Cayuga Lake Watershed Restoration and Protection Plan
2017

Prepared for the
Cayuga Lake Watershed Intermunicipal Organization

by the
Cayuga Lake Watershed Network
March 2017

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Cayuga Lake Watershed Restoration and Protection Plan 2017

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Cover photograph by Bill Hecht. Looking southeast across Cayuga Lake from above Sheldrake Point. Photo taken Friday, August 2, 2013 at 6:01 PM.

Acknowledgements

To be of value and use, a watershed plan must emerge from the efforts of hundreds of local residents, community leaders, and resource experts. Grounded personal experiences and expertise of many kinds have provided the basis for this updated Plan, to guide our decisions about water resources management and use in a rapidly emerging era of climate change, extreme weather events, and rising natural resource use pressures. Over the two-year period of this project from 2015 - 2017, many people, groups and agencies directly contributed to the update, and we recognize them here.

Thanks to the Town of Ithaca for fiscal sponsorship, project oversight and guidance.

Watershed Advisory Committee (WAC) members

With input from the Cayuga Lake Watershed Intermunicipal Organization (IO), Cayuga Lake Watershed Network (CLWN) and others, a Watershed Advisory Committee (WAC) was developed in spring of 2015 from concerned and interested residents and leaders from across the watershed. The WAC developed a Public Participation Plan and updated the Plan's Vision & Goals, focus of part I of this Plan. WAC members also provided input to and review of the technical sections written by the members of the Technical Advisory Committee (TAC).

Watershed communities

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Rich DePaolo, Town of Ithaca Board, environmental issues focus.
Deborah Grantham, Board of Directors, Cayuga Lake Watershed Network, Dryden and Ithaca, IO founding member.
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Peter Saltonstall, proprietor, King Ferry Winery/Treleaven Wines.
Bud Shattuck, Mayor, Union Springs.
Barb Stewart, Interlaken, resident and leader, IO founding member.
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Dave Zorn, Genesee/Finger Lakes Regional Planning Council; Consultant for original RPP process.

Technical Advisory Committee (TAC) members

With input from the Cayuga Lake Watershed Intermunicipal Organization (IO), Cayuga Lake Watershed Network (CLWN) and others, a Technical Advisory Committee (TAC) was developed in spring of 2015. These experts and specialists, mostly located in the Cayuga Lake watershed or in neighboring areas, were tasked with updating the Water Quality and Action Category chapters that are the focus of sections III and IV of this plan.

Sharon Anderson, Environment Team Leader, Cornell Cooperative Extension of Tompkins County.

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Lisa Cleckner, Executive Director, Finger Lakes Institute, Geneva.

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Organizations, Agencies and Institutions

Cayuga Lake Watershed Intermunicipal Organization (IO).

Cayuga Lake Watershed Network Board of Directors.

Central New York Regional Planning Office.

Community Science Institute.

Cornell Cooperative Extension offices for Tompkins, Cayuga, and Seneca counties.
Finger Lakes Institute.
Finger Lakes Partnership for Regional Invasive Species Management (FL-PRISM).
Floating Classroom of Cayuga Lake.
New York State Department of State.
New York State Division of Water.
Park Foundation.
Planning Departments for Tompkins, Cayuga, and Seneca counties.
Soil and Water Conservation District offices for Tompkins, Cayuga, and Seneca counties.
Town of Ithaca.
Water Quality Committee, Seneca County.
Water Quality Management Agency, Cayuga County.
Water Resources Council, Tompkins County.

Special thanks to active individuals

Several members of the Intermunicipal Organization of the Cayuga Lake Watershed have had central roles in supporting the completion of this updated plan and helping with the final review process. Additionally, several municipal officials and other community leaders kept this process going through thick and thin. We recognize them here.

John Abel, Treasurer and Board member, Cayuga Lake Watershed Network.
Kathy Bertuch, Central New York Regional Planning Office.
Grace Bates, Village of Aurora Board member.
Cynthia Brock, IO representative, City of Ithaca, and Alderperson, City of Ithaca.
Jackie Cassaniti, IO Secretary and representative, Town of Caroline.
Rich DePaulo, IO alternate, Town of Ithaca and Board member, Town of Ithaca.
Michael Duttweiler, Secretary and Board member, Cayuga Lake Watershed Network.
Herb Engman, past Ithaca Town Supervisor.
Bill Goodman, 2017 Ithaca Town Supervisor.
Deborah Grantham, Board, Cayuga Lake Watershed Network, past IO Chair.
Patricia Haines-Gooding, Chair, Board of Directors, Cayuga Lake Watershed Network.
Tee-Ann Hunter, IO Chair and Board member, Town of Ithaca.
Roxanna Johnston, Watersheds Coordinator, City of Ithaca.
Darby Kiley, Planner, Town of Ulysses; IO representative, Ulysses; past IO Chair.
Lynn B. Leopold, IO representative, Village of Lansing; advisor to Floating Classroom of Cayuga Lake.
Mike Solvig, Finance Officer, Town of Ithaca.
David W. Sprout, IO representative, Town of Dryden.
Barbara Stewart, IO representative, Interlaken.
Jennifer Tufano, Staff, Cayuga Lake Watershed Network.
Tom Vawter, IO representative, Town of Lansing.
Stephanie Wojtowicz, Office of Planning and Development, NYS Department of State.
Michelle Wunderlich, Associate Planner, Cayuga County Department of Planning and Economic Development.

Hilary Lambert, project manager, editor & geographer
Executive Director, Cayuga Lake Watershed Network

Attendees at Public Input meetings
July 30 (Seneca Falls) and August 13 (Trumansburg) 2015

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Nancy Currier, Canoga
Bill Ebert, Canoga
Tee-Ann Hunter, Ithaca
Theresa Lahr, STEPS (*Seneca* Towns Engaging People for Solutions)
Roxanne Razavi, Finger Lakes Institute
Mel Russo, Sheldrake
Tom Vawter, Lansing
Michele Wunderlich, Cayuga County
Jackie Cassaniti, Caroline
Steve Penningroth, CSI and Ulysses
Martin Hatch, Dryden
Louis Terry
D.B. Terry
Anna Thompson
Liz Thorndike
Jim White
Vinton Stevens
Warren Brom
Don Wilson
Tea Leslie
Mario Del Rosso
Graham Hoffman
Mary Hoffman

Participants in the "Cayuga Lake Watershed Public & Youth Questionnaire" online survey, October 2015 - August 2016

Three hundred and two people from around the lake including a few from elsewhere answered the questions in our online survey, "Cayuga Lake Watershed Public & Youth Questionnaire", from October 2015 to August 2016. In addition to answering the set questions, many provided extensive, detailed, thoughtful comments. Youth to age 18 answered a set of questions designed for them.

We are deeply grateful to all who gave their time, online via the survey, and in person at the public meetings. This input was significant in finalizing the list of Public Recommendations for Action in Section II, page 20.

Watershed-Wide RPP Information Session & Reception
Cayuga Lake Watershed Intermunicipal Organization Meeting
Aurora NY August 26, 2015

Held at Grace Bates' home on the Cayuga Lake shoreline in Aurora, this meeting and reception brought together five speakers and IO representatives and other community leaders from 16 of the watershed's 45 municipalities. Presenters Tom Macinski and Stephanie Wojtowicz gave overviews of available regional and state funding programs to assist municipalities with clean water goals. Deb Grantham and Tee-Ann Hunter discussed the past, present and potential future of the Cayuga Lake Intermunicipal Organization to unify watershed communities for better protection of our water resources, and Keith Batman discussed the political context of working toward clean water protection in Cayuga County.

Speakers

Keith Batman, Chair, Cayuga County Legislature
Deborah Grantham, Cayuga Lake Watershed Network Board and past IO chair
Tee-Ann Hunter, IO Chair
Tom Macinski, Finger Lake Regional Economic Regional Development Council, Lodi
Stephanie Wojtowicz, NYS Department of State

Attendees

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Jackie Cassaniti, Town of Caroline
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Herb Engman, Town of Ithaca
Bill Goodman, Town of Ithaca
Martin Hatch, Town of Dryden
Paul Hilliard, Town of Ledyard
Darby Kiley, Town of Ulysses
Lynn Leopold, Village of Lansing
Janet Murphy, Village of Aurora
C.J. Randall, Town of Danby
Janet Reohr, Town of Scipio
Sue Ritter, Town of Ithaca
Bud Shattuck, Village of Union Springs
Bill Sherman, Village of Cayuga
Dave Sprout, Town of Dryden
Elizabeth Thomas, Town of Ulysses
Tom Vawter, Town of Lansing
Alvin White, Town of Hector
Mark Witmer, Town of Caroline

Preface

Continuity, change, and protection of our water resources

It is a challenge to unify the administratively complex Cayuga Lake watershed for restoration, conservation and protection. This 785-square mile watershed includes

- Three counties on the lakeshore (Cayuga, Seneca and Tompkins), and smaller upland portions of three additional counties (Cortland, Tioga, and Schuyler).
- 45 municipalities (cities, towns and villages), full list http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caymun.htm).
- Numerous regional, state and federal agencies.
- Development pressures that draw the south end of the lake to focus on the Southern Tier and New York City, and pull the north end of the lake to focus on Syracuse, Rochester, and Lake Ontario.

Watershed unifiers include (among others) the Intermunicipal Organization of the Cayuga Lake Watershed (IO), the Cayuga Lake Watershed Network, and this updated Restoration & Protection Plan (2017). The IO and Plan enable the sharing of information, communication and resources across administrative boundaries, to protect the lake and water resources at the center of our lives.

The surface water resources of the Cayuga Lake Watershed include wetlands, streams, springs, waterfalls, creeks and the lake itself. The area is also rich in groundwater resources. These waters are used for drinking water, farming, wine-making, cheeses, beers, liquors; recreation; industrial uses and wastewater treatment; home and business uses; natural habitat for plants and animals; for ecosystem functions, and other uses. All watershed residents, visitors, businesses, and municipalities share and benefit from these water resources. All share the responsibility of protecting them.

New watershed challenges have arisen since 2001

The original Restoration & Protection Plan was issued in 2001, and can be viewed here: http://www.cayugawatershed.org/ . The accompanying encyclopedic Watershed Characterization document can be viewed here: http://www.cayugawatershed.org/characterization/

Since the first Plan was issued in 2001, new challenges have arisen that negatively affect water quality and quantity and the seemingly modest goal of a sustainable, healthy watershed. These challenges include climate change and extreme weather, resulting in the need for farmers and other producers to adapt; shifting patterns and seasons for wildlife, birds, tree species, other plants and biota; and shifting political and economic priorities that can quickly affect our ability to protect natural resources.

These changes affect human use and enjoyment of land and water, and are introducing new hazards, including invasive species, large-scale energy development, drought, and emerging pollutants to the 2001 Plan list of concerns that were focused around sources of pollution to the lake.

We enhance the economic vitality of the region while protecting the environment by working together via the Intermunicipal Organization (IO) and its allied groups in local communities, and at county, state and federal levels. The IO and allies first developed

a collaborative management plan and planning process for the Cayuga Lake watershed in the late 1990s.

Updating the plan: A public process, 2015-2017
In 2015-2017, the IO and Cayuga Lake Watershed Network joined forces to revisit the plan under the sponsorship of the Town of Ithaca, with a grant from the NYS Department of State. The process drew in hundreds of people, dozens of agencies, and numerous experts to update the plan and develop new recommendations for action to better protect our water resources.

The central 2017 goals of the Cayuga Lake Watershed Restoration and Protection Plan (RPP) are:

to inspire, to prioritize actions and strategies, and to bring about legislative change vital to protecting and preserving Cayuga Lake and its watershed. By supporting this plan, the Intermunicipal Organization (IO), municipalities, farmers, residents, private and public partners, and watershed stakeholder nonprofit organizations can build a productive economy which sustains a healthy watershed.

See full RPP Goals statement, p. 15.

Top priorities for next-steps action
Water protection and improvement strategies in this Plan address public concerns, expert recommendations, and municipal needs.

- The Top Priority IO Action Recommendations are found in Section II, p. 18.
- Public Priority Recommendations for Action are found in Section II, p. 20.
- Expert Priority Recommendations for Action are found at the end of Section III (pp. 25-44) and at the end of each of the Action Category chapters in Section IV, beginning on page 45.
- Next Steps: 2017-20 Watershed Coordination, Collaboration and Partnerships, p 22.

These water quality and quantity improvements and protections cannot happen overnight. Implementation of the plan will occur on a project-by-project basis, focused on the prioritized water quality threats and issues identified in the Plan.

What is the bottom line for this plan to work? Cooperation among municipalities and active citizen participation are the critical components for the success of the Cayuga Lake Watershed Restoration and Protection Plan, and for the future good health of our lake, creeks, streams, springs, waterfalls, and wetlands. As stated in the IO's 2017 Purpose and Charge:

The purpose of the Intermunicipal Organization is to bring the watershed municipalities together to work collectively and collaboratively on monitoring, protecting, and restoring the health of the watershed.

See full IO Purpose and Charge, p. 16.

How to Use this Plan

The scope of this two-year project included updating the Cayuga Lake Watershed Restoration & Protection Plan (2001), but not the accompanying Characterization (2000), an encyclopedia of information and data about every water-related aspect of the Cayuga Lake Watershed, the work of several people over several years time. In scale, the Plan is Earth to the Characterization's Jupiter. Much of the Characterization's data and almost all of its internet links are outdated, though useful as historic baseline data for new projects.

Thus this 2017 Plan combines an historic perspective with the functionality of a cookbook. Each section and chapter describes changes since 2001, and discusses how the original Plan's recommendations were implemented or remain current.

Each section and chapter summarizes the present-day status of watershed topics such as education, public participation, stormwater management, etc, and provides links to the latest information, data and programs about these topics at the local, county, state and if germane, federal level. Recommendations for action are provided for each topic, and 2017-20 next steps are described.

In these pages a watershed resident, student, elected official or staffperson can learn the history of the issue they are interested in, and find out which steps to take today to tackle a challenge to water quality they are facing in their municipality.

To view the 2001 Plan, go to the Cayuga Lake Watershed Intermunicipal Organization's website http://www.cayugawatershed.org/ .

The 2000 Characterization may be viewed here http://www.cayugawatershed.org/characterization/ .

To view this 2017 Plan online, go to the Cayuga Lake Watershed Network website http://www.cayugalake.org/watershed-plan-update-process.html.

For more information about the Intermunicipal Organization, contact Chair Tee-Ann Hunter at tdh12344@hotmail.com .

The 2017 Plan's internet links are current as of March 2017. If a reader of this Plan finds that a link is no longer active, please notify steward@cayugalake.org or RJohnston@cityofithaca.org .

I. Introduction

A. The 2017 Plan Update, Built on the 2001 Plan

The Cayuga Lake Watershed Restoration and Protection Plan (RPP) process began in 1998 with the creation of the Cayuga Lake Intermunicipal Organization. The central focus from the beginning of the process was to identify priority issues and solutions on a watershed-wide basis and have all of the local governments and organizations in the watershed agree on the priorities and work together to access funding in order to implement the recommendations of the RPP.

The several-year process to conduct new research, collect existing information, and motivate the involvement of the public and the watershed municipalities, is detailed in the "Approach" section of the 2001 Plan
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/AOC/cayapproch.htm

The 2001 Plan was built around the major section, "Water Quality Status, Water Quality Issues and Areas of Concern," and eleven topical "Action Categories."

For the 2015-7 update process, the water quality section has been revised and expanded, and several new topics have been added. The original eleven action categories have been revised and updated.

The Water Quality section and Action Category chapters each conclude with a list of Recommendations for actions that need to be taken to improve the targeted water quality, quantity or watershed issue. These Recommendations provide municipalities, community groups and citizens with prioritized, science- and research-based guidance for restoration and protection of the Cayuga Lake Watershed. Communities and citizens are encouraged to take a leadership role in this protection process by staying involved, at the local municipal and county level, in water-protection decision-making.

The top priority water quality threats and issues identified in this new Plan will be addressed and tackled over the next 3 to 5 years. New issues will arise, requiring re-evaluation and revision of the RPP and its recommendations for action. The RPP will be revisited and updated every five years, or more frequently; see Statement of Watershed Restoration Plan Vision & Goals and Statement of Intermunicipal Organization Purpose and Charge, pp. 15-17.

B. The Cayuga Lake Watershed: Brief Geographic Summary

1. Hydrology and topography

The Cayuga Lake watershed covers 785 square miles (approximately 500,000 acres) of agricultural, residential, urban, industrial, and forest land. Although the dominant surface water feature of the basin is the lake itself, a network of more than 140 waterbodies (perennial creeks and streams, ephemeral short streams, and springs) flow into the lake. See the watershed maps in Appendix F, page 172 (subwatersheds, administrative units, and human population density). Also online

http://www.cayugalake.org/files/all/cayuga_lake_subwatersheds_terrain_lowres_ver2_1.pdf.

Cayuga Lake is the second largest Finger Lake after its neighbor to the west, Seneca Lake. At 38.2 miles in length, it is the longest of the eleven Finger Lakes, and 1.75 miles wide (average width). Cayuga is second deepest after Seneca (which is up to 617 feet deep). Cayuga is up to 435 feet deep with a total shoreline of over 95 miles. Between them, Cayuga and Seneca lakes hold 80% of the Finger Lakes' water.

Thanks to a complex glacial history, several creeks have notable waterfalls, including Taughannock Falls, at 215 feet the highest single-drop waterfalls east of the Rocky Mountains. Taughannock Falls State Park is on the lake's west shore in the Town of Ulysses.

The often-spectacular topography was formed through periods of glacial advance and recession which deepened and widened the Cayuga Lake Valley and smoothed the surrounding hills. Waterfalls are found at the steep drops carved by the glaciers; widespread wetlands grace the upland surfaces. Owing to Cayuga Lake's relatively large size and significant depth, it is estimated that water entering the lake's southern end takes over 10 years to cycle north through the lake and out Mud Lock.

The Cayuga Lake watershed is part of the Oswego River Basin. The Oswego River Basin in Central New York State is a diverse system made up of numerous natural and human-altered hydrologic components that flow north to Lake Ontario. Cayuga Lake and other Finger Lakes are headwaters to the Great Lakes.

Within the Oswego River Basin, Cayuga Lake is downstream of Keuka and Seneca Lake. Keuka Lake waters flow into Seneca Lake via the Keuka Lake Outlet. Seneca Lake waters flow into the extreme northern end of Cayuga Lake via the Seneca-Cayuga Canal.

The northern outlet of Cayuga Lake receives about 48 percent of the total runoff from the Oswego River Basin's 5,100 square miles. Cayuga's waters flow via Mud Lock north into the Seneca River/Barge Canal, through the Montezuma National Wildlife Refuge's vast wetlands; and eastward across the Syracuse area. The Seneca River turns north as it joins the Oswego River, and Cayuga's waters flow into Lake Ontario at the city of Oswego.

For more information about the Oswego River System, see *Managing the Water Resources of the Oswego River Basin in Central New York*, USGS Fact Sheet 180-99 (revised 2002) http://www.cayugalake.org/files/all/usgs_oswego_rb_report_fs180-99.pdf

2. Economic strengths of the Cayuga Lake watershed

The land area of the Cayuga Lake Watershed includes six counties and 45 municipalities (cities, towns, and villages), and is home to 133,942 people, according to 2010 U.S. Census data (See human population density map, p. 174). The Cayuga

Lake watershed includes the land area that drains to the north end of Cayuga Lake via the Seneca-Cayuga Canal.

The economic and natural resources found in the Cayuga Lake watershed are valuable to residents and visitors alike. Economic resources include agriculture, tourism and recreation, real estate, industry, and commerce. Natural resources include wildlife, parks, fisheries, wetlands, forests, and water.

A healthy watershed makes good economic sense

The watershed's beaches, rivers, and lakes are an attractive vacation destination. In the Cayuga Lake watershed, tourism and recreational activities include boating, bicycling tours, hiking, sport and recreational fishing, hunting, bird watching, swimming, and camping, and winter recreational activities.

While the values, impacts and needs of recreation and tourism for the entire Cayuga Lake watershed are not thoroughly documented, we know that gross economic revenues of Finger Lakes tourism is on the order of $2.9 billion each year, supporting 59,293 jobs in 2015 (6.4% of all employment in the Finger Lakes). According to a study conducted for the Tompkins County Visitors Bureau in 2009, Tompkins County alone recorded more than 840,000 visitors, generating $156 million in associated spending and supporting more than 2,300 jobs. Along with world-renown educational institutions, the top motivators listed by visitors for these visits were directly or quite closely related to Cayuga Lake and its network of waterbodies.

According to a 2015 study, tourism in the Finger Lakes generated $863 million in direct labor income and $1.44 billion including indirect and induced impacts. The average household in the region would have to pay an additional $472 to maintain the same level of government revenue, without tourism-generated state and local taxes (*The Economic Impact of Tourism in New York 2015 Calendar Year, Finger Lakes Focus.* 2015. Tourism Economics, an Oxford Economics Company).

In addition to a flourishing local products and markets industry – wine, beers, ciders, liquors, cheeses, specialty crops, honey, and maple syrup among them – and a massive recreational boating industry, seven state parks and numerous county/town parks provide public access to the lake and preserve the integrity of various natural resources. Better understanding of recreation and tourism in the Cayuga Lake watershed would allow such benefits to be maximized while minimizing detrimental impacts on lake quality.

The Finger Lakes Region attracts businesses and educational institutions seeking a high quality of life for their employees and families. The region's tax base is tightly linked to lake proximity. In the town of Varick in Seneca County, for example, approximately 80% of the total taxable real estate assessment value in some years has been from lakefront properties.

Those tax revenues would decline when living on the lake became less appealing if lake quality were to diminish, and remaining residents would have to scramble to support critical services including schools and fire departments. Protecting Cayuga Lake and its wider watershed's water quality is essential to continued community prosperity.

C. Vision and Goals of the Cayuga Lake Watershed Restoration and Protection Plan

During the summer and fall of 2015, the Cayuga Lake Watershed Advisory Committee (WAC) updated the 2000 Vision & Goals statement in preparation for watershed leadership in a rapidly emerging era of rapid change and challenge. Change agents include climate change, extreme weather events and resulting threats to water security, quantity and quality; privatization of public space; and threats to watershed protection from energy development, invasive species, emerging contaminants, and conflicting goals for land use and development.

1. Vision for the Cayuga Lake Watershed Restoration & Protection Plan

Cayuga Lake is recognized and valued as the watershed's foremost natural feature and resource, deserving protection of its water and of the tributaries that drain to it. Protection can be achieved via adoption of land-use plans, practices, and regulations that minimize pollution, stormwater runoff, erosion and sprawl; preserve viewsheds, ecosystems, and soils; promote recreational uses; and that result in a sustainable and diverse economy contributing to a vibrant regional self-sufficiency. Clean water is essential to thriving communities.

2. Goals of the Cayuga Lake Restoration & Protection Plan

The central goals of the Restoration and Protection Plan (RPP) are to inspire, to prioritize actions and strategies, and to bring about legislative change vital to protecting and preserving Cayuga Lake and its watershed. By supporting this plan, the Intermunicipal Organization (IO), municipalities, farmers, residents, private and public partners, and watershed stakeholder nonprofit organizations can build a productive economy that sustains a healthy watershed. Watershed protection goals and actions include

- Minimize nonpoint source pollution of surface and groundwater.
- Remediate existing water pollution and water quality degradation.
- Preserve open space, wetlands and riparian areas for effective water quality protection.
- Support economic activities consistent with watershed protection.
- Provide programs to educate the public and public officials of issues pertaining to the watershed.
- Implement comprehensive plans, zoning and natural-resource ordinances to support watershed protection.
- Work together with other municipalities to secure funding to implement the RPP.

- Be good intermunicipal watershed neighbors: coordinate zoning plans, programs, projects and permits to minimize downstream impacts.
- Coordinate and improve communications and partnerships in projects with intermunicipal water quality impacts.
- Protect and restore areas critical to maintaining and restoring water quality.
- Work with agencies and authorities to ensure that their activities are compatible with the RPP.
- Support ecosystem dynamics research to prevent and/or respond to threats to ecosystem integrity.
- Keep abreast of new concerns such as emerging contaminants and invasive species threats.
- Protect and expand public access to the lake.
- Plan for resilient and adaptive responses to climate change.
- Revise the RPP to incorporate the requirements of US EPA's "9 Elements" planning standards.
- Review the RPP, Vision & Goals within five years following adoption of the Plan.

D. Purpose and Charge of the Cayuga Lake Watershed Intermunicipal Organization

During the fall of 2015, the Intermunicipal Organization (IO) updated its 2000 Purpose and Charge to match present and future goals of the group, its plans for an expanded role in the watershed, and to meet the changing needs of the Cayuga Lake watershed.

1. Purpose of the Cayuga Lake Watershed Intermunicipal Organization

The municipalities within the Cayuga Lake watershed recognize the enormous and irreplaceable ecological, economic and social value of Cayuga Lake, its tributaries, and its wetlands. The purpose of the Intermunicipal Organization is to bring the watershed municipalities together to work collectively and collaboratively on monitoring, protecting, and restoring the health of the watershed.

2. Charge for Administering the Cayuga Lake Watershed Restoration and Protection Plan

Charged with administering the RPP, the IO will

- Provide a forum for all municipalities within the watershed to interact, exchange information, and work together to protect the watershed as a whole.

- Set priorities from the RPP for action.
- Approve an annual work plan and budget.
- Develop funding for municipal and intermunicipal projects consistent with priorities.
- Review and approve funding requests consistent with priorities.
- Maintain required financial and administrative functions.
- Commit to revising the RPP to incorporate the requirements of US EPA's "9 Elements" planning standards.
- Commit to reviewing the RPP, Vision & Goals in five years from implementation of the updated RPP, Vision & Goals.

II. Recommendations for Action and Next Steps

A. Top IO Priority Recommendations for Action

The Cayuga Lake Watershed Intermunicipal Organization (IO)'s top priority recommendations for action are drawn from the 2017 Plan's individual chapters and the work of water quality experts who contributed their time and expertise to the update. Additional input was provided by municipal staff and officials, non-profit organizations working on water quality issues, and engaged and interested citizens.

Work on the update has coincided with New York State's phosphorus reduction project, the Whole Lake Phosphorus TMDL (Total Maximum Daily Load), necessitated by the listing of Cayuga Lake's southern shelf on the Federal Clean Water Act Section 303(d) list of impaired water bodies for both phosphorus and sediment. The TMDL, while yet to be finalized, has affirmed a regional understanding that the majority of phosphorus entering the lake comes from non-point sources. This, along with a verified understanding that the circulation of waters within the lake provides the possibility for events happening at one end of the lake to impact the waters of the other end, helped focus our recommendations.

And finally, a 2016 grant awarded through the NYS Department of State Local Waterfront Revitalization Program (LWRP) provides funding to turn plan update recommendations into implementation projects. Fulfillment of the tasks outlined in the grant's plan of work has been factored into our recommendations.

The IO has identified the following priorities. It is our intention to move these recommendations forward over the next 3 years. Upon completion of the upcoming LWRP project, the IO will revisit and update these recommendations.

MONITORING

Consistent monitoring of the lake and its tributaries is necessary for the restoration and protection of the watershed.

1. Develop and implement a monitoring plan for the entire watershed that is based on the 2008 Monitoring Plan for the South Basin of Cayuga Lake and the 2001 Framework for a Cayuga Lake Monitoring Plan.

2. Work with partners to ensure funding is established for long-term lake and tributary monitoring, expanding monitoring to include all tributaries draining into the lake.

3. Increase the frequency and regularity of monitoring in the lake.

4. Investigate the sources of phosphorus and *E. coli* in streams and ditches draining agricultural areas.

5. Implement phosphorus and chlorophyll monitoring, targeting areas near the mouths of streams that load large amounts of phosphorus to the lake that may be at risk of harmful algal blooms (HABs).

6. Continue an aggressive hydrilla identification and eradication program.

7. Broaden monitoring efforts to include pesticides and emerging contaminants such as pharmaceuticals and microplastic particles.

STORMWATER MANAGEMENT & EROSION CONTROL

Stormwater runoff carries with it pollutants and sediment that threaten the health of the watershed. Efforts to understand and manage the watershed's stormwater drainage system are essential to maintaining water quality.

1. Design and develop a watershed-wide stormwater management strategy, modeled on the Stormwater Coalition of Tompkins County.

2. Create a GIS-based "asset" inventory of roadside ditches for the purpose of identifying best ditch management practices and developing a watershed-wide ditch management program.

3. Work with county Soil and Water Conservation District offices and local municipalities to promote the creation and restoration of stream and lakeside buffers.

4. Work with county Water Quality Coordinating Committees on development and promotion of wetland protection legislation.

5. Create an inventory of industrial and commercial water users, and document water export from the watershed.

COLLABORATION AND COORDINATION

There are 6 counties, 34 towns, 9 villages, and 1 city in the Cayuga Lake Watershed. Effective watershed restoration and protection efforts necessitate intermunicipal collaboration and cooperation.

1. Support relationships between county Soil and Water Conservation District offices and local municipalities around water quality improvement projects, including help identifying projects, project partners, and sources of funding.

2. Work with county Soil and Water Conservation District offices to foster relationships and communication with the agricultural community, including providing support for funding requests for water quality-related projects.

3. Work with county Planning Departments to recommend and distribute model legislation to local municipalities and for help in identifying and protecting critical resource areas.

4. Work with county Health Departments to establish and implement watershed-wide septic system inspections and regulations.

5. Work with state, county, and local highway departments to establish and implement a ditch management maintenance program.

6. Support local governments in their efforts to upgrade aging water and sewer infrastructure.

PUBLIC EDUCATION AND ENGAGEMENT

Cayuga Lake and its watershed are the defining features of our area, beloved by residents and visitors alike. Preserving, protecting, and restoring this natural and economic resource requires an engaged and committed public.

1. Work closely with the Cayuga Lake Watershed Network to strengthen relationships with existing and emerging community groups.

2. Support the educational efforts of the Cayuga Lake Floating Classroom and the Cayuga Lake Watershed Network.

3. Support the work of the Finger Lakes Land Trust in identifying and preserving critical resource areas.

4. Encourage state and local efforts to provide public access to the lake and its tributaries.

5. Support efforts to create and provide educational opportunities for area school children, focused on Cayuga Lake and its watershed.

These priority recommendations for action were approved by the Cayuga Lake Watershed Intermunicipal Organization on March 22, 2017.

B. Public Priority Recommendations for Action

During 2015-6, two public input meetings were held to hear from the public about their concerns and recommendations. Additionally, an online survey (10/15-8/16) collected information from over 300 respondents to questions and concerns about the lake and recommended actions.

Following are the public recommendations for action from the public meetings and from the online survey. The full description of this process is provided in Plan section IV, Chapter A., Public Participation.

Public input meetings summer 2015

Recommendations for policy and action to protect lake and watershed

- Develop & enforce better land use practices for homes, farms, businesses.
- More public access for recreation and swimming – add two more beaches.
- Develop a lake-focused curriculum for schools and the public.
- Collect more data watershed-wide for better-informed decision-making.
- More funding for agencies and municipalities.
- Stop subdividing large properties into many building lots.
- Share best management practices across the watershed.
- Develop regulations for steep slope building and development control.
- Develop school curriculum for lake and water education with a stewards program for school youth, with input from educational institutions in the watershed.
- Develop a unified system for supporting and upgrading septic systems/sewers, like the rigorous inspection program on Otsego Lake, replacing old systems via low-interest loans attached to deeds.
- Anticipate privatization, encourage diversity.

Public response to the online survey October 2015-August 2016

Top actions that could most effectively protect or restore the watershed (302 respondents)

1 - Improving farming practices to reduce runoff and erosion. *75% of all 302 respondents.*
2 - Improving protection of wetlands and riparian corridors/buffers (land along the lake, creeks and streams). *65%.*
3 - Improving stormwater management and erosion control. *62%.*
4 - Improving control of invasive species. *51%.*
5 - Fostering stewardship through education and citizen engagement. *44%.*
6 - Improving communications, collaboration and partnerships across municipal and agency boundaries. *42%.*
7 - Improving private wastewater systems (septic systems*). 39%.*
8 - Improving public wastewater systems management. *38%.*
9 - Providing lawn care education to reduce erosion and lawn chemicals runoff. *27%.*

10 - Improving forestry management. *10%.*

C. Expert Priority Recommendations for Action

The Water Quality section (Section III) and Action Category chapters (Section IV, pp 45-153) each concludes with a list of recommendations for actions that need to be taken to improve the targeted water quality, quantity or watershed issue. The most significant/urgent of these have been incorporated into the Top IO Priority

Recommendations for Action, above on page 18. See Appendix G., p. 175 for a full Compilation of Action Recommendations.

D. Next Steps: 2017-20 Watershed coordination, collaboration and partnerships

Introduction: Uniting the watershed through new initiatives
Cayuga Lake is long and narrow. Much of the watershed's land area is distant from the lake, making it difficult for some residents to see a direct connection. Some do not understand that impacts to upland creeks and streams can affect downstream water quality and the lake itself.

The watershed is further divided by administrative, municipal, county, agency, development and regional boundaries. The north and south ends of the lake are culturally and politically different. As described in the Preface and the Introduction's Geographic Summary, these characteristics make it difficult to encourage a unified watershed capable of protecting its water resources.

Initiatives proposed and carried out by one of the three major shoreline counties (Seneca, Cayuga, and Tompkins), are easily missed or ignored by the other two, weakening the effectiveness for the lake as a whole.

The IO is a good model for overcoming these distances and differences. A Local Waterfront Revitalization Grant awarded to the IO by the NYS Department of State in the fall of 2016 will jump-start intermunicipal projects and partnerships for a three-year period from 2017-2020. The project will unfold in four phases, detailed below.

1. Goals for Coordination, Collaboration and Partnerships

The 2001 Plan's goals for coordination, collaboration and partnerships remain viable in 2017:

Coordination, collaboration and partnerships are the key to efficient and effective watershed management. All groups and organizations that do work within the Cayuga Lake Watershed should coordinate their activities and consider partnerships and collaboration as an efficient and effective means of improving the Cayuga Lake Watershed.

The participation of watershed partners in IO efforts, including watershed municipalities, IO Committees, the Cayuga Lake Watershed Network, the Cayuga Lake Watershed Steward, Cornell Cooperative Extension, the County Water Quality Coordinating Committees, and the Soil & Water Conservation Districts, academic institutions, as well as State and Federal agencies, is vital to the IO's success and to protection of our lake and tributaries.

2. Strengthening the IO and funding its municipal members, 2017-2020

The three-year Local Waterfront Revitalization Program-funded planning project begins in 2017. The project supports implementation of the top IO Priority Recommendations presented on page 18.

Goals of the project

- Redefine a sustainable operational and organizational structure for the Cayuga Lake Intermunicipal Organization (IO);
- Design a defensible and logical set of criteria for prioritizing watershed improvement recommendations made in the updated watershed management plan;
- Identify specific projects that advance the current watershed plan recommendations;
- Advance project preparedness in advance of funding opportunities that support implementation.

A primary objective of the project is to bring together municipal officials, professional staff, and regional state agencies to partner in identifying, planning, and implementing regional watershed improvement projects, many of which, by the very nature of this large watershed, need intermunicipal engagement and cooperation.

It is anticipated that as a result of this project watershed improvement projects will complement rather than compete with each other, thereby maximizing restoration and protection efforts and leveraging available funding to the maximum extent possible. Proactive project planning will streamline and improve effective grant proposals and create opportunities to implement a greater number of high benefit projects across the watershed.

The Town will contract with Central New York Regional Planning and Development Board (CNY RPDB) to manage the project and with the Cayuga Lake Watershed Network (CLWN) for the public outreach and educational components of the project. Both CNYRPDB and CLWN were involved in the original watershed management plan and its update. The project will be overseen by the IO, comprised of representatives from watershed municipalities.

3. Planned actions for Watershed Coordination, Collaboration and Partnerships, 2017-2020

The 2017-2020 project's four phases are designed to ensure ongoing public participation and engagement, local commitment and support. The Intermunicipal Organization of the Cayuga Lake Watershed (IO) recruits municipal government membership for watershed protection among the watershed's 45 municipalities, by encouraging regular participation in monthly meetings for improved communication about water quality issues, to encourage communication and cooperation across municipal and county boundaries, and to help write grants for replacement, improvement and enhancement of natural and built water quality infrastructure.

- **Phase I:** The project team will enlist IO municipality representatives in a subcommittee to review a researched selection of improved forms of governance in order to make the IO fully functional and more inclusive. The IO and Interagency Committee will work with the project team to select, approve and implement the organizational and operational structure best suited for the Cayuga Lake watershed's municipalities.

- **Phase 2:** The reorganized IO will work with the project team and Interagency Committee to review the watershed protection recommendations in the 2017 Cayuga Lake Watershed Restoration & Protection Plan, and prioritize for a first round of implementation projects that will protect and restore water quality infrastructure, natural and human features for the public good.

- **Phase 3:** The IO, Interagency Committee, and project team will identify and select specific projects for several watershed municipalities while weighing scale, opportunities, and public benefits.

- **Phase 4:** The IO, Interagency Committee, and project team will finalize several local water quality protection projects for funding & implementation. The Project Team and Interagency Committee will complete conceptual planning and design, data collection and analysis, and guide municipal applicants through the grant process for funding.

Public engagement is part of every step of this project through the active involvement of community representatives. Detailed specifics, workplan and timeline of this three-year project are available from the IO.

III. Water Quality Status and Water Quality Issues, including Geographic Areas of Concern

A. Water Quality Status

Data collected since the original watershed plan was issued in 2001 have added appreciably to our understanding of water quality. Nevertheless, significant data gaps remain.

Overview of major surface water monitoring activities and data sources

New York State

The New York State Department of Environmental Conservation (NYS DEC) is required under the federal Clean Water Act to track water quality in all of the state's water bodies, including streams, lakes, estuaries and bays, and to certify to the Environmental Protection Agency (EPA) every two years that waterbodies meet their designated uses. To track water quality, NYS DEC divides New York into 17 major drainage basins and studies each basin every five to six years, or approximately three drainage basins per year, in what is referred to as the Rotating Intensive Basin Studies (RIBS) program (http://www.dec.ny.gov/chemical/30951.html). A RIBS survey of a major drainage basin takes two years.

Biomonitoring using benthic macroinvertebrates (BMI) is conducted at a small number of sites in Year 1. In Year 2, any sites found to have impaired water quality based on BMI are selected for intensive chemical and toxicological analysis. RIBS results are reported in narrative form in the DEC's Waterbody Inventory/Priority Waterbodies List (WI/PWL) (http://www.dec.ny.gov/chemical/36730.html), and they are included in New York's 305(b) report to EPA every two years as required under the Clean Water Act (http://www.dec.ny.gov/chemical/66532.html). The NYS DEC's water home page (http://www.dec.ny.gov/chemical/290.html) links to narrative assessments of water quality.

Any waterbody found to be impaired with respect to its designated use may be nominated by DEC for placement on the federal list of impaired waterbodies under section 303(d) of the Clean Water Act http://www.dec.ny.gov/chemical/31290.html. If approved for 303(d) listing by EPA, the impaired waterbody is remediated by setting Total Maximum Daily Loads for pollutants. The shallow shelf area at the south end of Cayuga Lake was placed on the federal 303(d) list in 2002 for phosphorus and sediment. It was listed further for pathogenic bacteria in 2008, however, this listing was reversed in 2014 based on data collected by local monitoring programs.

The Cayuga Lake watershed is located within the Seneca-Oneida-Oswego River drainage basin. Given the size of the basin, locations in the Cayuga Lake watershed may or may not be included as part of the routine 5-year RIBS monitoring cycle. The most recent RIBS survey of Cayuga Lake and its tributary streams was conducted in 2007 with updates in 2015 related to the development of a phosphorus TMDL for Cayuga Lake (http://www.dec.ny.gov/docs/water_pdf/wioswegocayugainlet.pdf, http://www.dec.ny.gov/docs/water_pdf/wioswegosalmoncr.pdf,

http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf, http://www.dec.ny.gov/lands/88250.html).

Academic Research

Cayuga Lake has a history of academic research projects, summarized in these introductory paragraphs, with in-depth information following. Physical, chemical, and biological conditions of the lake and its tributary streams have been investigated over the years by Cornell University faculty including limnological studies by Oglesby and colleagues (https://energyandsustainability.fs.cornell.edu/util/clmp/documents.cfm, 1978)**,** nutrient and sediment loading studies by Bouldin and colleagues (in process, spring 2017) and by Haith (https://energyandsustainability.fs.cornell.edu/util/clmp/documents.cfm, 2012).

Halfman and his students at the Finger Lakes Institute of Hobart and William Smith Colleges in Geneva include Cayuga Lake in an annual survey comparing water quality in eight of the eleven Finger Lakes (http://people.hws.edu/halfman/FL-Lim/FL-Limnology.htm).

Northern Cayuga Lake water quality has also been characterized by researchers at SUNY-Brockport (http://cayugalake.wikispaces.com/file/view/Water+Quality+of+the+North+End+of+Ca.pdf).

Cleckner and her colleagues at the Finger Lakes Institute investigate invasive species and algae along the lake's northern shores and in the lake (https://flihappenings.com/2016/07/22/research-connections-invasive-species-and-benthic-algae-in-the-finger-lakes/).

Research conducted as conditions of SPDES permits for Cornell University's Lake Source Cooling facility

In addition to research projects initiated by individual faculty, Cornell University has sponsored two major investigations as conditions for maintaining its SPDES permit to operate its Lake Source Cooling facility on the southeast shore of Cayuga Lake. First, the University conducted detailed monitoring of phosphorus, chlorophyll a and other parameters on the lake's shallow southern shelf from 1998-2012, creating a unique and valuable data set (https://energyandsustainability.fs.cornell.edu/util/cooling/production/lsc/monitor.cfm). From 2013-2017, the University sponsored the Cayuga Lake Modeling Project, an ambitious combination of lake hydrodynamic and phosphorus loading studies designed to provide the NYSDEC with data needed to develop a phosphorus Total Maximum Daily Load (TMDL) for the 303(d)-listed south end of Cayuga Lake, as required under the Clean Water Act (https://energyandsustainability.fs.cornell.edu/util/clmp/default.cfm).

Research by local stakeholders

The Ithaca Area Wastewater Treatment Plant monitors water quality near the mouth of the Cayuga Inlet and at the south end of Cayuga Lake where it discharges treated wastewater (http://www.ithacawaters.org/).

The Community Science Institute (CSI) (http://www.communityscience.org/) partners with nine groups of volunteers to conduct regular monitoring of approximately 100 locations on streams draining about 70% of the watershed as well as several locations on Cayuga Lake, producing chemical and microbiological data in its certified lab (NYSDOH ELAP ID# 11790) and posting the results in its free public data archive (http://database.communityscience.org).

CSI also partners with volunteers to conduct biomonitoring of streams using communities of benthic macroinvertebrates (BMI) as indicators of ecosystem health (http://www.communityscience.org/bmi-results/).

Groundwater studies

Several studies of groundwater aquifers have been carried out by the US Geological Survey's New York Water Science Center, Ithaca Program Office http://ny.water.usgs.gov/about/officeithaca.html.

Overview of water quality

Cayuga Lake

Compared to other Finger Lakes, Cayuga Lake's water quality is generally good (http://people.hws.edu/halfman/FL-Lim/FL-Limnology.htm). Water quality standards, particularly levels of pathogenic bacteria as indicated by E. coli, are being met for the protection of recreational uses (http://database.communityscience.org/monitoringsets/9, http://database.communityscience.org/monitoringsets/7, http://database.communityscience.org/monitoringsets/39). An exception to this assessment is in the shallow southern tip of the lake (in Tompkins County) where sediment and nutrients loaded from Fall Creek and the Cayuga Inlet result in weed and algal growth that impair summer recreational uses. Recently, Cleckner and colleagues at the Finger Lakes Institute have reported that algal blooms, including cyanobacteria (Harmful Algae Blooms, or HABs), may be more frequent along the Seneca and Cayuga county shorelines of the lake than previously understood (https://flihappenings.com/2016/07/22/research-connections-invasive-species-and-benthic-algae-in-the-finger-lakes/).

Most of the lake is classified as being suitable for use as a drinking water supply (Class AA(T), A(T), or A); a small portion of the lake at the northern/outlet end is Class B(T) (Water Quality and Classifications NYSDEC http://www.dec.ny.gov/chemical/23853.html). Current water quality standards for water supply use of the lake are also being met. However while NYSDEC considers the lake to have water quality suitable for use as a water supply, this use has been assessed as threatened. The assessment is based on the NYS DOH Source Water Assessment Program (SWAP) evaluation of the potential, rather than actual, impacts to water supply use. The classification of much of the lake as a Class AA water, which designates the lake as suitable for use as a drinking water source *requiring a minimum of treatment,* makes the lake more vulnerable to potential sources of pollution.

For Cayuga Lake, the potential threats to its designated use as a drinking water source are, according to NYS DEC, due to considerable agricultural activity, wastewater sources, and other contributors of nutrients in the watershed. Elevated

nutrient and chlorophyll levels in the lake tend to be correlated with the formation of disinfection by-products (DBPs) in finished potable water that would require advanced treatment to meet drinking water standards. DBPs are formed when disinfectants such as chlorine used in water treatment plants react with natural organic matter (i.e., decaying vegetation) present in the source water. Prolonged exposure to DBPs may increase the risk of certain health effects. The most recent water quality assessment of Cayuga Lake conducted under NYS DEC's RIBS program was in 2007 and can be found in the Waterbody Inventory Priority Waterbodies List (WI/PWL) Report for the Oswego River/Finger Lakes Basin at http://www.dec.ny.gov/docs/water_pdf/cornelllscpwlasmt.pdf. The assessment for the impaired south end was updated in 2015 while the assessments for the mid-south, mid-north and north end segments were updated in 2016 (http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf)., These updates were undertaken in connection with the whole lake phosphorus TMDL that NYS DEC will release for public comment in May, 2017.

Cayuga Lake tributary streams

Overall, evidence gathered since 2002 confirms that most tributary streams exhibit moderate to high water quality, according to chemical indicators; they also exhibit habitat conditions that support a balanced biological community, as indicated by benthic macroinvertebrate (BMI) analysis. However, levels of pathogenic bacteria, based on tests of E. coli as a "red flag" indicator, exceed the recommended limit for contact recreation (235 colonies E. coli per 100 ml) at most of the ~100 stream locations tracked by CSI-volunteer monitoring partnerships (http://www.database.communityscience.org/monitoringregions/1; click on links to individual streams ("monitoring sets"), then on "E. coli" in drop-down menu of graph). Emerging evidence indicates that levels of pathogenic bacteria as well as bioavailable phosphorus are higher in the lake's northern tributaries (http://www.communityscience.org/whats-in-your-watershed-series/, 1/18/17, "Brief Overview of Water Quality Data in the Cayuga Lake Watershed;" see also Geographic Areas of Concern, below).

