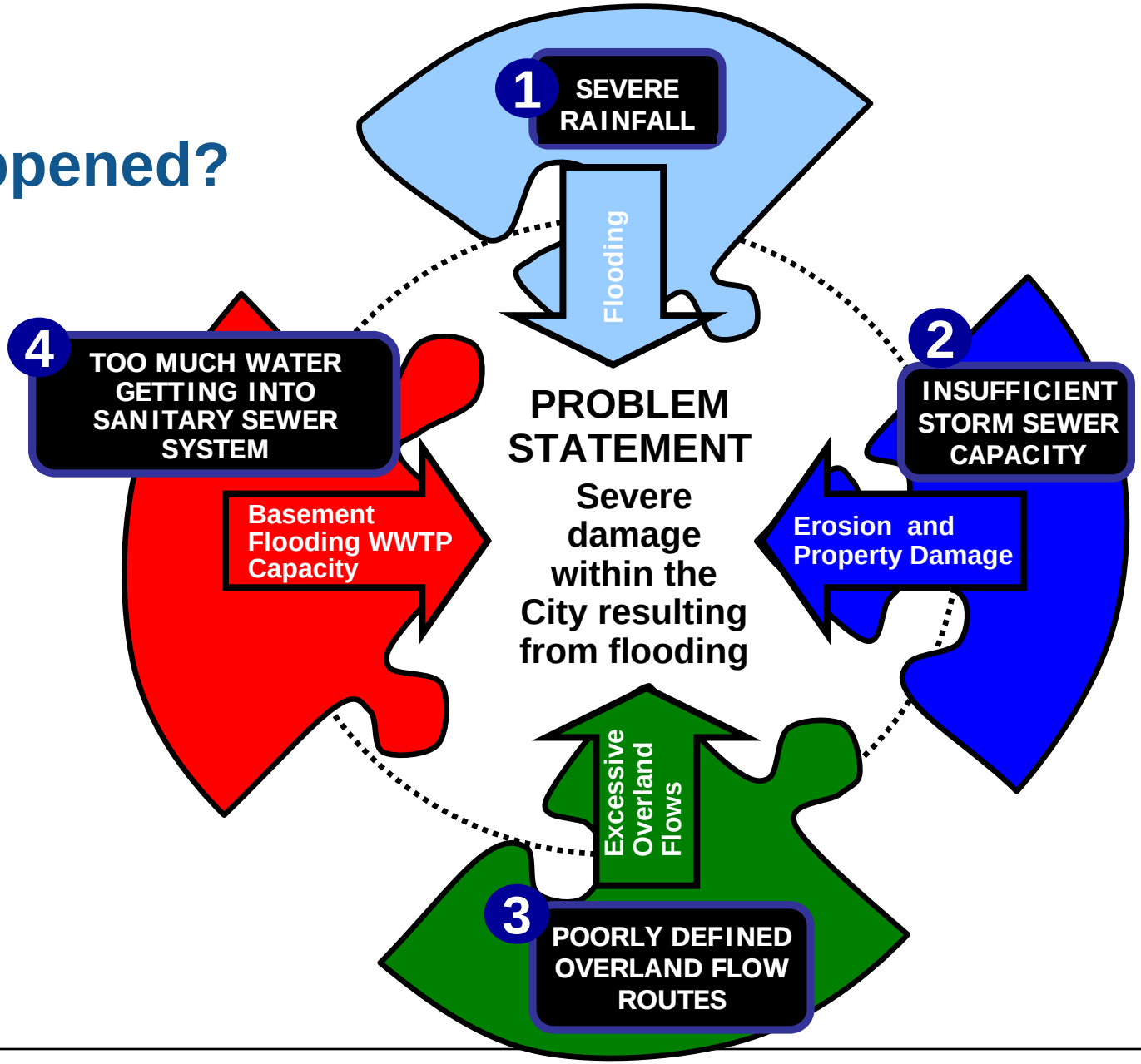
The Peterborough Flood

A Case Study in Urban Flood Damage Mitigation Strategies

Presentation Overview

- Flood Reduction Master Plan (FRMP)
- Detailed Study Results
- Observations

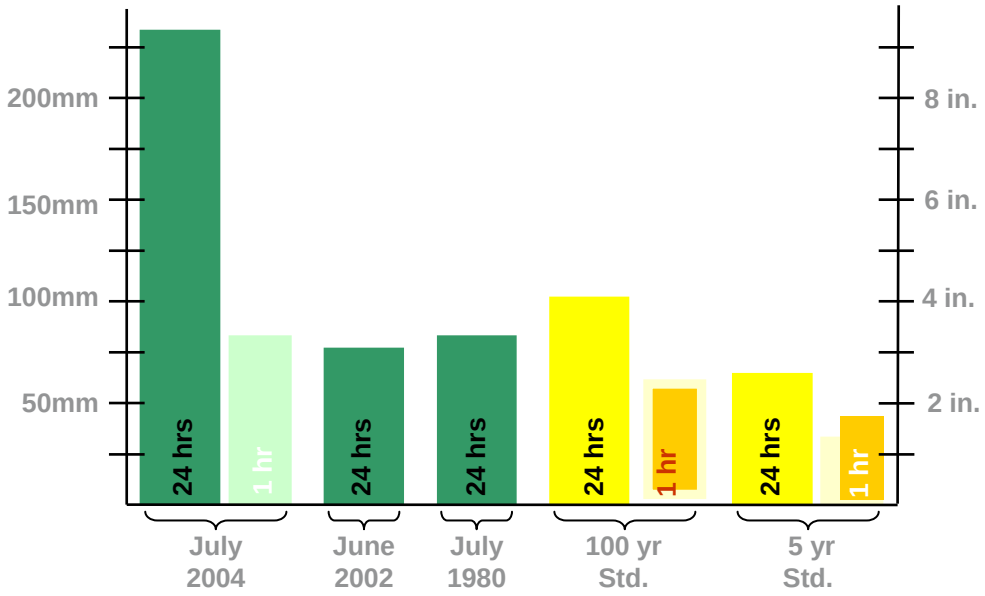
FRMP
What Happened?



