Sustainable Technologies EVALUATION PROGRAM

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Assessing the Feasibility of Communal Low Impact Development on Private Property

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Sustainable Technologies EVALUATION PROGRAM

The water component of STEP is a collaborative of:

Lake Simcoe Region conservation authority

Credit Valley Conservation inspired by nature

Toronto and Region Conservation Authority

Outline

Building the Case of Communal Stormwater Management

Stormwater challenges, low impact development,
Stormwater infrastructure on private property

Communal Retrofit Stormwater Study

Technical and financial feasibility assessment of communal stormwater retrofits on private property

Application of Study and Next Steps

Synergies with municipalities and province

Overview

STEP is a multi-agency initiative developed to support broader implementation of sustainable technologies and practices within a Canadian context.

The water component of STEP is a conservation authority collaborative. Current partners are:

Lake Simcoe Region conservation authority

Credit Valley Conservation inspired by nature

Toronto and Region Conservation Authority

Our key areas of focus are:

- Low Impact Development
- Erosion and Sediment Control
- Road Salt Management
- Natural Features Restoration

Development Alters Natural Hydrology

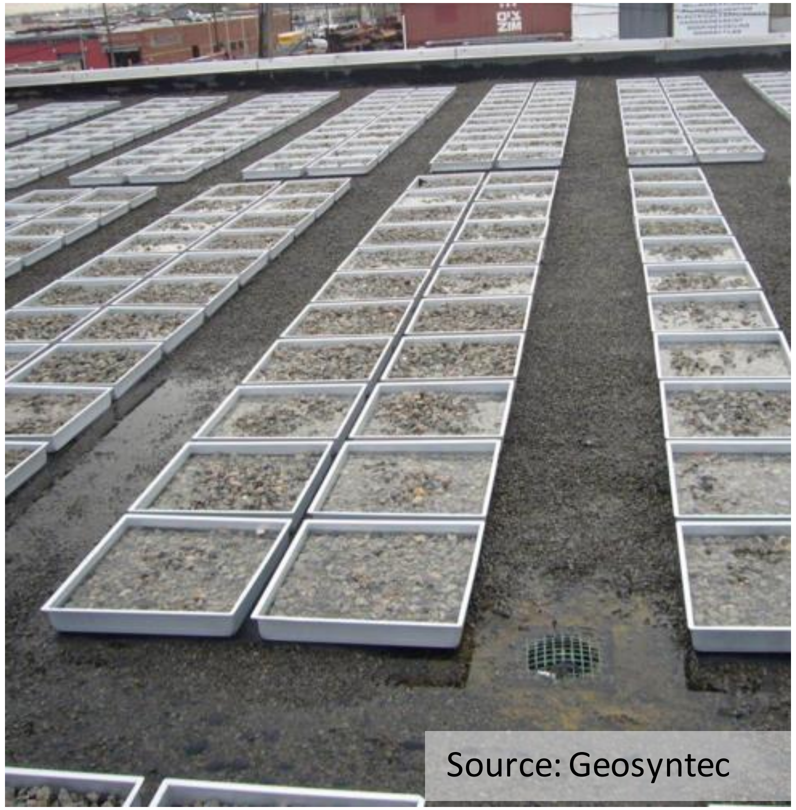
Post Development Stormwater Challenges

Stormwater control targets cannot be achieved through end of pipe controls alone

Low Impact Development (LID)

A green infrastructure stormwater management approach to filter, store and infiltrate rain where it falls

Source: ADS



Source: Geosyntec

Challenges with LID Infrastructure on Private Property

Private Property Owner Challenges

- Cost
- Pay back period for SWM retrofits is poor, even with stormwater credit programs
- Lack of process

Aggregation of Private Properties and Anticipated Benefits

- Economies of scale
  - One designer
  - One contractor
  - One maintenance contractor
- Maximize performance
- Maximize benefits (stormwater, water, wastewater, energy)

However, is there an implementation framework?

The Drainage Act

- A solution to drainage issues that occur on private and public property in Ontario.
- Key elements of drainage systems
    - Communal Infrastructure
    - Legal Existence
    - User-pay Framework
    - Municipality Manages Infrastructure

Communal LID Retrofit Feasibility Study

This project is exploring the technical and financial feasibility of implementing communal LID stormwater management systems on private property

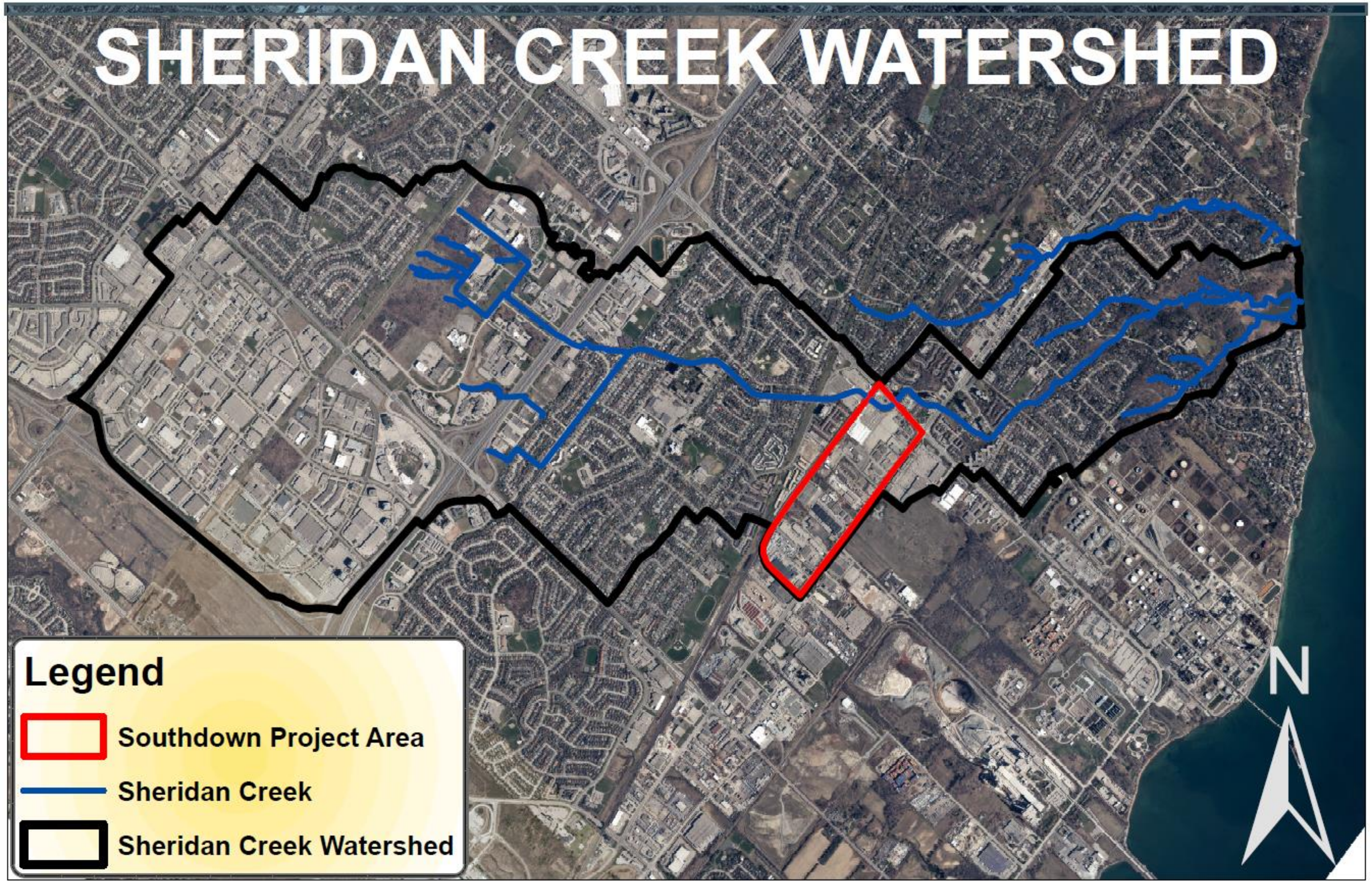
Credit Valley Conservation
inspired by nature