Selected Cayuga Lake tributaries were last assessed under the NYS DEC's RIBS program in 2007, when Yawger's Creek and Lower Taughannock Creek were examined using biomonitoring (BMI). Trumansburg Creek was assessed in 2016 in connection with an upgrade of the Village of Trumansburg wastewater treatment plant, to be completed in late 2016, that is designed to remedy a violation of its SPDES permit for pathogenic bacteria. The NYS DEC's 2015-6 waterbody assessment listing for Cayuga Lake and its tributary streams, which may be viewed here: http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf, makes it clear that the overwhelming majority of Cayuga Lake tributary streams have not been assessed under the RIBS program. The bulk of tributary data comes from the Community Science Institute's volunteer monitoring partnerships, Cornell University's Cayuga Lake Modeling Project, and earlier work by David Bouldin's group at Cornell (see above).

Groundwater

The Detailed Aquifer Mapping Program in Upstate New York was established in 1980 by the U.S. Geological Survey (USGS). By 2017, numerous aquifer studies specific to the Cayuga Lake watershed had been carried out, and the work continues. This

research is being used as the basis for several municipal-level drinking water protection plans and ordinances (see Geographic Areas of Concern, below). The aquifer studies include:

Todd S. Miller, D.A. Sherwood, P.M. Jeffers, and Nancy Mueller (1998). Hydrology, water-quality, and simulation of ground-water flow in a glacial aquifer system, Cortland County, New York. USGS Water-Resources Investigations Report 96-4255 https://pubs.er.usgs.gov/publication/wri964255

Todd S. Miller (2000). Unconsolidated Aquifers in Tompkins County, New York. USGS Water-Resources Investigations Report 00-4211 http://ny.water.usgs.gov/pubs/wri/wri004211/

Todd S. Miller (2009). Geohydrology and Water Quality of the Valley-Fill Aquifer System in the Upper Sixmile Creek and West Branch Owego Creek Valleys in the Town of Caroline, Tompkins County, New York. Prepared in cooperation with the Town of Caroline and Tompkins County Planning Department. USGS SIR 2009-5173. https://pubs.usgs.gov/sir/2009/5173/

Todd S. Miller and Daniel E. Karig (2010). Geohydrology of the Stratified-Drift Aquifer System in the Lower Sixmile Creek and Willseyville Creek Trough, Tompkins County, New York. Prepared in cooperation with the Town of Caroline and the Tompkins County Planning Department. USGS SIR 2010–5230. https://pubs.usgs.gov/sir/2010/5230/

Todd S. Miller and Edward F. Bugliosi (2013). Geohydrology, Water Quality, and Simulation of Groundwater Flow in the Stratified-Drift Aquifer System in Virgil Creek and Dryden Lake Valleys, Town of Dryden, Tompkins County, New York. Prepared in cooperation with the Town of Dryden and the Tompkins County Planning Department. USGS SIR 2013–5070 https://pubs.usgs.gov/sir/2013/5070/

Todd S. Miller (in process) Geohydrology of the Valley-Fill Aquifer in Upper Buttermilk Creek/Danby Creek Valleys, Town of Danby, Tompkins County, New York.
In addition, the Community Science Institute conducted comprehensive pre-fracking baseline testing of 16 groundwater wells in Tompkins, Cayuga and Seneca Counties (http://database.communityscience.org/groundwater) .

Monitoring and research point to water quality issues and specific geographic concerns

Despite the conclusion that water quality is generally good, several types of pollution migrate from the watershed to the surface water resources of the basin. Through the watershed planning process and ongoing monitoring programs, much has been learned regarding specific types and sources of pollution that threaten the lake and its tributaries for their designated uses under the Clean Water Act. This information has provided a factual basis for defining and describing updated **water quality issues** (defined as pollution types and sources) and **geographical areas of concern** (defined as sites in the lake or watershed that are implicated as sources of pollution). These have allowed for **issue prioritization**, updated to 2017. The 2017 Cayuga Lake Restoration and Protection Plan is built on the foundation provided by this analysis.

Priority areas reflect the significant sources and types of pollution that threaten the ecological integrity of the aquatic resources and, hence, their uses by human communities.

The issue prioritization, water quality issues, and areas of concern are detailed below, along with recommendations for additional data needed to set priorities and define effective remedial strategies. Links are provided to existing data sets, previewed in the sections above, and to a monitoring plan designed to fill data gaps, support priority determinations, and track progress towards improvement. The Plan's Section IV Chapters discuss strategies, recommendations and management options designed for these issues and areas of concern.

B. Water Quality Issues and Emerging Concerns

Several water quality issues threaten the continued use of our water resources as a high quality water supply and focus for recreation and aesthetic enjoyment. The following water quality issues, in priority order, pose the greatest long-term challenges to the ecosystem of Cayuga Lake and its watershed: sediment, phosphorus, fertilizers and pesticides, organic compounds, trace elements, pathogens, and exotic (invasive) species. View the assessment of these issues in the 2000 Plan: http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caystatus.htm

Each of these issues is updated to 2017 in the following paragraphs. Additionally, two new water quality issues have become apparent since 2001, and are discussed below: emerging contaminants, and climate change. The latter includes a brief introduction to an issue never previously considered a problem in this water-rich headwaters region: Water shortages.

Sediment

Sediment eroded from the landscape enters the extensive surface drainage network in the Cayuga Lake watershed and ultimately is transported to Cayuga Lake. Not all sediment is bad, but too much can become a pollutant. Important sources of sediment include streambank erosion, losses from cultivated fields, land development practices, and erosion along roadways. Materials applied to impervious surfaces wash into streams during storms and snowmelt. Stormwater runoff is the primary mechanism of transporting sediment from the watershed to the lake and streams. Both field observations and models were used to identify specific areas within the watershed contributing sediment from eroding streambanks, cultivated fields, development activity, and roadways. As described in the following sections, the major sources are different for each stream. This analysis has provided a basis for targeting restoration actions to specific sources and locations in order to reduce overall sediment loading.

Sediment: Streambank Erosion and Encroachment on Riparian Corridors

In the southern tributaries, the primary source of sediment appears to be streambank erosion. A detailed streambank survey was completed in 2000 documenting the severity and linear extent of bank erosion along major and minor streams throughout the watershed. The Salmon Creek subwatershed was reported with severe erosion problems, as was Fall Creek (including the nested subwatershed Virgil Creek), and Sixmile Creek (a nested subwatershed of Cayuga Inlet). Cayuga Inlet exhibited the

most severe streambank erosion problems in the entire basin. Detailed results of this analysis are presented in the 2001 *Cayuga Lake Preliminary Watershed Characterization Report* Streambank Inventory section and the map of Streambank Inventory by Subwatershed http://www.cayugawatershed.org/characterization/ . Geology, soil characteristics, and slopes in these subwatersheds contribute to the extent of erosion and sedimentation. Areas with erodible soils and steep slopes such as the Fall Creek and Six Mile Creek subwatersheds are naturally vulnerable to streambank erosion. Disturbance of natural vegetation along the shorelines of streams (the riparian corridor) can accelerate erosion. Finally, destruction and fill of the extensive wetland areas that were historically present in southern Cayuga Lake has exacerbated sediment loading by removing a natural filtration process that captured sediment from these southern streams before it entered the lake.

Also for the 2001 Characterization, Land use along riparian corridors throughout the watershed was examined. The majority of land within a corridor extending 150-ft along the tributary streams was categorized as "developed land"; agriculture by far the dominant land use. Only a few subwatersheds (Renwick, Canoga, Gulf Creek and Glenwood) had more than nine percent of the riparian corridor in residential land uses. Consequently, impervious surfaces represented a very small fraction of the riparian corridor on a watershed-wide scale in 2000.

Subwatersheds with a high percentage of the riparian corridor in developed land use are the most vulnerable to streambank erosion. These data and the following Table 2-1 from the 2001 Restoration and Protection Plan, but remain useful. They provide a baseline and can be updated for project needs.

Table 2-1. Percent of 150-ft riparian zone with developed land use, tributaries to Cayuga Lake

Subwatershed (view Subwatershed Map)	Percent Agriculture	Percent Residential	Total Percent Developed	ENCROACHMENT RANK
Great Gully	78	3	81	**High**
Yawger Cr.	74	3	77	**H**
Sheldrake	70	4	74	**H**
Hicks Gully	68	4	74	**H**
Paines Cr.	70	3	74	**H**
Ledyard	68	3	71	**H**
Tributary 68	64	5	70	**H**
Direct Drainage	61	7	70	**H**

Mack Cr.	63	1	64	**Medium**
Trumansburg	57	6	63	**M**
Salmon Cr.	58	4	62	**M**
Canoga Cr.	46	16	62	**M**
Renwick Cr.	23	27	61	**M**
Taughannock	50	4	54	**M**
Glenwood	41	10	52	**M**
Willow Cr.	48	1	49	**Low**
Fall Cr.	39	7	47	**L**
Gulf Cr.	37	9	46	**L**
Cayuga Inlet	28	8	38	**L**

Cayuga Lake Watershed Restoration and Protection Plan, 2001
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caystatus.htm

Sediment: Land Use & Development

Land use is also a factor in sediment loss. In 2017 agriculture, an important land use throughout the watershed, remains most concentrated in the northern two-thirds of the watershed, on both the eastern and western shores. As displayed in Figure 2-1 (2001 RPP), active agriculture ranged from more than 70% of the land area in Great Gully and Yawger Creek to less than 30% in Cayuga Inlet, and remains largely unchanged in 2017.

For the 2001 Plan, simple loading models were developed to estimate sediment loss based on land use and hydrologic conditions. As part of the technical analysis, annual average sediment loss from agricultural runoff was estimated for the major subwatersheds in the Cayuga Lake basin. These results, displayed in Figure 2-2 (2001 RPP), provide one basis for defining priority areas for action. The importance of Salmon Creek, a relatively large subwatershed with a high percentage of the land area in active agricultural use, was then evident and remains so in 2017. Monitoring is needed. A recommendation to install a stream gauge on Salmon Creek was included in the Monitoring & Assessment section of the 2001 RPP. A USGS gauging station was installed in July 2006 and operated until September 2009. It was reactivated in February 2013 for the Cayuga Lake Modeling Project and has been in continuous operation since then.

Areas of concern for agricultural runoff, which has the potential to transport sediment, nutrients, animal waste (a source of pathogens and oxygen-demanding material) and pesticides were noted in Table 2-2 (2001 RPP) and associated map of Potential for NPS Based on Land Use and Hydrologic Characteristics (2001 RPP) and remain a top

concern in 2017. The initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction is one of the largest potential sources of erosion and sedimentation. When natural vegetation and topsoil are removed, the exposed area is particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas. Sediment loss from developed areas is potentially significant in the Cayuga watershed. This table and data have not been updated from the 2000 Characterization and 2001 RPP, but remain useful. They should be updated for project needs.

Table 2-2. Subwatershed areas with highest potential for nonpoint source pollution, based on land use and hydrologic characteristics.

Potential for Nonpoint Source Pollution (Based on Annual Loading per Unit Area)	**Subwatershed Areas (view Subwatershed Map)**
High	Salmon Creek Fall Creek Six Mile Creek? Cayuga Inlet? Sheldrake Creek Great Gully Yawger Creek (including Yawger Tributary)
Moderate	Taughannock Paines Brook Hicks Creek Subwatershed 68 (Interlaken) Mack Brook Canoga Creek Cayuga Inlet Trumansburg Creek Ledyard Creek

	Willow Creek
Low	Gulf Creek Renwick Brook Glenwood Creek

Cayuga Lake Watershed Restoration and Protection Plan, 2001
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caystatus.htm

Sediment: Roadways and Roadside Ditches

Stream networks are integrally linked to a more extensive network of roadside ditches. Although functioning only during storm events and spring runoff, there is evidence that, within the Cayuga Lake Watershed, this network of ditches significantly increases the total volume of discharge and degrades the quality of water flowing into creeks (R. Schneider, 1999). Shoulder ditching practices can leave large areas of sediment exposed and vulnerable to erosion.

Runoff from rural roads can also contribute to water quality and habitat degradation of streams and lakes. Sand and sediment applied for winter deicing can wash into road ditches and streams. Throughout the watershed are many storm drains with no provision for sediment removal.

The roadbank survey conducted in 2000 for the 2001 Plan provided detailed site-specific data in the Cayuga Watershed. All of the roads in the watershed were surveyed for physical characteristics (slope, channel morphometry, vegetative cover, and the degree of erosion). Results highlight many areas where roadbanks themselves show signs of significant erosion and are a major source of sediment. This, in combination with the road ditch network, indicates a significant problem that directly affects wetlands, riparian corridors and ultimately Cayuga Lake.

Results of the roadbank survey were used to calculate sediment loss per road mile on a subwatershed basis and provide a basis for identifying priority areas for restoration. These findings are displayed in map of Estimated Potential Roadbank Sediment by Subwatershed and Table 2-3. Specific very severe sites and recommendations for remediation are covered in Section IV, Chapter D., Stormwater Management and Erosion Control. This table and data have not been updated from the 2000 Characterization, but remain useful. They should be updated for project needs.

Table 2-3. Estimated Annual Sediment Loss from Roadways and Restoration Priorities

Priority for Restoration and Protection	**Streams**	**Estimated annual sediment loss from roadways**	**Estimated annual sediment loss per roadway mile**

Group 1: Severe local impact, severe lake impact	Sixmile Creek Cayuga Inlet King Ferry Station area	More than 900 tons/yr	3-7 tons/mile/yr
Group 2: Severe local impact, moderate lake impact	Fall Creek Enfield Creek Lansing area Salmon Creek Cayuga Village area	250 - 700 tons/yr	2-4 tons/mile/yr
Group 3: Moderate local impact, moderate lake impact	Glenwood Creek area Cascadilla Creek Sheldrake Creek Taughannock Creek Virgil Creek Spring Brook	100-250 tons/yr	More than 2 tons/mile/yr
Group 4: Moderate local impact, low lake impact	Yawger Creek Buttermilk Creek Locke Creek	More than 100 tons/yr	More than 1 ton/mile/yr

Cayuga Lake Watershed Restoration and Protection Plan, 2001
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caystatus.htm

Sediment: Estimates of loading to Cayuga Lake

Beginning in 2003, monitoring partnerships between the Community Science Institute and groups of local volunteers have collected certified data on a dozen water quality indicators in tributary streams draining roughly 70% of the Cayuga Lake watershed. Concentrations of total suspended solids (TSS) under base flow and stormwater conditions may be viewed at

http://database.communityscience.org/monitoringregions/1 (select stream, then "Solids, Total Suspended" from the drop-down menu on the graph showing average values for each stream location). Raw data may be searched and downloaded at http://database.communityscience.org/queries.

CSI staff has performed TSS load calculations using USGS Loadest software for selected monitoring locations spanning the Fall Creek, Six Mile Creek and Cayuga Inlet subwatersheds. Annual load estimates for twelve locations for the 5-year period 2009-2013 may be viewed here: (http://www.communityscience.org/whats-in-your-watershed-series/, 11/25/14). Volunteer monitors captured high flows during Tropical Storm Lee in 2011, providing valuable insight into the impact of flood conditions on sediment and nutrient loading to Cayuga Lake.

Sediment loads in 2011 in Fall Creek, Six Mile Creek and the Cayuga Inlet were estimated to be, respectively, 6, 9 and 25 times greater than in 2012, a low flow year. For example, the sediment load at Cass Park at the mouth of the Cayuga Inlet was estimated to be 72,355 tons for 2011 and 2,933 tons for 2012. The large stormwater impacts were generally consistent with the rankings for these streams in Tables 2-2 and 2-3. Comparison of upstream and downstream locations indicated that the bulk of the 2011 stormwater increase in the Cayuga Inlet sediment load came from the upper Inlet (http://www.communityscience.org/whats-in-your-watershed-series/, 11/25/14).

The accuracy of CSI load estimates was assessed by comparison with USGS annual sediment load estimates at Bethel Grove on Six Mile Creek. CSI averaged 65% +/- 32% (S.D.) of USGS loads from 2004-2012. The discrepancy is consistent with differences in sampling methods, i.e., volunteers collect grab samples from the stream surface while USGS samples the entire water column. It suggests that CSI load calculations underestimate true sediment loads by roughly one-third.

Phosphorus

Non-point Sources: Concentrations and Loading from Cayuga Lake Tributary Streams

Phosphorus has been monitored intensely by volunteer-CSI partnerships beginning in Fall Creek in 2002 and expanding to cover tributary streams draining roughly 70% of the Cayuga Lake watershed by 2016 (http://www.communityscience.org/whats-in-your-watershed-series/, 1/18/17). Dissolved phosphorus is of particular interest because it is considered to be bioavailable to fertilize the growth of algae and weeds. Dissolved phosphorus is measured in the lab as "soluble reactive phosphorus," or SRP. It is important to note that SRP is understood to be an operational definition of dissolved phosphorus, meaning that the concentration of dissolved phosphorus is a function of the test protocol chosen to perform the SRP analysis. Two of the most commonly used SRP test protocols are Standard Methods and EPA. Of the two large phosphorus monitoring programs in Cayuga Lake and its tributaries: a) Cornell University and its consultant, the Upstate Freshwater Institute (UFI), and b) The Community Science Institute, Cornell/UFI uses the Standard Method protocol and CSI uses the EPA protocol for SRP analysis.

Both CSI and Cornell/UFI have estimated loading of bioavailable phosphorus to the impaired southern tip of Cayuga Lake. Using USGS Loadest software, CSI staff estimated that Fall Creek and the Cayuga Inlet contributed approximately 91% of the dissolved phosphorus while the three point sources: The Ithaca Area and Cayuga Heights wastewater treatment plants and Lake Source Cooling, together contributed approximately 9% (http://www.communityscience.org/whats-in-your-watershed-series/, 1/15/14, slide #4). Cornell University's Cayuga Lake Modeling Project (CLMP) estimated that 87% of bioavailable phosphorus was loaded to the impaired southern tip of the lake from Fall Creek and the Cayuga Inlet while the three point sources accounted for 13% (https://energyandsustainability.fs.cornell.edu/util/clmp/lakemonitoring.cfm, 11/12/15, slide #18). In terms of tonnage, CLMP estimated that the amount of bioavailable phosphorus loaded from the tributaries was 3.7 tons (3.4 metric tons) for the period April-October when tributary data were collected. CSI estimated that the tributaries loaded 6.1 tons of SRP during 2013, or, by extrapolation, 3.6 tons over a 7-month period (http://www.communityscience.org/whats-in-your-watershed-series/, 4/21/14).

The good agreement between CLMP's estimate of bioavailable phosphorus loading and CSI's estimate of SRP loading is welcome. The CLMP devoted considerable resources to analyzing several phosphorus fractions, defined operationally by the Standard Method protocol, with respect to their bioavailability. Fractions included SRP, Total Dissolved Phosphorus (TDP), Soluble Unreactive Phosphorus (SUP) (defined as TDP-SRP), and Particulate Phosphorus (PP) (defined as Total Phosphorus (TP) – TDP). The agreement between loading of bioavailable phosphorus based on the Standard Method protocol and soluble reactive phosphorus based on the EPA protocol suggests that SRP, as defined operationally by the EPA protocol, may serve as a useful surrogate for bioavailable phosphorus (see discussion in 2015 draft manuscript, "Systematic differences in dissolved phosphorus concentrations measured by two analytical protocols: implications," by Upstate Freshwater Institute (UFI) and Cornell University https://energyandsustainability.fs.cornell.edu/util/clmp/documents.cfm).

The potential significance of this observation is that unlike the CLMP, most nutrient monitoring programs do not have the resources to investigate the bioavailability of multiple phosphorus fractions as defined by the Standard Method protocol. The EPA protocol for SRP appears to capture much, if not most, of the dissolved phosphorus species in stream and lake samples, while the Standard Methods protocol for SRP appears to capture a subset such that a separate analysis of TDP is required for a more accurate reading on bioavailable phosphorus.

Possible reasons for the discrepant SRP results produced by the two analytical protocols were investigated by the UFI lab (Phosphorus Speciation and Lab QA/QC, UFI phosphorus presentation to the Cayuga Lake Water Resource Council Partnership Meeting, April 8, 2014, https://energyandsustainability.fs.cornell.edu/util/clmp/laketribmonitoring.cfm). The SRP discrepancy is currently under active investigation by the CSI lab (S. Penningroth, personal communication). Regardless of the reasons, the important observation that the Standard Methods and EPA protocols give different results for SRP -- an observation made possible by the unique existence of two large SRP data sets side-by-

side for Cayuga Lake and its tributaries -- has important general implications for estimating loads in phosphorus-limited ecosystems.

Cornell University has focused its phosphorus monitoring activities primarily at the south end of Cayuga Lake draining 40% of the watershed, with additional monitoring of Salmon and Taughannock Creeks for a total of 60% of the drainage area. CSI has monitored these streams and, in addition, has formed partnerships with volunteer groups to monitor streams draining heavily agricultural areas north of Taughannock and Salmon Creeks (http://www.database.communityscience.org/monitoringregions/1).

Results to date strongly suggest that considerably more bioavailable phosphorus is loaded proportionally from the northern 40% of the watershed than from the southern 60%. This observation is significant because NYS DEC has announced its decision to develop and release for public comment in May, 2017, a Whole Lake Phosphorus TMDL for Cayuga Lake, developed by extrapolating phosphorus loading to Cayuga Lake from northern tributaries on the basis of CLMP load estimates for the southern 60% of the watershed. Calculations based on this indirect approach yield a bioavailable phosphorus load for the tributaries north of Ithaca of 11.5 tons (converted from metric tons) (https://energyandsustainability.fs.cornell.edu/util/clmp/lakemonitoring.cfm, 11/12/15, slide 18).

Extrapolating from stormwater SRP concentrations measured in samples collected from northern tributaries by volunteer-CSI monitoring partnerships, however, gives an estimate of 20.5 tons (http://www.communityscience.org/whats-in-your-watershed-series/, 1/18/17 presentation). NYS DEC has indicated that they will consider CSI's evidence of high bioavailable phosphorus loading from northern tributaries in the Whole Lake Phosphorus TMDL (J. Myers, personal communication).

Point Sources: Wastewater Treatment Plants and Lake Source Cooling Facility

The Ithaca Area and Cayuga Heights wastewater treatment plants upgraded their phosphorus treatment capabilities after 2001. The Ithaca Area plant collected phosphorus data before and after the upgrade that show substantial decreases in the plant's output (http://www.cayugalake.org/files/all/2007_i4.pdf). Nevertheless, phosphorus concentrations in the impaired south end of Cayuga Lake have not decreased appreciably, as shown by data collected for Cornell's Lake Source Cooling monitoring program and Cayuga Lake Modeling Project as well as by data collected by the Community Science Institute. These observations are consistent with preliminary load estimates calculated both from CLMP data and from CSI's independent data set that indicate a majority of the phosphorus entering the impaired south end of Cayuga Lake comes from the tributary streams and not from the wastewater treatment plants and the Lake Source Cooling facility.

Cayuga Lake

Measurements in Cayuga Lake have consistently shown total phosphorus to fall in the mesotrophic range (having a moderate amount of dissolved nutrients), i.e., between

10-20 ug/L (Callinan, http://www.dec.ny.gov/lands/25576.html); Halfman, http://people.hws.edu/halfman/FL-Lim/FL-Limnology.htm; Makarawicz, Lewis and White, http://cayugalake.wikispaces.com/file/view/Water+Quality+of+the+North+End+of+Ca.pdf; Cayuga Lake Modeling Project, https://energyandsustainability.fs.cornell.edu/util/clmp/laketribmonitoring.cfm; Community Science Institute, http://www.database.communityscience.org/monitoringsets/9).

Concentrations on the southern shelf sometimes exceed 20 ug/L. While such exceedances are of concern, it is important to note that they can be caused, at least in some instances, by phosphorus-containing soil particles that are loaded to the lake during high stream flow events and remain in suspension for days. While particulate phosphorus adds to the total phosphorus concentration (total phosphorus = dissolved phosphorus + particulate phosphorus), the CLMP showed that particulate phosphorus has very low bioavailability (https://energyandsustainability.fs.cornell.edu/util/clmp/lakemonitoring.cfm, click on Nov. 12, 2015, progress report) and therefore adds little to the concentration of bioavailable phosphorus.

Moreover, the average base flow and stormwater concentrations of SRP (EPA protocol) are 13 ug/L and 26 ug/L, respectively, at the mouth of Fall Creek and 13 ug/L and 15 ug/L, respectively, at the mouth of the Cayuga Inlet (http://database.communityscience.org/monitoringregions/1), consistent with concentrations of bioavailable phosphorus on the southern shelf, where virtually all of the water is supplied by these two streams, exceeding 20 ug/L on occasion but not on a regular basis.

SRP concentrations at the mouths of tributary streams north of Taughannock and Salmon Creeks are considerably higher. Base flow and stormwater concentrations average, respectively, 53 ug/L and 180 ug/L for Canoga, Burroughs and Williamson Creeks entering the northwest corner of Cayuga Lake, and they are 65 ug/L and 107 ug/L, respectively, for Dean's, Paines, Mill and Town Line Creeks entering Cayuga Lake from the northeast. These high tributary phosphorus levels notwithstanding, lake phosphorus falls in the mesotrophic range, 10-20 u/L. It should be noted, however, that samples are typically collected near the midline of the lake, and it is possible that lake phosphorus is elevated around the mouths of tributary streams.

Fertilizers and Pesticides

The fertilizers of concern are inorganic phosphorus, or orthophosphate, and inorganic nitrogen, or nitrate. Phosphorus is considered to be the rate-limiting nutrient in Cayuga Lake and other freshwater ecosystems in the northeastern U.S. Its distribution in the Cayuga Lake watershed was discussed in the preceding section. Orthophosphate is effectively 100% bioavailable for uptake by algae, weeds and other aquatic vegetation. Nitrate-nitrogen is an essential plant nutrient but is not considered to be growth-limiting in our region. It is usually measured as a combination of nitrate- and nitrite-nitrogen referred to as NOx. Volunteer-CSI monitoring partnerships have tracked NOx since 2002 (http://database.communityscience.org/monitoringregions/1). The NYSDEC standard

for NOx in surface water is 10 mg/L, which is the drinking water standard. Concentrations range from ~0.2 mg/L in predominantly forested watersheds like Six Mile Creek and the Cayuga Inlet to ~5 mg/L and greater in predominantly agricultural watersheds such as Salmon, Paine's and Canoga Creeks and others.

Much less is known about pesticides than fertilizer. Fall Creek is included in the statewide pesticide monitoring network, a joint program of USGS and NYSDEC https://ny.water.usgs.gov/projects/nypesticides/networks.html. Herbicides used in corn cultivation are consistently detected at trace concentrations in Fall Creek.

USGS completed a storm sampling program to measure pesticide concentrations in three tributaries draining agricultural subwatersheds in June, 1998 ("Herbicides and Their Metabolites in Cayuga Lake and its Tributaries", New York, 1998, http://ny.water.usgs.gov/projects/nypesticides/reports/Eck_WRIR99-4018.pdf). Samples were collected in Salmon, Yawger and Paines Creeks during a storm that occurred shortly after the herbicides metolachlor and alachlor had been applied. Peak concentrations of herbicides were 100 to 1000 times higher than concentrations observed under base flow conditions in Fall Creek or Cayuga Lake.

No pesticide data exists for other Cayuga Lake tributaries. It is clear from this study that agricultural areas have the potential to export pesticides to the lake. However, very large data gaps remain regarding the concentrations of pesticides as well as the relative impacts of residential and commercial uses of pesticides on the quality of the lake and its tributary streams.

Trace Elements

Monitoring data documenting the concentrations and distribution of heavy metals in the Cayuga Lake watershed are very limited. Fall Creek is monitored as part of the Rotating Intensive Basin Studies (RIBS) program. Tompkins County local governments supported measurements by CSI-volunteer monitoring partnerships of barium, strontium and gross alpha and gross beta radioactivity in 2013 and 2014 as part of pre-fracking baselines in Cayuga Lake tributary streams. Results showed concentrations at background levels (http://database.communityscience.org/monitoringregions/1, select stream, then choose barium, strontium or gross alpha/beta from the "monitoring set" graph's drop-down menu).

Pathogens

Alone among watershed surveillance programs, volunteer-CSI monitoring partnerships track pathogenic bacteria using E. coli as a marker in Cayuga Lake tributary streams, in southern Cayuga Lake, and along portions of the lake's southwest and southeast shorelines (http://database.communityscience.org/monitoringregions/1, select stream, then E. coli from the graph's drop-down menu). An overview of E. coli results for southern Cayuga Lake and for tributaries draining ~70% of the watershed is available on the CSI website (http://www.communityscience.org/whats-in-your-watershed-series/, 1/18/17). Concentrations of E. coli measured in southern Cayuga Lake and along the southeast and southwest shores are well below 235 colonies/100

ml, the level considered safe for contact recreation. It is worth noting that E. coli data in CSI's online database, together with fecal coliform data collected by the Ithaca Area Wastewater Treatment Plant at the south end of the lake (J. Lozano, personal communication), caused EPA to delist Cayuga Lake for pathogenic bacteria in 2014, reversing its earlier erroneous listing decision of 2008.

Concentrations of E. coli in southern tributary streams under base flow conditions range from ~100 colonies/100 ml in Six Mile Creek to ~400 colonies/100 ml in Fall Creek. Average base flow concentrations in tributaries north of Ithaca range from ~200 colonies/100 ml in Taughannock Creek to~2,000 colonies/100 ml in Dean's Creek. Stormwater E. coli levels range from, very roughly, 1,000 colonies/100 ml to 4,000 colonies/100 ml at locations on southern tributaries and from 2,500 colonies/100 ml to 24,000 colonies/100 ml at locations on northern tributaries.

E. coli and phosphorus levels are generally correlated, consistent with agriculture being the predominant source for both (http://www.communityscience.org/whats-in-your-watershed-series/, 1/18/17).

Exotic Organisms/Invasive Species

Invasive species have become a larger concern since 2001. Numerous plant and animal invasive species have become part of the water quality challenge in Cayuga Lake. Eurasian water milfoil, zebra and quagga mussels are distributed throughout the lake, and water chestnut patches have appeared in the lake's northern waters. The lake's fish community is diverse and productive, but faces challenges from round goby, invasive spiny water fleas, hydrilla, and sea lamprey (DEC public presentation http://blog.syracuse.com/outdoors/2013/03/finger_lakes_fisheries_healthy.html).

Information about invasives present in the Cayuga Lake watershed can be found at iMap Invasives, New York State's online invasive species database and mapping system http://www.nyimapinvasives.org/

The Finger Lakes PRISM (Partnership for Regional Invasive Species Management) is one of eight regions across New York State working to manage invasive species and prevent their spread. They have prioritized invasives that are present, approaching the region, and have the potential to be managed or eliminated. More information is available on the Finger Lakes PRISM website: http://fingerlakesinvasives.org/priority-invasives/

Hydrilla

The most immediate threat to Cayuga Lake is the invasive aquatic plant hydrilla (*Hydrilla verticillata*). In 2011, hydrilla was discovered covering 166 acres of Cayuga Inlet at the south end of Cayuga Lake. The Hydrilla Task Force was formed to eradicate this aggressive and destructive weed at the southern end of Cayuga Lake, with a Tompkins County focus, and received state and federal financial support (http://ccetompkins.org/environment/aquatic-invasives/hydrilla/fighting-hydrilla-in-the-cayuga-lake-watershed/hydrilla-task-force-of-the-cayuga-lake-watershed).

The Task Force's management plan combines chemical treatments, managed by the Tompkins County Soil and Water District and other Task Force members, with meticulous monitoring of hydrilla populations by Racine-Johnson Associates. This approach resulted in control of hydrilla in the Inlet during 2015. An infestation on Fall Creek in Ithaca's Stewart Park is gradually yielding to a mixture of treatment strategies; an outbreak in the lake's southeast corner was treated and has not recurred.

Public education and the recruitment and training of local volunteers as "Hydrilla Hunters" has made it possible to monitor large portions of the watershed for new outbreaks of hydrilla. Outreach training and public education have been provided by the Cayuga Lake Watershed Network, Tompkins County Cornell Cooperative Extension, and the Cayuga Lake Floating Classroom.

A significant new infestation was discovered in September 2016 on the lake's central eastern shoreline, near the village of Aurora (Town of Ledyard). The south-end Hydrilla Task Force, Finger Lakes Institute, Cayuga County Department of Planning and Economic Development, and Finger Lakes PRISM teamed with Racine-Johnson and the Cayuga Lake Floating Classroom to assess the extent of the problem and begin to develop control strategies. The Intermunicipal Organization and the Cayuga Lake Watershed Network provided the public and municipal leaders with information and carried out a two-week lakewide Hydrilla Hunt.

In March 2017, a Hydrilla Task Force was established by a group of Cayuga County agencies and municipalities.

Notably, both of the primary hydrilla infestations known to date in Cayuga Lake were discovered by non-professional observers participating in training and citizen monitoring activities (with the Floating Classroom). This illustrates the importance of an active watershed citizenry, on a lake the size of Cayuga.
http://ccetompkins.org/environment/invasive-nuisance-species/aquatic-invasives/hydrilla

Emerging contaminants

US EPA defines an emerging contaminant (EC) as "a chemical or material characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards. A contaminant also may be "emerging" because of the discovery of a new source or a new pathway to humans" May 2016, https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern.

This concept first came to light in the Cayuga Lake watershed in 2014 with the discovery that microbeads – tiny particles of plastic added to manufactured care products (skin exfoliants, toothpastes) and in other uses – were showing up in small but detectible quantities in Cayuga Lake waters. While the use of synthetic microbeads in the manufacture of new products has since been banned by federal law (https://www.congress.gov/bill/114th-congress/house-bill/1321/text), these beads and a range of smaller microplastics and plastic fibers will likely persist in fish and

other aquatic organisms in Cayuga Lake. Whether or not they will constitute a significant problem will be a consideration for future RPP updates.

Other classes of emerging contaminants include pharmaceuticals, endocrine disruptors and caffeine. There are concerns, increasingly backed by research, that

> [E]merging contaminants may also demonstrate low acute toxicity but cause significant reproductive effects at very low levels of exposure. In addition, the effects of exposure to aquatic organisms during the early stages of life may not be observed until adulthood. Therefore, traditional toxicity test endpoints may not be sufficiently comprehensive for criteria derivation for these chemicals and the chemicals may also have specific modes of action that may affect only certain types of aquatic animals (e.g., vertebrates such as fish) (https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products).

The US Geological Survey (USGS) established a program to document and monitor emerging contaminants, the Contaminants of Emerging Concern in the Environment Investigation (http://toxics.usgs.gov/investigations/cec/index.php). USGS also monitors contaminants of known concern nationwide such as pharmaceuticals, hormones and organic wastewater constituents (http://toxics.usgs.gov/pubs/FS-027-02/).

In response to these national concerns, and in order to investigate the potential local impacts of emerging contaminants in Cayuga Lake, the Ithaca Area Wastewater Treatment Plant and Ithaca College have initiated a research study of these contaminants in Fall Creek, Six Mile Creek, and Cayuga Lake, which is ongoing. Please see Chapter E. Wastewater Management, in Section IV of this Plan, for more information about this emerging research.

Climate change

Climate change was not yet a major concern in the 2000-1 Plan, but in 2017, its looming presence impacts water resource decision-making and planning everywhere, with effects on water quality – and quantity. One predicted impact of climate change in the Finger Lakes region is an increase in precipitation, potentially increasing runoff and thereby increasing the impacts of nonpoint source pollutants such as sediment, nutrients and pesticides on water quality.

Concomitant with a rise in precipitation are extreme weather events, so that precipitation (snow, rain) is being delivered in large storms that dump several inches at a time, interspersed with longer dry periods. In 2016, this emerging pattern led to the drought of record, from March to November, in which farms, crops, livelihoods, wildlife and water quality in streams, creeks, wetlands and the lake were adversely impacted. Please see the Section IV, Chapter I. “Regulatory Management” section on Climate Change for more information.

C. Recommended Actions to Implement Improvements in Water Quality Status, Water Quality Issues, and Geographic Areas of Concern

1. Implement phosphorus monitoring of Cayuga Lake tributary streams, from north to south, in order to track the progress of the whole lake phosphorus TMDL.

2. Investigate the sources of phosphorus and E. coli (pathogens) in streams draining agricultural areas, attempt to determine whether some farms contribute more than others, and work with Soil and Water Conservation Districts to address practices of individual farmers, as appropriate.

3. Continue investigations of algae along the northern lake shore.

4. Implement a lake-wide volunteer monitoring program in cooperation with NYS DEC and other groups, to include collecting secchi disk clarity, temperature, macrophytes, HABs, etc., to provide an opportunity for regular activity, practice, and learning.

5. Implement phosphorus and chlorophyll monitoring of Cayuga Lake, targeting areas near the mouths of streams that load large amounts of phosphorus to the lake that may be at risk of HABs.

6. Continue aggressive aquatic invasive species identification program, and hydrilla eradication program.

7. Screen selected tributary streams and Cayuga Lake for pesticides using atrazine as a marker.

8. Screen selected Cayuga Lake locations for microplastics.

IV. Action Category Chapters for Watershed Protection

Chapter A. *Action Category:* Public Participation

1. Introduction

To be of lasting value and real-world use, updating a watershed plan must include in-depth public participation. The Cayuga Lake watershed spans 785 square miles, six counties, and 45 municipalities. Public participation – hearing and including the concerns and interests of residents and leaders – is the glue, tying together these many administrative units to provide a unified point of view and way forward.

A number of methods were used to capture and compile the public voice, including in-person public and work group meetings, conference calls, email, and an online survey, from October 2015 through November 2016. To begin the process, a Watershed Advisory Committee was convened, consisting of people from around the lake.

2. Watershed Advisory Committee: Role and Tasks

With input from the Cayuga Lake Watershed Intermunicipal Organization (IO), Cayuga Lake Watershed Network (CLWN) and others, a Watershed Advisory Committee (WAC) member list was developed in spring of 2015. A half-day in-person WAC meeting was held June 4, 2015 at Wells College in Aurora. At the meeting, the WAC was tasked with developing a Public Participation Plan, and updating the original watershed plan's Vision and Goals statement. The purpose of the PPP was defined:

> This public participation plan (PPP) identifies ways to engage members of the public in updating the Cayuga Lake Watershed Restoration and Protection Plan (RPP). The PPP provides guidelines for involving people across the watershed's 45 municipalities, and is not a checklist of required actions. Changes to the PPP may prove necessary; it is a flexible document.

The PPP's main elements included: Watershed Advisory Committee (WAC) meetings and communications; developing public outreach and meetings to get public input into the watershed plan; involving public agencies and local municipalities; recognizing and getting input from major stakeholder groups; approval of the finalized PPP by the WAC.

Numerous conference call meetings and email correspondence followed, plus two in-person work group meetings held in Ithaca, autumn 2015, with final approval of the PPP by the WAC in September. The full text is provided in the Appendices.

An updated RPP Vision and Goals statement was approved by the WAC (June 30, 2015). Concurrently, the IO updated and finalized a separate Purpose and Charge statement. The full text of both the RPP Vision & Goals and the IO Purpose & Charge are found in the RPP Update Introduction, above. The WAC participants list is provided in the Acknowledgements, above.

3. Outcomes from Public Participation

Public meetings and municipal leaders meeting

Two public input meetings were held, in Seneca Falls on July 30th and in Trumansburg on August 13, 2015. A summary of public comments and recommendations from the two public meetings follow. For the full list of all comments, please see the Appendices.

A watershed-wide informational meeting for municipalities was held in Aurora on August 26 2015, sponsored by the Intermunicipal Organization. Representatives of 16 of the watershed's 45 municipalities attended, and learned from several speakers about the values of watershed planning and benefits to municipalities and to watershed health. See Appendices for participant and speaker lists.

Public Meetings Findings

Discussion and comments from the two public meetings are combined and summarized as Values of lake and watershed; Concerns about lake and watershed; Visions for the future of lake and watershed, in 10 – 20 years; Recommendations for policy & action to protect lake and watershed. These are not ranked.

a. Values of lake and watershed

- Beauty in many forms, and its enjoyment.
- Recreation.
- Multiple beneficial uses for people and nature.
- Drinking water.
- People care about the watershed and work to protect it.
- Land, water and their uses are financially valuable.
- Improved access to the lake.

b. Concerns about lake and watershed

- Water quality – worse than in the past.
- Communities need to speak up and get help and funding.
- Climate change is causing problems with worse to come.
- Taxes are too high, too many regulations.
- Water quality degradation and weeds lessen property value.
- Must prevent the energy industry from bringing pipelines, drilling etc.
- Invasive species are on the rise and causing big problems.
- Flooding and sediment are worsening.
- Farm, ditch and yard runoff is bad for water quality.
- Septic problems are bad for water quality.

c. Visions for the future of lake and watershed, in 10 – 20 years

- Lakewide sewer systems.
- Climate change awareness and action.
- Less erosion and water pollution thanks to better land use practices.
- More public access.
- Effective regulations and practices that are widely enforced and obeyed.
- Improved public understanding and behavior regarding water protection.
- Healthy water and ecosystems for birds, fish, animals and people

- Better communication and coordination among municipalities.
- Controlled, regulated, sustainable development.

d. Recommendations for policy and action to protect lake and watershed

- Develop, enforce better land use practices for homes, farms, businesses.
- More public access for recreation and swimming – add two more beaches.
- Collect more data watershed-wide for better-informed decision-making.
- More funding for agencies and municipalities.
- Stop subdividing large properties into many building lots.
- Share best management practices across the watershed.
- Develop regulations for steep slope building and development control.
- Develop school curriculum for lake and water education with a stewards program for school youth, with input from educational institutions in the watershed.
- Develop a unified system for supporting and upgrading septic systems/sewers, like the rigorous inspection program on Glimmerglass Lake, replacing old systems via low-interest loans attached to deeds.
- Anticipate and plan for privatization and development on the lakeshore and along waterways.
- Encourage diversity by getting more people and families to our lake and creeks.

Online Survey

An online public survey, "Cayuga Lake Watershed Public & Youth Questionnaire", was developed by the WAC, IO and project manager during summer and fall of 2015. This SurveyMonkey survey was available online at the CLWN website from October 2015 – November 2016.

A total of 22 questions were included in the survey; 17 aimed at adults, 5 for young people. Several of the questions provided a pre-defined list of responses to select from, some with an option to make additional open-ended comments. The responses to these questions are provided below. Several of the questions were completely open-ended. The full responses are archived by the IO.

To encourage the public to take part, Ithaca Town Board and IO member Rich De Paulo wrote an editorial for the local media, asking people to fill out the survey. Tee-Ann Hunter, IO Chair, wrote an article for *Network News*, newsletter of the Cayuga Lake Watershed Network (CLWN). The latter is included in the Appendices. These two pieces were shared widely in newspapers, on community listservs, in community email newsletters, on Facebook, and in the CLWN's fall and winter newsletter issues, mailed to over 500 homes and businesses.

Additionally, the IO sent information with the survey link to all municipalities (supervisors, mayors, clerks). Numerous people around the lake shared the survey with their own friend and colleague groups. Members of the WAC participated and shared with others. Bill Foster of the Floating Classroom arranged for middle school students to take part.

Nonetheless, the participation rate was lower than hoped: 305 completed the survey in the ten-month period. However, participants from 22 of the 45 municipalities and several visitors took part and provided thoughtful, comprehensive answers. Summary results of the survey follow. The questions and full text of responses in the survey are provided in Appendix 2.

Online Survey Findings

Of the 45 municipalities in the Cayuga Lake watershed, 22 are represented in the survey responses, ranging from single responses (Fleming, Enfield) to 66 (Town of Ithaca).

a. Municipalities represented: 22 of 45 municipalities are represented, with a total of 303 responses.

Aurelius 5
Caroline 17
Covert 8
Danby 13
Dryden 29
Enfield 1
Fayette 2
Fleming 1
Genoa 4
Hector 2
Interlaken 5
Ithaca, City 31
Ithaca, Town 64
Lansing 35
Ledyard 26
Newfield 4
Ovid 7
Romulus 7
Seneca Falls 2
Springport 7
Ulysses 23
Varick 7

b. From outside the watershed:

Cayuga Lake and Lake Ontario 1
"Visit many" lakes 1
Susquehanna River Basin 1

Of the 305 who responded to the entire survey, 74 listed themselves as "young people," age 0 – 18. However, more than 74 people answered several of the "young people" questions, so the results cannot be regarded as accurately reflecting the mindset of those 0 – 18 years of age.

c. Results from the pre-defined questions, some with additional comments

What is the source of your drinking water? (304 respondents)

47% Municipally drawn from Cayuga Lake, creek, stream or stream-fed reservoir
6% Privately drawn from Cayuga Lake or tributary (creek or stream that drains to the lake)
4% Municipal well
32% Private well

Don't know/Other: 11%, with 33 responses that are mostly variants on Don't know. Also: Beach well, Bottled, Spring, We bring tap water from Rochester to lakeside home; Are visitors to Cayuga with water supplies on other lakes.

How strongly do you perceive Cayuga Lake, its creeks and streams, to be positive assets to the region? *(1 is "Not at all strongly" and 5 is "Very strongly.")* (305 respondents)

4 – Strongly 4%
5 – Very strongly 95%

If you are a working individual, how dependent is your business or employer's business on the watershed's lake, creeks and streams? *(1 is "Not at all dependent" and 5 is "Very dependent.")* (239 respondents)

1 – 17% Not at all dependent
2 – 11% Not dependent
3 – 26% Slightly dependent
4 – 16% Dependent
5 – 31% Very dependent

How important is the health of the watershed to the health of your or your employer's business? *(1 is "Not at all important" and 5 is "Very important.")* (240 respondents)

1 – 10% Not at all important
2 – 8% Not important
3 – 20% Slightly important
4 – 18% Important
5 – 45% Very important

What are the ways that you enjoy Cayuga Lake, its creeks and streams? Please select all that apply. (304 respondents)

65% - Canoeing/Kayaking/Paddling
52% - Boating/Sailing
28% - Fishing and ice fishing
16% - Skating, Hockey, Skiing, Snowshoeing
74% - Swimming
81% - Wildlife Viewing
79% - Hiking
62% - Picnicking
93% - Aesthetic Enjoyment

Other: 15% listed additional activities. Of the 47 responses, most are highly individualistic responses. Some "live on the lake"; some do photography, camping, learning about forest farming, "including food from nut trees, mushrooms and wild greens;" "I sit on the banks of Fall Creek to de-stress"; "We have springs, creeks, ponds and a marsh on our land which drain into Six Mile Creek – we farm, collect healthy watercress, raise ducks." Also scuba diving; sampling water quality in Cayuga Inlet; school activities and scientific research; art projects from Cayuga Lake driftwood; as gathering places; water skiing and tubing; wine-growing; sightseeing and drives; the lake view enhances

the value of home and property, which enhances the respondent's enjoyment; biking along the lake and using running trails; watching rowers and geese; appreciating nature's balance; learning and teaching about native plants; writing or painting.