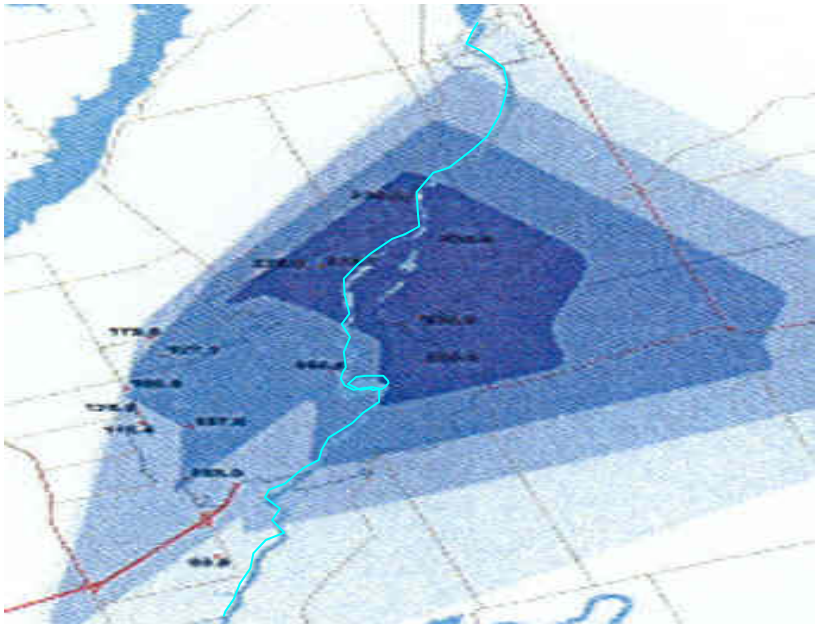
FRMP - What Happened?

