



Lessons Learned on Water Quality Treatment Wetlands for Phosphorus Reduction in an Urban Setting

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Natural Channels Conference 2026



**Credit Valley
Conservation**
inspired by nature



Presentation Outline

- **The Good:** The Background
- **The Bad:** The Problem
- **The Ugly:** The Findings
- **Lessons Learned:** Next Steps

The Good

The Background

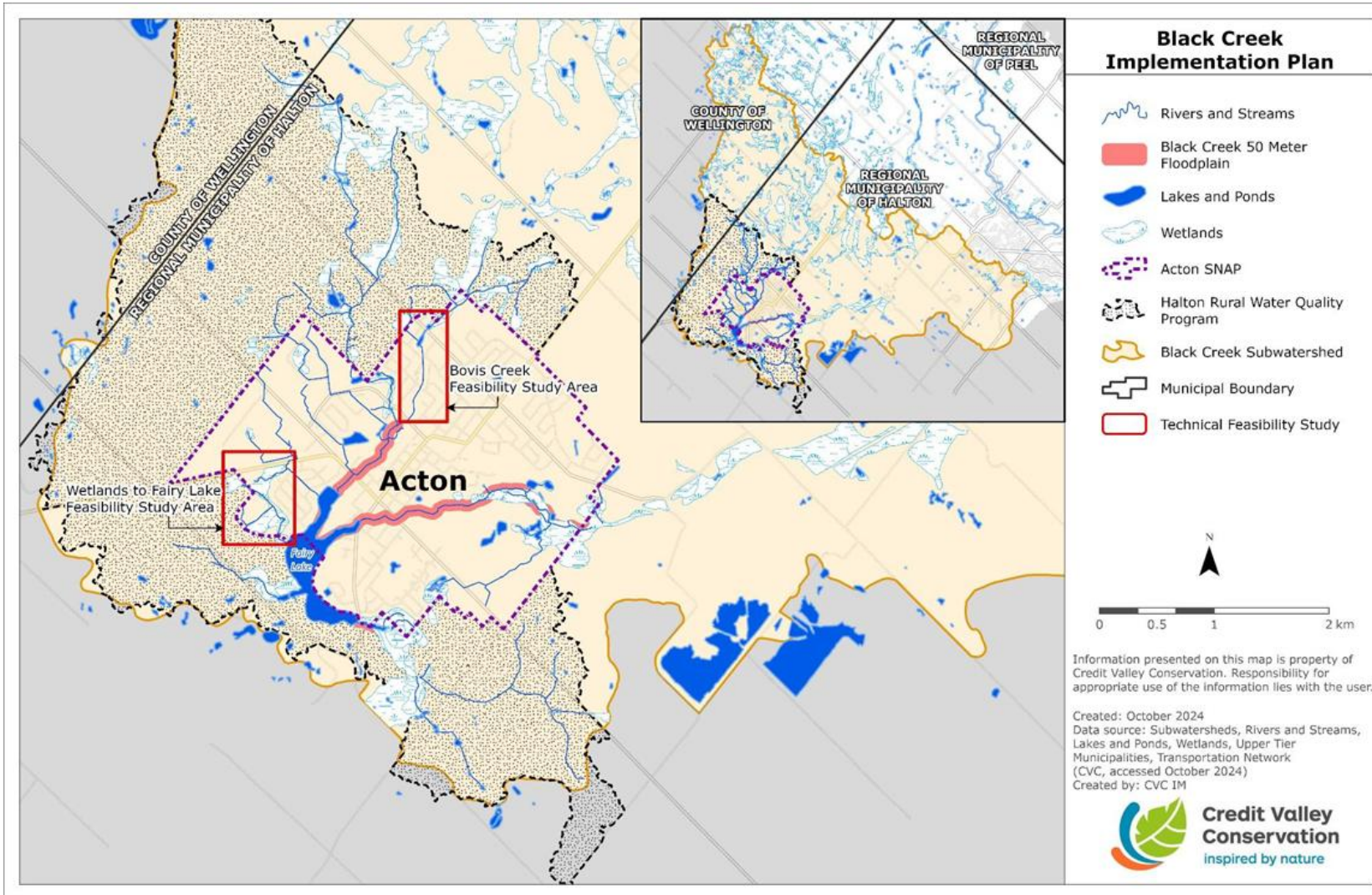
- Action plan realized through **Acton Sustainable Action Plan (SNAP)**
- Community-driven, science based-initiative focused on:
 - Action oriented implementation
 - Environmental health and water quality
 - Climate resilience
 - Community partnership



