MILONE & MACBROOM

Public Information Meeting

Tidal Rondout Creek Watershed Management Plan

David Murphy, P.E., CFM
Milone & MacBroom, Inc.

October 22, 2015

Agenda

- Purpose of Plan
- Watershed Vision, Goals, and Objectives
- Watershed Characterization
- Findings
- Management Strategies
- Suggested Actions
- Implementation
- Next Steps

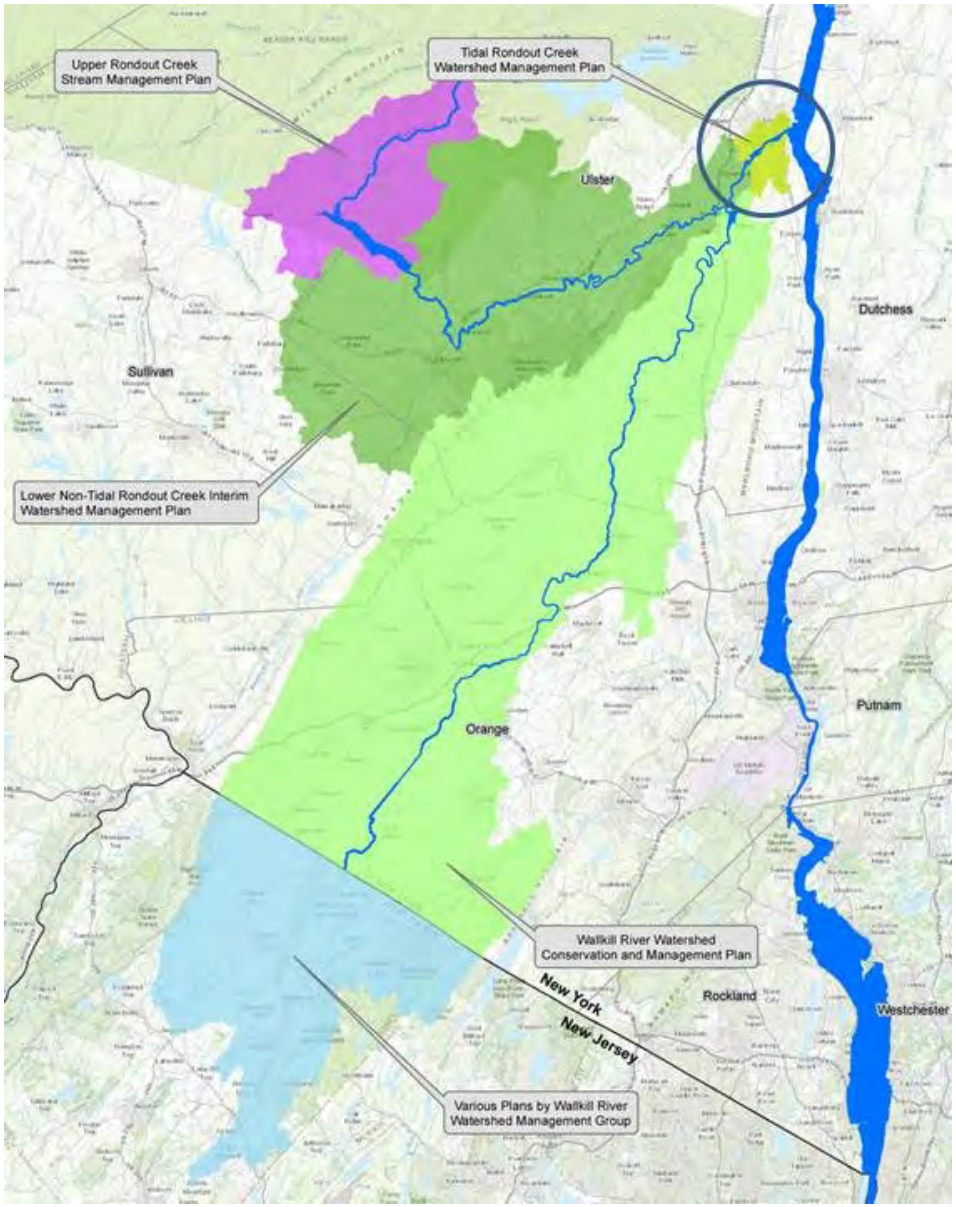
Purpose of Plan

Partners in the Planning Process

- City of Kingston
- Town of Esopus
- Town of Ulster
- New York Department of State
- Kingston Committees:
  - Tidal Flooding Task Force
  - Waterfront Committee
  - Comp Plan Committee

MILONE & MACBROOM

Purpose of Plan



Haven't we done this?

- **Other sections of the watershed have been the subject of planning**
- **However, unique characteristics of the watershed along the tidal part of the creek warrant additional planning**

MILONE & MACBROOM

Purpose of Plan

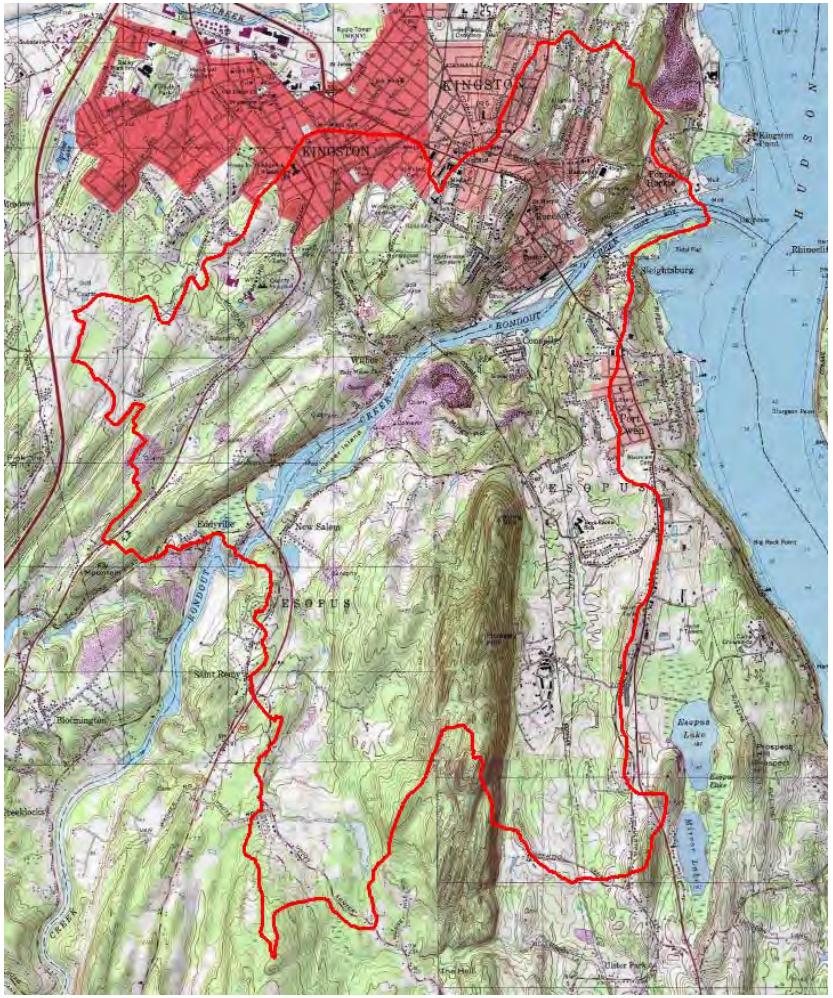
Why Tidal Rondout Creek?

- **The tidal portion of Rondout Creek is an important recreational, commercial, and economic resource**
- **Strong desire to address potential water quality impairments in the small tributaries to the tidal Rondout Creek**
- **Watershed planning can dovetail with ongoing tidal flooding evaluations, waterfront development, and the Kingston Comp Plan and regulation updates**

Purpose of Plan

What is a Watershed

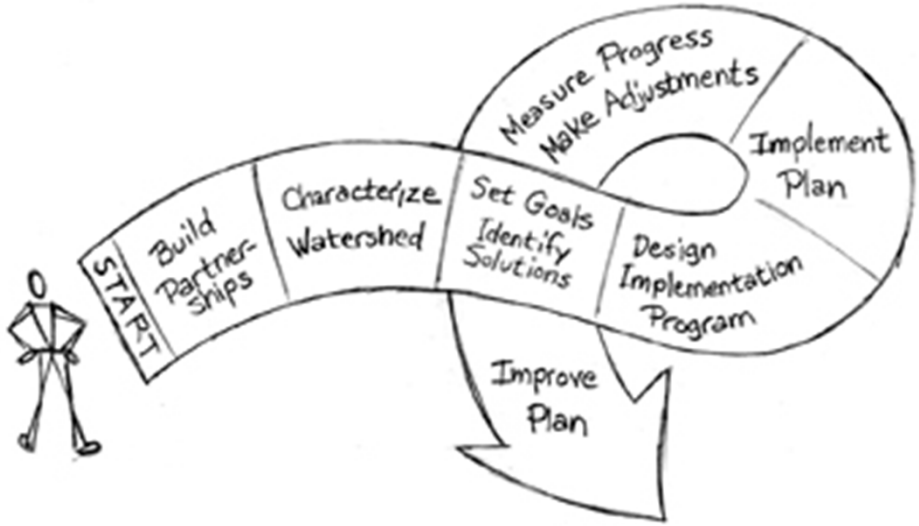
- A watershed is the area of land where all of the water that drains from it flows to a common point.
- This watershed is comprised of 11.25 square miles of land and water located in the City of Kingston and the Towns of Ulster and Esopus.
- 1% of the entire watershed.