Extreme Rainfall

July 15, 2004



Location



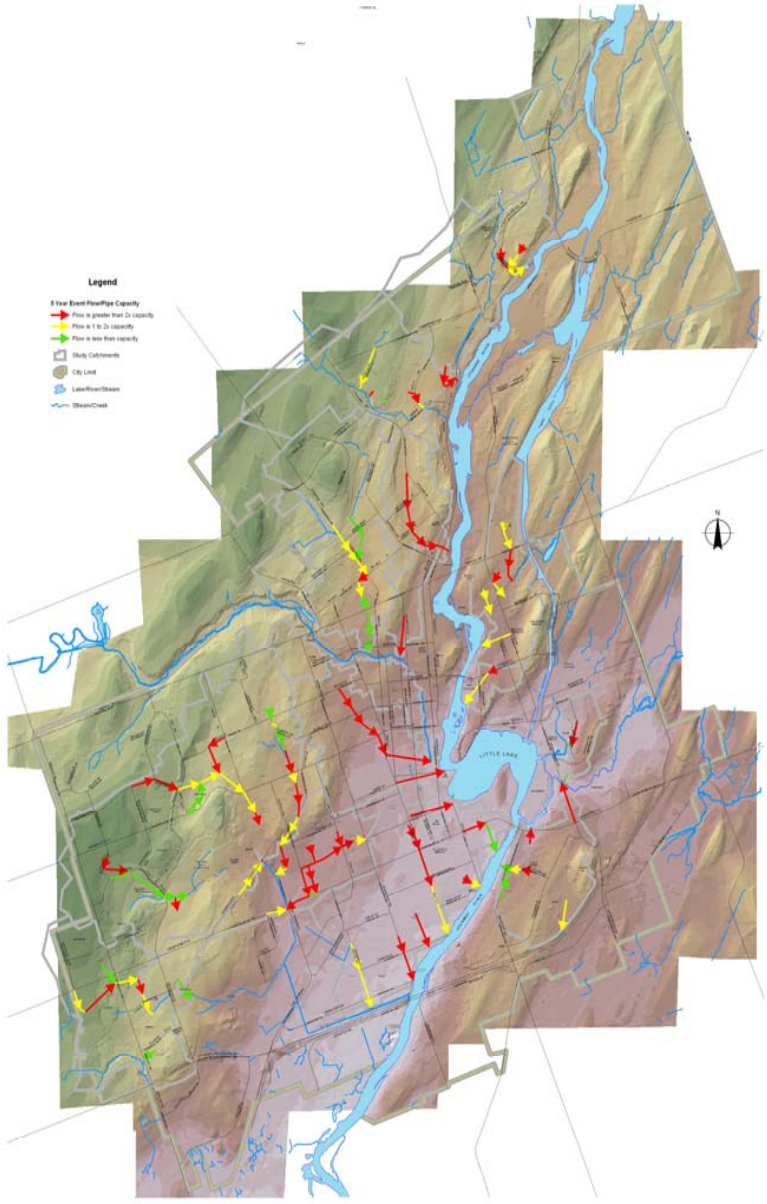
Map Source: County of Peterborough

- 200mm or more
- 150 – 199mm
- 100 – 149mm
- 99mm or less

Insufficient Storm Sewer Capacity

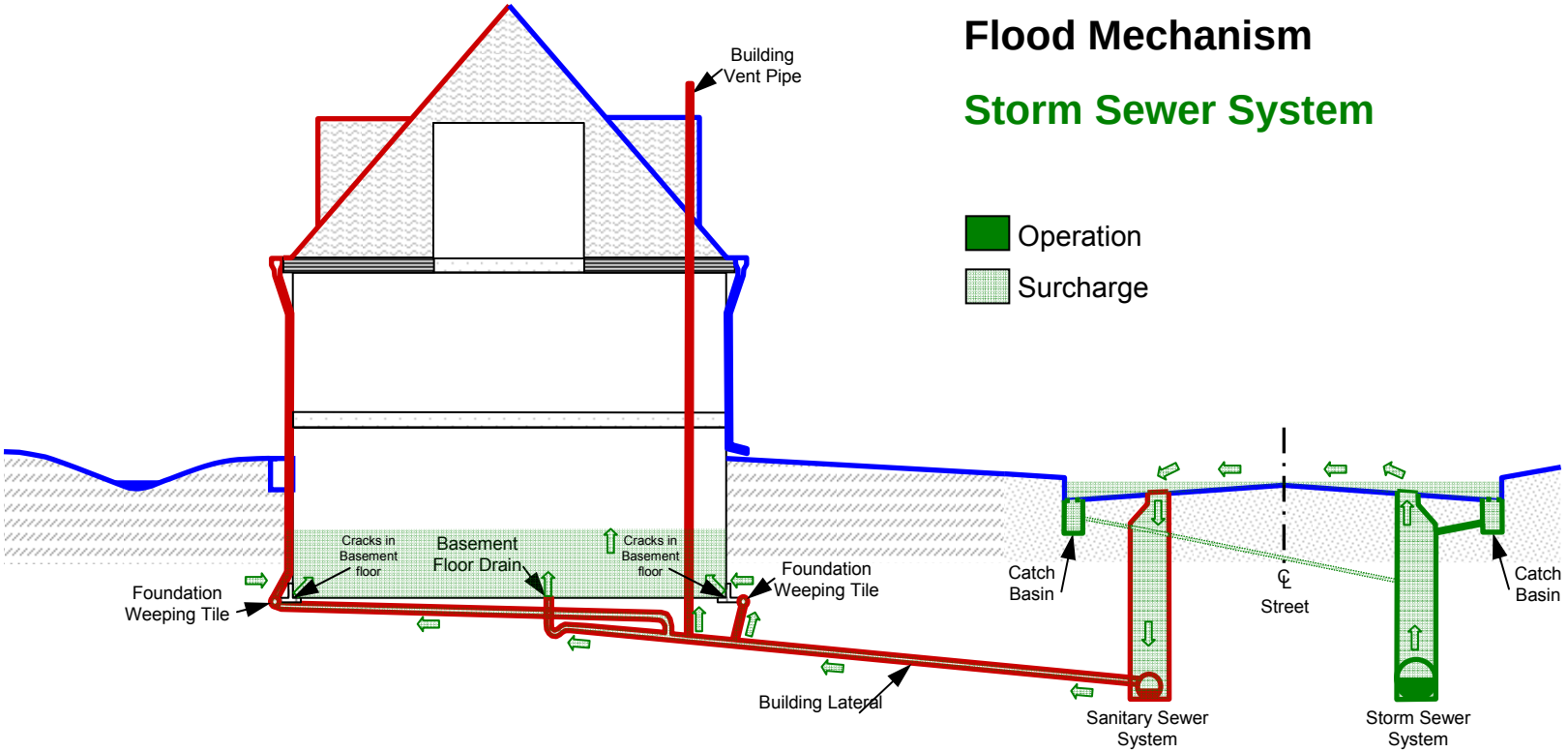
- Infill
- Aging pipes
- Older design standards
- Blocked catchbasins

