

Skaneateles Lake Watershed Nine Element Plan for Phosphorus



Department
of State



Department of
Environmental
Conservation



This 9E Plan was prepared with funding provided by the New York State Department of State under Title 11 of the Environmental Protection Fund.

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Executive Summary

The Skaneateles Lake Watershed Nine Element Plan for Phosphorus (9E Plan) is a community-led water quality plan that assesses current conditions in the lake and watershed, looks forward to future conditions, and provides a suite of recommendations to maintain the lake's already exceptional water quality.

Because Skaneateles Lake is the unfiltered drinking water source for the City of Syracuse, it has been the focus of a robust, proactive, and effective water quality protection program for more than 25 years. And because the lake and its surrounding communities and landscape offer a high quality of life, it is an area that encourages and rewards engagement by municipalities, citizens' groups, and non-profit organizations in conservation activities. Additionally, the watershed is relatively small and there are no wastewater treatment plants or other point sources of water pollution in the watershed. As a result of these factors, Skaneateles Lake has, by all key metrics, exceptional water quality.

In 2017, Harmful Algal Blooms (HABs) were documented in Skaneateles Lake by the New York State Department of Environmental Conservation's (DEC) HABs Program for the first time. HABs can be triggered by a range of factors, but nutrient levels – specifically levels of phosphorus, believed to be a contributor to the development of HABs – are a critical factor that can be controlled by direct action in the watershed. As a result, the focus of this plan is on measuring existing total phosphorus (TP) inputs and evaluating expected lake conditions based on estimated TP levels under various future scenarios and implementation of best management practices (BMPs). This plan also describes the watershed holistically, identifying BMPs to improve watershed health along a number of metrics, in addition to phosphorus levels.

The current three-year average level of TP in Skaneateles Lake is 4.5 µg/L, based on sampling data from the Citizens State-wide Lake Assessment Program (CSLAP) data. **This 9E Plan's target is to maintain a TP level of 4.5 µg/L based on a three-year rolling average of CSLAP measurements**, taken during the summer months (June 1st to September 30th).

Additionally, measuring and tracking chlorophyll-a levels provides an indicator of a water body's overall biological productivity. Chlorophyll-a levels in Skaneateles Lake for the period from 2017 to 2022 were at or slightly above 1.0 µg/L. This plan's goal is to ensure that these levels do not increase, given the effects of climate change, including increased temperatures and more intense rainfall events. **The target level for chlorophyll-a is to maintain a summertime average of 1.0 µg/L.**

Estimates of existing and future TP loading relied on a pair of quantitative tools: the Soil and Water Assessment Tool (SWAT), which creates a digital model of conditions in the watershed and CE-QUAL-W2 model, which was used to evaluate conditions in Skaneateles Lake under both existing conditions and various future scenarios. The in-lake model provides three key metrics of the lake's overall water quality: total phosphorus level, chlorophyll-a level, and cyanobacteria concentrations.

According to the modeling, current annual phosphorus loading in the Skaneateles Lake Watershed is low in comparison to national data on phosphorus loading; loading rates by subwatershed range from .12 lbs./acre/year to 0.64 lbs./acre/year in Skaneateles while, nationally, phosphorus loading is typically on the order of 1.0 to 1.5 lbs./acre/year. The annual TP load entering the lake is estimated at 13,973 pounds.

Over the next 30 years, the effects of climate change and development in the watershed are anticipated to increase TP loading to Skaneateles Lake by approximately 820 pounds per year (or 6.3%). Future conditions are also expected to result in higher levels of chlorophyll-a (9% increase) and higher levels of cyanobacteria (an 85% increase).

In order to maintain the lake's current TP level, this plan proposes to implement BMPs in the watershed that will offset the anticipated increase in TP loading due to climate change. The digital models were used to simulate future conditions (Scenario 1) as well as the effectiveness of five BMP scenarios (Scenarios 2 through 6) at reducing TP loading and in attaining the target of 4.5 µg/L:

- Scenario 1: modeled future conditions, including increased temperature and precipitation (based on data from the New York Climate Change Science Clearinghouse) and future development.
 - Scenario 2: implement additional measures on agricultural lands, such as expanding the use of cover crops and manure incorporation.
 - Scenario 3: add vegetated strips along tributaries in the watershed to capture sediments, nutrients, and pollutants before they can enter Skaneateles Lake.
 - Scenario 4: reduce residential phosphorus contributions by reducing the number of failing septic systems in the watershed.
-

- Scenario 5: implement a total of 3.15 miles of streambank stabilization projects over the next 30 years.
- Scenario 6: implement a combination of Scenarios 2, 3, and 4.

Scenario 6, which would implement a combination of agricultural BMPs, residential nutrient reduction, and filter strips, is the scenario that achieves the greatest reduction in TP and chlorophyll-a levels, more than offsetting the effects of climate change over the next 30 years. This approach is also anticipated to reduce cyanobacteria levels by 45%, relative to the effects of climate change.

Implementing Scenario 5, which would add streambank stabilization projects to the watershed, would also offset the effects of climate change, in terms of TP loading to the lake. This scenario was not modeled using the digital models developed for this project, so its effects on cyanobacteria levels are not known.

Watershed stakeholders will need to continue to work together to implement projects, policies, and programs to increase hydrologic resilience – that is, to reduce the amount and rate of stormwater runoff to the lake. In addition to the modeled BMPs, the 9E Plan includes a range of recommendations that can be implemented by homeowners, municipalities, farmers, nonprofits, and other watershed stakeholders. These recommendations extend beyond nutrient loading, and into areas such as public education and invasive species management.

Following approval of the 9E Plan, the Central New York Regional Planning and Development Board (CNY RPDB) will convene an Implementation Team that will be comprised of members of the existing WAC, as well as other organizations, such as academic institutions, that can support project implementation in the watershed. Quarterly meetings of this group will ensure that watershed stakeholders are able to collaborate on project ideas and remain aware of ongoing activities in and around Skaneateles Lake.

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Abbreviations

9E	Nine Element Plan
AEM	Agricultural Environmental Management
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CALM	Consolidated Assessment and Listing Methodology
CCE	Cornell Cooperative Extension
CE-QUAL-W2	Army Corps of Engineers Water Quality Model in 2 Dimensions (In-Lake Model)
CSLAP	Citizens Statewide Lake Assessment Program
ELAP	Environmental Laboratory Accreditation Program
FLLT	Finger Lakes Land Trust
FL-PRISM	Finger Lakes Partnership for Regional Invasive Species Management
HAB	Harmful Algal Bloom
HRU	Hydrologic Response Unit
HUC	Hydrologic Unit Code
HWA	Hemlock Woolly Adelgid
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NYSAGM	New York State Department of Agriculture and Markets
NYSDEC / DEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS / DOS	New York State Department of State
OWTS	Onsite Wastewater Treatment Systems
QAPP	Quality Assurance Project Plan
SLA	Skaneateles Lake Association
SLWAP	Skaneateles Lake Watershed Agricultural Program
SPDES	State Pollutant Discharge Elimination System
SWAT	Soil & Water Assessment Tool (Watershed Model)
SWCD	Soil and Water Conservation District
TN	Total Nitrogen
TP	Total Phosphorus
TS	Trout Spawning
UFI	Upstate Freshwater Institute
USACE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Watershed Advisory Committee
WI/PWL	Waterbody Inventory/Priority Waterbodies List
WISPA	New York State Watercraft Inspection Steward Program Application

1. Introduction

More than two million years ago, glaciers moved across the landscape of what we now know as Upstate New York. Glacial action carved out the basins of the eleven Finger Lakes, including Skaneateles Lake. Skaneateles Lake is situated on the eastern end of the Finger Lakes region, with its watershed extending into three counties: Onondaga, Cayuga, and Cortland.

Skaneateles Lake is part of the Seneca Watershed, which drains an area of nearly 3,500 square miles. The lake's outlet is at its northern end, in the Village of Skaneateles, where Skaneateles Creek begins its 14-mile run to meet the Seneca River. The Seneca Watershed contains several of the eastern Finger Lakes (Figure 1.1). The Seneca and Oneida Rivers meet in Central New York at Three Rivers, where they form the Oswego River, which flows north to Lake Ontario.

Skaneateles Lake is a remarkable resource for the Central New York region: a water source of such high quality that the water does not need an expensive filtration system to be potable. Careful management over the past 30 years combined with a relatively small, relatively undeveloped watershed have ensured that human activities have not diminished the lake's water quality. (see Figure 1.2 for a map of the Skaneateles Lake Watershed).

But Skaneateles Lake's future may be more complicated than its past. Invasive species, both terrestrial and aquatic, have altered the lake and threaten to change the landscape. Climate change has already affected weather patterns in the watershed and may mean that the frequency of severe weather events increases in coming decades, overwhelming existing infrastructure.

The purpose of this Nine Element (9E) Plan is to provide a data-driven basis for actions in the watershed to ensure that the lake continues to meet the highest water quality standards. This plan provides a starting point for an adaptive management approach to the Skaneateles Lake watershed; over time, the effects of project implementation will be evaluated and implementation strategies will be adjusted as needed.

1.1 Watershed Profile

Issues Impacting the Watershed

Skaneateles Lake is a highly valued water resource that supports multiple uses. In New York, all surface waters are classified by best use based on stream flow, water quality, habitat, land use, and other considerations. Skaneateles Lake (Segment ID, 0707-0004) is classified by the New York State Department of Environmental Conservation (DEC) as an AA lake, indicate its best usage as a source of water supply for drinking, culinary, or food processing purposes, as

well as for primary and secondary contact recreation, and for fishing.

The most recent NYSDEC Waterbody Segment Assessment Fact Sheet (dated December 7, 2021) lists Skaneateles Lake as fully supported for both primary recreation (such as swimming) and secondary contact recreation (where contact with the water is incidental, such as boating). Phosphorus is the pollutant that is monitored in the Fact Sheet for the protection of primary and secondary recreation. The assessment lists the lake as stressed as a water supply source because of chloride and nitrate / nitrite levels.

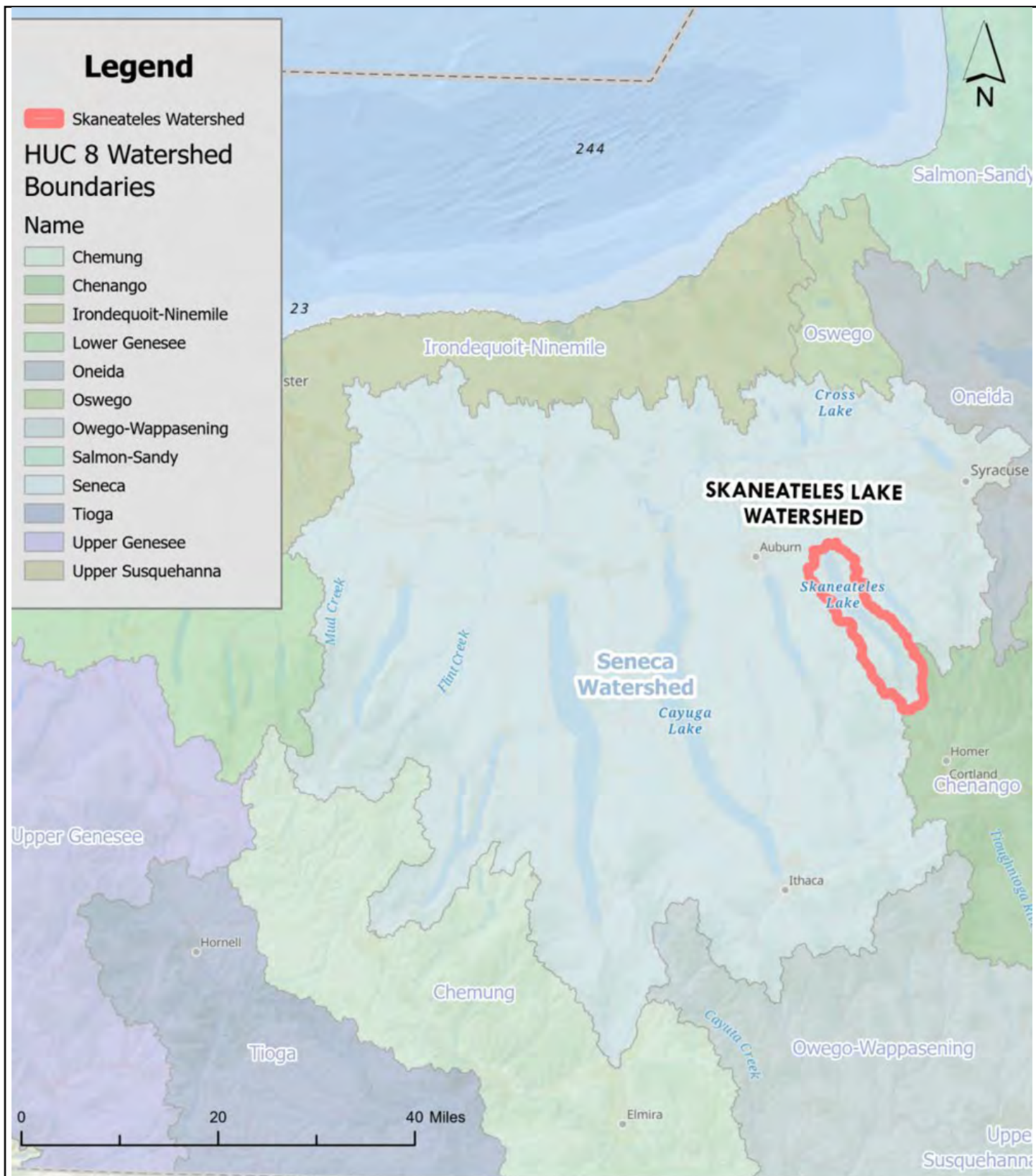
The Fact Sheet is available online at: <https://extapps.dec.ny.gov/data/WQP/PWL/0707-0004.html>

Harmful Algal Blooms

As in all freshwater systems around the world, Harmful Algal Blooms (HABs) are a concern in Skaneateles Lake. They generally consist of visible patches of cyanobacteria, or blue-green algae, and may produce toxins. Under conditions with adequate nutrient availability, warm temperatures, and calm winds, cyanobacteria may multiply rapidly and form blooms that are visible on a waterbody's surface. Regardless of toxin presence, HABs may pose health risks to people and animals through pathways of ingestion, skin contact, or inhalation (NYSDEC, 2024).

