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AUTOMATED SCREENING TOOL FOR RIGHT-OF-WAY LID MEASURES

Project Team

▶ City of Ottawa

- ▶ Laurent Jolliet, M.A.Sc. P.Eng. (PM)
- ▶ Darlene Conway, P.Eng.



▶ Aquafor Beech Ltd.

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- ▶ Peter Hebert, B.Eng., WRE, EIT
- ▶ Jakub Ripley, GIS Specialist



▶ Robinson Consultants Inc. (RCI)

- ▶ Kelly Lalonde, P.Eng.



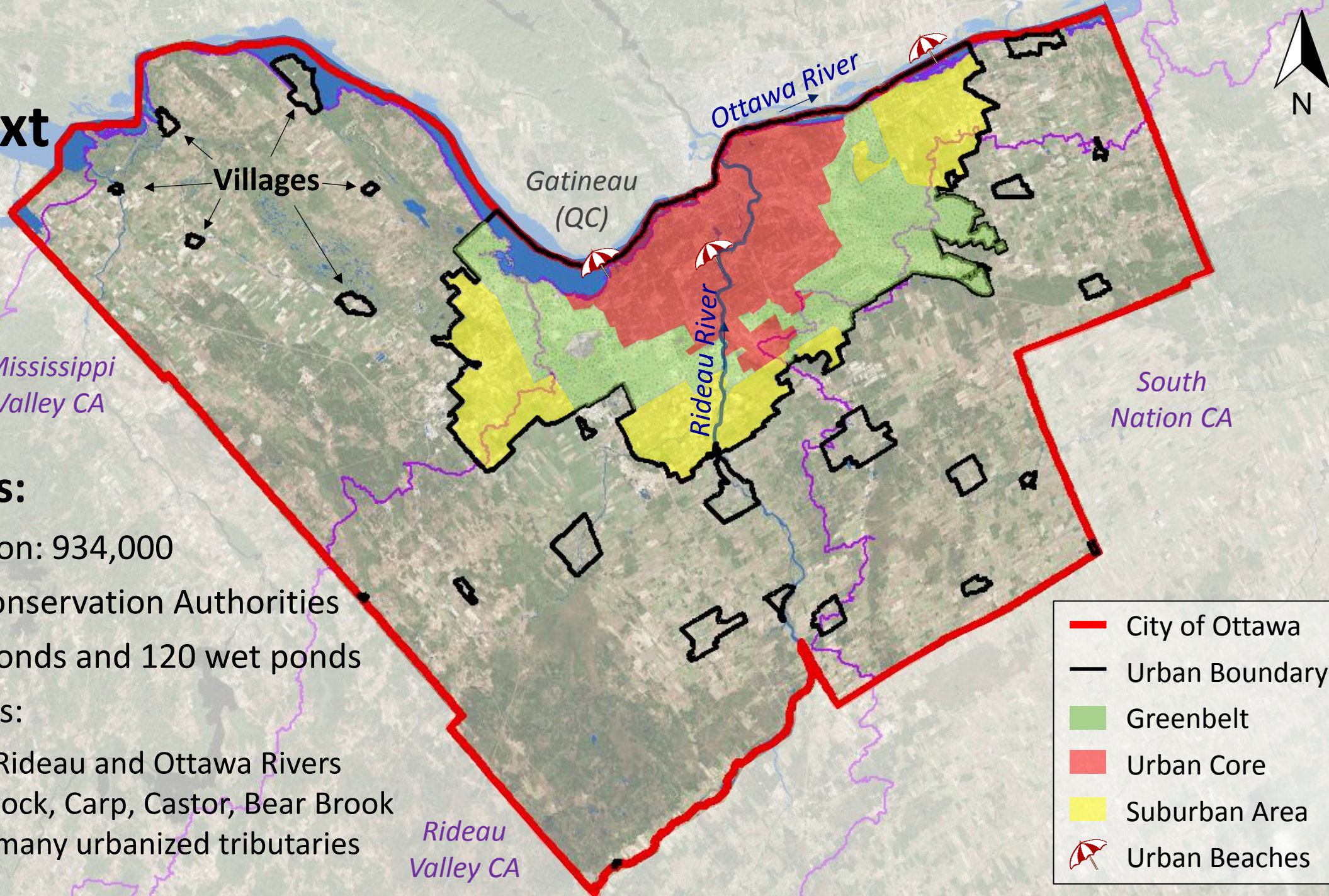
▶ Bolivar Phillips (BP)

- ▶ Roddy Bolivars, P.Eng.



Stewart St., Ottawa

Local Context



Villages

Gatineau (QC)