FCM
FEDERATION OF CANADIAN MUNICIPALITIES
FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

Region of Peel
working with you

MISSISSAUGA

Study Area – Sheridan Creek Watershed



CVC Study Area

Study Area

0 125 250 500 Meters

N

Legacy developments with no stormwater management

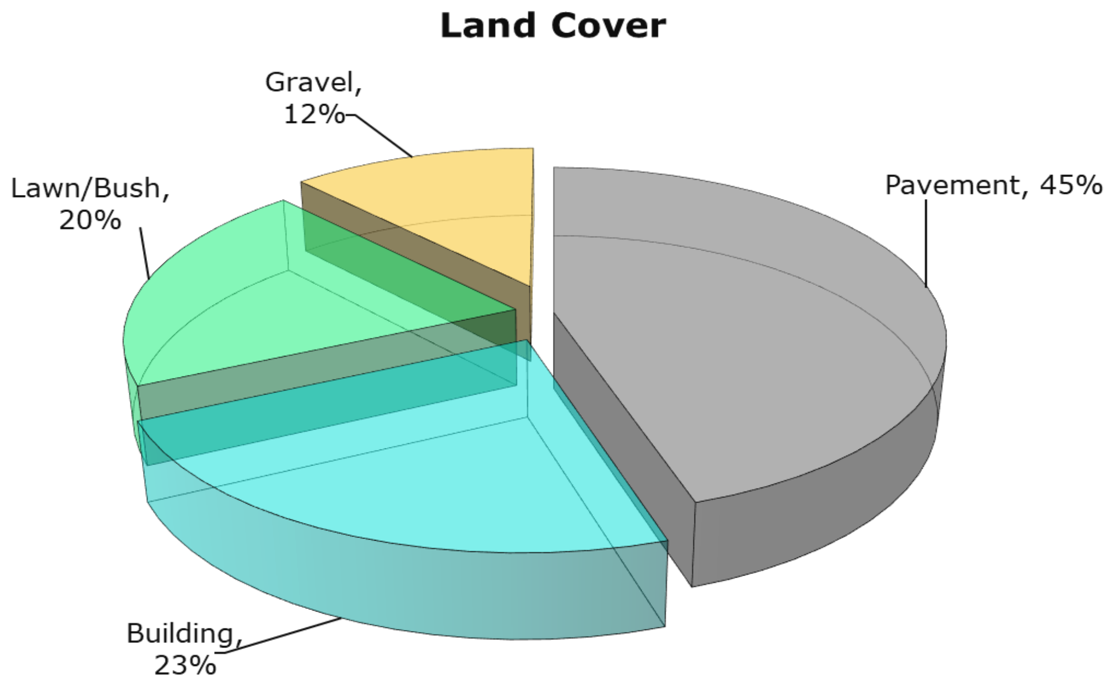
Stormwater Management Scenarios

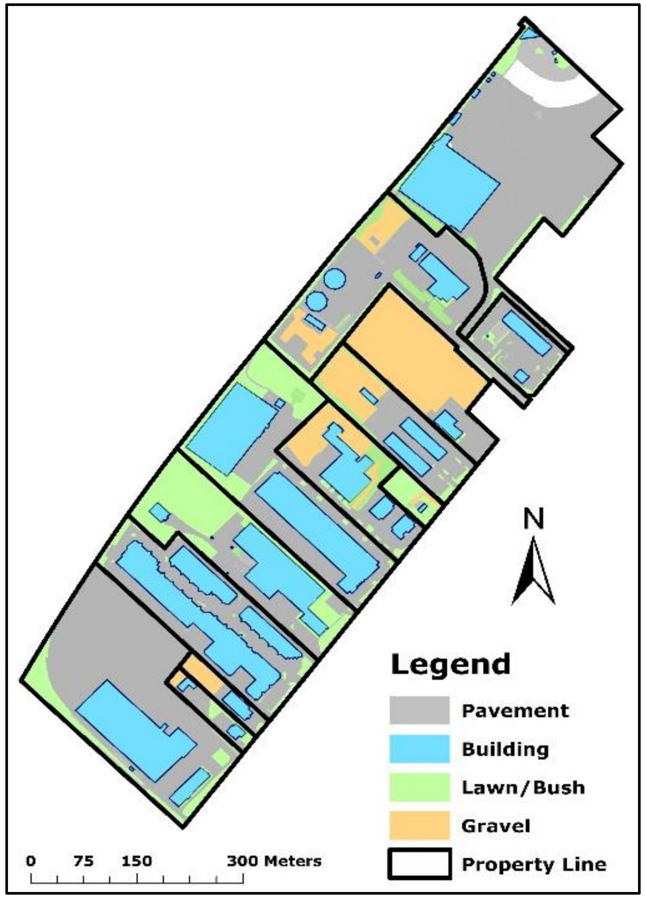
- Pre-development
- Existing conditions
- Communal LID – Stormwater credit
- Communal LID – One water
- End-of-pipe

Technical Assessment

Existing Condition Characterization

- Previous studies, complementary initiatives, environmental concerns
- Landowner property information
- GIS land cover analysis