Purpose of Plan

What is Watershed Management?

- **Watershed management is the process of creating and implementing plans, programs, and projects to sustain and enhance environmental health of the plant, animal, and human communities that reside within the watershed boundary.**



MILONE & MACBROOM

Watershed Vision, Goals, and Objectives

The vision for the Tidal Rondout Creek Watershed is that it becomes a healthy naturally sustainable stream system surrounded by a vibrant waterfront community.

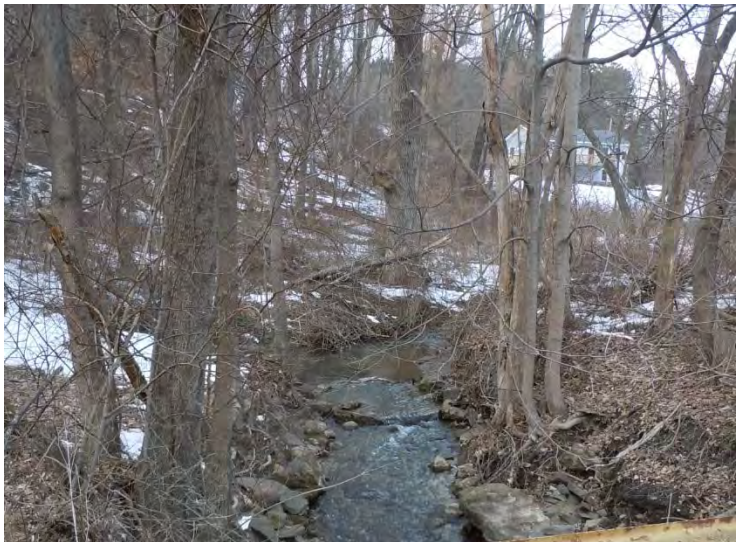
MILONE & MACBROOM

Watershed Vision, Goals, and Objectives

Goal #1

Restore tributary streams and subwatersheds to improve water quality.

This goal focuses on conditions along tributary streams and subwatersheds within the watershed communities of Kingston, Ulster, and Esopus.



Goal #2

Create a vibrant waterfront by improving water quality.

This goal focuses on the main stem of the tidal Rondout Creek abutting Kingston, Ulster, and Esopus.

MILONE & MACBROOM

Watershed Vision, Goals, and Objectives

Objectives for Goal #1: <u>Restore tributary streams and subwatersheds to improve water quality.</u>

- **Reduce streambank and channel erosion along tributary streams**
- **Restore and enhance riparian vegetation along tributary streams**
- **Prevent or minimize flood damage along tributary streams**
- **Modify stormwater management in tributary stormwatersheds**
- **Carefully manage land use and redevelopment in tributary subwatersheds**
- **Carefully manage disposal of sanitary wastewater in tributary subwatersheds**

MILONE & MACBROOM

Watershed Vision, Goals, and Objectives

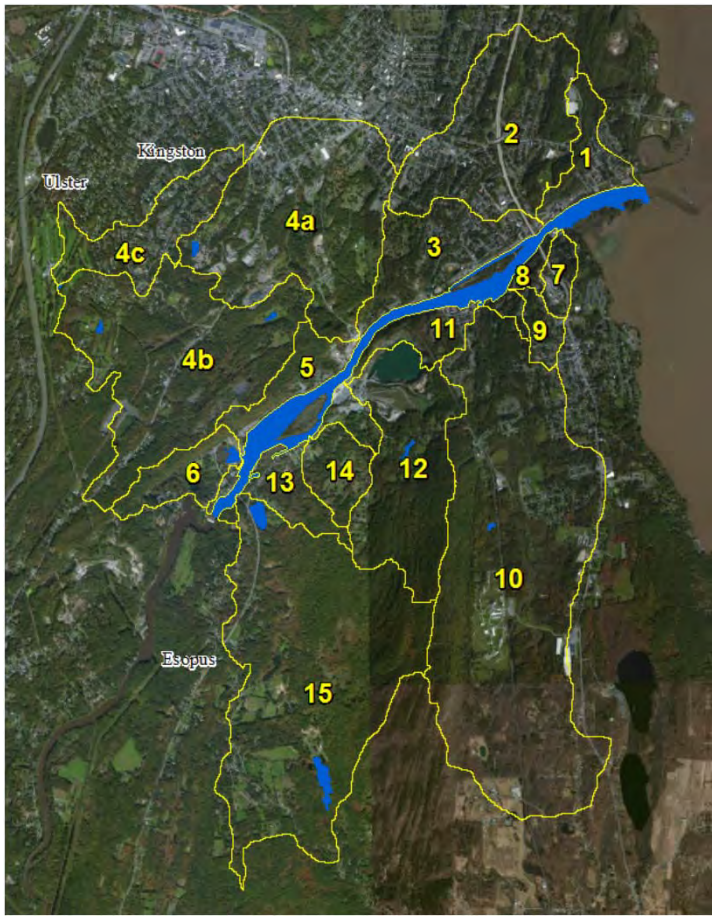
Objectives for Goal #2: <u>Create a vibrant waterfront by improving water quality.</u>

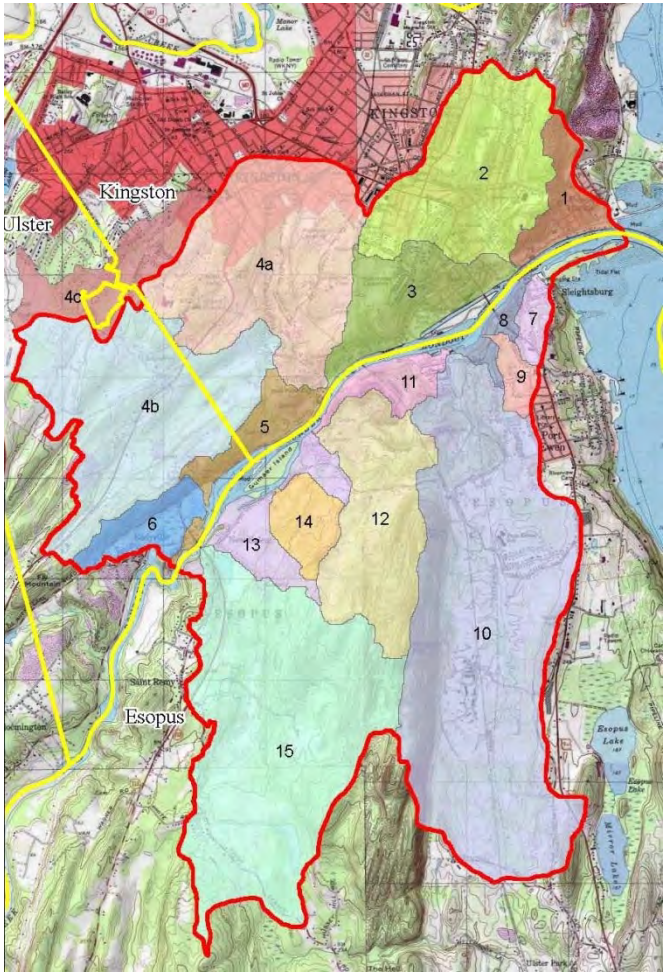
- **Carefully manage land use and redevelopment along the waterfront**
- **Mitigate tidal flooding in the waterfront area**
- **Reduce sewer overflows into Rondout Creek**
- **Improve water quality classification of Rondout Creek**
- **Increase training, education, and stewardship**