How important is the good health of the watershed to the activities you enjoy? (1 is "Not at all important" and 5 is "very important") (302 respondents)

3 – 2% Slightly important
4 – 7% Somewhat important
5 – 90% Very important

Is there enough public access to the lake and its tributaries (creeks and streams) for the activities you enjoy? (300 respondents)

47% - Yes
37% - No

Other: 16% provided 47 in-depth responses. Many state simply that they have private access; many state that more public access is needed. Many say that more swimming beaches and swimming access are needed. Several comments that the densely populated south end of the lake is lacking in access for boating and swimming, and that the nearest places are miles to the north. Specific comments: "More needs to be done to educate young people about the importance of the lake. All they do is stare at their damn phones." More boat launches and beaches; Need a dog park closer to Ovid; more access from the City of Ithaca to the lake; more places needed in the Ithaca area with restaurants and paddle-boat launches. "It was almost ten years of living here before I found a public access point for long distance lake swimming." Public access is needed on the west shore south of Taughannock State Park. "Aurora has lost its public access." "More access to Fall Creek would be great." "There are few posted access points for creeks & streams, although I will take my chances and access them wherever a road crosses them, providing that there are no 'private/no trespassing' signs." Worried that the wealthy will buy up available open land and prevent public access. "It is unconscionable that the lake is accessible to only a privileged few for swimming unless one travels far from Ithaca. Within both the Town and the City of Ithaca, all access to swimming is from private land. Can that be right?" Need more undeveloped shoreline with public access from both land and lake.

How would you describe the water quality within the Cayuga Lake watershed? (298 respondents)

4% - Poor
33% - Fair
56% - Good
8% - Excellent

In your opinion, which are the pollutants that most affect Cayuga Lake? Please select up to four. (302 respondents)

1 - Fertilizers, including phosphorus and nitrogen. *77% of all respondents.*
2 - Invasive species - pests, weeds, exotic species, such as hydrilla, zebra mussels. *71% of all respondents.*
3 - Pesticides, used in farms, homes and gardens, and on roadsides. *64%.*
4 - Sediment, including soil, sand and gravel. *44%.*

5 - Salts, such as the de-icer and brine used on roads in the winter; and from other sources. *39%.*

6 - Pharmaceuticals and personal care products, such as drugs, caffeine, microbeads. *27%.*

7 - Heavy metals, such as zinc and copper; metals from road runoff, coal storage and combustion waste, other sources. *27%.*

8 - Organic compounds, such as petroleum products; from pavement runoff, other sources. *26%.*

9 - Pathogens – disease-carrying microorganisms, such as coliform bacteria, fungi and viruses. *16%.*

10 – Warm water. *9%.*

Other: 9% provided 26 additional comments. Several expressed additional concerns about liquid manure slurry spread on fields by farmers, and residential fertilizer runoff; faulty septic systems and aging septic tanks. One person stressed that these are also problems along the creeks, not just directly into the lake. More testing needed for pesticides, organic compounds and heavy metals. Concern about syringes along the lake in Stewart Park. "Salt solutions from radioactive fracking waste in PA being used on state highways for snow melting should be banned." "Cornell vet school illegally dumping waste." "I chose the ones it seems that we could have the most control over in an immediate way if we chose." "Deep water phosphorus stirred up by Cornell's lake source cooling plant; loss of hemlocks to wooly adelgid."

One respondent feels that this question should not be in the survey, as it is "an invitation to special interest groups to skew the results. Any decisions regarding remediation and prevention should be based on scientific data, not on the opinions of interested parties (who are the only ones likely to respond to this survey.)" *Reply: the question asks specifically "In your opinion, what are the pollutants that most affect the lake?" – we were interested in learning people's opinions – their perception – of the worst problems.*

Please choose the top five actions that could most effectively protect or restore the watershed.**(**302 respondents)

1 - Improving farming practices to reduce runoff and erosion. *75% of the 302 who responded to this question.*

2 - Improving protection of wetlands and riparian corridors/buffers (land along the lake, creeks and streams). *65%.*

3 - Improving stormwater management and erosion control. *62%.*

4 - Improving control of invasive species. *51%.*

5 - Fostering stewardship through education and citizen engagement. *44%.*

6 - Improving communications, collaboration and partnerships across municipal and agency boundaries. *42%.*

7 - Improving private wastewater systems (septic systems*). 39%.*

8 - Improving public wastewater systems management. *38%.*

9 - Providing lawn care education to reduce erosion and lawn chemicals runoff. *27%.*

10 - Improving forestry management. *10%.*

Other – 12% of the respondents provided 37 additional comments. Generally the comments were in favor of increased regulation, education and law and regulatory enforcement; but reflected widely diverging political and environmental motivations. Specific comments: "Educate the educated ones that are trying to get their climate change political views across instead of attacking the real problem. Erosion control and redistribution of the silt back into the areas where it came from would be a better fix than blaming Cornell and farmers on phosphate [phosphorus]problem."

"Hold elected officials accountable for not pursuing best practices requirement by companies. It seems that unless DEC or EPA direct the sites they are left alone. Those entities have caused collateral damages by selectively enforcing only what they want to. NYS waters are in dire state because of the failure by design of those entities and unwillingness of officials to make them protect our water."

"We should do much more to protect our wetlands, identify them, protect them during development and push for all counties around the lake to do the same. It is not enough to protect the wetlands identified by the Army Corps of Engineers."

"The lake and the watershed are such huge geographical area that I imagine it's different over different parts of the lake, e.g. urban vs. rural areas, areas where there are lots of creeks like the south end of the lake, that drain water and snowmelt from the high hills in the south of Tompkins County, areas that have more forestation vs farm fields, areas like Montezuma that are protected and managed in a structured way, etc…"

"Seek funding and partnerships so that more lands within the watershed can be protected from development. Establish a prioritization process to identify shoreline areas, sensitive streams/gorges, wetland, remaining forested areas for protection."

"Let's be honest, the vast vast majority of problems are farm-related, the rest is trivial by comparison."

Various other comments: Educating inhabitants/workers about proper disposal of medications…There are gaps in our knowledge of personal and household-use chemicals that make their way into both public and private surface/groundwaters… enforcement of manure disposal regulations which are largely ignored… communications about alternative to salt, de-icers, etc…. four comments regarding negative effects of Cornell's Lake Source Cooling project… Reducing extreme over-ditching along roadways (2 comments about ditching) … Updated farm manure management plans that are enforced through on-site field inspection DURING STORM EVENTS; three comments regarding banning fracking and drilling and related infrastructure; more public access so that the general population is more connected to and engaged with the watershed in deeper ways…carry out long overdue dredging projects – Cayuga Inlet, reservoir at the 60 foot dam on Six Mile Creek, and silt pond above that reservoir; planning ahead for increased flooding/intense rain storms and short term droughts.

Please tell us a bit about yourself.

I am (check all that apply): (301 respondents)

1 - A watershed resident. *85% of all respondents.*
2 - Employed within the watershed. *36.54%.*
3 - Active with an advocacy group within the watershed. *18%.*
4 - A frequent visitor to the area. *16%.*
5 - A watershed business owner. *9.3%.*
6 - A student within the watershed. *7%.*

Other – 9.3% made 28 additional comments. These included seven elected officials/government employees; present-day and retired farmers; environmental and political activists; retired persons; people who enjoy the lake and creeks in various ways; employed in water-related jobs; volunteer water quality monitor; seasonal resident.

How willing are you to have municipal funding used for watershed protection and improvement? (302 respondents.)

9% - Somewhat willing
62% - Very willing
29% - Depends on the project

How willing are you to dedicate a portion of your time to foster watershed protection (attend meetings, support policies, other)? (301 respondents.)

5% - Not at all willing
42% - Somewhat willing
26% - Very willing
27% - Depends on the project

d. Youth-specific questions

What types of activities do you enjoy on Cayuga Lake or on the land and creeks surrounding the lake? (Check all that apply) (99 respondents– some not "youth")

1- Swimming *83% of all respondents.*
2 - Aesthetic enjoyment *69%*
3 - Canoeing/Kayaking/Paddling *67%*
4 - Wildlife Viewing *65%*
5 – Hiking *64%*
6 – Picnicking *55%*
7 - Boating/Sailing *49%*
8 - Fishing, Ice fishing *30%*
9 - Skating, Skiing, Snowshoeing, Hockey *20%*

Other: 3% made 3 additional comments: "Biking." "Looking for bugs." "Isn't this a repeat question?" (We're guessing the third reply is not that of a youth)

How often do you spend time on the lake, along our creeks, or doing other outdoor activities? (108 respondents – some not "youth")

14% - Daily
41% - At least once a week
40% - At least once a month
6% - At least once a year
0% - Never

Do you think the water in Cayuga Lake is healthy? (111 respondents – some not "youth")

50% - Yes

29% - No

Other – 21% made 23 additional comments. Most of these appear to be non-youth comments. A selection is provided without reference to age: OK now but in danger… There's probably some pollutants but besides that it is very healthy… You can't swim at Stewart or Cass parks… Most of the time I do, but sometimes the lake is yucky… no sure, but I see lots of garbage at the Stewart Park beach… not old enough to know…it is, but I wish that more attention would be paid to the health of the lake… it could be better.

What is your age group? (74 respondents)

7% - 0-5 years
30% - 5-11 years
28% - 12-15 years
35% - 15-18 years

4. Additional community participation resources

a. Waterway, lake and community groups with a lake focus

The Cayuga Lake watershed is seeing the development of numerous volunteer and community groups based on improving their communities, life, and water quality. These groups will be included in future public outreach about IO and Watershed Plan initiatives. New groups should be encouraged. Examples follow.

- **Waterway Friends of Fall Creek:** Organized during 2016, WFFF is a public education group located in Dryden, in the southeast corner of the watershed. The group is focused on raising awareness of the history and value of Fall Creek, which winds south through Cayuga and Tompkins County and numerous towns, villages and hamlets, to Cayuga Lake's south end. Contact Hilary Lambert steward@cayugalake.org

- **Canoga Shoreliners:** Located along the northwest shoreline of Cayuga Lake in Seneca County, the trained volunteer Shoreliners (founded 2014) carry out water quality sampling at several creek outlets, with the resulting certified lab water quality data shared on the Community Science Institute's website. The Shoreliners are working with Seneca County's Water Quality Committee (2017). Contact: Cayuga Lake Steward steward@cayugalake.org .

- **Seneca Towns Engaging People for Solutions (STEPS):** STEPS is a several-year community program funded by Greater Rochester Health Foundation to bring together the 10,000 residents of Seneca County's towns – Ovid, Romulus, Lodi and Covert – to develop their own neighborhood-based strategies and programs for improved health and wellness, including water quality and recreation. These towns are partly or fully in the Cayuga Lake watershed, and partly in the adjacent Seneca Lake watershed. Contact: Theresa Lahr, mtlahr@gmail.com

- **Trained volunteer water quality sampling groups, Community Science Institute (CSI**): Since 2002, the Community Science Institute's trained water quality volunteers have grown to 150, in 12 counties across New York State. Within the Cayuga Lake watershed, volunteers sample Fall Creek, Virgil Creek, Six Mile Creek, Salmon Creek, Trumansburg Creek, Taughannock Creek, the Cayuga Inlet (including Enfield, Buttermilk and Cascadilla Creeks), Canoga and Burroughs creeks, and several small streams that flow directly to Cayuga Lake. While membership and participation fluctuates, these are well-established, watershed-specific community groups. View the monitoring sets for the Cayuga Lake watershed region at CSI's website: http://database.communityscience.org/monitoringregions/1 . Contact: Steve Penningroth spenningroth@communityscience.org . CSI's phone number 607-257-6606.

b. Community activist groups

From 2008 to 2014, public water awareness rose sharply across the Cayuga Lake watershed (and beyond), in large part owing to several years of activism and engagement by the public to prevent high-volume hydraulic fracturing (HVHF) from entering New York State. Owing to the ceaseless work of many, water and other resources were protected via local moratoria and bans; a several-year lawsuit involving the Town of Dryden, energy companies, and the courts of the State of New York; and 2014 decisions by the NYS Department of Health, NYS Department of Conservation, and Governor Andrew Cuomo's administration to keep fracking out of New York State (Lambert, Hilary, 2016. "Whose Water is It?" *American J. Economics and Sociology* 75(3), pp. 681-720. May.)

As a result of this process, most communities around Cayuga Lake have an active local water protection concerned residents organization. If a town lacks its own group, residents are affiliated with one or more groups nearby, regionally, and at the state and national levels, to protect water and community from large-scale energy development.

Leadership from local residents continues to show the way forward. In 2015-7, community groups opposed pipelines and new fossil fuel infrastructure development in favor of sustainable, renewable energy sources. These groups are responsive to requests for public input to local, watershed, and state-wide water quality and other environmental issues. Examples of these groups follow.

- Dryden Resource Awareness Coalition (DRAC): https://draconline.wordpress.com/

- Gas Drilling Awareness for Cortland County (GDACC): https://gdacc.org/

- Shaleshock Media Open Group: https://www.facebook.com/groups/NFWgroup/

- Residents Opposed to Unsafe Shale gas Extraction (ROUSE): https://www.facebook.com/ROUSE-Residents-Opposed-to-Unsafe-Shale-gas-Extraction-125173594167712/

- Coalition to Protect New York: http://www.coalitiontoprotectnewyork.org/

- History of the fracking fight in NYS, 2008-2016:

Article detailing the Cayuga Lake watershed struggle by Lambert, Hilary, 2016. "Whose Water is It?" in: *American J. Economics and Sociology* 75(3), pp. 681-720. May.

Hydraulic Fracturing in New York State Web Archive, Cornell University: https://archive-it.org/collections/2788

5. Recommendations for Public Participation, toward Plan Implementation and Watershed Protection

1. Retain WAC (Watershed Advisory Committee) as active IO participant, to better coordinate and improve communications and partnerships in projects with intermunicipal water quality impacts.

2. Retain TAC (Technical Advisory Committee) as active IO participant, to keep abreast of new concerns such as emerging contaminants and invasive species threats.

3. Maintain list and contacts with and input from water-focused community groups, to better coordinate and improve communications and partnerships in projects with intermunicipal water quality impacts.

4. Use website, social media, print media to retain/develop active engagement with the public and local government.

5. Maintain a schedule of educational and interactive events throughout the year to encourage the message that public participation requires action.

Chapter B. *Action Category:* Public Watershed and Water Quality Education

1. Introduction

When the Plan was first issued in 2001, "watershed education" and "water quality education" were good ideas, not yet widely implemented, as indicated by the Plan's education goals:

Coordination, collaboration and partnerships are key to successful watershed education. This includes working with all associated organizations, municipalities, and groups and the Cayuga Lake Watershed Steward in implementing comprehensive watershed education that results in a more informed watershed community.

In the 2001 plan, four sources of watershed and water quality education were listed. These include public forums of the type organized to develop the RPP; the IO's website; the Cayuga Lake Watershed Network's website and other tools; and local government workshops provided by regional planning entities. Under Recommendations for Action, 34 recommendations were provided under topic headings including Agriculture, Stormwater Management, Wastewater, Hazardous Waste - and all the other Action Categories from the watershed plan. General Watershed Education and Distribution of Information were also included.

In other words, public education about our lake and its watershed and water quality was a top priority in 2001, and remains so in 2017. A review of the 2001 Recommendations indicates that, in one form or another, most of the recommended documents have been prepared and shared, and much of the recommended research has been carried out.

Link to the original recommendations
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/cayeducation.htm

2. The Cayuga Lake Floating Classroom: A Case Study in Watershed Education

Responding to the need for watershed education articulated in the 2001 Plan, members of the IO's education committee (Education/Public Participation/Outreach Committee (EPPOC) examined successful models in environmental education, such as the Lake George Floating Classroom, and initiated an effort to create the Cayuga Lake Floating Classroom, a boat-based education program that would be available for all watershed residents and school classes.

In 2002, a private company (Tiohero Tours) joined the project and introduced the 30-passenger MV *Haendel* to Cayuga Lake. Since the first Floating Classroom cruises in 2003, the program has been enthusiastically endorsed by educators, and supported by regional funding organizations, Wells College, and the IO. As of 2017, the Floating Classroom provides educational programs for some 3000 students and residents, annually, and enjoys not-for-profit status as a partner of the Center for Transformative

Action at Cornell University. The Floating Classroom still contracts for use of the MV *Haendel*, but is anticipating purchasing its own vessel in the near future.
The Floating Classroom works with the member communities of the Intermunicipal Organization and the Cayuga Lake Watershed Network, and has achieved many of the Recommendations of the original RPP.

In terms of "General Watershed Education" (Recommendation 3.J1 in the 2001 Plan), the Floating Classroom now provides watershed-related education to nearly every school-aged child in the Cayuga Watershed. Floating Classroom instructors take approximately 100 classes of students onto the lake annually, and also host a network of over 40 classes that raise trout and learn about stream ecology, fisheries and water resources throughout the school year.

In addition to school field trips and programs, the Floating Classroom partners with regional experts to offer public education cruises and events for roughly 300 adults each year, addressed most of the topical education objectives identified in the original RPP (Recommendations 3A-3K), including agricultural and stormwater impacts, household hazardous waste, shoreline and riparian management, regulatory management and volunteer monitoring. Volunteers aboard the Floating Classroom are responsible for both major discoveries of the invasive species, *Hydrilla verticillata*, on Cayuga Lake, in Cayuga Inlet in 2011 and off the Village of Aurora in 2016.

As a result of changing priorities in our watershed, the Floating Classroom has also focused on newer priorities, such as invasive species and the impacts of global climate change on our waterways. As of 2017, the Floating Classroom is looking forward to continuing to provide high quality education opportunities to both youth and adult residents of the Cayuga Lake watershed, in keeping with the recommendations of the 2017 Plan, and to expand this model to serve more of the Finger Lakes. The mission of the FC is to provide educational opportunities for all ages, promoting academic excellence, environmental literacy, and lifelong relationships with the waterways that define our communities.

3. Watershed and water quality education today

Today, basic public watershed and water quality knowledge among the public is much improved thanks to the hard work of the Floating Classroom, Cayuga Lake Watershed Network, Community Science Institute and the Finger Lakes Institute, Cornell Cooperative Extension, the County Water Quality Committees/Agencies, the Soil and Water Conservation Districts, and many local teachers in kindergarten through twelfth grades.

However, much needs to be done to bring about widespread watershed and water quality understanding among the broader population, and among our elected and appointed officials. Improved understanding will lead to wiser water resources decision-making.

Based on the ways in which the above-listed groups and agencies interact with the watershed's resident population and visitors, it seems evident that a new understanding about effective education has emerged since 2001: The public is made

up of tens of thousands of individuals each with their own motivation, concerns and interests about our lake, creeks, waterfalls and wetlands.

People interacting with one another, on or near the water of concern, yields more effective education than pamphlets and reports. This is a matter of general agreement today, amongst educators, particularly when education is being provided in order to stimulate specific responses, or engage the audience in further action. Notably, while limited lake and waterway access for most of the watershed population was alluded to in the watershed characterization, it was not addressed in the 2001 Plan. While acquisition of shoreline or other means to create more direct public access to the lake is not likely within the scope of this plan, there are opportunities to maximize the opportunities that presently exist, including public programs (and free entry) at State Parks, volunteer monitoring and training programs, and educational programs such as those offered by the Floating Classroom and other organizations. These all create access to boats, the lake and regional stream corridors for residents who would not otherwise have such access.

Building the foundation of science-based information and research was a necessary first step, and remains a backdrop for informed decision-making about our water resources by the public and its elected and appointed leaders.

Communications and resources-sharing is difficult to coordinate among the many groups and agencies providing the public with watershed and water quality education. Cayuga Lake's fractured political geography – long, narrow, divided into 3 main and 6 total counties, many agencies and 45 municipalities – means that a shared, core watershed and water quality education program for all watershed residents remains a distant goal.

4. Future paths to improved watershed and water quality education

The IO's reach across these boundaries and divisions makes it the natural hub for improving this situation over the next ten years. In 2000, the Education/Public Participation/Outreach Committee (EPPOC) was formed by the IO to undertake activities that interface between the IO and the general public. The group then consisted of members of the IO and the CLWN, and its main task was to conduct the public input portions of the 2001 plan.

A revived EPPOC, as part of the IO's functions, is a central recommendation for next-steps watershed and water quality public education. The EPPOC would work in coordination with the main providers of watershed and water quality education in 2017:

Cayuga Lake Floating Classroom: http://www.floatingclassroom.net ; https://www.facebook.com/cayugalakefloatingclassroom/

Cayuga Lake Watershed Network: http://www.cayugalake.org/ ; https://www.facebook.com/Cayuga-Lake-Watershed-Network-101436081850/

Community Science Institute: http://www.communityscience.org/; https://www.facebook.com/CommunityScience/?fref=ts

Cornell Cooperative Extension

On the lake

CCE Cayuga http://blogs.cornell.edu/ccecayuga/

CCE Seneca http://senecacountycce.org/

CCE Tompkins http://ccetompkins.org/

In the headwaters

CCE Cortland http://cortland.cce.cornell.edu/

CCE Schuyler http://cceschuyler.org/

CCE Tioga http://tioga.cce.cornell.edu /

County Water Quality Committees/Agencies

On the lake

Cayuga http://www.cayugacounty.us/Departments/Water-Quality-Management-Agency

Seneca - see SWCD list, below.

Tompkins http://www.tompkinscountyny.gov/planning/committees-wrc

In the headwaters

Cortland http://www.cortland-co.org/324/Agriculture-Planning-Committee

Schuyler http://www.stcplanning.org/index.asp?pageId=41

Tioga http://www.tiogacountyny.com/programs-agencies/soil-and-water/

Finger Lakes Institute http://www.hws.edu/fli/

Soil and Water Conservation Districts

On the lake

Cayuga http://www.cayugaswcd.org/

Seneca http://senecacountyswcd.org/

Tompkins http://tompkinscountyny.gov/swcd

In the headwaters

Cortland http://www.cortlandswcd.org/

Schuyler http://www.schuylerswcd.com/

Tioga http://www.tiogacountyny.com/programs-agencies/soil-and-water/

5. Recommendations for Watershed and Water Quality Education

1. The *Education/Public Participation/Outreach Committee (EPPOC)* should be re-established, and governed via collaboration between its principals, the IO and CLWN.

- IO should allocate a reasonable amount of financial support to ensure this group functions - two meetings/year to produce/maintain an EPPOC action plan annually.

- CLWN should identify EPPOC priorities as an annual objective.

- Organizations such as Cayuga Lake Floating Classroom should incorporate EPPOC annual plan priorities into public programming plans.

- EPPOC should be tasked with reviewing information on work being pursued relevant to all other Watershed Strategy Components on an annual basis, and compiling a priority list of Public Participation objectives/strategies/measures.

- EPPOC needs to develop and formally accept criteria for public participation strategy:
    - Equity & inclusiveness within larger watershed population.
    - North/south end balance & participation numbers.
    - What else constitutes a potentially successful effort?

2. A central clearinghouse should be established to provide the public with access/information to ongoing projects and watershed-quality related work, either via an updated IO website, or via CLWN website. Also provide links to organizations and working groups and public-access meetings, including Cayuga Hydrilla Task Force, Watershed Monitoring Partners, others.

3. A Watershed Curriculum should be established to offer a framework for educational efforts. For students, this curriculum should reference NYS learning standards and existing local curricula that already been developed to address topics such as invasive species, climate change, geologic history and other relevant topics.

Chapter C. *Action Category:* Agricultural Practices and Prospects

1. Introduction

Following is a summary view of the status, challenges and opportunities facing agriculture in the Cayuga Lake watershed, focused on the three shoreline counties, Cayuga, Seneca, and Tompkins. Each county's most recent Agriculture and Farmland Protection Plan's water and land protection goals and actions are summarized. County-level initiatives to protect both farmland and water quality are summarized. Goals and Recommendations for Action are provided at the end of this chapter.

Water quality research, 2001 and today

In the 2001 Plan and accompanying Preliminary Watershed Characterization, a list of water pollutants was provided which originate from many sources including residential lands and urban stormwater, and from farm runoff. Nutrients, sediment, pathogens, organic material, and pesticides can migrate from agricultural lands to surface and ground water through processes including surface runoff, erosion, infiltration, and aerial drift.

The pollutant loads entering our creeks and lake are quantified and better understood in 2017 than 2001, thanks to water quality monitoring and research carried out by, among others:

- David Bouldin, Emeritus Professor, Cornell University Department of Soil and Crop Sciences.
- Cayuga Lake Floating Classroom ((http://www.floatingclassroom.net/).
- Cayuga Lake Modeling Project (Cornell University and NYS DEC, https://energyandsustainability.fs.cornell.edu/util/clmp/default.cfm).
- Community Science Institute, Inc. (CSI, http://www.communityscience.org/) and trained volunteer water quality monitoring teams.
- EcoLogic LLC (http://ecologicllc.com/).
- Finger Lakes Institute at Hobart and William Smith Colleges (http://www.hws.edu/fli/).
- Finger Lakes PRISM (Partnership for Regional Invasive Species Management, http://fingerlakesinvasives.org/).
- Douglas Haith, Professor in Cornell University's Department of Biological and Environmental Engineering (https://bee.cals.cornell.edu/people/douglas-haith).
- John D. Halfman, Professor of Geolimnology & Hydrogeochemistry, Hobart and William Smith Colleges (http://people.hws.edu/halfman/).
- Robert L. Johnson, Racine-Johnson Aquatic Ecologists (1185 Ellis Hollow Road Ithaca, NY 14850).
- Stormwater Coalition of Tompkins County (http://tcstormwater.org/).
- Tompkins County Water Resources Council and Cayuga Lake Monitoring Partnership (http://www.tompkinscountyny.gov/planning/committees-wrc).
- Upstate Freshwater Institute (http://www.upstatefreshwater.org/).
- M. Todd Walter, Professor and Director of the Water Resources Institute, Department of Biological and Environmental Engineering, Cornell University (https://bee.cals.cornell.edu/people/m-todd-walter)

For more information about this research – with a 2017 update for each major pollutant of concern listed in the 2001 Plan, plus several emerging issues – please see Section III Water Quality, Issues and Geographic Areas of Concern. Also see Section IV Chapter J., Monitoring and Assessment.

However, pollutant sources remain elusive in 2017. We do not yet know what fraction of phosphorus, for example, is from farm sources, and what fraction is from lawn care chemicals, faulty septics, and other sources. Also, a lot more is known about pollution entering the south end of the lake in Tompkins County, than along the two-thirds of shoreline in Seneca and Cayuga counties. Research has previously focused at the south end, where the big creeks deliver somewhere between 40-65% of all water entering Cayuga Lake.

South end water moves north to join water entering the lake along the Cayuga and Seneca county shorelines. The lake drains north to Lake Ontario via Mud Lock and the Oswego River Basin system (https://ny.water.usgs.gov/pubs/fs/fs18099/fs180-99.pdf). Thus, some south-end pollutants can accumulate as lake waters flow slowly north, and more pollution may be entering the lake from Seneca and Cayuga counties' shorelines, creeks and streams.

A new era of water quality monitoring emerged in Seneca and Cayuga counties during 2015-2017, as CSI-trained volunteer teams began tracking north-end creek water quality on the east and west shores; the Seneca County Soil and Water District office began work with Racine-Johnson Aquatics on a hydrilla survey; inter-county agencies and nonprofit groups joined with the Finger Lakes PRISM program to combat the spread of hydrilla; and the Finger Lakes Institute established monitoring for harmful algae blooms (HABs) and other indicators of water quality problems, along Seneca and Cayuga county shorelines.

Also in 2017, NYS DEC introduced a phosphorus reduction plan, the Whole Lake Phosphorus TMDL for phosphorus, to cover the entire watershed. See Section III of this Plan for details, check DEC's Cayuga Lake Watershed webpage http://www.dec.ny.gov/lands/88250.html for next steps, and Cayuga Lake TMDL Outreach Page for documents http://www.dec.ny.gov/lands/95403.html .

Additional regular, long-term monitoring is needed, lakewide, to measure pollution amounts, impacts to lake water quality and tackle solutions. This is a high priority recommendation of the 2017 Plan.

Recommendations from 2001, still relevant in 2017

In the 2001 Cayuga Lake Watershed Restoration & Protection Plan, specific actions for agriculture were recommended to reduce the loss of sediment and associated pollutants from the landscape, including two central recommendations for controlling agricultural nonpoint source pollution. The first was to continue to develop and implement whole farm plans using the Agricultural Environmental Framework (AEM).

In 2017, AEM is overseen by the New York State Soil and Water Conservation Committee and administered by county-level Soil and Water Conservation District offices. AEM is defined as "a cooperative, interagency program that provides one-on-one help to farmers to identify environmental risks on their farms. Once these risks

are identified, farmers receive planning, design and help obtaining financial assistance to correct existing problems and prevent future ones" (https://www.nys-soilandwater.org/about_us/what_we_do.html). Link to AEM programs: https://www.nys-soilandwater.org/aem/ .

A second 2001 recommendation was the protection and/or restoration of riparian corridors adjacent to agricultural lands throughout the watershed. In 2010, a portion of Canoga Creek marsh was restored from farmland to wetland (in the Town of Fayette, south of Seneca Falls on the lake's west shore). See Section IV. H., Wetlands and Riparian Corridor Management, for more information about this project and others.

A perennial concern both in 2001 and today is funding for research, and to get innovations to farmers. A discussion of shifts in funding to farm conservation programs is available here https://www.ers.usda.gov/agricultural-act-of-2014-highlights-and-implications/conservation/ .

2. National trends affecting farming and water in the Cayuga Lake watershed

Factors reducing farmland

According to a 2014 report by the American Farmland Trust summarized on their website, data from the 2012 Agricultural Census shows a nationwide drop in agricultural land uses, "from 922 million acres in 2007 to less than 915 million acres. This reduction continues a downward trend that has resulted in a 72 million acre decrease of land in agriculture since 1982."

The American Farmland Trust's President and CEO Andrew McElwaine spotlights two additional land-loss trends: farmland conversion to development (roads, malls, housing, etc); and to erosion.

Development: "In recent years, we've developed more than 50 acres of agricultural land every hour," said McElwaine. "Since 1982, we've converted 24.1 million acres—an area the size of Indiana and Rhode Island combined."

Erosion: "We also lost farmland another way—in 2010 alone, more than 1.7 billion tons of soil eroded from our cropland," said McElwaine. "You would need more than 15.6 million railway cars that would stretch around the earth almost eight times to haul all of that dirt."

("American Farmland Trust: 2012 Census of Agriculture Shows Steady Decline Continues In Land Devoted To Farming, But That's Not The Whole Story" http://www.farmlandinfo.org/american-farmland-trust-2012-census-agriculture-shows-steady-decline-continues-land-devoted-farming, May 2014.)

Climate change and farming

Fertilizer, fuel and methane emissions from cows in the US is a small part of total methane emissions nationwide, but there is a growing sense that farmers should do something to reduce emissions via precision feeding (reduces how much and what is

fed); not using as much fertilizer. With less feed and fertilizer use, production costs are reduced, good news to any farmer.

There is also concern about rising temperatures, because dairy cows are most efficient around 70F. If temperatures rise much above that, milk production drops. A big question for the dairy industry is: How to keep cool in a warming climate, without using energy and spending money? This is also a concern with poultry. As climate warms, it affects the financial bottom line as well as energy consumption. (Gooch, 2017, "Application and Management of Dairy Cattle Heat Stress Relief Systems", https://ecommons.cornell.edu/handle/1813/46186).

The industry is looking at other technologies to reduce inputs that lead to excess emissions. The use of manure lagoons and manure storage has dominated for decades – now the industry is talking about covering them with membranes and flaring off the methane, which turns into CO2, a less potent greenhouse gas than methane. Other new technologies and methodologies are being adopted or investigated which improve efficiency and reduce the impacts of farming, especially dairy farming.

To help agriculture adapt, Cornell University's Institute for Climate Smart Solutions has launched the Climate Smart Farming program http://climatesmartfarming.org/.

Other resources include New York State's Energy Plan https://energyplan.ny.gov ; and the NYS Public Service Commission's New York Clean Energy Standard https://www.governor.ny.gov/news/governor-cuomo-announces-establishment-clean-energy-standard-mandates-50-percent-renewables,with a section for agriculture.

Useful to farmers for fuel and potential crops is NYSERDA's Renewable Fuels Roadmap: https://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Biomass-Reports/Renewable-Fuels-Roadmap .

Available for municipalities is DEC's Climate Smart Communities Resources and Services http://www.dec.ny.gov/energy/76910.html.

3. State-level trends in farming, reflected across the Cayuga Lake watershed

Trends in farm size

Statewide, a 2012 study by Schmit and Bills lists a number of economic and geographic trends for NYS farming in recent decades. Three of watershed importance: farm businesses continue to be consolidated into larger economic units; the number of smaller part-time farms has increased; and farm acreage has dropped by over half since 1950.

> Today, more than 40 percent of all New York farms can be classified as residential farms because the operator has a full-time job off the farm. In addition, the number of farms selling direct to consumer in New York State is rapidly increasing but from a small base; Farms selling directly to consumers represent about 15% of all farms, but span 2% of annual commodity sales statewide. Farm consolidation, along with expanded competition for land from nonfarm uses, has resulted in continual decreases in farm acreage. Land in

farms decreased from 16 million acres in 1950 to just over 7 million acres in 2007.

p. 7, T.M. Schmit and N. L. Bills, "Agriculture-Based Economic Development in NYS: Trends and Prospects," Charles H. Dyson School of Applied Economics and Management College of Agriculture and Life Sciences Cornell University Ithaca, New York http://cooperatives.dyson.cornell.edu/pdf/EB%202012-11.pdf

4. Watershed-wide trends affecting farming and water in the Cayuga Lake watershed

Nutrient management and confined animal feeding operations (CAFOs)

Concentrated animal feeding operations, aka CAFOs or "factory farms," are on the rise in the Cayuga Lake watershed. Here is the DEC link to the map of CAFOs in NY State: http://www.dec.ny.gov/permits/36895.html . According to DEC, there are more than 500 CAFOs in the state, the majority of which are dairy farms with 300 or more cows and associated livestock operations.

Information about CAFOs, the two 2017 SPDES CAFO General Permits, background and links, are available at NYS DEC's Concentrated Animal Feeding Operation web pages: http://www.dec.ny.gov/permits/6285.html

Numerous medium and large CAFOs drain to Cayuga Lake's east shore via short and longer creeks and streams. CAFOs are highly regulated. If done correctly, their nutrient management programs prevent pollution of local waterways. More water quality monitoring and better communications between farmers and other landowners are key to resolving conflicts and ensuring good water quality in our creeks and lake. These are high priority recommendations for this Plan.

Working group to compile and assess farming practices, water impacts

A working group has been established (March, 2017) by Cornell Cooperative Extension, the Cayuga Lake Watershed Network, and the office of the Agricultural Environmental Management (AEM) Coordinator to gather information from a number of agencies for a detailed, watershed-wide understanding of farming and water protections effectiveness in the Cayuga Lake watershed, focused on the three main shoreline counties. The information to be collected and examined includes AEM planning efforts – Tier I through IV, and the funded Agriculture Nonpoint Source practices; Soil & Water Conservation District offices information about funded BMPs; Farm Service Agency and Natural Resources Conservation Service data on conservation practices; and implementation on CAFO regulated farms. These agencies are being asked to compile data, and to help review and assess. A report will be produced during 2017.

Extreme weather and climate change

Climate change is already impactful in the Cayuga Lake watershed, with effects felt first by farmers. We are experiencing localized and short-term droughts. The drought of 2016 (continuing into 2017, though less severe), was historic in severity and impact

to farmers, water suppliers, recreational users and natural ecosystems ("Northeast drought update", Northeast Regional Climate Center http://www.nrcc.cornell.edu/regional/drought/drought.html).

Extreme precipitation is affecting the Northeastern USA more than any other region, with an increase of more than 70% in very heavy events (the heaviest 1% of all daily precipitation events) between 1958 and 2010 ("Northeast – Observed Climate Change", The National Climate Assessment at GlobalChange.gov http://nca2014.globalchange.gov/report/regions/northeast). Runoff should be captured and stored, to recharge groundwater. Roads, ditches and tiling systems deliver water directly to streams, short-circuiting absorption for pollutant filtering and groundwater recharge. Better infiltration of flashy runoff to groundwater would recharge wells, keeping animal feeding operations well-watered.

Different crops are being grown, because of changes in seasonal temperature and water availability. Farming is highly vulnerable to these changes. Farmers need help and advice to adapt and build resilience.

Emerging opportunities

Niche farming and specialty farming are statewide trends, in many instances leading to *agrotourism*. Cayuga Lake wine producers and those on adjoining Finger Lakes were the pioneers in linking their products to a pleasant day out, decades ago. This concept now embraces many more products and services. Specialized farms are personalized to fit markets and production opportunities at local levels.

There are more *farmers markets and pick-your-own orchard operations.* Following the great success of the Cayuga Wine Trail http://cayugawinetrail.com/, the watershed now has numerous commodity "trails" and markets, with associated festivals and seasonal events. Small farmers go into agrotourism more easily than do bigger, less flexible operations. Another emerging small farmer niche is occupied by *equine businesses*, also on the rise locally, as horse owners transform boarding and riding into marketable services.

The boom in the appeal of *Greek style yogurt* has had an enormous impact on the watershed (and state's) dairy industry. Positive effects include high milk sales; many new processing plants, meaning many good new jobs, with associated primary and secondary economic impacts. This still-expanding success story can be a model for other farm product revolutions.

Not just in urban areas, *food deserts* are places where good local food is hard to get, with unhealthy food choices the only readily available, inexpensive options for local residents. What is needed is fresh food produced on and sold from small farms in city, town and village settings. Farmers markets and Community Farm Shares help decrease food deserts, where they are affordable. Recognizing and responding to this need could have good feedback into our economy, providing new and different markets for local farmers.

5. County-level farming indicators and water quality protection initiatives

Introduction: Farming in the watershed's three shoreline counties

From the watershed plan of 2001 to this 2017 update, agriculture has continued as a dominant land use across the watershed, more so along the lake's northern two thirds than around the south end. Recent county-level figures indicate the continued importance of farming regionally. In 2012, 64% of Seneca County's land was in agriculture and 54% of Cayuga County's land area was in agriculture. In 2012 in Tompkins County, farming activities occupied 30% of the land area (2012 Census of Agriculture).

Cayuga County:
Farm production and land-use trends, water protection, and climate change information

Production and land-use trends

Cayuga County ranked first in New York State in the production of grains and soybeans and second in the production of milk and other dairy products. While overall farm numbers and amount of land farmed did not change significantly over the past twenty years, Cayuga County is seeing many farms expand to achieve economies of scale while also experiencing a proliferation of smaller farm operations. Long-term, Cayuga County has seen a drop in land farmed over the past half century.

2012 Census of Agriculture, Cayuga County; Cayuga County Agricultural and Farmland Protection Plan, Final (2014): http://www.cayugacounty.us/Departments/Planning-and-Economic-Development/Agricultural-Farmland-Protection/Ag-Plan-Update/Draft-Plan.

A comment about Cayuga County's development pressures applies watershed-wide:

> The availability of water and sewer infrastructure has increased dramatically in the past few decades and continues to rise, creating a potential market for residential development and placing agricultural lands in and near those districts at greater risk of conversion.
>
> pp. 63-64, Cayuga County Agricultural and Farmland Protection Plan 2014.

Water protection

The Cayuga County Agriculture and Farmland Protection Board (AFPB) and partners developed an implementation plan to support the county's agricultural economy and protect farmland from 2015 to 2025. The plan prioritizes several objectives and actions for water-resources protection.

Action 3-2.1: Provide one-on-one technical assistance to address farmers' nutrient, resource and farm management challenges, with a focus on improving the quality and implementation of farm plans. Assist farmers in identifying relevant state and federal loan and grant opportunities to help meet their needs.

Objective 3-3: Protect viable agricultural land from non-agricultural uses and development pressures.

Action 3-3.1: Make informed zoning and planning decisions by using the resources in this plan to identify agricultural lands experiencing development pressures or other conflicts.

Action 3-3.2: Establish local purchase of development rights (PDR) programs where appropriate and include provisions requiring that protected agricultural lands remain in active agricultural use.

pages 36 and 67, Cayuga County Agriculture and Farmland Protection Plan 2014
http://www.cayugacounty.us/Portals/0/planning/Documents/AgPlanUpdate/full.05.14.14%20no%20blanks.pdf

Climate change

Cayuga County prepares for climate change on Owasco Lake via their 2015 Watershed Plan, Chapter 6 of the Plan's Inventory Report:
http://www.cayugacounty.us/Portals/0/planning/WQMA/Documents/Inventory%20Report%20Chapter%206.pdf .

Seneca County:
Farm production and land-use trends, water protection, and climate change information

Production and land-use trends

In 2008, Seneca County ranked 28th in New York State. The county's production sector is diverse, and 35% of the land in production is taken up by dairy, grain production, and beef and feedlots. Farm numbers and amount of land farmed did not change significantly over the past twenty years, although Seneca County's farms today are smaller and more numerous, reflecting buy-in by Amish and Mennonite farmers. Long-term, Seneca County has seen a drop in land farmed over the past half century.

2012 Census of Agriculture, Seneca County; 2011 Seneca County Agricultural and Farmland Protection Plan:
http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SC_CompPlanTemp_021214.pdf .

The county reports concern about farmland loss by conversion to non-farming uses:

> … farmland is taken out of production by the many small cuts. The County Population peaked in 1970, but our number of housing units continues to increase. New home sites have been developed outside of population centers such as Villages, and taken acres out of production. Seneca County's growth patterns are not the 25 + unit subdivisions that people recognize when a large area is converted to housing. Rather the pattern that we more often see is the single lot here, and there.
>
> pp. 19-20 Seneca County Agriculture Plan, 2011

Water protection

Seneca County's Agriculture and Farmland Protection Plan includes goals and actions protective of water quality and farmland preservation.

Goal 3: Provide an Ongoing Community Education Program for the Non-Farm Public. Actions: Form an Agriculture Promotion Council. Develop a Seneca County Agriculture Web Site. Produce a Video about Seneca County Agriculture. Encourage

Participation in "Agriculture in the Classroom." Strengthen Continued Support of "Fun on the Farm" Events.

Goal 4: Acknowledge and Enhance the Environmental Stewardship of Agricultural Businesses. Actions: Involve all stakeholders in the process of protecting the environment. Implement the Agricultural Environmental Management Program on Seneca County Farms.

Goal 5: Preserve Prime Agricultural Land. Actions: Maintain the effective implementation of the Agricultural District Program. Initiate Voluntary Farmland Preservation Programs. Encourage Local Towns to Plan for Farmland Protection.

pp. 21-37, Seneca County Agriculture and Farmland Protection Plan, 2011 http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SC_CompPlanTemp_021214.pdf

Climate change

Seneca County provides essential climate change information via its Cooperative Extension website: http://senecacountycce.org/environment/climate-change

Tompkins County:
Farm production and land-use trends, water protection, energy and climate change information

Production and land-use trends

In Tompkins County, small farms (less than $250,00 in sales) make up 85% of the total number of farms. County farmers export milk, livestock and commodity crop sales. The balance of sales includes horticultural crops and small livestock, primarily sold directly to consumers via local and niche markets. Farm numbers and amount of land farmed did not change significantly over the past twenty years, with a slight trend toward small farms becoming more prominent. Long-term, Tompkins County has seen a drop in land farmed over the past half century.

Tompkins County Agricultural and Farmland Protection Plan 2015; 2012 Census of Agriculture, Tompkins County. http://www.tompkinscountyny.gov/files/planning/Natural_Agriculture/Final_Tompkins_Ag_%26_Farmland_Protection_Plan%2009-15.pdf .

Competing uses for farmland are on the rise in some areas of Tompkins County:

> [C]ertain areas of the County, particularly the North Lansing-West Groton ARFA, the eastern edge of the Northwest ARFA, and the southern reaches of the Northeast ARFA closest to the Village of Dryden are under growing development pressure and are susceptible to loss of farmland and conflicting land uses. Farmland located on State highway frontage (State Routes 13, 79, and 96) has high visibility and access, making it inherently vulnerable to development pressure. ARFAs are Agricultural Resource Focus Areas (ARFAs). Six were identified for Tompkins County in 2002.
>
> pp. 49 and 52, Tompkins County Agriculture and Farmland Protection Plan 2015.

Water protection
Tompkins County's Environmental Conservation Goal includes water quality protections. Only directly water-related excerpts are provided here. For details view the document link below.

Goal: Farmers follow sustainable farming practices that protect natural resources and mitigate negative environmental impacts on soil, water, ecology, wildlife, and people while increasing resilience to address climate change and environmental challenges over the long term.

Action 2: Work with municipalities, the farm community and rural landowners to advance projects that reduce property risk from stormwater while not contributing to flooding on surrounding land uses.

pp.60-61, Tompkins County Agriculture and Farmland Protection Plan 2015
http://www.tompkinscountyny.gov/files/planning/Natural_Agriculture/Final_Tompkins_Ag_%26_Farmland_Protection_Plan%2009-15.pdf .

Energy and climate change information
Tompkins County's 2016 Energy Roadmap:
http://tompkinscountyny.gov/files/planning/energyclimate/Executive%20Summary%20-Recs-TOC%203-4-16.pdf.

Also see the Tompkins County Agriculture and Farmland Protection Plan (2015), pp. 60-61, for a list of objectives and actions for energy conserving innovations.
http://www.tompkinscountyny.gov/files/planning/Natural_Agriculture/Final_Tompkins_Ag_%26_Farmland_Protection_Plan%2009-15.pdf .