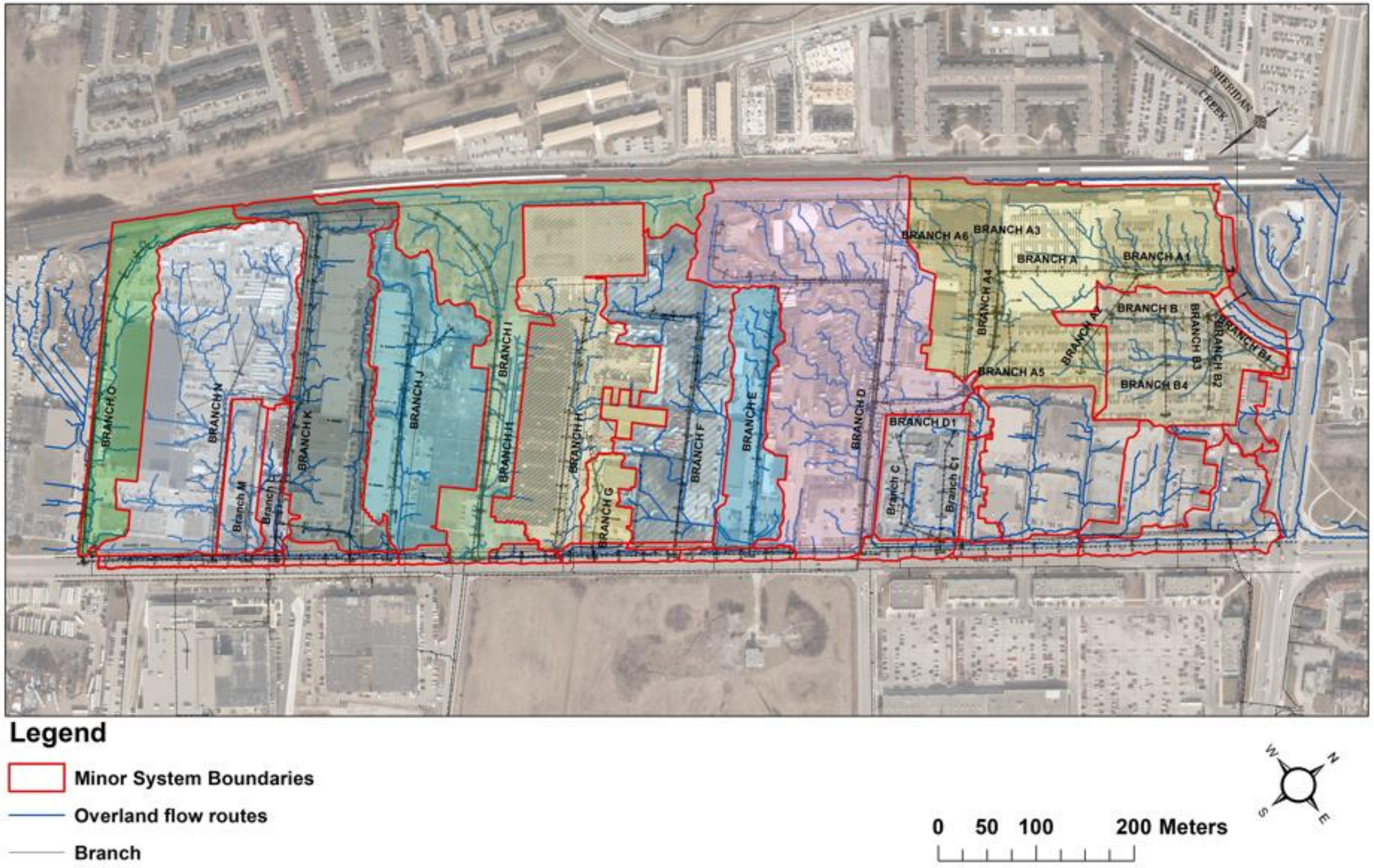




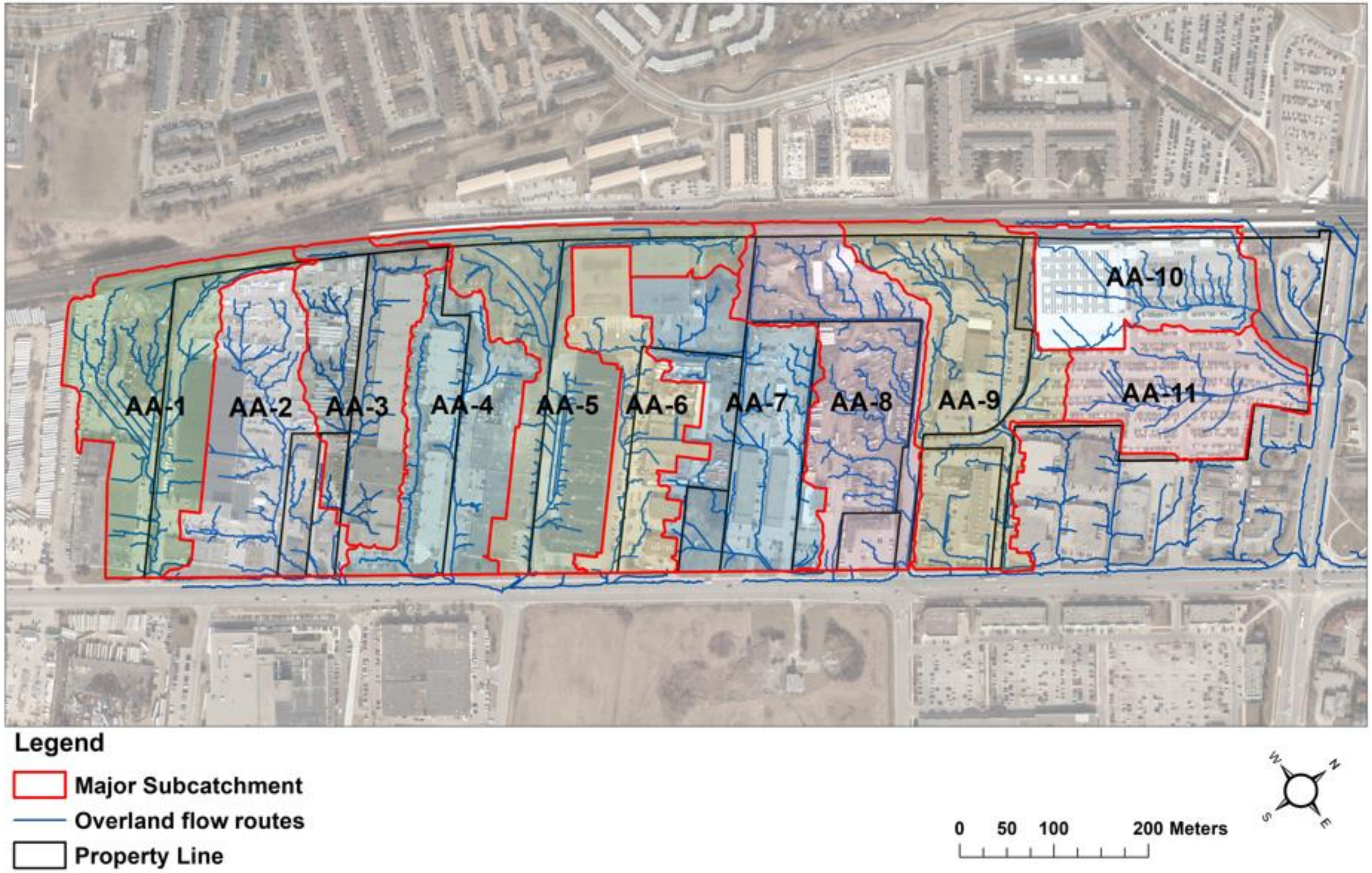
Topographic Survey

- Sanitary and storm sewer pipe network
- 5000 ground elevation points
- Used to define major and minor system sub catchments

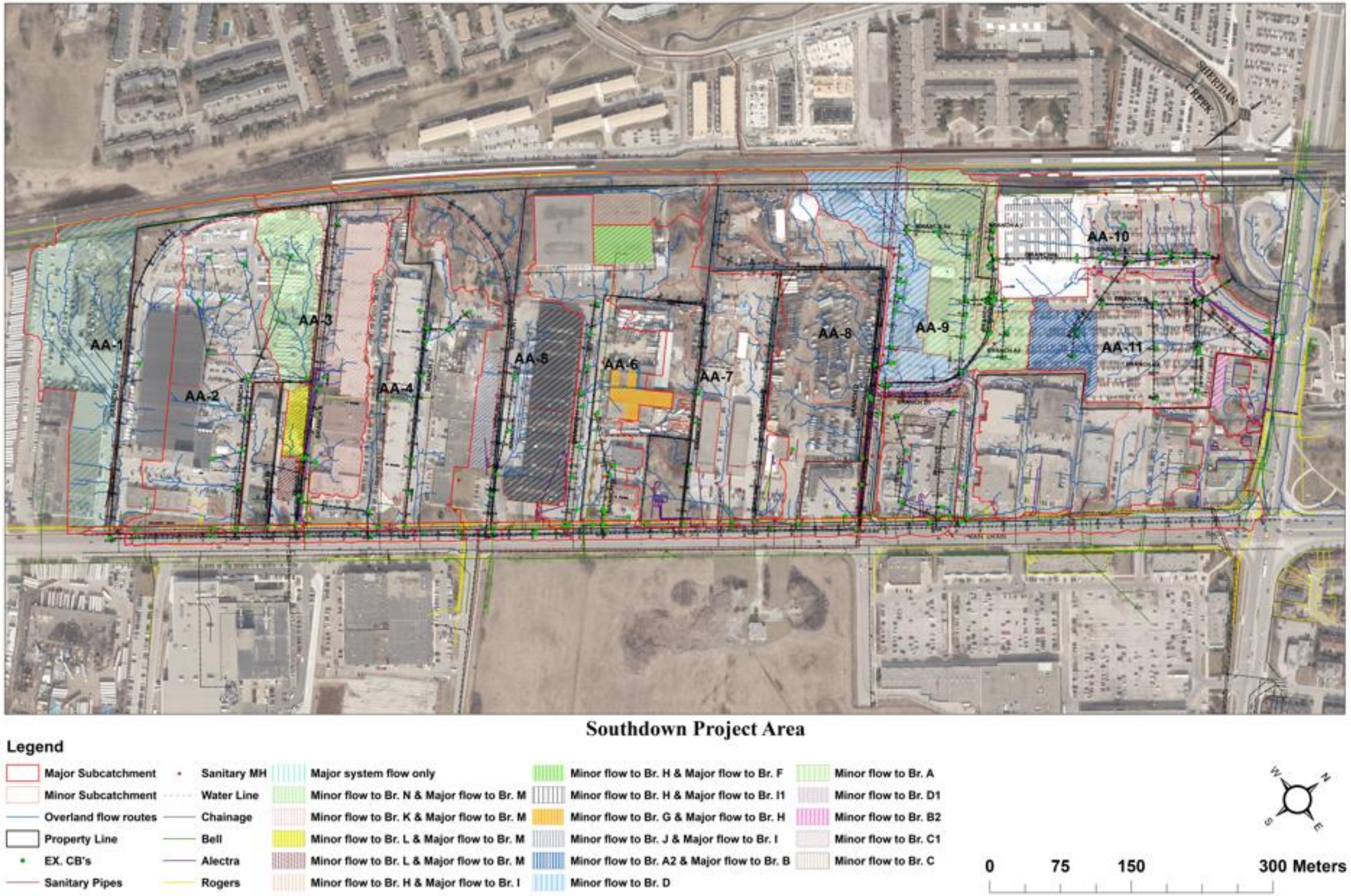
GIS Analysis – Minor System Subatchments



