



The Municipal Adaptation and Resiliency Service (MARS)

Webinar 8

WASTEWATER & STORMWATER INFRASTRUCTURE



WEBINAR 8: OVERVIEW



1. MARS Training Overview
2. Current waste water and storm water infrastructure stressors and management challenges
3. Climate change impacts on storm water and waste water systems
4. Presentations by:

John Nemeth, C.E.T.

Program Manager, Transportation Division, Region of Peel

Marvin Ingebrigsten, P. Eng.

Technical Analyst, Infrastructure Programs, City of Welland

5. Resources

MARS TRAINING SERIES: OVERVIEW



- Webinar 1: Introduction to Municipal Climate Adaptation and Climate Projections for Great Lakes Region
- Webinar 2: Portal tour
- Webinar 3: Financial and Legal Implications of Climate Change for Municipalities
- Webinar 4: Transportation Infrastructure
- Webinar 5: Building Infrastructure and land use planning
- Webinar 6: Vulnerable Populations
- Webinar 7: Urban Natural Systems

Webinar recordings stored on MARS Community of Practice (CoP) Portal:
<https://www.ccadaptation.ca/en/mars>

WEBINAR 9: OVERVIEW



Webinar 9- Communication and Collaboration, **April 10th**

Guest Speaker: David Pearson, Laurentian University

Guest Speaker: Gabriella Kalapos, Clean Air Partnership

2 CURRENT WASTE WATER AND STORMWATER MANAGEMENT CHALLENGES

INFRASTRUCTURE DEFECIT & AGING INFRASTRUCTURE



- Infrastructure Vs Taxation disconnect
- Ontario's infrastructure deficit
- Canadian Infrastructure Report Card
 - Wastewater infrastructure condition
 - Stormwater infrastructure condition
 - Replacement costs
 - Maintaining state of good repair



BALLOONING URBAN POPULATIONS



- Increasing population densities
- Ontario's total population growth
- GTA projected growth

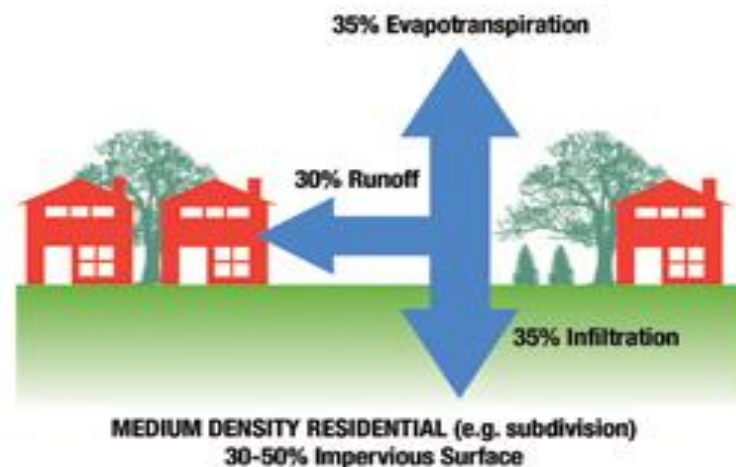
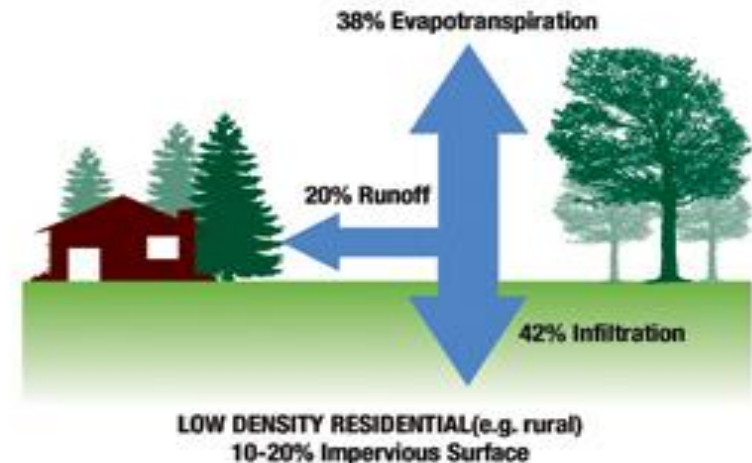
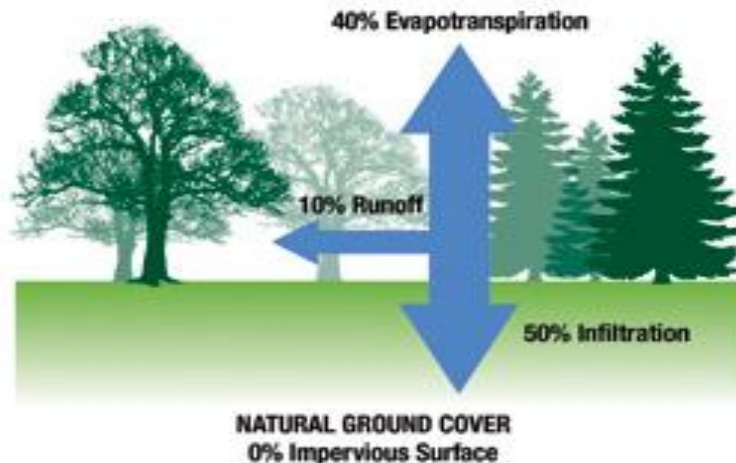
Population Shares of Ontario Regions, 1986 to 2036

Share of Ontario Population (%)	1986	1996	2011	2016	2026	2036
GTA	41.4	43.0	47.3	48.3	50.0	51.5
Central	21.8	22.2	21.6	21.5	21.1	20.9
East	14.0	13.8	13.0	12.9	12.9	12.7
Southwest	14.1	13.4	12.0	11.6	10.9	10.2
Northeast	6.2	5.4	4.2	4.0	3.6	3.2
Northwest	2.6	2.3	1.8	1.7	1.6	1.4

Sources: Statistics Canada, 1986–2011, and Ontario Ministry of Finance projections.