- Agricultural BMPs
- Updated floodplain mapping for Black Creek
- Feasibility study to determine restoration options for concrete-lined portions of Bovis Creek
- Feasibility study to see if a constructed wetland could reduce TP in Fairy Lake

- Priority action from a Fairy Lake Water Quality Study and Halton Region's TP Offset Strategy for the Acton Wastewater Treatment Plant
- High phosphorus concentrations, elevated levels of E.coli and cyanobacteria blooms
 - Caused by mixed urban and agricultural runoff and large waterfowl population

Acton SNAP Study Area and Fairy Lake



Fairy Lake Water Quality Study (2010 & 2023)

- Agricultural BMPs
- Storm sewer retrofits
- LID design and retrofits
- **Natural channel design**
- **Wetland creation**
- Vegetation management
- Waterfowl management
- Engage local property owners

Acton WWTP TP Offset Program Phase 2 (2024)

- Agricultural BMPs
- **Natural channel design**
- Stormwater and LID improvements
 - Infiltration bioswales
 - MTD
 - **Creation of pocket wetlands**

The Bad

The Problem

Phase 2: Impact Assessment (2016)



- Use field data to identify stressors
- Determine impacts of stressors on the condition
- Identify actions to mitigate stressors and impacts

Stressors and Challenges

- Urban development
 - Increased impervious surfaces (increase runoff, decrease recharge)
 - Increased groundwater taking
 - Increased discharge from the Acton Wastewater Treatment Plant
- Lack of stormwater controls in existing urban areas
- Impacts from aggregate operations and unsustainable agricultural activities
- Lack of connectivity in the existing natural heritage system
- Water quality issues in Fairy Lake
- External factors such as climate change

	Current Land Uses (2018)	Future Land Uses (2031)
Population	9,700	11,500
Urban	16%	19%
Natural Areas	44%	36%
Agriculture	34%	25%
Acton Groundwater Pumping Rate (m³/day)	5,660	8,340
WWTP Discharge (m³/day)	5,600	7,000

Management Recommendations

- 75 project-based recommendations
- Redundancy analysis reduced it to 22 recommendations grouped into **8 themes**

SWM Enhancements (Zones 1, 4, 5) – infiltration based SWM (LIDs), downspout disconnection

Fairy Lake Pollution Prevention & Reduction – reduce metals, nutrients, salt & bacteria at Tyler Ave., Elmore St. outlets;

Riparian Management (Zones 4 &5) – Riparian cover restoration, natural channel design

Complex Restoration Studies Requiring Feasibility Studies – Bovis Creek, Beardmore Site, Hospital Trib

Natural Heritage Enhancements (Zones 4, 5) - woodland interior, grassland habitat, plantation management

Hydrologic and Geomorphic Study to Identify Enhancement Targets

Dam Mitigation (680, 55, 56)

Agricultural BMP Implementation (Zones 5 & 6)

Fairy Lake Feasibility Study Objectives

Fairy Lake Inlets:

- Consider **wetland design alternatives** at inlets to Fairy Lake to **reduce phosphorus loading and improve water quality**, and to progress the selected alternative to the conceptual design level
- This feasibility study will identify site constraints, permits required for implementation, additional study requirements, and requirements for additional baseline and performance monitoring