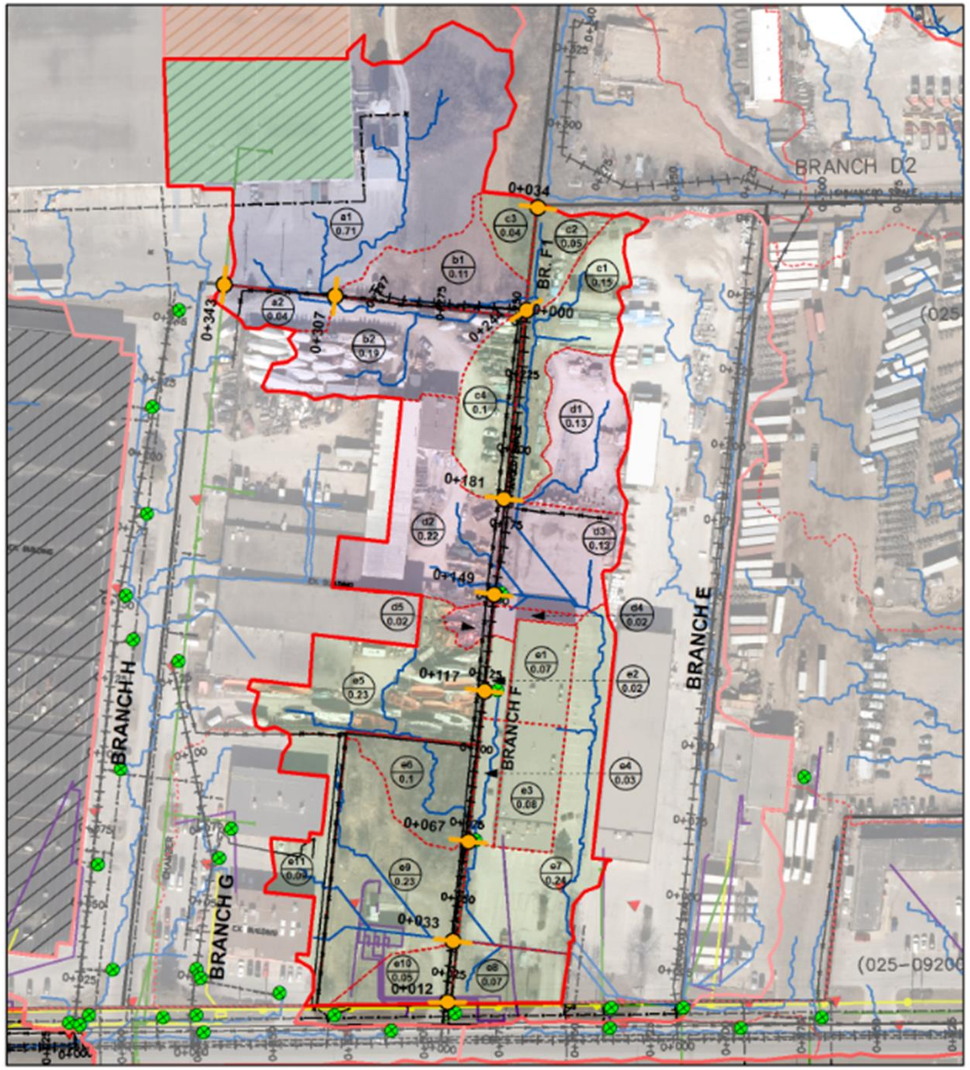
GIS Analysis – Major System Subcatchments



GIS Analysis – Major + Minor System



Major and Minor System – Branch F



Southdown Project Area: Branch F

Wastewater - Inflow of Stormwater to Sanitary Sewer

Inflow – stormwater that enters the sanitary sewer through direct connections from manhole lids, downspouts and foundation drains.

Sanitary Inflow Investigations

Two main investigations to identify inflow

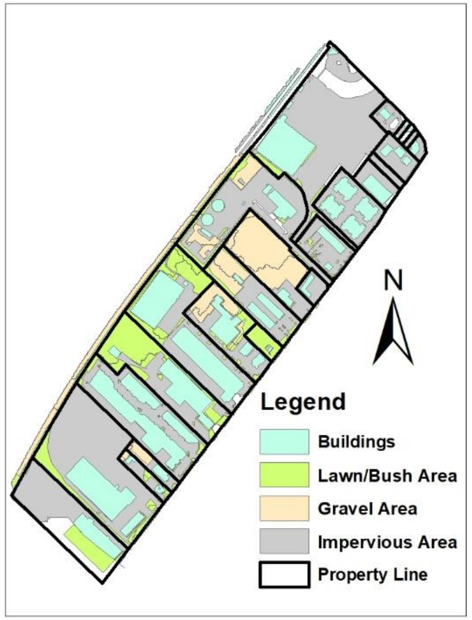
1. Maintenance hole investigations
2. Pipe connection investigations

Water Conservation Investigations

Demand

- Irrigation
- Washing transport vehicles
- Toilet Flushing
- Cooling towers

Supply

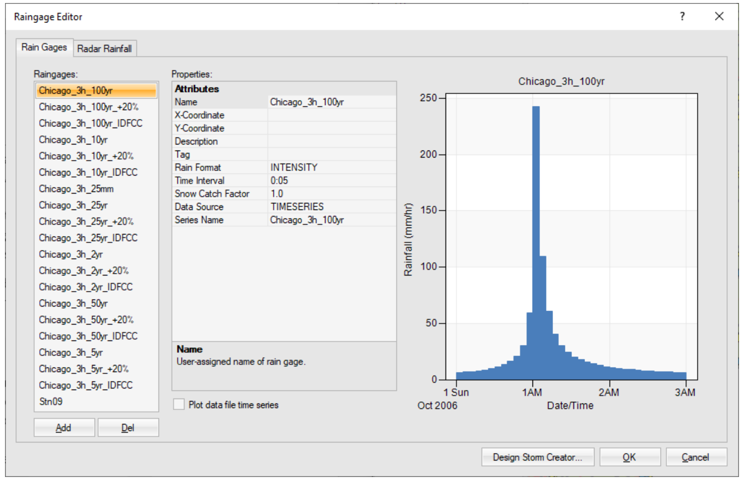


Buildings represent 23% of the study area

Developed PCSWMM 1D-2D hydrologic and hydraulic model to represent study area

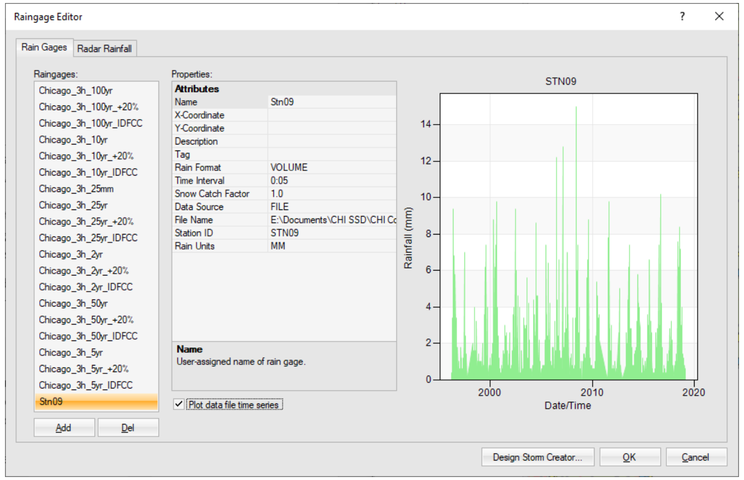
Rainfall Pattern Selection

- 3-hour Chicago Design storms: Based on City of Mississauga's Intensity-Duration-Frequency (IDF) rainfall curves for 2, 5, 10, 25, 50, and 100-year return periods
- Continuous Simulation for representative water year
- Climate change impacts



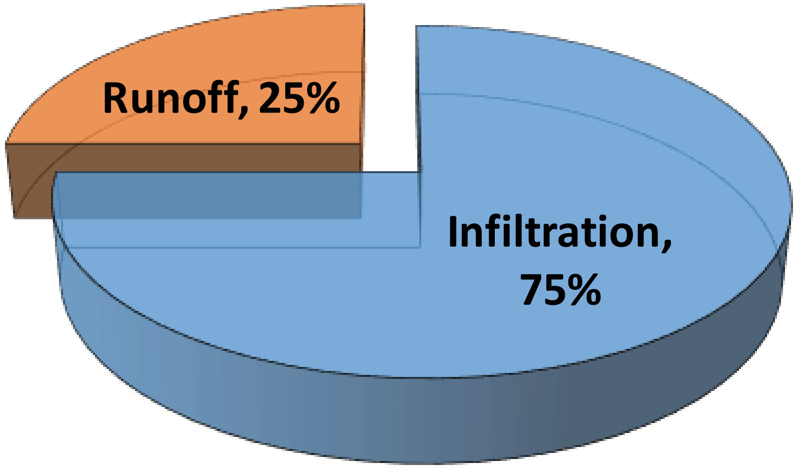
Parameters Modeled

- Peak Flow
- Water Quality (TSS & TP)
- Water Balance (Infiltration, Runoff)
- Sanitary sewer inflows contributed by stormwater sources



Pre-Development condition Model

The soil infiltration parameters and percent imperviousness was adjusted to achieve the volumetric runoff coefficient target of 0.25 for the 100-year event.