MILONE & MACBROOM

Watershed Characterization

Subwatersheds





Legend

- Town Boundaries
- Rondout Creek Tidal Watershed
- 1 Waterfront
- 2 Kingston
- 3 Downtown West
- 4a Twaalfskill East
- 4b Twaalfskill West
- 4c Tannery Brook
- 5 West Bank
- 6 Eddyville
- 7 Sleightsburg
- 8 Bridge
- 9 Port Ewen
- 10 Esopus
- 11 Connelly
- 12 Mingo Hollow
- 13 East Bank
- 14 West Mingo Hollow
- 15 New Salem

MILONE & MACBROOM

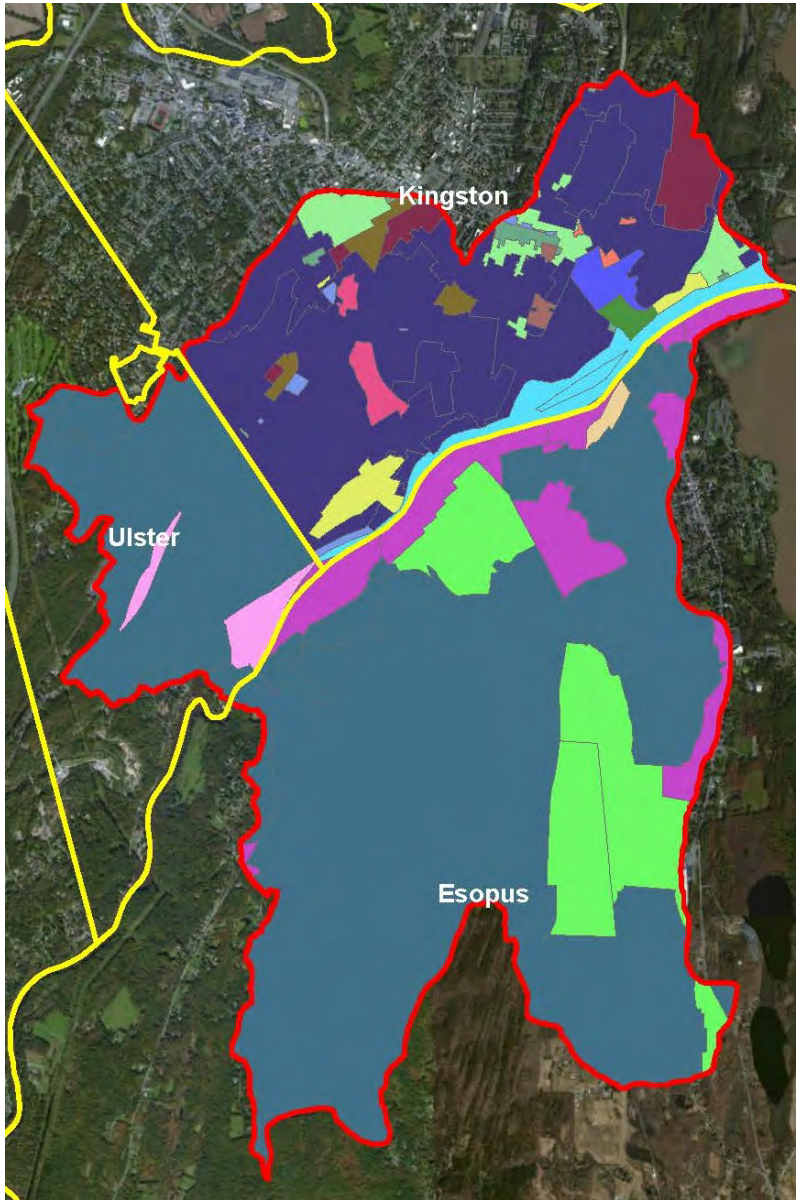
Watershed Characterization

Number	Subwatershed	Size (acres)	Streams (mi)	Waterbodies (acres)
1	Waterfront	141	0.4	0
2	Kingston/Rondout	585	0.3	0.25
3	Downtown West	295	0	0
4a	Twaalfskill East	789	1.5	2.1
4b	Twaalfskill West	842	2.3	4.5
4c	Tannery	257	0.7	2.8
5	West Bank	142	0	0
6	Eddyville	141	0	6.1
7	Sleightsburg	56	0.25	0
8	Bridge	55	0	0
9	Port Ewen	57	0.5	0.3
10	Esopus	1,649	2.3	0.9
11	Connelly	103	0	0
12	Mingo Hollow	502	0.6	1.8
13	East Bank	178	0	0
14	West Mingo Hollow	123	0	0.8
15	New Salem	1,264	3.2	19.7
	Totals:	7,179	12.1	39.3

- **Stream Section Identification**
- **Subwatershed Statistics**

MILONE & MACBROOM

Watershed Characterization



- **Generalized Zoning**

Legend

- Town Boundaries
- Rondout Creek Tidal Watershed
- Central Commercial
- Commercial
- Convenience Business
- General Commercial
- General Manufacturing
- Industrial
- Light Manufacturing
- Limited Office
- Local Commercial
- Multiple Residence
- One-Family Residence
- Planned Unit Development
- Res. Limited Commercial
- Residential
- Rondout Creek District
- Three-Story Multiple Residence
- Two-Family Residence
- Two-Story Multiple Residence

MILONE & MACBROOM

Watershed Characterization

A significant component of watershed management is identifying land use within the watershed that directly impacts that overall health of a system.

	Size (acres)	Open Water	Developed, Open Space	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Barren Land	Deciduous Forest	Evergreen Forest	Mixed Forest	Shrub / Scrub	Grassland / Herbaceous	Pasture / Hay	Cultivated Crops	Woody Wetlands	Emergent Herbaceous Wetlands
Tannery Brook	257	0.00%	59.88%	13.76%	0.87%	0.00%	0.00%	10.56%	1.64%	5.02%	0.52%	0.00%	0.00%	0.00%	8.39%	0.00%
Twaalfskill Brook West	842	1.48%	11.25%	2.75%	0.11%	0.00%	0.74%	30.72%	7.87%	27.73%	0.40%	0.00%	0.34%	0.45%	16.38%	0.00%
Twaalfskill Brook East	789	0.17%	30.86%	18.86%	10.29%	2.93%	0.00%	16.69%	3.21%	12.01%	0.14%	0.00%	0.00%	0.00%	4.93%	0.00%
Kingston	585	0.00%	33.49%	32.01%	15.59%	4.60%	0.27%	12.05%	1.06%	0.49%	0.00%	0.00%	0.53%	0.00%	0.00%	0.00%
Sleightsburg	56	0.00%	36.93%	23.03%	20.65%	9.93%	2.38%	8.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Port Ewen	57	0.00%	38.63%	39.80%	6.24%	2.73%	0.00%	13.66%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Esopus	1649	0.00%	13.24%	8.23%	2.71%	1.20%	0.07%	40.86%	1.39%	8.77%	0.59%	0.36%	6.96%	2.72%	13.07%	0.07%
Mingo Hollow	502	1.33%	4.39%	1.77%	2.30%	3.77%	12.05%	24.85%	7.09%	35.13%	0.00%	0.00%	4.34%	0.97%	2.70%	0.00%
West Mingo Hollow	123	0.00%	10.49%	0.36%	0.00%	0.00%	0.00%	19.89%	1.63%	41.95%	0.00%	0.00%	18.98%	4.16%	2.89%	0.00%
New Salem	1264	1.04%	6.84%	1.09%	0.00%	0.00%	0.00%	36.79%	1.11%	36.74%	0.00%	0.00%	5.35%	2.39%	8.64%	0.00%
Eddyville	141	4.10%	19.56%	4.26%	1.58%	0.00%	0.00%	28.86%	1.58%	21.61%	0.00%	0.00%	0.00%	1.42%	13.25%	3.63%
East Bank	178	0.25%	9.87%	5.50%	2.62%	6.50%	2.12%	23.24%	0.50%	34.11%	0.00%	0.00%	2.00%	0.12%	14.87%	0.00%
Connelly	103	1.30%	19.65%	9.07%	9.50%	2.16%	8.64%	29.80%	0.00%	7.34%	0.00%	0.00%	0.00%	5.83%	0.86%	5.83%
Bridge	55	3.23%	21.03%	31.54%	2.02%	4.45%	0.00%	26.28%	7.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.40%	5.26%
West Bank	142	0.78%	15.35%	8.14%	5.79%	0.00%	0.00%	30.23%	0.31%	19.89%	0.00%	0.00%	0.00%	8.46%	11.59%	0.00%
Downtown West	295	0.60%	46.51%	22.31%	12.74%	1.88%	0.00%	11.01%	0.00%	4.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%
Waterfront	141	0.16%	18.93%	22.40%	20.82%	1.73%	5.68%	21.92%	0.47%	2.68%	0.00%	0.00%	3.79%	0.00%	0.00%	1.73%

Land use information was obtained from the 2006 National Land Cover Database: Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PE&RS, Vol. 77(9):858-864.