LACK OF IMPERVIOUS SURFACES

EFFECTS OF IMPERVIOUSNESS ON RUNOFF AND INFILTRATION



COMBINED SEWER AND STORMWATER OVERFLOWS, TREATMENT PLANT OVERLOADS



- Outdated systems found in many Ontario municipalities
- Transports sanitary sewage and storm water in same pipe
- Heavy rains and snowmelts often result in:
 - Combined sewer overflows: the release of untreated sewage mixed with storm water into local water bodies and Great Lakes
 - Sewage treatment plant overloads i.e.: Thunder Bay, May 2012

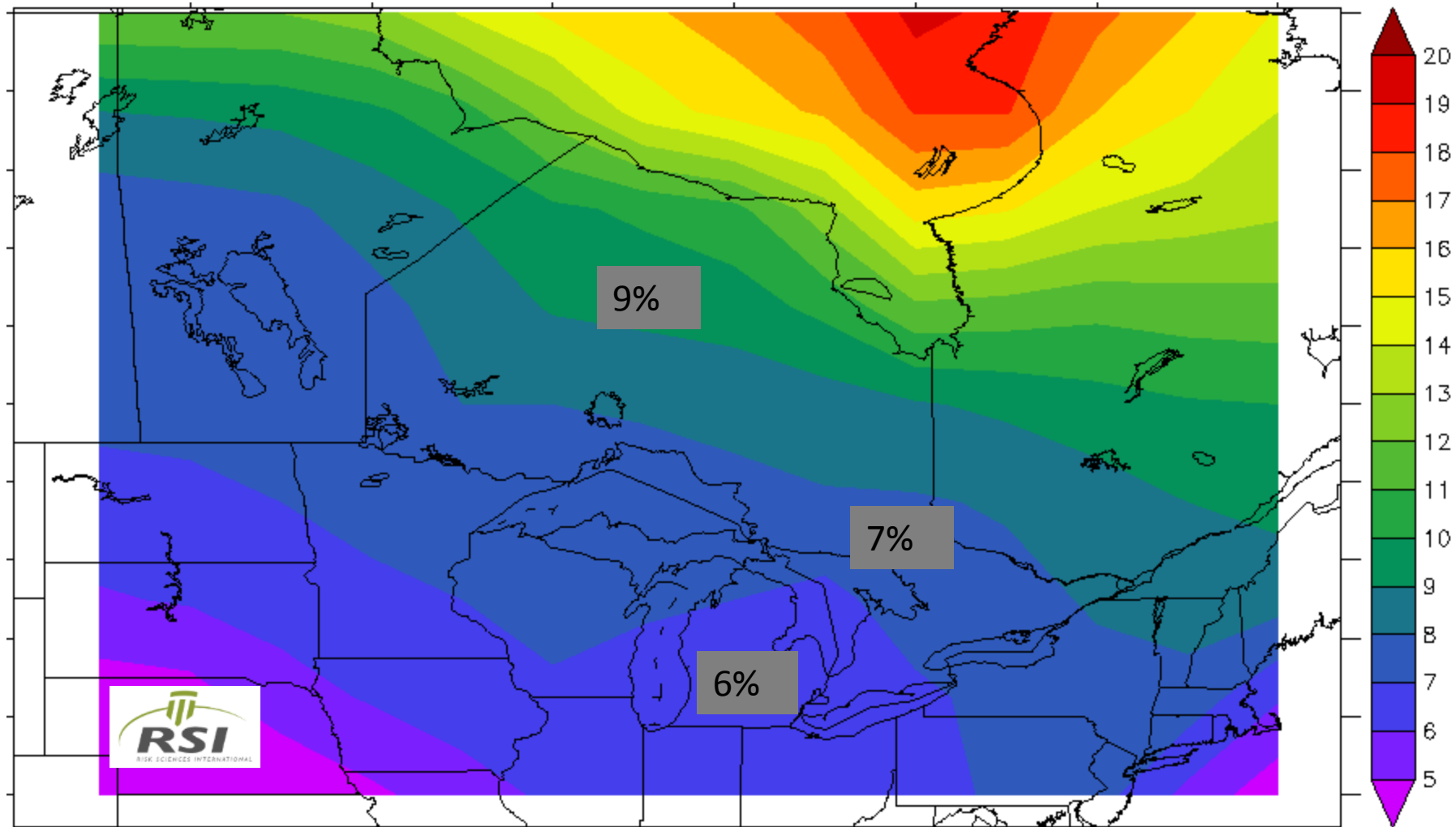


3 CLIMATE CHANGE IMPACTS ON WASTE WATER AND STORM WATER SYSTEMS

IPCC (AR5) 2013 ENSEMBLE MEAN ANNUAL PRECIP



(RCP8.5) 1981-2010 to 2050s PERCENT CHANGE - **WETTER**



GTA Ontario Precipitation Extremes (2050s and 2100)

Indicator Name (observed baseline value)	Change mid-century from 1981-2010	Change by 2100
Maximum 1 day precipitation (37 mm)	+9%	+20%
Maximum 5 day precipitation (60 mm)	+6%	+17%
99 th Percentile precipitation amount (79 mm)	+37%	+87%

Extremes expected to be more responsive to climate change than averages
Potential for intense thunderstorm rainfalls to increase at greatest rates

Indicates that a greater proportion of precipitation will
come from more extreme events

CLIMATE CHANGE IMPLICATIONS FOR STORM & WASTEWATER INFRASTRUCTURE

- Exposure to weather extremes not accounted for in original design; construction occurred on assumption that past climate extremes will represent future conditions
- Shorter life span of systems
- Increase in maintenance and operating costs
- More frequent and intense combined sewer overflows, sewage treatment plant overloads
- Municipalities faced with severe and unanticipated economic losses due to damaged or overwhelmed storm water and waste water systems



SECONDARY IMPACTS



- Disruption to additional municipal operations and services
- Public safety and human health compromised
- Flood related damage to private and public property; business disruption
- Evacuation, relocation or homelessness
- Flood related damage to urban natural systems
- Increase in insurance costs and legal liability among municipalities



4 PRESENTATION NAME

John Nemeth, Program Manager, Transportation Division, Region of Peel

5 ASSESSING CLIMATE CHANGE RISK TO STORMWATER & WASTEWATER INFRASTRUCTURE: RECOMMENDATIONS & FOLLOW-UP

Marvin Ingebrigsten,

Technical Analyst, Engineering Division,
City of Welland

6 RESOURCES



- Credit Valley Conservation Authority Low Impact Development (LID) Guidance Documents
<http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/stormwater-management-lid-guidance-documents/>
- City of Welland Stormwater and Wastewater Infrastructure Assessment- Technical Report
<http://www.welland.ca/Eng/pdfs/TP111002WellandVol001Final.pdf>
- Pioneer Park Stormwater Management Rehabilitation
<http://www.cleanairpartnership.org/files/5%20Case%20Study.pdf>
- Adapting to Changing Flood Patterns in the City of Hamilton
<http://www.cleanairpartnership.org/files/Hamilton%20Final.pdf>
- Insurance Bureau of Canada: Municipal Risk Assessment Tool
http://www.ibc.ca/en/Natural_Disasters/Municipal_Risk_Assessment_Tool.asp

6 RESOURCES



- Peterborough Flood Reduction Programming
<http://www.cleanairpartnership.org/files/9%20Case%20Study.pdf>
- Survey of Municipal Policies and Administrative Approaches to Overcoming Institutional Barriers to Low Impact Development
http://www.creditvalleyca.ca/wp-content/uploads/2012/04/Muni_LID_Policy_withAppendix_Jan10.pdf
- Thunder Bay Cogeneration
<http://www.cleanairpartnership.org/files/8%20Case%20Study.pdf>
- Health, Prosperity and Sustainability: The case for Green Infrastructure in Ontario
http://www.greeninfrastructureontario.org/sites/greeninfrastructureontario.org/files/Health,%20Prosperity%20and%20Sustainability_The%20Case%20for%20Green%20Infrastructure%20in%20Ontario.pdf