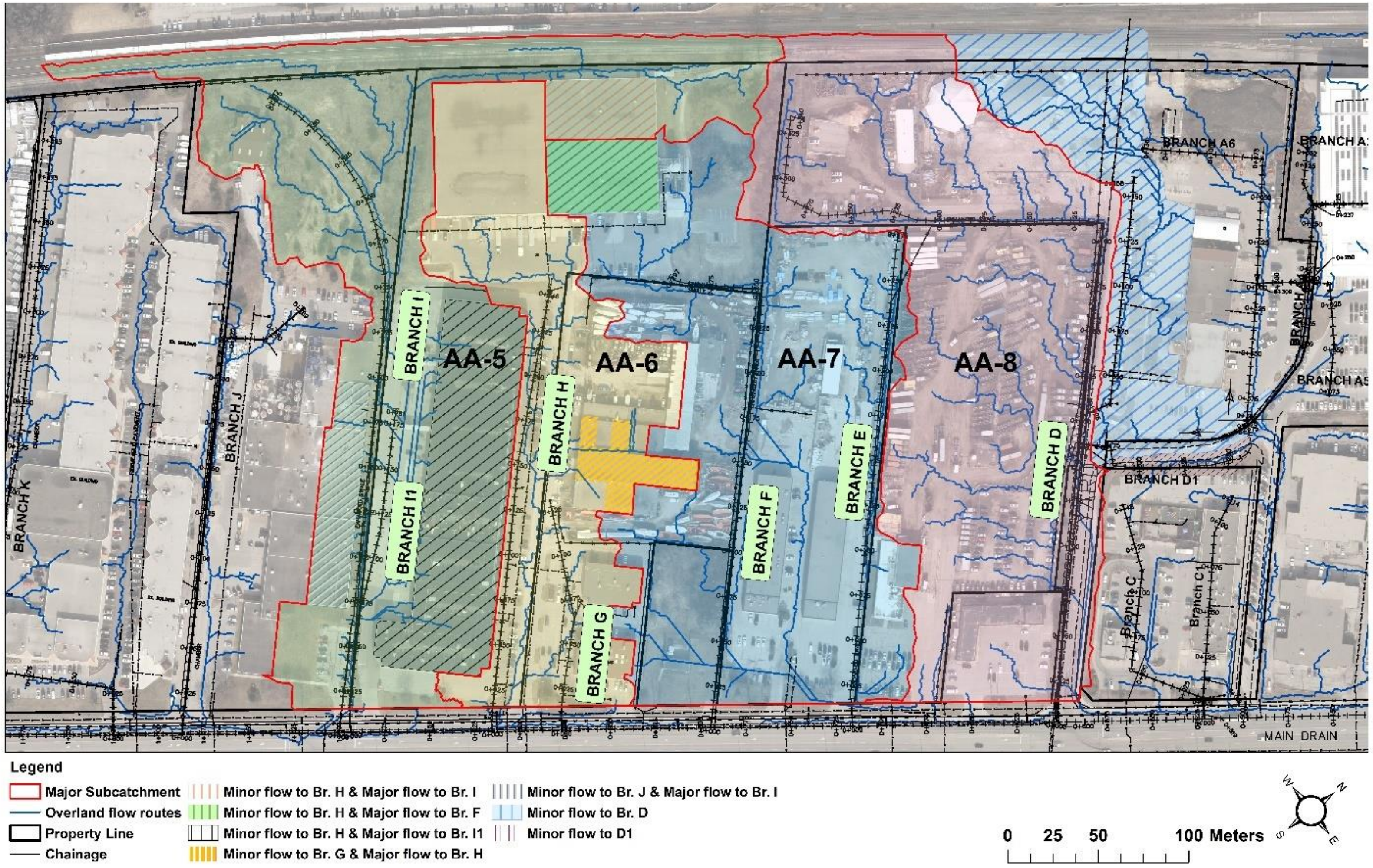


Study Area - 1954

Conceptual Communal LID Designs

1. Maximum Stormwater Credit Scenario

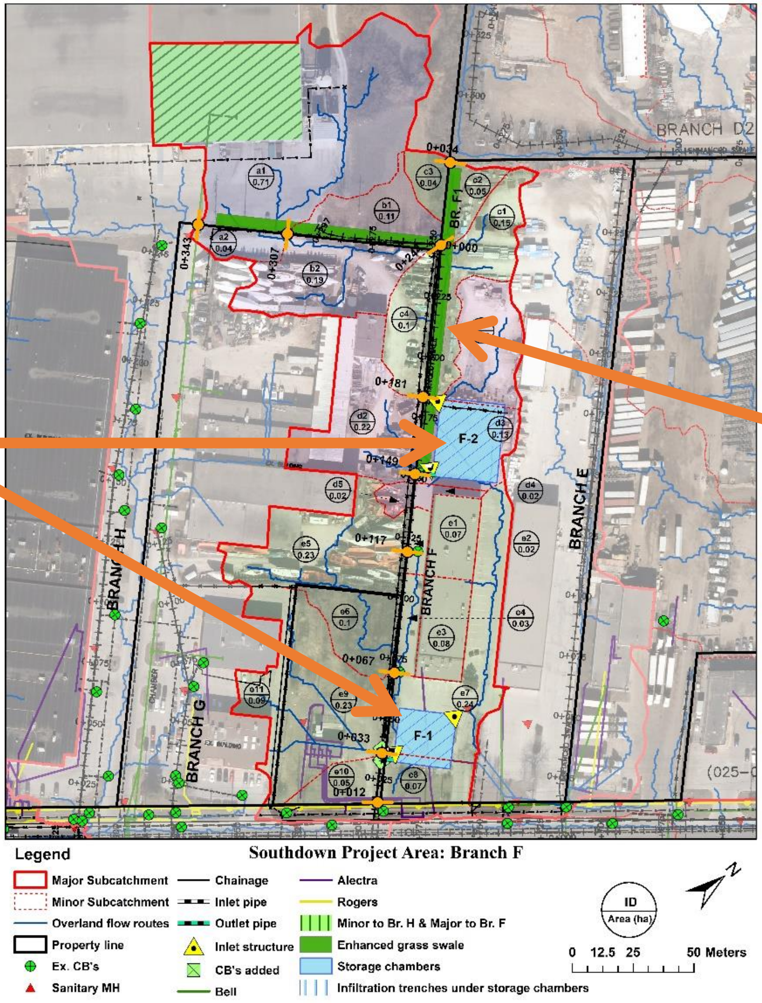
2. One Water Scenario



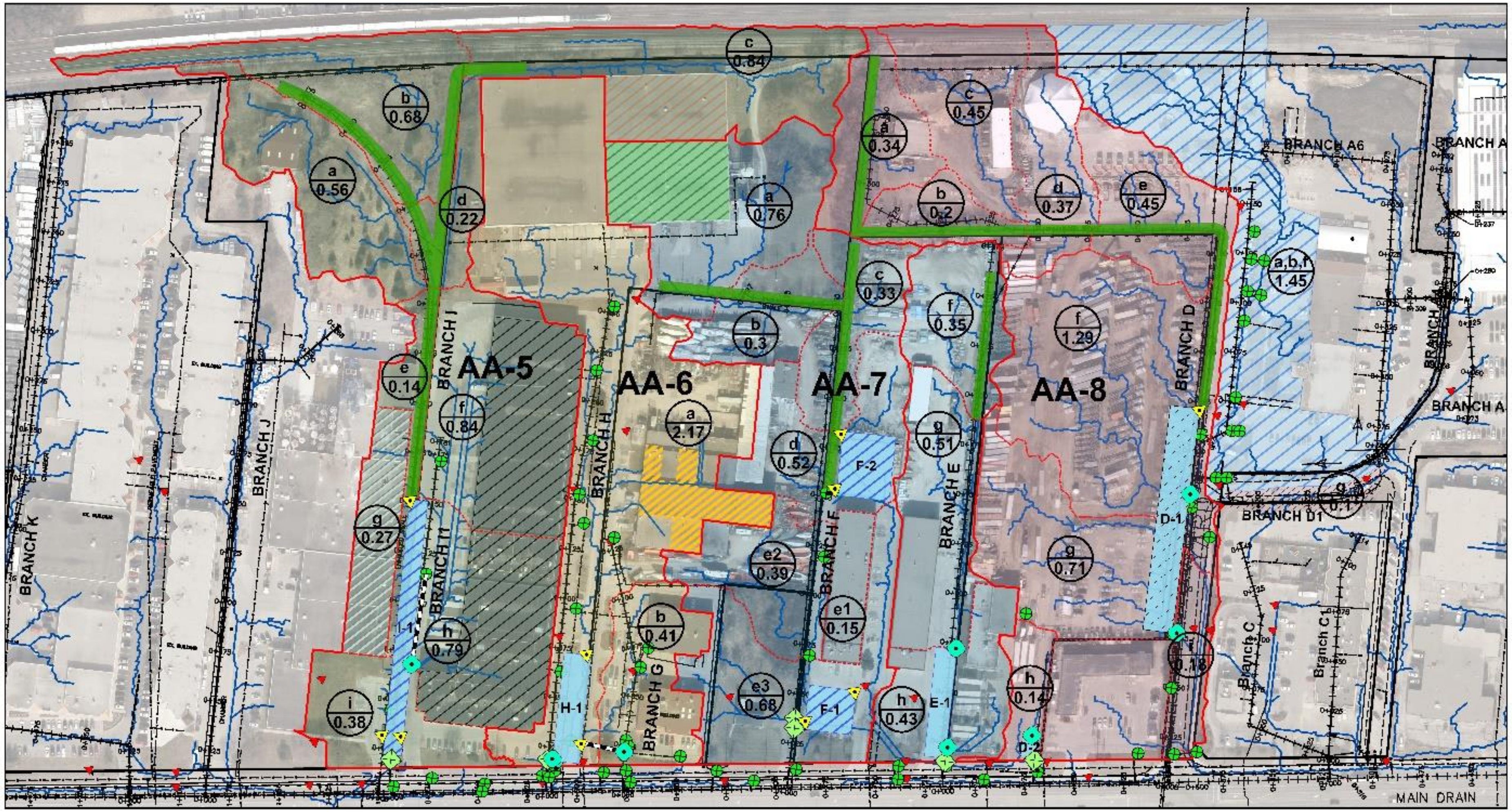
Stormwater Credit Scenario – Design Criteria