6. Goals and Recommendations for Action

Goals

- Maintain viability of agricultural land use in the Cayuga Lake Watershed.
- Minimize the negative impact of agriculture on the environment and reduce migration of pollutants to surface and groundwater.
- Adapt to and mitigate climate change and extreme weather events.
- Increase support for agriculture as a preferred land use by increasing public awareness of the value and importance of farming.

Recommended Actions to Implement Agricultural Practices Improvements for Water Quality Protection, 2017

1. Promote economically and ecologically responsible renewable energy options for farmers and farmlands.

2. Help farmers establish better water storage and retention, for climate change/extreme weather events.

3. Encourage municipal and county protection plans for drinking water and agricultural water.

4. Establish better communications between farmers and non-farmers, and better education among non-farmers about farm practices and programs.

5. Support higher state and federal funding for agricultural agencies including Cornell Cooperative Extension, Soil and Water Conservation Districts.

6. Establish and fund water quality monitoring programs at creek outlets around the lake, in cooperation with Soil and Water Conservation District offices.

7. Encourage adoption by farmers of the climate change objectives and actions in the Tompkins County's Agricultural Plan.

8. An IO working group should be established to study CAFOs, tiling and drainage, excess runoff, and other concerns, and provide a report for public and municipal use.

Chapter D. *Action Category:* Stormwater Management and Erosion Control

1. Introduction

In the 2001 Plan, one of the highest priority projects for immediate implementation was to deal with "very severe streambank segments and roadbank/road ditch sites." A watershed-wide Streambank & Roadbank Inventory was conducted in the summer of 2000 for the watershed Characterization. Stream segments and roadbank/road ditch sites were ranked by severity based on erosion potential. Over the 17 years since, innovative practices and policies have been put in place on farmlands, along roadways and in urban areas to control and reduce stormwater runoff and erosion. New programs are under development. These are described in the following pages.

The challenge of stormwater runoff and erosion remains near or at the top of municipal and public water quality concerns in 2017. Additionally, the rise in extreme weather events as part of climate change is already adding to stormwater and erosion problems, evidenced by the damage done during heavy summer rainstorms in 2014 and 2015 (notably on Enfield Creek in and downstream of Robert H. Treman State Park, the upper reaches of Cayuga Inlet in Newfield, along roads, and on farm fields across the watershed).

This chapter's Recommendations for Action include carrying out an update/assessment of the Inventory, delineating severe roadside ditch problem areas in Seneca, Cayuga and Tompkins counties, and developing a multi-municipality project to test roadside ditches best management practices. This project is a focus of the IO's recommendations for implementation, part of the next-steps 2017-2020 grant awarded to the IO by the NYS Department of State's Local Waterfront Revitalization Program in fall 2016. See Section II, Next steps: Watershed Coordination, Collaboration and Partnerships (p. 22), for details.

2. Background on stormwater, erosion and road salt problems

Stormwater runoff is a major pathway for transporting sediment and other materials from the watershed to the surface water network. The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands trap rainwater and snowmelt and allow it to slowly filter into the ground. Runoff tends to reach receiving waters gradually. In contrast, nonporous developed landscapes like roads, bridges, parking lots, and buildings do not let runoff slowly percolate into the ground. Water remains above the surface, accumulates, and runs off in large amounts.

Municipalities install storm sewer systems designed to quickly channel runoff from roads and other impervious surfaces. These engineered solutions are important to control high flows that may be a threat to public safety. Unfortunately, there are adverse ecological consequences to traditional stormwater management.

Runoff gathers speed once it enters the storm sewer system. When the water leaves the sewer system and empties into a stream, large volumes of high velocity runoff erode streambanks, damage streamside vegetation, and widen stream channels. In turn, this will result in lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures.

Runoff from roads can contribute to water quality and habitat degradation of streams and lakes. Sediment and chemicals originate from winter deicing agents, shoulder ditching practices to maintain swales, and storm drains with inadequate provision for sediment removal.

Development activities can also increase the **variety and amount of pollutants** transported to receiving waters. Sediment from development and new construction; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems and pet waste; road salts; and heavy metals are examples of pollutants generated in urban areas. Sediments and solids constitute the largest volume of pollutant loads to receiving waters in urban areas.

The initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction is one of the largest potential sources of **erosion** and sedimentation. When natural vegetation and topsoil are removed, the exposed area is particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas. Sediment loss from developed areas is potentially significant in the Cayuga watershed.

Deicing material, primarily sodium chloride, is used by area highway departments to help de-ice road surfaces during the colder months of the year. Each highway department has individual policies and procedures regarding salt application, salt/sand mixtures and storage. There are several environmental concerns regarding the use of deicing salts. After application, salts are highly soluble in water. They easily wash off pavement into surface waters and leach into soil and groundwater. High concentrations of salt can damage and kill vegetation, disrupt fish spawning in streams, reduce oxygen solubility in surface water, interfere with the chemical and physical characteristics of a lake, pollute groundwater making well water undrinkable, disintegrate pavement, and cause metal corrosion of bridges, cars and plumbing.

As part of the 2001 Watershed Plan, a road deicing and storage survey was conducted throughout the Cayuga Lake watershed. This search found 49 state, county and municipal salt storage pile sites within the Cayuga Lake Watershed. Twenty-one (42%) were exposed directly to the weather and many are significantly close to a stream or the lake itself. At that time, the average total amount of deicing material spread in the watershed exceeds 30,000 tons per year. This survey has not yet been updated.

In December 2016, a presentation by the Community Science Institute suggested that salt (chloride) is slowly rising in local waterbodies, not yet to problematic levels (http://www.communityscience.org/whats-in-your-watershed-series/). This trend needs to be monitored. Also see Section III. G., Hazardous Waste Management, for a discussion of legacy pollutants produced by long-time area industries including Cargill, Inc.

Salt levels in neighboring Seneca Lake, are high enough to be a health hazard for some people. Salt levels in Cayuga Lake are only slightly elevated above the other Finger Lakes (John Halfman, January 2017 presentation in Romulus, and 2014 publication

http://people.hws.edu/halfman/Data/PublicInterestArticles/An%20Update%20on%20Major%20Ion%20Geochemistry%20in%20Seneca%20Lake,%20NY.pdf).

Continued salt mining and energy development activities on Seneca and Cayuga lakes is a cause for concern (see Chapter F., Hazardous Waste Management).

Fracking (HVHF), brine, fossil fuel development and infrastructure

Concerns were raised from 2008-2014 that fracking brine from high volume hydraulic fracturing (HVHF) operations was being used as a de-icer and "road conditioner" on local roads. According to FrackTracker.org, this practice is not in use in the Cayuga Lake watershed (http://maps.fractracker.org/latest/?appid=eb1904df42c848ed967a48c52e873c91). A Tompkins County ordinance was passed in 2012 to prevent this practice from being used on county roads. The status of this practice needs to be checked regularly because brine is cheap, and road crews may not be aware of local laws.

The rights of local communities in NY State to ban fracking via zoning ordinances was won in 2014 following a protracted legal challenge and much public input. A state ban was finalized in 2014 by NYS DEC and the NY Department of Health, and most land leases for gas well pads have been suspended by drilling companies.

Fracking, pipelines and associated infrastructure, which convey fracked gas and other fossil fuels long distances to customers, remain a threat to our lake and creeks, and should be strongly discouraged in order to protect Cayuga Lake, its watershed and communities.

Construction and maintenance of pipelines, support facilities, and corridors can have short and longer-term disruptive environmental effects, notably stormwater runoff and erosion. See Chapter A., Public Participation.

3. Sediment in the lake and tributaries

As discussed in Section III under Water Quality Status and Issues, silt and sediment are significant water quality issues in Cayuga Lake. The southern end of Cayuga Lake is included on the NYS and EPA Section 303(d) lists of Impaired Waters http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf

The three northerly sections of Cayuga Lake (Cayuga Lake, Northern End; Cayuga Lake, Main Lake, Mid-North; Cayuga Lake, Main Lake, Mid-South) and tributaries are not listed for sediment or other impairments:

> Concerns have been raised regarding nonpoint runoff of nutrients into the lake, although in-lake concentrations of phosphorus and other productivity indicators remain low. Sediment plumes have been documented during storm events, but these do not represent conditions that are typical of the lake. Continued practices to minimize runoff are recommended, however there are no apparent sources of significant pollutant loading to the waterbody."
>
> p.3, http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf

On New York State's Priority Waterbodies List (2015-6), several of Cayuga Lake's tributaries are listed as having problems with silt/sediment, including Yawger Creek, Lower and Upper Salmon Creek, Virgil Creek, Lower and Upper Cayuga Inlet, Cascadilla Creek, and Upper Six Mile Creek (Cayuga/Yawger Creek pp.1-19 http://www.dec.ny.gov/docs/water_pdf/wioswegoyawgerscr.pdf; Cayuga/Salmon Creek pp. 1-21 http://www.dec.ny.gov/docs/water_pdf/wioswegosalmoncr.pdf).

4. Emerging data sets for Seneca and Cayuga county shorelines and tributaries

Until 2015 the only regularly updated, long-term data collection for three quarters of the lake's length (the Seneca and Cayuga County shorelines and tributaries) has been the baseline water quality test carried out annually by John Halfman at Hobart and William Smith Colleges/Finger Lakes Institute (2016, http://people.hws.edu/halfman/Data/2016%20FL-WQ-Update.pdf).

Section III, Water Quality, and Chapter C., Agriculture Practices and Prospects, provide a summary of Seneca-Cayuga counties shoreline and lake water quality research being carried out by Lisa Cleckner of the Finger Lakes Institute as of 2016; also water quality data collection by a volunteer group trained by the Community Science Institute, on several northwest shoreline creeks in the towns of Fayette and Seneca Falls. A water quality database for five short, steep streams and small creeks on the lake's east shore between Aurora and King Ferry, is available on CSI's website from 2009-2012, and was re-activated in 2016.

These data begin to suggest that sediment and other pollutants may play an as-yet largely un-assessed role in water quality challenges along the Seneca and Cayuga lakeshore and at the shallow northern end of the lake.

Additionally, volunteer monitoring groups are being organized and funding sought to begin sampling for silt/sediment and other water quality indicators at tributaries on the lake's northeast and southeast shorelines during 2017 (see Recommendations, below), including Yawger Creek.

5. Existing Technical Solutions

Federal guidance In late 2016, **US EPA** made available a draft guide, toolkit, and technical assistance to promote comprehensive, community-wide planning approaches to manage stormwater: *Stormwater Planning - Community Solutions for Voluntary Long-Term Stormwater Planning.* "EPA considers this guide a draft that will be supplemented with an integrated online tool to assist communities in implementing the planning process, piloted through community-based technical assistance efforts, and updated over time with feedback from users": https://www.epa.gov/npdes/stormwater-planning.

The National Pollutant Discharge Elimination System (NPDES) programs maintained by EPA include the **NPDES Stormwater Program** https://www.epa.gov/npdes/npdes-stormwater-program . The New York State Department of Environmental Conservation administers NPDES programs and permits, excepting permits on all Indian Country in the state, which are administered by the federal agency.

The Natural Resources Conservation Service provides stream restoration information, including handbooks on Stream Corridor Restoration, Stream Restoration Design, and a Stream Corridor Restoration resources page: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/restoration/

New York State guidance New York State updated its *Standards and Specifications for Erosion and Sediment Controls*, aka "the blue book," in 2016. The blue book provides standards and specifications for selection, design and implementation of erosion and sediment control practices: http://www.dec.ny.gov/chemical/29066.html

The *New York State Stormwater Management Design Manual* (January, 2015) provides standards and specification for selection and design of stormwater management practices to comply with State stormwater management performance standards: http://www.dec.ny.gov/chemical/29072.html .

Other resources The Center for Watershed Protection is "a national network of professionals dedicated to advancing the state-of-the-art in watershed and stormwater management," providing consulting services; a highly informative web site of technical information and educational resources http://www.cwp.org/ ; hosting the annual National Watershed & Stormwater Conference: http://www.cwp.org/2017-national-conference/; and publishing the online peer reviewed journal *Watershed Science Bulletin*, focused on watershed and stormwater issues.

The Water Environment Federation (WEF) Stormwater Institute has produced *Rainfall to results – the future of stormwater*, a report pointing the way to a future in which "all stormwater will be considered a resource and managed through an optimized mix of affordable and sustainable green, gray, and natural infrastructure." Available at http://wefstormwaterinstitute.org/rainfall-to-results/, the report identifies six objectives "to achieving a healthier water environment": Work at the watershed scale, Transform stormwater governance, Support innovation and best practices, Manage assets and resources, Close the funding gap, and Engage the community.

Cornell University's Cornell Local Roads Program provides trainings and information and technical assistance about drainage, road construction and design to municipal officials and employees: http://www.clrp.cornell.edu/.

6. Regulatory Approaches

Federal The Clean Water Act (1972) includes provisions for regulating municipal wastewater, stormwater management and pollution. Stormwater pollution "occurs when debris, chemicals, sediment or other pollutants from urban areas and construction sites get washed into storm drains and flows directly into water bodies. Uncontrolled stormwater discharges can pose significant threats to public health and the environment. The CWA requires that industrial facilities, construction sites, and municipal separate storm sewer systems (MS4s) have measures in place to prevent pollution from being discharged with stormwater into nearby waterways." https://www.epa.gov/enforcement/water-enforcement

Reducing discharges of contaminated stormwater into the USA's rivers, streams and lakes waterways is an EPA National Enforcement Initiative: https://www.epa.gov/enforcement/national-enforcement-initiative-keeping-raw-sewage-and-contaminated-stormwater-out-our

State: New York administers provisions of the Federal Clean Water Act through the State Pollution Discharge Elimination System (SPDES) Program

The SPDES program is designed to eliminate the pollution of New York waters and to maintain the highest quality of water possible-- consistent with

- public health
- public enjoyment of the resource
- protection and propagation of fish and wildlife
- industrial development in the state. http://www.dec.ny.gov/permits/6054.html

Planning and permitting of stormwater falls under this state program. Currently, there are three SPDES general permits that address activities associated with stormwater discharges. These are the Multi-Section General Permit for Stormwater Discharges Associated with Industrial Activities, SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s), and SPDES General Permit for Stormwater Discharges from Construction Activity.

Tompkins County: Several municipalities have created committees or boards to address stormwater issues within their local land use regulation and control structure. The Stormwater Coalition of Tompkins County was established in 2003 following implementation of Phase II stormwater regulations: http://tcstormwater.org/. Ten regulated municipalities and one unregulated municipality participate in the coalition to collaboratively implement components of the stormwater regulations.

In cooperation with Cornell Cooperative Extension, the City of Ithaca has established a Flooding Task Force with several foci: Cayuga Inlet, Computer Models, Lake Levels, Precipitation and Climate, Proposals, RFPs and SOWs, Sediment, Six Mile Creek, and Culvert Project. The City is in the process of developing a flood management plan for the streams that flow through the City.
http://ccetompkins.org/environment/water/flooding-task-force

Cayuga County: In 2015, the Owasco Lake Watershed Plan was updated by the Cayuga County Department of Planning and Economic Development with consultant EcoLogic, and is available at the Cayuga County Government website. As part of the update, an assessment was made of local laws, programs, and practices for municipalities in the Owasco Lake Watershed, a number of which are also in the Cayuga Lake watershed.

The *Owasco Lake Institutional Framework and Assessment of Local Laws, Programs, and Practices Affecting Water Quality* (September, 2015) may be viewed here: http://www.cayugacounty.us/Portals/0/planning/WQMA/Documents/OwascoLakeWatershedInstitutionalFrmwk_Body.pdf?ver=2015-10-28-141612-000 . Stormwater and Erosion Control regulations are discussed on p. 2-16, and Chapter 3 provides an

Evaluation of Local Laws and Tools in the Owasco Lake Watershed, with a review of germane rules and regulations in each Cayuga and Tompkins County municipality with land in the Owasco Lake watershed. The proportion of the watershed covered by each municipality is shown in Figure 3-1.

From the Methodology section

> The inventory and assessment of municipal measures to protect water resources in the Owasco Lake watershed was based on the process outlined by the New York State Department of State (NYSDOS): 1. Identification of existing local laws and tools that guide land use throughout the watershed; 2. Review of existing measures to assess their strength in addressing issues that influence water quality; 3. Identification of opportunities for improvement that can form the basis for recommendations in the Owasco Lake Watershed Management and Waterfront Revitalization Plan.
>
> (Chapter 3.2, Methodology. *Owasco Lake Institutional Framework and Assessment of Local Laws, Programs, and Practices Affecting Water Quality,* 2015).

7. Goals and Recommendations

Goals

- Reduce impact of development on natural hydrology.
- Implement stormwater practices in focus areas to reduce stormwater.
- Reduce stormwater impacts downstream by working with upstream municipalities.
- Increase public knowledge re climate change and impacts from it.
- Promote stormwater infiltration into groundwater.
- Use ditch BMPs to reduce water quality impacts from roadside ditches.

Recommended actions to implement stormwater management and erosion control measures

1. Encourage municipalities to adopt a Stormwater Management & Erosion Control Local Law. Provide a template and incentive programs.

2. Monitor development and growth projects for piecemeal degradation. Provide training bootcamps to minimize altering land and drainage on small lots caused by practices of cutting and filling.

3. Design and develop a watershed-wide stormwater management strategy, based on the Stormwater Coalition of Tompkins County.

4. Update/assess the roadside Ditch Inventory (2000 *Characterization*), delineate severe roadside ditch problem areas in Seneca, Cayuga and Tompkins counties, and develop a several-municipality project to test roadside ditches best management practices.

5. Organize and seek funding for trained volunteer monitoring groups for tributaries on the northwest, northeast and southeast shorelines in 2017 and future years.

6. Exclude further fossil fuel infrastructure development – including fracking (HVHC), pipelines, compressor stations, injection wells, etc – by supporting sustainable renewable energy alternatives and public education about their environmental benefits, and by renewing and strengthening bans and moratoria.

7. Update the watershed salt storage study and monitor salt/chloride trends in waterways and lake.

Chapter E. *Action category:* Wastewater Management

1. Introduction

US EPA defines wastewater as "Water that has been used and contains dissolved or suspended waste materials." http://www.ecologydictionary.org/EPA-Glossary-of-Climate-Change-Terms/Wastewater . Domestic (household) wastewater is what most of us are familiar with: "Water containing human and/or animal metabolic wastes, and water that has the residuals from cooking, cleaning and/or bathing" (EPA source). Fresh, drinkable water is a non-renewable resource. It can be cleaned after use, but no new water is being made. For water to be re-used, wastes must be removed, via septic systems and sewage treatment plants.

Household wastewater treatment
Household wastewater is treated either on-site by *wastewater* systems designed to *treat* and dispose of *effluent* on the same property that produces the *wastewater*, or off-site via sewers which transport wastes for treatment to municipal wastewater treatment facilities. There are nine regulated municipal wastewater discharges to Cayuga Lake and its tributaries (see Table 1) with a combined design flow of 16.635 million gallons per day (was just over 15 mgd in 2000).

A helpful primer about wastewater treatment is John R. Buchanan's "Wastewater Basics 101" presentation, viewable at EPA's website: https://www.epa.gov/sites/production/files/2015-06/documents/epa-mou_wastewater_basics_101.pdf . Buchanan discusses the various forms of treatment, from Primary (removing settleable solids); Secondary (using biological process to remove dissolved and suspended organic compounds), and Tertiary (specific excess nutrients are removed). Buchanan posits that we soon will require "Quaternary" treatment to remove "Pharmaceuticals and Personal Care Products – the other "stuff" that goes down the drain with our wastes – medicines, hormones, antibacterial soaps – many of these products are not removed with traditional means." See 3. Emerging Contaminants, below, for more information about the pioneering research into these contaminants being carried out by the Ithaca Area Wastewater Treatment Plant and researchers at Cornell University and Ithaca College.

Outside of the more urbanized or clustered rural areas served by municipal facilities, residents and businesses within the watershed of Cayuga Lake are served by onsite wastewater systems (aka septic systems). This decentralized treatment is very common in New York State and throughout the United States. A discussion of onsite treatment – and its limitations – is provided below.

For more information about municipal wastewater treatment in lake watersheds across New York State, see pp.224-8 in *Diet for a Small Lake: The Expanded Guide to Lake and Watershed Management* (NYSFOLA. 2009. New York State Federation of Lake Associations, Inc. Eds. Sharon K. Anderson and others). Onsite (septic) systems are discussed pp. 233-236. Viewable online: http://www.dec.ny.gov/docs/water_pdf/dietlake09.pdf

Industrial wastewater

Wastewater also contains the waste products of industry. Some industrial wastewater can be treated by municipal plants, but a lot of it cannot. The Cayuga Lake watershed does not have many large industrial waste producers, but facilities such as the Cayuga Power Plant (Heiot Power) and Cargill, Inc., both on the lake shore in Lansing, have closely-regulated DEC permits to use lake water for their operations and to discharge wastewater directly into the lake. Fracking wastes are not allowed in municipal wastewater treatment plants, because their (often toxic, unidentified) chemical constituents are not removed by treatment and can damage a plant's processes.

US EPA has "national regulatory standards for wastewater discharged to surface waters and municipal sewage treatment plants. EPA issues these regulations for industrial categories, based on the performance of treatment and control technologies" (https://www.epa.gov/eg). These are mirrored at the state level in part by the NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit Program http://www.dec.ny.gov/permits/6054.html, and other programs in DEC's Division of Water: http://www.dec.ny.gov/about/661.html .

Please refer to Section IV, G. Hazardous Wastes, for a discussion of toxic chemicals in the watershed and in our waters.

Table 1. Summary of Regulated Municipal Wastewater Discharges to Cayuga Lake and its Tributaries
2005 data (latest available in January 2017): http://www.dec.ny.gov/docs/water_pdf/descdata2004.pdf

Facility	Population served	Type	Name of Discharge Waterbody Segment, Water Quality	Permitted Flow (million gallons per day, mgd)
Ithaca Area Wastewater Treatment Plant	Serving Ithaca, Cayuga Heights and portions of the Towns of Dryden and Lansing. IAWTP: 50,000 CHWTP:18,000 (2005)	Municipal wastewater	Discharges to Cayuga Lake, Class A water	13.1
Cayuga Heights Wastewater Treatment Plant		Municipal wastewater	Discharges to Cayuga Lake, Class A water	2
Village of Union Springs	2000 (2005)	Municipal wastewater	Discharges to Cayuga Lake, Class A(T)	0.33
Village of Aurora	900 (2005)	Municipal wastewater	Discharges to Paines Creek at confluence with Lake, Class C	0.3
Village of Trumansburg	Unknown (2005)	Municipal wastewater	Discharges to Trumansburg Creek	0.25

			(flows to Cayuga Lake), Class C	
Village of Dryden	2500 (2005)	Municipal wastewater	Discharges to Fall Creek, Class A water	0.4
Village of Freeville	750 (2005)	Municipal wastewater	Discharges to Fall Creek, Class A water	0.125
Village of Interlaken	560 (2005)	Municipal wastewater	Discharges to Minors Creek (flows to Cayuga Lake) Class C	0.1
Town of Newfield	Unknown (2005)	Municipal wastewater	Groundwater (Class GA)	0.03

NOTE: The Seneca Falls Wastewater Treatment Plant is not included. It discharges treated water into the Cayuga and Seneca Canal just downstream (east) of downtown Seneca Falls. The Canal flows into the northern end of Cayuga Lake and into the Seneca River system northward to Lake Ontario."Class" refers to training certification required for chief operator.

2. Wastewater treatment improvements in the Cayuga Lake watershed since 2001

In 2010, Tompkins County released the *Countywide Inter-Municipal Water and Sewer Feasibility Study for Tompkins County*. 2010. T.G. Miller and John M. Andersson. https://www.dos.ny.gov/lg/publications/LGEProjectReports/2007/TompkinsCountyFinalReport.pdf This report details water and sewer infrastructure in Tompkins County's sixteen municipalities, and makes recommendations for potential growth and development areas. Of note: Table 1, page 5 summarizes the numerous inter-municipal relationships that currently exist to share water supply and wastewater treatment facilities; Appendix A2 is a map of Municipal Sewer Service Areas, Tompkins County.

The Village of Dryden's wastewater treatment plant had a $1.2 million upgrade in 2011.

The Village of Trumansburg's wastewater treatment plant was repaired and upgraded (2015-6): 250,000 GDP activated sludge and filtration for phosphorus removal. From 2008 to 2013, on average, the Trumansburg Wastewater Treatment Plant discharged treated sewage that contained 378 times the allowable amount of fecal coliform bacteria, according to water testing data from the Community Science Institute. The plant had overflow problems, and sent partially treated sewage flowing

into Trumansburg Creek eight times from 2008-12. The $6 million dollar project was scheduled for completion in late 2016.

IAWWTP, Ithaca Area Wastewater Treatment Plant: 2016 upgrade to tertiary treatment for enhanced phosphorus removal.

Cayuga Heights Wastewater Treatment Plant: Upgrade, with 250,000 GDP Synthetic media trickling filtration (Bio-towers), filtration for phosphorus removal and pick-flows diversion to the IAWWTF.

Sewer line installation along the northeast shoreline, 2015-6: The lakefront Village of Cayuga's wastewater plant was aging, and adjoining lakeshore properties in the Town of Aurelius were having septic system issues. A sewer line is being installed to partially correct these problems, connecting to the City of Auburn's sewer system. While this area drains north into the Seneca River downstream of Cayuga Lake, it is on the lake's northeast shoreline and is included here. More information: http://bartonandloguidice.com/Services/Wastewater/AureliusCayugaWS/tabid/399/Default.aspx

Cayuga County to develop a master plan for the improvement of water and sewer systems: 2017: "The Cayuga County Water and Sewer Authority will develop a master plan for the improvement of water and sewer systems throughout Cayuga County and extension of municipal water and sewers to areas needing these services. Existing systems will be evaluated with recommendations for improving efficiency of operations, along with cost estimates and financial impacts for system improvements. Alternative sources of water will also be evaluated." In November 2016, Cayuga County received a $100,000 NYS Regional Economic Development Award, to be matched by the Cayuga County Legislature.

https://www.ny.gov/sites/ny.gov/files/atoms/files/REDCAwardsBooklet2016.pdf ; and http://auburnpub.com/news/local/cayuga-county-water-and-sewer-authority-hopes-to-map-upgrade/article_08d71613-5d93-53f0-80cb-4617e6bc3a11.html

3. Wastewater water quality issues

Onsite Systems

According to NYS DEC, one quarter of New York State's homes, businesses and institutions are served by onsite systems (aka septic systems). While onsite systems are effective and economical when properly designed, installed and maintained, many homes and cottages have failing systems: "the lack of an adequate onsite system, poor routine maintenance, increased density of homes served by onsite systems, undersized and overused systems (particularly due to conversion of vacation cottages and camps into year-round residences), and the installation of systems on sites with unacceptable conditions can all lead to onsite system failure and water quality impacts" (http://www.dec.ny.gov/chemical/69653.html).

Acute failures resulting in wastewater pooling on the ground, impacts to beaches or backups into buildings are potential health problems. Chronic problems can result in bacteria contamination of groundwater and nutrient loadings to lakes and other

recreational waters, spurring excessive aquatic weed and algal growth (see Section III, Exotic and Invasive Species).

Research indicates that inadequate and/or failing onsite wastewater treatment (septic) systems are "a major source [of pollution] in 7% of all waterbodies assessed as impaired in New York State. In another 20% of impaired waterbodies, onsite systems are noted as a contributing source (though not the most significant source). In addition, for 7% of the waters with less severe impacts or threats, onsite systems are noted as a major contributing source. Failing onsite systems are also cited as the major suspected source in 11% of waters where impacts need to be verified, while also being cited as suspected contributing sources for 22% of waters needing verification of impacts" (http://www.dec.ny.gov/chemical/69653.html).

Not enough is yet known about the extent of septic system failures or their impacts on water quality, and a lot needs to be done to improve the situation.

Septic system installation, operation and limitations

The septic tank is an underground, watertight vessel installed to receive wastewater from a home or business. It is designed to allow solids to settle out and separate from the liquid, to allow for limited digestion of organic matter, and to store the solids while the clarified liquid is passed on for further treatment and disposal. In the Cayuga watershed, effluent wastewater typically leaves the tank and is distributed to a subsurface soil absorption area (the leach field). Here the clarified effluent gradually seeps in to the surrounding soils where biological and physical reactions further reduce the concentrations of nutrients, microorganisms, and oxygen-demanding material. See USEPA's Onsite Wastewater Treatment and Disposal Systems resources: https://www.epa.gov/septic/onsite-wastewater-treatment-and-disposal-systems

When correctly installed and maintained, septic tank/soil absorptions systems are an effective way to treat and dispose of domestic wastewaters. Nevertheless, even the best systems are designed to release contaminants into groundwater. Siting, design, installation, operation, and maintenance must be focused on reducing the environmental impact of the release. To avoid contamination of drinking water systems and other problems, soil absorption systems must be situated at prescribed distances from wells, surface waters, springs, and property boundaries. In New York, State and County Health Departments have jurisdiction to approve septic systems.

Shoreline cottages can present special challenges to proper operation of on-site wastewater systems. Depth to groundwater is shallow and lot size can be small. Disposal systems may have been installed prior to modern sanitary codes. Systems that may have functioned adequately with limited seasonal use and a prolonged recovery period may not be able to handle the increased demand associated with year-round use and additional appliances.

Facing the problem and finding a solution

The only county in the Cayuga Lake Watershed with a program to inspect onsite wastewater systems is Cayuga County. The goal of their Septic System Installation and Inspection Program is "to minimize potential health hazards and protect surface and ground water by ensuring that septic systems located within Cayuga County operate satisfactorily."

This program provides services in the following areas:

- Enforces the Cayuga County Sanitary Code that requires that all septic systems be inspected periodically and at the time of a property transfer.
- Reviews plans for new and modified/repaired septic systems proposals.
- Investigates complaints related to septic systems.
- Provides technical assistance to septic systems installers and designers.
- Provides a list of registered septic system installers and septic tank pumpers.
- Answers questions from the public regarding septic system operation and maintenance.

http://www.cayugacounty.us/Community/Health/Environmental-Health/Septic-System-Installation-and-Inspection

EPA estimates that anywhere from 10 to 30 percent of onsite systems are failing annually. Failure of systems to adequately treat wastewater may be related to inadequate siting, improper installation, or poor operation and maintenance. A critical factor in optimal system performance is the depth of unsaturated soil beneath the soil absorption field. Based on the County Soil Surveys, large portions of the unsewered areas within the Cayuga Lake watershed have soil and slope characteristics that are not ideal for on-site wastewater systems.

While it is difficult to measure and document specific cause-and-effect relationships between onsite systems and the quality of Cayuga Lake and its tributaries, there is little doubt that improperly operating systems can contribute to water quality problems. At the local level, Code Enforcement Officers are responsible for approving design and specifications of individual on-site wastewater systems. Article 11 of the Public Health Law and Title 15 of the Environmental Conservation Law provide for review of water supply and sewerage services by the State or County Health Departments for tracts of land divided into five or more parcels of five acres of less.

This Plan strongly advocates for a focused project or projects to raise the level of Seneca and Tompkins counties' septic system inspection and installation programs to that of Cayuga County, via each county's Environmental Health Division within their Departments of Health.

Also exemplary is the Town of Lake George's Septic Initiative Program, referenced below in a short list of resources for improvement of onsite wastewater systems: "This program mandates that all existing onsite wastewater treatment systems (OWTS) within the town are cataloged and inspected, with the goal to ensure that OWTS (also known as septic systems) are functioning optimally." All homes and businesses within 500 feet of Lake George and 100 feet of a stream, tributary or wetland are required to participate.

EPA has identified five major barriers to the successful implementation of decentralized wastewater technologies. These include (1) misinformation and limited public knowledge about onsite systems; (2) legislative and regulatory constraints; (3) lack of system management; (4) existing engineering practices; and (5) restricted access to funding
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/cayugaonsitesystems.htm .

Improvements in the design, siting, operation, inspection, and maintenance of on-site wastewater systems are needed to protect and maintain the integrity of the water resources. This is an area of active research nationally. New technologies are being applied to onsite systems, resulting in higher treatment levels, greater reliability and more flexibility than ever before. In many communities onsite and decentralized systems are the most appropriate, least costly treatment option, and they allow maximum flexibility in planning for future growth.

Resources for onsite (septic) wastewater systems improvements

- Town of Lake George Septic Initiative Program https://lakegeorgetown.org/departments/septic-initiative-program/

- Otsego Lake Watershed Management Plan, Onsite Wastewater Treatment Program https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/documents/Canadarago_February_Waterfield.pdf

- *Detecting Failing Septic Systems on Your Lake: A Cost-Effective Methodology* https://www.warrenswcd.org/reports/failingseptic.pdf . 2006. Warren County NY Soil and Water Conservation District and Adirondack Community College.

- *Diet for a Small Lake: The Expanded Guide to Lake and Watershed Management* NYSFOLA. 2009. New York State Federation of Lake Associations, Inc. Edited by Sharon K. Anderson and others. pp.233-236. http://www.dec.ny.gov/docs/water_pdf/dietlake09.pdf

- Cornell Cooperative Extension: Household Wastewater Treatment Including Septic Systems http://waterquality.cce.cornell.edu/septic.htm. An encyclopedic resource, with many links to detailed information. Topics include: General information and maintenance; Funding to repair/replace failing systems; Frequently asked questions; Causes and signs of failure; Pumping and inspection; much more.

- USEPA's Onsite Wastewater Treatment and Disposal Systems resources https://www.epa.gov/septic/onsite-wastewater-treatment-and-disposal-systems

Emerging contaminants/pollutants

Local public attention was first drawn to emerging contaminants in 2014-5 when a Cayuga Lake advocacy group, Plastic Tides, alerted the public to the problem of microbeads, tiny plastic particles used in toothpastes as abrasives and in skin products as scrubbers, and in other household and industrial products. While mostly removed by drinking water filters, in our creeks and lake these materials persist and can harm fish and other organisms that ingest them. At least in Tompkins County, these products were removed from shelves, Cornell and IC students were notified, and

in 2015 a federal law was passed banning the use of microbeads. http://www.cayugalake.org/microbeads-emerging-issue.html

Perhaps even more pernicious than microbeads are the waste products of the personal care products, pharmaceuticals and hormones that humans consume and excrete. Medicines, caffeine, birth control pills, steroids and many others are among these emerging contaminants, so-called because their presence in our waterways is on the rise. Many of these substances are not removed by conventional wastewater treatment. (See comment above about the need for "Quaternary treatment systems" to remove them.)

The US Geological Survey has been studying and tracking this problem for a while, and their webpages (included in the Resources list below) provide links to numerous research studies where emerging contaminants are having negative impacts on aquatic organisms, with implications for impacts to human beings and water quality.

During 2014-6, Jose Lozano (Ithaca Area Wastewater Treatment Plant (IAWWTP), Dr. Susan Allen-Gil (Ithaca College), and Sharon Anderson (Tompkins County Cooperative Extension, began a study of emerging contaminants in water entering and leaving the Ithaca treatment plant, before and after treatment. They found that these chemicals are present – in minute amounts – in the raw water from Fall Creek and Six Mile Creek prior to treatment for drinking and other uses by Cornell University (Fall Creek) and Ithaca and Ithaca College (Six Mile Creek). Further, these and other contaminants were found in the water – following use by local population – arriving at the IAWWTP for treatment; and to a lesser extent, some were still present following treatment.

Keep in mind that these contaminants are present in minute amounts – like a pinch of salt in a ton of potato chips, measurable only by high-resolution mass spectrometry http://www.news.cornell.edu/stories/2017/01/new-technique-ids-micropollutants-new-york-waterways. These contaminants are presently measurable at levels far below those deemed problematic by EPA, DEC and the Department of Health. However, their very presence raises questions: how low is low enough? Is any measurable amount of some of these contaminants acceptable? Is any measurable amount harmful? What are potential impacts to humans, aquatic life, and other life forms dependent on our waterways and lake? Are these contaminants on the rise? Are they bio-accumulating in the food chain? Should we be planning for their removal now, before their presence rises to detectable levels? Is it time for a risk assessment process? See the Recommendations below for priority planning and actions in this troubling area.

Emerging contaminants/pollutants in the Ithaca area

Compounds Always Detected (denoted as background compounds)

- Bis (2--ethylhexyl) phthalate – Common plasticizer, classified as a High Production Volume Chemical.
- Caffeine – Stimulant in coffee, beverages.
- DEET – N,N-Diethyl-meta-toluamide, or diethyltoluamide, the most common active ingredient in insect repellents.
- Prometon – Herbicide used for landscaping; not used for food crops.
- Sucralose – Sweetener.
- Venlafaxine – Antidepressant.

Compounds not removed by conventional wastewater treatment (IAWWTF)

	Compound	Removal efficiency		Compound	Removal efficiency
DET					
	p-Nonylphenol	45%		**anti-depresants**	
	4-ter-Octylphenol	60%		Bupropion	0%
				Citalopram	0%
PHARM				Desvenlafaxine	0%
	Albuterol	0%			
	Carbamazapin	0%		**anti-histaminics**	
	Carisoprodol	0%		Chlorpeniramine	0%
	Dextrpmethormophan	0%		Diphenyldramine	0%
	Lidocaine	0%		Fexofenidine	0%
	Meprobamate	0%			
	Metaxalone	0%		**cardio/pulmonary**	
	Metmorphin	0%		Atenonol	0%
	Methocarbamol	0%		Diltiazem	0%
	Trimethoprim	0%		Pentoxyifyline	0%
	Venlafaxine	0%		Traimterene	0%
	Efavirenz	10%			
	Penciclovor	0%		**opiods**	
Other				Codeine	0%
	Methyl-1H-benzotriazole	0%		Methadone	0%
	Piperonyl butoxide	20%		Oxycodone	0%
	Propofol	5%		Tramadol	0%

Susan Allen-Gil and Jose L. Lozano, (2016) "Endocrine disruptors and persistent organics in Ithaca NY." Ithaca College and Ithaca Area Wastewater Treatment Facility. Available from the authors.

Resources about Emerging Contaminants

- Susan Allen-Gil and Jose L. Lozano, 2017. *Emerging Pollutants: From College Campuses to Cayuga Lake.* NYS Water Resources Institute, Ithaca NY. https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/20073/AllenGil_and_Lozano_Emerging_Contaminants_Final_Report.pdf?1485884039

- Cornell Cooperative Extension, Tompkins County http://ccetompkins.org/environment/water-conservation-quality/emerging-contaminants-pharmaceuticals-and-personal-care-products

- New York State Federation of Lake Associations, (no date)presentation: "Emerging Contaminants in our lakes: A look into the pharmaceuticals and consumer products in the Cayuga Lake" by Susan Allen-Gil and Mathew Finegan, Dept. of Environmental Studies & Sciences Ithaca College: https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/15550/NYSFOLA_Emerging_Contaminants_in_Our_Lakes_1_.pdf?1463600108

- U.S. Geological Survey, Contaminants of Emerging Concern in the Environment: https://toxics.usgs.gov/investigations/cec/index.php

4. Goals and Recommendations

Goals

- Reduce the negative effects of onsite wastewater systems on human health and the environment.
- Educate and act aggressively (via local laws, state and federal laws; monitoring, and research) to prevent rapid rise in Emerging Contaminants.

Recommended actions to implement wastewater treatment improvements

1. Develop and implement project(s) to raise the level of Seneca and Tompkins counties' septic system inspection and installation programs to that of Cayuga County, using as a template the Town of Lake George's Septic Initiative Program, other examples.

2. Create county-wide computerized databases of all OWTSs to allow tracking of inspection, maintenance and replacement.

3. Modify state and/or county legislation to require periodic inspection and maintenance of OWTSs and to require replacement/improvement of non-functional systems – with special emphasis on systems within 500' of the lake and 100' of steams and other water bodies – and provide enforcement powers for appropriate agencies.

4. Increase staffing of County Health Departments to provide inspectors, to maintain the database, and to enforce the regulations.
5. Explore ways for counties to work with lending institutions to assist property owners to finance required replacements and improvements, perhaps with amortization included in tax bills and associated with the property deed.
6. Require property owners with OWTSs to connect to adjacent sewer lines if they have not already done so.

7. Improve technology to control emerging pollutants in municipal waste/do research for ecological solutions.

8. Educate the public about purchasing and waste disposal choices that affect water quality, for example, do not flush medications, fragrances, disinfectants do not flush. Reduce use of plastics.

9. Where laws require flushing of medicines and drugs, change them.

10. Adopt technologies to remove emerging contaminants, including u.v., ozone, filtration.

11. Support continued research on emerging contaminants, such as using microbial biofilms for emerging contaminants removal from wastewater.

Chapter F. *Action Category:* Hazardous Waste Management

1. Introduction

USEPA defines hazardous waste as

> a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries and may come in many forms, including liquids, solids gases, and sludges. https://www.epa.gov/hw/learn-basics-hazardous-waste#hwid

As part of the original Watershed Plan process in 2000-01, major categories of potential or active hazardous waste sites in the Cayuga Lake watershed were researched and documented. Online searchable databases were used to develop lists and maps, available for viewing in the *Cayuga Lake Preliminary Watershed Characterization*, the encyclopedic background document accompanying the Plan, and its Appendices http://www.cayugawatershed.org/characterization/ .

Most of these activities and waste sites were in place before the passage of environmental protection laws in the late '60s and '70s and the advent of the permitting process. Those still active in 2017 need vigilant attention and follow-through to ensure that adequate environmental reviews are carried out, that correct practices are being followed, and that the situation has not worsened. These hazardous materials and practices have the potential to affect both short and long term ground and surface water quality in the Cayuga Lake watershed.

The scope of the 2017 Watershed Plan update process does not include a full update of the hazardous waste site lists and maps. However, updated definitions and online access are provided for each waste category, below. Additionally, the beginning of a narrative discussion is provided about our watershed's legacy wastes and those sites where industrial activities continue that may directly impact the lake and our creeks and groundwater, and urgently require research, monitoring and mitigation.

At the end of this section see Goals and Recommendations, focused on concerns about the potential for long-term water quality impacts to our creeks, wetlands and lake from legacy and continuing waste disposal practices, and what needs to be done soon to control and lessen these impacts. Human activism and education is the solution to pollution.

2. Hazardous waste sites in the Cayuga Lake watershed, 2000 and 2017

Storage tanks
Tables and maps of bulk storage and chemical bulk storage, petroleum bulk storage, underground and aboveground storage tanks in the Cayuga Lake Watershed, to 2000: http://www.cayugawatershed.org/characterization/PDF/chapter3.5-3.6.pdf pp.1-7.

NYS DEC links and websites for updated information

- Bulk storage of chemicals, petroleum, LNG, natural gas; regulations, public records, more: http://www.dec.ny.gov/chemical/287.html
- Bulk storage data on Google Earth: http://www.dec.ny.gov/pubs/42978.html
- Bulk storage database search: https://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=4

Hazardous materials

Table, hazardous materials list, and map of hazardous materials, inactive hazardous waste sites, municipal waste landfill (closed), and scrap and junkyards in the Cayuga Lake Watershed, to 2000:
http://www.cayugawatershed.org/characterization/PDF/chapter3.7.pdf pp.1-3

NYS DEC links and websites for updated information

- Hazardous waste management, including regulations and upcoming changes, land disposal, annual reports, compliance inspection, more: http://www.dec.ny.gov/chemical/8486.html

Hazardous material storage includes above and below ground storage tanks. Based on NYSDEC databases in 2000 there were 14 permitted chemical bulk storage facilities with 31 active tanks in the watershed. These include storage terminals, retail sales, manufacturing, utility, municipal, school, and other facilities. Based on NYSDEC databases there were approximately 320 active and inactive petroleum bulk storage facilities with 441 tanks. These include storage terminal/petroleum distributor, retail, manufacturing, utility, trucking/transportation, apartment building, school, farm, private residence, and other facilities.

While regulations exist for hazardous material storage, in recent years there has been recognition that old, unpermitted, leaking, or inactive storage of hazardous material is affecting ground and surface water quality. In some cases groundwater use in the watershed has been limited due to improper storage of hazardous material. These sites pose a potential human health risk from exposure to toxic contaminants, including a wide variety of organic chemicals.

Hazardous spills

Background information, table and maps of hazardous spills from gasoline stations, vehicles, tank trucks, private dwellings, vessels and railroad cars, facilities, and other in the Cayuga Lake Watershed, to 2000.
http://www.cayugawatershed.org/characterization/PDF/chapter3.8.pdf pp. 1-14.

NYS DEC links and websites for updated information

- Chemical and petroleum spills, spill response and remediation, spills incident database search, more: http://www.dec.ny.gov/chemical/8428.html

The major categories of spills in the NYS DEC reporting system are gasoline stations, vehicle, commercial vehicle, tank truck, private dwelling, vessel, railroad car, non major facility > 1,100 gallons spilled, major facility > 400,000 gallons spilled, other commercial/industrial, other noncommercial/industrial, and unknown.

Based on the NYSDEC reporting system there are five resources affected by reported spills, including land, dumping into sewers, groundwater, surface water, and air. Generally, surface water quality will ultimately be affected by pollution of any of these.

With hazardous spills, it is important to consider the resource affected and the type of spill. Of the approximately 550 reported hazardous spills in the watershed in the 15 years prior to 2000, 360 were on land, 15 in sewers, 105 into groundwater, 60 directly into surface water, and 10 into the air. Of the total spills in the watershed approximately 30 were at gasoline stations, one was major facility related, 7 were non-major facility related, 140 were other commercial/industrial related, 105 other noncommercial/industrial related, 10 were passenger vehicle related, 50 were commercial vehicle related, 20 tank truck related, 105 were at private dwellings, 2 were vessel related, and 80 were unknown.

Industrial sources of hazardous and toxic materials
Background information, table of industrial sites and toxic/hazardous materials to 2000: http://www.cayugawatershed.org/characterization/PDF/chapter3.9.pdf pp.1-2; map of industrial sites (factories, pipelines, stockpiles, transfer stations and transportation facilities), p. 3.

NYS DEC links and websites for updated information

- Hazardous substances identification, release prohibition, and release reporting: http://www.dec.ny.gov/docs/remediation_hudson_pdf/part597text.pdf
- Radiation http://www.dec.ny.gov/chemical/296.html

Industrial wells
Description of types of wells: dry gas and oil wells, brine wells, stratigraphic wells, and gas development and extension wells, to 2000: http://www.cayugawatershed.org/characterization/PDF/chapter3.9.pdf See Table 3.9.1 and map p. 7.