HABs were first documented, and their toxin levels measured, in 2017, when blooms were visible in multiple parts of the lake for the first time. Prior to that year, algae had been present and were being studied, but were not suspected of posing a threat to water quality. The 1998 Skaneateles Lake Watershed Management Plan notes the presence of *Microcystis* as "the dominant blue-green". This plan goes on to note that "With the onset of warmer temperatures, green algae become common and represented by a rather wide diversity of genera" (NYSDEC and EPA Region II, 1998). A 1951 Post-Standard article describes a system whereby lake water samples were taken "and, if they began to taste 'fishy'" the lake was to be treated with copper sulfate to kill the algae (Post Standard, 1951). An article from 1975 describes algae samples being studied as far back as the early 1920s. This article also describes highly visible blue-green algae blooms appearing on the lake's surface in the early 1970s but being assessed as posing no threat to water quality because they were of small quantity and short-lived (Lee M. D., 1975).

Since 2017, Skaneateles Lake has experienced algal blooms and documented multiple occurrences of cyanobacterial blooms. There has been a confirmed bloom every year since 2017. Figure 1.3 provides a summary of reported HABs observations in Skaneateles Lake from 2017 to 2023. As this figure shows, reported HABs in Skaneateles Lake have typically been localized.



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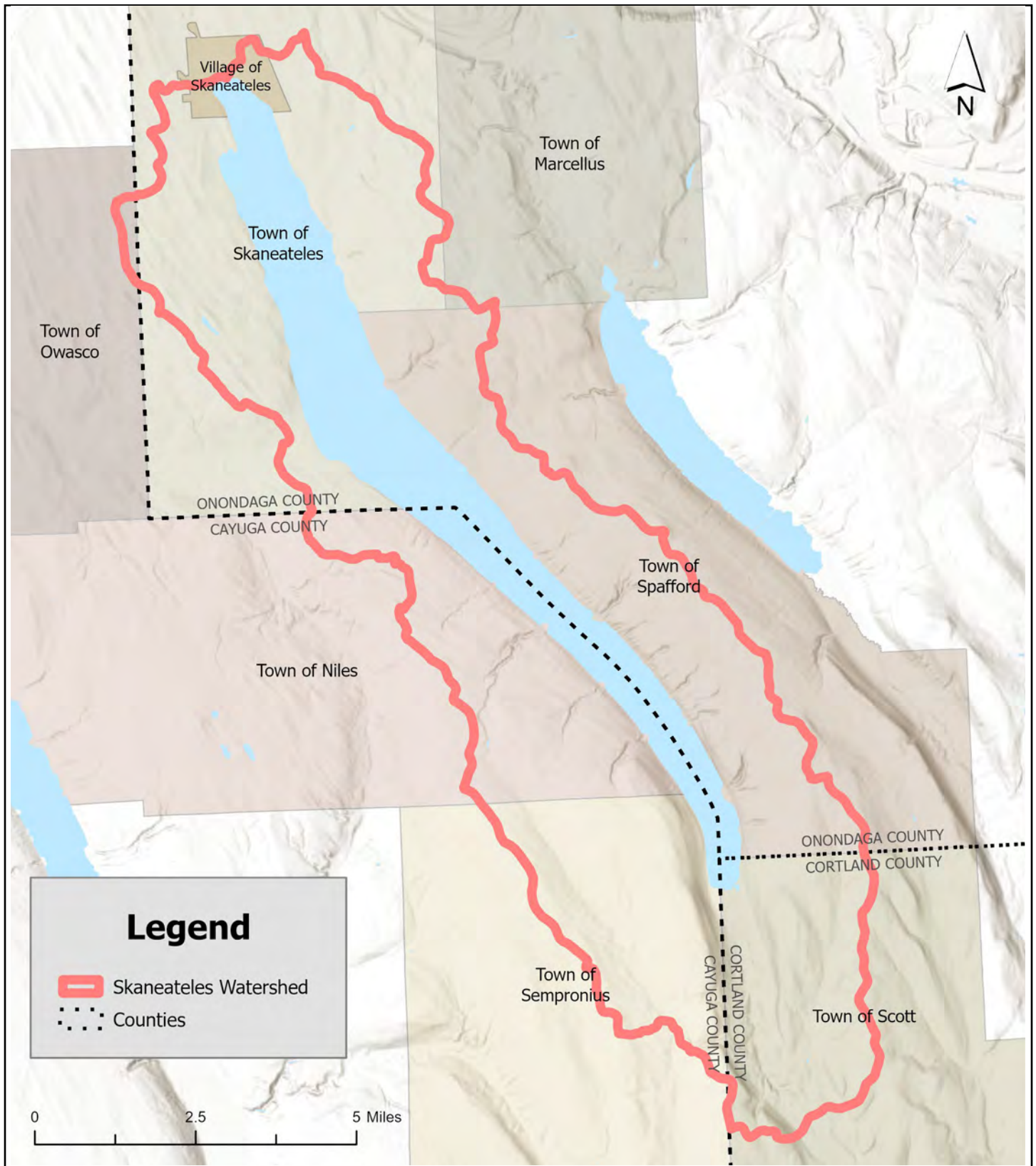
Central New York
Regional Planning & Development Board

This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 1.1 – Seneca Watershed

Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA

Coordinate System: NAD UTM Zone 18N



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Figure 1.2 – Skaneateles Lake Watershed Boundary

Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
Coordinate System: NAD UTM Zone 18N

HABs – Causal Factors

Several factors are thought to be related to the occurrence of HABs in a lake, including total phosphorus levels, the presence of dreissenid mussels, the maximum length of open water over which wind can travel, also known as a lake’s “fetch length”, and the compass orientation of the maximum fetch length.

According to the HAB Action Plan for Skaneateles Lake, “for every 0.01 mg/L increase in total phosphorus levels, the probability that a lake in New York will have a HAB in a given year increases by about 10% to 18%” (NYSDEC, 2020).

Research shows that the presence of dreissenid mussels is associated with an increase in the annual HAB probability of 18% to 66% (NYSDEC, 2020). Research indicates that mussels selectively feed on algae, filtering out harmful cyanobacteria. This can lead to increased concentrations of HABs in lakes with substantial mussel populations (Vanderploeg, et al., 2017).

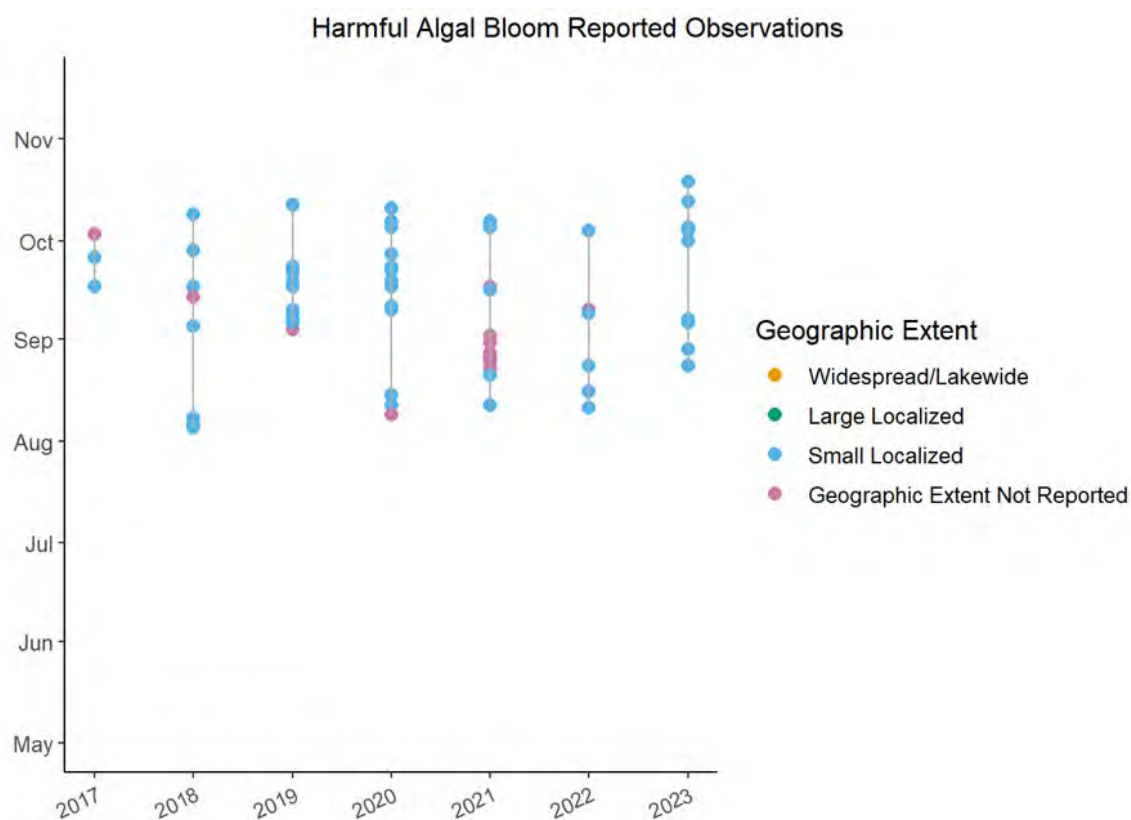
Lakes with long fetch lengths are also associated with HABs formation. The HAB Action Plan states that “for every mile of increased fetch length, lakes are associated with up to a 20% increase in the annual probability of HABs” (NYSDEC, 2020). Lakes with a northwest orientation along their longest fetch are also more likely to see HABs than other lakes.

Skaneateles Lake has three of the four factors associated with the occurrence of HABs: the presence of dreissenid mussels, a northwest orientation, and a relatively long fetch length. However, the lake’s phosphorus levels are low. CSLAP monitoring data shows that summer averages for total phosphorus in Skaneateles Lake were relatively low both in the late 1990s and early 2000s, and in recent years (2017 – 2022; see Figure 1.4). As described in Section 2.16, 10 µg/L is often referenced as the upper limit of total phosphorus levels for oligotrophic lakes. Skaneateles Lake’s average phosphorus levels are consistently below this threshold.

The HAB Action Plan for Skaneateles Lake hypothesizes that the occurrence of HABs in 2017 may have resulted from the combination of an unusually wet growing season, warm surface water, and a period of calm winds.