- 80% of the City's storm trunk sewers pre-date current 5-year design standards



Flood Mechanism

Storm Sewer System

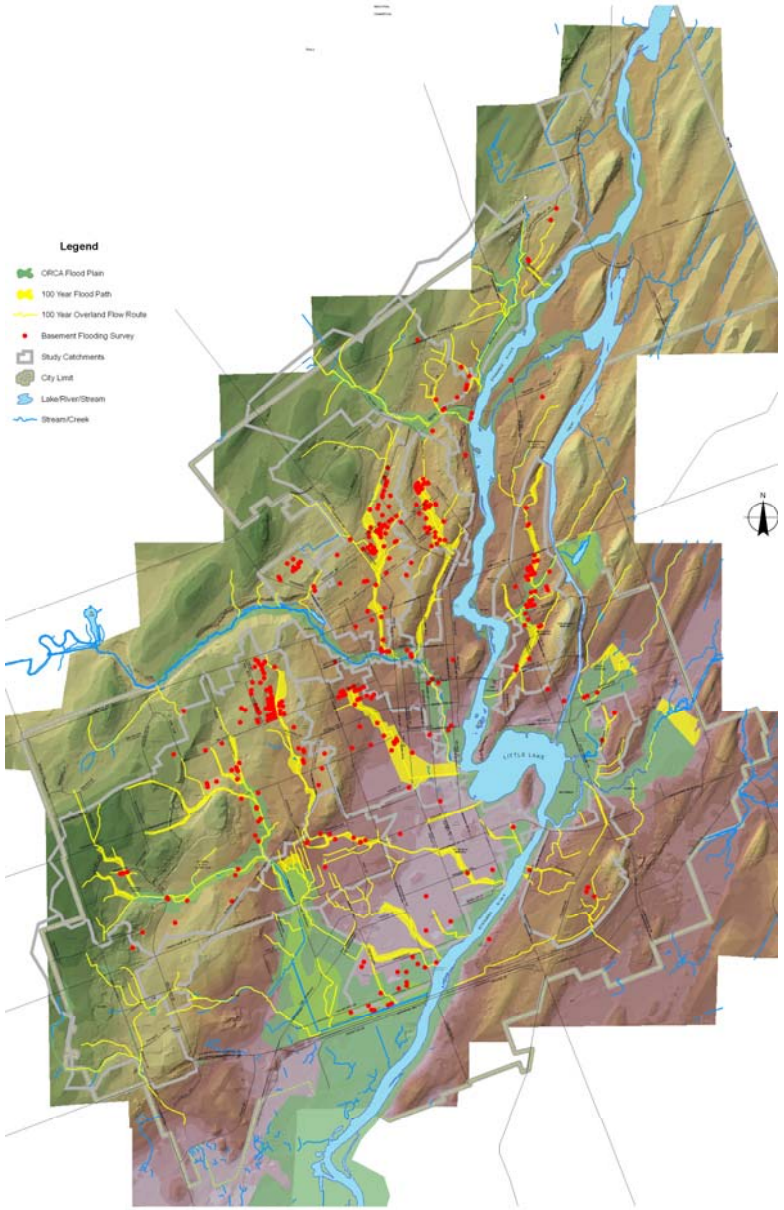


FRMP - Analysis Results

Poorly Defined Overland Flow Routes

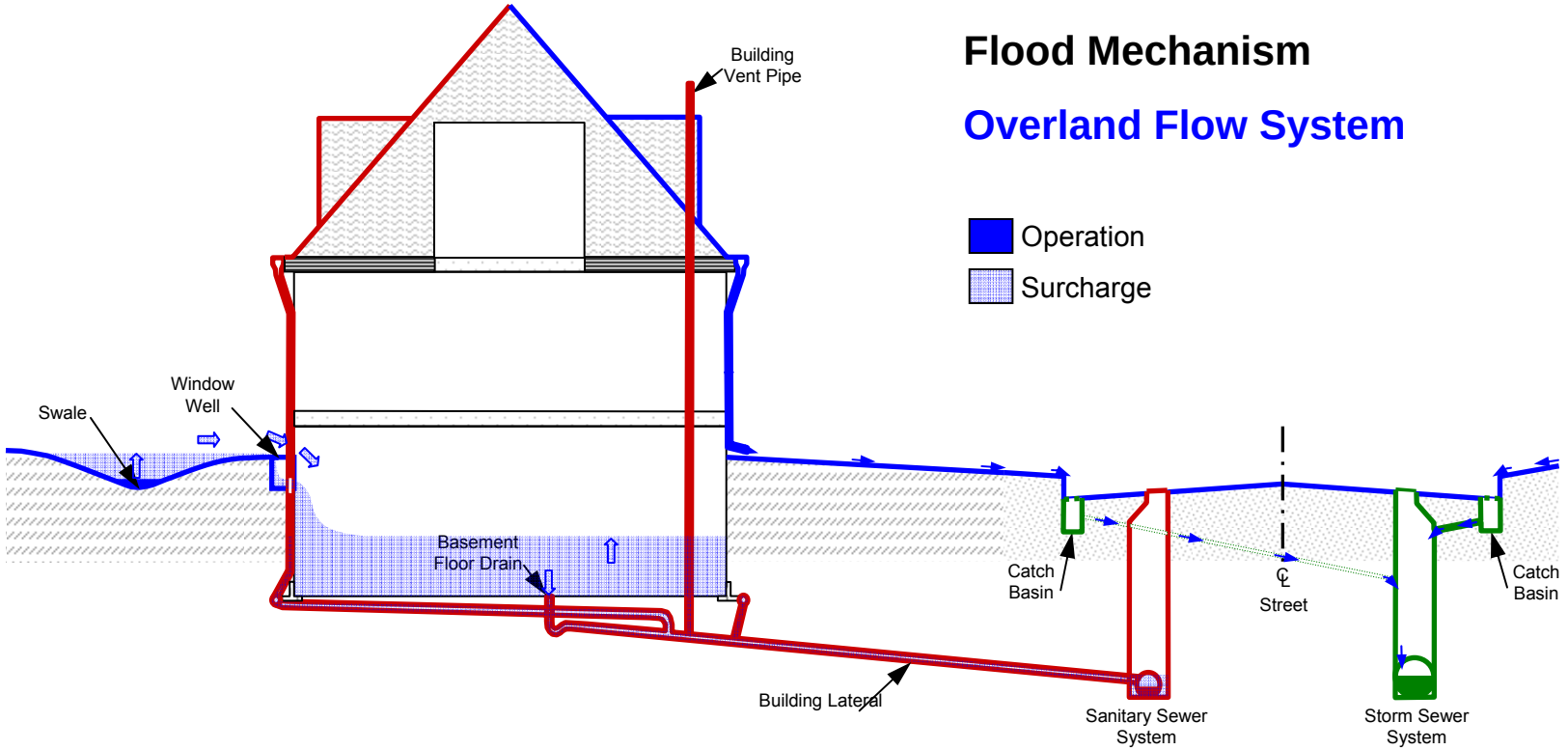
- Drumlins
- Infill development
- Streams diverted
- Wetlands filled in
- Gradual erosion of natural drainage features

225 properties in the City are vulnerable to overland flow damage from a 100-year storm event – more detailed studies - OMD