NYS DEC links and websites for updated information

- Oil, gas and solution mining wells in New York State: http://www.dec.ny.gov/energy/205.html
- High Volume Hydraulic Fracturing in NY State: http://www.dec.ny.gov/energy/75370.html
- What NYS landowners need to know about oil and gas wells, with information about abandoned wells: http://www.dec.ny.gov/energy/1532.html#Abandoned_Wells
- Injection wells in NYS: http://www.dec.ny.gov/energy/1610.html
- USEPA permitting for injection wells in NYS: http://www.dec.ny.gov/energy/1805.html

As of 2011, NYSDEC listed over 330 non-water wells in the watershed (same as in 2000). These include dry gas and oil wells, brine wells, stratigraphic wells, and gas development and extension wells. These wells are dispersed throughout the

watershed, with a pronounced density of over 70% in the northeast portion in the Aurelius, Fleming, and Springport area. These are mainly active gas wells. Approximately 5% of the wells in the watershed are brine wells, almost all of which are in the Town of Lansing. Approximately 18% of the wells in the watershed are dry wells, approximately 25% of which are plugged and abandoned. Many exact locations have been lost.

Mines and mining operations
Description of types of mines in the Cayuga Lake watershed to 2000: http://www.cayugawatershed.org/characterization/PDF/chapter3.9.pdf See p. 2, map p. 6.

NYS DEC links and websites for updated information

- Mining and reclamation http://www.dec.ny.gov/lands/5020.html
- Blasting in quarries and mines http://www.dec.ny.gov/docs/materials_minerals_pdf/blastingbw2007.pdf
- Protecting and reclaiming mined land http://www.dec.ny.gov/lands/5051.html
- Searchable online mined land database http://www.dec.ny.gov/cfmx/extapps/MinedLand/
- Mining database http://www.dec.ny.gov/lands/5374.html

Based on NYSDEC data, there were approximately 30 mines in the watershed in 2000. The vast majority of these (all but 3) were sand and gravel mines. Sand and gravel mining poses a threat to water resources. Because of their relatively permeable nature, sand and gravel deposits are generally coincident with recharge areas. In order to mine these deposits, the topsoil is first removed, eliminating an important buffer zone between the ground surface and the underlying aquifer. Lowering the ground surface decreases the relative depth of the water table, thereby making it more susceptible to contamination from mining apparatus and vehicles. The loss of vegetation exposes sediment, making it more easily removable by wind and surface runoff. Permitted mines are required to have reclamation plans and performance bonds. Operating permits include specifications for the protection of adjacent surface and groundwater. The NYSDEC permitted mines are in varying stages of excavation.

Many gravel pits in the watershed were operated and abandoned before the permit system was started. Such inactive, non-permitted and poorly regulated mines may pollute surface and groundwater. Unrestricted runoff from bare mine banks may carry significant sediment loading. Once bare, mine banks are difficult to revegetate and can remain a problem for decades.

Unpermitted pits will only be addressed by the NYSDEC Bureau of Minerals under two conditions: 1) if there is a contravention of New York State water quality standards or, 2) if a previously unpermitted pit is re-opened to mining in quantities of over one thousand cubic yards per year. Citizens living in the vicinity of these pits who wish to see them reclaimed should monitor activity in the mines. Documented surface water quality problems from runoff, renewed mining activity, or well-water test results indicating illegal dumping may trigger regulatory action.

Industrial pipelines
Gas, oil and other industrial pipelines were an accepted if sometimes unpleasant part of the watershed landscape in 2001. In 2017, many are concerned about the surge in proposals for new and refurbished pipelines to carry natural gas, oil and other polluting substances across our creeks, streams, and wetlands.

Industrial pipelines, definition, what they carry, in the Cayuga Lake watershed to 2000:
http://www.cayugawatershed.org/characterization/PDF/chapter3.9.pdf pp.1-2. With map of industrial sites (factories, pipelines, stockpiles, transfer stations and transportation facilities), p. 3.

NYS DEC links and websites for updated information
NYS DEC does not have centralized web information or pages about industrial pipelines, although this is an issue of rising concern across the watershed, state, region and country. US EPA provides a link to the National Environmental Policy Act's guidance on the siting of pipelines, apparently to help ease approval: https://www.epa.gov/nepa/natural-gas-pipeline-guidance-national-environmental-policy-act-reviews . An informed citizenry can make a difference in controlling a proliferation of pipelines and leading change to clean renewable energy.

Cayuga Lake watershed alternatives to fossil fuels – concerned residents actions and next steps

- The proposed West Dryden pipeline, which would impacts wetlands, a nature preserve, and Fall Creek: http://www.fossilfreetompkins.org/dryden-pipeline and http://www.drydenpipeline.com/
- The proposed expansion of the Borger Gas Compressor Station in Dryden, as part of the Dominion New Market pipeline expansion project – this proposed expanded pipeline cuts across the headwaters of the creeks that drain to Cayuga Lake's southern end. Expansion would ncrease present impacts and increase the likelihood of damaging pollution to water quality in the event of a rupture: https://saneenergyproject.org/infrastructure-invasion/proposed-projects/dominion-new-market-project/
- Information about alternatives to oil and gas pipelines and facilities, Tompkins County: http://www.fossilfreetompkins.org/
- HeatSmart Tompkins and Solar Tompkins: http://www.solartompkins.org/
- Cayuga and Seneca counties: http://www.solarizecny.org/

3.Landfills and dumps: permitted, inactive and unpermitted

Closed local dumps and dumping places
The Cayuga Lake watershed once had numerous municipal dumps and numerous informal dumping places. These were closed and replaced with regional lined landfills during the 1980s and 1990s as new landfilling regulations and big companies took over from small local garbage hauling and dumping companies. The old dumps were not cleaned up or capped. Many were abandoned and are often now hidden in woods and wetlands.

These dumps may lead to surface and groundwater pollution. They contain not just household waste but also chemicals that were once disposed of without precautions or protections. Farmers also once disposed of unused chemicals by dumping them down slopes in wooded depressions and stream valleys. This practice has been discontinued, but many such sites are unknown and unremediated, and may yet have water quality impacts.

The NYSDEC database showed seven inactive hazardous waste sites and 25 municipal waste sites in the watershed for 2000, with table and map of these inactive hazardous waste sites, municipal waste landfills (closed), and scrap and junkyards in the Cayuga Lake Watershed, to 2000
http://www.cayugawatershed.org/characterization/PDF/chapter3.7.pdf pp.1-3.

These sites pose a potential human health risk from exposure to toxic and pathogenic contaminants, including heavy metals, pathogens, nutrients and a wide variety of organic chemicals. While pathogens and nutrients are generally not considered a major threat from landfills, heavy metals and organic chemicals can remain toxic for years, having a lasting effect on both groundwater and surface water supplies.

In recent years, there has been a growing recognition by the public and elected officials that inactive landfills and dumps are a potential threat to human health and water quality. Remediating a landfill is an expensive process and money available from federal and state sources is limited.

Permitted solid waste landfills today

This "interactive map" displays locations of permitted solid waste landfills, with details about each one https://data.ny.gov/Energy-Environment/Landfill-Solid-Waste-Management-Facilities-Map/afg5-7i6u

Two solid waste landfills are shown in the Cayuga Lake watershed for 2017.

The Cayuga Coal Ash Landfill is situated uphill of the Cayuga Power Plant (owned by Heiot Energy, 2016) on the east shore of the lake in Lansing. This private Industrial/Commercial landfill accepts the following waste types: Ash (Coal-Bottom); Ash (Coal-Fly); Dust (Baghouse); Industrial; Sewage Treatment Plant Sludge. This landfill is partially lined. Present permit expires 03/14/2023. See discussion below about this landfill in "Legacy and Active Hazardous Waste Concerns in the Cayuga Lake Watershed."

The **Seneca Meadows Solid Waste Landfill** is located on the western edge of the Cayuga Lake watershed in Waterloo. Its drainage has been routed to the northeast. This regional mega-landfill, which accepts municipal waste from many Finger Lakes communities, also accepts chemicals under controlled and permitted conditions. It is listed as an inactive hazardous waste site in the 2001 Plan. See
http://www.cayugawatershed.org/characterization/PDF/chapter3.7.pdf table, p.1.

Other landfill types, locations, permits:

http://www.dec.ny.gov/chemical/23681.html

4. Household Hazardous Waste (HHW)

Most residents of New York State generate waste in their homes which contains some of the same chemical components as the hazardous waste generated by industry. Often, this is stored for extended periods of time or is mixed with other solid waste intended for disposal. This waste is called household hazardous waste (HHW), and includes many household cleaners, paint and related products, automobile maintenance wastes, pesticides, batteries, hobby chemicals, and other items.

Industrially-generated hazardous wastes are subject to stringent management and disposal standards that are designed to be protective of human health and the environment. However, all household waste, regardless of its hazardous characteristics, is excluded from the regulatory definition of hazardous waste and is currently exempt from all State and federal hazardous waste regulations.

Household hazardous waste is any household waste which would be regulated as a hazardous waste if it were not generated by a household, and includes all waste pesticides from a household. Many products used in households with the words "CAUTION," "WARNING," "DANGER," or "POISON" on the label may meet this definition and eventually become HHW. It is conservatively estimated that of approximately *30 million tons of solid waste* generated annually in New York State, about one half of one percent, or 150,000 tons, is HHW (2000).

Household Hazardous Waste information, disposal methods, locations (2017)

- NYS DEC information and links about HHW, with definitions and safe disposal methods: http://www.dec.ny.gov/chemical/8485.html

- Interactive map of Household Hazardous Waste Management Facilities: https://data.ny.gov/Energy-Environment/Household-Hazardous-Waste-Solid-Waste-Management-F/c7uj-3v4k .

- One HHW Management Facility is located in the Cayuga Lake watershed in Tompkins County at the Tompkins County Recycling and Solid Waste Center, in Ithaca: https://recycletompkins.org/ The Tompkins County facility offers several HHW collection days each year, for which people must register in advance: https://recycletompkins.org/Garbage/Household-Hazardous-Waste . Other watershed communities hold collection days, to collect and recycle wastes or transport them to a hazardous waste treatment, storage, or disposal facility.

- Pharmaceutical waste disposal:
  Leftover medicines and drugs must be disposed of properly. Please refer to Chapter E., Wastewater Management, for information about Emerging Contaminants. These wastes are making their way into our water supplies.
  In Tompkins County, these products can be disposed of at several locations: http://www.healthyyouth.org/medication-disposal.php .
  Medical drop boxes in Cayuga County: https://www.health.ny.gov/professionals/narcotic/medication_drop_boxes/cayuga.htm.
  Seneca County does not presently provide this service.

5. Legacy and Active Hazardous Waste Concerns in the Cayuga Lake Watershed

Legacy pollutants are those that may lie dormant for a while – in the abandoned dumps, the leaking tanks – that may potentially seep into wells, wetlands, streams, creeks, aquifers and the lake, with negative impacts on water quality, water use and availability. In this era of climate uncertainty, we need to be vigilant about protecting our water resources from pollution. A well or aquifer contaminated by toxic substances is a water source lost forever.

Additionally, several locations around Cayuga Lake continue as active industrial sites, using lake water for operations and returning it via NYSDEC permits to the lake for "dilution" of added industrial contaminants. These older sites may have additional leakage and pollution problems that are not in the system.

In the 2001 Plan, these closed and current sites were summarized neatly in databases with links and generalized statements about potential problems down the road. Following are several updated, specific examples of unseen and unremediated pollutants and continued polluting practices.

Closed sites, unremediated or partially remediated

The City of Ithaca maintains the Community Advisory group, "concerned with Ithaca's environmentally contaminated sites and has been convened to promote greater public participation in clean-up projects, and help both citizens and involved government agencies make better-informed decisions." http://cityofithaca.org/374/Community-Advisory-Group . See list of sites with documents and links, right hand column.

- **Gun Shop Hill, Ithaca:**
  http://www.cityofithaca.org/DocumentCenter/Home/View/3259 and
  http://www.cityofithaca.org/DocumentCenter/Home/View/1619

The former Ithaca Gun Factory was in operation from approximately 1883 to 1986 with primary activities including the manufacture of guns and ammunition, located adjacent to Fall Creek and using the creek as a source of energy. Ithaca Falls, immediately adjacent to the site, is an iconic site drawing thousands of visitors and residents annually. This superfund site is known as a major source of environmental pollution including lead and solvents, and as of 2016 onsite remediation efforts continue to remove lead from the former factory site and adjacent Fall Creek/Ithaca Falls area. Post remedial sampling showed re-deposition of lead in excess of 400 mg/kg, indicating that material migrating from the cliff and depositing on the talus slope is a contributing source of lead and arsenic contaminated soil. http://cityofithaca.org/DocumentCenter/Home/View/4751 Offsite work conducted in 2016 characterize subsurface migration of TCE and VOCs originating from the former Ithaca Gun Factory site and soil vapor intrusion on neighboring residential areas. http://cityofithaca.org/DocumentCenter/Home/View/4098 and http://cityofithaca.org/DocumentCenter/Home/View/3544

Recommended next steps: Continued testing and remediation of lead, arsenic and TCE migrating off-site into Fall Creek and groundwater.

- **South Hill, Ithaca:** http://www.ithaca-ship.org/index.htm ; http://soilandwater.bee.cornell.edu/Research/TCE/TCEproject_Final.pdf ; http://www.cityofithaca.org/DocumentCenter/View/2364

The Morse (Chain) Industrial Corporation site, (also known as Emerson, Morse Chain, Borg-Warner, ChainWorks) is located on approximately 100 acres on Ithaca's South Hill, immediately south of Six Mile Creek. From approximately 1906 to 1994 the site saw the manufacturing of steel chain, automotive components and power transmission equipment. The site is a class 2 Inactive Hazardous Waste Disposal Site. The primary contaminants of concern are trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (DCE), 1,1,1-trichloroethane, methylene chloride and the degradation products of these compounds. Other contaminants of concern include petroleum hydrocarbons and metals. Groundwater contaminant levels exceed NYSDEC Class GA Standards for barium, cyanide, and/or and TCE and its breakdown products. Public scoping meetings have been conducted by the developer and the draft GEIS has been submitted. A supplemental RI is currently being performed by Emerson for OU2 based on the Phase II ESA. The site is a significant threat to the environment.
http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=3 Search site 755010

Recommended next steps: No action recommended to this point has come close to either identifying the sources of contamination, adequately remediating or mitigating the site.

- **Landfill, Nate's Floral Estates, Ithaca**

Nate's Floral Estates is a mobile home park situated on a former City of Ithaca landfill that was in operation from approximately 1938 through 1970. No records indicate that household or industrial wastes were removed or that the landfill was properly capped. The site is located adjacent to the Ithaca Flood Relief Channel. A study conducted by the NYS DEC in 2000 identified 2 seeps, a drum disposal site located along the Flood Relief Channel, and recommended drum and soil removal and remediation to achieve soil cleanup values. Subsequent drum removal was carried out.

Recommendation for action: Adequate and appropriate testing should be done along the Flood Relief Channel to confirm that contaminants are not leaching into the waterway.

Closed sites, partially or fully remediated

- **General Electric Company, Auburn, with subsurface drainage into Cayuga Lake at Union Springs:**
https://www3.epa.gov/region02/waste/fsgeaubu.htm and http://www.dec.ny.gov/docs/remediation_hudson_pdf/706006ou1rod.pdf

- **Goulds Pumps Cobalt Site, Cayuga-Seneca Canal, Seneca Falls:** http://www.dec.ny.gov/data/der/factsheet/c850012coc.pdf

- **Radioactive waste and Chemical waste sites, Cornell University, Lansing**

  Cornell University information
  http://www.sustainablecampus.cornell.edu/initiatives/disposal-sites-cleanup

  Annual reports to Tompkins County
  http://tompkinscountyny.iqm2.com/Citizens/Detail_LegiFile.aspx?Frame=&ID=3489&CssClass=

Active industrial sites with legacy and current pollution concerns

- **Cayuga Salt Mine (Cargill Deicing Technology), Lansing**

Salt has been mined by this company since 1922 at the Portland Point, Lansing location on the Cayuga Lake shore. Excavated salt mines extend under parts of the Town of Lansing and under Cayuga Lake. A new shaft with tower has been proposed, also in Lansing. Map of mined areas and other information:
http://www.cayugalake.org/cayuga-salt-proposal-to-drill-a-new-shaft.html

Recommended action: Urge NYS DEC to conduct an Environmental Impact Study on the further operation of the mine.

- **Cayuga Power Plant (Heorot Power Holdings LLC, 2016), and landfill, Lansing**

This coal-fired power plant was established at its Town of Lansing lakeshore site in 1955. It operated full-time until 2012-3, when a discussion began over whether to mothball the plant or repurpose to natural gas. This discussion continues. Uphill from the power plant is the coal ash disposal landfill, partially unlined. Prior to this landfill being established, coal ash was disposed of in several adjacent locations. The landfill's impact on groundwater has been monitored for decades, with several indications of contamination offsite. Milliken Creek is adjacent. More information
http://www.cayugalake.org/cayuga-aes-power-plant.html

Recommended actions: Carry out water quality monitoring on Milliken Creek, determine if area water wells are affected, and if Cayuga Lake has been impacted by power plant operations and/or coal ash landfill operations. Map, evaluate, and mitigate the older dump sites.

- **Rod and Gun Club, Lansing**

In 2016, the Lansing Rod and Gun Club began work on an agreement with EPA to change their shooting practices in order to prevent further accumulation of lead in Salmon Creek in Ludlowville. This is a private agreement. No data is available. The club has had an active firing range adjacent to the creek and wetlands for several

decades. For more information about the potential impacts of lead in streams: http://www.cayugalake.org/101.html

Recommended actions: Design, fund, conduct and evaluate a monitoring program to determine impacts of this lead legacy to the creek, its water and aquatic life, and if there are downstream impacts to Cayuga Lake.

6. Measures to control and manage hazardous waste production, use and disposal

- USEPA Hazardous Waste program areas (such as land disposal regulations), regulations for specific wastes (such as crude oil and natural gas, listed as "special wastes"), special project areas (such as pharmaceutical wastes) and cradle to grave system and resources (such as compliance history for producers and companies using hazardous wastes): https://www.epa.gov/hw

- NYSDEC hazardous waste management: http://www.dec.ny.gov/chemical/8486.html
- NYSDEC environmental site database research http://www.dec.ny.gov/chemical/8437.html
- NYSDEC Regulations, bulk storage of petroleum, chemicals, used oil http://www.dec.ny.gov/chemical/92526.html
- NYSDEC Oil and gas, mining and reclamation laws http://www.dec.ny.gov/lands/2417.html
- NYSDEC Mining and reclamation http://www.dec.ny.gov/lands/5020.html
- NYSDEC Spills hotline and response http://www.dec.ny.gov/chemical/8428.html

7. Goals and Recommendations

Goal

To minimize the impact of hazardous material on the water quality of the watershed and to alleviate and remove threats to human health.

Recommended actions to implement improvements for hazardous waste management, practices and disposal

Several of the 2001 Recommendations remain current in 2017, because not much has been done in the way of the proposed systematic surveys and studies of potential impacts from abandoned sites, etc. (http://www.cayugawatershed.org/Cayuga%20Lake/RPP/cayhazwaste.htm). The Cayuga Lake Watershed is shared among numerous agencies, leading to fracturing of information gathering and storage.

Owing to fracking and pipeline opposition (see High Volume Hydraulic Hydrofracking above under Industrial wells, list of concerned residents actions under Industrial

pipelines, and Chapter E. Wastewater Treatment), in 2017 public understanding of these concerns, with potential impacts to water quality, is high and engaged and will remain so. Thus we focus on humans as the solution to pollution.

1. Continue to work with the engaged public for water quality protection vis-à-vis old and new industrial threats to water quality.

2. Obtain funding to train volunteers to carry out long term water quality monitoring of old and new water quality threats.

3. Train and empower community groups in municipalities to express concerns and take effective action.

4. Create a central information and data node for hazardous waste issues watershed-wide.

5. Create educational curriculum elements to encourage well-informed use and disposal of medications and personal care products.

6. Action should be taken to do the needed research to mitigate known problem sites, some of which are delineated in this chapter.

Chapter G. *Action Category:* Forestry and Silviculture Management

1. Introduction

Forestry: *the science or practice of planting, managing, and caring for forests.*
Silviculture: *the growing and cultivation of trees.*

Undisturbed forests are highly conservative ecosystems, with minimal loss of sediments and nutrients to downstream waters. Forestry activities have the potential to greatly increase erosion and sedimentation. Because sediment is a high priority pollutant in the Cayuga Lake watershed, it is important that both commercial interests and individuals manage forestry practices to minimize sediment loss.

The increasing removal of floodplain forests bordering creek shores leads to a rise in sediment pollution. These forests form a key buffer against the loss of sediments and nutrients into the creeks by holding easily erodible soils on creek banks tightly in their matrix of roots. In addition, they serve as filters for nitrogen and phosphorus in surface and ground water flow from the surrounding uplands. In the summer, they rapidly take up these nutrients into their roots, stems, and foliage, trapping them in the forest nutrient cycle. In addition, their branches hanging over the creeks cool the water and improve the fish habitat. Consequently, it is critical to keep these buffer forests intact.

Another challenge to forest health and resilience is the even-aged structure of woodlands throughout the watershed. Most trees started growing at about the same time, as agricultural land was abandoned throughout the area in the early 20th century. These age-uniform forests are becoming highly susceptible to diseases and insects that are being accelerated by global climate change. The Hemlock Wooly Adelgid is only the first of many potential problems that we are likely to see. If these forests lose significant quantities of trees to climate change, the water quality of our creeks is likely to suffer. There is currently a direct correlation between the percentage of a sub-watershed that is forested and the deterioration of stream water quality.

According to the NYS DEC *Forest Resource Assessment and Strategy Report* (2010), the principal threats and challenges to New York's forest health are: global climate change, invasive plant and animal species, loss of habitat connections across the landscape, and poor reestablishment of desired trees and plants following natural or human caused disturbances (p. 277). Today statewide, total forested land area is 18.95 million acres, 63% of New York's total land area, and slowly increasing. That is good news for woodlands, except that 14.4 million acres is privately owned, with fewer protections in place than on public lands (p. 13). Careful stewardship is key to forest health across the Cayuga Lake watershed. *NYS DEC Forest Resource Assessment and Strategy 2010-2015* (2010). http://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf).

2. Forestry, timber harvesting and best practices in the Cayuga Lake Watershed

Forestry practices favoring timber harvesting make up an important industry in the Cayuga Lake watershed, with an annual removal of over six million board feet. Survey records from the late 18th century indicate that more than 97% of the 785 square mile Cayuga Lake watershed was forested prior to European settlement. By late in the 19th century, less than 20% of the watershed was forested. Today the majority of the watershed is in crop and pasture land, interspersed with wooded areas, except in the southern end of the watershed, which has a higher percentage of wooded areas (p. 2-28, Cayuga Lake Watershed Characterization (2001). http://www.cayugawatershed.org/characterization/PDF/chapter2.12.pdf). Tree removal and timber harvesting are active landuses across the watershed on both private and public woodlands. Best management practices can mitigate runoff, erosion and sediment loading in streams, creeks and Cayuga Lake. In some cases, permits are required.

Existing measures and Best Management Practices (BMPs)

NYSDEC has developed programs for both private and commercial woodland managers to manage the forest resource and protect environmental quality. The focus of the programs is education and voluntary compliance with incentives. Some local towns have enacted regulations to protect streamside floodplain forests from being removed.

Landowners, resource managers, and timber harvesters are responsible for evaluating specific harvest sites and selecting management practices that will protect water quality. A Forest Management Plan that accounts for specific site conditions should be developed before any harvesting operation. This is a voluntary plan designed to protect the health and future regeneration of the forest, and nearby aquatic resources.

Proper site-specific planning for the use of BMPs before forestry operations are begun can prevent or minimize soil erosion and sedimentation of waters from improperly designed and constructed logging roads, skid trails, log landings, and stream crossings. In addition, management plans should be devised for other forests to implement ways of increasing the successful growth of younger trees in these forests, and to enhance the presence of species that are likely to have superior survival under new climatic conditions.

More information:

NYS DEC

Timber Harvesting: stewardship, permits, management: http://www.dec.ny.gov/lands/5242.html

Forestry BMPs for water quality: http://www.dec.ny.gov/lands/37845.html

Cornell Cooperative Extension

Timber income: http://hamilton.cce.cornell.edu/environment/forestry/woodlot-management/timber-income

Firewood from your forest: http://hamilton.cce.cornell.edu/environment/forestry/woodlot-

management/firewood-from-your-forest

Riparian buffer ordinances, funding sources

Towns should consider enacting local laws that create buffers adjacent to our creeks and streams, limiting the types of development that can intrude into these buffer areas. Tompkins County has developed a template for a Model Stream Buffer Ordinance, and other tools for waterside protection: http://www.tompkinscountyny.gov/planning/water-resources-stream-buffers . The Town of Ithaca passed a stream setback law (2012) http://ecode360.com/16064379 , and the Town of Dryden is reviewing the feasibility of a riparian protection law (2017), supported by Waterway Friends of Fall Creek and other groups.

Riparian buffer funding programs in New York State and via US Dept. of Agriculture are found here: http://www.dec.ny.gov/chemical/106345.html . Especially focused on tree cover are the Trees for Tribs program http://www.dec.ny.gov/animals/77710.html , and the Tompkins County Stream Corridor Restoration & Flood Hazard Mitigation Program http://www.tompkinscountyny.gov/planning/water-resources-stream-buffers . The Tompkins County Legislature periodically funds a program to help residents and municipalities minimize property damagers associated with future flood events.

3. Climate change impacts to our forestlands

From New York's *Forest Resources and Assessment Strategy (*2010):

> Today, New York faces the challenges of a changing climate that could have far greater impacts than the 1930s drought. Forests, including urban forests, provide front-line defenses against the many impacts of climate change. Urban trees help shade and cool cities where heat builds up, saving energy that would otherwise be used for air-conditioning. Forests act as sponges during storms; they absorb rainfall and reduce flooding. Trees work as filters to clean the air we breathe; they catch and remove airborne particulate matter which causes respiratory irritation and illness. Trees use carbon dioxide (a greenhouse gas) and give off oxygen, an element essential for animal life. And, in an increasingly technological society, forests can help us reconnect to the natural world. Even a short walk in a forest can be restorative. In the shade of a forest, surrounded by trees and green foliage, we can feel the calming and renewing effect of the natural environment around us.
>
> Take a moment to think about what New York State would be with little or no forests: A reservoir, your campsite, your town, your yard, where you work, the Adirondack Mountains, Central Park in New York City. It would be a place where few would like to live, work or in which to spend their leisure dollars. It would be a place that would be extremely vulnerable to the effects of global climate change.
>
> pp. 144, 167-8, New York State's *Forest Resources and Assessment Strategy 2010-2015* (2010) http://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf

The NYS *Forest Resources and Assessment Strategy* outlines effective response strategies for several priority issues facing the state's forestlands, including Issue 8, Adapting to Climate Change (p. 192)

- Recognize the role of forests to mitigate & adapt to climate change.
- Increase use of sustainably produced bio-energy to replace fossil fuel use.
- Increase practice & recognition of carbon sequestration through forest management. Measure net change of forest carbon stocks on a project/regional basis using FIA data. Promote economic return to landowners from carbon sequestration.
- Understand trends in climate change & its effects on wildfire occurrence & potential.

p. 192, New York State's *Forest Resources and Assessment Strategy 2010-2015* (2010). http://www.dec.ny.gov/docs/lands_forests_pdf/fras070110.pdf

The U.S. Forest Service's Climate Change Resource Center offers interactive online tools for better understanding the coming impacts of climate change to our forests: https://www.fs.usda.gov/ccrc/home . These resources vary from family-friendly to highly technical.

Among the most compelling USFS interactive visual tools are the Climate Change Tree Atlas and Bird Atlas: https://www.fs.usda.gov/ccrc/tools/tree-and-bird-atlas . The Climate Change Atlases can be used to examine the current distribution of tree and bird habitats in the eastern United States, and how these habitat distributions might change in response to different climate scenarios. Learn which trees and birds are most likely to inhabit the Cayuga Lake watershed as the climate warms over the next century or longer.

Invasive species: HWA

Invasive species are already adversely affecting our watershed's woodlands, with negative impacts to water quality. The number and impact severity of invasive species will rise as climate change advances. The Hemlock Wooly Adelgid (HWA) is an aphid-like pest, long a scourge of the American south, and was first found in the watershed in 2008. It has since spread rapidly along the Cayuga Lake shoreline, into hemlock woodlands of our state parks, forests and preserves, and privately owned hemlock stands. HWA is problematic in the Six Mile Creek watershed at the south end of Cayuga Lake. Six Mile Creek provides the water supply for the City of Ithaca.

The HWA pest can kill a hemlock tree in a few years following infestation. When hemlocks die, their roots no longer hold in place steep slopes found around the lake's southern end. Erosion and collapse add sediment to previously-clear streams and creeks. Denuded slopes mean warmer waters, affecting fish and invertebrate habitat. However there are effective treatments. Under the guidance of Cornell University based experts, landowner groups and the Cayuga Lake Watershed Network have been working with the Finger Lakes Institute and the Finger Lakes PRISM (Partnership for

Regional Invasive Species Management) to locate and treat HWA.

For more information about HWA in the Cayuga Lake watershed, view the New York State Hemlock Initiative: https://blogs.cornell.edu/nyshemlockinitiative/

NYS DEC's Hemlock Wooly Adelgid website:
http://www.dec.ny.gov/animals/7250.html

4. Public access forestlands in the Cayuga Lake watershed

In addition to the privately-owned woodlands across the Cayuga Lake watershed, forests can be found in state parks, state forests, preserves and other public places. State Forests are located throughout New York State and include Reforestation Areas, Multiple-Use Areas, Unique Areas and State Nature and Historical Preserves. Other agencies manage the state's Wildlife Management Areas, Forest Preserve, and Conservation Easements (p. 19, Forest Resources and Assessment Strategy 2010-2015 (2010).

State forests, other public forestlands in the Cayuga Lake watershed

State Forests in the Cayuga Lake watershed are concentrated in the upland areas at the southern end of the lake in Tompkins County. These forested areas provide public access and trails, and are essential in protecting the uplands from erosion and downstream sedimentation. State Parks are focused on recreation access, and their woodlands provide important water protection benefits. Other significant forestlands are present.

Seneca County:
http://www.dec.ny.gov/outdoor/46090.html and
http://www.dec.ny.gov/outdoor/7789.html
Canoga Marsh Wildlife Management Area, Cayuga Lake Wildlife Management Area
State Park: Cayuga Lake State Park.

Cayuga County:
http://www.dec.ny.gov/outdoor/44227.html and
http://www.dec.ny.gov/outdoor/7792.html
State Forest: Summer Hill State Forest drains north to Owasco Lake Inlet and Owasco Lake, and south to Fall Creek and Cayuga Lake.
State Park: Long Point State Park.

Tompkins County:
http://www.dec.ny.gov/outdoor/44213.html and
http://www.dec.ny.gov/outdoor/7792.html
State Forests: Dryden Lake, Yellow Barn, Hammond Hill, Robinson Hollow, Potato Hill, Shindagin Hollow, Danby, Newfield (drains both to Seneca and Cayuga). State Forests of the south-end Cayuga Lake headwaters may also be viewed on Wildlife Management Area Map Unit 7-R:
http://www.dec.ny.gov/docs/regions_pdf/7rwmu.pdf

State Parks: Allan H. Treman State Marine Park, Robert H. Treman State Park,

Buttermilk Falls State Park, Taughannock Falls State Park.

Tompkins and Schuyler counties:
Connecticut Hill Wildlife Management Area:
http://www.dec.ny.gov/outdoor/9331.html (drains to both Cayuga and Seneca lakes)

Hector and Schuyler counties:
Finger Lakes National Forest (drains to both Seneca and Cayuga lakes):
http://www.dec.ny.gov/outdoor/66666.html and
https://www.fs.usda.gov/main/gmfl/home

Map https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd527030.pdf
Management Plan (2006)
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5333919.pdf
Hemlock Wooly Adelgid Suppression Project 2015 http://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=45582

Privately-owned forestlands open to the public

Smith Woods, Trumansburg (Town of Ulysses), Tompkins County: 32 acre old growth forest co-managed by the Cayuga Nature Center
http://ithacafingerlakes.com/tag/smith-woods/

Cayuga Nature Center (Paleontological Research Institution), Ithaca, Tompkins County: 120 wooded and open steeply sloping acres, with gorge:
http://www.priweb.org/outreach.php?page=ednaturectr

Lime Hollow Center for Environment and Culture, 430 acres of wooded and open glacial terrain, draining to both Fall Creek/Cayuga Lake, and to the Tioghnioga River (Susquehanna River Basin), located in both Cortland and Tompkins counties:
http://www.limehollow.org/index.html

Finger Lakes Land Trust
The Finger Lakes Land Trust is a nonprofit organization tasked with private-public partnering to protect special places and natural resources across the Finger Lakes region: http://www.fllt.org/ .

Their 32 preserves are open for public access, and provide protective ecosystem functions for land, water, air, flora and fauna. In the Cayuga Lake watershed, the Finger Lakes Land Trust has 14 preserves and conservation areas:
http://www.fllt.org/learntheland/preserves

In 2016, the FLLT released a report calling for a $100 million investment to better protect the Finger Lakes region's land and waters:

> *Lakes, Farms, & Forests Forever is* the title of the Land Trust's report, which is based on a year-long comprehensive assessment of the region's natural resources coupled with input from 40 non-profit organizations, county and regional planning departments, and government conservation agencies. The report highlights ten priority conservation strategies for the region, emphasizing

the need to address both excessive nutrient runoff into the region's lakes and sprawling rural development that threatens farmland, vistas, water quality, and recreational resources.

http://www.fllt.org/land-trust-report-calls-for-100-million-to-address-regional-threats/

The Emerald Necklace project

The FLLT's major focus for the Cayuga Lake watershed is the Emerald Necklace project http://www.fllt.org/land-trust-marks-the-10th-anniversary-of-the-emerald-necklace/, "an ambitious conservation effort to link 50,000 acres of existing public land that extends in a broad arc around the south end of Cayuga Lake from the Finger Lakes National Forest in the west to Hammond Hill and Yellow Barn State Forests in the east."

As of late 2016, the FLLT working with state agencies and private landowners has "conserved more than 3,000 acres within the necklace through a careful mix of direct acquisitions, project assistance, and conservation easements on private lands."

The Emerald Necklace provides unparalleled recreational opportunities and is protective of sensitive open and wooded lands, waterfalls and gorges in the headwaters to both Cayuga Lake and the Susquehanna River basin.

Brochure with map:
http://www.fllt.org/content/uploads/2015/02/FLLT_EmeraldNecklace.pdf

Conservation Plan: Finger Lakes Trail in the Emerald Necklace (2009):
http://www.fllt.org/conservation-plan-the-finger-lakes-trail-in-the-emerald-necklace/

5. Goals and Recommendations

Goals

- Minimize erosion from forestry/timber harvesting operations;
- Prevent sediment originating from forestry practices from reaching water bodies;
- Avoid altering physical characteristics of the stream from improperly constructed stream crossings and/or felling practices;
- Keep streamside vegetation intact to avoid increased erosion, slow nutrient loss, and reduce thermal modification.
- Manage forests to reduce their vulnerability to climate change effects.

Recommendations for action to improve forested areas protection across the Cayuga Lake watershed

1. With a focus first on steep-sloping creeks, towns should pass riparian buffer local laws, based on the Tompkins County template.

2. Develop and share community education focused on climate change impacts to woodlands, and how residents and landowners can be resilient and adaptive to protect woodland cover.

3. Actively support programs to educate and involve the public and municipalities in invasive species programs protective of forests, including EAB and HWA and emerging threats.

4. Educate about the need to protect creeks and streams from overdevelopment (houses, roads, parking lots, bridges) via buffers, trails, parks, preserves and other tools.

5. Improve public education on requirements for streamside protection when tree cover is altered or removed, penalties for failure to comply, and how to report suspected violations.

Chapter H. *Action Category:* Wetlands & Riparian Corridor Management

1. Introduction

Wetlands and riparian (streamside) corridors provide an important transition from the terrestrial to the aquatic environment. These areas represent a unique habitat for the community of plants and animals. Wetlands and healthy, vegetated streamsides, or riparian zones, improve water quality by filtering out contaminants from groundwater, removing sediment and sediment-attached phosphorus by filtration, transforming nitrate to nitrogen gas, acting as a sink by storing nutrients for an extended period of time, providing a source of energy for aquatic life, and retarding floodwaters.

2. Wetlands

Wetlands form in a range of environmental conditions and include familiar areas such as marshes, swamps, and bogs. They are formally defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (Definition of wetlands as used by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency since the 1970s for regulatory purposes https://www.epa.gov/cwa-404/section-404-clean-water-act-how-wetlands-are-defined-and-identified See also https://www.epa.gov/wetlands/what-wetland).

Wetlands are regulated at the federal level by the U.S. Army Corps of Engineers, and mapped by the U.S. Fish and Wildlife Service. Within New York State, wetlands regulation and mapping are overseen by NYS DEC. This has resulted in two separate wetland mapping systems, which overlap somewhat, but not entirely, because NY's freshwater wetlands are defined as covering an area of 12.4 acres (5 ha) or more unless they have unusual importance, whereas the federal maps include wetlands of any size.

The discrepancy between the two aging databases led to a re-mapping of Tompkins County wetlands (2015) using updated imagery and methods, yielding a higher number of wetlands of all sizes. See below, "Wetlands study and re-mapping of Tompkins County wetlands." The Recommendations table at the end of this section includes a proposal to update wetlands maps across the watershed.

The National Wetlands Inventory

From their website: "The US Fish and Wildlife Service (FWS) is the principal US Federal agency tasked with providing information to the public on the extent and status of our Nation's wetlands. The US FWS National Wetlands Inventory (NWI) is a publically available resource that provides detailed information on the abundance, characteristics, and distribution of US wetlands. NWI data are used by natural resource managers, within the US FWS and throughout the Nation, to promote the understanding, conservation and restoration of wetlands." Go here to view the Wetlands Mapper tool, updated data reports, more: https://www.fws.gov/wetlands/

New York State Wetlands mapping

From their website: "The Freshwater Wetlands Act (Article 24 of the Environmental Conservation Law) requires DEC and the Adirondack Park Agency (for areas inside the Adirondack Park) to map the freshwater wetlands that are subject to jurisdiction of the law. The law requires the maps to show "the approximate location of the actual wetland boundary." DEC will refine that approximate boundary by doing a field delineation for landowners when they need more precise information, such as when they are planning to work near a wetland area." Go here for more, with further links: http://www.dec.ny.gov/lands/5124.html

Wetlands in the Cayuga Lake watershed

In 2000, the Cayuga Lake Watershed was estimated to contain approximately 6,575 acres of New York State Department of Conservation regulated wetlands (NYSDEC, 2000) and approximately 16,402 acres of federally designated wetlands (National Wetlands Inventory, 2000), based on surveys conducted during the mid 1980s. Because of the protective and restorative role for water quality and quantity played by riparian and wetland areas, the 2001 Plan focused on their protection and restoration across the Cayuga Lake watershed. The Wetlands section of the 2001 Plan may be viewed here: http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caywetrip.htm .

To accompany the Plan, a methodology was developed to prioritize wetlands and riparian areas for protection and restoration, summarized in the *Cayuga Lake Watershed Wetlands Management Report* (2001) Wetland & Riparian Corridor Management Project Report. See Map 4, p.11, "Cayuga Lake Watershed Wetlands," including both NYS DEC Regulatory Freshwater Wetlands and National Inventory Wetlands.

To characterize wetland distribution across the Cayuga Lake watershed, the state designated wetlands are, in general, evenly distributed from the north to the south within the watershed with slightly more located toward the south end. In the east-west direction, the wetlands are clustered along the edges of the watershed away from the lake, creating upland wetland linkages between lakes. In the northwestern edge of the watershed, in the upper reaches of the Red Creek watershed, there is a large wetland area. At the very north end of the lake is the Montezuma National Wildlife Refuge.

As noted in their Conservation Plan (2014), "Seneca County is endowed with some of the most productive, attractive, and best-conserved wetlands in the world. The Montezuma Wetlands Complex, Junius Ponds, Seneca Meadows Wetlands, and Canoga Marsh are national models for conservation practices and wildlife management, offering opportunities for both passive observation of striking vistas of flora and fauna, especially migratory birds, and active sport hunting and fishing." (p. 11, Seneca County Conservation Plan, 2014 http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SCEnvConsFnlPln2_17_14.pdf).

Smaller wetlands are scattered throughout the upper watershed area. These smaller wetland areas tend to be clustered more in the outer edges of the watershed but are more evenly distributed in the east-west direction than the larger wetlands. Other than those associated with the very large streams and at the southern and northern ends of the lake, very few wetlands are found adjacent to the lake's shoreline.

While the physical, biological, and chemical characteristics of wetlands largely determines how they function, the impact wetlands have on water quality depends on their position within the watershed. Because of the steep nature of the Cayuga Lake watershed, wetlands tend to be located in the headwaters of streams, serving more as baseflow stream augmentation than flood reduction. The few wetlands in the lower portion of the landscape provide flooding attenuation. Each wetland cover type will provide a different set of functions to the watershed and downstream water quality. As a general rule the amount of nutrients that can be trapped by a wetland is directly proportional to the amount of flow going through.

A number of wetland types are found throughout the watershed. The US Fish and Wildlife Service mapped wetland cover types throughout the United States and documented these wetlands on the National Wetlands Inventory Maps, as displayed on Map 4, p. 11 of the *Cayuga Lake Watershed Wetlands Management Report*. Based on these maps, the wetland cover types found within the Cayuga Lake Watershed include Palustrine Forested, Broad-leaved Deciduous, Seasonally Flooded/Saturated Areas (PFOIE), Palustrine Shrub-scrub, Broad-leaved Deciduous, Semi-Permanently Flooded Areas (PSSIF), and Open Water Excavated Wetlands (POWZh). A full description of these wetland cover types is found on pp. 10-11 of the 2001 report. The degree to which wetlands provide society with ecological, social, and economic functions is influenced by these wetland characteristics.

An updated wetlands map of the watershed, already complete for Tompkins County but still needed for Seneca and Cayuga counties (see below, "Wetlands study and re-mapping of Tompkins County wetlands", and Recommendations), might reveal additional wetland types.

Wetlands restoration

In the 2001 Plan, the following restoration recommendations were made:

> As a means of setting restoration priorities, each major subwatershed was analyzed for the area of NYSDEC wetland by class. Table 2 indicates the percentage of each class by subwatershed (Class 1 indicates wetlands with the greatest ecological significance and the most restrictive standard for disturbance).
>
> The subwatersheds with the highest percentage of NYSDEC wetlands are: Canoga (6.7%), Gulf (5.2%), Hicks (2.3%), Renwick (2.2%) and Fall Creek (2.1%). These subwatersheds would be candidates for wetland restoration and protection. The other subwatersheds contain less than 2% NYSDEC wetlands and would be candidates for restoration and wetland creation.
>
> http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caywetrip.htm

From this 2001 list, the Canoga Marsh delta of Canoga Creek was partially restored in 2007. A description of the Canoga project follows, along with information about wetlands protection and restoration in Cayuga and Seneca counties, not on the 2001 list. A proposed watershed-wide process to update priority restoration areas is included as a Recommendation for action, at the end of this section.

Canoga Marsh, Seneca County

Along the northwest shoreline of Cayuga Lake in the Town of Fayette, Canoga Creek drains farmed uplands to Cayuga Lake via the Canoga Marsh, which had been converted to farmland. The 2001 Plan listed the Canoga Creek subwatershed as a priority for restoration and protection efforts, important because among Cayuga Lake's subwatersheds it has the largest percentage of land as wetlands, it is proximate to the large Montezuma Wetlands Complex and it has a unique system of springs at its headwaters. The 2001 Plan stressed the value of both wetlands education and on the ground efforts as strategies for watershed management.

Taking action, private landowners Keith and Moira Tidball partnered with numerous state and federal agencies including the three lakeshore counties' Soil and Water Conservation Districts, Cornell University, several organizations including the Cayuga Lake Watershed Network and Ducks Unlimited (full list here: http://canogafarms.com/wetlandprog.html) to begin restoration of the marshes that border the lake, converting them from farmland to wetlands.

From the project website: "Restoration is planned for approximately 70 acres of freshwater marsh: 35 acres on private property (Tidball) and another, adjacent 35 acres on public property known as the Canoga Marsh Wildlife Management Area (New York State Department of Environmental Conservation). These sites are adjacent and are located on the west side of Cayuga Lake, in the County of Seneca and Town of Fayette." This work, construction of open water areas (potholes and level ditches) in a freshwater, non-tidal marsh, was completed in 2008. The Canoga Creek Marsh Wetlands Enhancement Initiative is chronicled here: http://canogafarms.com/wetlandprog.html, with photos of the restoration process here: https://www.flickr.com/photos/wheniwax/sets/72157623329186668/

Owasco Inlet and Flats, Cayuga County

Just outside the Cayuga Lake watershed to the east, the Owasco Lake Inlet is an immediate neighbor to the Cayuga Lake watershed and its Fall Creek subwatershed in an area rich with wetlands. The wetlands restoration process ongoing there is worth learning from, as a complex of wetlands south of Owasco Lake is being actively managed and restored by Cayuga County and partners. The Inlet's Tompkins County section is chronicled here: http://www.tompkinscountyny.gov/files/planning/nffa/docs/OwascoInlet.pdf . North and downstream in Cayuga County, the Owasco Flats wetlands area at the south end of Owasco Lake is the focus of a major restoration process, including conversion of farmlands back to wetlands, to lessen the sediment runoff into Owasco Lake. For more information, see:

Cayuga County's *Restoration Feasibility Report* (2010) http://www.cayugacounty.us/portals/0/wqma/projects/OwascoFlatsReport/Body.pdf .

Owasco Lake Watershed Plan (2015), p. 3-16 "Recommendation E-5: Protect and Enhance the Owasco Flats Area" http://www.cayugacounty.us/Portals/0/planning/WQMA/Documents/OLWMP%20recommendations_20151106.pdf?ver=2015-11-06-152544-000

Montezuma National Wildlife Refuge, in Cayuga, Seneca and Wayne counties

Stretching north from the northern end of Cayuga Lake, the vast Montezuma National Wildlife Refuge was established in 1938 as a refuge and breeding ground for migratory birds and other wildlife. The refuge contains 9,809 acres and is situated in Seneca, Wayne, and Cayuga Counties. The preserve is made up of marsh, punctuated with channels. Shallow pools have been constructed and are carefully managed to benefit wildlife and visitors.