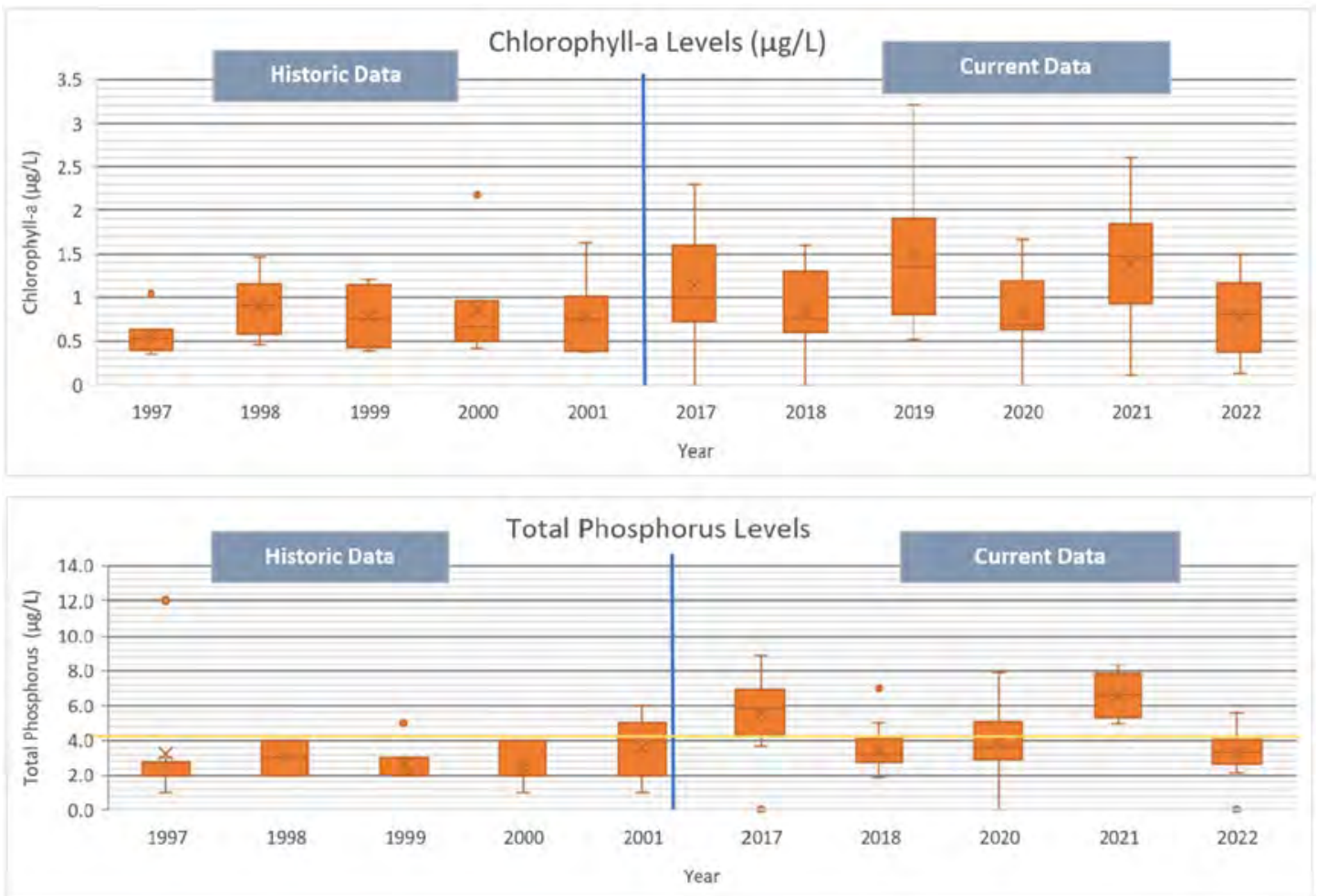
Of the risk factors identified that are associated with the occurrence of HABs, only phosphorus loading can be meaningfully altered through human action at the local level. The HAB Action Plan for Skaneateles Lake identified a wide range of actions that would reduce the probability of future HABs, including development of a 9E plan (NYSDEC, 2020).

Figure 1.3 – Harmful Algal Bloom Reported Observations, 2017 - 2023



Source: (NYSDEC, 2024)

Figure 1.4 - Chlorophyll-a and Total Phosphorus Levels - Historic, 2017 – 2001, and Current Data, 2017 – 2022



Source: Data from the Citizens Statewide Lake Assessment Program, measured at Station 139 (Historic Data) and Stations 139.1 and 139.2 (Current Data). Data shown are from epilimnion measurements. The yellow line in the lower chart represents the most recent three-year average for total phosphorus (4.5 µg/L).

1.2 Existing Plans and Initiatives

Water Resources Planning and Related Documents

- Harmful Algal Bloom Action Plan – Skaneateles Lake*, New York State Department of Environmental Conservation, 2020, available online at: https://extapps.dec.ny.gov/docs/water_pdf/skaneateleshabplan.pdf

 - The *HABs Action Plan* is a compilation of the best available data on and analysis of Skaneateles Lake and the watershed and was an important resource in the preparation of this plan.
 - The *HABs Action Plan* was based on CSLAP data from two periods: the five-year period from 1997 to 2001 and a single year of sampling in 2017. Water quality data collected for various studies from the late 1990s to the time of report preparation was also utilized.
- Skaneateles Lake Watershed Plan, US EPA Region 2 and NYSDEC, 1998

 - This plan predates several key developments in the lake and watershed, including the widespread presence of HABs, the introduction of the invasive hemlock woolly adelgid (HWA, see Section 2.8), and the development of detailed metrics and projections related to climate change. It does, however, provide an excellent reference for lake and watershed conditions in the late 1990s, as well as demonstrating the persistence of some issues, such as the importance of maintaining the City’s Filtration Avoidance Waiver, the need for streambank stabilization projects to reduce streambank erosion, and the usefulness of (and obstacles to) riparian buffers.
- Skaneateles Lake Data Review and Gap Analysis*, New York State Department of Environmental Conservation, 2019

- The scope of this analysis was to advance the recommendation in the *Harmful Algal Bloom Action Plan* to develop a 9E Plan by compiling and reviewing existing data that could be used to develop the mathematical models of the lake and watershed needed to complete a 9E Plan. This analysis identified a set of 13 tributaries to the lake to consider for monitoring during the 2019 and 2020 field seasons.
- *Water Quality and Flow of Ten Tributaries to Skaneateles Lake*, CNY RPDB, 2019
 - This report provides a summary of the data collected on ten of the tributaries identified in the *Gap Analysis* from 2019. This data was critical to the development of the modeling for the 9E Plan.
- *Water Quality and Limnological Monitoring of Skaneateles Lake*, Town of Skaneateles, 2019
 - This report summarized the results of monitoring and measurement of Skaneateles Lake – data that helped form the basis for the development of the 9E’s in-lake model. Water quality parameters and optical characteristics were monitored from June to October 2019. All measurements of common metrics of trophic state (total phosphorus, chlorophyll a, water clarity metrics) were supportive that the lake remains oligotrophic. In addition to the common trophic indicators, measurements of phosphorus fractions (total dissolved phosphorus and soluble reactive phosphorus), particulate organic carbon, and algal community composition were taken at various depths of the water column.
- *Town of Skaneateles Open Space Plan*, CNY RPDB, 2016
 - This plan identified and prioritized land parcels for open space conservation and to develop recommendations that would protect natural and cultural resources, support agricultural sustainability, and protect Skaneateles Lake water quality. One outcome of this plan was a set of low, medium, and high priority parcels for preservation, based on factors such as parcel size, proximity to wetlands, soil characteristics, and other factors.

areas, pristine natural, settings, and everything in between, watershed plans are necessarily collaborative and intermunicipal, involving a variety of stakeholders.

The goals of a watershed plan are to document existing conditions, identify major issues in the watershed (i.e., point and non-point sources of pollution), and develop consensus around a set of recommendations to improve conditions in the watershed, or to protect existing conditions or an existing resource (such as a specific habitat). This can include going beyond problem-solving to improve existing resources, such as wildlife habitat, or to otherwise protect or enhance the community’s enjoyment of the watershed or water body.

What is a 9E Plan?

The 9E Plan structure was developed by the US Environmental Protection Agency, and includes certain analytical components not always utilized in watershed plans. A 9E Plan includes many of the components of a traditional watershed plan, but it must include these additional quantitative elements to be approved as a 9E Plan. NYSDEC provides guidance on the 9E process and reviews and approves the final document. When funding is provided by NYS DOS, their guidance and approval is also provided. The analytical elements relate primarily to the means of quantifying pollutant levels and pollutant sources in the watershed, identifying a water quality target, and identifying the best management practices (BMPs) that will help to achieve the pollutant reductions needed to meet the water quality target.

The nine minimum elements in a 9E Plan are intended to ensure that the contributing causes and sources of non-point source pollution are identified, that key stakeholders are involved in the planning process, and that restoration and protection strategies are identified that will address the water quality concerns.

Table 1.1 provides the location (by section) of each of the nine minimum elements in the 9E Plan document.

1.3 Plan Development Process

What is a Watershed Plan?

A watershed plan is a tool used to address issues that happen at a larger scale than at the municipal level and which helps communities effectively and comprehensively address water quality and quantity issues throughout their watershed, while balancing the need for economic growth and development. Because watershed boundaries often span municipal boundaries and can include heavily developed

Table 1.1 – Location of the Nine Element Plan Components in the Document

Nine Element Criteria	NYSDEC / US EPA Definition	Location in Document (Section)
Element A	Identify and quantify sources of pollution in the watershed	3.3
Element B	Identify water quality target or goal and pollutant reductions needed to achieve this goal	4.1 & 4.2
Element C	Identify the best management practices (BMPs) that will help to achieve the reductions needed to meet water quality goal/target	4.3, 4.4, Table 5.1
Element D	Describe the financial and technical assistance needed to implement the BMPs identified in Element C	6.6
Element E	Describe the outreach to stakeholders and how their input was incorporated and the role of stakeholders in implementing the plan	1.4
Element F	Estimate a schedule to implement the BMPs identified in plan	6.7
Element G	Describe the milestones and estimated time frames for the implementation of BMPs	6.4 & 6.5
Element H	Identify the criteria that will be used to assess water quality improvement as the plan is implemented	7.0
Element I	Describe the monitoring plan that will collect water quality data needed to measure water quality improvement (the criteria identified in Element H)	7.1 & 7.2

New York State Agencies

The New York State Department of State (NYSDOS) provided funding for this project under Title 11 of the Environmental Protection Fund. In addition to providing support for data collection for this 9E Plan, NYSDOS contracted with the Town of Skaneateles to provide funding to the Central New York Regional Planning and Development Board (CNY RPDB) to develop the 9E Plan. The CNY RPDB is responsible for coordination with the NYSDOS, other state, regional, and local entities, and consultants.

The New York State Department of Environmental Conservation (DEC) ensured that this plan was developed within the nine-element framework originally developed by the United States Environmental Protection Agency (EPA). The DEC also funded the in-lake and watershed modeling on which this plan was based.

Both DOS and DEC staff served on the plan’s Watershed Advisory Committee (WAC) as non-voting members, and helped guide plan development as members of the Modeling Team.

Watershed Advisory Committee

A WAC was assembled to provide input on the plan throughout its development. The following WAC members were in-

cluded to represent Skaneateles Watershed stakeholders from the following municipalities, organizations, firms, and agencies:

- Cayuga County Department of Planning and Economic Development
- Cayuga County Soil and Water Conservation District
- Cortland County Soil and Water Conservation District
- City of Syracuse
- Central New York Land Trust (CNY Land Trust)
- Cornell Cooperative Extension (CCE)
- Cortland County Soil and Water Conservation District (SWCD)
- Finger Lakes Land Trust (FLLT)
- Onondaga County Office of the Environment
- Onondaga County Department of Planning
- Onondaga County Legislature
- Onondaga County Soil & Water Conservation District (SWCD)
- Skaneateles Lake Association (SLA)
- Skaneateles Lake Watershed Agricultural Program (SLWAP)
- The Nature Conservancy

- Town of Niles
- Town of Scott
- Town of Sempronius
- Town of Skaneateles
- Town of Spafford
- Village of Skaneateles

The WAC's input was critical to the development of this plan. The WAC developed the plan's Vision and Goals, provided data, reviewed project documents, and supported public outreach efforts. The WAC's guidance helped to ensure that this 9E Plan reflects the priorities and values unique to the Skaneateles Watershed.

NYSDOS reviewed and approved project deliverables and the 9E Plan, as well as provided guidance to the WAC and the Modeling Team. NYSDEC reviewed and approved the 9E Plan to ensure that the report included all the required elements. NYSDEC also funded development of the digital models used to analyze the watershed and assess the results of various scenarios.

Modeling Team

The 9E Planning process is organized around the development of digital models that are calibrated to existing watershed conditions and that can be used to test the water quality implications of changes in the watershed. In the case of the Skaneateles 9E, this meant the development of two models: one to simulate conditions in the watershed (the Watershed Model) and another to provide detailed information on the lake itself (the In-Lake Model).

Modeling activities for this plan were coordinated by staff from Ramboll. The In-Lake Model was prepared by the Upstate Freshwater Institute, based in Syracuse. The Watershed Model was prepared by LimnoTech, a firm based in Michigan.

To ensure that the modeling process proceeded with input from the WAC, a Modeling Team met monthly to discuss data collection, data processing, ideas and concerns from the WAC, and the development of modeling scenarios.

Modeling Team members included representatives from the following agencies and firms:

- NYSDOS
- NYSDEC
- New York State Office of General Services (OGS)
- Ramboll
- LimnoTech
- Upstate Freshwater Institute (UFI)
- Anchor QEA
- CNY RPDB

Pollutant of Concern: Phosphorus

HABs are a significant concern for all Skaneateles Lake stakeholders. HABs have the potential to produce toxins, which can be harmful to animals and people. As a result, the presence of HABs can mean beach closures and other restrictions on water-based recreation. It also leads to concerns about the safety of drinking water (see Section 3.2 for information on the City of Syracuse's program to monitor drinking water for toxins).