Ottawa River

Rideau River


Mississippi Valley CA

South Nation CA

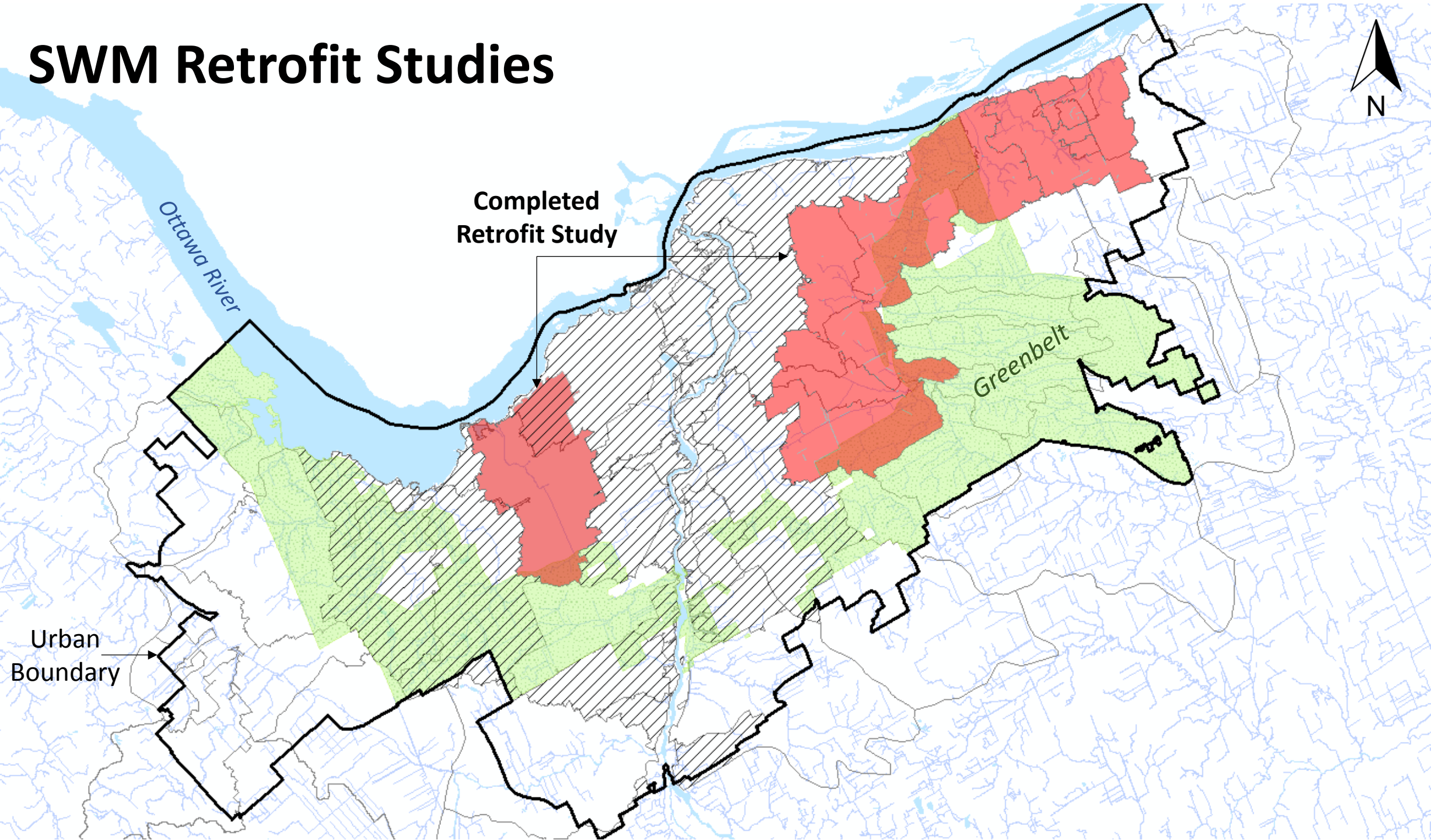
Rideau Valley CA

Key Facts:

- Population: 934,000
- Three Conservation Authorities
- 70 dry ponds and 120 wet ponds
- Receivers:
 - Large: Rideau and Ottawa Rivers
 - Med.: Jock, Carp, Castor, Bear Brook
 - Small: many urbanized tributaries

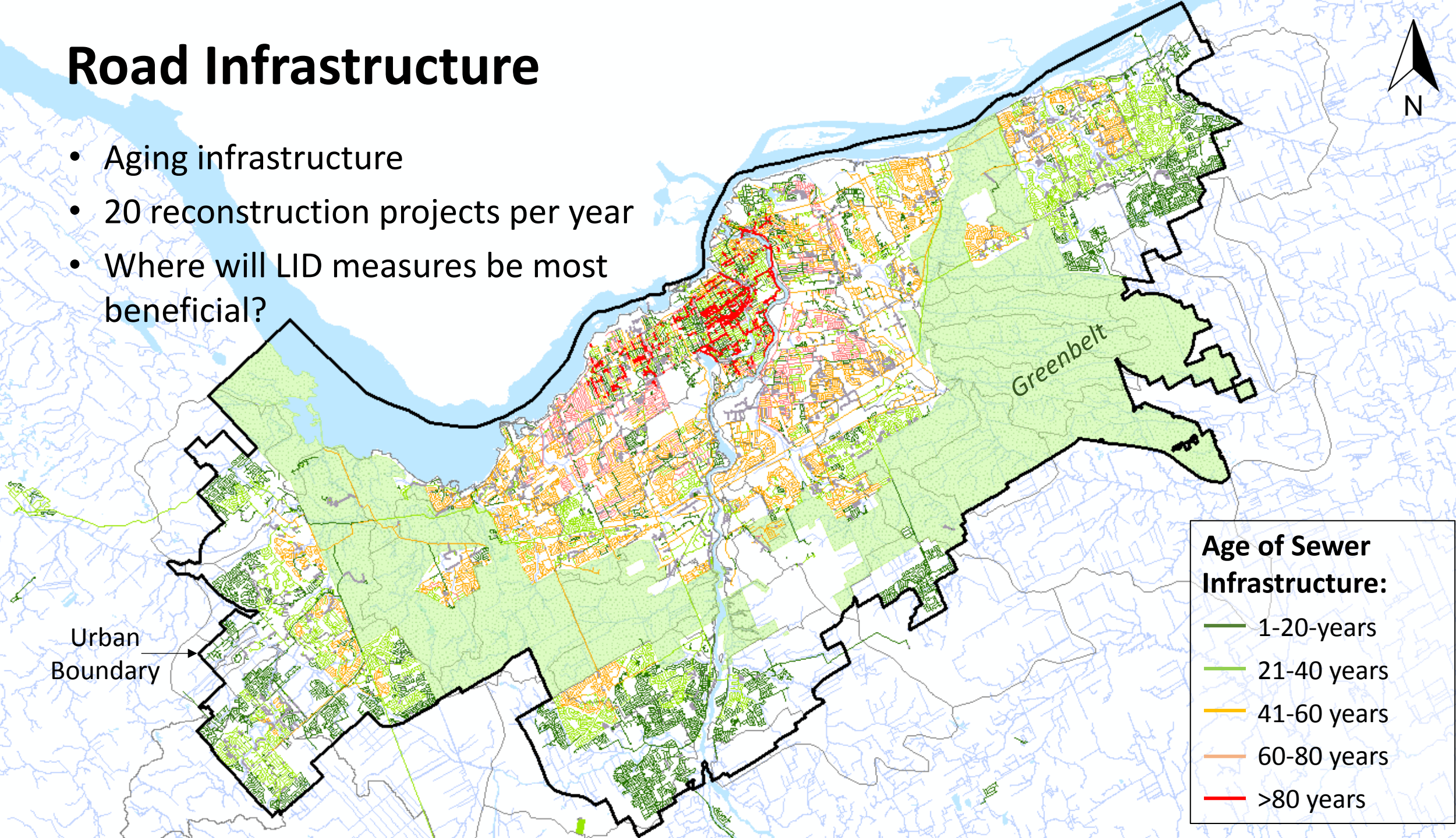
	City of Ottawa
	Urban Boundary
	Greenbelt
	Urban Core
	Suburban Area
	Urban Beaches