Wetland Feasibility Study Area



Tyler Avenue Outlet

Black Creek Outlet

The Ugly

The Findings

Black Creek Outlet



Tyler Avenue Outlet



Literature Review

Constructed Wetlands for Stormwater Treatment

Constructed Wetland for Water Quality Treatment

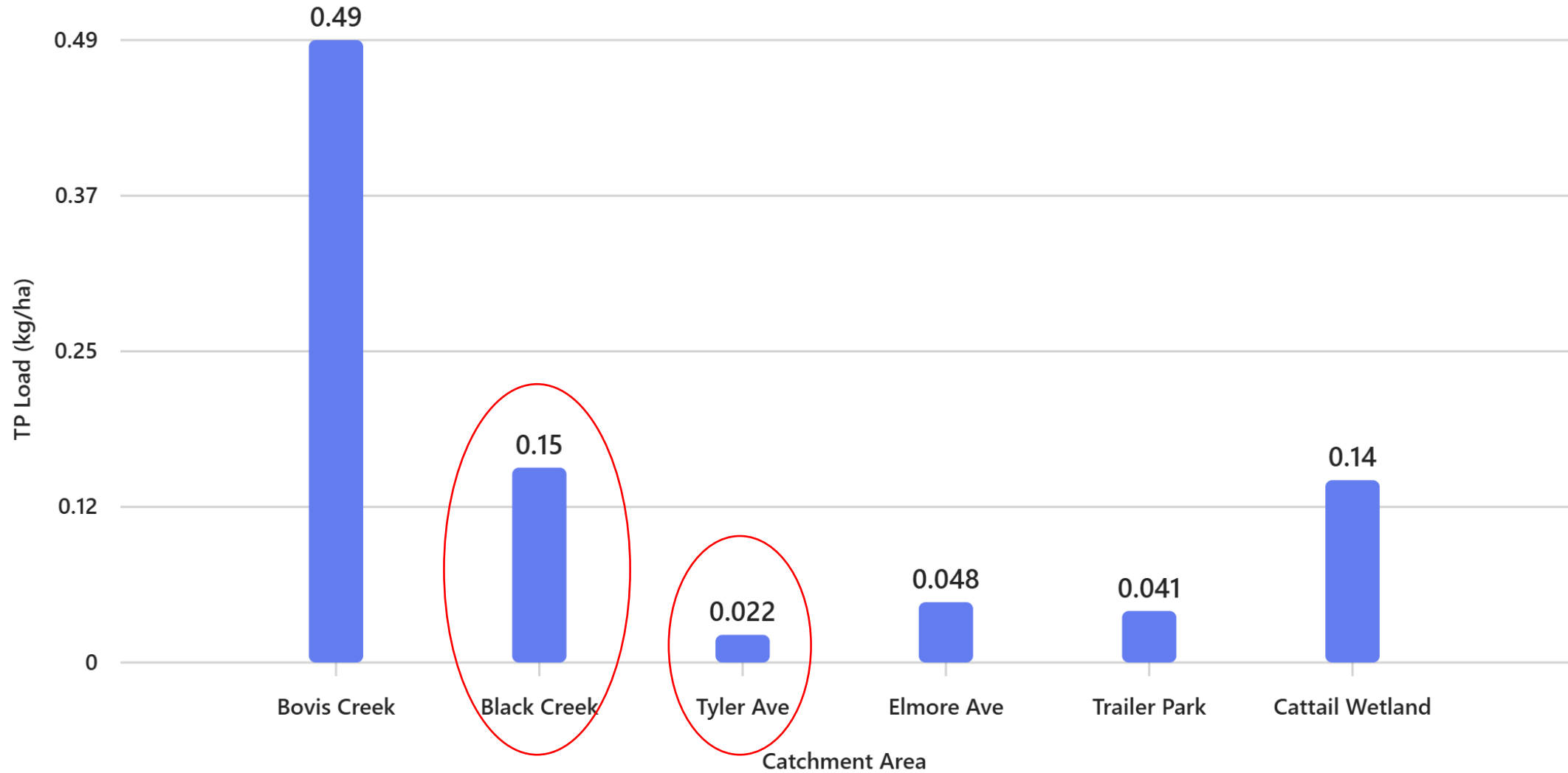
Total Phosphorus (TP) removal efficiency depends on:

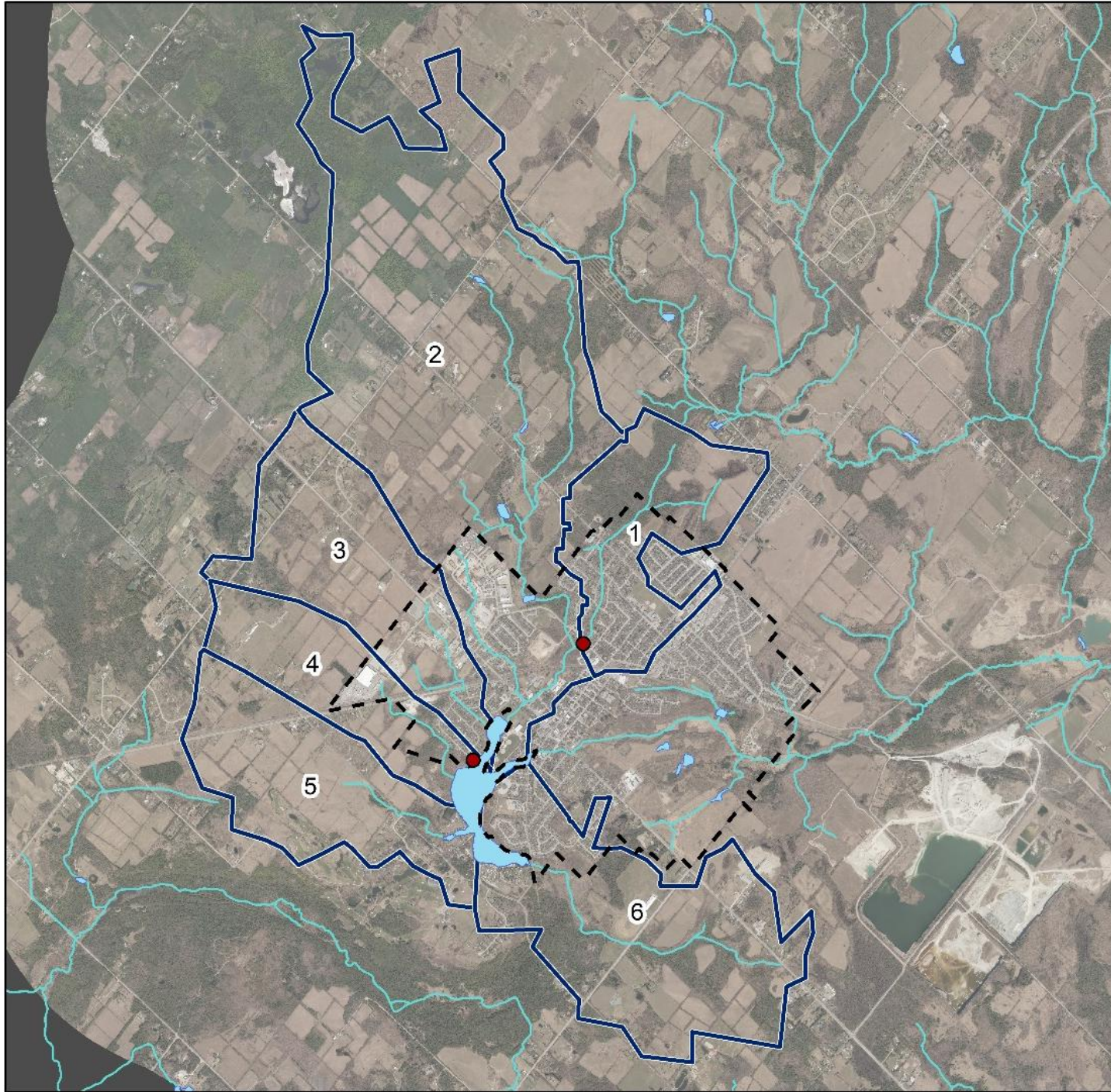
- **Inflow**
- **Loading rate**
- **Detention time**
- **Wetland size**

Wetlands can be both sink and source of phosphorus

Most constructed wetlands are designed in new construction and rural areas where land is less constrained