COMMUNICATING AND COLLABORATING AROUND ADAPTATION, **APRIL 10TH**, 2pm

GUEST SPEAKER: DAVID PEARSON, LAURENTIAN UNIVERSITY

GUEST SPEAKER: GABRIELLA KALAPOS, CLEAN AIR PARTNERSHIP

Assessing Climate Change Risk to Stormwater & Wastewater Infrastructure Recommendations & Follow-up

Welland, Ontario

March 27, 2014

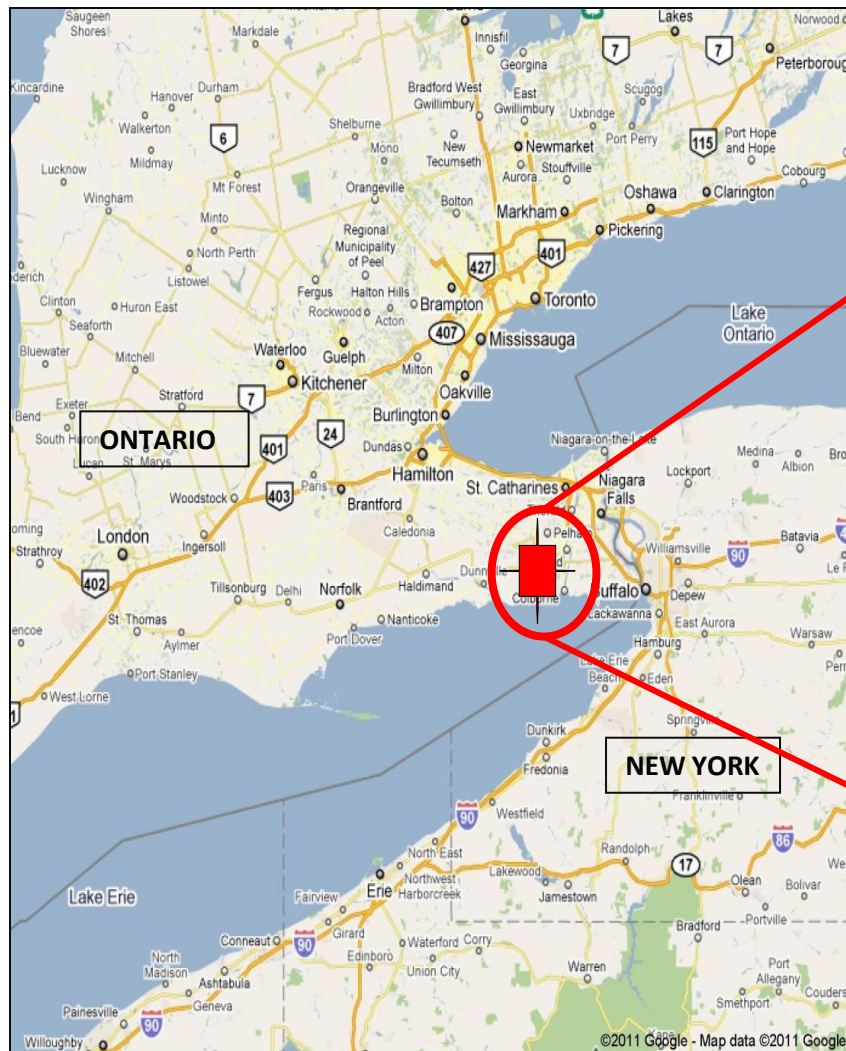
Great Lakes & St. Lawrence Cities Initiative



Marvin Ingebrigtsen (City of Welland)

Presentation Overview

1. Location
2. Acknowledgements, Project Partners & Funding
3. Study Objectives & Purpose
4. Study Area
5. Recommendations Categories & Classifications
6. Recommendations Follow-up
7. Next Steps



City of Welland
Urban Boundary
(approximate)



Acknowledgments & Project Partners



Co- Authors:

Ron Scheckenberger AMEC Environment and Infrastructure (Burlington, ON)

Peter Nimmrichter, AMEC (Mississauga, ON)

Ben Harding, AMEC (Boulder, CO)

Project Partners



Niagara Water Strategy



MINISTRY OF THE
ENVIRONMENT



Environment
Canada

Environnement
Canada

Great Lakes & St. Lawrence Cities Initiative
Alliance des villes des Grands Lacs et du Saint-Laurent



Project Funding

- \$120,000 total project funding
- Engineers Canada (CCPE) - \$40,000
- Ministry of Environment (MOE) - \$30,000
- WaterSmart Niagara - \$50,000