SWM Retrofit Studies



Road Infrastructure

- Aging infrastructure
- 20 reconstruction projects per year
- Where will LID measures be most beneficial?



Project Objectives

- **Identify areas** where the implementation of LID measures will be **most beneficial** and areas where they should be precluded, discouraged, or not implemented.
- Develop a fully automated GIS based screening tool process to improve **efficiency and consistency** and aid City staff to conduct **systematic reviews** of a large number of ROWs on a regular basis.
- Fully automated GIS based screening tool to **select candidates** that have demonstrated potential for the implementation of LID measures.

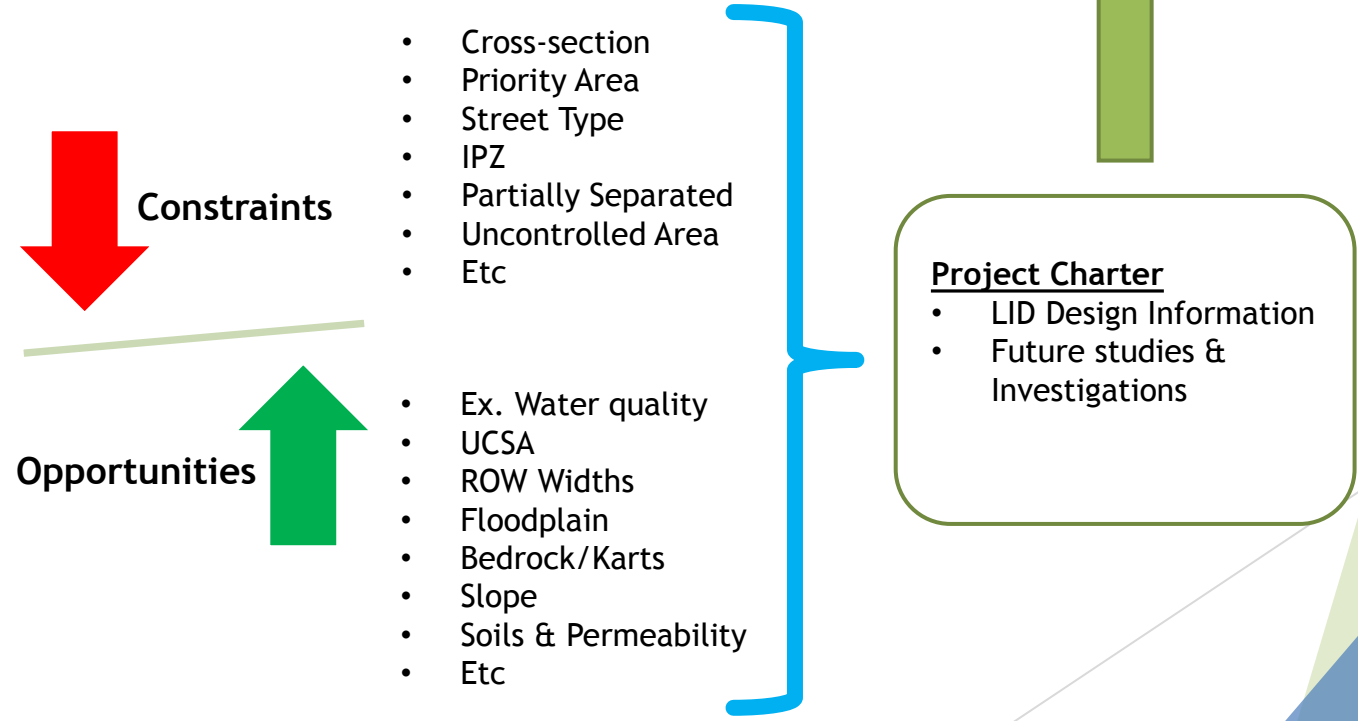
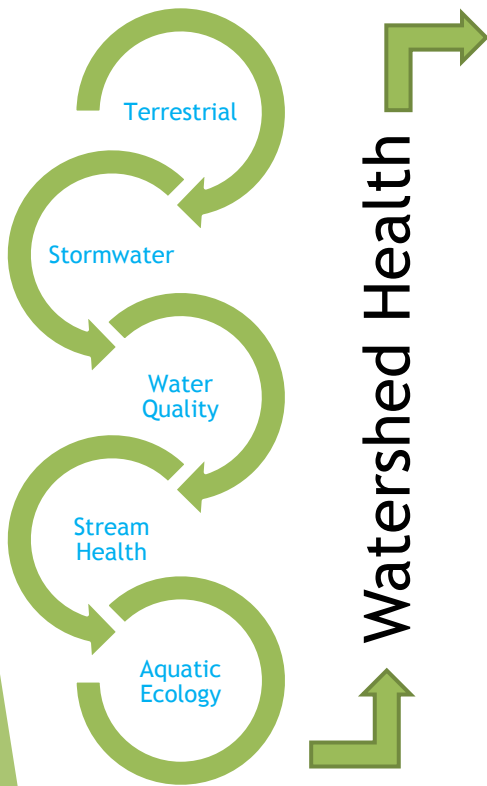
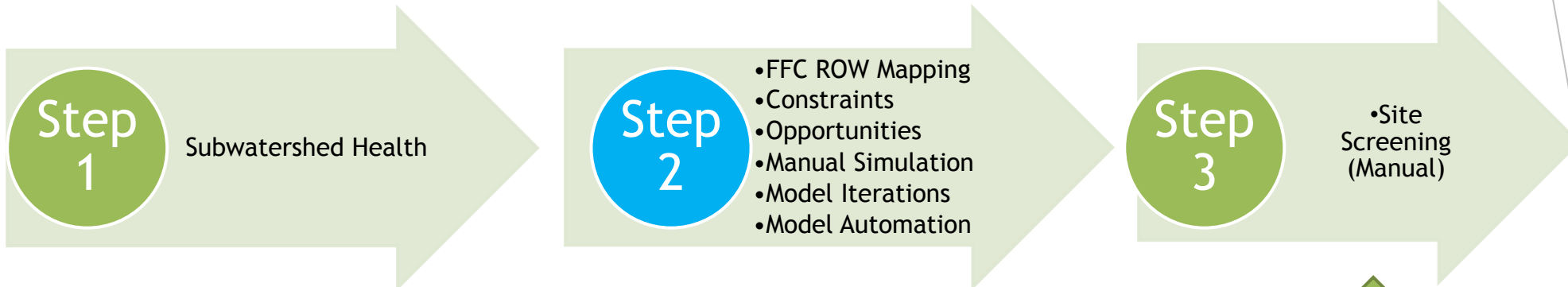