Flood Mechanism

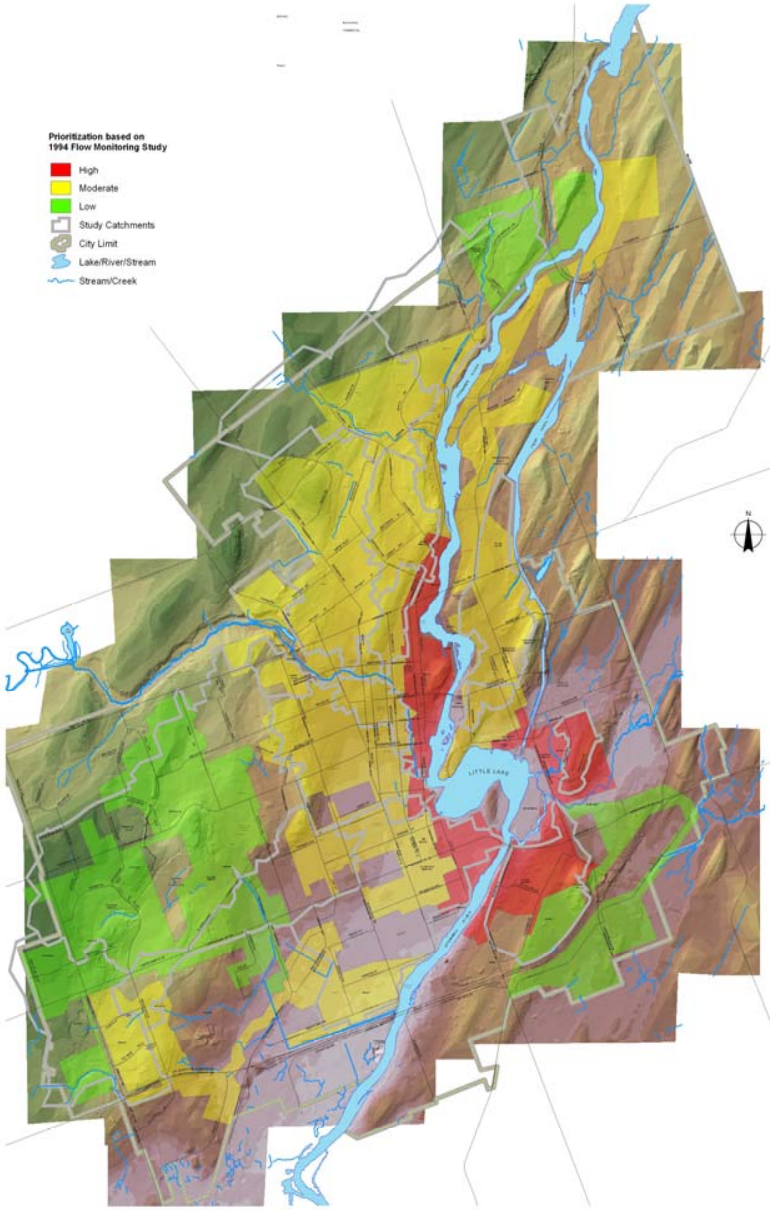
Overland Flow System



FRMP - Analysis Results

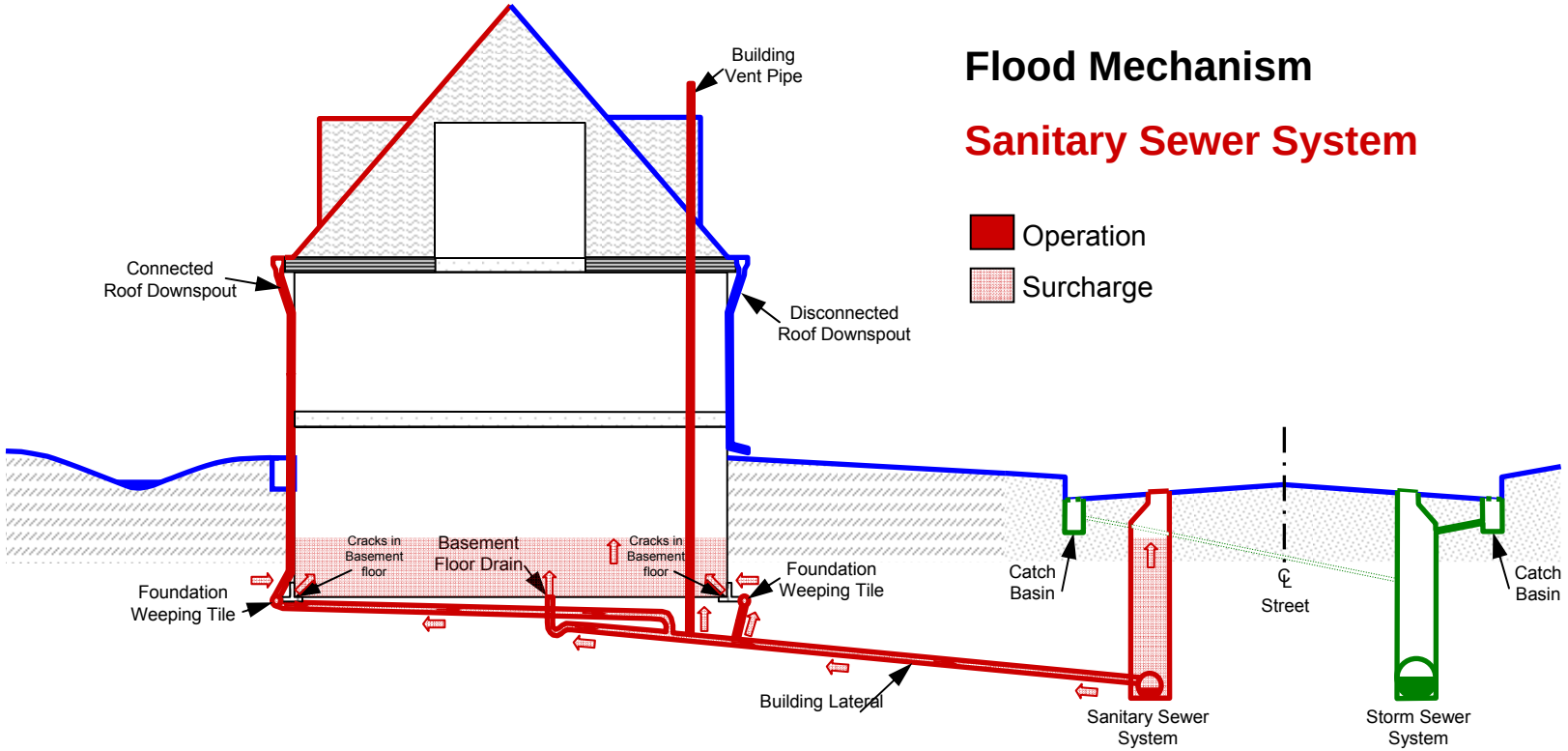
Too Much Water Entering the Sanitary Sewers

- Foundation drains
- Aging pipes
- Illegal connections/downspouts
- Cross connections
- High groundwater table and poor soil drainage
- Annual average flows 2 X the water usage rate
- Wet weather flows up to 6 X of water usage during rain/melt events