MILONE & MACBROOM

Watershed Characterization

Impervious surfaces and road/stream ratios

Number	Subwatershed Name	% Impervious	Streams (mi)	Roads (mi)	Road/Stream Ratio
1	Waterfront	25.3%	0.4	3.7	9.3
2	Kingston	31.0%	0.3	17.9	59.7
3	Downtown West	24.3%	0	7.8	N/A
4a	Twaalfskill Brook East	20.4%	1.5	13.7	9.1
4b	Twaalfskill Brook West	2.8%	2.3	5	2.2
4c	Tannery Brook	13.9%	0.7	4.4	6.3
5	West Bank	8.8%	0	1.6	N/A
6	Eddyville	5.5%	0	1.7	N/A
7	Sleightsburg	34.9%	0.25	1.9	7.6
8	Bridge	22.0%	0	1.6	N/A
9	Port Ewen	28.4%	0.5	1.5	3.0
10	Esopus	7.8%	2.3	11.1	4.8
11	Connelly	13.7%	0	0.9	N/A
12	Mingo Hollow	6.0%	0.6	0.9	1.6
13	East Bank	10.8%	0	1.7	N/A
14	West Mingo Hollow	1.4%	0	0.5	N/A
15	New Salem	1.4%	3.2	4.8	1.5
	Total:	11.0%	12.1	80.6	6.7

MILONE & MACBROOM

Watershed Characterization

- **Flood Risks**

Legend

- Town Boundaries
- Rondout Creek Tidal Watershed
- 500 Year Flood Zone
- 100 Year Flood Zone
- Floodway

MILONE & MACBROOM

Watershed Characterization

Water Quality

- **Rondout Creek is a Class C watercourse in its tidal section.**
- **Class C designation indicates that the waters support fisheries and are suitable for non-contact activities, but are not suitable for swimming, contact recreation, or drinking.**
- **Tidal section of Rondout Creek is not listed on the Section 303(d) List of Impaired Waters.**

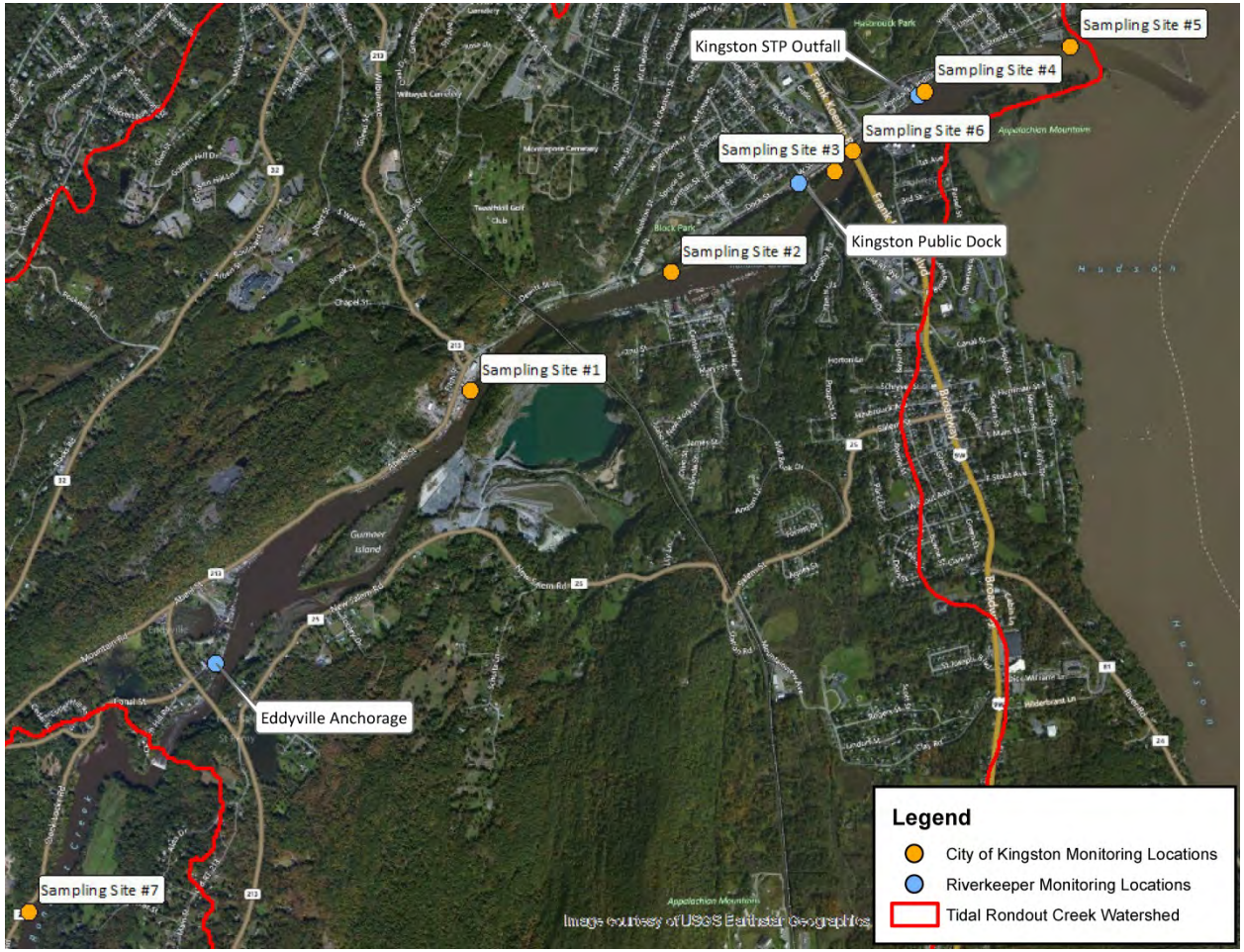
Name	Description	Class	Standards
Rondout Creek	From mouth to dam at Eddyville, N.Y. Enters Hudson River at Kingston	C	C
Tidal Rondout Creek	Tributaries of the Tidal Rondout Creek	C	C
Tributary of Rondout River or Creek	"Enters from south approximately 1.3 miles above mouth of Rondout River."	C	C
Tributary of Rondout River or Creek	"Enters Rondout River from south near and below Eddyville dam."	C	C

Notes: Class C waters = suitable for fishing

Watershed Characterization

Water Quality

- **The City of Kingston's water quality study found that water quality parameters in Rondout Creek did not exceed the NYSDEC water quality standards.**

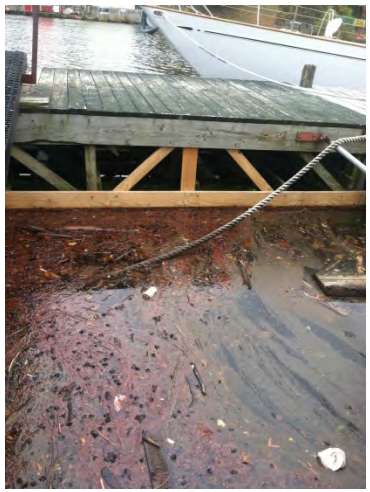


MILONE & MACBROOM

Watershed Characterization

Water Quality (Continued)

- **Water quality monitoring results provided by Riverkeeper demonstrate that water quality in Rondout Creek may benefit from improvements in the watershed.**
- **These conclusions are not mutually exclusive, nor do they directly contrast with the lack of Rondout Creek appearing on the list of impaired waters.**
- **The bottom line is that there may be room for improvement in the water quality found in Rondout Creek.**