Automated GIS-Based Selection Tool



- ▶ Builds on past LID implementation experience in the City
- ▶ Designed to permit rapid re-assessment of LID feasibility as road reconstruction priorities change
- ▶ Complete complex assessments on a large geographic scale
- ▶ Utilizes only City GIS layers and data without manipulation
- ▶ Identifies data gaps
- ▶ Applies surrogate scores/data where data gaps exist using proxy measures
- ▶ Designed to permit future data upgrades when data gaps are filled
- ▶ Optimized to ensure the end-product is useable and traceable
- ▶ Ensures the Priority Lists are defensible to city staff, elected officials, the community and agencies

3 Step Process



3 Step Process - Overview

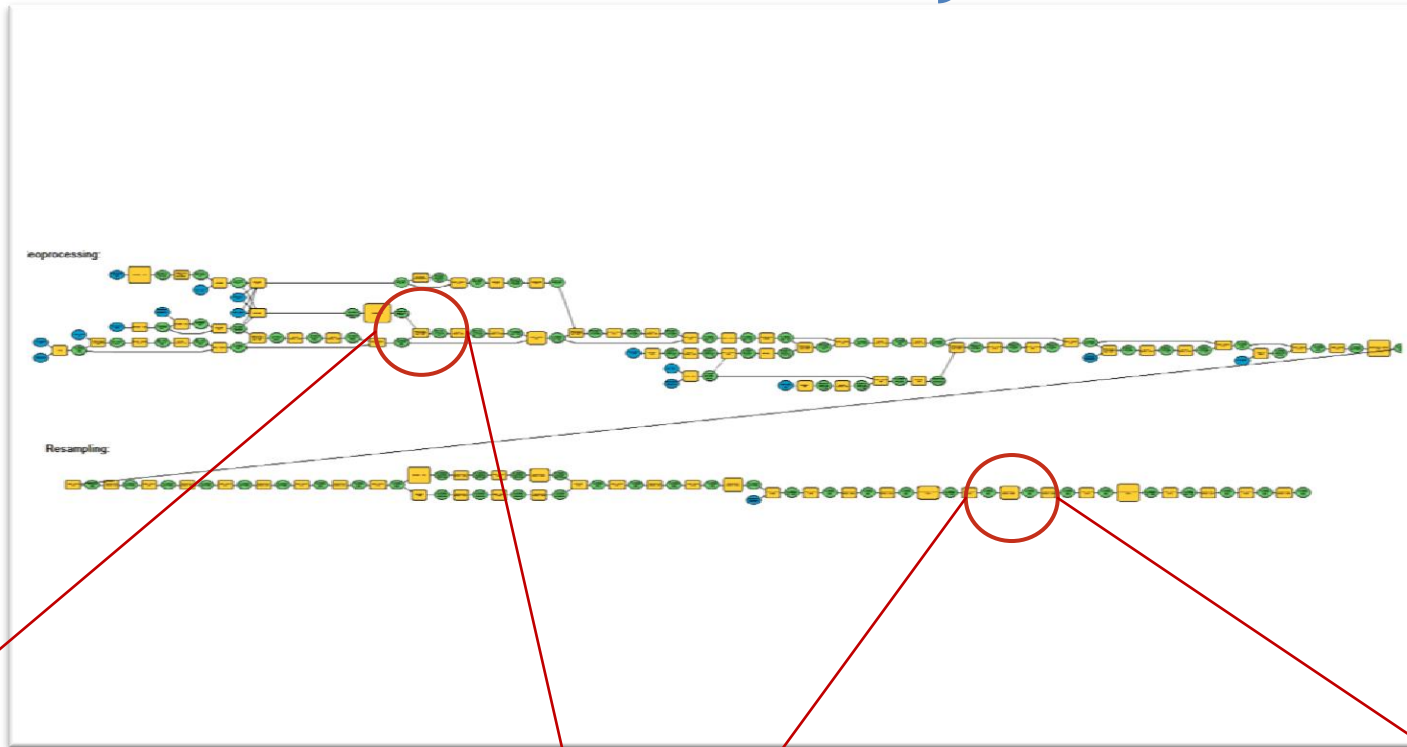
Step	Purpose	Data Used	Tool	Examples	Deliverable
Subwatershed Health Metric	Identify Subwatersheds where Stormwater Improvements will have the most benefit	5 Metrics with multiple parameters	GIS	<ol style="list-style-type: none"> 1. % SWM coverage 2. Flooding incident density 3. Natural Area Connectivity 	<p>Subwatershed Prioritization (Four Tiers)</p> <p>Priority 1 = Poor Overall Health (Most in need)</p> <p>Priority 4 = Best overall health</p>
Constraints and Opportunities Screening	Identify Constraints to LID Mechanisms and Site Opportunities	<p>11 Constraint Categories</p> <p>9 Opportunity Categories</p>	GIS	<p>High Groundwater, High Bedrock, Excessive Slope, Etc.</p> <p>Cross-section Profile, Priority Areas, Etc.</p>	<ol style="list-style-type: none"> 1. Prioritization of ROW Projects based on LID Feasibility 2. List of Potential LID Options for each ROW Project
Site Screening	Refine LID Choice for Roadway Project	Site Assessment, Plans/Profiles, Public Input	Post-GIS Selection Tool (selection-sheet)	<ol style="list-style-type: none"> 1. Desired Aesthetic 1. Maintenance Requirements 	Preferred LID Option for ROW Project