Total Phosphorus Loading Rate per Area

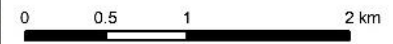




Fairy Lake Catchments

- SWM Outfall
- Watercourse
- Water Body
- Urban Acton Boundary
- Catchments

Catchment	Area (ha)
1	187.81
2	769.68
3	232.75
4	155.20
5	219.61
6	342.74

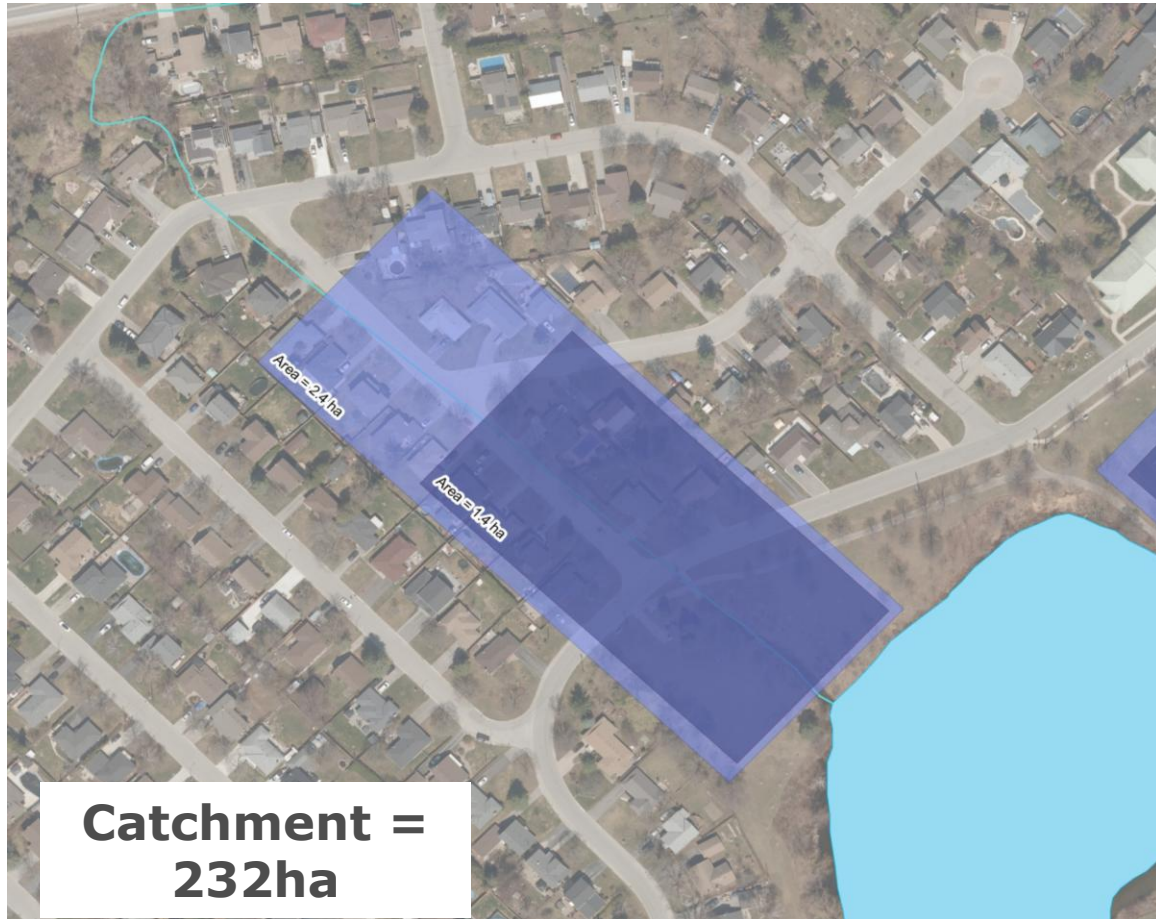


Source: Credit Valley Conservation, 2025
 Created: October 2025
 Disclaimer: The data used to create this map was compiled from a variety of sources. CVC takes no responsibility for errors or omissions in the data and retains the right to make changes or corrections at anytime without notice.