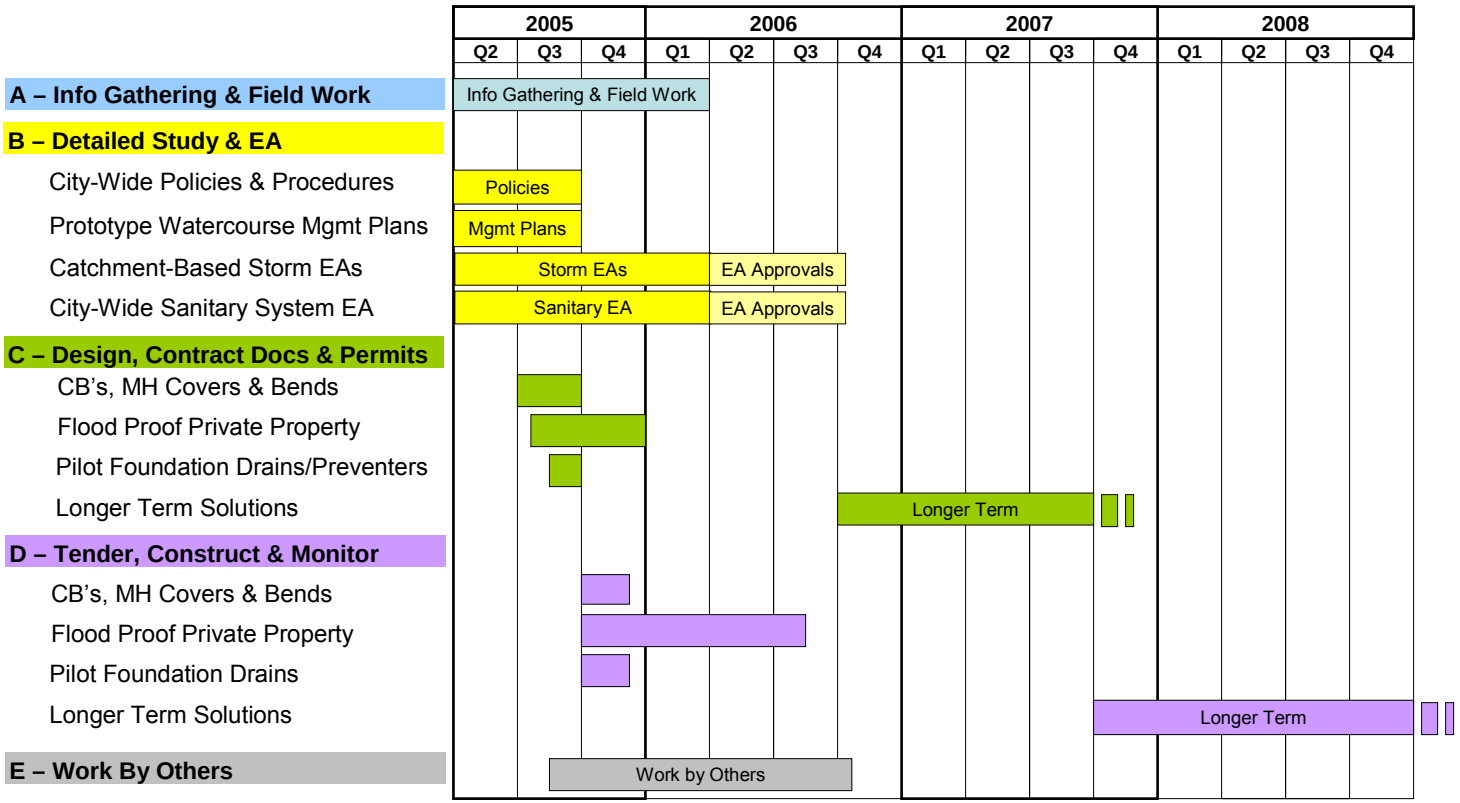


Flood Mechanism

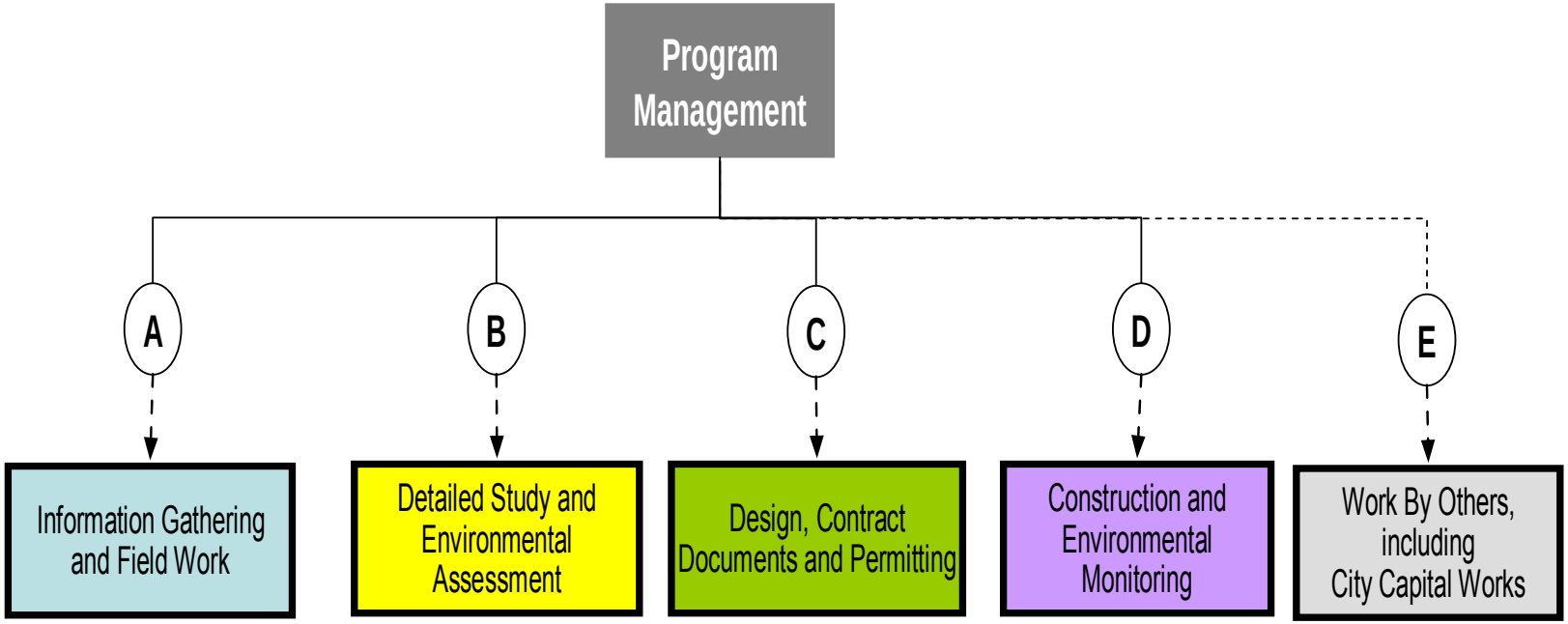
Sanitary Sewer System



Flood Reduction Master Plan



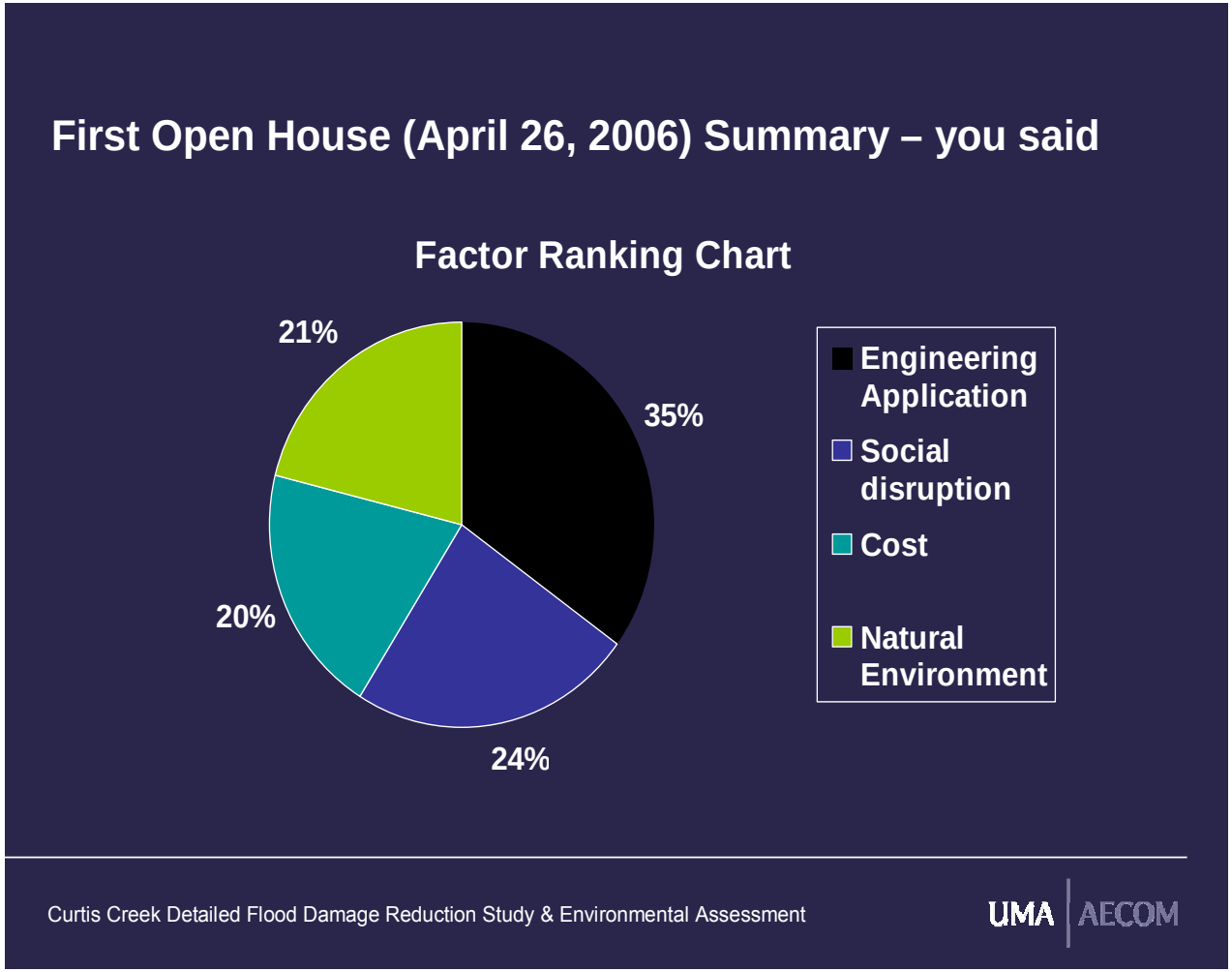
Recommended Action Plan



Detailed Study

- Use of Public Input to set Priorities
- Technological Challenges
- Study Recommendations

Public Priorities



Technological Challenges

- **Utilization of RADAR data;** King City vrs Franktown up to 50% variance.
- **Perceived limitations in available private property flood proofing measures, ? Renovations ?**
- **Uncertainties in rainfall runoff low and high flow model verification, calibrate < 2, use > 100?**
- **Impact of infill development on runoff & flood potential, =** increased flood potential,
- **Impact / attenuation of private property grading on runoff,** topographic kettle volumes exceeded 100 year runoff.
- **Potential shortcomings in current infrastructure practices /assumptions,** sanitary manhole in roadways = surcharging

Study Recommendations

Table ES~1, Alternative Evaluation

Alternative	Engineering Feasibility	Social Disruption	Cost	Natural Environment	Damage Reduction
Maximum Pond & upsized Culverts	Limited, (regulatory concerns)	Short term disruption	$14 million	Short term High Impact	$3.3 Million
Upgrade Creek Culverts only	Good	Short term disruption	$5 Million	Short term Moderate impact	$3.3 Million
Upgrade Creek Culverts & 1:100 year sewers	Good	High Social Disruption	$8.4 Million	High Impact	$6.3 Million
Upgrade Creek Culverts & selected sewer upgrades sewers	**High**	**Short term disruption**	**$6.4 Million**	**Moderate Impact**	**$6.5 Million**
Flood Proofing	Limited, (maintenance problematic)	Long Term disruption	$1 Million	Minimal Impact	$6.5 Million
Property Acquisition	Not Applicable	High Social Disruption	$16.2 Million	Extensive Impact	$6.5 Million