Subwatershed Health Metric Weighting

Five (5) Metrics to assess Subwatershed Health:

Metric	Weighting (%)
Terrestrial Subcatchment Health	20
Stormwater Management	20
Water Quality	20
Stream Channel and Riparian Health	20
Aquatic Ecology	20
TOTAL	100

Subwatershed Health Analysis Model



```
528 # Process: Clip
529 arcpy.Clip_analysis(WatershedSub, StudyArea, clip_WatershedSub_38, "")
530
531 # Process: Tabulate Intersection
532 arcpy.TabulateIntersection_analysis(clip_WatershedSub_38, "OBJECTID", Wetlands, wetlandTabIntersect, "", "Shape_Area", "", "RECTANGLES")
533
534 # Process: Alter Field (11)
535 arcpy.AlterField_management(wetlandTabIntersect, "PERCENTAGE", "Wetland_PERC", "", "S", "NON_NULLABLE", "false")
536
537 # Process: Alter Field (7)
538 arcpy.AlterField_management(wetlandTabIntersect_2, "AREA", "Wetland_AREA", "", "S", "NON_NULLABLE", "false")
539
540 # Process: Join Field
541 arcpy.JoinField_management(clip_WatershedSub_38, "OBJECTID", wetlandTabIntersect_3, "OBJECTID_1", "Wetland_AREA|Wetland_PERC")
542
543 # Process: Select (8)
544 arcpy.Select_analysis(ForestUrban, ForestUrban_Select, "Shape_Area >= 1500")
545
546 # Process: Erase (2)
547 arcpy.Erase_analysis(RoadsAreaAndNo2011, ForestUrban_Select, erase_woodedarea, "")
548
```