As noted in Section 1.1, the exact cause of HABs can be difficult to determine, and the causes of HABs may vary from one location to another. The cyanobacteria that cause HABs thrive in a mix warm temperatures, sunlight, and high levels of nutrients – phosphorus and nitrogen.

Both phosphorus and nitrogen are essential nutrients: both need to be present in order to support the growth of phytoplankton and other forms of life. Generally speaking, nitrogen is more abundant in lakes in New York than phosphorus. As will be seen in Section 2.14, nitrogen levels are more than 100 times higher than phosphorus levels in Skaneateles Lake. Phosphorus is considered the "limiting nutrient" for biological productivity.

According to data from the New York Climate Change Science Clearinghouse, temperatures will continue to increase over the next 40 to 50 years, with the severity of rainfall events increasing (NYSERDA, 2022). With increased rainfall will come increased stormwater runoff from across the watershed.

Because phosphorus levels are so important to the overall health of Skaneateles Lake, the focus of this plan is on ensuring that total phosphorus levels in the lake remain at or near existing levels in the future, even as climate change increases precipitation levels and nutrient runoff.

Quality Assurance Project Plans (QAPPs)

New York State-funded projects that involve collection of environmental data and/or use modeling require development and formal approval of a Quality Assurance Project Plan (QAPP). Three QAPPs were required for this project. David A. Matthews, PhD., from the Upstate Freshwater Institute (UFI) prepared the tributary monitoring QAPP (Appendix A), which was critical to providing sufficient data to support the 9E. Dr. Matthews also prepared the QAPP for the In-Lake Model (Appendix B). This document describes the methods and quality assurance practices to be used in the development of the CE-QUAL-W2 (Version 4.1) model used to simulate bathymetry, chemistry, meteorological conditions, and other factors influencing the water quality of Skaneateles Lake.

Cheslie Boles, project manager for LimnoTech, prepared the QAPP for the Watershed Model (Appendix C). This docu-

ment provides details on the assumptions made, data to be used, and methods to be applied to ensure that the watershed model, the Soil and Water Assessment Tool (SWAT) reflects conditions in the Skaneateles Lake Watershed to the greatest extent possible.

CE-QUAL-W2

The In-Lake Model selected for this project is known as 'CE-QUAL-W2', an acronym that refers to its origins with the Army of Corps of Engineers (CE) in the 1980s and 1990s, its focus on water quality (QUAL), and its use of width averaging in two dimensions (W2). CE-QUAL-W2 is a public domain two-dimensional hydrothermal/transport and eutrophication model. This model was selected because its structural features are a good fit for Skaneateles Lake's long and narrow basin (long and relatively narrow) and because an earlier version of CE-QUAL-W2 was successful in simulating thermal features of the lake. CE-QUAL-W2 is also the most widely used hydrothermal/transport model in the US and one that UFI has successfully used on other similar lakes.

Soil and Water Assessment Tool (SWAT)

The 9E Plan approach relies on a quantitative watershed model that predicts the transport of pollutants to the water body and that can be used to make recommendations to meet the 9E targets. The model selected for the Skaneateles Lake watershed analysis is the Soil and Water Assessment Tool (SWAT). This watershed model was developed and is currently supported by the joint efforts of the USDA Agricultural Research Service and Texas A&M AgriLife Research (Arnold, 1998) (Neitsch, 2011). The model's base code is in the public domain, and SWAT is the topic of more than 2,000 scientific journal articles. Many of the model's calculations are carried out on land units called hydrologic response units (HRUs). These HRUs represent unique combinations of soil type, slope, and land use (LU). In a large model, HRUs may be very general and represent only the most dominant combinations of these factors; however, finer scale models can represent a large number of these unique soil-slope-land combinations. SWAT can represent a range of agricultural crops and management conditions as well as other land cover/use types, and it provides outputs for hydrology, nutrients, and sediment at a daily time step.

The SWAT model framework contains the following features that will allow it to be used to meet the project objectives:

- Spatial extent: HRU land sizes can be near field scale, making it possible to implement detailed conservation practice modeling.
- Temporal resolution: annual, monthly, or daily modeling time steps available.
- Crops: corn (grain & silage), soybean, wheat, cotton, potatoes, rice, alfalfa, barley, and others.
- Cropping systems: The model allows for multi-year

crop rotations.

- Agricultural Practice Considerations: The model allows for the simulation of changes in water quality outcomes due to a range of conservation practices.
- Field and Subbasin Level Outputs: The key outputs are quantitative nutrient losses from near-farm-field (HRU) scale and the subbasin scale in both runoff and subsurface flow:
 - Total N (both dissolved and adsorbed forms) in quantity per land unit area per year (e.g., lbs-N/acre/year);
 - Total P (both dissolved and adsorbed forms) in quantity per land unit area per year (e.g., lbs-P/acre/year); and
 - Sediment load in runoff per land unit area per year (e.g., tons/acre/year)
- Instream Outputs: The key outputs are instream nutrient and sediment concentrations and loadings available at the outlet of each modeled subbasin.

The SWAT model approach has been successfully used to model other Finger Lakes watersheds, including Seneca and Keuka Lakes, Cayuga Lake, Canandaigua Lake, and Owasco Lake.

Literature Review

In addition to the modeling, a literature review was conducted to develop an estimate for the average phosphorus reduction that can be expected for each linear foot of streambank stabilization done in the watershed. This research drew on data from other watersheds in the Great Lakes region, peer-reviewed journal articles on this subject, and data from the Chesapeake Bay's watershed protection program. The results of this research can be found in Section 4.3 under Scenario 5.

1.4 Public Participation and Outreach

A Public Participation Plan was developed for this project in conjunction with the NYS DOS, NYS DEC, and project stakeholders. Watershed stakeholders include all of the people who live in, work in, and visit the watershed. This includes agricultural producers, seasonal and permanent residents, business owners and employees, and short-term vacationers. Because the lake is the water supply for the City of Syracuse, the city's residents are also stakeholders in this process, represented by the City's Water Department.

This plan outlines the public participation strategy that was used in the development of this plan, specifically:

- Convening the WAC
- Regular meetings of the Modeling Team
- The role of the Public Outreach Subcommittee

- Development of a project website (<https://skaneateles9e.cnyrpdb.org/>)
- A minimum of three public meetings.

The WAC met a total of 18 times between spring 2022 and summer 2024 to discuss all aspects of the 9E Plan's development. Because the WAC's membership included municipal representatives, included elected officials at the village, town, and county level, as well as representatives of membership organizations such as SLA, the Nature Conservancy, and local land trusts, the WAC's members were able to provide input informed by experience with a broad swath of watershed residents. The WAC also provided critical input on the content presented in public meetings.

Public meetings were held on the following dates:

- June 15, 2022 – In-person meeting at Lourdes Camp, Town of Spafford
- June 22, 2022 – Virtual public meeting (held via Zoom)
- January 30, 2024 – In-person meeting, Town of Skaneateles Town Hall
- May 21, 2024 – In-person meeting, The Lodge

Recordings of the public meetings are available at: <https://skaneateles9e.cnyrpdb.org/get-involved/>

Press releases were issued prior to the public meetings, and they were advertised through the Skaneateles Lake Watershed website (www.skanlakeinfo.org), as well as municipal websites.

Public input on the plan's Vision and Goals was pursued through display boards at the June 15, 2022 meeting and through interactive software (Jamboards) at the June 22, 2022 virtual meeting. The public's input on watershed project priorities was sought through polling tools at the January 30, 2024 meeting.

The May 21, 2024 meeting was the public's opportunity to review the plan's recommendations and to discuss in greater detail how the plan will be implemented.

An additional public meeting following plan completion (Spring 2025) is anticipated, in order to mark the transition from the plan development phase to plan implementation.

The Public Participation Plan and meeting summaries are included as Appendix E.



Attendees at the first public meeting, providing feedback on the project's vision and goals

Watershed Vision and Goals

Vision

Maintain the excellent water quality in Skaneateles Lake to ensure continued enjoyment and use of the lake for drinking water, recreation, aesthetic, social, and community value as well as habitat for a diverse assortment of native species. Implement sustainable watershed management practices to improve the ecological integrity of the land and water for all forms of life.

Goals

Land Use and Stormwater Management Goals

- ▶ Enhance measures to capture and infiltrate stormwater across the landscape.
- ▶ Continue the work that is being done with the agricultural community through the Skaneateles Lake Watershed Agricultural Program.
- ▶ Best Management Practice (BMP) selection and design will factor in projected changes in climate and rainfall.

Residential Inputs

- ▶ Work with residents and property owners to implement BMPs that will improve water quality.
- ▶ Continue to promote lake-friendly living practices among watershed residents.

Roadway Maintenance

- ▶ Work with NYS Department of Transportation (NYSDOT) and local highway departments to implement maintenance practices to minimize adverse water quality impacts.

Invasive Species Management

- ▶ Implement programs in prevention, early detection, and rapid response to aquatic and terrestrial invasive species.

Education & Outreach

- ▶ Continue to educate watershed stakeholders on issues, opportunities to participate in water quality improvement, and ongoing lake protection activities.
- ▶ Continue to build community awareness of how human activities affect the future of the Skaneateles Lake Watershed.

9E Targets

Total Phosphorus

The current three-year average level of TP in Skaneateles Lake is 4.5 µg/L, based on sampling data from the Citizens Statewide Lake Assessment Program (CSLAP) data. **This 9E Plan's target is to maintain a TP level of 4.5 µg/L based on a three-year rolling average of CSLAP measurements, taken during the summer months (June 1st through September 30th).**

Chlorophyll-a

Additionally, measuring and tracking chlorophyll-a levels provides an indicator of a water body's overall biological productivity. Chlorophyll-a levels in Skaneateles Lake for the period from 2017 to 2022 were at or slightly above 1.0 µg/L. This plan's goal is to ensure that these levels do not increase, given the effects of climate change. **The target level for chlorophyll-a is to maintain a summertime average of 1.0 µg/L.**



Photo by Ty Denslow, courtesy of Skaneateles Lake Association

2. Watershed Characterization

2.1 Physical and Natural Features

Lake Origin and Geographic Location

Skaneateles Lake was formed more than 2 million years ago during the Pleistocene Epoch. Glacial scouring carved deep slices into the land through the area, moving land and rocks southward. As the ice gradually melted and the glaciers receded, valleys of water dammed by unconsolidated glacial debris were left, which are now the Finger Lakes (NYSDEC 2020).

Skaneateles Lake takes its name from the Haudenosaunee for “long lake.” It is one of the 11 Finger Lakes located in Central New York. It is the third deepest, has the fourth largest volume and is the fifth smallest by surface area of the Finger Lakes (Upstate Freshwater Institute 2019). The Skaneateles Lake Watershed encompasses portions of Cortland, Cayuga, and Onondaga counties. It is within the Oswego River Drainage Basin Series, specifically the Skaneateles Creek Drainage Basin, encompassing approximately 59 square miles (37,760 acres) (Skaneateles Lake Association 2015).

Lake Morphology

Skaneateles Lake is 16 miles long with a northwest orientation, a maximum width of 1.5 miles, average width of 0.75 miles and approximately 34 miles of shoreline (Figure 1.2).

The lake is bordered along portions of its length by steep cliffs. It is topographically elevated at 863 feet above mean sea level and has a surface area of 13.6 square miles (8,704 acres), which is approximately one fourth of the basin area. This relatively low watershed-to-lake ratio is often associated with higher water retention times as well as relatively low sedimentation rates and land-based loading of phosphorus. There is no primary inlet, but many tributaries and a single natural outflow at the northern end of the lake, Skaneateles Creek (Figure 2.2). The lake is classified as oligotrophic, characterized by low levels of nutrients and chlorophyll-a and high water clarity (NYSDEC 2020).

Bathymetry

Skaneateles Lake has a volume of 413 billion gallons, a maximum depth of approximately 315 feet and an average depth of 145 feet (NYSDEC 2020). Due to its steeply sloping, “bathtub” shaped bathymetry, the lake has a small littoral zone (i.e., nearshore zone of full sunlight penetration), and 80% of the lake exceeds 30 feet in depth (Figure 2.1) (Kelly, et al., 2024).