Category	Evaluation Criteria	Credit	Maximum Credit
Peak Flow Reduction	Per cent reduction of the 100-year storm to pre-development conditions	Up to 40%	Up to 50%
Water Quality Treatment	Per cent of hard surface receiving 80% TSS removal	Up to 10%	
Runoff Volume Reduction	Per cent capture of first 15 mm of rainfall during a single rainfall event	Up to 15%	
Pollution Prevention Plan	Develop and implement a pollution prevention plan.	Up to 5%	

Stormwater Credit Scenario – LID Selection Branch F



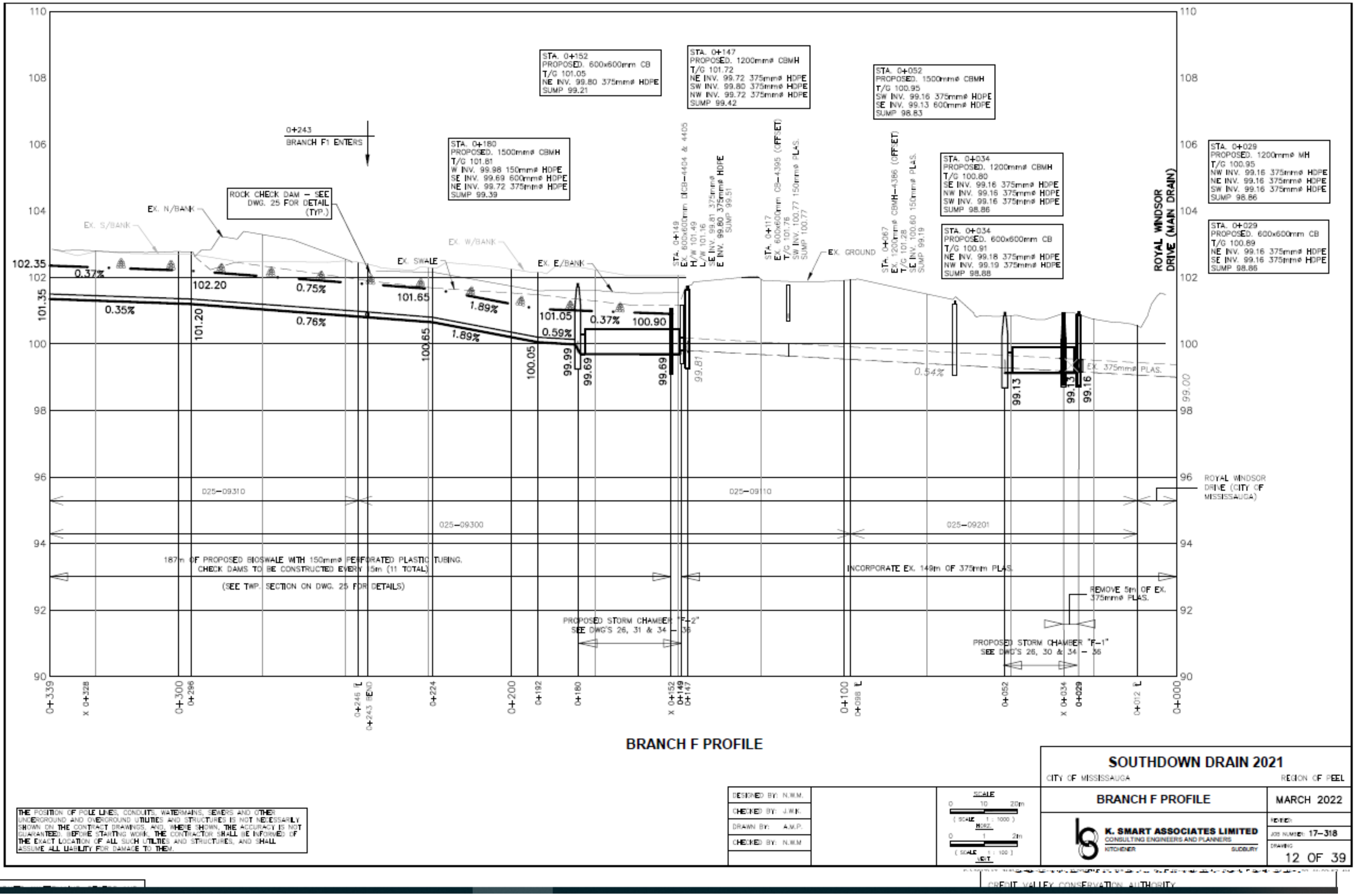
Stormwater Credit Scenario Plan



Enhanced Grass Swale

Underground Storage

Conceptual Design – Profile



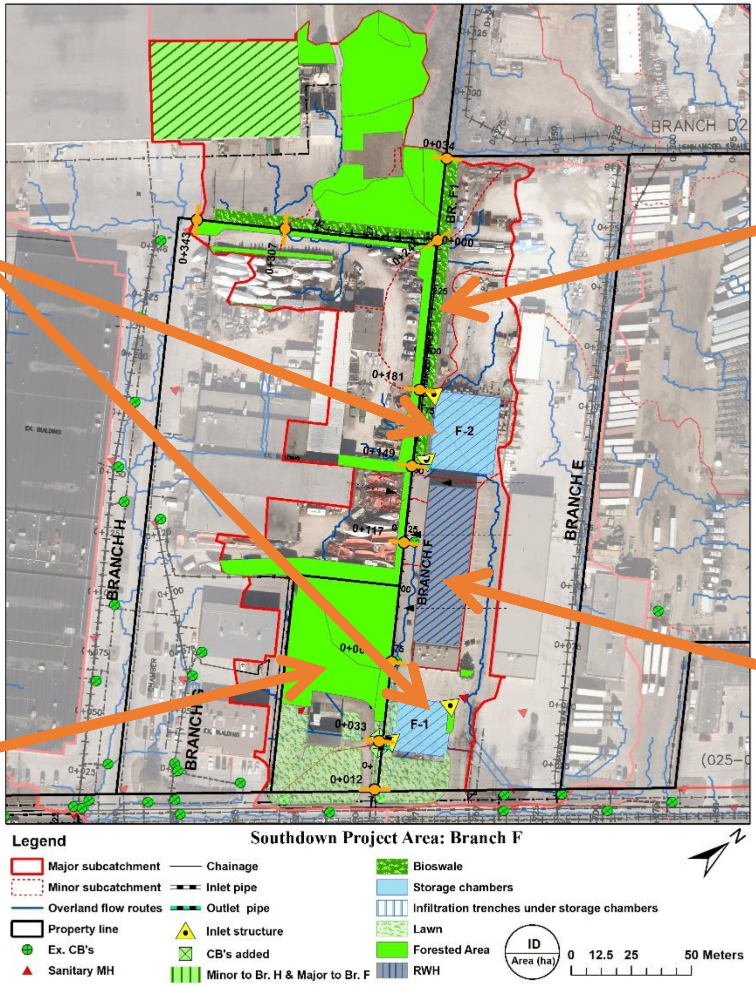
BRANCH F

One Water Scenario – LID Selection Branch F

Underground Storage with Infiltration Trench

Source: ADS

Forested Area



Bioswale

Blue Roof with Rainwater Harvesting

One Water Scenario – LID Selection

Bioswale

Underground Storage

Underground Storage with Infiltration Trench

Urban Forest

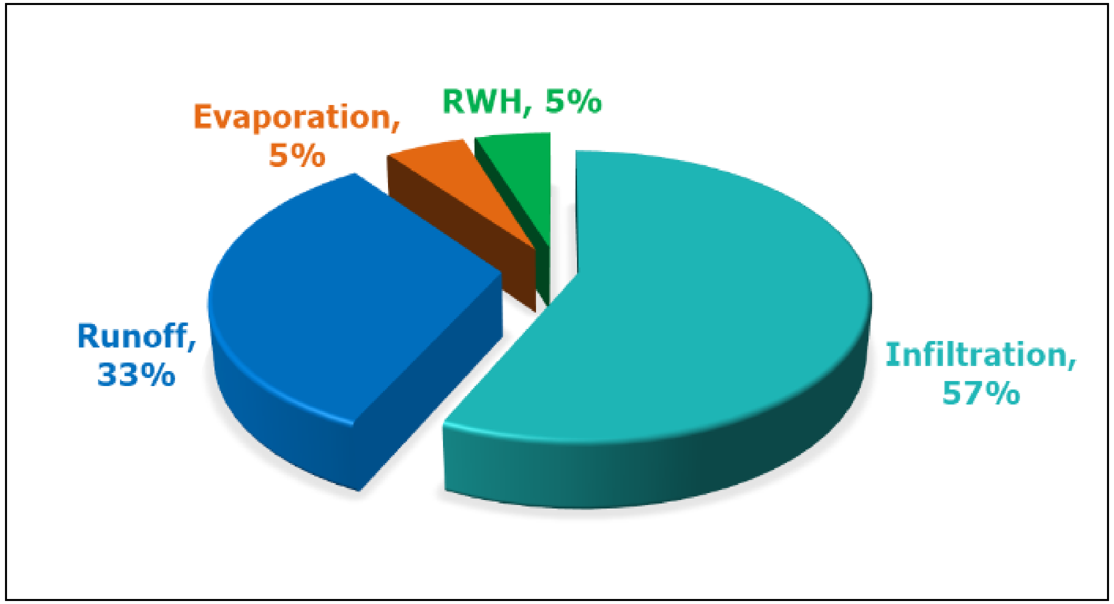
Rainwater Harvesting

Comparing LID Scenarios Against Stormwater Credit Criteria