Provincial Standard for Wetland Sizing

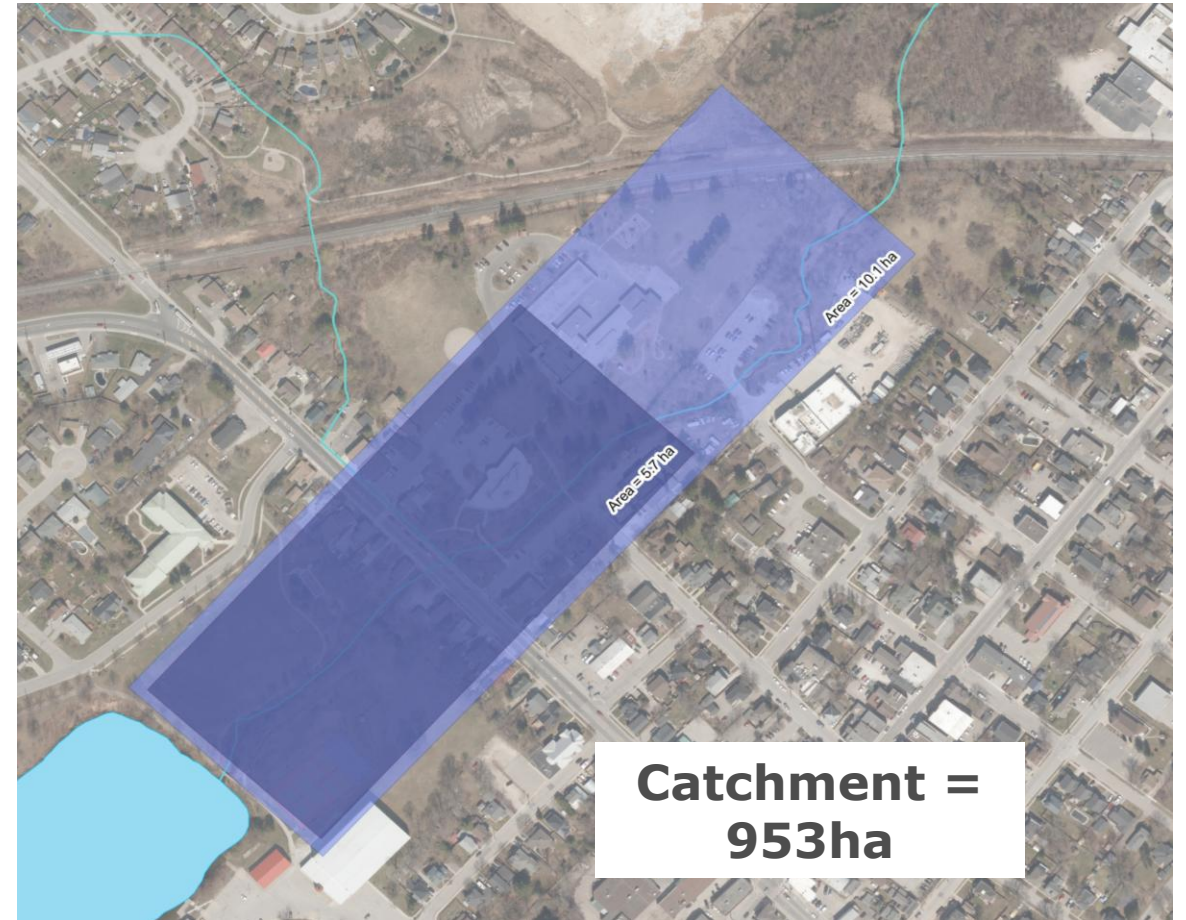
Tyler Avenue

Wetland Size = 1.4-2.4ha



Black Creek

Wetland Size = 5.7-10.1ha



Total Phosphorus Treatment Needs Larger Area

Tyler Ave

Wetland Size = 2.3- 4.7ha



Black Creek

Wetland Size = 9.6-19.2ha



Sink and Source: Re-suspension

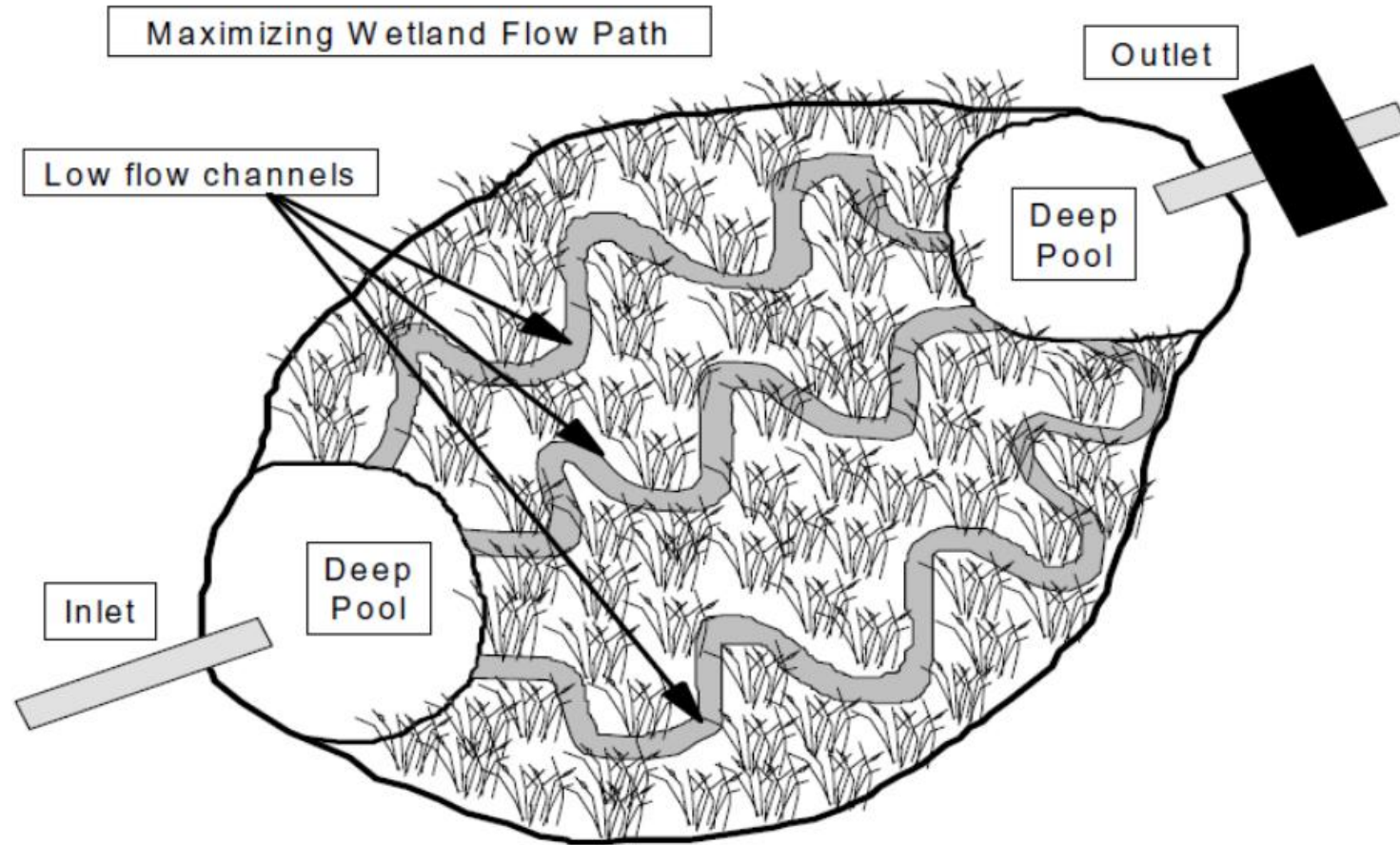


Figure 3.5: Using low flow channels to maximize flow path in constructed wetlands (From MOE, 2003).

Cost of New Wetland Construction and Operation

Cost Category	Small Pond (<1 ha catchment)	Description	References
Capital Costs	\$250,000 – \$500,000	Includes excavation, grading, structures, sediment/erosion controls, materials.	Ontario SWMP Manual
Engineering & Design	10–15% of capital cost	Planning, design, permitting, and project management.	Ontario SWMP Manual
Annual O&M Costs	\$3,000 – \$7,000/year	Inspections, vegetation management, trash removal, minor repairs.	LSRCA
Major Maintenance	\$100,000 – \$200,000 every 15–25 yrs	Dredging and disposal of accumulated sediment.	Water Canada
Monitoring & Reporting	\$1,000 – \$5,000/year	Water quality monitoring, performance assessments.	LSRCA Pond Performance Report
Contingency	10–20% of total cost	For unforeseen conditions or cost overruns.	Ontario SWMP Manual
Total Life Cycle Cost (30 years)	\$800,000 – \$1.5M	Includes capital, O&M, sediment removal, and contingencies.	

Lessons Learned

Next Steps

Lessons Learned

- Constructing wetlands at the inlets of Fairy Lake is not considered a viable method for removing phosphorus
 - **Wetland size** and **retention time** are key design factors for phosphorus removal; there is not enough space for design criteria
 - **Significant site constraints** at Fairy Lake inlets, not considering current land-use, and impact on social/recreational uses
- Smaller wetland sizes would have limited cost benefits for phosphorus reduction and **could even be a source of phosphorus**