Soils

The major soil associations found in the northern two-thirds of the watershed are: Honeoye-Lima, Lansing-Conesus, Honeoye-Lansing, and Aurora-Angola-Darien (See Table 2.1 and Figure 2.3). These associations are generally characterized as deep, medium textured silt loams and gravelly

Table 2.1 – Soil Associations

Association	County	Percent of Watershed	Dominant Location in Watershed	Percent of Watershed*	Slope	Soil Type and Seasonal Ground Water	Drainage/ Permeability
Honeoye- Lima	Onondaga	39%	West & Northwest Onondaga	20%	2-8%	Deep, medium textured silt loams and gravelly silt loams Groundwater: 15-36"	Moderately-well to well-drained and very slow to moderately permeable
Lansing- Conesus	Onondaga & Cayuga	17% and 22%	Spafford Uplands and Northeast Cayuga	16%	2-8%		
Honeoye-Lansing	Onondaga	9%	Spafford Shoreline	6%	15-25%		
Aurora- Angola-Darien	Onondaga	14%	North of Spafford Town Line	8%	2-8%	Deep, medium textured silt loams Groundwater: 6-20"	Poorly to moderately well drained
Langford- Erie	Cayuga	45%	South Cayuga	15%	2-25%		Poorly to well drained and slow to moderately permeable
Valois- Langford-Lansing	Cortland	87%	Lowlands	15%	2-55%	Medium textured and gravelly silt loams Groundwater: 18-60"	Poorly to well drained

Source: Skaneateles Lake and Watershed 2019 Annual Report, City of Syracuse

*These six soil associations are the major soil groups in the Skaneateles Watershed and make up 80% of the watershed. The remainder of the watershed is made up of minor soil associations with characteristics similar to these major groups.

silt loams. Permeability is slow to moderate and seasonal groundwater is generally 15 inches to less than 36 inches.

The Langford-Erie Association comprises the southwestern portion of the watershed. It is considered a deep, medium textured silt loam. The soils are slowly to moderately permeable. Seasonal groundwater and bedrock are shallow at between six and 20 inches for the Langford Series, and between 20 and 40 inches for the Erie series.

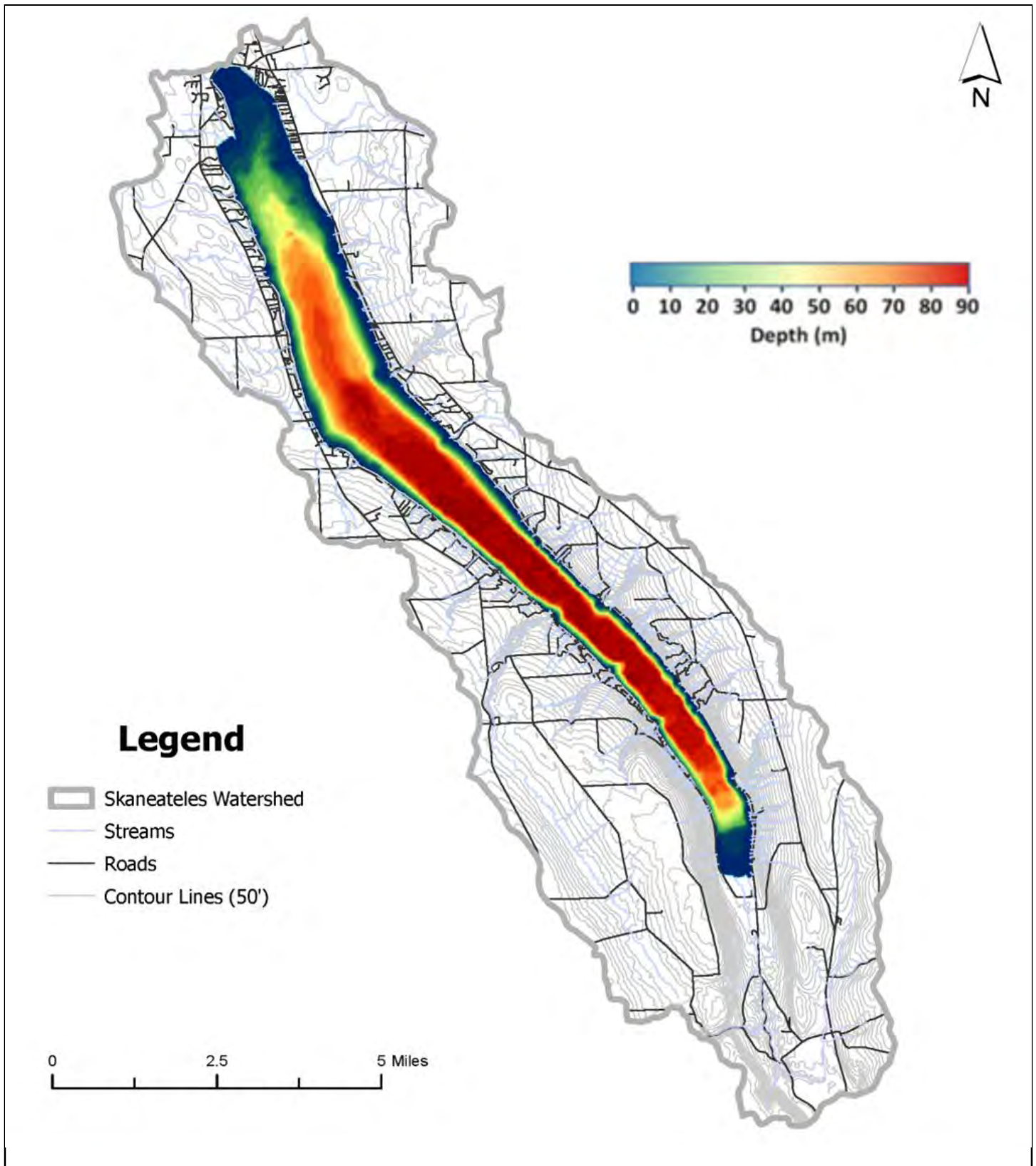
There are three associations found primarily within Cortland County (the southeastern portion of the watershed): Valois-Langford-Lansing, Volusia-Mardin-Lordstown, and Lordstown-Volusia-Mardin. The soils are medium textured silt loams and gravelly silt loams. Slopes can be extreme and can exceed 55%. They are poorly to well drained and very slowly to moderately permeable. Seasonal groundwater ranges from 18 inches to 60 inches (City of Syracuse 2020).

All soils in the watershed pose a severe risk of erosion if left bare, with increasing degree of slope compounding the potential for soil loss. The use of conventional onsite wastewater treatment systems (OWTS) is severely limited due to high seasonal groundwater, degree of slope, and poor permeability (City of Syracuse 2020).

Topography

Much of the lake's shoreline is steeply sloped, especially at the southern end of the lake where cliffs can exceed 100 feet in height (Figure 2.4). Generally, the elevation is higher and the slopes are steeper in the southern portion of the watershed as compared to the northern area. The highest elevation is found in the southeastern watershed at 1,980 feet above sea level (City of Syracuse 2022).





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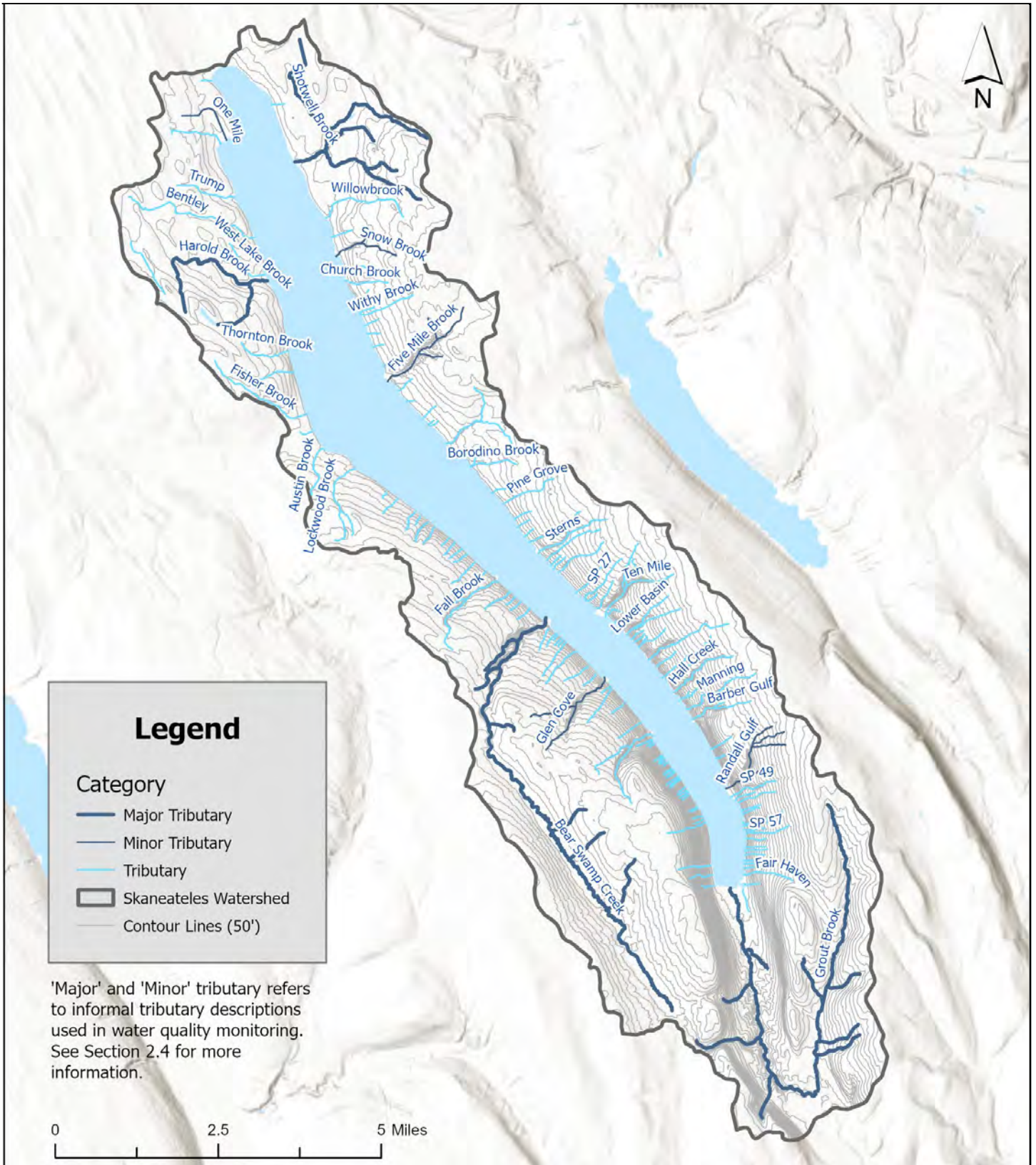
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Figure 2.1 – Lake Bathymetry

Source: Upstate Freshwater Institute
Basemap: Esri
Coordinate System: NAD UTM Zone 18N



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Figure 2.2 – Skaneateles Lake Tributaries

Source: City of Syracuse (for full map, see Appendix F)
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA

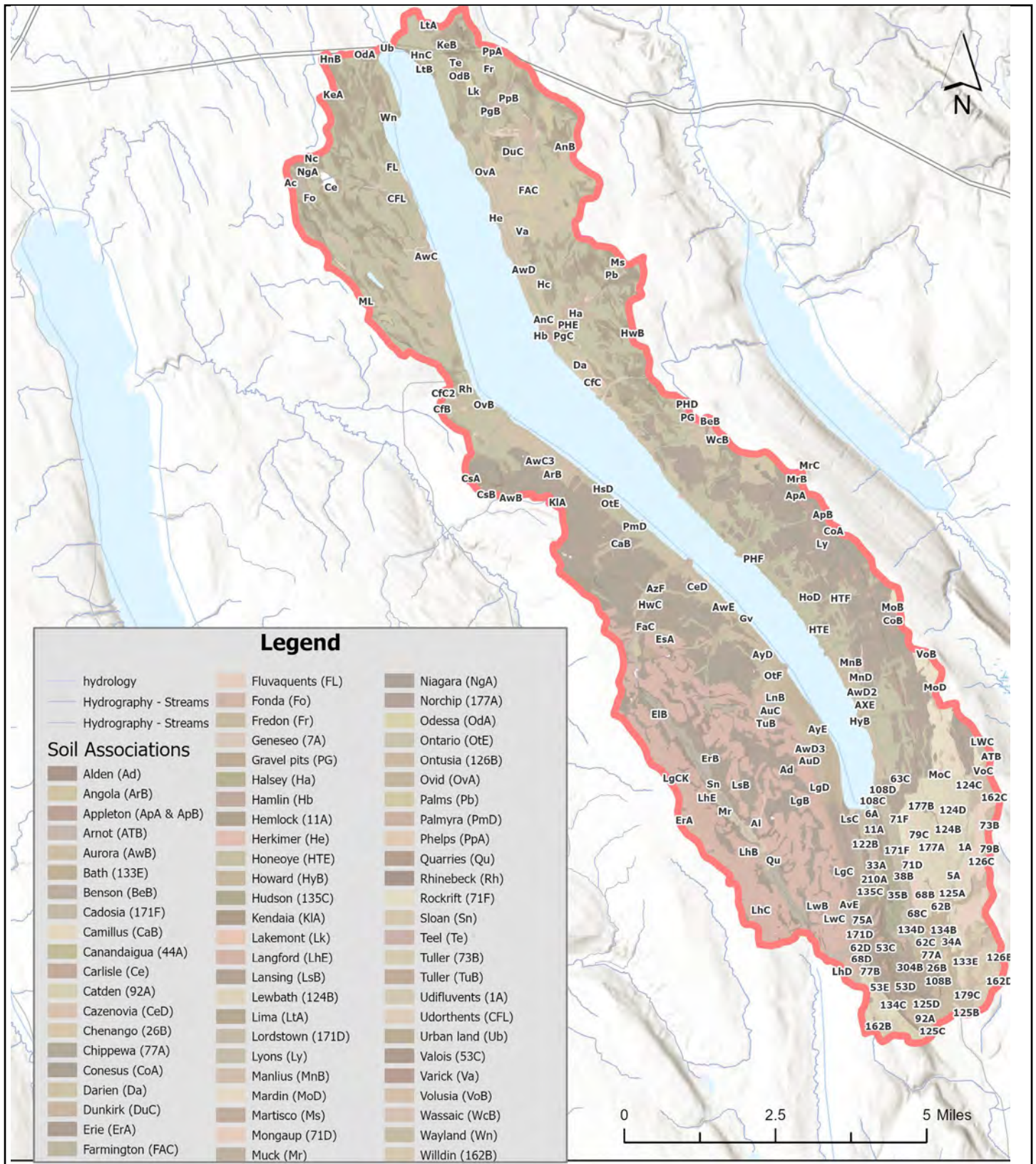
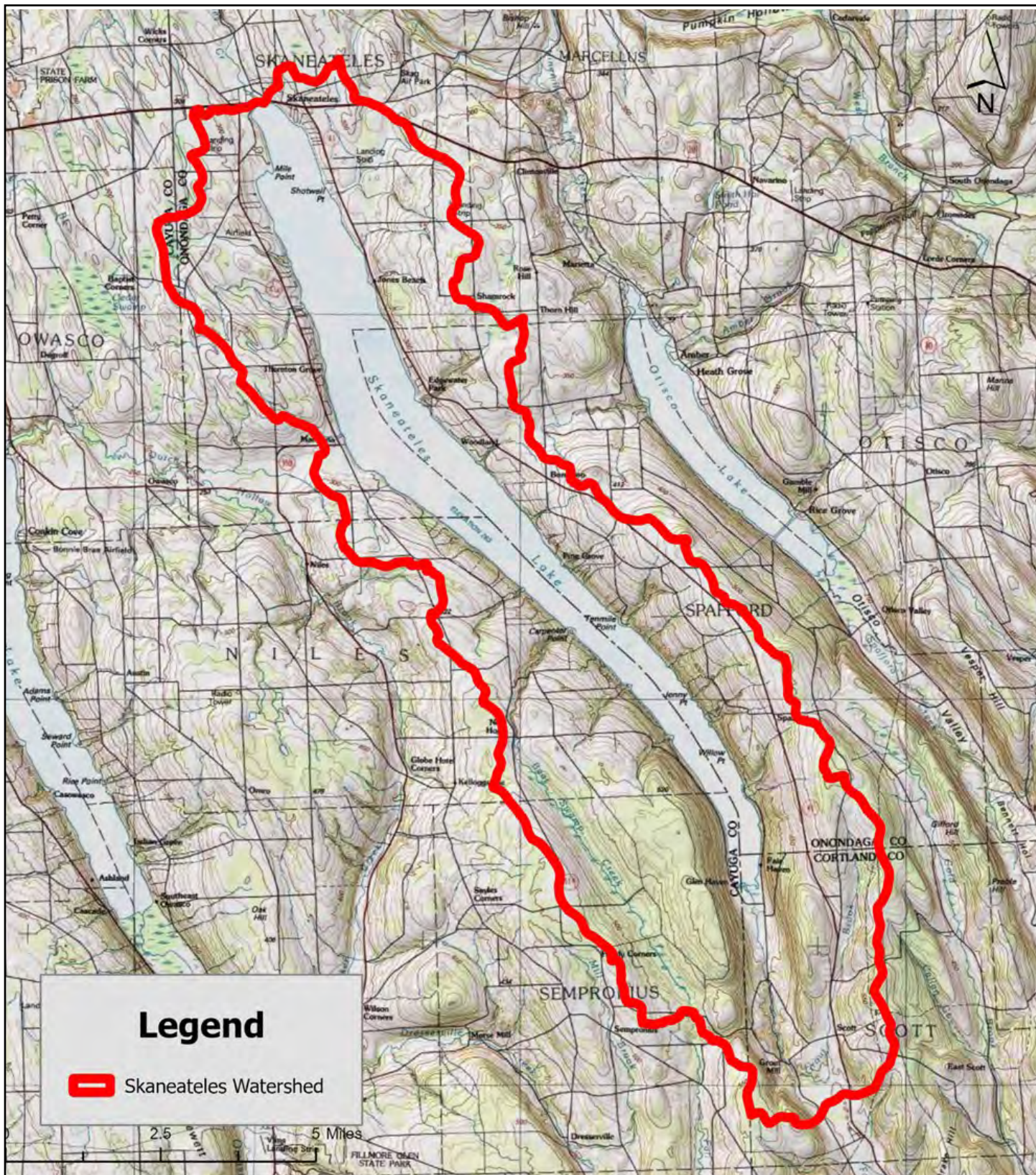



Figure 2.3 – Soil Associations

Source: NRCS Soil Survey Geographic Database
 Some association variants not shown in legend due to space constraints
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

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Figure 2.4 – Skaneateles Watershed Topography

Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
Coordinate System: NAD UTM Zone 18N

2.2 Hydrology

Skaneateles Lake’s hydraulic retention time, or the average amount of time it takes water to pass through the lake, is relatively long: approximately 18 years on a fully mixed basis (Upstate Freshwater Institute 2019). The lake drains north to Skaneateles Creek, which flows into the Seneca River, and from there to Lake Ontario.

USGS Hydrologic Units

The United States Geological Survey (USGS) divides the landmass of the United States into a hierarchical system of “hydrologic units” based on surface hydrological features and topography. Each of these hydrologic units is assigned a code (a hydrologic unit code, or HUC) of two to twelve digits, with the twelve-digit subwatershed level (HUC-12) being the smallest geographic unit in the system. Because HUC-12 subwatersheds are self-contained water drainage basins, they are a helpful geographic division for water resource management, resource protection and enhancement planning activities, and data collection.

The Skaneateles Lake Watershed (HUC 0414020116) is split into two HUC-12 subwatersheds (see Figure 2.5) :

- Skaneateles Lake Outlet (HUC 041402011605): northern half of the watershed
- Grout Brook (HUC 041402011604): southern half of the watershed

The Skaneateles Lake Outlet subwatershed is just under 12,500 acres and takes in much of the Village of Skaneateles, as well as the relatively heavily developed residential areas on the lake’s shore, including the Skaneateles Country Club and lake front homes accessed by minor roads branching off State Routes 41 and 41A on the east and west sides of the lake. This area’s topography tends to be less steep than the southern half of the watershed, making it more conducive to development.

The Grout Brook-Skaneateles Lake subwatershed is approximately 24,800 acres and is characterized by forested areas and steep slopes. There are no villages or large communities in this subwatershed; hamlets include Borodino in the Town of Spafford and New Hope in the Town of Niles. Many of the lakeside homes and cottages in this area are accessed by fire lanes and privately-maintained roads.

Subwatersheds

The SWAT model divides the watershed into 773 hydrologic response units (HRUs), based on factors such as land use, soils, and slope. These HRUs are relatively small geographically. In order to have a manageable number of subwatersheds, and to make it easier to visually represent the model’s results, this 9E Plan aggregates the HRUs into ten subwatersheds, shown in Figure 2.5. Table 2.2 provides basic information about these subwatersheds.

Table 2.2 – Subwatersheds from Watershed Modeling

HUC-12	Subwatershed	Acres
Skaneateles Lake Outlet	Northeast	3,981
	Northwest	4,643
	Shotwell Brook	2,230
	North	1,326
	Central East*	2,871
	Central West*	2,450
Grout Brook	Bear Swamp Creek	5,811
	Grout Brook	6,590
	Southeast	4,456
	Southwest	3,458
	Total	37,816

**The Central East and Central West subwatersheds include small portions in the Skaneateles Lake Outlet HUC-12.*

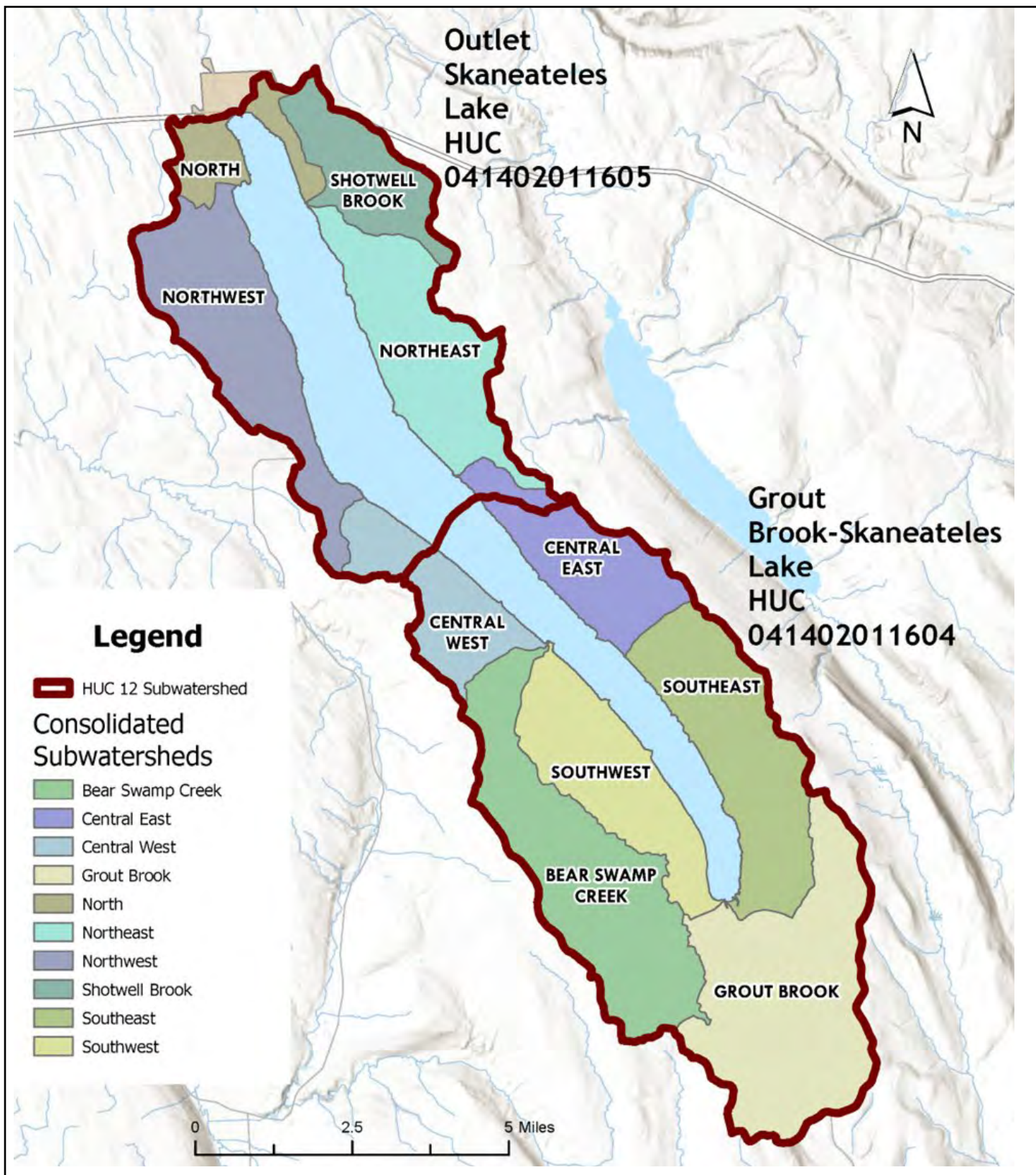





Figure 2.5 – HUC 12s and Aggregated Subwatersheds from SWAT Modeling

Source: LimnoTech
Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
Coordinate System: NAD UTM Zone 18N


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2.3 Land Cover

Skaneateles Lake has a total watershed area of approximately 37,300 acres, with a watershed-to-lake ratio of approximately 4.3 acres of watershed land to each acre of lake. Most of the land in the watershed (86%) is either forested or used for agriculture (see Figures 2.6 and 2.7 and Table 2.3). Agriculture, in the form of both cultivated crops and pasture, is the largest land cover in the watershed, occupying more than 16,000 acres (44%) of the watershed’s area. Agricultural uses are found on both the eastern and western sides of the watershed, between the developed village area on the north and the forested area on the south.