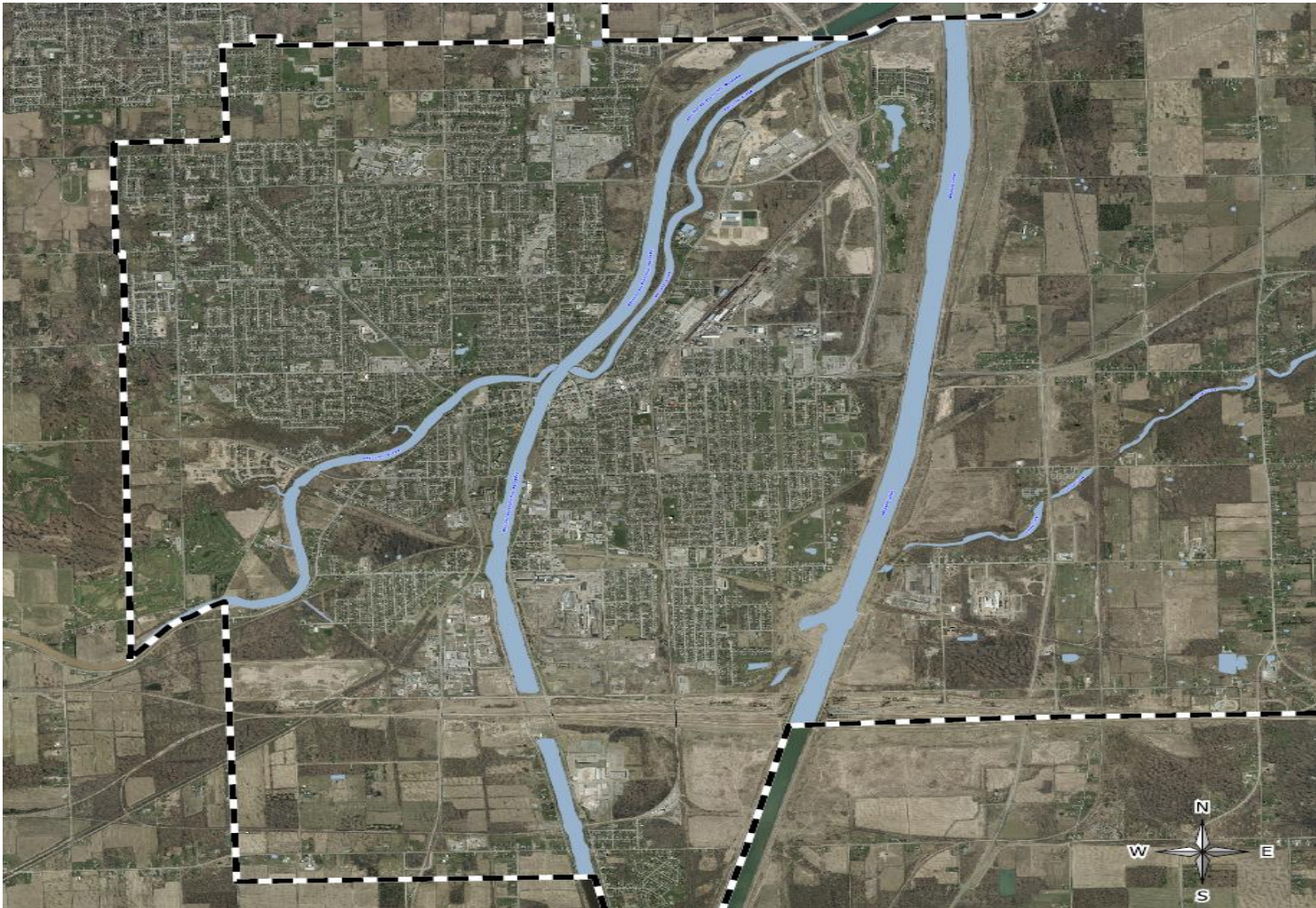
Study Objectives & Purpose

- Welland's storm and wastewater (combined) system selected as a case study to add to Engineers Canada's National data base.
- Additional investigation of updating Welland's Intensity – Duration – Frequency (IDF) Information for Rainfall.
- Climate change to be considered when replacing/constructing new assets.

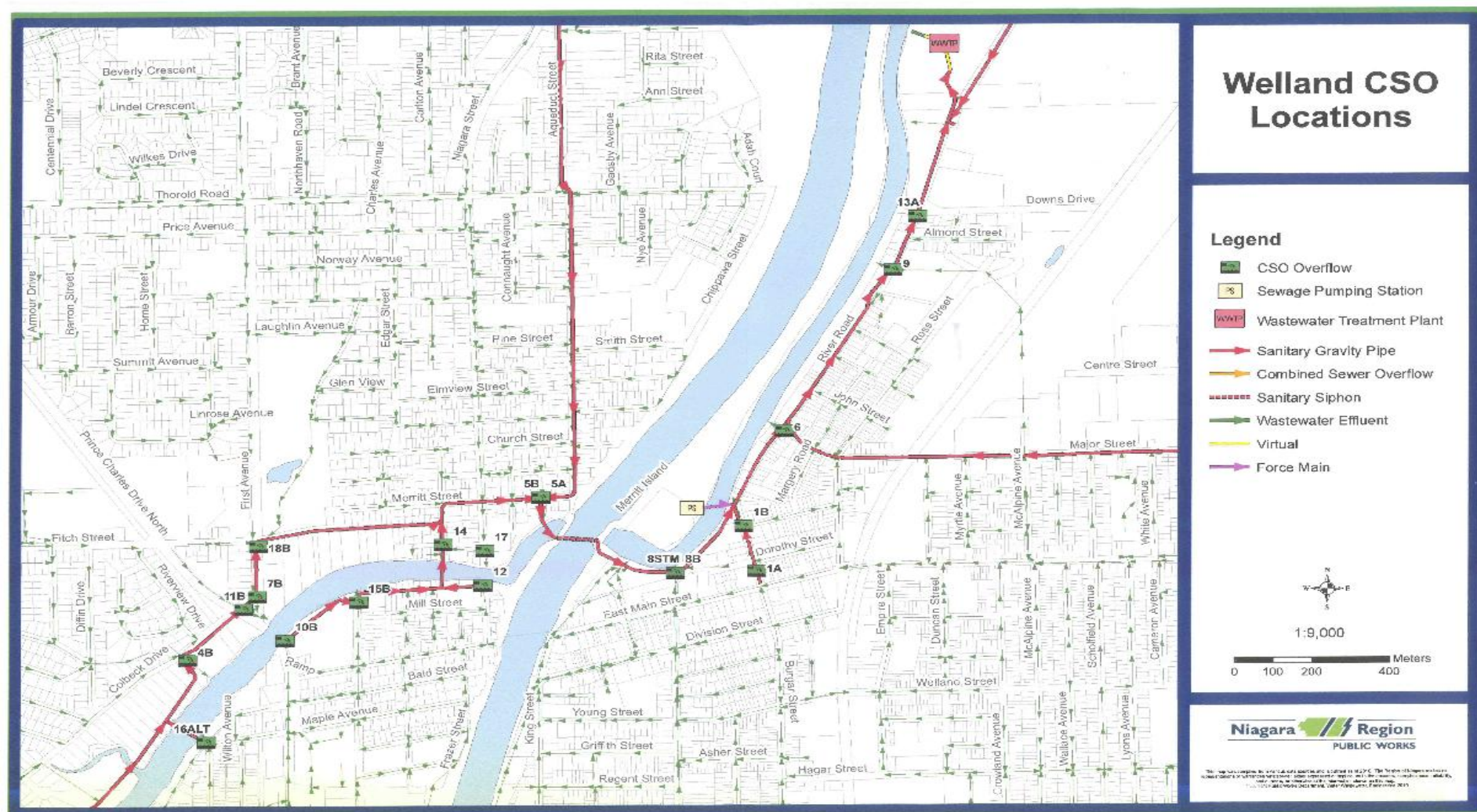
Unique Items

1. Welland's geographical location, situated between 2 Great Lakes
2. Location near the westerly end of Lake Erie, impacted by prevailing west winds
3. Very flat topography, average 2% land slope (sewers very flat grade)
4. Bisected by 2 canals (shipping & recreational) and the Welland River
5. Welland has siphons for Welland River & sanitary sewer

Bisected By Canals & River



Siphons



Categories

1. 44 Recommendations
2. Remedial engineering or operations action required (***Adjust sewer design standard***)
3. Management action required, (***More infrastructure funding***)
4. Additional study or data required (***what IDF curve to use?***)
5. No further action required



Recommendation Classifications

Action Classifications	# of recommendations
Additional Study as a prerequisite for Management Action	1
Additional Study as a prerequisite for Management and/or Operational Action	6
Additional Study as a prerequisite for Remedial Action	2
Additional Study as a prerequisite for Remedial Action and/or Management Action	21
Management Action	12
Management and/or Operational Action	2