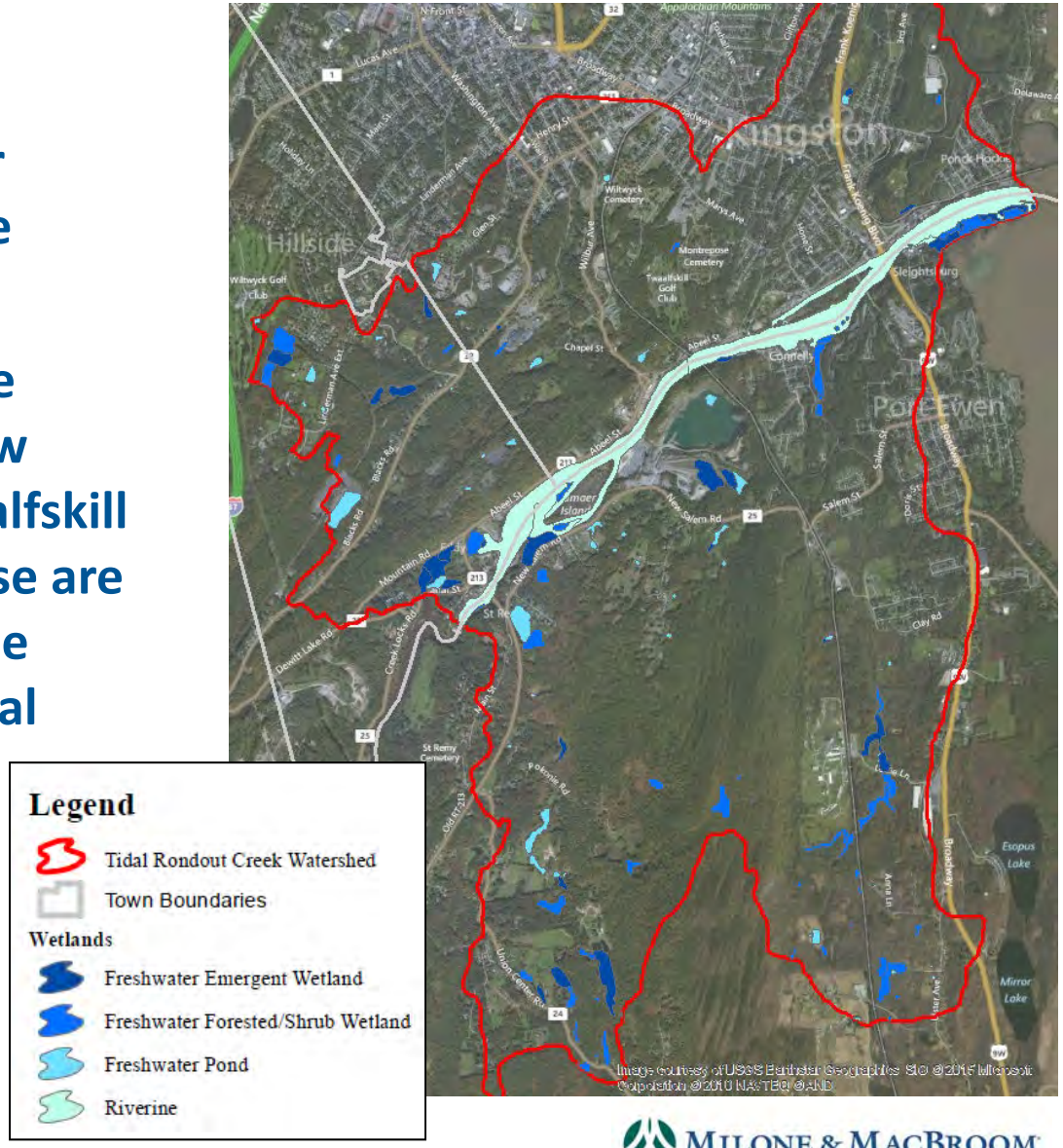


MILONE & MACBROOM

Watershed Characterization

Wetland Habitats

- State-regulated freshwater wetlands are located in the watershed.
- Most of these wetlands are mapped in the Esopus, New Salem, Eddyville, and Twaalfskill West subwatersheds. These are the subwatersheds with the most undeveloped and rural land.



MILONE & MACBROOM

Watershed Characterization

Bureau of Fisheries Annual Report

- **Provides a summary of significant activities completed during fiscal year 2009-2010 by Bureau of Fisheries staff.**
- **Fish samples were collected from Rondout Creek, Honk Lake, Neversink River, East Branch Croton River and West Branch Croton River as part of a mercury sampling program.**
- **The sections sampled were downstream of New York City operated reservoirs located on those rivers.**
- **The fish samples were analyzed for mercury, and approximately half of the samples were analyzed for PCBs and selected pesticides.**
- **All results were below actionable levels.**

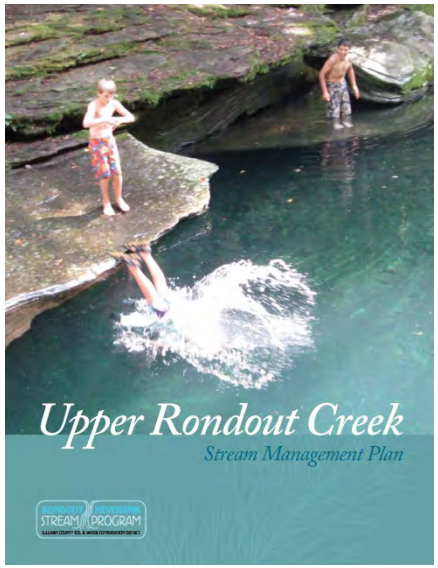
Watershed Characterization

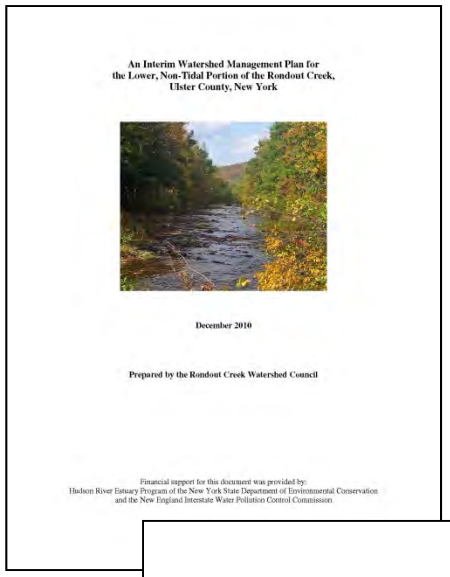
Prioritization of Watershed Areas

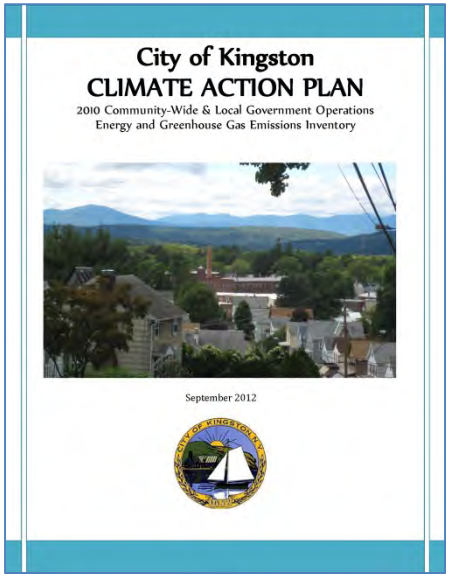
#	Subwatershed	% Impervious	Zoning	Land Use	Amount of Open Space	Prioritization for WQ Management
1	Waterfront	25.3%	R-1, RRR, M-1, R-2, C-2	Residential, Commercial, Industrial	Low	High
2	Kingston	31.0%	RRR, R-1, R-2, R-5, C-2, C-3, O-2, M-1	Residential, Commercial, residential, Industrial	Low	High
3	Downtown West	24.3%	RF-R, RRR, R-1, R-2, C-2, R-6	Rondout Creek District, Residential, Commercial	Low	High
4a	Twaalfskill East	20.4%	C-3, C-2, O-2, R-2, RRR, R-1	Commercial, Office, Residential	Low	High
4b	Twaalfskill West	2.8%	Kingston: RRR, R-1; Ulster: R-30, R-60	Residential	Moderate	Low
4c	Tannery Brook	13.9%	Kingston: RRR, R-1, O-2 Ulster: R-30	Residential, Limited Office	Moderate	Moderate
5	West Bank	8.8%	Kingston: R-1, C-3, M-2, RR, R-1; Ulster: R-10	Residential, Commercial, Industrial	Low	Moderate
6	Eddyville	5.5%	R-60, R-10	Residential	Moderate	Low
7	Sleightsburg	34.9%	R-12	Residential	Low	High
8	Bridge	22.0%	R-40, W	Residential, Commercial	Low	High
9	Port Ewen	28.4%	R-40, GC	Residential, Commercial	Low	High
10	Esopus	7.8%	R-40, H-1, L-1, R-12, GC	Residential, Industrial, Commercial	High	High
11	Connelly	13.7%	PUD, WR	Planned Development Unit, Commercial	Low	Moderate
12	Mingo Hollow	6.0%	R-40	Residential	High	Low
13	East Bank	10.8%	R-12	Residential	Low	Moderate
14	West Mingo Hollow	1.4%	R-40	Residential	High	Low
15	New Salem	1.4%	R-40	Residential	High	Low