Montezuma is technically downstream of Cayuga Lake, accepting the waters of the Cayuga-Seneca Canal via the northern shore of the lake. Its drainage and hydrology are tied both to the lake and the surrounding complex of numerous other natural and human-managed waterways, all flowing inexorably north and east via the Seneca River to Lake Ontario at Owego. MNWR's website:
https://www.fws.gov/refuge/montezuma/ ;

Partners doing restoration work:
https://www.fws.gov/refuge/Montezuma/what_we_do/partnerships.html
Resource management:
https://www.fws.gov/refuge/Montezuma/what_we_do/resource_management.html

Wetlands study and re-mapping of Tompkins County wetlands

A review and report on the status of wetlands in Tompkins County was commissioned by the Tompkins County Water Resources Council and Tompkins County Planning Department by GBH Environmental's Nick Schipanski: *Wetland Protections in Tompkins County: Existing Status, Gaps, and Future Needs (*2008) http://www.cityofithaca.org/DocumentCenter/View/1303, with funding from USEPA, the Wetlands Committee of the Tompkins County Water Resources Council, and the Soil and Water Conservation District of Tompkins County.

This report was prompted by concerns over the loss of wetlands, varying municipal and county protections, and a regulatory confusion over wetland protection following two adverse federal rulings in 2001 and 2006 that has greatly curtailed Clean Water Act protections for wetlands and other water resources (discussion pp 9-18, *Wetland Protections* report; see Plan Section IV, K. Regulatory Management).

Summary conclusions of the report:

> Three major factors contribute to the vulnerability of wetlands in Tompkins County to losses due to land disturbance activities: (1) the regulatory gap resulting from changes in federal regulations, (2) inconsistent application of existing regulations, and (3) general absence of management on a landscape-scale.
>
> In the short-term, municipalities can adopt regulations and practices fill the regulatory gaps and improve the consistency in the application of existing regulations. In the longer-term, developing wetland specifics for the watershed-

based approach envisioned by the RPP, and incorporation of this approach into municipal comprehensive plans, is needed.

p.35, Wetland Protections in Tompkins County: Existing Status, Gaps, and Future Needs (2008) http://www.cityofithaca.org/DocumentCenter/View/1303

This 2008 study contains several tools of value for improved municipal protection of wetlands resources, including Appendix A, Gap Analysis Field Study; Appendix B, Existing Local Wetland Regulations in Tompkins County (by Municipality); Appendix C, Wetlands Ordinance Example; and Appendix E, Review of Wetland Science and Management.

A major finding of the Gap Analysis Field Study was that many wetland areas in Tompkins County were not included in the federal (US Fish & Wildlife Service) wetlands database, and that a significant portion of mapped wetlands were no longer protected by law, based on the 2001 and 2006 federal rulings. The Wetlands Committee and Water Resources Council determined that a re-mapping of the county's wetlands was a high priority project for water resources protection.

From 2014-6, funding and support from the Tompkins County Soil and Water Conservation District, the Park Foundation, Tompkins County, and the Cayuga Lake Watershed Network supported the re-mapping of Tompkins County's wetlands by Nicholas Hollingshead, Ithaca-based independent environmental GIS consultant.

From the project's final report:

Wetland mapping method
Wetlands in Tompkins County were mapped by visual interpretation of high-resolution aerial imagery available at no cost from the New York State Digital Orthoimagery Program (NYSDOP) and topographic analysis of high resolution LiDAR elevation data collected in 2008 by Pictometry (Rochester, NY). The primary goal of the project was to map all wetlands in the County, regardless of size or type. The wetlands were described using the USFWS Cowardin classification for Wetlands and Deepwater Habitats (Cowardin, Carter, Golet, & LaRoe, 1979). Geospatial data processing and analyses were completed using Manifold 8.0 GIS System (Manifold Software Limited Wanchai, Hong Kong) and ArcGIS 10.1 (ESRI, Redlands, CA) where indicated. The resulting geospatial dataset will be referred to as the Tompkins County 2012 Wetlands Map, in reference to the most recent NYSDOP aerial imagery which served as a primary data resource. -- p. 5, final report, citation and link below.

Summary of results
Tompkins County is 305,000 acres, excluding the large surface water areas of Cayuga Lake and the inlet. All wetlands within the county or intersecting the county boundary were mapped. Therefore, portions of some mapped wetlands extended beyond the county area. However, statistics given in this report section include only wetlands or portions of wetlands within the county. This provides a clear definition of the area being described by the statistics and is important for comparisons to NWI and NYSDEC Freshwater Wetland Maps data. In addition,

wetland areas given a probability of "unlikely", which indicates insufficient but suggestive evidence of a wetland occurring at a given location, are not included in the statistics.

In total, 15,312.5 acres of wetlands were mapped, which is approximately 5.0% of the total area of Tompkins County (Table 2). Natural Palustrine wetlands accounted for 88% of the total wetland area. Riverine and lacustrine wetlands were 0.8% and 1.4% of the total wetland extent, respectively. In total, 3,164 natural contiguous wetland areas (wetland complexes) were mapped. The median wetland complex size was 0.5 acres and the average was 4.2 acres.

The distribution of wetland complexes sizes was strongly skewed, with a large number of smaller wetlands and a small number of very large 16 contiguous wetland areas. There were 23 wetland complexes over 100 acres each, of which two were over 500 acres each. There were 3,950 artificially created wetlands areas mapped, totaling approximately 1,550 acres. These artificial wetland areas are primarily farm ponds, residential ponds, retention basins, and adjacent emergent vegetation areas caused by the artificial impoundment of water by man-made ponds and roads. – pp. 15-16, final report, citation and link below.

Comparing the NYSDEC Freshwater Wetland Maps, the USFWS NWI maps, and the new Tompkins County 2012 Wetlands Map

Considering the differences in the purpose, intended applications, and source data, significant differences between the NYSDEC Freshwater Wetland Maps, the USFWS NWI maps, and the new Tompkins County 2012 Wetlands Map were anticipated.

As shown in Table 3, "Total wetland area in Tompkins County as shown on NYSDEC Freshwater Wetland Maps, USFWS NWI maps, and the Tompkins County 2012 Wetlands Map" (p. 17), the NYSDEC Freshwater Wetland Maps include approximately 37% of the wetland area depicted on the Tompkins County 2012 Wetlands Map. The NWI, which is similar to the Tompkins County 2012 Wetlands Map in terms of its purpose and methods, had 70% of the wetland area included in the Tompkins County 2012 Wetlands Map."

p. 17, final report, citation and link below

Please refer to Hollingshead's final project report to Tompkins County, "Wetlands Mapping and Protection for Tompkins County," for full documentation of results and potential uses of this valuable new wetlands mapping tool.
http://www.cayugalake.org/files/all/wetlands_mapping_-_tompkins_county_wetlands_mapping_project_2015_final_report.pdf

Wetlands project maps and data are accessible via DropBox:
https://www.dropbox.com/sh/hqtnn9wx2a5pboh/AACZ9YCr7Whg35cgNx-5dEZ5a?dl=0 Hollingshead is working with Cornell digital librarians to provide access via CUGIR (Cornell University Geospatial Information Repository).

The DropBox link and final project report are also available at the Cayuga Lake Watershed Network website: http://www.cayugalake.org/wetlands-mapping-project.html

The Recommendations at the end of this section include a proposal for carrying out a similar updating of maps for the wetlands of Seneca County and Cayuga County. An additional recommendation is to encourage the watershed's municipalities to adopt a Wetland Ordinance, based on the template provided in the 2008 report (Appendix C, "Wetland ordinance example," p. 52 *Wetland Protections in Tompkins County: Existing Status, Gaps, and Future Needs* (2008) http://www.cityofithaca.org/DocumentCenter/View/1303).

Additional online wetlands resources

New York State

NYS DEC Freshwater Wetlands Mapping *http://www.dec.ny.gov/lands/5124.html*
Disclaimer by DEC about the completeness of their wetlands maps *http://www.dec.ny.gov/gis/erm/wetlands.html*
NYS DEC wetlands information *http://www.dec.ny.gov/lands/305.html*
NYS DEC Freshwater Wetlands Program *http://www.dec.ny.gov/lands/4937.html*
NYS Freshwater Wetlands Act *http://www.dec.ny.gov/lands/4937.html#Freshwater*

US EPA

A new Clean Water Rule was finalized by US EPA in 2016, to help clarify which waters are and are not protected by the Clean Water Act:
USEPA wetlands information *https://www.epa.gov/wetlands*
Clean Water Rule (2015) *https://www.epa.gov/cleanwaterrule*
Which wetlands are protected by new CWR (2015) *https://www.epa.gov/sites/production/files/2015-05/documents/fact_sheet_summary_final_1.pdf*

US EPA and US Army Corps of Engineers

Permitting discharges of dredge or fill material: https://www.epa.gov/cwa-404
Enforcement: https://www.epa.gov/cwa-404/cwa-section-404-enforcement-overview

3. Riparian areas, corridors & buffers

A definition of terms and a list of the uses and values of vegetated land along our waterways:

> Riparian areas, the areas immediately adjacent to flowing waters such as streams, lakes, shorelines, and wetlands, provide a transition between aquatic and terrestrial ecosystems (Environmental Law Institute 2003). Though riparian areas and stream buffers generally comprise a small proportion of the landscape, they provide a disproportionably high amount of habitat and ecosystem benefits, including protecting water quality, stabilizing streams, minimizing flood damages, and enhancing ecological diversity.
>
> p.1, *Enhancing Water Resources in Tompkins County: Benefits of Riparian Areas and Stream Buffers* (no date), Tompkins County Planning Department http://www.tompkinscountyny.gov/files/planning/water-resources/EnhancingWaterResources.pdf

Riparian zones are the lands bordering surface waters; under natural conditions these zones represent a transition from aquatic to terrestrial ecosystems, and vary in width. For the 2000-1 Cayuga Lake Watershed Restoration & Protection Plan, the riparian zone was defined as 150 ft. from the centerline of each major stream. The Riparian Corridors section of the 2001 Plan may be viewed here: http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caywetrip.htm.

Table 1 indicates the percentage of each land use within this buffer area for the major subwatersheds in 2001. The amount of developed area varies from about 40% to 80%, indicating significant development along most of the tributaries. See also: Cayuga Lake Watershed Roadbank Inventory**,** Cayuga Lake Watershed Streambank Inventory and the map of Land Use in the Riparian Corridor . These data have not been updated for 2017, but are of value as baselines for further research and application.

Tompkins County: Riparian areas protection

The Tompkins County Riparian/Streamside study (no date), cites the following clean water values for forested stream buffers:

> Forested stream buffers provide a variety of benefits:
>
> - Habitat and Biodiversity. Stream buffers enhance habitat and biodiversity by providing terrestrial wildlife habitat and travel corridors, and food and habitat in aquatic ecosystems;
> - Stream Stability. Buffers attenuate flooding, stabilize stream banks and prevent erosion of streambanks and streambeds;
> - Water Quality. Buffers protect water quality by removing pollutants and moderating temperatures; and Exemplary stream buffer. Forested stream buffers provide the greatest benefit when compared to other types of stream buffers.
> - Financial Savings. Buffers prevent property damage, reduce public investment and enhance property values.
>
> p. 1,
> http://www.tompkinscountyny.gov/files/planning/water-resources/EnhancingWaterResources.pdf

The southern end of Cayuga Lake in Tompkins County presents a complex, challenging situation for water resources management, with several large creeks flowing down steep slopes via waterfalls and crossing through downtown, residential and business districts to the lake. Stormwater runoff (see Section IV, E. Stormwater Management and Erosion Control) can be problematic, especially with extreme weather events of the emerging climate change era (see Section IV, J. Regulatory Management).

Tompkins County has responded to these challenges via the development and implementation of a suite of tools for riparian management. These tools were field tested 2006-10 in several streamside projects, restoring or protecting over 11,000

linear feet of streambank and planting over 1,800 native trees and shrubs in four subwatersheds and six municipalities.

http://www.tompkinscountyny.gov/planning/water-resources-stream-buffers

These tools include the following with online links:

- **Stream Buffer Planting Guide (PDF)**
- **Riparian Protection Agreement (PDF)**
- **Riparian Buffer Easement (PDF)**
- **Model Stream Buffer Ordinance (PDF)**

Additional resources for Tompkins County stream and riparian protection

Tompkins County Water Quality Strategy, 2016-8 (2015) Tompkins County Water Resources Council http://www.tompkinscountyny.gov/files/planning/water-resources/WQS%202016-2018.pdf

Riparian buffer funding program
http://www.tompkinscountyny.gov/planning/water-resources-stream-buffers

Tompkins County Stream Corridor Protection and Management
http://www.tompkinscountyny.gov/planning/water-resources-stream-buffers

Tompkins County Comprehensive Plan (2015). Chapter 6, Water resources http://www.tompkinscountyny.gov/files/planning/ComprehensivePlan/Water%20Resources.pdf Prepared by the Tompkins County Planning Department for the Tompkins County Legislature.

Seneca County: Stream and riparian areas protection and management

Establishing riparian buffers is a central goal of the 2014 Seneca County Environmental Protection Plan:

> Goal 2. Ensure the long-term preservation of surface and groundwater resources in Seneca County – riparian buffers and other waterway protection strategies.
>
> p. 30 http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SCEnvConsFnlPln2_17_14.pdf

The Seneca County Environmental Protection Plan stresses the need to work effectively with the county's thriving agricultural community for long-term water quality protection. Stream and water quality protection is supported via numerous programs and strategies:

> The New York State Department of Environmental Conservation's latest 303(d) list, issued in 2012, includes no waterways from Seneca County, though impairment in Pond Brook from agricultural runoff is suspected, but not verified. This does not mean that Seneca County can relax its vigilance of its water resources.

Most stream corridors are on private property and thus susceptible to development pressures. While many stream corridors provide opportunities for passive recreation, especially fishing and hiking, while protecting wildlife habitats and stream water quality, they are not public open space.

The County's surface waters are especially susceptible to degradation through improper land use development and management. Water quality can be degraded by excessive pollutant loads, including nutrient loads that result from malfunctioning and improperly-sited septic sewage systems; runoff from impervious surfaces; runoff from construction sites; less-than-careful agricultural practices; and the filling of adjacent wetlands, which serve to contain and remove plant nutrients in runoff.

According to research scientists from Hobart and William Smith Colleges, summer algae blooms are increasing in both Seneca and Cayuga Lakes, a sign of declining water quality. New York State offers a voluntary Agricultural Environmental Management program to help farmers implement best management practices to control runoff, recycle nutrients, Seneca County - Environmental Conservation Plan 8 and conserve soil.

The program, which is delivered by the Seneca County Soil and Water District, offers customized farm-by-farm assessments. About 60 farms in Seneca County are currently enrolled. In recent years, the program has expanded to help connect farmers with new opportunities including the production of renewable energy and reduction of greenhouse gas emissions.

Pp. 7-8, Seneca County Environmental Protection Plan (2014)
http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SCEnvConsFnlPln2_17_14.pdf

Cayuga County: Comprehensive recommendations for riparian protection
The Owasco Lake Watershed Plan (2015) contains recommendations with county-wide implications that include Cayuga County's 25 miles of Cayuga Lake's eastern shore. Cayuga County is prominent agriculturally (see Plan Section IV. D., Agriculture Practices and Prospects). Owasco Lake has been negatively impacted by sediment and nutrients. Contained in the document *Owasco Lake Watershed Management and Waterfront Revitalization Plan, Draft recommendations* (2015) are detailed recommendations for actions that protect the thriving farming industry and seek to improve water quality.

Beyond the scope of this Plan update to discuss in detail, the Owasco Plan Recommendations provide a wealth of specifics for riparian and stream health restoration and protection. For example, view:

B. MEASURES TO REDUCE NONPOINT SOURCE POLLUTION
Recommendation B-1: Control Agricultural Nonpoint Sources, pp 3-2 - 3-3;
Recommendation B-2: Streambank Stabilization in Priority Areas, p. 3-4;

Recommendation B-3: Adopt or Amend Local Regulations Designed to Reduce Nonpoint Source Pollution from Developed Areas, p.3-5;
Recommendation B-4: Reduce Nonpoint Source Pollution from Municipal Activities, p.3-6;
Recommendation B-5: Reduce Nonpoint Source Pollution from Residential Property and Community Landscapes, p. 3-8.

Source:
http://www.cayugacounty.us/Portals/0/planning/WQMA/Documents/OLWMP%20recommendations_20151106.pdf?ver=2015-11-06-152544-000, *Owasco Lake Watershed Management and Waterfront Revitalization Plan, Draft recommendations* (2015) prepared for the Cayuga County Department of Planning and Economic Development by EcoLogic, LLC)

Statewide information
Riparian buffers NYSDEC http://www.dec.ny.gov/chemical/106345.html

4. Priorities for restoring wetlands and riparian zones

In 2001, a field-based project was carried out in the Taughannock Creek and Yawger Creek subwatersheds (in Tompkins and Cayuga counties, respectively) to develop and implement a methodology to quantify the restoration potential of wetland and riparian corridors. The final report, *Cayuga Lake Watershed Wetlands Management Report* (2001) Wetland & Riparian Corridor Management Project Report, provides a technical strategy for identifying priority actions to restore riparian corridors and wetlands: "Using this approach, watershed managers can rank subwatersheds in terms of the environmental benefit that can be realized by restoring and protecting these critical riparian areas. The strategy also guides selection of appropriate restoration strategy based on landscape position, dominant land use, and the water quality issues to be addressed" (p. 1, *Cayuga Lake Watershed Wetlands Management Report* (2001), Genesee/Finger Lakes Regional Planning Council and EcoLogic, LLC).

The role riparian zones play in protecting water quality is determined by a combination of physical environment characteristics including vegetation, slope, soils and land use. The percentage of land use class within the riparian zone is the best measure of condition within these areas. Based on 2001 data, Table 3 ranks each major subwatershed in order of percentage-developed land within the 150-foot buffer zone. Subwatersheds with over 70% development are ranked "high"; from 70% to 54%, "medium"; and below 53%,"low". Subwatersheds with the highest percent of developed area should be given the highest priority for riparian zone restoration.

See Recommendations, below, which include a proposed watershed-wide update process for priority riparian restoration areas, coordinated by the Intermunicipal Organization to include municipal governments and partner agencies and organizations in Seneca, Tompkins and Cayuga counties.

5. Goals and Recommendations

Goals

Work to restore, preserve, and protect wetlands via three basic goals

- Preserve existing wetlands and restore degraded wetlands within the watershed.
- Preserve existing riparian vegetation zones and restore them in areas where they have been degraded.
- Restore degraded streams to a natural condition for the purposes of reducing streambank erosion and restoring aquatic habitat.

Recommendations for action to improve wetlands and riparian areas protection across the Cayuga Lake watershed

1. Obtain data and funding for Seneca and Cayuga counties to update their wetlands maps using the methods and imagery from the Tompkins County wetlands re-mapping project.

2. Advise and assist municipalities to adopt wetlands protection ordinances based on the available template (2008).

3. Conduct a watershed-wide update process for priority riparian restoration areas, coordinated by the Intermunicipal Organization to include municipal governments and partner agencies and organizations in Seneca, Tompkins and Cayuga counties.

4. Educate public and municipalities about the importance of wetlands and their protection and encourage review and updating of municipal and county planning documents to include effective wetlands protections.

Chapter I. *Action Category:* Regulatory Management

1. Introduction

The foci of this watershed plan are controlling and reducing water pollution and preventing water quality degradation, by working with the watershed's municipalities and the public. Also of concern is ensuring a continued, dependable supply of high quality water for human and ecosystem uses, in an era of extreme weather events and climate change. Development and infrastructure choices made now affect future water resources, so they must be carefully planned. Beyond the boundaries of the Cayuga Lake watershed, all of the Finger Lakes are active participants in larger engineered and natural systems: what we do within our watershed affects downstream water resources beyond our borders. Globally, climate change is underway. We can work together to slow or lessen its impacts locally.

These issues and challenges are tackled at different levels of government, each providing differing powers for water resources regulation and enforcement. Non-regulatory agencies and organizations also have roles. The result is complex, imperfect, and necessary. This section of the Cayuga Lake Watershed Restoration and Protection Plan provides some of the information needed to find out how our water resources are protected – and how to strengthen those protections.

This is not an exhaustive review. Look here for background information and links to basic Cayuga Lake watershed municipality, county, state and federal agencies, and other regional and topical entities concerned with water resources protection.

View the 2001 Plan version of this section:
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/cayregmanagement.htm

View the 2001 Characterization reference materials for this section:
http://www.cayugawatershed.org/characterization/PDF/Chapter5.pdf

2. Local government: municipalities and counties

Municipalities and counties

Local municipalities (towns, villages, hamlets) have powers to regulate the physical development of the municipality. This power is exercised through a variety of available authorizations and regulatory mechanisms, in cooperation with county government and with deference to state and federal powers. Through control of land use, each community is able to develop and display the most desirable physical features, protect the public health and welfare and environmental quality of the community.

Water quality is mostly regulated at the county level; however, several municipalities are in the process of developing drinking water protection plans (and local ordinances), under the guidance of the New York Rural Water Association:
http://www.nyruralwater.org/technical-assistance/source-water-protection .

The New York State Department of State provides information about the roles and responsibilities for each level of local government – county, city, town and village:
https://www.dos.ny.gov/lg/localgovs.html

Municipal land use regulation and control

A great tool for determining exactly which powers belong to which level of government, and where to go for more information, is the NYS Division of Local Government Services publication (2009) *Creating the Community You Want: Municipal Options for Land Use. From the introduction:*

> This publication summarizes the various land use management tools that New York municipalities can use to help deal with issues of community character and change. It is a primer that briefly describes both the importance of planning to identify how a municipality wishes to develop, as well as the regulatory techniques available to help it realize its goals. It begins with a discussion of the comprehensive plan, continues with a survey of various zoning tools and smart growth concepts that can be used to regulate land use and development, and concludes with an explanation of other methods useful for managing land resources and the built environment.
>
> The growth management tools and techniques available to meet a community's goals can be grouped into five basic categories: (1) regulation of how land is developed and used through local laws and ordinances; (2) public spending and taxing policies; (3) land acquisition; (4) private voluntary preservation and development techniques; and (5) the location and capacity of infrastructure. This publication focuses on the first category.

- 1st page, *Creating the Community You Want: Municipal Options for Land Use* Control JAMES A. COON LOCAL GOVERNMENT TECHNICAL SERIES (revised 2009, reprinted 2015) https://www.dos.ny.gov/lg/publications/Creating_the_Community_You_Want.pdf

At the municipal level, topics covered in this publication of particular interest for water resources protection are: zoning, site plans, subdivision review, mining, scenic resource protection, open space preservation, agricultural land protection, floodplain management, wetland protection, water resource protection, sanitation, erosion and sedimentation control, and environmental review.

Municipal websites, comprehensive plans and water resource-related links

See below for active links (January 2017) to every municipality in the Cayuga Lake watershed, organized by county. Following a municipality's name is their website, and a brief listing of the status of the municipal comprehensive plan and a short list of other water issues, topics and regulations available. Each website provides the names and contact information for that municipality's elected and appointed officials.

Tompkins County municipal websites and links

From the Tompkins County Comprehensive Plan (2015):

> All local municipalities in Tompkins County have also prepared and adopted comprehensive plans. These plans serve multiple purposes, but among them are to act as the basis for adopting local land use regulations, including zoning, site plan review, and subdivision regulations. The authority for such land use regulation in New York State lies at the town, village, and city level, and not at the County level.

p. 6. (2015) Tompkins County Comprehensive Plan. http://www.tompkinscountyny.gov/files/planning/ComprehensivePlan/Introduction.pdf

- Cayuga Heights, Village of: Comprehensive Plan 2014, zoning, ordinances, code enforcement, stormwater.
- Dryden, Village of: Comprehensive Plan 2016, zoning, code enforcement, water and sewer.
- Freeville, Village of: http://freevilleny.org Comprehensive Plan 2013, code enforcement, sewer.
- Groton, Village of: http://www.grotonny.org/ Comprehensive Plan 2005, water and sewer, codes and enforcement.
- Lansing, Village of: Comprehensive Plan 2015, code and enforcement, planning and zoning.
- Trumansburg, Village of: http://trumansburg-ny.gov/ Comprehensive Plan 2008, water, Wastewater Treatment Plant Project, public works, zoning and code enforcement.
- Caroline, Town of: http://www.townofcaroline.org/ Comprehensive Plan 2006, aquifer protection, watershed and stormwater management, subdivisions.
- Danby, Town of: http://townofdanbyny.org/content Comprehensive Plan 2011, Environmental Quality Review Local Law, code enforcement, planning and zoning, subdivisions, water district, stormwater management erosion and sediment local law; Groundwater Protection Law. http://townofdanbyny.org/content/Departments/View/3:field=documents;/content/Documents/File/242.pdf.
- Dryden, Town of: http://dryden.ny.us/ Comprehensive Plan 2005, planning, sustainability, code enforcement, public works, gas drilling, planning and zoning.
- Enfield, Town of: http://townofenfield.org/ Comprehensive Plan 2001 (update in process), planning, code enforcement, environmental concerns.
- Groton, Town of: http://www.townofgrotonny.org/ Comprehensive Plan 2005, Land Use and Development Code 2011, planning, zoning, code enforcement.
- Ithaca, Town of: http://www.town.ithaca.ny.us/ Comprehensive Plan 2014, Agriculture committee, planning, zoning, etc.
- Lansing, Town of: Comprehensive Plan 2006, planning, zoning, code enforcement, stormwater, water district.
- Newfield, Town of: Comprehensive Plan 2013, code enforcement, public works.
- Ulysses, Town of: Comprehensive Plan 2009, planning, zoning, Agriculture Committee, Sustainability & Conservation Advisory Council, water district, stormwater.
- Ithaca, City of: http://www.cityofithaca.org/ Comprehensive Plan 2015, Planning, Building, Zoning and Economic Development Department, Public Works, etc.

Cayuga County municipal websites and links

- Aurelius, Town of: http://aureliustown.org/ Comprehensive Plan 2006, drinking water report, zoning law.
- Cayuga, Village of: http://www.villagecayugany.com/ Comprehensive Plan 2013, drinking water report.
- Fleming, Town of: http://www.villagecayugany.com/ Comprehensive Plan 2008, zoning, water quality report.

- Genoa, Town of: http://www.cayugacounty.us/portals/1/genoa/contacts.html Comprehensive Plan 2013, code enforcement, Water Quality Committee, reports
- Ledyard, Town of: http://www.cayugacounty.us/townofledyard/ Comprehensive Plan 2012, zoning, planning.
- Aurora, Village of: http://auroranewyork.us/ Comprehensive Plan 2016, zoning, planning, water and sewer, preservation, lake and water quality links.
- Locke, Town of: http://www.cayugacounty.us/portals/1/locke/index.htm Long Term Plan 2010, zoning under discussion, water quality report.
- Scipio, Town of: http://www.cayugacounty.us/portals/1/scipio/index.htm zoning, subdivisions; Comprehensive Plan 2011 http://www.cnyrpdb.org/scipiocompplan/
- Sempronius, Town of: http://www.cayugacounty.us/portals/1/sempronius/index.html . Additional information: http://www.cayugacounty.us/portals/0/planning/hazmit/documents/Section_9.25_Town_of_Sempronius_Annex_0613draft.pdf . No Comprehensive Plan.
- Springport, Town of: http://www.cayugacounty.us/portals/1/springport/index.html Comprehensive Plan (2013): http://www.cayugacounty.us/portals/1/springport/untitled-2/05-08-13_compplan_finaldraf.pdf. Zoning, planning, water quality report.
- Union Springs, Village of: http://unionspringsny.com/ Comprehensive Plan (2007), planning, zoning, water quality report, water and sewer, code enforcement.
- Summerhill, Town of: http://www.cayugacounty.us/portals/1/summerhill/index.htm planning, code enforcement, Comprehensive Plan 2010 (contact Cayuga County Planning for link).
- Venice, Town of: http://www.cayugacounty.us/portals/1/venice/index.html No Comprehensive Plan.

Seneca County municipal websites and links

- Covert, Town of: http://www.townofcovert.org/ Land Management Ordinance (2013); Right to Farm (2009); planning.
- Interlaken, Village of: http://www.interlaken-ny.us/ Village Comprehensive Plan (2015); water, sewer, water quality report.
- Fayette, Town of: http://townoffayetteny.org/ Comprehensive Plan, Towns of Fayette and Varick (2006). Plan viewable at the Town of Varick weblink below; planning, zoning, water
- Lodi, Town of: http://www.lodiny.com/ Comprehensive Plan (2010), Right to Farm (2009); code enforcement.
- Ovid, Town of: http://www.townofovid.net/ Comprehensive Plan (being updated 2017); planning, code enforcement.
- Ovid, Village of: No separate website. Water quality reports: https://www.co.seneca.ny.us/village-of-ovid-2015-annual-water-quality-report/; STEPS (Seneca Towns Engaging People for Solutions) organization: http://www.s2aynetwork.org/steps.html .
- Romulus, Town of: http://www.romulustown.com/ Comprehensive Plan (date unknown), water and sewer, water quality reports, zoning, subdivision.

- Seneca Falls, Town of: http://www.senecafalls.com/ Comprehensive Plan for Town and Village (2006) http://www.senecafalls.com/pdfs/draftplan062306-1.pdf ; new town and village sewer inspection program (2016); water and sewer, planning and zoning, code enforcement.
- Seneca Falls, Village of: Dissolved in 2010.
- Varick, Town of: http://varicknewyork.com/ Towns of Fayette and Varick Comprehensive Plans (2006); planning, zoning, subdivision, code enforcement, water.

County Regulatory Authority

In New York State, counties have a major role in regulating and protecting public and private water supplies and their uses, also applying state and federal standards for on-site septic and sewage systems. County programs are carried out in conjunction with cities, towns, villages and rural populations, via resources and programs provided by state and federal governments. Following is a partial listing of water resources programs at the county level for the Cayuga Lake watershed's three lakeshore counties, Seneca, Cayuga and Tompkins. Essential contact information is provided for three counties that contribute small upland portions of the Cayuga Lake watershed – Schuyler, Tioga, and Cortland.

Background information on what counties do, from the NYS Department of State:

> Counties are New York State's largest and most inclusive form of local government, but probably the most limited in the services that a government can provide… Counties have developed as partners with the state to provide many of state mandated services, including Medicaid and other social services and management of jails and prisoner retention. They may also provide police services, maintain certain roads and transportation infrastructure and provide economic development assistance. As the largest of New York's local governments, the county is the convenient level of government to develop regional responses to common problems and opportunities.
>
> -- "County governments,"
> https://www.dos.ny.gov/lg/localgovs.html

County-by-county information is available from the New York State Association of Counties: http://www.ny.gov/counties. Why counties matter: http://www.nysac.org/countiesmatter

Tompkins County

Water resources planning and programs

- Department of Planning: http://www.tompkinscountyny.gov/planning
- Water Resources: http://www.tompkinscountyny.gov/planning/water-resources
- Water Resources chapter of the Comprehensive Plan (2015): http://www.tompkinscountyny.gov/files/planning/ComprehensivePlan/Water%20Resources.pdf
- Climate Change Adaptation: http://www.tompkinscountyny.gov/planning/climate-adaptation

- Hazard Mitigation: http://www.tompkinscountyny.gov/files/planning/Climate_Adaptation/Tompkins%20County%20HM%20Final%20Draft%2001-16-14.pdf
- Cayuga Lake Waterfront Plan (2004): http://www.tompkinscountyny.gov/files/planning/community%20planning/documents/Full%20Report%20Dec%202004%20with%20maps.pdf
- Conservation Plan (2007): http://www.tompkinscountyny.gov/files/planning/nri/documents/Tompkins_County_Conservation_Plan09-24-07.pdf
- Agriculture and Farmland Protection Plan (2015): http://www.tompkinscountyny.gov/files/planning/Natural_Agriculture/Final_Tompkins_Ag_%26_Farmland_Protection_Plan%2009-15.pdf

Water resources-related public health programs, standards, and enforcement

- Environmental Health Division, Department of Health: http://www.tompkinscountyny.gov/health/eh Includes: Hydrilla: Water monitoring data, Onsite Wastewater Treatment Systems (OWTS), Residential Development, Sanitary Code.
- Tompkins County Water and Sewer Division: http://www.cityofithaca.org/291/Water-Sewer
- Drinking Water Annual Report: "In the spirit of intermunicipal cooperation, the Bolton Point, City of Ithaca, and Cornell University water systems provide this unified Drinking Water Quality Report": http://www.cityofithaca.org/296/Annual-Drinking-Water-Quality-Report
- Ithaca Area Wastewater Treatment Facility: http://www.cityofithaca.org/331/Wastewater-Treatment

Advisory, policy, education: agencies and programs for water quality

- The Water Resources Council and Environmental Management Council carry out research, develop and advise on policies and ordinances to the Tompkins County Legislature and municipal governments.
  Tompkins County Water Resources Council: http://www.tompkinscountyny.gov/planning/committees-wrc
  Tompkins County Environmental Management Council: http://tompkinscountyny.gov/emc
- Tompkins County Soil and Water Conservation District Office: http://tompkinscountyny.gov/swcd ; Program Areas include stormwater, invasives, water quality improvement, farm management, other. http://www.tompkinscountyny.gov/swcd/Programs
- Cornell Cooperative Extension Tompkins County: http://ccetompkins.org/

Cayuga County

Water resources planning and programs

- Department of Planning and Economic Development http://www.cayugacounty.us/Departments/Planning-and-Economic-Development Includes links to: Water Quality, Waste & Recycling, Flooding, All-Hazard Mitigation Plan, Environmental Planning, Manure Management
- Agriculture and Farmland Protection Plan (2014): http://www.cayugacounty.us/Departments/Planning-and-Economic-Development/Agricultural-Farmland-Protection/Ag-Plan-Update/Draft-Plan
- Climate Change: the Owasco Lake Watershed Plan (2015)'s "Emerging Issues" chapter discusses climate change and other new issues, noting that their impact and solutions reach far beyond the boundaries of the Owasco Lake watershed: http://www.cayugacounty.us/Portals/0/planning/WQMA/Documents/Inventory%20Report%20Chapter%206.pdf

Water resources-related public health programs, standards, and enforcement

Cayuga County Water and Sewer Authority:
http://www.cayugacounty.us/Departments/Water-and-Sewer-Authority

Cayuga County Environmental Health Division:
http://www.cayugacounty.us/Community/Health/Environmental-Health

- Public water supplies: http://www.cayugacounty.us/Community/Health/Environmental-Health/Public-Water-Supplies
- Septic System Installation and Inspection Program: http://www.cayugacounty.us/Community/Health/Environmental-Health/Septic-System-Installation-and-Inspection
- Blue-green algae information and programs: http://www.cayugacounty.us/Community/Health/Environmental-Health/Blue-Green-Algae
- Swimming Pools and Bathing Beaches: http://www.cayugacounty.us/Community/Health/Environmental-Health/Swimming-Pools-and-Bathing-Beaches

Advisory, policy, education: agencies and programs for water quality

- Water Quality Management Agency (WQMA): http://www.cayugacounty.us/Departments/Water-Quality-Management-Agency
- Other Cayuga County water protection programs: http://www.cayugaswcd.org/
- Soil and Water Conservation District Office, Cayuga County: http://www.cayugaswcd.org/ ; Stormwater & Erosion Control Training

Workshops: http://www.cayugaswcd.org/erosion-and-sediment-control.html
- Cornell Cooperative Extension Cayuga County: http://blogs.cornell.edu/ccecayuga/

Seneca County

Water resources planning and programs

- Department of Planning and Community Development: https://www.co.seneca.ny.us/departments/planning-and-community/
- Seneca County Environmental Conservation Plan (2014): http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SCEnvConsFnlPln2_17_14.pdf
- Agricultural and Farmland Protection Plan (2014): http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SC_CompPlanTemp_021214.pdf
- Department of Public Works: https://www.co.seneca.ny.us/departments/public-works/water-sewer/
- Emergency management: http://www.co.seneca.ny.us/departments/safety-services/emergency-services/
- Climate change information: http://senecacountycce.org/environment/climate-change

Water resources-related public health programs, standards, and enforcement

Seneca County Health Department: http://www.co.seneca.ny.us/departments/community-services/public-health/

- Septic systems: http://www.co.seneca.ny.us/departments/community-services/environmental-health/environmental-health-services-septic/?doing_wp_cron=1485202841.2949960231781005859375
- Public water supplies, with annual reports by municipal source: http://www.co.seneca.ny.us/departments/community-services/environmental-health/environmental-health-services-public-water-supplies/
- Watershed regulations: http://www.co.seneca.ny.us/wp-content/uploads/2016/01/watershed-regulations01292016.pdf
- Also private wells, e.coli infection fact sheet, well disinfection, other.

Advisory, policy, education: agencies and programs for water quality

- Cornell Cooperative Extension, Seneca County: http://senecacountycce.org/
- Soil and Water Conservation District: http://senecacountyswcd.org/ Services include Agricultural assessments, weed harvesting, A.E.M. (Agricultural Environmental Management), “Drainage Law” information from the Cornell Roads Program; erosion control trainings; invasive species information, other.

- Seneca County Water Quality Committee: Meets every other month (2017) at the Seneca County Seneca County Office Building, 1 DiPronio Drive, Waterloo. Contact (2017): The Soil and Water Conservation District Office (315)568-4366.

Tioga County

Towns and villages: http://www.tiogacountyny.com/towns-and-villages/
Tioga County, NY: http://www.tiogacountyny.com/

Schuyler County

Towns and villages: http://www.schuylercounty.us/495/Municipal-Land-Use
Schuyler County, NY: http://www.schuylercounty.us/

Cortland County

City, towns and villages: http://www.cortland-co.org/321/Municipalities-of-Cortland-County
Cortland County, NY: http://www.cortland-co.org/

3. State and federal roles and powers

Enacted by Congress, federal environmental laws and the regulations developed to implement the laws form the basis for water protection laws and regulations in New York State. State law may be stricter than federal law. The NYS Department of Environmental Conservation is a state-level version of US EPA. Each U.S. state has an environmental management agency (January 2017). Several important environmental laws and their regulations are overseen by agencies other than EPA, and at the state level are overseen by agencies other than DEC. In some states, federal agencies manage state's programs for them, but New York State fully manages its own programs.

In some cases these programs are then delegated by NYS to county agencies, as delineated in the previous section. These programs involve a great deal of participation at the local level by municipal boards and elected officials, citizens, and businesses.

New York State water management and protection

From DEC's "Water" webpage (http://www.dec.ny.gov/chemical/290.html):

> New York's abundant rivers, streams, lakes and coastal waters are used for recreation, fishing, tourism, agriculture and manufacturing. Dams and other infrastructure help us manage our waters.
>
> Though plentiful, the water resources of the state are threatened by chemical contaminants and other pollutants from a wide range of sources.
> DEC provides various programs that track the quality of the waters, identify and investigate sources of pollution, control these sources and develop strategies to address water quality threats. DEC programs regulate and provide guidance on water supply withdrawal. DEC also manages floodplains and coastal areas to reduce flood risk to protect New Yorkers from coastal and inland flooding.

This page provides links to information on topics related to programs for the management and protection of the waters of New York State, including:

- Water Quality Information (Monitoring, Water Quality Assessment, Impaired Waters, Waterbody Inventory, Priority Waterbodies List, Research Studies).
- Water Quality Concerns (Nonpoint Sources, Stormwater, CSOs, CAFOs, Septic Systems, Drugs in Water, Nutrients, Wastewater Infrastructure, Atmospheric Deposition, Legacy Pollutants, Invasive Species, Blue-green HABs).
- Keeping Waters Clean (Water Quality Standards, Dishwater Detergent & Nutrient Law, TMDLs, Green Infrastructure, Watershed Plans, Wastewater Treatment, Compliance and Enforcement, No Discharge Zones).
- Permitting Information (Municipal Permits, Industrial Permit, CAFO Permits, Sewers, Vessel General Permit, Coastal Activities).
- Managing Water Resources (Water Withdrawal, Conservation, Flood Protection and Floodplain Management, Coastal Erosion, Dam Safety, Groundwater, Reservoir Releases, Streamgages, Compliance and Enforcement).
- DOW Library and Additional Information (Articles by DEC staff, ClearWaters Columns, Diet for a Small Lake, Manual for completing the Discharge Monitoring Report (DMR)).

Watersheds, watershed management

Learn more about the water programs and how DEC uses a watershed management approach to protect and conserve water resources. These statewide water programs are often supplemented by specific watershed programs that focus on the protection and restoration of waters in a particular drainage area of the state. Information and activities for a specific watershed in the state can be found on the River and Lake Watersheds page.

- NYS DEC "Water: Managing our lakes, rivers and coasts" http://www.dec.ny.gov/chemical/290.html .

Other DEC water programs and topics

- Sewage Pollution Right to Know - Information about the Sewage Pollution Right to Know Law.
- Combined Sewer Overflow (CSO) - Combined sewer systems are sewers that are designed to collect storm water runoff, domestic sewage, and industrial wastewater in the same pipe.
- Sanitary Sewer Overflow (SSO) - Information about sanitary sewer overflows, including, common causes and abatement strategies.
- Drugs in New York's Waters - Why it is no longer recommended to dispose of unwanted or expired medications by flushing and what the recommended disposal method is.
- Sewers - Information on sewers and sewer use.
- Stormwater - This page provides information about storm water related issues.
- Keeping Water Clean - DEC programs that manage sources of water pollution, reduce specific pollutants, and improve and protect water quality.

- Green Infrastructure for Wet Weather - Information about using green infrastructure practices to manage stormwater.
- SPDES Compliance & Enforcement - Recently Revised TOGS 1.4.2 on SPDES Compliance and Enforcement and Responsiveness Summary to Public comments.
- Managing Water Resources - DEC programs that are aimed at managing dams and other infrastructure, water supply, and protecting New Yorkers from coastal and inland flooding..
- Pesticide General Permit - Pesticide General Permit GP-0-16-005, is required and authorizes coverage for point source discharges resulting from any application of a registered biological or chemical pesticide labeled for aquatic uses directly to, in, or over a surface water of New York. This supplements requirements in Article 15 and Article 24 permits.

    - NYS DEC "Water: Managing our lakes, rivers and coasts" http://www.dec.ny.gov/chemical/290.html .

NYS Department of Health
The New York State Department of Health oversees programs, regulations and enforcement relating to human health, in cooperation with county agencies and local communities.

Drinking water is a central concern:
https://www.health.ny.gov/environmental/water/drinking/
Links provided to information on the following topics and programs:

- Information about Your Drinking Water Supply
- Information About the Quality of Your Drinking Water Supply
- Emergency Preparedness and Response for Water Systems
- Water System Level Improvements
- Preventing Drinking Water Contamination
- Additional Public Health Related Water Protection Programs

Federal Emergency Management Agency, Region II
FEMA is part of the US Department of Homeland Security. Business and homeowners, residents and local governments deal directly with this federal agency in the event of a declared emergency, which can include the destructive aftermath of extreme weather and flooding. FEMA Region II serves the States of New Jersey and New York, the Commonwealth of Puerto Rico, the U.S. Virgin Islands territory and eight Tribal Nations. Region II Headquarters is located in New York, N.Y.:
https://www.fema.gov/region-ii-nj-ny-pr-vi-0

New York counties work with FEMA to map flood hazard areas for disaster prevention and mitigation. Flood Map Service Center http://msc.fema.gov/portal

Tompkins County flood mapping
Map of Flood Hazards Zones, Tompkins County (1996 data):
http://www.tompkinscountyny.gov/files/gis/maps/pdfs/TCFlood_Zones.pdf

From Tompkins County (2014) *Multi-Jurisdictional All-Hazard Mitigation Plan*:

FEMA's Q3 flood data, which is derived from their FIRMs, were reviewed for Tompkins County. These datasets were last updated in 1996. Enfield is the only jurisdiction in the County that has never been mapped by FEMA. The Village of Cayuga Heights has been mapped, though there are no floodplains identified within the Village's municipal boundary. There are a total of about 6,464 acres of land in the County that are located within 100-year or 500-year mapped flood zones. A 100-year flood indicates a flood elevation that has a 1-percent chance of being equaled or exceeded each year. Similarly, a 500-year flood indicates a flood elevation that has 0.2-percent chance of being equaled or exceeded in any given year.

The land area in Tompkins County that is mapped within either of these flood zones accounts for, at least portions of, 3,749 tax parcels. The full market value of these parcels, in their entirety, is $7,423,609,047. Parcels located within mapped floodplains consist of the following land uses: 364 parcels – Commercial, 129 parcels – Community Services, 76 parcels – Forest, 9 parcels – Industrial, 59 parcels – Public Services, 36 parcels – Recreation, 2475 parcels – Residential, 507 parcels – Vacant.

As indicated, an overwhelming majority of lands mapped within 100- and 500-year floodplains are residential properties. The majority of identified parcels are located adjacent to Salmon Creek, Taughannock Creek, Fall Creek, Cascadilla Creek, Sixmile Creek, Cayuga Inlet, Owasco Inlet, Mud Creek, and Virgil Creek. Table 34 lists the total number of parcels mapped in 100- and 500-year floodplains according to their jurisdiction location.

- Pp. 103-104 (Table is p 104) Tompkins County (2014). *Multi-Jurisdictional All-Hazard Mitigation Plan*. http://tompkinscountyny.gov/files/planning/community%20planning/documents/Tompkins%20County%202014%20HMP%20National%20Flood%20Insurance%20Program%20and%20Plan%20Process%20Sections.pdf

Cayuga County flood mapping

From *Hazard Mitigation Plan – Cayuga County, New York* (2013):

Flooding in Cayuga County may occur during any time of the year, primarily in response to severe or long-duration precipitation events. Highest recorded water levels for Cayuga Lake occurred following Tropical Storm Agnes in June 1972, only to be exceeded by 0.75 inches during the snowmelt from the Blizzard of 1993. The highest levels ever reached on Owasco Lake were in 1936 and 1940, before the U.S. Army Corps of Engineers developed the Rule Curve followed by the City of Auburn since about 1960. These two flood events both produced lake levels a half foot highter than Tropical Storm Agnes. Flooding in the watershed has also occurred in response to combined early spring heavy rain and snowmelt events. Streams draining into Cayuga Lake and Owasco Lake are subject to lake backwater effects (FEMA, 2007; County Input, 2013).