Recommendation Cost Range	# of recommendations
< \$ 100,000	33
\$ 100,000 to \$ 500,000	11
\$ 500,000 +	0

Implementation Time Frame	# of recommendations
ASAP (Now)	12
Short (1-5 yrs)	13
Medium (10 yrs)	19

Recommended Action by	# of recommendations
City	12
Region	8
City & Region	24

Recommendations Follow-Up

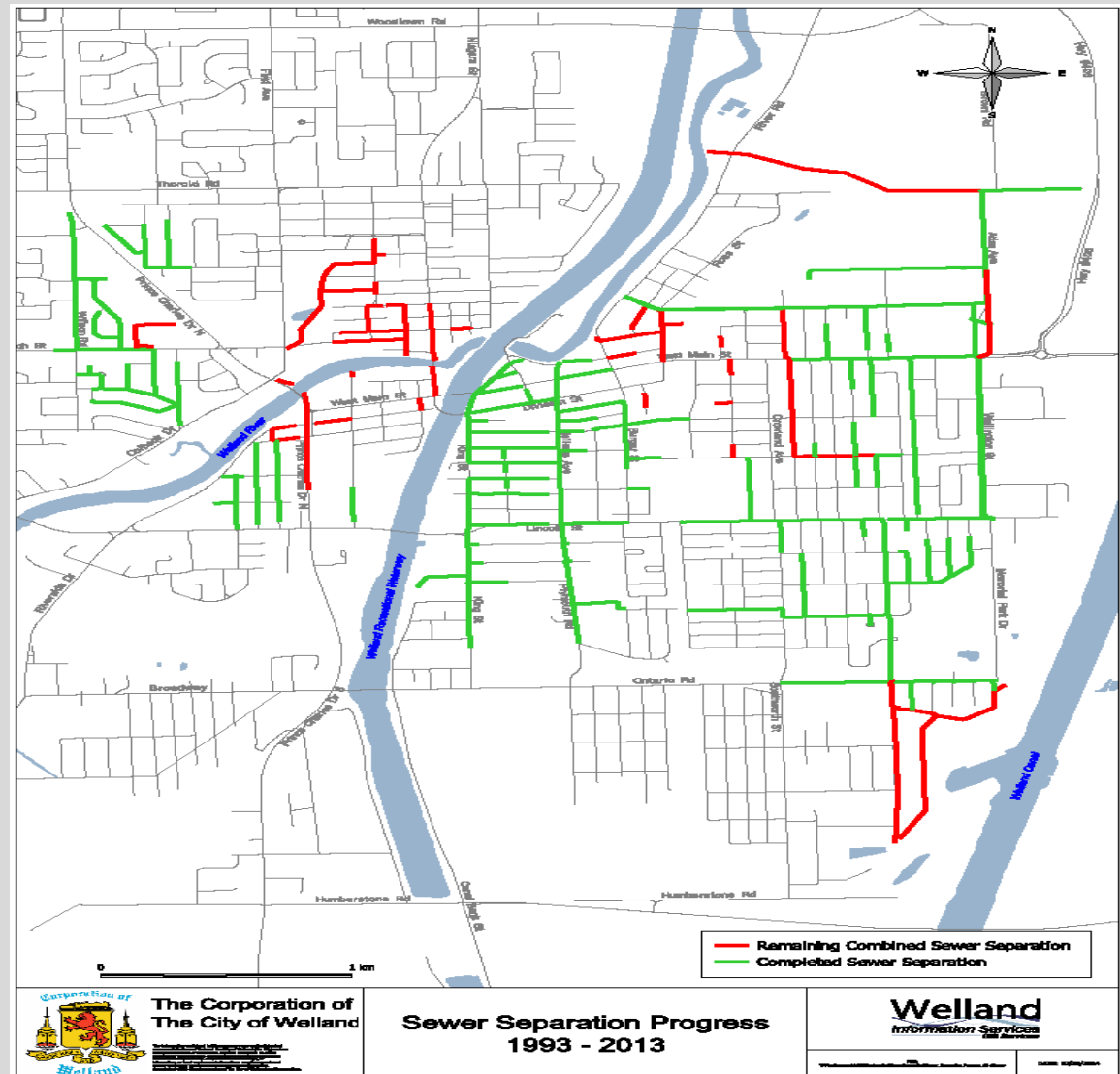
1. Combined sewer separation
2. I/I Studies
3. Update current 1963 IDF curve
4. Cost/benefit analysis of increasing storm design standard
5. Constructing City wide sanitary sewer model & PCP update
6. Inventory of SWM facilities and oil/grit separators

Combined Sewer Separation

- MOE Regulation F-5-5 (90% capture of WWF) & eventually F-5-1 (100% capture)
- Environmental impacts to Welland River & Niagara River, 472,600 m³ of CSO (190 swimming pools), TSS (170,121 kg, 6,300 bags of cement)
- Annual Treatment costs, \$3.2M (\$0.79/m³) to treat WWF in 2012
- \$17M spent to date by City/Region (50/50 cost sharing)
- \$10M remaining to complete separation