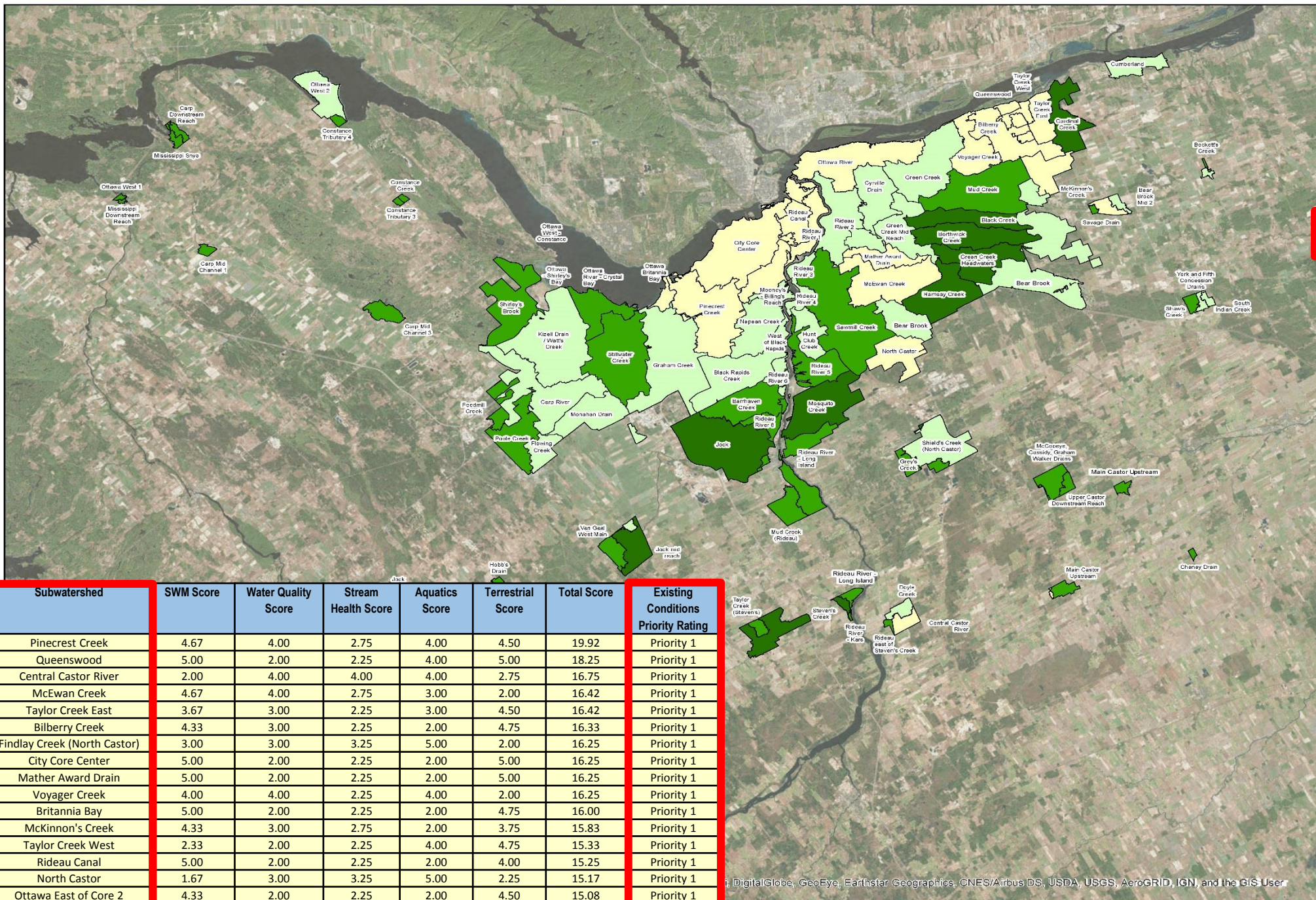
```
502 # Process: Calculate Field (2)
503 arcpy.CalculateField_management(clip_WatershedSub_31, "Wetland_Score", "Reclass(Wetland_PERC)", "PYTHON", "def Reclass(Wetland_PERC):\n if (Wetland_PERC > 6):\n return 1\n elif (Wetland_PERC > 4.4 and Wetland_PERC <= 6):\n return 2\n elif (Wetland_PERC > 2.9 and Wetland_PERC <= 4.4):\n return 3\n elif (Wetland_PERC > 1.4 and Wetland_PERC <= 2.9):\n return 4\n elif (Wetland_PERC <= 1.4):\n return 5")
504
505 # Process: Add Field (8)
506 arcpy.AddField_management(clip_WatershedSub_10, "Forest_Score", "FLOAT", "", "", "", "NULLABLE", "NON_REQUIRED", "")
507
508 # Process: Calculate Field (6)
509 arcpy.CalculateField_management(clip_WatershedSub_14, "Forest_Score", "Reclass(Forest_PERC)", "PYTHON", "def Reclass(Forest_PERC):\n if (Forest_PERC > 30):\n return 1\n elif (Forest_PERC > 21.5 and Forest_PERC <= 30):\n return 2\n elif (Forest_PERC > 14 and Forest_PERC <= 21.5):\n return 3\n elif (Forest_PERC > 6.5 and Forest_PERC <= 14):\n return 4\n elif (Forest_PERC <= 6.5):\n return 5")
510
511 # Process: Add Field (5)
512 arcpy.AddField_management(clip_WatershedSub_16, "Natural_Score", "FLOAT", "", "", "", "NULLABLE", "NON_REQUIRED", "")
513
514 # Process: Calculate Field (8)
515 arcpy.CalculateField_management(clip_WatershedSub_18, "Natural_Score", "Reclass(HatCover_PERC)", "PYTHON", "def Reclass(HatCover_PERC):\n if (HatCover_PERC >= 50):\n return 1\n elif (HatCover_PERC > 37.4 and HatCover_PERC <= 50):\n return 2\n elif (HatCover_PERC > 24.9 and HatCover_PERC <= 37.4):\n return 3\n elif (HatCover_PERC >= 12.4 and HatCover_PERC <= 24.9):\n return 4\n elif (HatCover_PERC <= 12.4):\n return 5")
```


CITY OF OTTAWA LID SCREENING TOOL

Legend

Priority Ranking

- Priority 1
- Priority 2
- Priority 3
- Priority 4



Subwatershed	SWM Score	Water Quality Score	Stream Health Score	Aquatics Score	Terrestrial Score	Total Score	Existing Conditions Priority Rating
Pinecrest Creek	4.67	4.00	2.75	4.00	4.50	19.92	Priority 1
Queenswood	5.00	2.00	2.25	4.00	5.00	18.25	Priority 1
Central Castor River	2.00	4.00	4.00	4.00	2.75	16.75	Priority 1
McEwan Creek	4.67	4.00	2.75	3.00	2.00	16.42	Priority 1
Taylor Creek East	3.67	3.00	2.25	3.00	4.50	16.42	Priority 1
Bilberry Creek	4.33	3.00	2.25	2.00	4.75	16.33	Priority 1
Findlay Creek (North Castor)	3.00	3.00	3.25	5.00	2.00	16.25	Priority 1
City Core Center	5.00	2.00	2.25	2.00	5.00	16.25	Priority 1
Mather Award Drain	5.00	2.00	2.25	2.00	5.00	16.25	Priority 1
Voyager Creek	4.00	4.00	2.25	4.00	2.00	16.25	Priority 1
Britannia Bay	5.00	2.00	2.25	2.00	4.75	16.00	Priority 1
McKinnon's Creek	4.33	3.00	2.75	2.00	3.75	15.83	Priority 1
Taylor Creek West	2.33	2.00	2.25	4.00	4.75	15.33	Priority 1
Rideau Canal	5.00	2.00	2.25	2.00	4.00	15.25	Priority 1
North Castor	1.67	3.00	3.25	5.00	2.25	15.17	Priority 1
Ottawa East of Core 2	4.33	2.00	2.25	2.00	4.50	15.08	Priority 1
Rideau River 1	5.00	2.00	2.00	1.00	5.00	15.00	Priority 1

FIGURE: SUBCATCHMENT RANKING - PRIORITY RANK



Date: February 2019
Source: City of Ottawa, 2017
Projection: MTM_9
Datum: NAD_1983