Forested areas – including deciduous, evergreen, and mixed forests – make up 42% of the watershed. Forested areas are found throughout the watershed but are the dominant land cover on the lake’s southern end. Bear Swamp State Forest covers more than 3,500 acres in the watershed’s southwestern corner. This includes the largest single wetland in the watershed (Bear Swamp), but there are more than 1,200 acres of wetlands scattered throughout the watershed, including a large wetland area at the mouth of Grout Brook in the Town of Scott.

Very little of the watershed is developed – roughly 1,100 acres (3%) is categorized as being in medium- or low-intensity development (there are no areas of high-intensity development in the watershed). An additional 2,160 acres is categorized as “open space” development, including parks, golf courses, and residential land (lawns).

Figure 2.6 shows land cover for the Skaneateles Watershed as it is categorized by the National Land Cover Database (NLCD) , which is maintained by the United State Geological Service (USGS) (<https://www.usgs.gov/centers/eros/science/national-land-cover-database>). The NLCD provides mapping and descriptive data for characteristics of the land surface such as thematic class (e.g., urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. NLCD data is useful because it is updated periodically and uses a standard set of land cover categories, allowing users to track changes in land use over time.


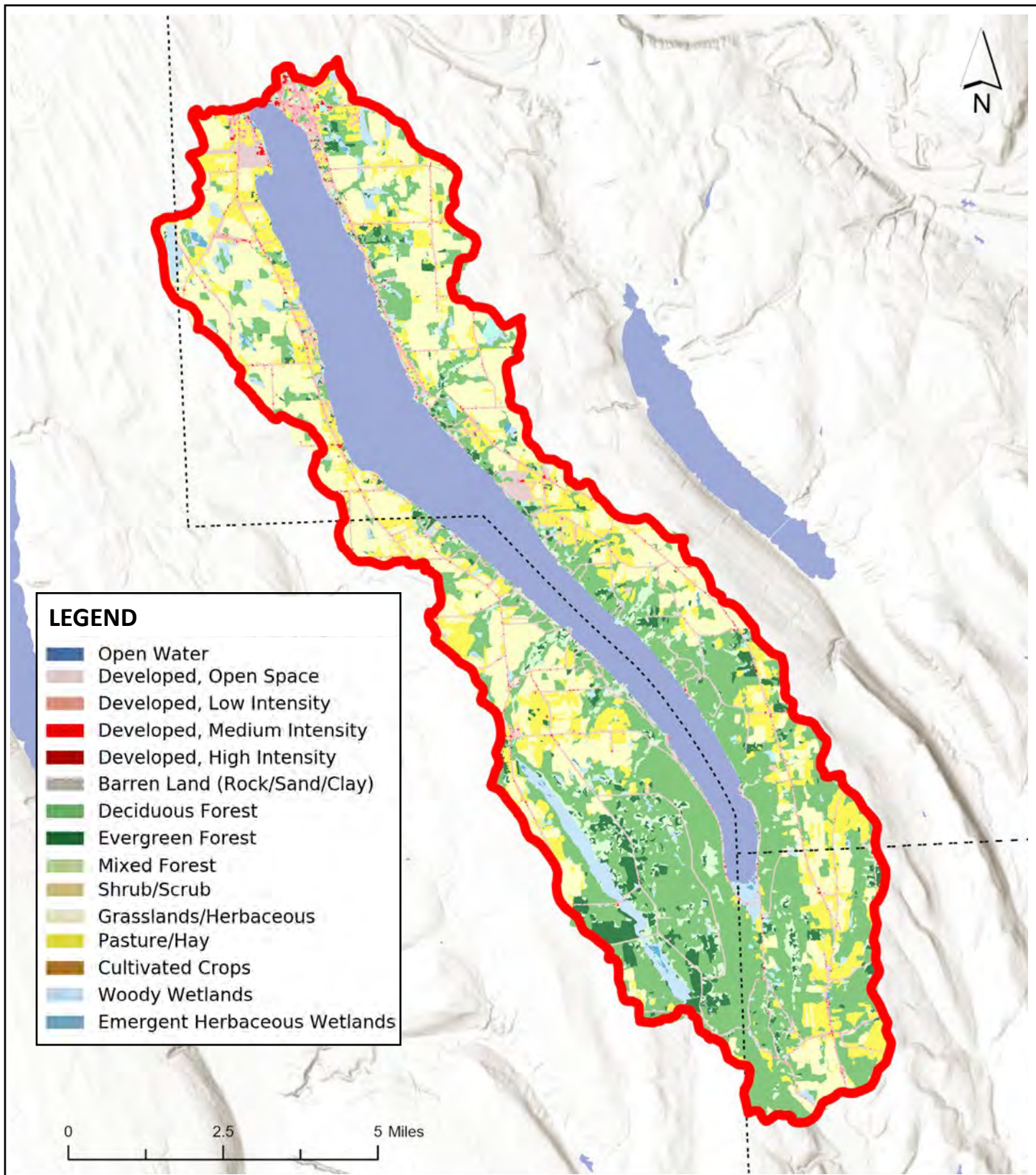
Land Cover in the Skaneateles Lake watershed has remained largely stable over the past two decades. As part of the NLCD 2019 release, a change index was included that indicated various changes in land cover from 2001 to 2019. Land cover changes of interest are expansion of urban and/or agricultural land cover types, and loss of wetland, which are not extensive in the period from 2001 to 2019. Most of the land cover changes in the Skaneateles Lake watershed were within classes (i.e. from cultivated crops to hay/pasture or vice versa). There was a modest increase in development intensity around the Village of Skaneateles (Boles, 2024).

NLCD data is based on satellite imagery and does not include local data that is useful in assessing nutrient loading, such as crop types. Figure 2.7 shows a slightly different categorization of land cover in the watershed; these are the land cover categories utilized in the SWAT model. The SWAT model’s land cover data includes information from the watershed’s agricultural community, including where row

Table 2.3 – Land Cover by HUC-12 Subwatershed

Land Cover	Skaneateles Lake Outlet		Grout Brook		Total	
	HUC 041402011605		HUC 041402011604			
	<i>Acres</i>	<i>Percent</i>	<i>Acres</i>	<i>Percent</i>	<i>Acres</i>	<i>Percent</i>
Cultivated Crops	5,892	46%	4,900	20%	10,792	29%
Deciduous Forest	1,829	14%	10,661	43%	12,490	33%
Developed - Low Intensity	604	5%	342	1%	946	3%
Developed - Medium Intensity	110	1%	61	0.2%	171	0%
Developed - Open Space	800	6%	1,361	5%	2,161	6%
Evergreen Forest	282	2%	1,514	6%	1,796	5%
Hay/Pasture	2,089	16%	3,527	14%	5,616	15%
Mixed Forest	163	1%	1,375	5%	1,538	4%
Shrub/Scrub	201	2%	331	1%	532	1%
Woody Wetlands	510	4%	765	3%	1,275	3%
TOTALS	12,480	100%	24,837	100%	37,317	100%

Source: USGS National Land Cover Database, 2019



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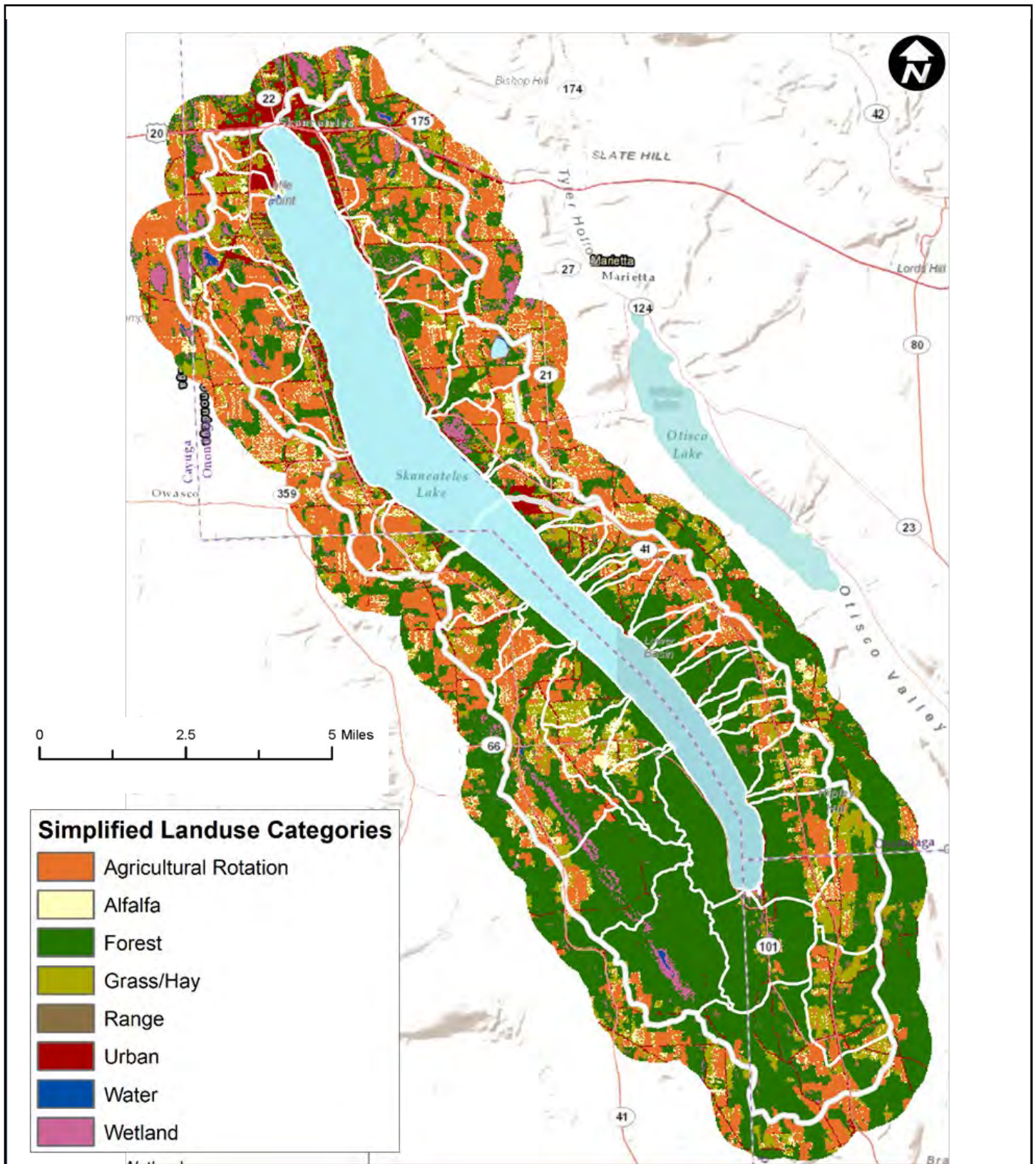
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Figure 2.6 – Watershed Land Cover

Source: 2019 National Land Cover Database
Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
Coordinate System: NAD UTM Zone 18N



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This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

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Regional Planning & Development Board

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Figure 2.7 – Simplified Land Use as used in SWAT Modeling

Source: LimnoTech/Soil and Water Assessment Tool
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

crops are grown in a rotational system.