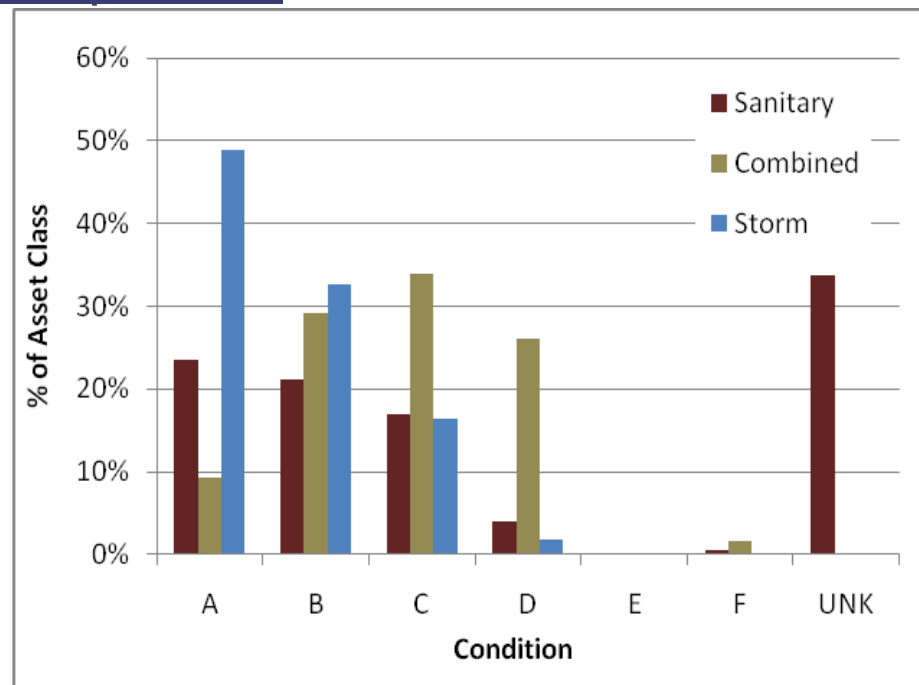
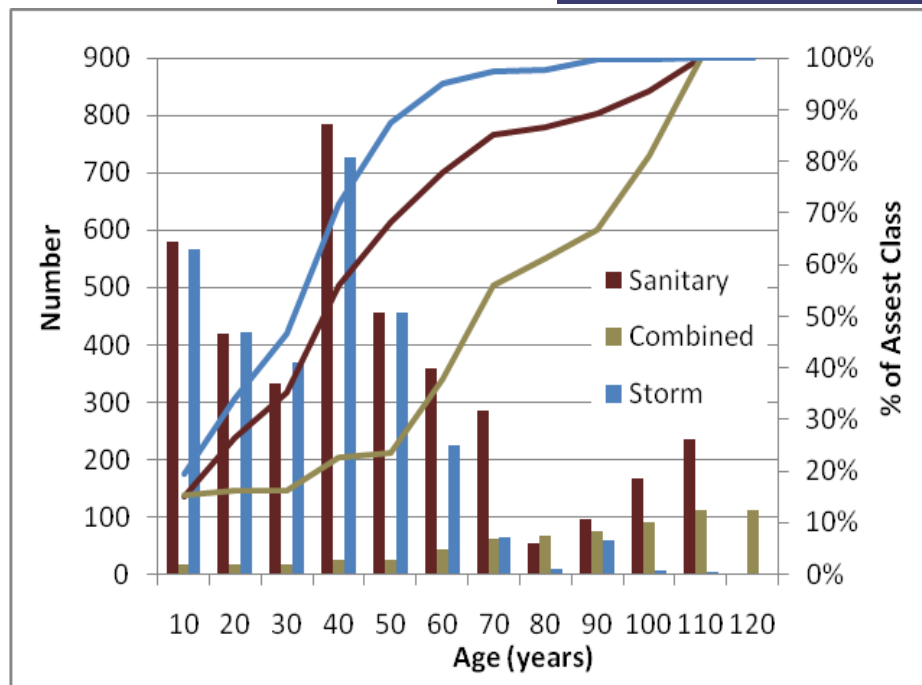
Recommendations Follow-Up

Combined Sewer Separation



Recommendations Follow-Up

Combined Sewer Separation



Infrastructure by Age

Rating	Description
A	Newly installed or like new
B	First signs of aging
C	Moderate aging/ deterioration
D	Asset functioning with deterioration
F	Loss of function imminent
UNK	Unknown

Infrastructure by Condition

Useful Life Remaining
>64%
≥ 45% and ≤ 64%
≥ 29% and ≤ 44%
≥ 18% and ≤ 28%
< 18%

Combined Sewer Separation

Descriptor	Storm	Sanitary/Combined
# of Pipes	1,717 (laterals) 2,906 (mains)	17,161 (laterals) 3,789 (mains)
Total Length	186 km	268 km
Maximum Size	3,000 mm	2,700 mm
Minimum Size	150 mm	125 mm
Average Age of Pipes	30 years	42 years (sanitary) 66 years (combined)
Oldest Pipes	106 years	111 years (sanitary) 110 years (combined)

I/I (Inflow & Infiltration Studies)

- Annual sewer flow monitoring, 20 to 25 locations, flags key areas. Follow up with site specific studies (\$250,000 annually)
- Annual CCTV inspection program, initiated 5 year cycle (\$100,000)
- Annual downspout inspection/disconnection program (\$5,000)
- Initiated annual sewer lining contract (\$300,000)



Combined Sewer Separation & I/I

Sewage/Water Consumption Per Year in Relation to Ontario Rd. RG





Recommendations Follow-Up



Update Current 1963 IDF Curve



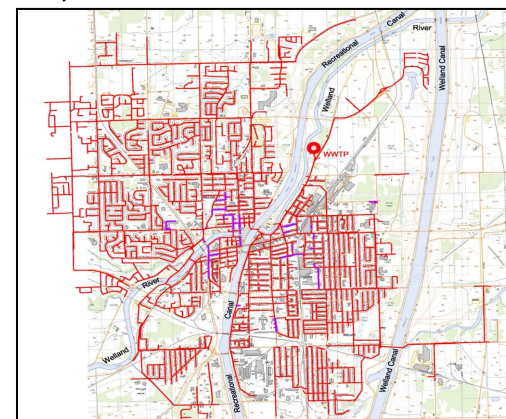
Recommendations Follow-Up



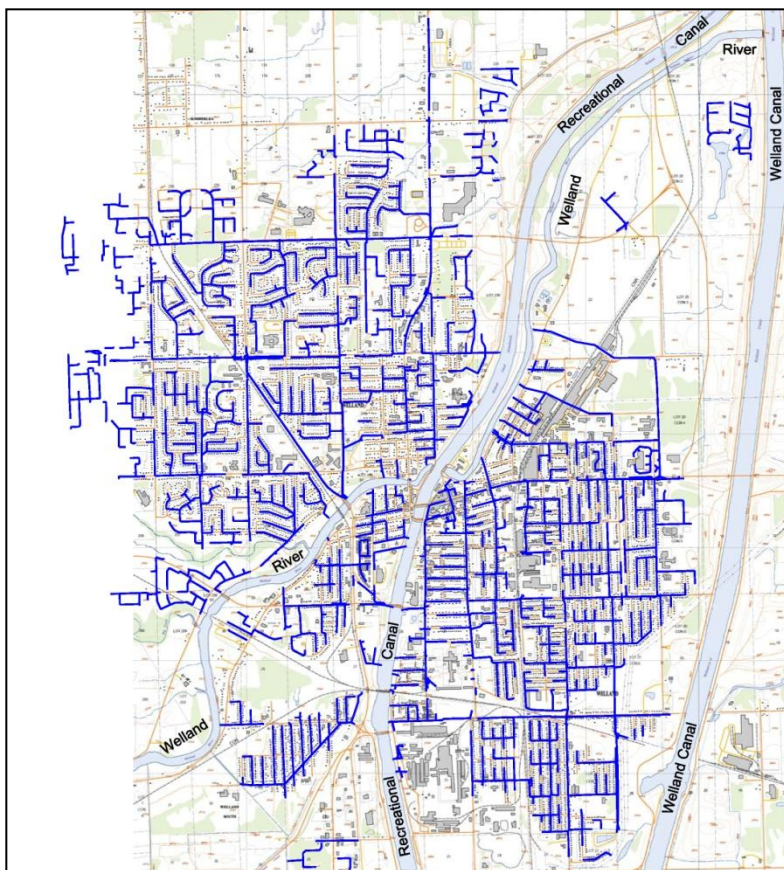
Cost/Benefit Analysis of Storm Design Standard