Constraint Name	Description	Scoring	Data Source
Catchments with Existing Water Quality Treatment	Drains to SWM Quality Pond or OGS	Removed from Priority List if within Catchment	StormMinorCatchments & SWMFacilities
Catchments within UCSA	Drains to CSST	Removed from Priority List if within Catchment	Ultimate_Combined_Area_2015
ROW width outside Paved Roadway	Average Boulevard Area potentially available for Retrofit	0-4 m = 0 points 4-6 m = 5 points 6+ m = 10 points	Road Segments & Parcels
Floodplain	Within Regulatory Floodplain	Outside = 0 points Within = -2 points	Floodplain
Karst Topography	Proximity to identified Karst	100 + m = 0 points Less than 100 m = -5 points Bisecting = -10 points	KarstPolygonsOGS
Bedrock Depth	% of Road Segment with bedrock depth 2 m or less	0-25 % = 10 points 25-50 % = 0 points 50-75 % = -5 points 75+ % = -10 points	LID_Drift_0to1m_Final & LID_Drift_1to2m_Final
Slope	Maximum Slope down the road segment	0-2% = 10 points 2%-5% = 0 points 5%-10% = -5 points 10% + = -10 points	Topography4x4m
Historical Land Use Inventory	Proximity to HULI area	Adjacent = -5 points All other = 0 points	PL_HULI
Soil Permeability	Soil permeability Classification	High = 10 points Low-Medium = 0 points Low = -10 points	SurficialGeologyOGS
Zoning Type	Land Use Parcel	Residential Both Sides = 10 points Residential One Side = 5 points Industrial on one Side = -5 points Industrial on both Sides = -10 points All Other Combinations = 0 points	LandUSE_2010
WHPA and ICAs	Within WHPA or ICA	Outside both = 0 points Within WHPA = -2 points Within ICA = -10 points	WellheadVulnerableArea

LID Constraints

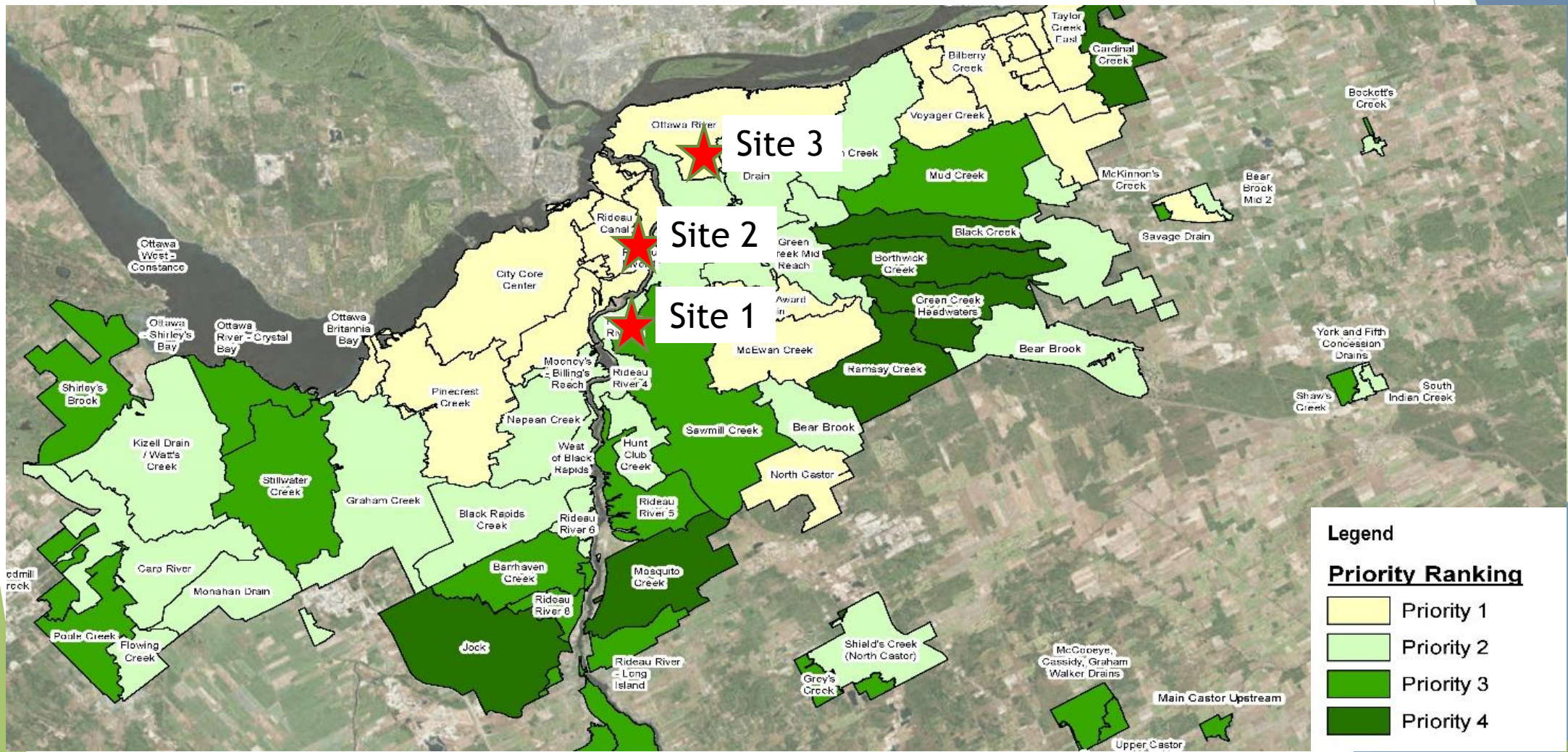
- Can remove a site from the Priority List
- Constraints lower or increase each site's priority
- Based on:
 - LID design guidance
 - Physical elements
 - Policy considerations
 - Other City initiatives and long-term plans
 - SPP