There are several areas [in the Cayuga Lake watershed area of] Cayuga County that are historically floodprone. These include:

- The southern shore of Lake Como has poorly drained soil that floods several times a year. According to the preliminary FIRM (2005), there are houses located in the SFHA that are subject to 100-year floods (Cayuga County Department of Planning and Economic Development, 2007).
- In the Village of Union Springs, the shoreline of Cayuga Lake is subject to periodic flooding. There are also three areas, along tributaries, where large flooding events may cause widespread flooding. The first area is Frontenac Park, North Pond and Spring Street; the second area is near Foundry, Factory and Basin Streets; and the third area is in the area of Arnold and Evergreen Streets (Village of Union Springs Comprehensive Plan, 2007).
- In the Town of Springport, areas within a 100-year floodplain include areas along Yawger Creek, Great Gully Creek and other unnamed tributaries to Cayuga Lake (Town of Springport Vision Plan, 2011).
- In the Town of Fleming, flood hazard areas are generally found along Crane Brook, Van Ness Brook, and Yawger Creek (Town of Fleming Comprehensive Plan, 2001).

P. 5.4.1-1 DMA 2000 (2013) *Hazard Mitigation Plan – Cayuga County, New York.*

Seneca County flood mapping

From *Seneca County - Environmental Conservation Plan* (2014):

Floods are Seneca County's most common and most expensive natural disaster, and therefore sound floodplain management is critically important… Seneca County - Environmental Conservation Plan 11 FEMA designates and maps 100-year and 500-year floodplains. The National Flood Insurance Program is available to property owners in many floodplains. In Seneca County, several municipalities administer the insurance program. A potential benefit under the National Flood Insurance Program allows local policyholders in communities that participate in a Community Rating System to receive lower premiums. CRS communities agree to implement effective floodplain management measures to reduce flood and erosion damage. No municipalities in Seneca County participate in the CRS.

Beyond safeguarding property values, proper floodplain management provides other important benefits. Healthy and intact floodplains reduce and filter sediments into surface waters, store floodwaters during major storms, and providing habitat for fish and wildlife. In Seneca County, floodplains contain important elements of the natural resource base, including woodlots, wetlands, and wildlife habitat. They, therefore, constitute prime locations for parks, recreation, and open space. Seneca County is committed to making every effort

to discourage incompatible development of floodplains and to encourage compatible park, recreation, and open space uses.

Pp 10-11 (2014). Seneca County - Environmental Conservation Plan http://www.co.seneca.ny.us/wp-content/uploads/2014/01/SCEnvConsFnlPln2_17_14.pdf

Federal water protections

Effective protection of our water resources stems from a number of federal laws passed in the late 1960s, comprising the National Environmental Policy Act (1970). Several federal laws are used as the basis for state, county and local water protection, including the Clean Water Act and the Safe Drinking Water Act. EPA's Office of Water administers these laws and their many programs: https://www.epa.gov/aboutepa/about-office-water . Where these documents and links have been removed (2017), they remain available in archived form on the websites or from agency personnel.

An EPA guide to "Water topics" https://www.epa.gov/environmental-topics/water-topics includes information on: Drinking Water, Water Bodies, Wastewater and Water Treatment, Monitoring and Preventing Water Pollution, Water Research, What You Can Do. Links are provided to specific program areas.

The Clean Water Act was weakened following legal challenges in 2001 and 2006. In 2015, a final Clean Water Rule was issued by US EPA to clarify what is and is not covered by CWA protections, and to what extent. For more information:

- Summary of the CWA https://www.epa.gov/laws-regulations/summary-clean-water-act
- History of the CWA https://www.epa.gov/laws-regulations/history-clean-water-act
- Clean Water Rule (2015), what it is, what it covers, and no longer covers: https://www.epa.gov/cleanwaterrule
- Streams and Wetlands Matter: https://www.epa.gov/cleanwaterrule/clean-water-rule-streams-and-wetlands-matter

The Safe Drinking Water Act (SDWA) "is the federal law that protects public drinking water supplies throughout the nation. Under the SDWA, EPA sets standards for drinking water quality and with its partners implements various technical and financial programs to ensure drinking water safety": https://www.epa.gov/sdwa .

EPA's six priority areas for **drinking water protection** (12/16): https://www.epa.gov/newsreleases/epa-outlines-actions-improve-safety-reliability-nations-drinking-water

EPA, the US Army Corps of Engineers New York District, and NYS DEC work together to protect wetlands and review permits for alteration of **wetlands**. The US Fish and Wildlife Service maps wetlands, as does NYS DEC. Please see Section IV Chapter I. "Wetland and riparian corridor management" in this Plan for more

information about wetlands mapping and protection, including a new wetland map for Tompkins County.

- EPA wetlands definition and identification: https://www.epa.gov/cwa-404/section-404-clean-water-act-how-wetlands-are-defined-and-identified
- US Army Corps of Engineers New York District: http://www.nan.usace.army.mil/
- US Army Corps of Engineers regulatory program to protect US aquatic resources: http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/

4. **Regional roles and wider responsibilities**

Numerous additional agencies, organizations and initiatives support and amplify the work carried out by our government to protect our water resources in the Cayuga Lake watershed and on larger scales. Here are some, not all.

The NYS Department of State oversees, advises on, and provides funding for watershed planning and clean water projects of many types via watershed-focused Water Resources Management programs: https://www.dos.ny.gov/opd/programs/waterResourcesMgmt/index.html

The Cayuga Lake Watershed Intermunicipal Organization provides a shared municipal-level framework for watershed-wide management and protection of Cayuga Lake, creeks, waterfalls and wetlands: http://www.cayugawatershed.org/

The Cayuga Lake Watershed Network provides a membership and volunteer-based organization for area residents and visitors to help protect the lake, creeks and communities: http://www.cayugalake.org

The Finger Lakes Hub: A 2017 initiative from DEC to better coordinate watershed restoration initiatives in the Finger Lakes region, located at the DEC office in Syracuse. The immediate spur for this Hub are the ongoing water quality issues in Owasco Lake, and the need to manage the funding that lake's management entities have brought in to focus on phosphorus and other pollutants. Longer term, the Hub will focus its efforts region-wide with implications for assistance, advice and funding. DEC's November 2016 press release: http://www.syracuse.com/outdoors/index.ssf/2016/11/new_finger_lakes_water_hub_to_address_toxic_algae_blooms_pollution.html#incart_river_home

Great Lakes initiatives
The Cayuga Lake Watershed is part of the Great Lakes basin. Many initiatives have been developed to help protect the Great Lakes from pollution, with treaties and agreements which involve eight US States, Canada, and Tribal entities. Here is a link to one small window into this immense process http://www.dec.ny.gov/lands/25562.html . The Great Lakes Southeast Sub-Basin Work Group has been a route for Cayuga Lake and other Finger Lakes groups to get engaged with these massive programs. The Finger Lakes Hub will include a separate Finger Lakes Sub-Basin Work Group. We will have a larger voice and role in ensuring that our lake's water quality is protected as a water source for Lake Ontario.

The Canal Corps and lake levels management
The Cayuga Lake watershed is part of larger hydrologic systems. Water flowing north out of Mud Lock at the lake's north end eventually flows into Lake Ontario at Oswego. Cayuga, lowest in elevation of the Finger Lakes, collects water from upstream: the Cayuga Lake Basin includes Seneca and Keuka Lakes upstream and the rest of the Seneca and Oswego River Basins downstream.

From the Canal Corps website's Oswego River Basin pages

> The Oswego River Basin is located in Central New York. It encompasses the Erie Canal from Macedon to Rome and the Cayuga-Seneca and Oswego Canals, including Cayuga Lake, several neighboring Finger Lakes and other lakes. It drains a total area of 5,122 square miles into Lake Ontario. The area of the basin is larger than the states of Rhode Island and Delaware combined. Please View Map. The Canal Corporation's Syracuse Division Canal Office is responsible for maintaining water levels of the Canal System within the Oswego River Basin for navigational purposes.
>
> http://www.canals.ny.gov/waterlevels/oswego/

Annual lake level management information and data are available at the Corps' Oswego River Basin webpages http://www.canals.ny.gov/waterlevels/oswego/

U.S. Geological Survey See this excellent USGS report, "Mapping the water resources of the Oswego River Basin in Central New York (2000, revised 2002): https://ny.water.usgs.gov/pubs/fs/fs18099/fs180-99.pdf . The USGS's Ithaca-based New York Water Science Center, provides our region with an unparalleled richness of science-based hydrology and other geosciences research about our lakes, creeks, and aquifers, for improved planning and policy making https://ny.water.usgs.gov/about/officeithaca.html .

A proposed Oswego River Basin Commission could help unify the many waterbodies and responsible parties across the region for more effective water resources management. Legislation would need to be reintroduced (following failure in 2007) to develop a formal network to manage water levels collectively, in all the central and eastern Finger Lakes and contributing tributaries, especially those that drain to the Seneca and Oswego River Basins. Similar legislation does exist for the Great Lakes (albeit very contentious) in dealing with Great Lakes water- level management among other issues. The Mohawk River watershed's Mighty Waters initiative provides a model – see following entry.

Interaction between the Oswego Basin and the Great Lakes (Ontario) is limited to the discharge of the Oswego River to Lake Ontario at Oswego, NY. There are ongoing studies of major tributaries to Lake Ontario under the Great Lakes Restoration Initiative (GLRI), but impact of individual Finger Lakes or as a whole, is mitigated by the New York State Canal system regulation of flow by the canal system and the hydropower projects at many lock structures. Water-quality impacts are similarly mitigated by the canal system and the size of the basin (~5,100 mi sq).

The Mohawk River's Watershed Plan (2015) and "Mighty Waters" initiative A possible model for better coordination of multiple water resources management across the Oswego River Basin and in the individual Finger Lakes basins. Information here: http://mohawkriver.org/ , http://minerva.union.edu/garverj/mws/2017/symposium.html

While the Oswego River Basin is only in New York State, an adjacent waterway, the Mohawk River through its "Mighty Waters" Conferences has developed a Mighty Waters Task Force and Hudson-Mohawk Basin Commission. This might serve as a model for an Oswego River Basin Commission:

> ***Mighty Waters***
> *Conceived at Congressman Paul Tonko's first annual Mighty Waters Conference in July of 2010, the mission of the Mighty Waters Task Force is to help create a climate of investment, recovery and public awareness for the waterways and communities of the Mohawk River, Erie Canal and related waterways by mobilizing federal resources that encourage policy reform, economic development, public access and enjoyment and effective environmental and cultural resource management.*
>
> *Following information collected at three successive Mighty Waters Conferences held each June, meetings of the Mighty Waters Task Force, listening tours with key constituencies, dozens of meetings with federal and state agencies and maintaining a close connection with the region's higher education and non-profit community, Congressman Tonko introduced federal legislation (H.R. 5927), to create a Hudson-Mohawk Basin Commission, a federal-state commission that will enhance and preserve the economic, environmental, historic and cultural values of one of the most demographically and politically important regions in the nation.*

http://www.dec.ny.gov/docs/water_pdf/mohawkactagenda.pdf

The Finger Lakes Land Trust is a nonprofit organization tasked with private-public partnering to protect special places and natural resources across the Finger Lakes region: http://www.fllt.org/ Their 32 preserves are open for public access, and provide protective ecosystem functions for land, water, air, flora and fauna. In the Cayuga Lake watershed, the Finger Lakes Land Trust has 14 preserves and conservation areas: http://www.fllt.org/learntheland/preserves

In 2016, the FLLT released a report calling for a $100 million investment to better protect the Finger Lakes region's land and waters:

> *Lakes, Farms, & Forests Forever is* the title of the Land Trust's report, which is based on a year-long comprehensive assessment of the region's natural resources coupled with input from 40 non-profit organizations, county and regional planning departments, and government conservation agencies. The report highlights ten priority conservation strategies for the region, emphasizing the need to address both excessive nutrient runoff into the region's lakes and

sprawling rural development that threatens farmland, vistas, water quality, and recreational resources.
http://www.fllt.org/land-trust-report-calls-for-100-million-to-address-regional-threats/

Cayuga Nation and the Haudenosaunee Confederacy The area's first residents are eloquent supporters of Cayuga Lake, clean water, and water protection. See Appendix E. for their pioneering statement about not using water for fracking (2008), and other pro-water values statements. The traditional Unity Council of the Cayuga Nation can be contacted at the S.H.A.R.E. Farm in Union Springs.

- S.H.A.R. E. Farm https://blogs.cornell.edu/foodstories/2013/10/31/share-and-the-share-farm-strengthening-relationships-to-food-and-place/
- Haudenosaunee Confederacy http://www.haudenosauneeconfederacy.com/leagueofnations.html
- Cayuga Nation http://www.cayuganation-nsn.gov/
- Cayuga Lake Water Protectors is a water protection group led by the Cayuga Nation and supporters, formed in 2017. Facebook page https://www.facebook.com/CayugaLakeWaterProtectors/

Outdoor recreation resources

Who manages public lands for recreation - a guide to federal, state and local forests and parks in NY State http://www.dec.ny.gov/outdoor/347.html

Finger Lakes Parks, Recreation & Historic Preservation
https://parks.ny.gov/regions/finger-lakes/default.aspx

The Cayuga Lake Blueway Trail Plan (2013) provides an intermunicipal, inter-county framework to link and support travel and recreation around Cayuga Lake http://cayugablueway.weebly.com/

Trail clubs stimulate and empower residents and visitors to protect lands and waterways across municipal, county and watershed boundaries
Finger Lakes Trails http://www.fltconference.org/trail/
Cayuga Trails Club http://cayugatrailsclub.org/

5. Climate change

Climate change is arriving, impacting crops, waterways, wildlands and wildlife, and contributing to unexpected and unpredictable changes in water quality and quantity in a region that has always taken clean, plentiful, free water for granted. This Plan has been updated to integrate climate change implications into each section, and into the goals and vision statements for both this Plan and the Cayuga Lake Watershed Intermunicipal Organization.

Adapting to climate change and developing resilient management strategies to deal with it will be essential to protecting our lake and watershed into the future. For

informed policy-making and planning, some of many government and academic resources include

Northeast Regional Climate Center, Cornell University
http://www.nrcc.cornell.edu/

- Climate perspectives
  http://www.nrcc.cornell.edu/wxstation/perspectives/perspectives.html
- Climate Change links
  http://www.nrcc.cornell.edu/climate/resources/resources.html
- New York's Changing Climate http://climatechange.cornell.edu/wp-content/uploads/2013/03/ny_changing_climate.pdf

NYS DEC Office of Climate Change http://www.dec.ny.gov/about/43166.html

NYS DEC Mitigation of Climate Change http://www.dec.ny.gov/about/99223.html

Union of Concerned Scientists *Confronting the Realities of Climate Change*

http://www.ucsusa.org/global_warming#.WNq-E2_yvIU

US EPA Climate Change https://www.epa.gov/climatechange

US Forest Service *Climate Change Tree Atlas and Bird Atlas*

https://www.fs.usda.gov/ccrc/tools/tree-and-bird-atlas

World Wildlife Fund, *2016 Living Planet Report*

http://wwf.panda.org/about_our_earth/all_publications/lpr_2016/

6. Goals and recommendations

Goals
Municipalities and counties in the Cayuga Lake Watershed working with the IO should use federal and state programs and funding along with municipal land use controls to ensure that

- Land use and economic development plans, and plan implementation strategies such as zoning are based on sound assessment of natural and environmental resources constraints.

- Development is precluded from environmentally sensitive areas in the watershed, such as stream corridors, wetlands, steep slopes, and areas having highly erosive soils.

- Effective watershed management plans, and stormwater management and erosion control programs have been adopted to protect water resources in the watershed.

Recommendations for improvement of regulatory controls and management of the Cayuga Lake watershed's water resources

1. An IO/CLWN/partners water resources protection working group should be established to

- Review and comment on land use and economic development plans and proposals, to ensure that they are based on sound assessment of natural and environmental resources constraints and protective of our lake, creeks, streams, waterfalls, wetlands, shoreline and groundwater resources.

- Educate the public and municipal and county officials and agencies about the available land and water protection options at local, state and federal levels, how to benefit from them, and how to respond if these are threatened.

2. The IO and CLWN should encourage local and county governments to pass resolutions embracing US EPA's six 2016 Priority Areas for Drinking Water Protection, and develop strategies for implementation across our watershed.

3. A working group should review the Mohawk River's Watershed Plan and "Mighty Waters" Initiative

- As a model for better coordination of multiple water resources management across the Oswego River Basin and in the individual Finger Lakes basins.

- To work for its implementation with regional groups including the Finger Lakes Regional Watershed Alliance, the Great Lakes Restoration Initiative (GLRI) and proposed Finger Lakes Sub-Basin Work Group, the Finger Lakes Institute, the Finger Lakes Hub and others.

4. The IO, CLWN and partners should study, support, help obtain the funding, and implement the Finger Lakes Land Trust's 2016 *Lakes, Farms, & Forests Forever* proposal for land and water quality protection.

5. Climate change awareness, preparedness and resilience planning comprise a basic metric for development, review and implementation of all water resources tasks, initiatives and programs.

6. The CLWN will publish this chapter on its website and promote its use and value across the watershed.

Chapter J. *Action Category*: Monitoring and Assessment

1. Introduction

A well-designed monitoring program is essential for effective stewardship and management of Cayuga Lake and its watershed. Data from monitoring can help the IO and research partners to identify or confirm areas of concern within the watershed, assess concerns and impacts, and set priorities for implementing best management practices in cooperation with municipalities and landowners. Monitoring can be used to measure the effectiveness of specific actions and assess the need for further actions to protect our water resources.

Ultimately, long-term trend analysis of lake and tributary monitoring data will be the soundest evaluation of the effectiveness of the Restoration and Protection Plan; of the Total Maximum Daily Load (TMDL) program for phosphorus, to be implemented in May 2017 by NYS DEC; and of other protective measures carried out in subwatersheds and along tributaries.

A monitoring plan for a large, deep lake with an extensive network of tributaries must be carefully designed to reflect spatial and temporal heterogeneity. Also, water quality monitoring and public awareness work hand-in-hand. In addition to the monitoring conducted by academic researchers and public agencies, water quality monitoring programs run by trained volunteers add to the data available for assessment and action, focus community support on local creek and lake health, and instill life-long lessons on how actions on the landscape can affect water quality.

Thus, a well-designed monitoring program includes scientific study, agency-driven monitoring, and trained volunteer input, and effective communications and support among all parties. This broad-based approach makes it possible to tackle watershed-wide, long-term questions about lake health; to design effective actions; and to address specific public concerns such as “is water quality getting better or worse”, “why are there weeds at my cottage”, “can I eat the fish I catch”, or “is the water safe to drink”.

View the 2001 version of this chapter here
http://www.cayugawatershed.org/Cayuga%20Lake/RPP/caymonassess.htm

2. 2000-2017: An Iterative Process of Monitoring and Assessment

A. 2000: The Cayuga Lake Watershed Monitoring Framework and Characterization Study

In 2000, the IO’s Technical Committee drafted a Monitoring Framework (C.W. Callinan and W. Kappel), outlining an approach to an integrated monitoring plan for the Cayuga Lake Watershed. The *Monitoring Framework* was supplementary to the Preliminary Cayuga Lake Watershed Characterization Study (2000) and the present document, the *Cayuga Lake Watershed Restoration and Protection Plan* (2001, updated in 2017).

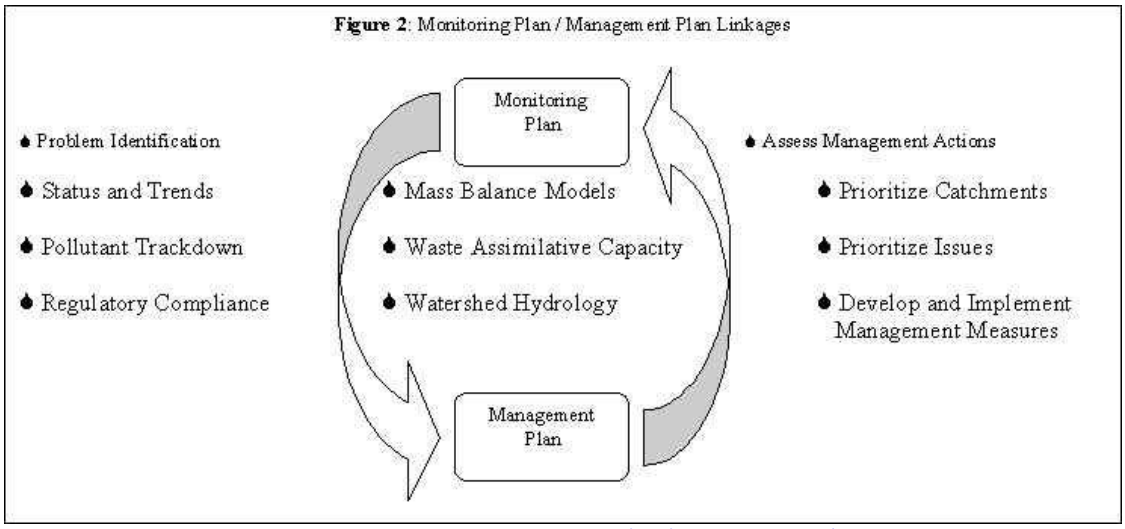
The Cayuga Lake Watershed Monitoring Framework

Purpose of the Monitoring Framework :

The purpose of the *Cayuga Lake Watershed Monitoring Plan* [aka Framework] is to initiate collection of the necessary information to support effective stewardship and management of the lake and surrounding watershed. Specific objectives of the Monitoring Plan should include the following:

1. Gather *baseline* water quality data (both current and historical where available) and define *ambient water quality conditions* for the lake and tributary system.
2. Define historical *trends* in water quality.
3. Determine *compliance* with applicable water quality criteria.
4. Assist in the *identification* of pollution sources.
5. Provide the necessary information to assess the *assimilative capacity* of given water segments.
6. Provide necessary data for the development of *mass loading* estimates and *computer simulation models*.
7. Enable effective *prioritization* of sub-watersheds.
8. Evaluate the effectiveness of water quality management activities.

Further, the Monitoring Plan envisioned an iterative process to foster regular updates (see Figure 2, Monitoring Plan/Management Plan Linkages), reflecting the dynamic nature of the natural watershed and its human uses.



Monitoring Framework , 2000

The Cayuga Lake Preliminary Watershed Characterization

The *Cayuga Lake Preliminary Watershed Characterization* ("*Characterization*") was also published in 2000, as the first phase of the *Cayuga Lake Watershed Restoration and Protection Plan* (2001).

From the *Characterization*:

> The Cayuga Lake Preliminary Watershed Characterization Report is a working document developed to meet two objectives:
>
> (1) Present the current state of scientific understanding of Cayuga Lake and its watershed with a focus on water quality of the lake and its tributaries. Physical, chemical, and biological conditions are discussed. Specific areas of potential concern and areas where more data are needed are highlighted
>
> (2) Describe the multitude of activities underway by government, the private sector, and individuals to protect and improve this unique resource. The overall goal is to provide a basis for understanding the state of the watershed.
>
> p.1, Executive Summary, http://www.cayugawatershed.org/characterization/PDF/Executive%20Summary.pdf

This rich document, both inventory and encyclopedia, provided data, maps and tables to encapsulate the natural and human context of the lake and watershed at the start of the new millennium. It is available online at the Cayuga Lake Watershed Intermunicipal Organization's website.

Table of Contents:
http://www.cayugawatershed.org/characterization/PDF/Tablecont.pdf .
Full report: http://www.cayugawatershed.org/characterization/

B. 2001-08: The Monitoring Plan for the Southern Basin of Cayuga Lake

As a result of the iterative process, in the context of numerous long-term studies and annual research meetings to share results, in 2008 the Water Resources Council-Cornell University Partnership (Water Monitoring Partners) issued the Monitoring Plan for the Southern Basin of Cayuga Lake:
http://www.cityofithaca.org/DocumentCenter/View/1304.

The south-end *Monitoring Plan* focused on: Regular monitoring; Special studies; Stream monitoring; and Outreach, with the following goals:

1. Reduce duplication in monitoring efforts.
2. Understand more about southern-lake and main-lake interactions.
3. Understand circulation patterns.
4. Capture forcing events and diurnal fluxes.
5. Better understand the lake's "impairment."
6. Begin baseline monitoring for toxics and emergent contaminants.
7. Increase understanding of mussel, shrimp, and fish populations.
8. Problem solve for algae and aquatic plant abundance.

C. 2009-2017: South end impairment, Cayuga Lake Modeling Project, and lakewide TMDL for phosphorus

Research and monitoring on Cayuga Lake and its tributaries has flourished since the early '00s. At the south end of the lake in Tompkins County, this work has been

coordinated by the Water Resources Council-Cornell University Partnership (Water Monitoring Partners). Along the Seneca and Cayuga county shorelines and tributaries, regular monitoring and assessment commenced in 2015 via a CSI volunteer monitoring group and the Finger Lakes Institute. See Section III A. "Water Quality Status" for a list of major projects and partners.

Via the Water Monitoring Partners, the Southern Basin Monitoring Plan was used to tackle the issue of the impairment of the southern end of Cayuga Lake. Based on Callinan's 2000 "Water quality study of the Finger Lakes," http://www.dec.ny.gov/lands/25576.html, Cayuga Lake was included on the 2002 and 2008 New York State section 303(d) list of impaired water bodies, for phosphorus and silt/sediment (in 2002) and also for pathogens (in 2008). Based on research conducted by CSI and others, the pathogens designation was removed in the 2014 303(d) list. The impaired designation meant that a total maximum daily load (TMDL), i.e., a regulatory limit specifying how much the lake can tolerate and still function acceptably, must be explored.

In cooperation with NYS DEC, Cornell University sponsored two major investigations as conditions for maintaining its SPDES permit to operate its Lake Source Cooling facility on the southeast shore of Cayuga Lake. The University conducted detailed monitoring of phosphorus, chlorophyll a and other parameters on the lake's shallow southern shelf from 1998-2012, creating a unique and valuable data set https://energyandsustainability.fs.cornell.edu/util/cooling/production/lsc/monitor.cfm.

From 2013-2017, the University sponsored the Cayuga Lake Modeling Project, an ambitious combination of lake hydrodynamic and phosphorus loading studies designed to provide the NYSDEC with data needed to develop a phosphorus Total Maximum Daily Load (TMDL) for the 303(d)-listed south end of Cayuga Lake, as required under the Clean Water Act https://energyandsustainability.fs.cornell.edu/util/clmp/default.cfm. http://www.dec.ny.gov/lands/88250.html .

A February 2017 news release from NYS DEC assembled information about the several studies carried out during this period, coming together to inform TMDL implementation:

> In December 2016, Cornell University submitted to NYSDEC the Cayuga Lake water quality model it had been developing to support the development of a Total Maximum Daily Load (TMDL) plan to address water quality impairment in the South End of Cayuga Lake. The submittal of the model was the last major commitment included in the SPDES discharge permit for the Cornell Lake Source Cooling (LSC) facility. Other completed commitments include a preliminary discharge outfall redesign study, an entrainment study of the LSC facility intake, and regular Best Management Practices (BMP)/Optimization Plan reports focused on the operation of the LSC facility (BMP/Optimization reports are continuing). NYSDEC is now evaluating the model for use in testing different water quality scenarios to be used in the TMDL plan.

Updates are to be provided on the Cayuga Lake Watershed page maintained by DEC http://www.dec.ny.gov/lands/88250.html ("DEC Delivers," February 17, 2017).

During 2016, DEC determined that the Whole Lake Phosphorus TMDL would cover the entire watershed. Public outreach regarding the proposed TMDL commenced in 2013 http://www.dec.ny.gov/lands/95403.html . A Public & Stakeholder TMDL Outreach Plan was issued by DEC in March 2017. The draft Whole-Lake Phosphorus TMDL will be released for public comment in May 2017.

D. 2017-2027: Increasing monitoring lakewide; Integrating the long view perspective; Adapting to change

In March 2017, the Community Science Institute and Cayuga Lake Watershed Network (CLWN) are developing a program to continue the monitoring of phosphorus in the lake begun by Cornell in 1998. The first year (2017) focuses on the southern shelf, expanding north in succeeding years as funding becomes available. Trained volunteers from the CLWN and Cayuga Lake Floating Classroom will carry out a seasonal sampling (based on DEC's CSLAP program) under the guidance of CSI and the Water Monitoring Partners. Additional monitoring of tributaries will be an emphasis via CSI-CLWN shared efforts to recruit, train and retain volunteer community monitoring groups. Additional CSLAP funding from DEC may supplement this work at the lake's north end.

According to DEC, the success of the Whole Lake Phosphorus TMDL will be measured via the RIBS program every five years (Rotating Intensive Basin Studies (RIBS) program (http://www.dec.ny.gov/chemical/30951.html). An understanding of Dave Bouldin's 40 years of lake and tributary research suggests that a robust and nuanced monitoring program is needed. An effort is underway to review over 40 years of data with respect to stream inputs, water quality parameters and predicting possible algal blooms. Early indications are that a multi-year running annual average is the appropriate time "unit" to use when assessing meaningful changes in water quality. This work may guide the selection of long term monitoring criteria as well as how quickly (or slowly) changes should be expected.

Climate change is here, with significant impacts already being seen to our water resources and weather. Monitoring and assessment need to be finely-tuned and responsive to capture short- and long-term shifts and changes in water quantity, quality, and availability for humans and the natural world.

3. Existing Monitoring and Assessment, and Gaps

For a 2017 list of agencies, organizations and academic scientists presently conducting research or monitoring in the Cayuga Lake watershed, see Section III A., "Overview of major surface water monitoring activities and data sources", and Section IV, Chapter C., Agricultural Practices and Prospects. These listings partially update the 2000 *Characterization*'s *Cayuga Lake Projects Directory* and provides links to additional information.

Information about Health Department water testing in Seneca, Cayuga and Tompkins counties is found in Section IV Chapter E., Wastewater Management, as is a

discussion of onsite wastewater challenges (and recommendations for action); and a list of wastewater treatment plants and updates since 2001. This information partially updates the data provided in Chapter 6 of the 2000 *Characterization*, and provides links to additional information. The scope of the 2017 update does not include a full update of these data.

In 2000, the *Cayuga Lake Preliminary Watershed Characterization* noted numerous gaps in data and understanding that needed to be pursued:

> Cayuga Lake has a rich history of research activities. Physical, chemical, and biological conditions of the lake and its tributary streams have been investigated for decades. The lake and its watershed remain the focus of several long-term monitoring initiatives. However, several important data gaps remain.
>
> (p.1, Executive Summary, http://www.cayugawatershed.org/characterization/PDF/Executive%20Summary.pdf)

Chapter 6 of the *Characterization*, Watershed and Subwatershed Technical Findings, listed important data gaps at that time. In 2017, have these gaps been filled in with research and understanding, toward better monitoring and assessment of the lake and watershed? A brief summary points the reader to germane sections of the 2017 updated Plan for an update on each "gap topic" listed in Chapter 6 of the 2000 *Characterization*.

Fertilizers and pesticides: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Sediment: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Organic chemicals: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Heavy metals: Section IV, Chapter F. "Hazardous Waste Management."

Stormwater: Section IV, Chapter D. "Stormwater management and erosion control."

Phosphorus: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Annual monitoring of a limited suite of limnological parameters*:* Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Biological parameters - *macroinvertebrate community monitoring in tributary streams:* Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Tributary water quality monitoring: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Mathematical model as a tool for linking the inputs from the tributaries to the lake's water quality response: This chapter and Plan Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Exotic organisms/Invasive species: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status; and Section IV, Chapters E. "Wastewater Systems" and I. "Regulatory Management."

Pathogens and indicators: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status; and Section IV, Chapter E. "Wastewater Systems."

On-site wastewater treatment: Section IV, Chapter E. "Wastewater Management."

Impacts of non-permitted, pre-permitted or unenforced uses: Section IV, Chapters E. "Wastewater Management"; and F. "Hazardous Waste Management."

Floodplain and wetlands delineation, management and mitigation: Section IV, Chapter H. "Wetland and Riparian Corridor Management."

Impacts of Cornell Lake Source Cooling: This chapter and Section III, "Water Quality Status and Water Quality Issues."

Groundwater: Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status.

Emerging Contaminants (new for the 2017 Plan): Section III, "Water Quality Status and Water Quality Issues," A. Water Quality Status; and Section IV, Chapter E. "Wastewater Management."

Climate Change, including Water Shortage (new for the 2017 Plan): Section III, "Water Quality Status and Water Quality Issues," B. Water Quality Issues; Section IV, Chapter I. "Regulatory Management." A climate change perspective has been integrated into every chapter.

4. Goals and Recommendations for actions to improve monitoring and assessment

Goals

Several Goals from the 2001 *Restoration and Protection Plan* stand the test of time. The iterative approach ensures that monitoring and assessment strategies and methods are renewed and updated over time. For example, some data gaps have been filled but new ones will appear as new threats emerge and as we learn more about impacts from existing pollutants, and so on.

- Improve the scientific basis for managing Cayuga Lake and watershed
    - Continue to update and address data gaps identified in the *Preliminary Watershed Characterization.*
    - Update, confirm pollution sources and priority areas, and develop actions.
    - Document and implement the effectiveness of Best Management Practices for ditches, tiling and roadside runoff.
    - Provide data that can be used to develop or verify models.

- Provide information to lake managers and the watershed community regarding
    - Trends in quality of surface water and groundwater in the Cayuga Lake basin.
    - Suitability of water quality for designated human uses (such as drinking and swimming).
    - Status of the lake's food web, habitat health and biodiversity.

- Coordinate monitoring activities to maximize resources and eliminate redundancies.

Recommendations for actions to improve monitoring and assessment

Completed recommendation from the 2001 list

- The USGS gauging station on Salmon Creek was re-established in 2013. Period of record: July 2006-September 2009; February 2013-present.

2017 Recommended actions

1. Many different researchers, agencies and groups are doing parts of the monitoring and assessment process. This ongoing work and its varied funding need to be networked and coordinated, along with the continual flow of updates for the Plan.
    - Update repository: The City of Ithaca's Roxanne Johnston is the repository for Plan updates: RJohnston@cityofithaca.org
    - Resume annual meetings with sharing of research, watershed-wide. A simple State of the Lake report should be a product for the public.
    - Resume building a central database for results, reports, plans.
2. Increase monitoring of tributaries lakewide to refine estimates of pollutant loading for lake modeling and the Whole Lake Phosphorus TMDL, and to prioritize subwatersheds for protective actions. Roles for IO, CSI, CLWN, FLI, others.
    - Encourage municipalities to support regular monitoring.
    - Continue and expand macroinvertebrate monitoring in tributaries**.**
    - Coordinate data collection, analysis and assessment with other groups.

3. A workstudy group needs to focus on developing an understanding of the lake's seasonal and chemical fluctuations, informed by the work of Bouldin, UFI, others. Products:
    - Presentation to researchers, DEC and public.
    - Create and adopt a framework for monitoring, assessment and protection of lake health.

4. As climate change advances, monitoring and assessment need to be finely-tuned and responsive to capture short- and long-term shifts and changes in water quantity, quality, and availability for humans and the natural world.

Appendices

Appendix A. Cayuga Lake Watershed Public Participation Plan 2015

Finalized September 22, 2015

Purpose of the Public Participation Plan
This public participation plan (PPP) identifies ways to engage members of the public in updating the Cayuga Lake Watershed Restoration and Protection Plan (RPP). The PPP provides guidelines for involving people across the watershed's 45 municipalities, and is not a checklist of required actions. Changes to the PPP may prove necessary; it is a flexible document.

Main Elements of the PPP

I. **Watershed Advisory Committee Meetings and Communications**
II. **Public Outreach and Meetings**
III. **Public Agencies/Local Municipal Governments and Meetings**
IV. **Stakeholder Groups and Meetings**
V. **Consultations, Discussions and Reporting**

Key Contact:
Hilary Lambert, Steward/Executive Director
Cayuga Lake Watershed Network
Stratton Hall 212 POB 348 Aurora NY 13026
steward@cayugalake.org (607) 229-9870

I. Watershed Advisory Committee (WAC) Meetings and Communications

Purpose of WAC:

- Develop a plan to involve the public (Public Participation Plan) in updating the Cayuga Lake Restoration and Protection Plan (RPP).
- Update the long-term Vision and Goals Statement for the Watershed Plan.
- Depending on expertise, interest, and time availability, WAC members can help with public meetings and document editing.

Membership of WAC: Identified by the participating communities, consultant, Intermunicipal Organization, and the NYSDOS. Subject to change.

Public Participation: WAC meetings are open to the public.

Notification to WAC members: E-mail/Phone call from Hilary Lambert, coordinator of the Watershed Plan update process.

Schedule for WAC: Two meetings during 2015, with email, skype and conference calls as needed to monitor progress and review interim and final documents. Work on the Vision and Goals Statement commences once the PPP is completed.

II. Public Outreach and Meetings

Participants: All members of the public, including individuals, neighborhood associations, other community groups as appropriate.

Purpose of these events: To build public awareness that a watershed plan exists and is being updated, to make sure that everyone who wants to be is included in the process, and to provide the public with multiple opportunities to express their concerns about the lake, its creeks, communities, and future prospects. Their concerns and recommendations will be built into the updated plan.

At the public community meetings, the consultant will gain input for updating the original 2001 RPP. This input will be shared with the WAC for reaction and comment, and relevant material will be made part of the updated RPP. Two public participation/outreach meetings will be facilitated by the consultant (Hilary Lambert, Steward, Cayuga Lake Watershed Network).

Schedule: Two public participation/outreach meetings facilitated by the consultant on July 30th 2015 in Seneca Falls, and August 13th in Trumansburg. One or more followup public meeting(s) will be held in late fall to report findings. An online and print questionnaire is being made available to obtain input from members of the public who cannot attend in-person meetings or who want to provide more information.

Contact list and notification:

- Announcements on community, organization and agency Web sites.
- Press releases to local print media including Cayuga Lake media, Facebook, CLWN and other listservs, etc. Press release media list coordinated by the Town of Ithaca, approved by NYS DOS.
- E-mail sharing, word of mouth, sharing with additional listservs and groups via members of the WAC.
- Announced at and coordinated with presentations to Seneca Co, Cayuga Co and Tompkins Co water quality agencies.
- Content developed by consultant with input from the Intermunicipal Organization, WAC-members. Distribution of notices handled by the Town of Ithaca, approved by NYS DOS.

III. Public Agencies/Local Municipal Governments and Meetings

Participants: Public agencies, municipal officials in the watershed's 45 municipalities, and closely related interest groups.

Purpose: To ensure that these groups are aware that a watershed plan exists and is being updated, to make sure they are included in the update process, and to provide them with multiple opportunities for comment and recommendations to be included in the updated RPP.

To inform them about the role of the Cayuga Lake Watershed Intermunicipal Organization (IO). Their concerns and recommendations will be built into the updated plan, and fundable project ideas will be part of the Implementation Schedule submitted to the NYS Department of State.

Project coordinator Lambert, IO chair Hunter and others will work with watershed municipalities on the Watershed Management Recommendations, and Implementation Strategy and Schedule portions of the updated plan. This will result in a prioritized list of next-step projects, including, where possible, cost estimates and potential funding sources.

Schedule: Members of this list are invited to all public meetings. Additionally, an August 26, 2015 meeting was provided in the Village of Aurora for the watershed's municipal officials, other elected officials, and local, regional and state agency representatives.

An online/print questionnaire will be sent/shared with to watershed municipal officials this fall to obtain input from municipal officials who cannot attend in-person meetings or who want to provide more information.

Contact list and notification:

- Members of this group have been identified by the WAC, the IO, participating municipalities, NYSDOS and appropriate others.

To be contacted via:

- Media outreach lists maintained by the Cayuga Lake Watershed Network and the Town of Ithaca;
- Email list of the watershed's municipal leaders (supervisors and clerks) maintained by the Intermunicipal Organization of the Cayuga Lake Watershed;
- Listservs maintained by the Cayuga Lake Watershed Network, and by the Cayuga County Department of Planning.

IV. Stakeholder Groups and Meetings

Purpose for inclusion: Numerous special interest or stakeholder groups have a significant role in water use and protection in the Cayuga Lake watershed. They are encouraged to speak out about the updated Watershed Plan, and will be invited to attend smaller, focused-group meetings to ensure that we hear and include their concerns and recommendations.

Participants: It was agreed by the WAC at their June 2015 meeting that, while numerous stakeholder groups are vital to the watershed's future, under the constraints of this project only a few can be approached at this time. Others will be listed as priority groups for inclusion going forward under the updated plan.

Stakeholder groups for inclusion at this time:

- **Local Officials/Public Agencies –** This group's Stakeholder Group plan is underway, above, led by Tee-Ann Hunter.

- **Farming Community** - This work will provide input from a wide array of farms and farmers on what changes they have seen since 2001 and what they want to see in future, and what projects they might suggest for water quality improvements.

We also have up-to-date online resources that can be researched: Ag and Farmland Protection plans for all three counties, plus Ag plans from several municipalities (Ulysses, other); the three counties' Comprehensive Plans, plus numerous municipal Comprehensive Plans, all with agriculture elements for inclusion in the plan update and recommendations.

- **Lake-dependent businesses –** We have up-to-date online resources, including the Comprehensive Plans, tourism planning, the Blueways Trail and other tourism initiatives, and regional economic surveys and reports.

Other stakeholders

Following is the full list of additional possible stakeholder groups generated at the 6/15 WAC meeting. We cannot tackle all these at this time. This could be a possibility for the CLWN to manage, to do the outreach to develop and bring in these groups once the updated plan is in place.

b. Proposed WAC stakeholders which fall into the three established stakeholder groups and or are represented by Tech Advisory Committee experts: Boards of realtors and chambers of commerce, business associations; Farmers and AEM programs from SWCD offices; recreationists (the public), fishing (the public); municipal governments, county councils, boards of supervisors; wine and other 'trails', agrotourism, planners; lakeshore dwellers (the public – and Mel R knows how to reach them!), invasive species experts, ornithologists, land conservancy groups, wastewater treatment managers and companies.

c. Proposed WAC stakeholder groups that we cannot focus on at this time but must list in the updated plan, and work to reach in the near future:

- Youth – schools, Great Lakes literacy curriculum; Ausable NY as example; Finger Lakes Institute can provide examples; Floating Classroom. Questions for this group are included in the public questionnaire.
- Highway departments/Cornell Local Roads program.
- Amish and Mennonites.
- The Haudenosaunee.

Schedule for the Stakeholder Groups: Stakeholder meetings are being held into the fall of 2015 with these three groups, to obtain specialized input and feedback regarding particular elements of the watershed plan. This input will inform the updated watershed management plan. Each stakeholder group meets once, with online surveys provided for the public and local officials. There will be interactive followup via email, online posting of results, etc., once preliminary comments and recommendations have been written up for the groups.

Contact list and notification:

- Invitations and meeting detail notification will be provided by telephone, email, and/or postal mail prior to stakeholder group meetings.
- Each group will receive notice at least two weeks prior to the scheduled meeting.

- A summary of group discussions will be made available on the Cayuga Lake Watershed Network's website and the pending updated Intermunicipal Organization website.

V. CONSULTATIONS, DISCUSSIONS AND REPORTING

Purpose: Regular ongoing formal and informal communication is needed between the WAC, local partners, funder, and consultant for monitoring and smooth flow of all planning tasks related to the PPP and other steps made toward updating the watershed plan. The WAC and other parties will be kept informed as the task of the Technical Advisory Committee develops.
Participants: WAC, consultant CLWN, NYS DOS, Town of Ithaca, Intermunicipal Organization of the Cayuga Lake Watershed.
Notification: E-mail and phone calls among participants
Schedule: As needed; will reflect project milestones, deliverables and in-kind match.
List of WAC participants: See Acknowledgements.

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Appendix B. Questions included in the online survey September 2015-August 2016

Cayuga Lake Watershed RPP Update

Questions for online and downloadable survey aimed at the PUBLIC and the YOUTH stakeholders group
9 23 15

Part I. Please tell us about how you connect with the Cayuga Lake Watershed.

1. Which watershed town, village, or city do you live in or visit? (Click here to view a map of the watershed and its municipalities.) _____

2. What is the source of your drinking water?

   ___Municipally drawn from Cayuga Lake, creek, stream or stream-fed reservoir
   ___Privately drawn from Cayuga Lake or tributary (creek or stream that drains to the lake)
   ___Municipal well
   ___Private well
   ___Don't know/Other

3. How strongly do you perceive Cayuga Lake, its creeks and streams, to be positive assets to the region? (1 is "very strongly" and 5 is "not at all strongly.") 1 2 3 4 5

4. If you are a working individual, how dependent is your business or employer's business on the watershed's lake, creeks and streams? (1 is "Not at all dependent" and 5 is "Very dependent.") 1 2 3 4 5

5. How important is the health of the watershed to the health of your or your employer's business? (1 is "Not at all important" and 5 is "Very important.") 1 2 3 4 5

6. What are the ways that you enjoy Cayuga Lake, its creeks and streams? Please select all that apply.

   __ Canoeing/Kayaking/Paddling
   __ Boating/Sailing
   __ Fishing and ice fishing
   __ Skating, Hockey
   __ Swimming
   __ Wildlife Viewing
   __ Hiking
   __ Picnicking
   __ Aesthetic Enjoyment
   __ Other

7. How important is the good health of the watershed to the activities you enjoy?
   Very Somewhat Not at all Don't know

8. Is there enough public access to the lake and its tributaries (creeks and streams) for the activities you enjoy? Yes No Explain

II. Please tell us how familiar you are with issues facing the watershed.

9. How would you describe the water quality within the Cayuga Lake watershed?
   Excellent Good Fair Poor

10. Which do you feel are the most significant issues facing the watershed? (List)

11. In your opinion, which are the pollutants that most affect Cayuga Lake? Please select up to four.
    ___ Sediment, including soil, sand and gravel.
    ___ Fertilizers, including phosphorus and nitrogen.
    ___ Pesticides, used in farms, homes and gardens, and on roadsides.
    ___ Organic compounds, such as petroleum products; from pavement runoff, other sources.
    ___ Heavy metals, such as zinc and copper; metals from road runoff, coal storage and combustion waste, other sources.
    ___ Salts, such as the de-icer and brine used on roads in the winter; and from other sources.
    ___ Pathogens – disease-carrying microorganisms, such as coliform bacteria, fungi and viruses.
    ___ Invasive species - pests, weeds, exotic species, such as hydrilla, zebra mussels.
    ___ Pharmaceuticals and personal care products, such as drugs, caffeine, microbeads.
    ___ Other:

12. Please choose the top five actions that could most effectively protect or restore the watershed.
    ___ Improving stormwater management and erosion control.
    ___ Improving communications, collaboration and partnerships across municipal and agency boundaries.
    ___ Fostering stewardship through education and citizen engagement.
    ___ Improving farming practices to reduce runoff and erosion.
    ___ Improving public wastewater systems management.
    ___ Improving private wastewater systems (septic systems).
    ___ Providing lawn care education to reduce erosion and lawn chemicals runoff.
    ___ Improving protection of wetlands and riparian corridors/buffers (land along the lake, creeks and streams).
    ___ Improving forestry management.
    ___ Improving control of invasive species.
    ___ Other:

III. Please tell us a bit about yourself.

13. I am (check all that apply):
___ A watershed resident
___ A watershed business owner
___ Employed within the watershed
___ A frequent visitor to the area
___ A student within the watershed
___ Active with an advocacy group within the watershed
___ Other: _____

14. How willing are you to have municipal funding used for watershed protection and improvement? Very Somewhat Not at all Depends on the project

15. How willing are you to dedicate a portion of your time to foster watershed protection (attend meetings, support policies, other) Very Somewhat Not at all Depends on the project

16. Do you have any additional comments?

17. Would you like to receive project updates or more information? (optional).

Please let us know how to reach you:
Name_____
Phone, Email _____
Mailing address _____
_____

IV. Special questions for YOUTH, major stakeholders in the future of the Cayuga Lake watershed!
If you have a young person (up to age 18) in your life or household, please ask them to answer these questions.