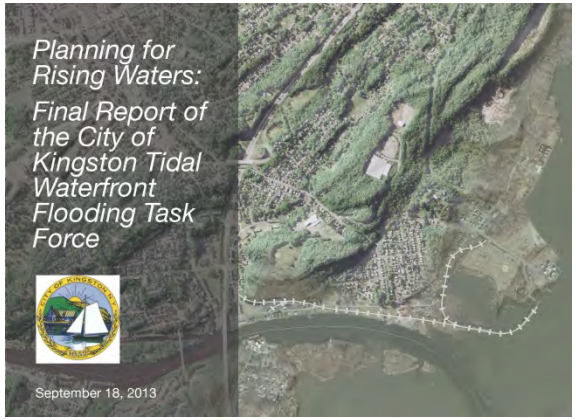
Watershed Characterization

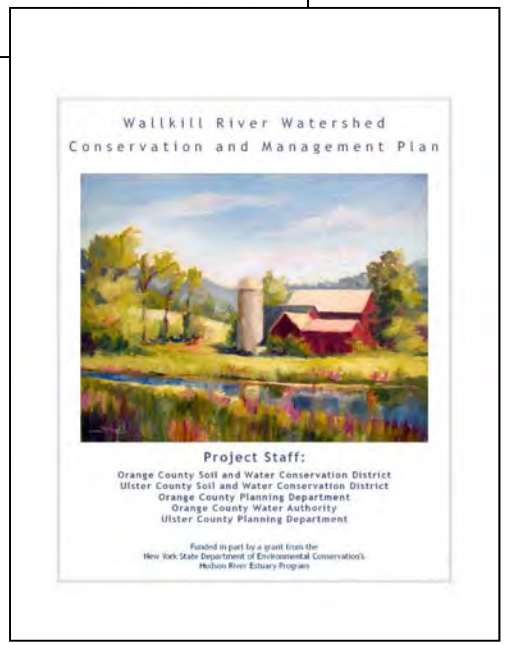
Plans Considered











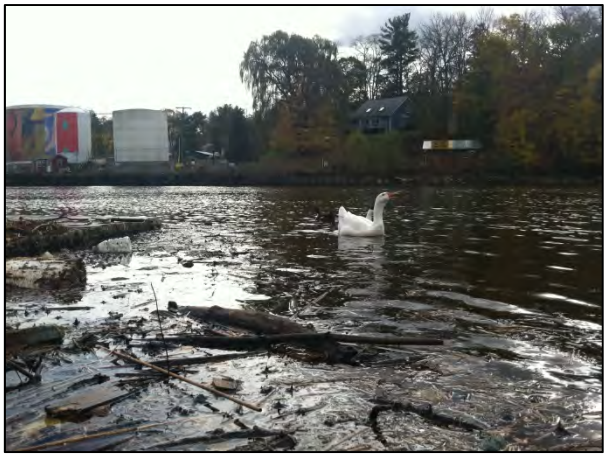
Plus:

- Comp Plans
- Ulster County Hazard Mitigation Plan
- Watershed management plans in New Jersey

MILONE & MACBROOM

Key Watershed Findings

- **Rondout Creek is simultaneously *not* listed as an impaired watercourse, yet has somewhat diminished water quality**
- **Flooding and flood damage are among the most significant contributors to poor water quality.**
  - ✓ ***Along tributary streams***
  - ✓ ***Where tributary streams are no longer present***
  - ✓ ***Tidal flooding along the creek***
- **Thus, flood damage mitigation is warranted.**



MILONE & MACBROOM

Key Watershed Findings

- **Tributary streams have been placed in culverts or stormwater infrastructure, disconnecting floodplains from streams and erasing natural functions.**
- **Combined sewer overflows in the city still need attention.**
- **Green infrastructure can reduce stormwater generation.**
- **Land use and redevelopment policies and procedures are good, but can be amended or improved in specific areas.**

MILONE & MACBROOM

Management Strategies: Goal #1

Objectives	Categories of Management Strategies									
	Stormwater Management	Sanitary Wastewater Management	Land Use Planning Tools	Land Use Regulations	Tributary Stream Restoration	Tributary Flood Mitigation	Waterfront Flood Mitigation	Wetlands and Habitat Restoration	Water Quality Monitoring	Education and Training
Reduce streambank and channel erosion along tributary streams	X				X	X		X	X	X
Restore and enhance riparian vegetation along tributary streams					X	X		X	X	X
Prevent or minimize flood damage along tributary streams	X			X	X	X		X	X	X
Modify stormwater management in tributary stormwatersheds	X		X	X					X	X
Carefully manage land use and redevelopment in tributary subwatersheds			X	X					X	X
Carefully manage disposal of sanitary wastewater in tributary subwatersheds		X	X	X					X	X

MILONE & MACBROOM

Management Strategies: Goal #2

Objectives	Categories of Management Strategies									
	Stormwater Management	Sanitary Wastewater Management	Land Use Planning Tools	Land Use Regulations	Tributary Stream Restoration	Tributary Flood Mitigation	Waterfront Flood Mitigation	Wetlands and Habitat Restoration	Water Quality Monitoring	Education and Training
Carefully manage land use and redevelopment along the waterfront			X	X			X			X
Mitigate tidal flooding in the waterfront area							X			X
Reduce sewer overflows into Rondout Creek		X							X	X
Improve water quality classification	X	X	X	X	X	X	X	X	X	X
Increase training, education, and stewardship									X	X

MILONE & MACBROOM

Management Strategies

Stormwater Management

- Install collection and conveyance systems
- Vegetate swales
- Maintain detention and retention basins
- Clean and maintain catch basins and other system components
- Retrofit aging systems

MILONE & MACBROOM

Management Strategies

Use Green Infrastructure

Typical Definitions of Green Infrastructure (GI)

EPA: GI uses vegetation, soils, and natural processes to manage water and create healthier urban environments.

American Rivers: GI is an approach to water management that protects, restores, or mimics the natural water cycle…. GI incorporates both the natural environment and engineered systems to provide clean water, conserve ecosystem values and functions, and provide a wide array of benefits to people and wildlife…. On the local level, GI practices include rain gardens, permeable pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting systems.

The Nature Conservancy: GI solutions are planned and managed natural and semi-natural systems which can provide more categories of benefits, when compared to traditional gray infrastructure. GI solutions can enhance or even replace a functionality that is traditionally provided by man-made structures…. GI solutions employ ecosystem services to create more resource efficient systems involving water, air and land use.

Green Infrastructure Example – Kingston Library

The Kingston Library undertook a project to improve environmental and site conditions. One objective was to resurface the parking lot with new pavement. The roof downspouts were connected to the sanitary sewer system, which carried the roof runoff to the Wastewater Treatment Facility and contributed to combined sewer overflows into Rondout Creek. The library disconnected the roof leaders from the sewer system to assist the City in its efforts to remove stormwater from the sanitary system. This led to the reduction of 400,000 gallons per year of rainwater entering the sanitary sewer system.

Another challenge was to treat and reduce the flow of stormwater from the site. The Library achieved this by reducing impervious surfaces, installing a rain garden, and installing a stormwater exfiltration system.

Management Strategies

Sanitary Wastewater Management

- Reduce combined sewer overflows
- Reduce infiltration and inflow
- Maximize treatment capacities
- Protect wastewater treatment plant from flooding
- Septic system maintenance
- Extension of sewer systems

MILONE & MACBROOM

Management Strategies

Tributary Stream Restoration and Flood Mitigation

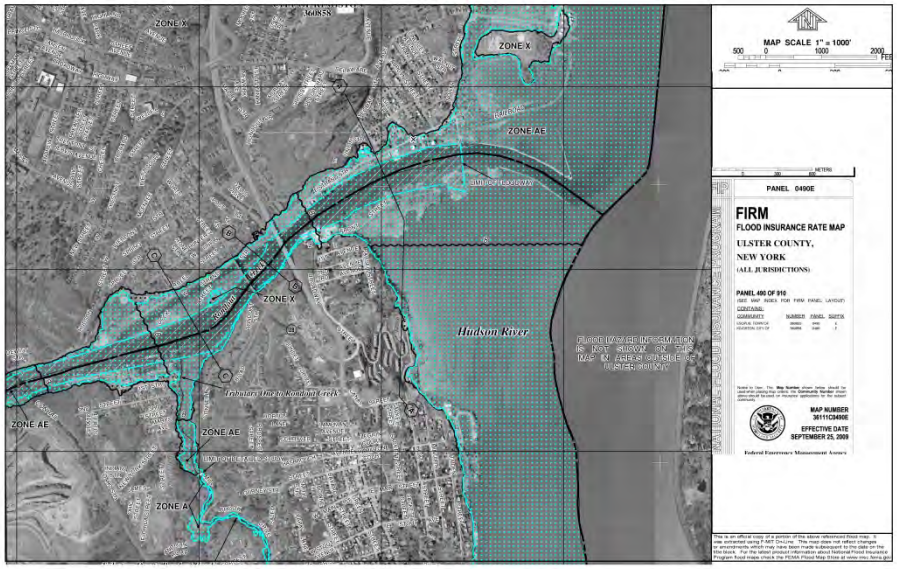
- Re-connect streams with floodplains
- Daylight stream sections where feasible
- Create floodplains and floodplain benches
- Repair eroded streambanks and strengthen through bioengineered treatments
- Set aside stream buffers
- Replace culverts and bridges
- Relocate buildings
- Elevate and floodproof buildings

