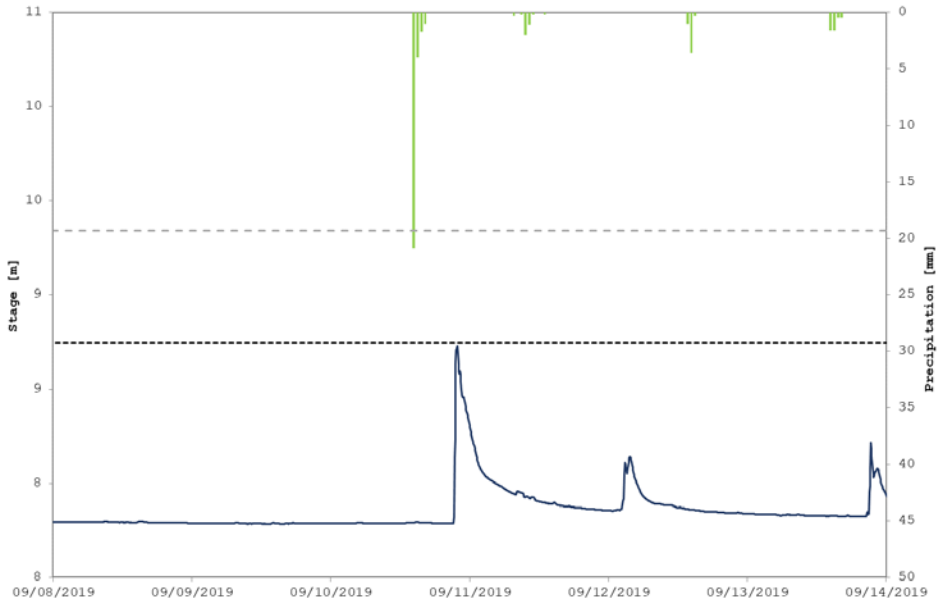
2015 – Pre-Clean Out





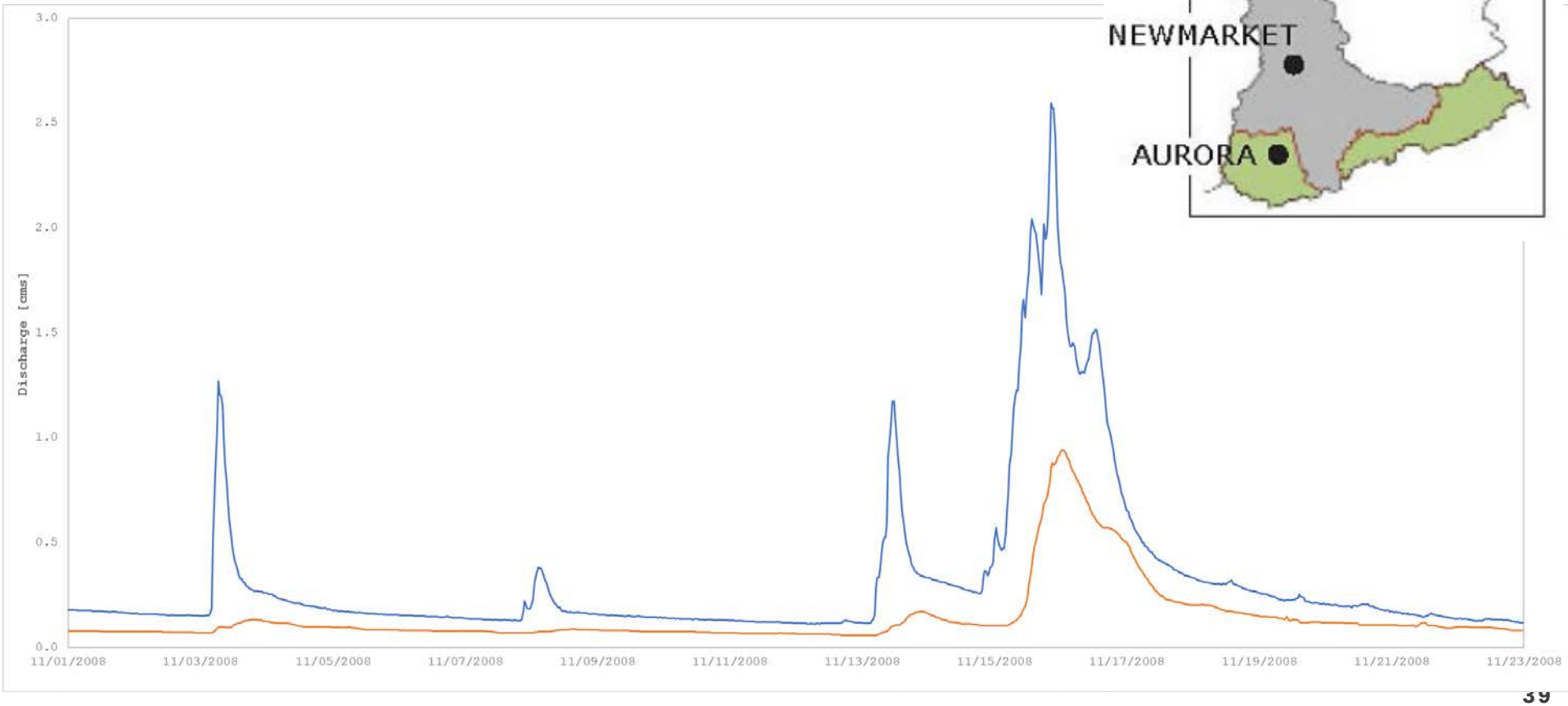
- Upper Canada Mall pond clean out occurred 2016
- Pre-clean out flooding of road occurred
- Post-clean out no road flooding recorded