Lessons Learned

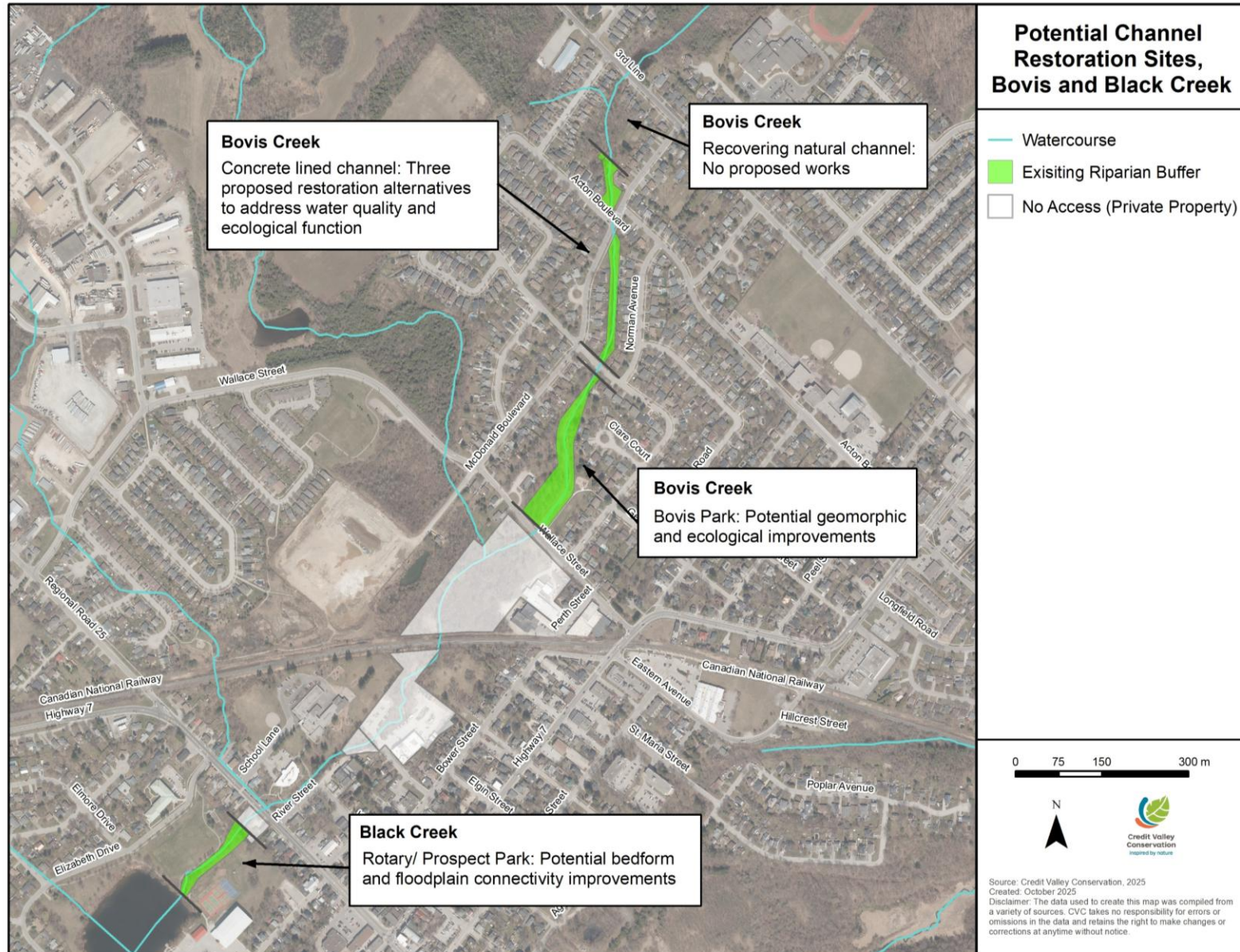
- The catchment size to wetland ratio is critical to water quality treatment wetlands
- Retrofitting existing neighbourhoods is difficult
- Treat phosphorus at the source
- Re-direct restoration resources to get the best of our finite resources to protect and restore Acton and Fairy Lake



Bovis Creek Restoration

Next Steps

Bovis Creek Study Area



Drivers:

- Terrestrial & aquatic habitat
- Morphological function
- Water quality



Alternative 1: Natural channel with armourstone walls

- Objective: Maximize floodplain storage capacity and wetland opportunity
- Challenges: Cost, disruption to residents

Alternative 2: Natural Channel , maintain side slopes

- Objective: Naturalize with lower construction impact
- Challenges: Potential flood risk

Alternative 3: Cut out portion of concrete, maintain side slopes for water quality

- Objective: Allow infiltration with minimal change to existing condition
- Challenges: Channel not naturalized, no new plantings



Treat Phosphorus at the Source!



Agricultural BMPs



LID

Thank You

Questions?