MILONE & MACBROOM

Management Strategies

Waterfront Flood Mitigation

- Drainage system improvements
- Elevate roads
- Elevate buildings
- Floodproof buildings



MILONE & MACBROOM

Management Strategies

Land Use Planning Tools and Land Use Regulations

- Update Comprehensive Plans
- Amend Zoning and Subdivision Regulations
- Update engineering design standards to incorporate increasing precipitation intensities
- Require zero increase in runoff from new developments
- Retire obsolete zoning districts and classes
- Consider watershed improvement overlays that require additional reviews
- Consider open space districts

Management Strategies

Wetlands and Habitat Restoration

- **Protect existing riparian wetlands**
- **Remove invasive species**
- **Set aside stream buffers**
- **Provide diverse habitats (palustrine, emergent, shrub/scrub, and open water wetlands)**

MILONE & MACBROOM

Management Strategies

Water Quality Monitoring, Education, Training, Stewardship

- Coordinate existing water quality monitoring programs
- Set up and implement a new water quality sampling and monitoring program
- Set up and implement a monitoring protocol for watershed projects such as revegetation and streambank stabilization
- Link watershed water quality awareness to existing recreational programs
- Look for other educational opportunities

MILONE & MACBROOM

Suggestions Actions

- **Approximately 60 recommended actions were developed with a handful of actions from each management strategy**

Objective #1.1 – Restore tributary streams and enhance riparian vegetation along tributary streams

a. Pursue opportunities to daylight sections of streams
b. Replace walled stream banks with naturalized and bioengineered stream banks along Twaalfskill Brook and its tributaries
c. Provide diverse habitats (palustrine, emergent, shrub/scrub, and open water wetlands) throughout the subwatersheds
d. Protect existing riparian wetlands
e. Set aside stream buffers and vegetate accordingly
f. Remove invasive species

Objective #1.2 – Reduce streambank and channel erosion along tributary streams

a. Stabilize eroding banks along watercourses using natural, bioengineered, and hybrid gray/green bank treatments
b. Address downcutting and channel erosion with cross vanes and other base level control techniques

Objective #1.3 – Prevent or minimize flood damage along tributary streams

a. Re-connect tributary streams to floodplains by daylighting streams, replacing walls with naturalized stream banks, stabilizing banks, and removing berms and other obstructions
b. Enhance existing floodplains and construct floodplain benches
c. Increase bridge and culvert capacities to allow conveyance
d. Remove outbuildings, stored materials from stream corridors
e. Consider relocating residents and removing homes located adjacent to streams
f. Develop flood risk mapping along sections of streams that have not been studied by FEMA
g. Refine flood risk mapping along the un-numbered A zones
h. Elevate residential structures located along tributaries
i. Floodproof nonresidential structures along tributaries
j. Ensure that projects completed along Twaalfskill Brook include consideration of flows from Tannery Brook
k. Evaluate options for restoring more flow to the downstream portion of Tannery Brook

Suggestions Actions

Objective #1.4 – Modify stormwater management in tributary subwatersheds

a. Continue to separate storm and sanitary sewer systems
b. Increase the frequency of catch basin clean-outs
c. Replace impervious surfaces with pervious surfaces when approving redevelopment
d. Require green infrastructure techniques and low impact development for new developments and significant redevelopments
e. Maintain existing detention and retention basins
f. Identify opportunities to detain stormwater in areas of existing development and construct stormwater basins in areas that can receive runoff from groups of existing development
g. Install collection and conveyance systems in areas that are not served by stormwater systems to reduce erosion and overland transport of pollutants
h. Vegetate swales and ditches located along roadways
i. Incorporate green infrastructure at and along the Route 9W bypass

Objective #1.5 – Manage land use and redevelopment in tributary subwatersheds

a. Enact stream dumping prevention regulations in Kingston and Esopus
b. Increase outreach and technical assistance for agricultural and animal feed operations
c. Increase outreach and technical assistance for extraction/mining
d. Support remedial actions at Dyno facility, if applicable
e. Update the Town of Esopus Comprehensive Plan
f. Update engineering design standards for increasing precipitation intensities
g. Require zero increase in runoff from new developments
h. Retire or modify obsolete zoning districts and classes
i. Amend Zoning and Subdivision Regulations to incorporate Low Impact Development standards
j. Consider amending zoning and subdivision codes in Kingston and Ulster to encourage clustered developments
k. Consider watershed or water resources protection overlay zoning districts that require additional reviews and design
l. Acquire open space
m. Consider open space districts to further protect open space

Suggestions Actions

Objective #1.6 – Manage disposal of sanitary wastewater in tributary subwatersheds

a. Reduce sanitary sewer inflow and infiltration
b. Ensure that regular maintenance of septic systems is occurring
c. Extend sewer systems where groups of septic systems are failing or reaching the ends of their period of effectiveness
d. Delineate sewer avoidance and future sewer system areas

Objective #2.1 – Manage land use and redevelopment along the waterfront

a. Develop a Harbor Management Plan for all three municipalities
b. Repair and replace bulkheads using standard methods but also considering other methods evaluated by the Hudson River Estuary Program
c. Ensure that marinas are utilizing best practices to avoid pollution

Objective #2.2 – Mitigate tidal flooding in the Kingston, Esopus, and Ulster waterfront areas

a. Pursue drainage system improvements
b. Elevate roads
c. Elevate buildings that cannot be floodproofed
d. Floodproof buildings that cannot be elevated

Objective #2.3 – Reduce sewer overflows into Rondout Creek

a. Reduce sanitary sewer inflow and infiltration
b. Eliminate combined sewers
c. Maximize treatment capacities to avoid overflow of untreated wastewater
d. Protect the wastewater treatment plant from flooding

Objective #2.4 – Improve water quality classification of Rondout Creek from C to B