2019 – Post-Clean Out

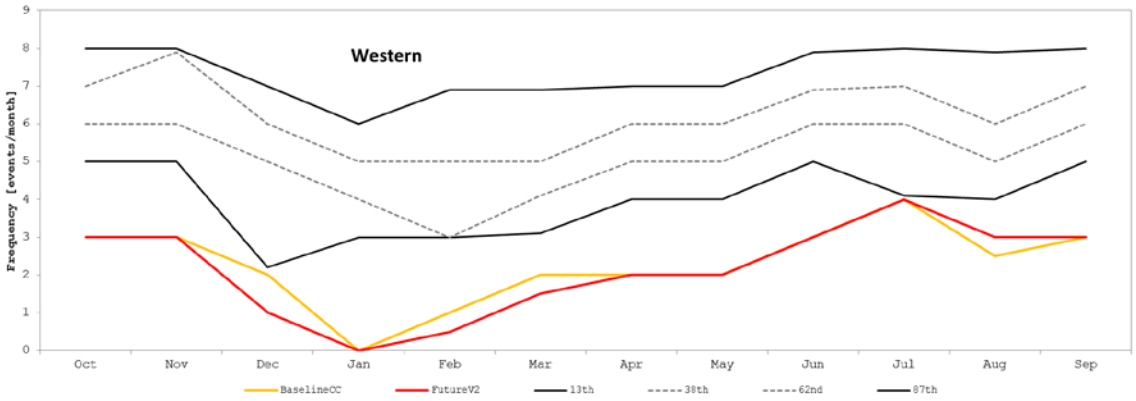


2. Reference system or 3. Maintain existing regime

- Example of neighbouring – Urban and – Rural catchments within the same watershed