Constructing City Wide Sanitary Sewer Model & PCP Update

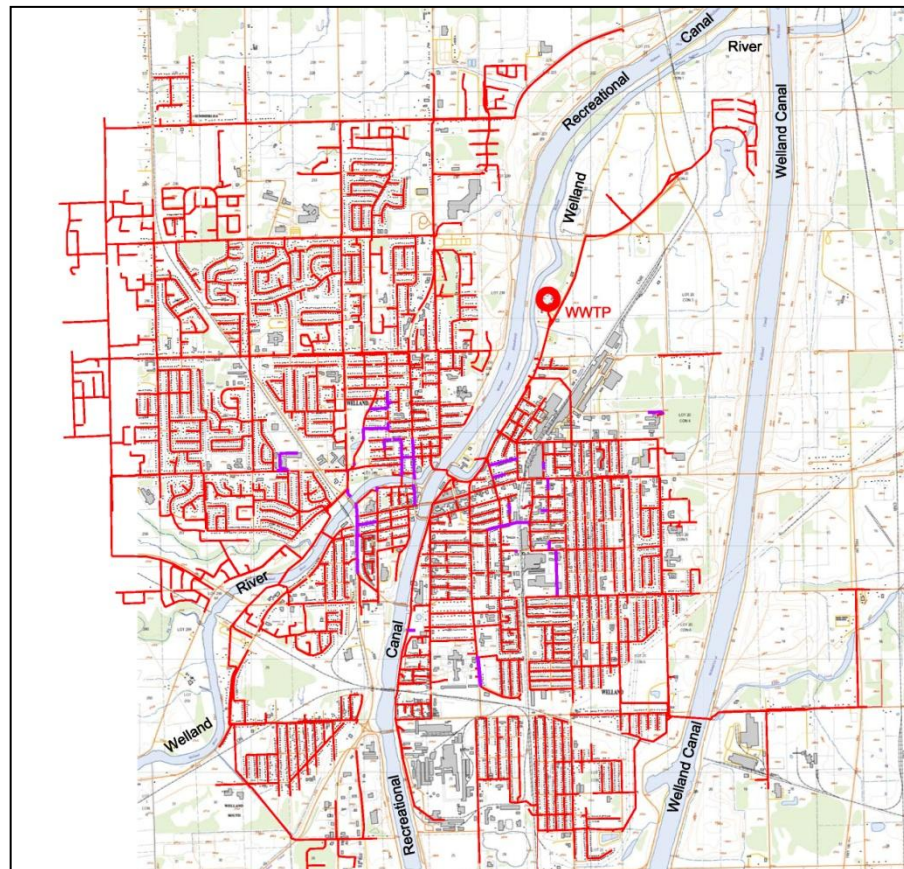
- 50/50 cost sharing project with Region of Niagara, \$300,000 estimated cost
- Model to be used to quantify impact of individual sewer separation projects & prioritize future works
- Phase 1 of field data collection nearing completion, Phase 2 to begin late spring
- Targeting model completion by spring 2015
- PCP update target date summer 2015



Constructing City Wide Sanitary Sewer Model & PCP Update



Stormwater Collection System



Wastewater / Combined Collection and Treatment System



Recommendation Follow-Up



Inventory of SWM Facilities & Oil/Grit Separators

1. Staff preparing inventory of SWM facilities, assumed/unassumed, sediment levels. Prepare maintenance program.
2. Staff preparing inventory of oil/grit separators, private/public. Prepare maintenance program.



Next Steps

- Complete current follow-up projects
- Assess existing SWM facilities and oil/grit separators against the updated IDF curve
- Prepare City wide Asset Management Plan, key focus of linear infrastructure spending being sewer separation & I/I reduction
- Review recommendations in a 5 to 10 yr timeframe in light of new climate change information.

Thank You – Questions?

Contact Info:

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*An Opportunity for
Leadership, Innovation, and Partnership*

***Stormwater Management
and Low Impact
Development***

March 27, 2014
Clean Air Partnership

John Nemeth, CET
Program Manager, Business Strategies
Infrastructure Planning and Studies
Transportation Division, Public Works Department
Region of Peel

Term of Council Priority No. 4 - What is it?

- The Region's Strategic Plan and Term of Council Priorities has elevated the importance of stormwater management at a Regional level geared to reduce citizens' risks for flooding and to plan for stormwater management in an effort to address broader environmental impacts.
- Staff will develop a stormwater management framework with Area Municipalities and Conservation Authorities.



Why Manage Stormwater?

“The ultimate goal of stormwater management is to maintain the health of streams, lakes and aquatic life as well as provide opportunities for human uses of water by mitigating the effects of urban development. To achieve this goal stormwater management strives to maintain the natural hydrologic cycle, prevent an increased risk of flooding, prevent undesirable stream erosion, and protect water quality”

Source – Province of Ontario



Municipal Interest

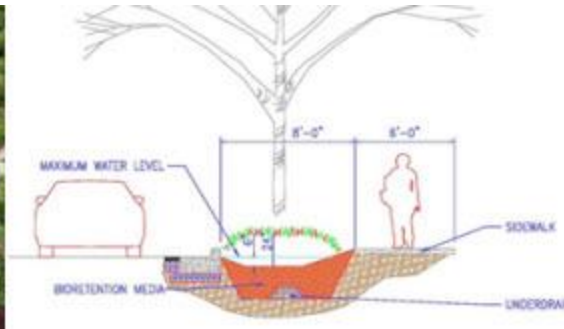
Stormwater is considered in three distinct areas of municipal interest;

1. through the planning and land development processes;
2. through capital programs delivering engineering projects of the municipality e.g. roads, erosion, facility design, etc;
3. operations and maintenance programs and practices.



Stormwater Infrastructure

- Stormwater management infrastructure is generally identified by the local area municipalities through the preparation of Master Environmental Servicing Plans, prepared in support of secondary plans, and constructed through the land development process.
- The Region of Peel identifies new Regional road storm water requirements through the preparation of Environmental Assessment process (EA's) as each road project is being designed.



Green Infrastructure

Green infrastructure:

means natural and human-made elements that provide ecological and hydrological functions and processes. *Green infrastructure* can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.