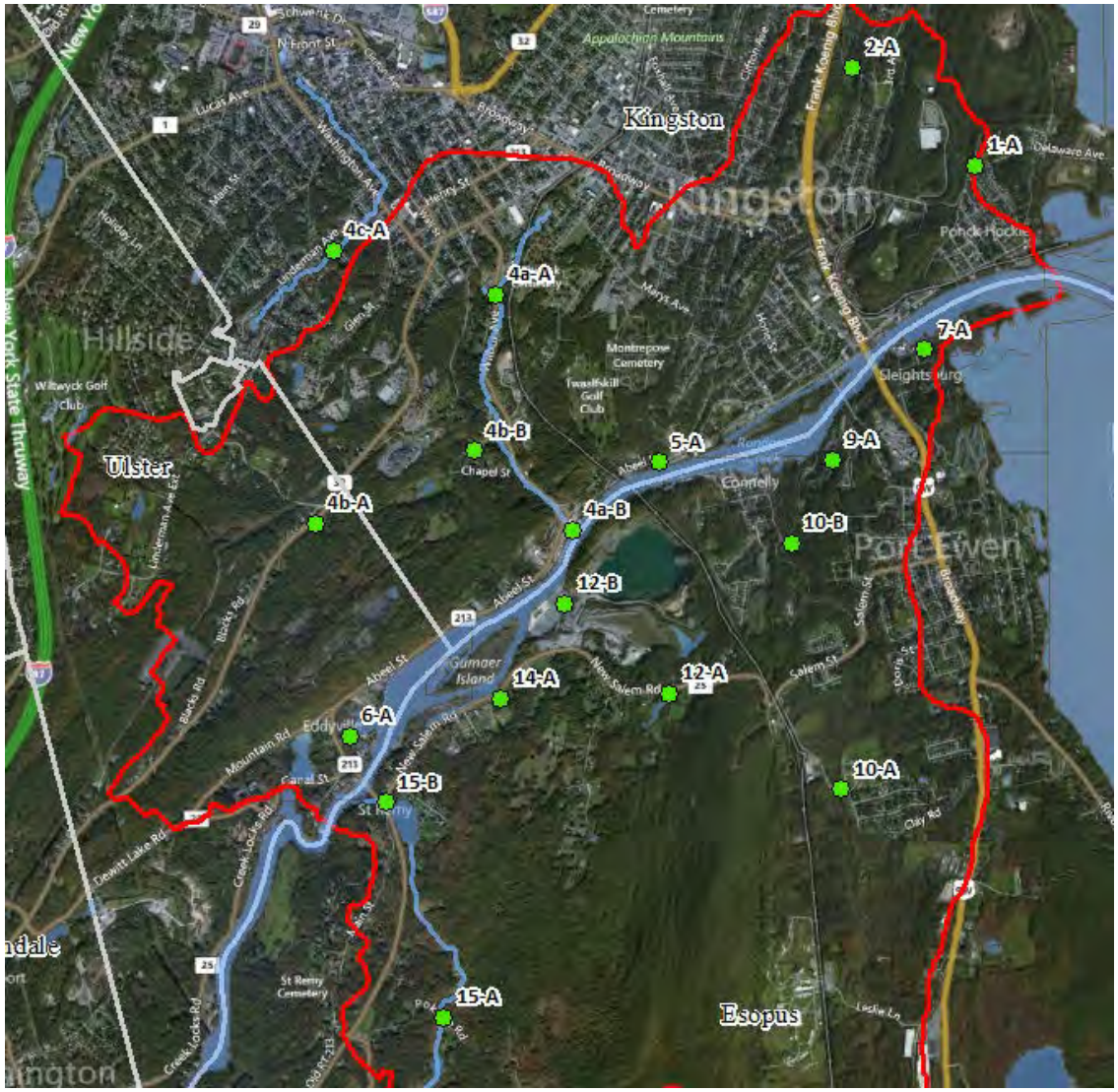
a. Consider requesting designation of impaired status for the tidal Rondout Creek
b. If impaired status is granted, leverage the resources made available as a result

Objective #2.5 – Increase training, education, and stewardship

a. Coordinate water quality monitoring programs to increase sharing and avoid redundancy
b. Set up a new water quality monitoring program to fill gaps while providing metrics for measuring implementation of this plan
c. Set up a monitoring protocol for tributary stream projects such as revegetation and stabilization
d. Link watershed water quality awareness to existing recreational programs

Suggestions Actions

- **Water quality monitoring locations along tributary streams**
- **Could help establish baseline data**
- **Could help demonstrate whether improvements are occurring over time**



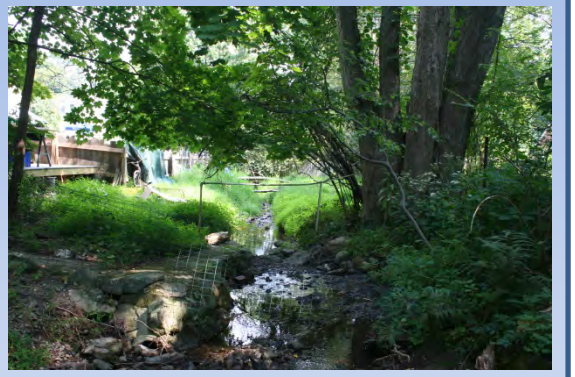
MILONE & MACBROOM

Implementation

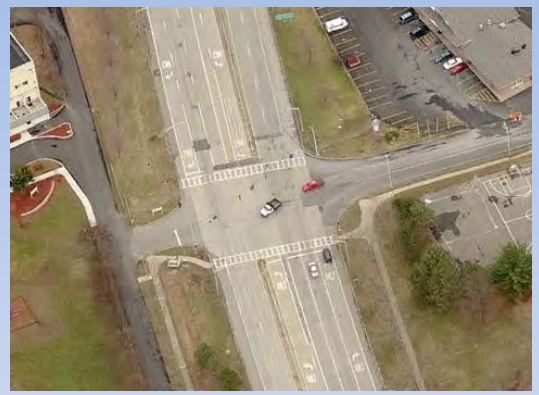
Three projects may be advanced initially

Twaalfskill Brook bank stabilization

Tannery Brook flood mitigation



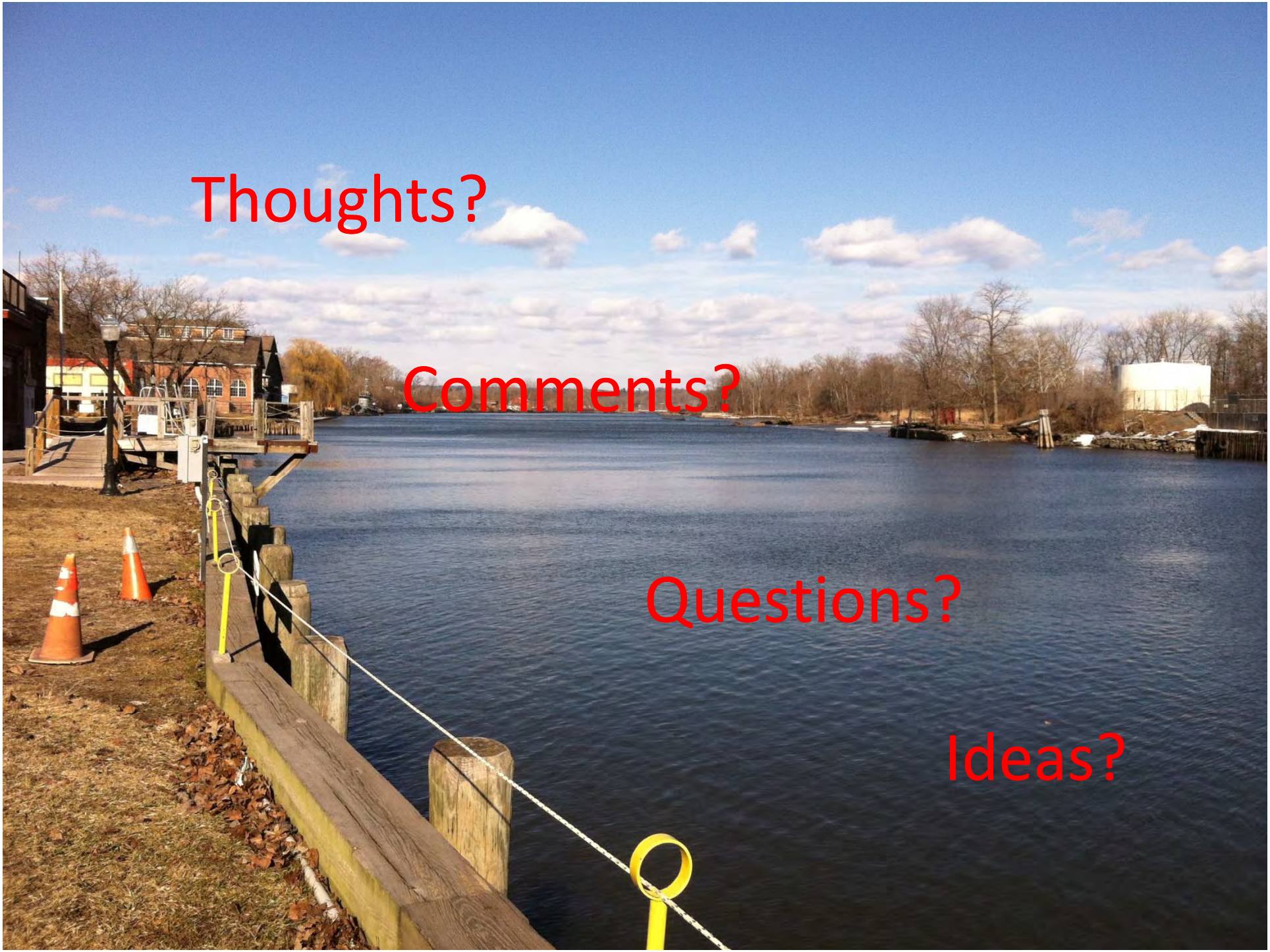
Green infrastructure along Route 9W Bypass



MILONE & MACBROOM

Next Steps

- **Incorporate public comments**
- **Issue final Watershed Management Plan**
- **Adopt Watershed Management Plan**
- **Implement actions**


Thoughts?
Comments?
Questions?
Ideas?