Branch	Peak Flow Reduction Post development to pre for 100-year event (40% Credit)		Water Quality 80% TSS Removal (10% Credit)		Runoff Volume Reduction First 15 mm (15% Credit)		Total Score (50% Maximum)	
	Credit Scenario	One Water Scenario	Credit Scenario	One Water Scenario	Credit Scenario	One Water Scenario	Credit Scenario	One Water Scenario
AA-5 (Branch I)	✓	✓	✓	✓	2	5	52	55
AA-6 (Branch G,H)	✓	✓	✓	✓	X	11	50	61
AA-7 (Branch E,F)	✓	✓	✓	✓	1	10	51	60
AA-8 (Branch D)	✓	✓	✓	✓	X	5	50	55

One Water Scenario – Rainwater Reuse

- RWH was not included in modeling results
- Water Conservation potential was 5,253 m^3 per year.
- Over 30% of the water reused in these subcatchements was from communal rainwater harvesting



Communal Rainwater Harvesting Example

Roof 1

Roof Area: 1332 m^2

Water Supply: 609 m^3

Water Demand: 200 m^3

409 m^3 from building 1 shared with building 2 annually

Roof 2

Roof Area: 815 m^2

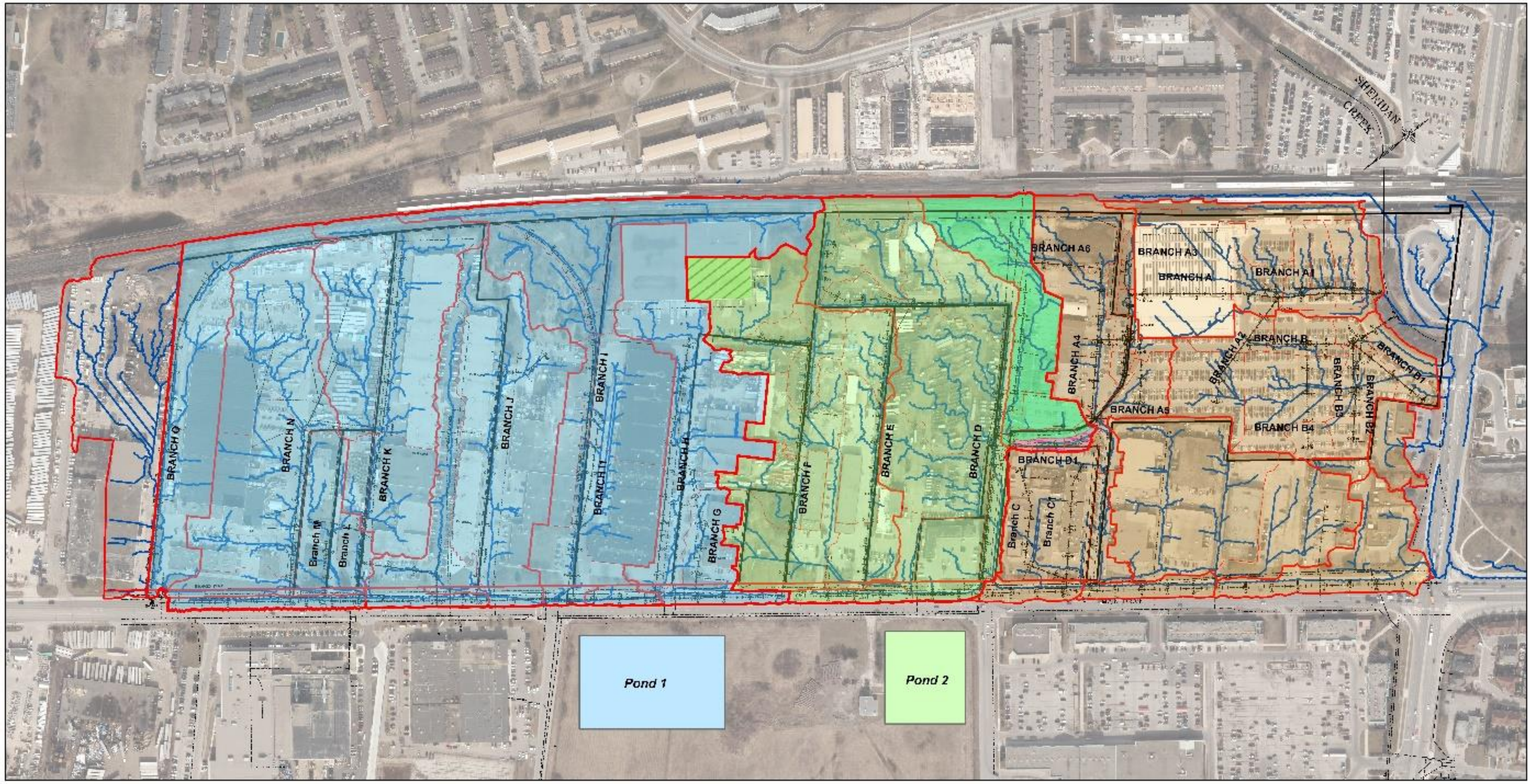
Water Supply: N/A

Water Demand: 920 m^3

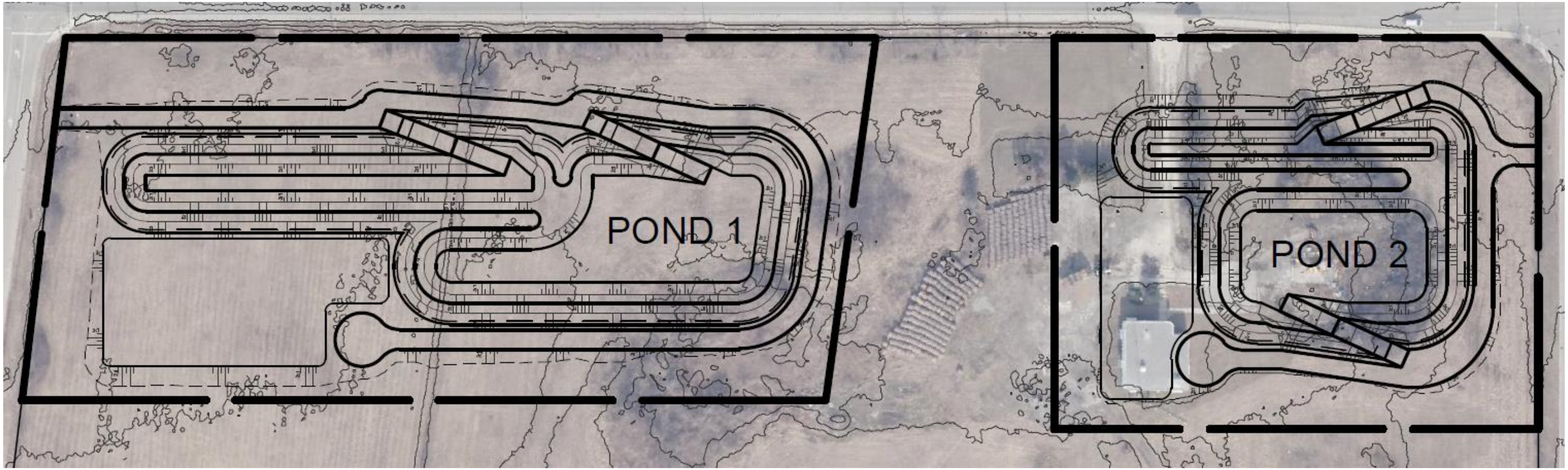
Wastewater – Annual Inflow through maintenance holes

Existing Conditions (m^3)	Stormwater Credit Scenario (m^3)	One Water Scenario (m^3)
1600	1570	0