Constraint Name	Description	Scoring	Data Source
Cross-section	Urban or Rural Cross-section	Rural (Ditch) = 5 points Urban = 0 points	DitchesUrban
Design Priority Areas	With delineated City of Ottawa DPAs	Within = 10 points Outside = 0 points	DesignPriorityAreas
Greenbelt Areas	With Greenbelt	Within = 2 points Outside = 0 points	Greenbelt
Street Type	Local Road designated or other	Local = 5 points All other = 0 points	RoadSegments
Intake Protection Zone	Within IPZ	Within = 2 points Outside = 0 points	IPZ
Partially Separated Sewershed	Within PS Sewershed	Within = 5 points Outside = 0 points	Neighbourhood_Aug_2018
Uncontrolled SWM Quantity Catchments	Catchment not provided with Peak Flow Controls	Not Controlled = 5 points Controlled = 0 points	StormMinorCatchments & SWMFacilities
Proximity to Watercourse or Wetland	Is 50 m distance achieved	Within 50 m = 5 points Outside 50 m = 0 points	Watercourse
Subwatersheds that do not Drain to the Ottawa River, Rideau River or Rideau Canal	Road Segment within Subwatershed	Drains to directly = 0 points Does not drain to directly = 5 points	Watercourse

LID Opportunities

- Opportunities increase the site priority
- Based on:
 - LID design guidance
 - Physical elements
 - Policy considerations
 - Other City initiatives and long-term plans
 - SPP

Draft Results - Priority Sites 1, 2 & 3



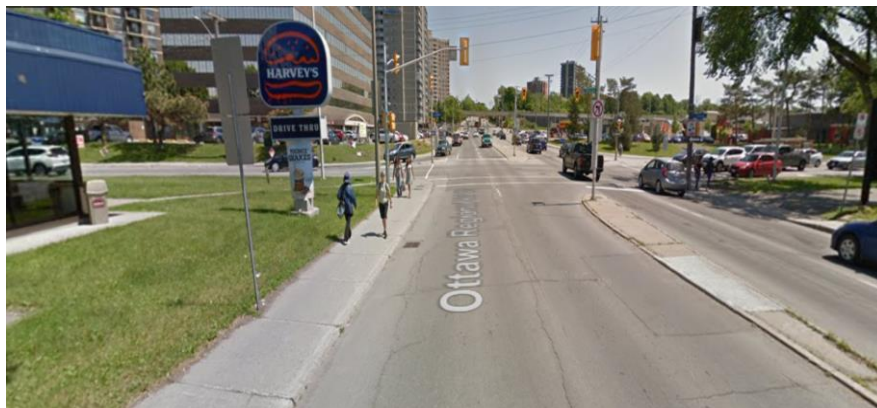
Draft Results - Priority Site 1

Bank St - Riverside Dr. to Lamira St. (Rideau River 3 SWS)



Outputs from Automated Selection Tool = Input to Project Charter

- ▶ Road Classification: Arterial
- ▶ Boulevard Width: 8.77m
- ▶ Rural Profile: No
- ▶ Floodplain: No
- ▶ Wellhead Vulnerable Area: No
- ▶ Depth To Bedrock > 2m : Yes
- ▶ Karst: No
- ▶ Proximity to Impacted Soils: Yes
- ▶ Design Priority Area: Yes
- ▶ Greenbelt: No
- ▶ Intake Protection Zone (IPZ): No
- ▶ Partially Separated Area (PSA): No
- ▶ Ex. Stormwater Quality Control: No
- ▶ Ex. Stormwater Quantity Control: No
- ▶ Ultimate Combined Area: No
- ▶ Permeability: Low
- ▶ Slope: 4%
- ▶ Flooding Density < 1 per ha: Low Risk
- ▶ Landuse 1: TR-RTR, Landuse 2: TR
- ▶ Proximity To Watercourse > 50m: Yes
- ▶ Directly Outletting To River: No



Draft Results - Priority Site 2

Montreal Rd - Alfred St. to Rue De L'Eglise (Ottawa River SWS)



Outputs from Automated Selection Tool = Input to Project Charter

- ▶ Road Classification: Arterial
- ▶ Boulevard Width: 4.89m
- ▶ Rural Profile: No
- ▶ Floodplain: No
- ▶ Wellhead Vulnerable Area: No
- ▶ Depth To Bedrock > 2m : Yes
- ▶ Karst: No
- ▶ Proximity to Impacted Soils: Yes
- ▶ Design Priority Area : Yes
- ▶ Greenbelt: No
- ▶ Intake Protection Zone (IPZ): No
- ▶ Partially Separated Area (PSA): Yes
- ▶ Ex. Stormwater Quality Control: No
- ▶ Ex. Stormwater Quantity Control: No
- ▶ Ultimate Combined Area: No
- ▶ Permeability: Low-Medium
- ▶ Slope: 1.67%
- ▶ Flooding Density < 1 per ha : Low Risk
- ▶ Landuse 1: IC-CEM, Landuse 2: R4
- ▶ Proximity To Watercourse > 50m: No
- ▶ Subwatershed Directly Outletting To River: Yes

Draft Results - Priority Site 3

Hawthorne Ave - Colonel By Dr to Main St (Rideau River 1 SWS)



Outputs from Automated Selection Tool = Input to Project Charter

- ▶ Road Classification: Arterial
- ▶ Boulevard Width: 2.83m
- ▶ Rural Profile: No
- ▶ Floodplain: No
- ▶ Wellhead Vulnerable Area: No
- ▶ Depth To Bedrock > 2m : Yes
- ▶ Karst: No
- ▶ Proximity to Impacted Soils: Yes
- ▶ Design Priority Area: Yes
- ▶ Greenbelt: No
- ▶ Intake Protection Zone (IPZ): No
- ▶ Partially Separated Area (PSA): Yes
- ▶ Ex. Stormwater Quality Control: No
- ▶ Ex. Stormwater Quantity Control: No
- ▶ Ultimate Combined Area: No
- ▶ Permeability: Low
- ▶ Slope: 0.86%
- ▶ Flooding Density < 1 per ha : Low Risk
- ▶ Landuse 1: R1, Landuse 2: C3
- ▶ Proximity To Watercourse > 50m: Yes
- ▶ Directly Outletting To River: Yes

QUESTIONS ?



Mississauga, Guelph, Milton, Kingston

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