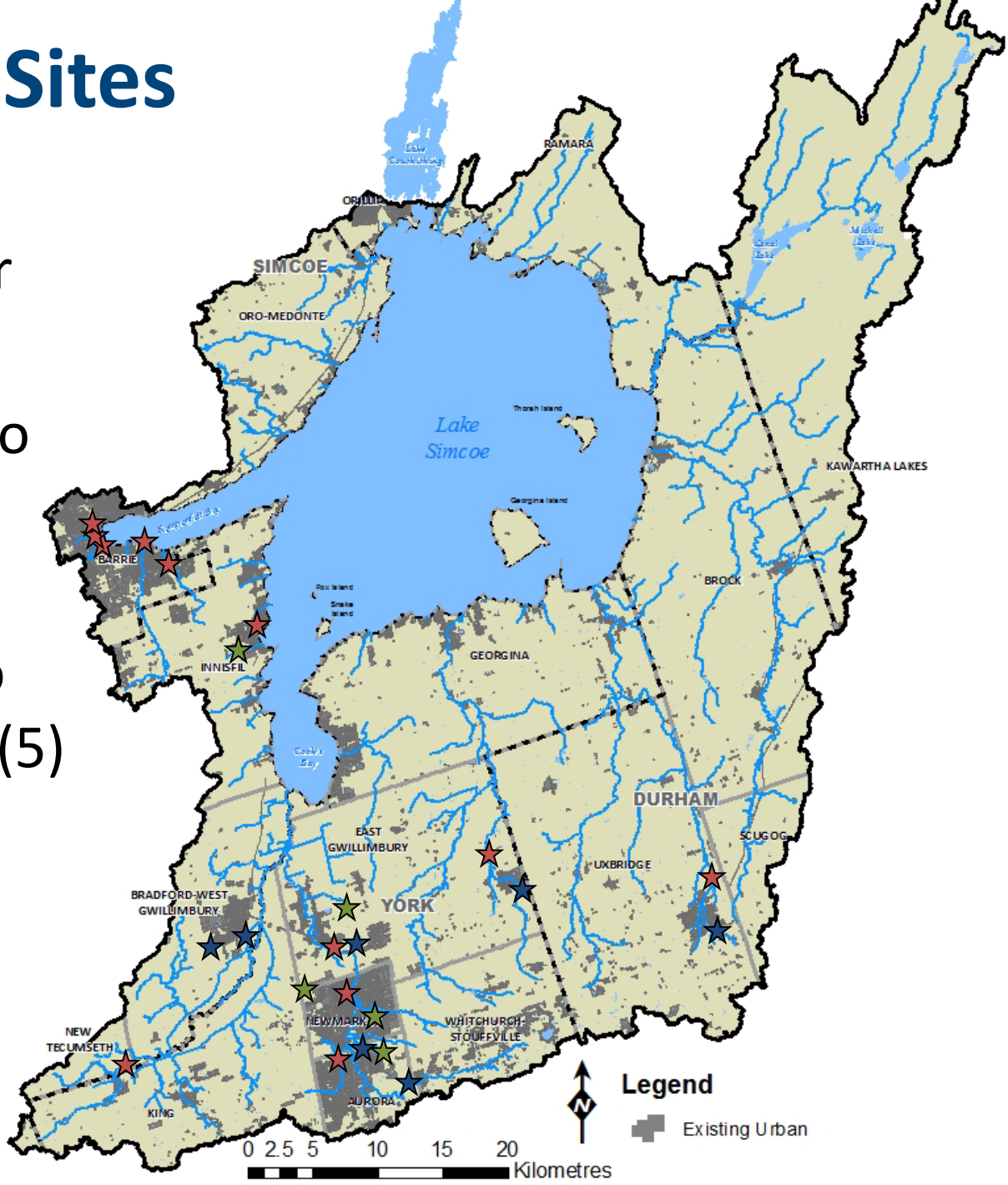
Scenarios 1, 2 or 3 - Flow Regime Analysis



- Reduction in peak flows or flood prone areas
- Use of Index of Hydrological Alteration (IHA) or Stream Assessment and Analysis Software (SAAS)
  - Time to peak
  - High flow Pulses
  - Base Flow Index (proportion of baseflow vs quick flow)
  - Channel forming flows
- Use of a reference system or reference regime to compare runoff ratio / unit area runoff

Water Quality Sites

- ★ existing urban water quality station (12)
- ★ additional stations to meet level 1 monitoring (6)
- additional station to match flow location (5)



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