End of Pipe Scenario



End of Pipe Conceptual Design



Economic Assessment

Cost Estimates

Low Impact Development Life Cycle Costing Tool (LCCT)

https://sustainabletechnologies.ca/lid-lcct/

Lifecycle Cost Comparison

Maximum Stormwater Credit Scenario: $320,000 +/- per ha managed

One Water Scenario: $500,000 +/- per ha managed

*Not including rainwater harvesting

Pond Scenario: $400,000 +/- per ha managed

Cost Sharing Approach

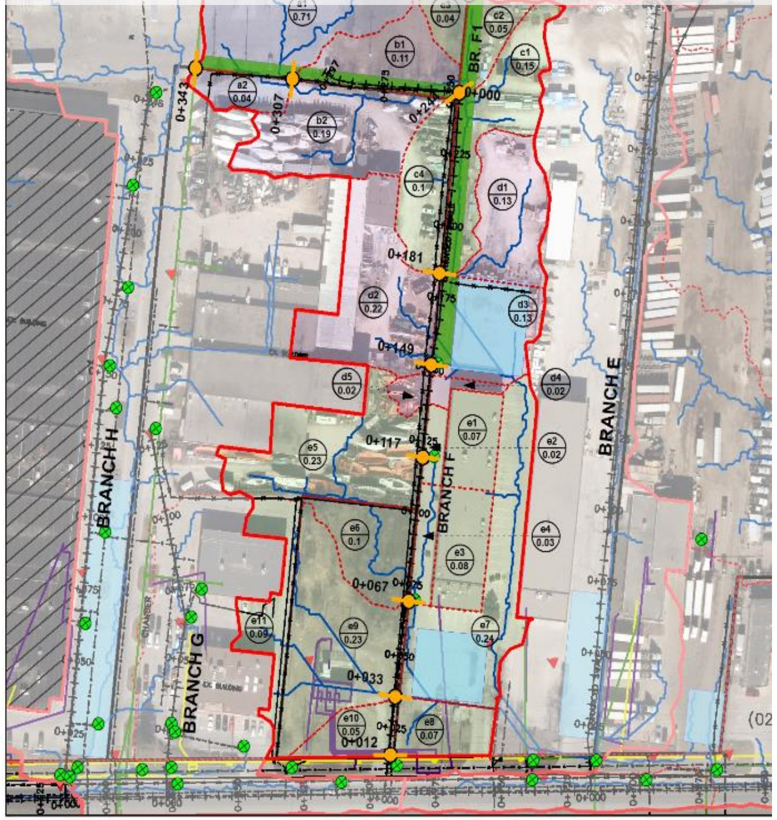
- Used the Drainage Act approach to cost sharing – user pay framework
- Section 21 to 28 of the Drainage Act specifies to apportion costs to various parties affected by the drain
- A set of tables (called Assessment Schedules) were developed
- The portion of the cost is based on how much each property benefits from the work and uses the drainage system.

Hypothetical Cost Sharing for Communal Systems

Credit Scenario– $320,000/ha

Municipal cost: $200,000/ha

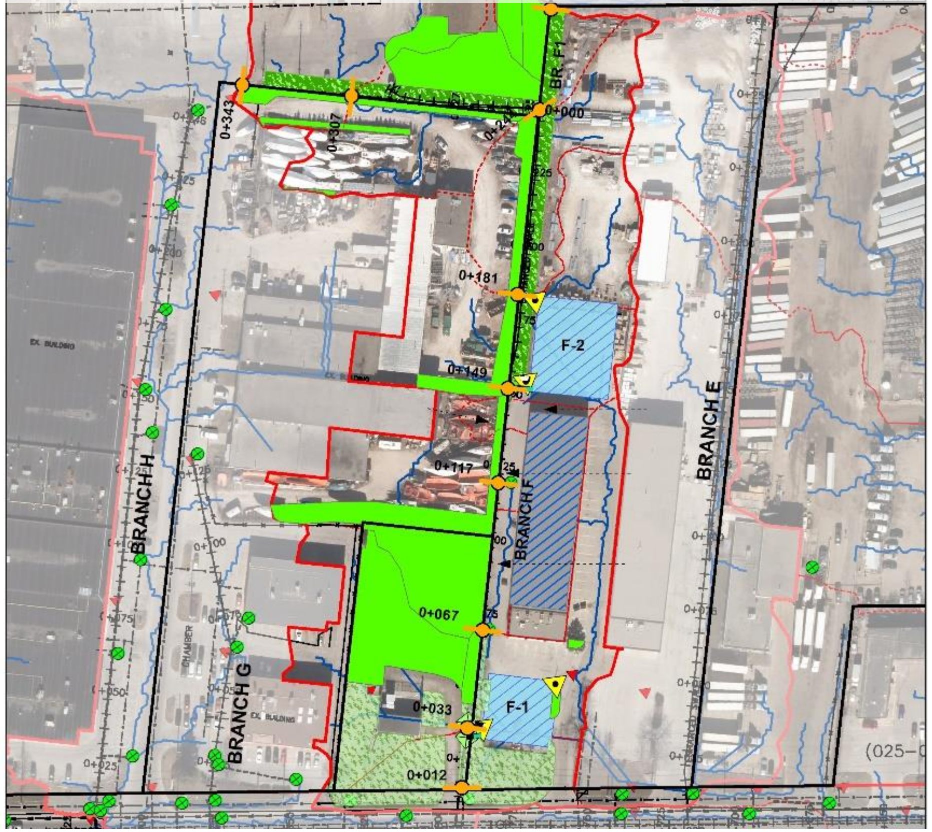
Landowner Cost– $120,000/ha)



One Water Scenario– $500,000/ha

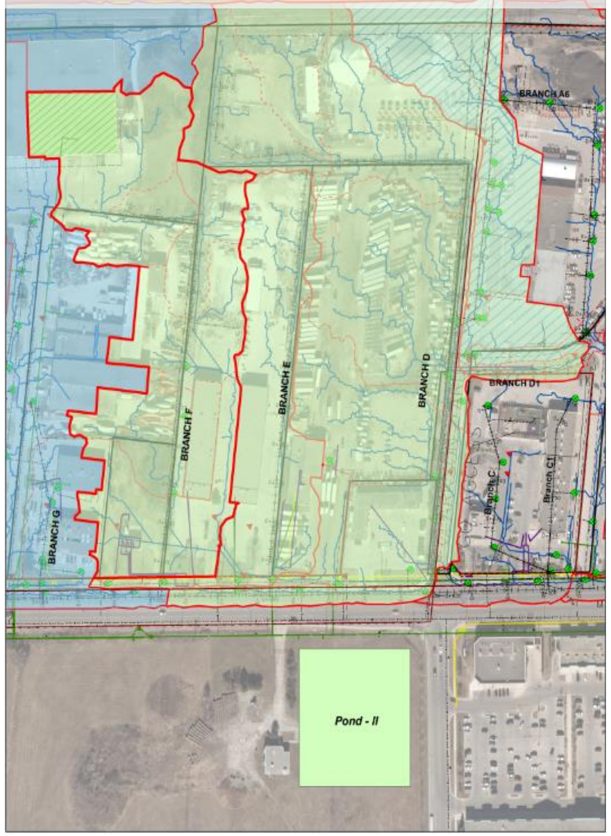
Municipal cost: $200,000/ha

Landowner and other Partner Cost– $300,000/ha)



End of Pipe on Public Property – $400,000/ha

Municipal cost: $400,000/ha



Application of Study and Next Steps

Aggregation Methodology Guidance

Stage I Pre-Aggregation

Step 1 – Review upper tier studies
Step 2 – Develop measurable criteria and prioritize areas
Step 3 – Review land uses
Step 4 – Review companion/complementary initiatives
Step 5 – Conduct consultation

Stage II Aggregation Planning

Step 1 – Review priority areas
Step 2 – Direct landowner engagement
Step 3 – Establish aggregation proponent
Step 4 – Assess priority area drainage system
Step 5 - Establish preliminary aggregation areas
Step 6 – Select preferred aggregation area

Stage III Aggregation Design

Step 1 – Preliminary engineering and field work studies
Step 2 – Screen potential LID BMPs
Step 3 – Economic assessment
Step 4 – Landowner engagement
Step 5 – Assess drainage system
Step 6 – Prepare preliminary design of preferred alternatives
Step 7 – Landowner engagement
Step 8 – Detailed design
Step 9 – Landowner engagement
Step 10 – Final design and tender

Stage IV Post-Aggregation

Step 1 – Construction
Step 2 – Monitoring
Step 3 – Operations and Maintenance

Why is this important?

1. Environmental Assessment Act
2. Environmental Compliance Approval
   - ‘Legal Instruments’
3. ERO - Municipal Wastewater and Stormwater Management in Ontario Discussion Paper

3. Changing the Way Stormwater is Managed in Urban Areas

Discussion Questions

1. How can greater municipal adoption of green stormwater infrastructure/low impact development practices on public, private and commercial/industrial property be encouraged?

Resources

Sustainable Technologies Evaluation Program (STEP)

https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/aggregated-communal-approaches-to-gi-implementation/

Thank You

For more information:

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