Construction Upgrade 2
Cost: $0.23 Million
Benefit/Cost: MED
Two Box Culverts:
2.4m x 1.2m
Two Conspan Arch
Culvets: 7.32m x 2.13m
Curtis Creek
Two Box Culverts:
2.4m x 1.5m
Two Box Culverts:
2.4m x 1.2m
Construction Upgrade 3
Cost: $0.16 Million
Benefit/Cost: HIGH
WOODBINE
EUCLID AVE
CADDY ST
WELSH
WATTS AVE
DUFFERIN
ROSS ST
ELGIN
HAZLITT
OXFORD ST
BEVERLY ST
McFARLANE
SIMMONS AVE
CARLISLE AVE
CLIFTON ST
MUNROE AVE
STANLEY AVE
SUTHERLAND PL
DOURO ST

General Implications

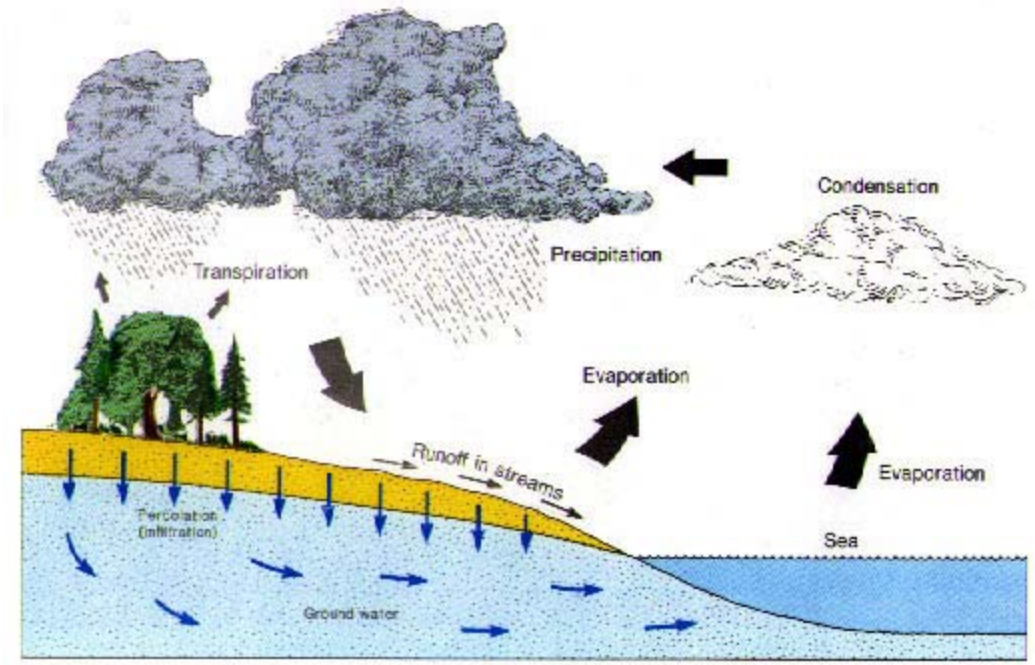
- Rainfall Intensity
- Flood Susceptibility/Sensitivity
- Infrastructure Limitations
- Planning

Observations

Rainfall Intensity

Statistically significant data for GTA not yet available,

Possibility that heavy / extreme daily precipitation events will increase



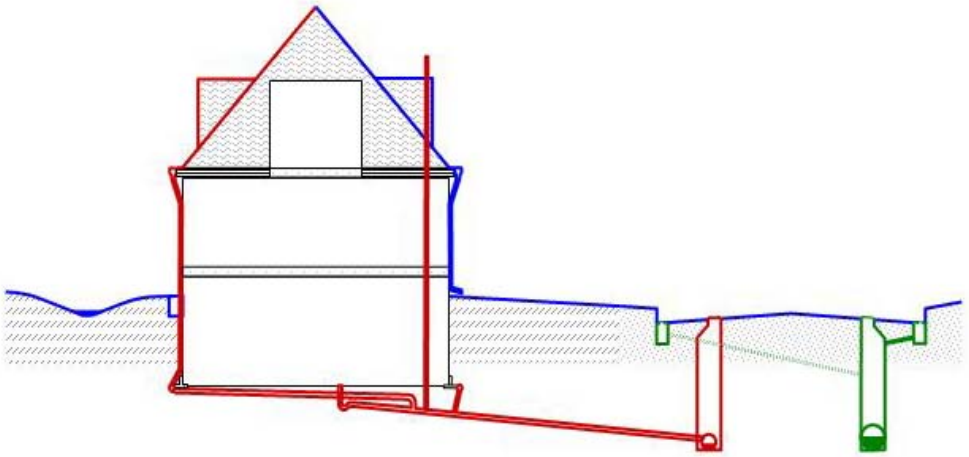
The Water Cycle

www.winona.edu

Observations

Flood Susceptibility/Sensitivity

- Newer homes = deeper basement (root cellar ⇨ 8'basement)
- Basements are living spaces, (basement ⇨ dry wall, carpet, flat-screens, etc.)
- Basement flood damages → $50,000 & risk to life



Observations

Infrastructure Limitations

- Older storm sewers designed for smaller storms
- Paved area increased (gravel → paved & Infill)
- Older areas, no OLF route, (development pre-dates dual drainage)
- Increased Sanitary Loading, (increased population & per capita generation)
- Stormwater in Sanitary, (WM leakage, cracks, sump overflows, cross connections)
- = increased flood potential

Observations - PLANNING

- Detailed Flood Damage Reduction Studies to Identify Problems – define Urban Flood Zones

- Public Education Programs to mitigate flooding (wetland preservation, back yard ponding, downspout disconnection, cross connection elimination, sump pumps & backflow valves)

- Selective remedial works ⇨ identify infrastructure bottlenecks and long term plan to current standards