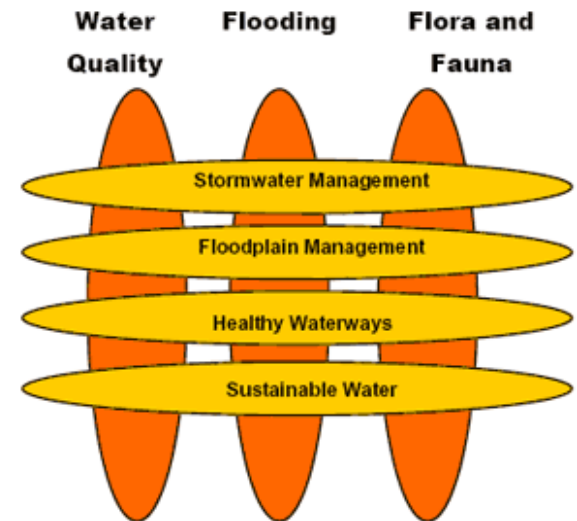
Areas of SWM Delivery

Area of Interest	Process	Examples
Policy	Principles and Guidance	Official Plans Secondary plans
Development	Planning and Land Development	Master Environmental Serving Plans, Plans of Subdivision, Site Plans, Subdivision Agreements, etc.
Capital Programming	Environmental Assessments Infrastructure construction	Engineering projects of the municipality i.e. roads, erosion, facility design, etc,
Operations and Maintenance	Owner/ Operator	Operating programs delivering operations, maintenance and monitoring programs and practices

Key Theme Areas of Work

The following key theme areas of work have been identified:

1. Development of Watershed Management Principles/Policies
2. Flooding Preparedness and Response
3. SWM Quantity and Quality management for Regional Infrastructure
4. Development of Common Standards, Criteria, Guidelines, Levels of Service and Standard Operating Procedures
5. Sustainable Funding Program
6. Communications, Outreach and Education
7. Monitoring - Data Collection and Enhancement
8. Studies, Communications and Emergency Services
9. Governance



Stormwater at Peel Today

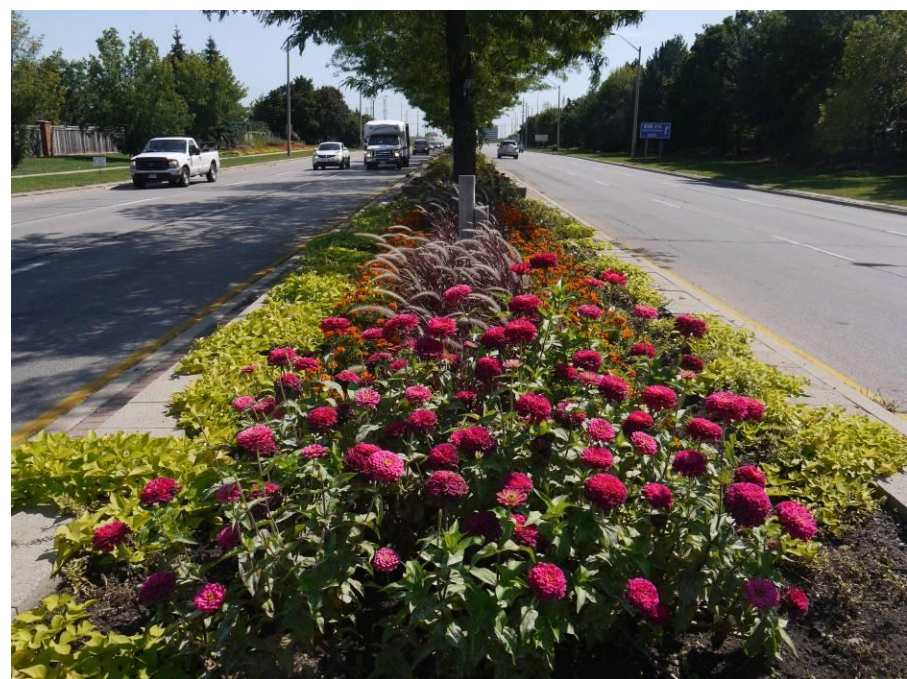
Transportation

- SWM Infrastructure Asset Management
- Strategic Planning of Storm System (Water Quantity and Quality)
- Regulatory Obligations and Liability
- Design Standards and Criteria
- Establishing Levels of Service
- Standard Operating Procedure
- Operations and Maintenance
- Monitoring
- Watershed Protection
- Flood Protection
- Partnerships
- Projects
- Sustainable funding
- Technical Support to other Departments and Divisions





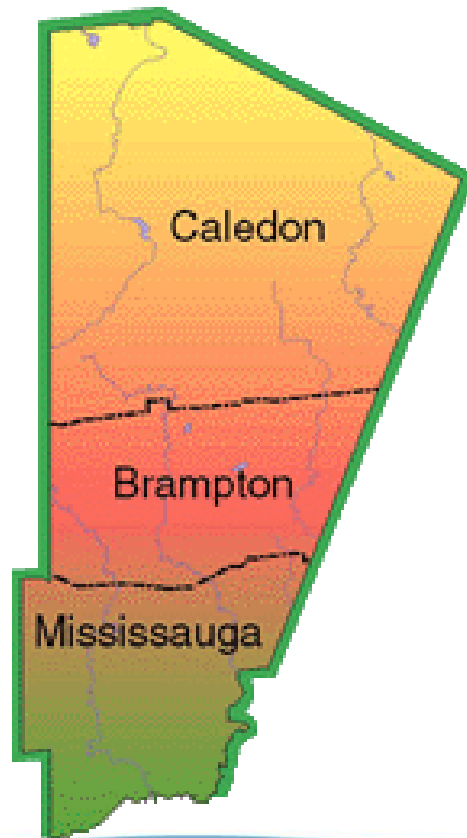
**City of Mississauga
Duke of York Boulevard**



**City of Brampton
Hurontario Street**

Mississauga Road LID Project

Reconstruction and expansion of road surface



Basic LID Functional Benefits

- LID's function effectively to capture the first 1.5 to 2 inches of rainfall runoff, which is 75 to 95 percent of the rainfall events in most locations.
- Urbanized and urbanizing watersheds can experience localized flooding during these rainfall events due to the amount of impervious surface that accompanies development.
- LID captures this runoff and retains it on site, rather than allowing it to flow downstream into streets or nearby properties.

Project Objectives

- 1. Aesthetics & Maintenance** - The median landscape must meet a high aesthetic standard while requiring minimal to no long term irrigation and maintenance. Irrigation with potable region of Peel water is not an option.
- 2. Water Conservation** - Uses stormwater to the greatest extent possible to sustain the vegetation in the median (ie. underground storage tanks with pumps or gravity fed irrigation).
- 3. Water Quality** - Provide level 1 treatment or better (80% removal of TSS). Assume a water quality volume of 25 mm. Mitigate impacts to Red Side Dace including temperature mitigation.
- 4. Water Balance/Erosion** - Maintain pre-development to post-development water balance to the greatest extent possible. Infiltrate or reuse a minimum of 5 mm.
- 5. Flooding** - Match pre-development to post-development peak flows to the greatest extent possible.



Site Reconnaissance

Existing Conditions: Filter Fabric and Mulch



Site Reconnaissance

Existing Conditions: Without mulch and filter fabric



[illegible]

Median 1



Median 2



Median 3



- ~30 m long
- Both sides drain away
- No catchbasins

Median 4



- ~70 m long
- Both sides drain away, nearly flat
- Does include catchbasins on both sides

Thank you !