1. What types of activities do you enjoy on Cayuga Lake or on the land and creeks surrounding the lake? (Check all that apply)

__ Canoeing/Kayaking/Paddling
__ Boating/Sailing
__ Fishing
__ Ice Fishing
__ Skating, Skiing, Snowshoeing
__ Swimming
__ Wildlife Viewing
__ Hiking
__ Picnicking
__ Other:

2. How often do you spend time on the lake, along our creeks, or doing other outdoor activities?

__ Daily
__ At least once a week

__ At least once a month
__ At least once a year
__ Never

3. Do you think the water in Cayuga Lake is healthy?

Yes
No
Please explain

4. Please share your ideas on how to protect Cayuga Lake and its creeks and streams.

5. What is your age group?
   __ 0 – 5
   __ 5 – 11
   __ 12 – 15
   __ 15 - 18

THANK YOU for providing your informed opinion for the update to the Cayuga Lake Watershed Restoration & Protection Plan. We will share results and recommendations with the public and survey participants later this year, and will use your input to help chart a sustainable healthy course for our beautiful lake and watershed into the future.

Submit answers

Appendix C. Full list of all comments provided by participants in public meetings July 30 and August 13, 2015

Recorded by Sharon Anderson, Tee-Ann Hunter, Deb Grantham, Hilary Lambert.
Compiled by Hilary Lambert

Questions asked of the groups as a whole, and in small-group discussion.

- **What do you value about Cayuga Lake and its creeks?**

"I can't believe I live here." Relatively unusual natural feature. Relatively pristine. Recreation (4). As a drinking water source, both surface water and groundwater(3). Love to boat, swim and look at the lake. Residents strongly desire to protect our lakes. Economic driver. High quality of life. Just go to the dock and jump in. Commerce. Natural beauty (5). Soul-soothing. Wildlife. People are ready to protect what we have. Lakes and creeks bring people together. A healthy lake and creeks makes for healthy natural habitats. Looks clean. Supports wildlife. Limited development. Parks anyone can go to. The tourism, fishing etc support the economy and the result is not overcrowded. Recreational and contemplative values including boating, fishing, swimming, birdwatching, active and passive forms of enjoyment. Economic value, tax base. You can see the rocks on the bottom.

- **What are your concerns?**

"It's not my lake any more." Water seems dirtier – climate, weather events? Filthy water. Can't see the bottom any more, don't want to get in. In mourning for the lake it used to be. Are farmers the problem – do we need more or better farm regulations to protect creeks and lakeshore? Seem to have water quality issues from March on, caused by nearshore nutrients cycling from zebra and quagga mussels. Erosion. Lack of effective regulations. Need a community voice in caring for the lake. Fears for the future of the lake, due to climate change disruption. Fearful that there is nothing we can do. Tremendous amount of erosion coming into the creeks – does not look like there are any regulations to control it. Taxes. Water pollution. Over-regulation – needs a balance so you don't feel like you are in a police state. Inability of smaller municipalities to tackle the bigger, more costly issues like roadside ditches. Need to take care of creeks (use stencils?). Avoid duplication of efforts and promote coordination. Keep track of pollution sources and notify the public. Need a process to figure out the farm pollution issue. The character of growth has changed. Fracking, drilling and gas storage. Need to direct development to be consistent with what we want the area to be like. Gas storage can be done safely, needs to be in rural areas away from the lake. Seneca Meadows landfill means trucks coming through Ithaca. The Milliken coal fired power plant on the shore in Lansing intrudes on beauty. The Milliken coal fired power plant does not intrude on beauty. Need more public parks. The Village of Trumansburg wastewater treatment plant needs to be replaced [is being replaced, 2016]. The Van Dorn Road/Ulysses water project. Hydrilla. Flooding (3) that results in erosion, property damage and infrastructure damage. Changes to the lake bottom, from 70 years of annual observations: the bottom was rocky, not muddy. Now it is sandy and muddy with thick algae. Have to take a shower after coming out of the water – Willow Creek area and south – have to change filters weekly. Nutrient levels and siltation/erosion. Invasive species (3) especially round goby, hydrilla, water

chestnut. Blue green algae (2). Negative ecosystem impacts that affect recreation and property values. Frequent algal blooms. Pollution from onsite waste water treatment. Impacts of climate change. Roadside ditches adding to erosion. Holes in data. Public officials and disengaged and inattentive. Manure spreading with giant machines. Malfunctioning municipal sewage treatment systems that affect creeks and lake.

- **What is your positive vision for the lake and creeks over the next 10 to 20 years?**

Clean and healthy water that supports a variety of uses. Greater public knowledge and understanding of the science of the lake. Better lake level control at Mud Lock for flooding. Swimmable. Maintaining what we've got, while accepting that we can't stop people from coming, or go back in time. Balancing agriculture and environmental protection. Better communication watershed-wide. Coordinate land use perspective with water, creeks and lake of paramount importance. Need balance between public and private to develop watershed-wide stewardship. Things need to be controlled in such a way to support tourism without destroying what we have: need to focus on public use, not private development. Work on invasive species, deal with hydrilla in Cayuga Inlet, look at the contributing factors for effective control. Need more services on the lake, but should have sustainable development in mind, in accordance with a plan. More focus on lake and boating safety, working with the Coast Guard Auxiliary to promote safe boating and environmental education. In 20 years I want the lake to be as beautiful as it could be, with better energy use, less fossil fuel dependency. Optimal bird populations. Add more vegetation for less runoff. A farm-to-table local food and beverage focus, for ourselves and to add to the local economy. Safe, clean water. More public access (2). Need a "water czar" with authority to protect watersheds (Seneca and Cayuga). Preservation of natural qualities. Healthy ecosystems. Regional stable economy to support lake stewardship. Increased public knowledge and appreciation. Increased sense of stewardship among residents and visitors. Better capacity to deal with waste water and stormwater. No scum, so that children can swim. Clean, swimmable water – do something about sediment loading. More dairy farms – balance farming with environmental concerns. A healthy fishery, healthy water for swimming and other activities.

- **What would you most like to see?**

Termination of excessive development, where large lots are subdivided to support many lakeside homes. Development is environmentally regulated and sound. "Quality" development is encouraged. Better lake access(2+). Mix big mansions with better access. Regulations to prevent erosion. Cayuga power plant gone. Healthy fisheries. Good water quality. Everyone cares! Share best management practices across the watershed. No noisy boats! Change lawns to wildlife habitats, food gardens and orchards. No use of chemicals and fertilizers. Change asphalt driveways to crushed stone. Allow only a minimum number of livestock on farms. Conservation of trees and land for habitat protection. Save trees from infestations and development. Continue to monitor water quality and environmental factors. Need more volunteers! Weed cutters (harvesters) not needed. Everyone thinks about the lake, people cooperating – thinking about the lake personally, like we do our own bodies. Smaller sediment plumes coming out of the creeks, as a result of good farming, highway and ditch practices. Free of conditions leading to blue green algae blooms. Understand the lake's connection to climate [change]. Diversify users of the lake and ensure that all have personal experience of the lake. It is good to develop a shared discussion between

Seneca and Cayuga lakes, with the SHARE group involved. Restrictions/regulations to control erosion and changes in drainage. Encourage vineyards over row crops. Cleaner, clearer water. Improved conditions for fish reproduction. Better to have groundcover than open soils. In twenty years, go along the lake and you will see: clearer water, fewer weeds, noise control on boats, sewers around the lake, less abrasive agriculture, no CAFOs, the Lansing coal-fired power plant is gone, there are better agricultural buffers along creeks and the lakeshore.

- **What specific projects would support your vision?**

Public sewers. Hedgerows. More data. Enforcement. Highway BMPs. Riparian buffers. Knowledge about and study of emerging contaminants such as mercury, microbeads. Watershed inspectors (2). Education about invasive species. Consistent land use regulations. Sharing of data and information. $ for Soil and Water Conservation Districts. Greater access. Education about the lake in classrooms and via the Floating Classroom. “If the Milliken power plant is shut down, will the trains stop running so that area of shoreline is opened for development? It could be a world class rails to trails opportunity, from the power plant site to the municipal park in Lansing: be ready to pounce, if the plant shuts down!” The new Trumansburg waste water treatment plant is a step forward for improved creek and lake water quality. Improve communications and cooperation among municipalities. Foster stewardship through education and public engagement. Improve farming practices. Better protection of wetlands and along waterways. Better control of and education about invasive species. Increase funding for buffers and best management practices (BMPs). Use BMPs for road maintenance, ditches, salting. Grow hedgerows (again). Consistent onsite waste water inspections. Consistent land use regulations, consistently enforced. Riparian buffers to control streambank erosion. Learn more about emerging contaminants. Need a system for sharing data and information watershed-wide. Need funding for innovative waste water treatment facilities. Better lakeside construction practices. Do something about pipes that carry water and silt directly to the lake from farms and lawns. A good economic driver is the Bass Master and other fishing tournaments – good for the villages. Sharing best management practices across the watershed, for example a ditch demonstration project for Tompkins County. An online repository of concerns, such as sediment plumes. Collect more data, for the lake and streams (creeks) – track changes. More data, more scientists. Public sewer for more communities. State grants. Septic systems checked. Encourage compostable toilets where the water table is really high. Steep slope ordinances. Highway BMPs. Hedgerows in farm fields. Coordinated riparian buffers including farm fields growing crops that hold soil. Enforcement of regulations and protective practices. Increase staffing at NYS DEC. Continued investment in school programs with a badge program for school youth to be lake stewards in a lakewide program. Unified system for supporting and upgrading septic systems/sewers, like the rigorous inspection program on Glimmerglass Lake – replace old systems via low interest loans attached to the deed. Access: need two more beaches. Anticipate privatization, encourage diversity of house size and income levels, vs. Ecological protection for the lake comes from fewer wealthy homes on large lots. Need a lake curriculum for all the schools, involving educational institutions around the lake.

Appendix D. Article by Tee-Ann Hunter about the Plan Update and Online Survey Fall 2015

Published in the late 2015 issue of *Network News*, Cayuga Lake Watershed Network

Public input is needed
Please give fifteen minutes to help update
the Cayuga Lake Watershed Restoration & Protection Plan
Special questions for stakeholders in the future of our lake: Youth!

Tee-Ann Hunter

As a member of the Cayuga Lake Watershed Intermunicipal Organization (IO), the Town of Ithaca has accepted funding from the New York State Department of State (NYS DOS) to oversee an update of the Cayuga Lake Watershed Restoration and Protection Plan (RPP). During 2015 and into 2016, the Intermunicipal Organization is partnering with the Cayuga Lake Watershed Network (Network) and numerous others to conduct this update.

The original plan was completed in 2001, the result of a watershed-wide process that drew together town and village officials, local and regional agencies, experts and local residents via meetings and presentations. The group developed a long-range visionary plan, harnessing the energy of the watershed's 45 municipalities to evaluate the condition of Cayuga Lake and its tributaries, and formulate restoration and protection strategies.

As a result of the original plan (available at www.cayugawatershed.org), IO member municipalities have been awarded six rounds of funding from NYS DOS totaling nearly $300,000 for projects devoted to streambank stabilization, habitat restoration, and flood control. In addition, the IO supports public engagement and youth education through the Floating Classroom, which provides scholarships, lake access, STEM enrichment cruises and "Trout in the Classroom" programs for over 2,500 students annually.

Hilary Lambert, the Network's steward, is coordinating the 16-month update process with information about the process and opportunities for public input available on the Network's website (www.cayugalake.org). An important part of the process is hearing from the public. A current opportunity for the public to provide input is a questionnaire seeking comments, observations, and recommendations from watershed residents, available online here: http://www.cayugalake.org/watershed-plan-update-process.html

Please alert younger people – aged 0-18 – to the set of questions designed for their response. Youth is an important stakeholder group in the watershed: they inherit tomorrow what we do today, and may have some interesting opinions and ideas about how to take care of the Cayuga Lake watershed.

It is important for people within the watershed to let their municipalities and New York State know how they value the watershed and how they view its condition. I hope you will take the opportunity to fill out the online questionnaire. Our beautiful and invaluable water resources will need our continual attention and care in the coming years and an updated Restoration and Protection Plan plays an

important part in those efforts. This plan is funded by the NYS Department of State through the Title 11 Environmental Protection Fund.

To be added to the RPP Process Update email list, or to have a copy of the questionnaire mailed to you, please send an email request to Hilary Lambert steward@cayugalake.org or leave a message at the Network's office number (607) 319 0475.

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Appendix E. Cayuga Nation and Haundenosaunee Confederacy Water Documents

Haudenosaunee Statement on Hydrofracking

Haudenosaunee Environmental Task Force
Mohawk – Oneida – Onondaga – Cayuga – Seneca – Tuscarora

The Haudenosaunee have a unique spiritual, cultural, and historic relationship with the land, which is embodied in Gayananshogowa, the Great Law of Peace. This relationship goes far beyond federal and state legal concepts of ownership, possession, or other legal rights. The Haudenosaunee are one with the land and all that depends on the land, and consider ourselves part of it. It is the duty of the Nations' leaders to work for a healing of the land, to protect it, and to pass it on to future generations.

The Haudenosaunee know that every part of the natural world is important and interrelated; when humans tinker more and more with the natural balance, we do so at the peril of our grandchildren. In few cases is this more apparent than the proposed method of natural gas drilling known as hydraulic fracturing or "hydrofracking". Representatives of the Onondaga Nation and the Haudenosaunee Environmental Task Force have visited communities impacted by hydrofracking in Pennsylvania. We have seen first-hand the impacts of hydrofracking; the vast industrialization of the landscape, the pollution of the air from hundreds of trucks, propane stripping stations, gas flares, and compression stations; the fragmentation of habitat and landscape by the incursions of roads and drill pads; the ruining of streams and drinking wells from drilling-related contamination; and most heartbreakingly, the permanent disruption of peoples homes, lives and communities. Even when things are done "right", the impacts are devastating.

The Onondaga Nation knows first-hand the impacts of messing with the deep bedrock of Mother Earth. Over 100 years ago, a company began solution mining in the Tully Valley upstream of the Nation, pumping water down wells to dissolve the brine deposits found deep below. The necessary time has passed to feel the impacts; our once clear Onondaga Creek is now contaminated with sediments from the mudboils; the Tully Valley has subsided 15 feet; and sinkholes and hundreds of deep fissures have opened up where the wells once were.

Hydrofracking similarly desecrates Mother Earth; earthquakes are being felt where no earthquakes were felt before, 8 years after intensive drilling began in the Barnett Shale underneath Clebum, Texas. Our grandchildren will be the ones to feel the worst impacts.

The New York State Department of Environmental Conservation (DEC) promised that it could do a better job of protecting our environment from the effects of hydrofracking than other states by issuing a draft Supplemental Generic Environmental Impact Statement. The Haudenosaunee will not comment on this document because in doing so, means we accept the process of allowing hydrofracking into our environment and

impacting our future generations. The Haudenosaunee will hold DEC to its' Contact, Cooperation and Consultation Policy with Indian Nations to improve government to government relations, open dialogue, face to face meetings, to resolve any differences when it comes to protecting our natural resources that is shared by both. The Haudenosaunee is indeed very disappointed and we determined that this will not be tolerated in the future.

On September 13, 2007, The United Nations General Assembly adopted the "Declaration on the Rights of Indigenous Peoples." This document developed by the mutual efforts of many Indigenous leaders and States over a 30 year period, contains many provisions relating to rights of Indigenous peoples that all countries agree to respect and protect. Of the 46 articles and related provisions outlined in the declaration, there are three (3) that directly relate to this matter. They are:

Article 19, States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them.

Article 29, This article contains three important provisions relating to the rights to the conservation and protection of the environment of the lands, territories and resources of indigenous peoples.

Article 37, Indigenous peoples have the right to the recognition, observance and enforcement of treaties, agreements and constructive arrangement concluded with States and their successors.

The Haudenosaunee will not allow hydrofracking on or near their aboriginal territory, and calls on the Government of New York State to similarly ban hydrofracking and other unconventional gas drilling methods within New York State. If NYS Government allows this to happen, and hydrofracking impacts our environment, then DEC will be held accountable. We do so for the future of all our relations.

"Words That Come Before All Else"
Haudenosaunee (Iroquois) Thanksgiving Statement
Greetings to the Natural World
Ohen:ton Karihwatehkwen

Excerpt, "The Waters"

The Waters

We give thanks to all the Waters of the world for quenching our thirst and providing us with strength. Water is life. We know its power in many forms—waterfalls and rain, mists and streams, rivers and oceans. With one mind, we send greetings and thanks to the spirit of Water.

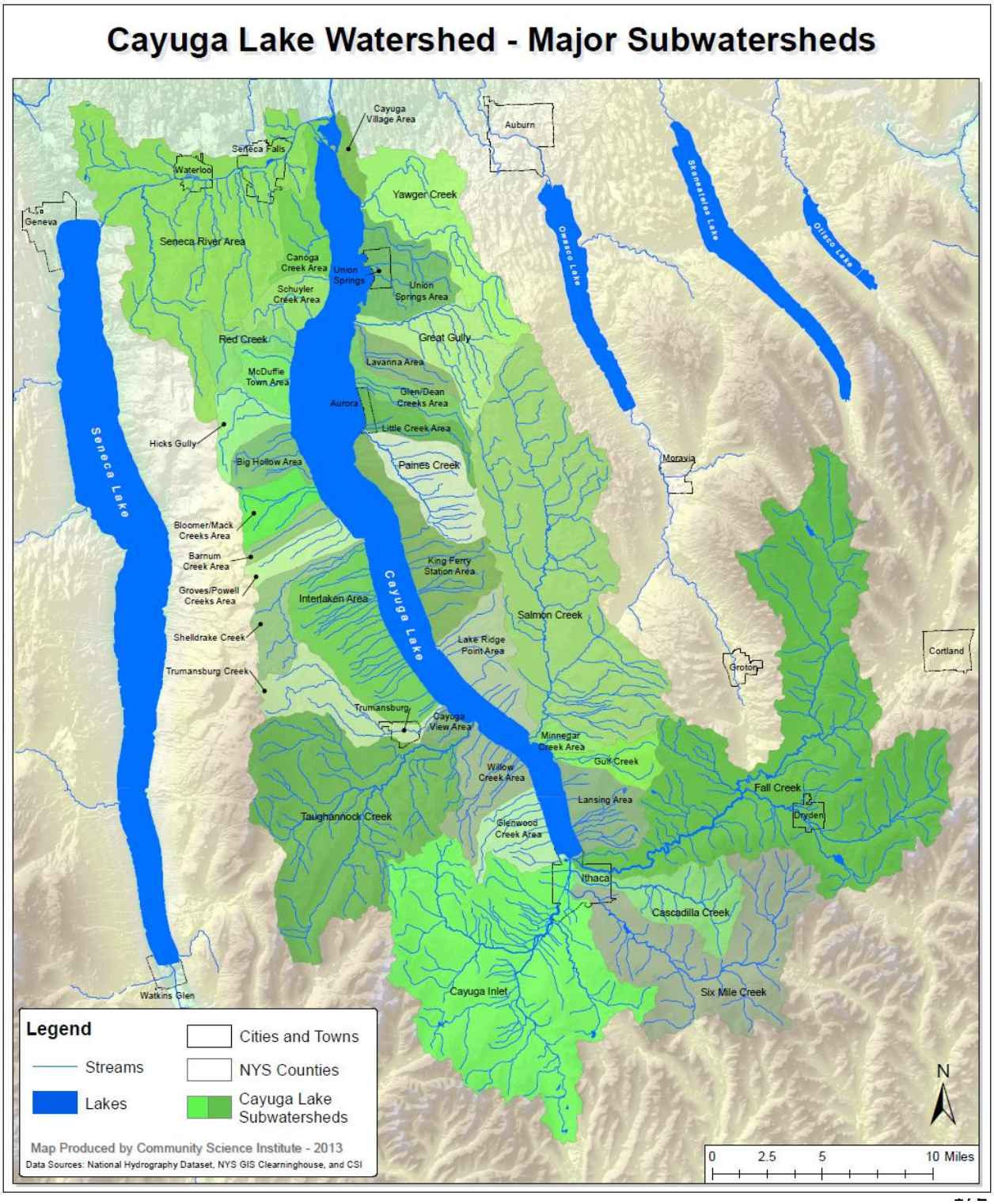
Now our minds are one.

The full text of the Haudenosaunee Thanksgiving Statement can be viewed on the National Museum of American Indians website:
http://nmai.si.edu/environment/pdf/01_02_Thanksgiving_Address.pdf

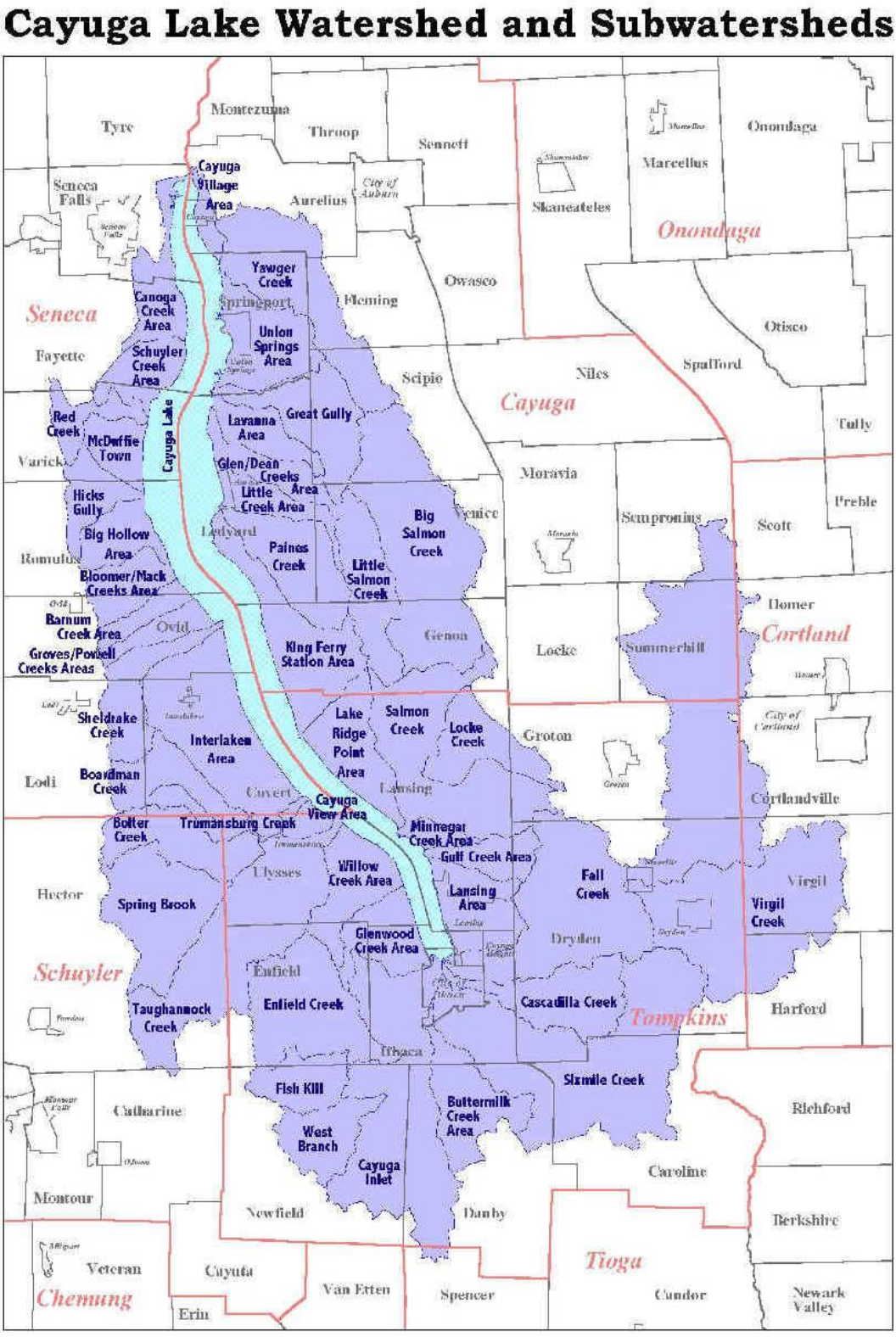
Words that Come Before All Else, Haundeonsaunee Task Force Eds, 2000. Native North American Traveling College.

Appendix F. Maps of the Cayuga Lake Watershed

1. Cayuga Lake Watershed – Major Subwatersheds. Map produced by the Community Science Institute for the Cayuga Lake Watershed Network, 2012. View and download: http://www.cayugalake.org/map-of-the-cayuga-lake-watershed.html

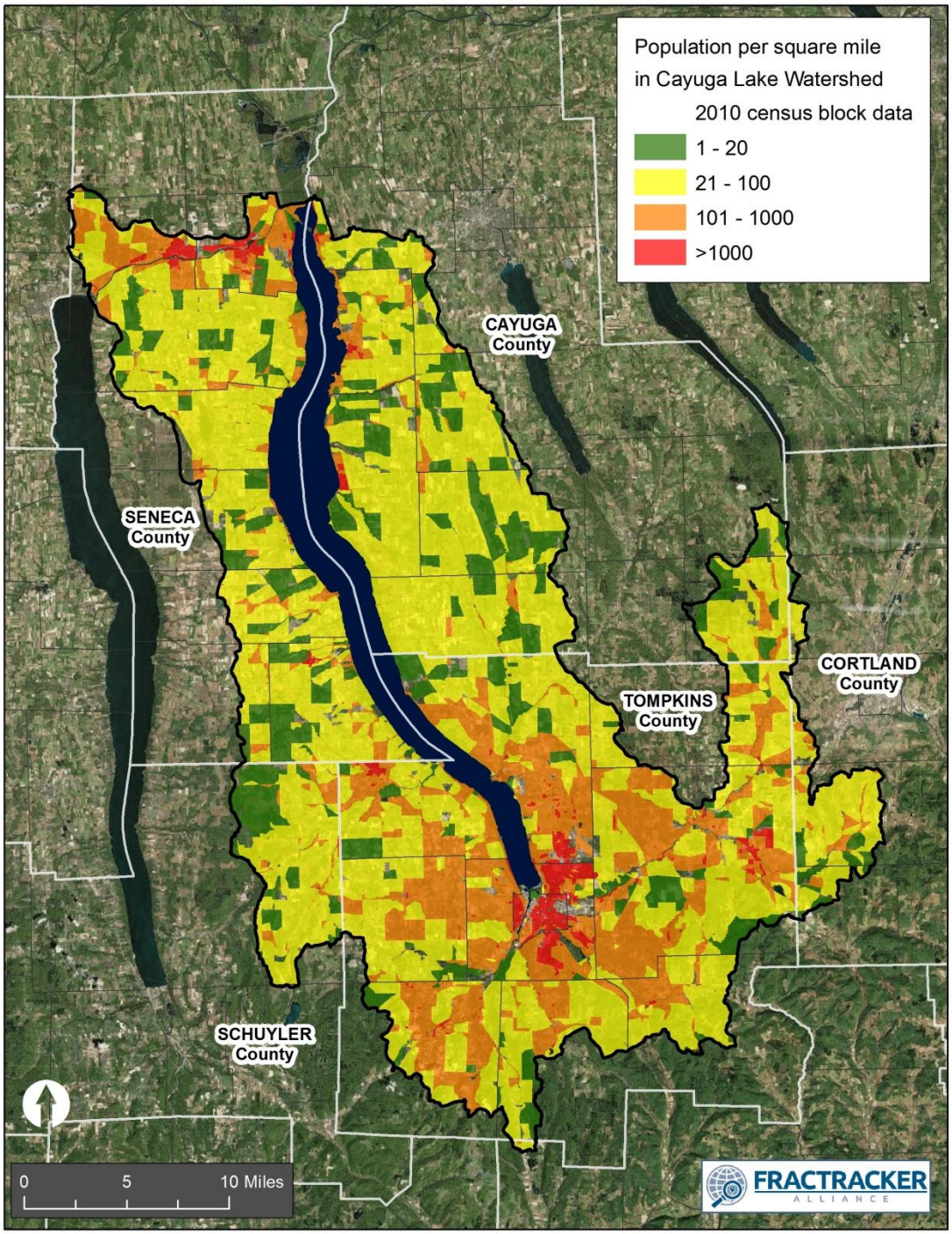


2. Cayuga Lake Watershed map, with administrative divisions: counties and municipalities, 2001. View online: http://www.cayugawatershed.org/clwsmap.html



3. Cayuga Lake Watershed human population density, based on 2010 Census data, 2017. Map by Karen Edelstein, cartographer, Fractracker.org

View online: http://www.cayugalake.org/map-of-the-cayuga-lake-watershed.html



Appendix G. Compilation of all Action Recommendations

Top IO Priority Recommendations for Action

MONITORING: Consistent monitoring of the lake and its tributaries is necessary for the restoration and protection of the watershed.

1. Develop and implement a monitoring plan for the entire watershed that is based on the 2008 Monitoring Plan for the South Basin of Cayuga Lake and the 2001 Framework for a Cayuga Lake Monitoring Plan.

2. Work with partners to ensure funding is established for long-term lake and tributary monitoring, expanding monitoring to include all tributaries draining into the lake.

3. Increase the frequency and regularity of monitoring in the lake.

4. Investigate the sources of phosphorus and *E. coli* in streams and ditches draining agricultural areas.

5. Implement phosphorus and chlorophyll monitoring, targeting areas near the mouths of streams that load large amounts of phosphorus to the lake that may be at risk of harmful algal blooms (HABs).

6. Continue an aggressive hydrilla identification and eradication program.

7. Broaden monitoring efforts to include pesticides and emerging contaminants such as pharmaceuticals and microplastic particles.

STORMWATER MANAGEMENT & EROSION CONTROL

Stormwater runoff carries with it pollutants and sediment that threaten the health of the watershed. Efforts to understand and manage the watershed's stormwater drainage system are essential to maintaining water quality.

1. Design and develop a watershed-wide stormwater management strategy, modeled on the Stormwater Coalition of Tompkins County.

2. Create a GIS-based "asset" inventory of roadside ditches for the purpose of identifying best ditch management practices and developing a watershed-wide ditch management program.

3. Work with county Soil and Water Conservation District offices and local municipalities to promote the creation and restoration of stream and lakeside buffers.

4. Work with county Water Quality Coordinating Committees on development and promotion of wetland protection legislation.

5. Create an inventory of industrial and commercial water users, and document water export from the watershed.

COLLABORATION AND COORDINATION

There are 6 counties, 34 towns, 9 villages, and 1 city in the Cayuga Lake Watershed. Effective watershed restoration and protection efforts necessitate intermunicipal collaboration and cooperation.

1. Support relationships between county Soil and Water Conservation District offices and local municipalities around water quality improvement projects, including help identifying projects, project partners, and sources of funding.

2. Work with county Soil and Water Conservation District offices to foster relationships and communication with the agricultural community, including providing support for funding requests for water quality-related projects.

3. Work with county Planning Departments to recommend and distribute model legislation to local municipalities and for help in identifying and protecting critical resource areas.

4. Work with county Health Departments to establish and implement watershed-wide septic system inspections and regulations.

5. Work with state, county, and local highway departments to establish and implement a ditch management maintenance program.

6. Support local governments in their efforts to upgrade aging water and sewer infrastructure.

PUBLIC EDUCATION AND ENGAGEMENT

Cayuga Lake and its watershed are the defining features of our area, beloved by residents and visitors alike. Preserving, protecting, and restoring this natural and economic resource requires an engaged and committed public.

1. Work closely with the Cayuga Lake Watershed Network to strengthen relationships with existing and emerging community groups.

2. Support the educational efforts of the Cayuga Lake Floating Classroom and the Cayuga Lake Watershed Network.

3. Support the work of the Finger Lakes Land Trust in identifying and preserving critical resource areas.

4. Encourage state and local efforts to provide public access to the lake and its tributaries.

5. Support efforts to create and provide educational opportunities for area school children, focused on Cayuga Lake and its watershed.

Public input meetings summer 2015: Recommendations for policy and action to protect lake and watershed

- Develop & enforce better land use practices for homes, farms, businesses.
- More public access for recreation and swimming – add two more beaches.
- Develop a lake-focused curriculum for schools and the public.
- Collect more data watershed-wide for better-informed decision-making.
- More funding for agencies and municipalities.
- Stop subdividing large properties into many building lots.
- Share best management practices across the watershed.
- Develop regulations for steep slope building and development control.
- Develop school curriculum for lake and water education with a stewards program for school youth, with input from educational institutions in the watershed.
- Develop a unified system for supporting and upgrading septic systems/sewers, like the rigorous inspection program on Otsego Lake, replacing old systems via low-interest loans attached to deeds.
- Anticipate privatization, encourage diversity.

Public response to the online survey October 2015-August 2016: Top actions that could most effectively protect or restore the watershed

1. Improving farming practices to reduce runoff and erosion.
2. Improving protection of wetlands and riparian corridors/buffers (land along the lake, creeks and streams).
3. Improving stormwater management and erosion control.
4. Improving control of invasive species.
5. Fostering stewardship through education and citizen engagement.
6. Improving communications, collaboration and partnerships across municipal and agency boundaries.
7. Improving private wastewater systems (septic systems).
8. Improving public wastewater systems management. .
9. Providing lawn care education to reduce erosion and lawn chemicals runoff.
10. Improving forestry management.

Water Quality: Recommended Actions to Implement Improvements in Water Quality Status, Water Quality Issues, and Geographic Areas of Concern

1. Implement phosphorus monitoring of Cayuga Lake tributary streams, from north to south, in order to track the progress of the whole lake phosphorus TMDL.

2. Investigate the sources of phosphorus and E. coli (pathogens) in streams draining agricultural areas, attempt to determine whether some farms

contribute more than others, and work with Soil and Water Conservation Districts to address practices of individual farmers, as appropriate.

3. Continue investigations of algae along the northern lake shore.
4. Implement a lake-wide volunteer monitoring program in cooperation with NYS DEC and other groups, to include collecting secchi disk clarity, temperature, macrophytes, HABs, etc., to provide an opportunity for regular activity, practice, and learning.
5. Implement phosphorus and chlorophyll monitoring of Cayuga Lake, targeting areas near the mouths of streams that load large amounts of phosphorus to the lake that may be at risk of HABs.
6. Continue aggressive aquatic invasive species identification program, and hydrilla eradication program.
7. Screen selected tributary streams and Cayuga Lake for pesticides using atrazine as a marker.
8. Screen selected Cayuga Lake locations for microplastics.

Public Participation: Recommendations for Public Participation, toward Plan Implementation and Watershed Protection

1. Retain WAC (Watershed Advisory Committee) as active IO participant, to better coordinate and improve communications and partnerships in projects with intermunicipal water quality impacts.

2. Retain TAC (Technical Advisory Committee) as active IO participant, to keep abreast of new concerns such as emerging contaminants and invasive species threats.

3. Maintain list and contacts with and input from water-focused community groups, to better coordinate and improve communications and partnerships in projects with intermunicipal water quality impacts.

4. Use website, social media, print media to retain/develop active engagement with the public and local government.

5. Maintain a schedule of educational and interactive events throughout the year to encourage the message that public participation requires action.

Watershed/Water Quality Education: Recommendations for Watershed and Water Quality Education

1. The *Education/Public Participation/Outreach Committee (EPPOC)* should be re-established, and governed via collaboration between its principals, the IO and CLWN.

2. The IO should allocate a reasonable amount of financial support to ensure this group functions - two meetings/year to produce/maintain an EPPOC action plan annually.

3. CLWN should identify EPPOC priorities as an annual objective.

4. Organizations such as Cayuga Lake Floating Classroom should incorporate EPPOC annual plan priorities into public programming plans.

5. EPPOC should be tasked with reviewing information on work being pursued relevant to all other Watershed Strategy Components on an annual basis, and compiling a priority list of Public Participation objectives/strategies/measures.

6. EPPOC needs to develop and formally accept criteria for public participation strategy:
    - Equity & inclusiveness within larger watershed population.
    - North/south end balance & participation numbers.
    - What else constitutes a potentially successful effort?

7. A central clearinghouse should be established to provide the public with access/information to ongoing projects and watershed-quality related work, either via an updated IO website, or via CLWN website. Also provide links to organizations and working groups and public-access meetings, including Cayuga Hydrilla Task Force, Watershed Monitoring Partners, others.

8. A Watershed Curriculum should be established to offer a framework for educational efforts. For students, this curriculum should reference NYS learning standards and existing local curricula that already been developed to address topics such as invasive species, climate change, geologic history and other relevant topics.

Agriculture: Recommended Actions to Implement Agricultural Practices Improvements for Water Quality Protection

1. Promote economically and ecologically responsible renewable energy options for farmers and farmlands.

2. Help farmers establish better water storage and retention, for climate change/extreme weather events.

3. Encourage municipal and county protection plans for drinking water and agricultural water.

4. Establish better communications between farmers and non-farmers, and better education among non-farmers about farm practices and programs.

5. Support higher state and federal funding for agricultural agencies including Cornell Cooperative Extension, Soil and Water Conservation Districts.

6. Establish and fund water quality monitoring programs at creek outlets around the lake, in cooperation with Soil and Water Conservation District offices.

7. Encourage adoption by farmers of the climate change objectives and actions in the Tompkins County's Agricultural Plan.

8. An IO working group should be established to study CAFOs, tiling and drainage, excess runoff, and other concerns, and provide a report for public and municipal use.

Stormwater/Erosion: Recommended actions to implement stormwater management and erosion control measures

1. Encourage municipalities to adopt a Stormwater Management & Erosion Control Local Law. Provide a template and incentive programs.

2. Monitor development and growth projects for piecemeal degradation. Provide training bootcamps to minimize altering land and drainage on small lots caused by practices of cutting and filling.

3. Design and develop a watershed-wide stormwater management strategy, based on the Stormwater Coalition of Tompkins County.

4. Update/assess the roadside Ditch Inventory (2000 *Characterization*), delineate severe roadside ditch problem areas in Seneca, Cayuga and Tompkins counties, and develop a several-municipality project to test roadside ditches best management practices.

5. Organize and seek funding for trained volunteer monitoring groups for tributaries on the northwest, northeast and southeast shorelines in 2017 and future years.

6. Exclude further fossil fuel infrastructure development – including fracking (HVHC), pipelines, compressor stations, injection wells, etc – by supporting sustainable renewable energy alternatives and public education about their environmental benefits, and by renewing and strengthening bans and moratoria.

7. Update the watershed salt storage study and monitor salt/chloride trends in waterways and lake.

Wastewater: Recommended actions to implement wastewater treatment improvements

1. Develop and implement project(s) to raise the level of Seneca and Tompkins counties' septic system inspection and installation programs to that of Cayuga County, using as a template the Town of Lake George's Septic Initiative Program, other examples.

2. Create county-wide computerized databases of all OWTSs to allow tracking of inspection, maintenance and replacement.

3. Modify state and/or county legislation to require periodic inspection and maintenance of OWTSs and to require replacement/improvement of non-functional systems – with special emphasis on systems within 500' of the lake and 100' of steams and other water bodies – and provide enforcement powers for appropriate agencies.

4. Increase staffing of County Health Departments to provide inspectors, to maintain the database, and to enforce the regulations.

5. Explore ways for counties to work with lending institutions to assist property owners to finance required replacements and improvements, perhaps with amortization included in tax bills and associated with the property deed.

6. Require property owners with OWTSs to connect to adjacent sewer lines if they have not already done so.

7. Improve technology to control emerging pollutants in municipal waste/do research for ecological solutions.

8. Educate the public about purchasing and waste disposal choices that affect water quality, for example, do not flush medications, fragrances, disinfectants do not flush. Reduce use of plastics.

9. Where laws require flushing of medicines and drugs, change them.

10. Adopt technologies to remove emerging contaminants, including uv, ozone, filtration.

11. Support continued research on emerging contaminants, such as using microbial biofilms for emerging contaminants removal from wastewater.

Hazardous Waste: Recommended actions to implement improvements for hazardous waste management, practices and disposal

Several of the 2001 Recommendations remain current in 2017, because not much has been done in the way of the proposed systematic surveys and studies of potential impacts from abandoned sites, etc. (http://www.cayugawatershed.org/Cayuga%20Lake/RPP/cayhazwaste.htm). The Cayuga Lake Watershed is shared among numerous agencies, leading to fracturing of information gathering and storage.

Owing to fracking and pipeline opposition (see High Volume Hydraulic Hydrofracking above under Industrial wells, list of concerned residents actions under Industrial pipelines, and Chapter E. Wastewater Treatment), public understanding of these concerns, with potential impacts to water quality, is high and engaged and will remain so. Thus we focus on humans as the solution to pollution with recommendations to

continue to work with the engaged public for water quality protection vis-à-vis old and new industrial threats to water quality.

1. Continue to work with the engaged public for water quality protection vis-à-vis old and new industrial threats to water quality.

2. Obtain funding to train volunteers to carry out long term water quality monitoring of old and new water quality threats.

3. Train and empower community groups in municipalities to express concerns and take effective action.

4. Create a central information and data node for hazardous waste issues watershed-wide.

5. Create educational curriculum elements to encourage well-informed use and disposal of medications and personal care products.

6. Action should be taken to do the needed research to mitigate known problem sites, some of which are delineated in this chapter.

Forestry/Silviculture: Recommendations for action to improve forested areas protection across the Cayuga Lake watershed

1. With a focus first on steep-sloping creeks, towns should pass riparian buffer local laws, based on the Tompkins County template.

2. Develop and share community education focused on climate change impacts to woodlands, and how residents and landowners can be resilient and adaptive to protect woodland cover.

3. Actively support programs to educate and involve the public and municipalities in invasive species programs protective of forests, including EAB and HWA and emerging threats.

4. Educate about the need to protect creeks and streams from overdevelopment (houses, roads, parking lots, bridges) via buffers, trails, parks, preserves and other tools.

5. Improve public education on requirements for streamside protection when tree cover is altered or removed, penalties for failure to comply, and how to report suspected violations.

Wetlands/Riparian: Recommendations for action to improve wetlands and riparian areas protection across the Cayuga Lake watershed

1. Obtain data and funding for Seneca and Cayuga counties to update their wetlands maps using the methods and imagery from the Tompkins County wetlands re-mapping project.

2. Advise and assist municipalities to adopt wetlands protection ordinances based on the available template (2008).

3. Conduct a watershed-wide update process for priority riparian restoration areas, coordinated by the Intermunicipal Organization to include municipal governments and partner agencies and organizations in Seneca, Tompkins and Cayuga counties.

4. Educate public and municipalities about the importance of wetlands and their protection and encourage review and updating of municipal and county planning documents to include effective wetlands protections.

Regulatory/Management: Recommendations for improvement of regulatory controls and management of the Cayuga Lake watershed's water resources

1. An IO/CLWN/partners water resources protection working group should be established to

- Review and comment on land use and economic development plans and proposals, to ensure that they are based on sound assessment of natural and environmental resources constraints and protective of our lake, creeks, streams, waterfalls, wetlands, shoreline and groundwater resources.

- Educate the public and municipal and county officials and agencies about the available land and water protection options at local, state and federal levels, how to benefit from them, and how to respond if these are threatened.

2. The IO and CLWN should encourage local and county governments to pass resolutions embracing US EPA's six 2016 Priority Areas for Drinking Water Protection, and develop strategies for implementation across our watershed.

3. A working group should review the Mohawk River's Watershed Plan and "Mighty Waters" Initiative

- As a model for better coordination of multiple water resources management across the Oswego River Basin and in the individual Finger Lakes basins.

- To work for its implementation with regional groups including the Finger Lakes Regional Watershed Alliance, the Great Lakes Restoration Initiative (GLRI) and proposed Finger Lakes Sub-Basin Work Group, the Finger Lakes Institute, the Finger Lakes Hub and others.

4. The IO, CLWN and partners should study, support, help obtain the funding, and implement the Finger Lakes Land Trust's 2016 *Lakes, Farms, & Forests Forever* proposal for land and water quality protection.

5. Climate change awareness, preparedness and resilience planning comprise a basic metric for development, review and implementation of all water resources tasks, initiatives and programs.

6. The CLWN will publish this chapter on its website and promote its use and value across the watershed.

Monitoring and Assessment: Recommended actions

1. Many different researchers, agencies and groups are doing parts of the monitoring and assessment process. This ongoing work and its varied funding need to be networked and coordinated, along with the continual flow of updates for the Plan.

- Update repository: The City of Ithaca's Roxanne Johnston is the repository for Plan updates: RJohnston@cityofithaca.org
- Resume annual meetings with sharing of research, watershed-wide. A simple State of the Lake report should be a product for the public.
- Resume building a central database for results, reports, plans.

2. Increase monitoring of tributaries lakewide to refine estimates of pollutant loading for lake modeling and the Whole Lake Phosphorus TMDL, and to prioritize subwatersheds for protective actions. Roles for IO, CSI, CLWN, FLI, others.

- Encourage municipalities to support regular monitoring.
- Continue and expand macroinvertebrate monitoring in tributaries**.**
- Coordinate data collection, analysis and assessment with other groups.

3. A workstudy group needs to focus on developing an understanding of the lake's seasonal and chemical fluctuations, informed by the work of Bouldin, UFI, others. Products:

- Presentation to researchers, DEC and public.
- Create and adopt a framework for monitoring, assessment and protection of lake health.

4. As climate change advances, monitoring and assessment need to be finely-tuned and responsive to capture short- and long-term shifts and changes in water quantity, quality, and availability for humans and the natural world.