2.4 Floodplains & Flooding

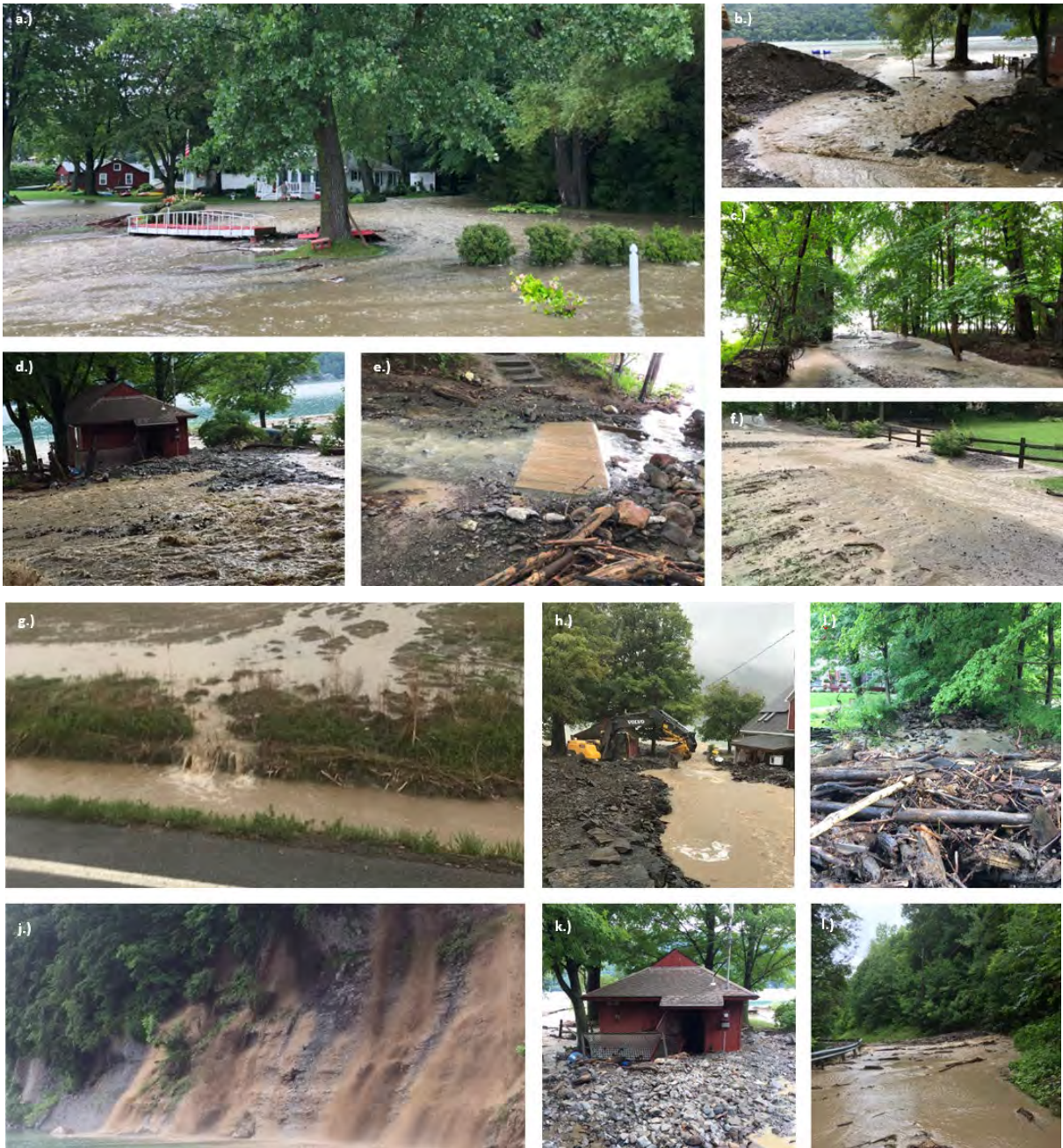
According to the Federal Emergency Management Agency’s (FEMA) flood zone mapping, there are three major floodplain areas in the watershed (see Figure 2.8):

- Bear Swamp Creek

- Grout Brook inlet area
- Shotwell Brook area

The Bear Swamp Creek and Grout Brook inlet flood zones largely overlap the wetlands in these areas.

During storms, all of the watershed’s tributaries (Figure 2.2), including ephemeral streams that are usually dry gullies, become conduits for stormwater discharge to the lake. During major storms, these streams can become overwhelmed and stormwater can flood adjacent structures, infrastructure, and residences. The photos below, taken during and after



These photos demonstrate the effects of stormwater on structures, infrastructure, and the landscape in the Skaneateles Watershed, during and after major rain events. Note the high level of turbidity and sedimentation apparent in the stormwater. Photos a.), c.), and e.) show the remnants of Tropical Storm Fred in 2021 (Courtesy of Skaneateles Lake Association). Photos b.), d.), j.), k.) and l.) were taken during and after severe storms in 2017 (Courtesy of John Hinchcliff). Photos f.), g.), h.), and i.) show a variety of rain events across the watershed (Courtesy of the City of Syracuse).

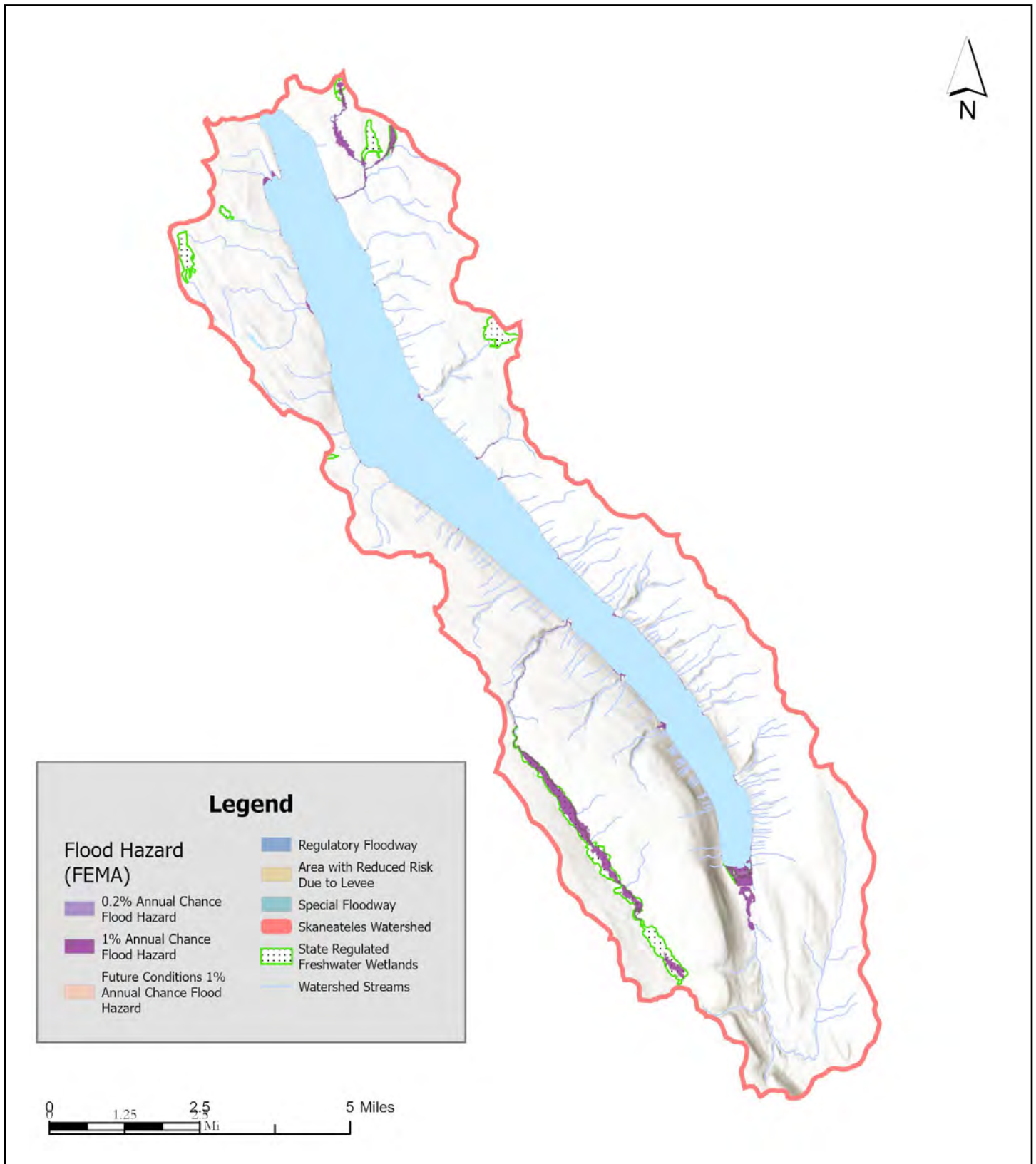


Figure 2.8 – Floodplains and Wetlands

Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

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storm events in recent years, provide examples of stormwater flooding around the watershed.

2.5 Water Quality Classifications

All surface waters in New York State are classified according to their best uses, such as drinking water, swimming, boating, and fishing, with each classification assigned a specific letter rating (A, B, C, and D – see Table 2.4). Water quality standards associated with each classification define the maximum allowable levels of chemical pollutants for that class. Standards are intended to ensure that water bodies can continue to be used for their best uses. New York State Regulation 6 Part 703 defines these standards.

Skaneateles Lake

As shown in Table 2.5, Skaneateles Lake is a Class AA waterbody, best utilized for drinking water, culinary or food processing purposes, primary and secondary contact recreation, and fishing. Class AA waters, if subjected to approved disinfection treatment, with additional treatment (if

necessary) will meet New York State Department of Health (NYSDOH) drinking water standards (New York State 2021). Skaneateles Lake is the unfiltered water supply for the City of Syracuse.

Major Tributaries

The four largest tributaries to Skaneateles Lake, in terms of the surface area they drain, are:

- Bear Swamp Creek,
- Grout Brook,
- Shotwell Brook, and
- Harold Brook.

Table 2.4 – New York State Water Quality Classifications

Classification	Best Usage
A, AA, A-S, AA-S	Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish and wildlife propagation and survival
B	Primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival.
C	Fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
D	Fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish, shellfish and wildlife survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
<i>Additional Designations</i>	
(T)	Suitable for Trout
(TS)	Suitable for Trout Spawning
Source: New York State Code of Rules and Regulations, Section 6, Part 701	

Table 2.5 – Waterbody Classifications and Standards for the Skaneateles Creek Drainage

Surface Water Body	Description	Class	Standards
Skaneateles Lake	Located at source of Skaneateles Creek and extending southeasterly of Village of Skaneateles for a length of approximately fifteen miles.	AA	AA
Tribs. of Skaneateles Lake	Enters Skaneateles Lake from generally easterly directions in section beginning at Village of Skaneateles and extending along easterly side of lake to Five Mile Point.	AA	AA
Trib. of Skaneateles Lake	Enters Skaneateles Lake from northeast at Five Mile Point and 5.5 miles southeast of Skaneateles.	AA	AA
Tribs. of trib. 14 of Skaneateles Lake	Enter trib. 14 of Skaneateles Lake from east and northeast 0.7 and 1.0 mile upstream from mouth respectively and 1.8 and 1.5 miles southwest of Thorn Hill.	AA	AA
Tribs. of Skaneateles Lake	Enter Skaneateles Lake from generally easterly directions in section beginning at Hardscrabble Point and extending along easterly side to southerly end of lake.	AA	AA
Grout Brook	Enters southerly end of Skaneateles Lake from south 1.5 miles south of Spafford Landing.	AA	AA(T)
Tribs. of Grout Brook	Enter Grout Brook in section beginning 1.0 mile upstream from mouth and 3.7 miles south of Spafford and extending upstream to source.	AA	AA
Tribs. of Skaneateles Lake	Enter Skaneateles Lake from generally westerly directions in section beginning at southerly end and extending along the westerly side of lake to Carpenter Point.	AA	AA
Bear Swamp Creek	Enters Skaneateles Lake from southwest at Carpenter Point and 2.0 miles northeast of New Hope.	AA	AA(T)
Tribs. of Bear Swamp Creek	Enter Bear Swamp Creek in section beginning 0.6 mile upstream from mouth and 1.5 miles northeast of New Hope and extending upstream to source.	AA	AA
Tribs. of Skaneateles Lake	Enter Skaneateles Lake from generally westerly directions in section beginning at Carpenter Point and extending along westerly side to Village of Skaneateles at northerly end of lake.	AA	AA

Source: Table 1, 6 CRR-NY 896.4NY-CRR; <https://govt.westlaw.com/>; current through April 15, 2021

Between them, these four streams drain approximately 60% of the lake’s watershed (Upstate Freshwater Institute 2019). Figure 2.2 shows the location of these major tributaries. Table 2.6 provides a summary of the land cover in the drainage areas of these four major tributaries.

Bear Swamp Creek

Bear Swamp Creek is a Class AA(T), second order stream. It originates from an extensive, but narrow, wetland complex in the southwest portion of the Skaneateles Lake Watershed in Bear Swamp State Forest. The creek meets Skaneateles Lake at Carpenter Point. The drainage area is nine square miles, of which 62% is forested.

Bear Swamp Creek runs north from the uplands on the southwest side of the lake, forming Carpenter Falls on its way to its outlet on the west side of Skaneateles Lake. The Bear Swamp Creek Subwatershed has some of the steepest slopes in the watershed, with a maximum slope of 151%. The mean slope is 8%, and 11% of the subwatershed is made up of steep slopes.

Grout Brook

Grout Brook is a Class AA(T) stream that originates south of Skaneateles Lake, entering the lake in the Town of Scott in Cortland County. Grout Brook’s drainage area is approximately ten square miles – the largest area of the four major tributaries. The bulk of this area (60%) is forested. Agricultural uses are concentrated in the eastern part of this subwatershed.

The topography of the Grout Brook subwatershed is a mix of steep slopes and gentle terrain. Over a third of the subwatershed is comprised of steep slopes, and Grout Brook has the highest average slope of any of the major or minor watersheds: 15%. Grout Brook starts in the uplands to the east of the lake and runs due south through steep terrain, before turning north to run through the relatively gentle terrain in the flatlands south of the lake.

Shotwell Brook

Shotwell Brook is a Class AA stream that enters Skaneateles Lake in the northeast corner of the lake, approximately one mile south-southeast of the Village of Skaneateles and the City of Syracuse’s drinking water intakes; the creek flows under Highway 20 east of the Village of Skaneateles.

Shotwell Brook has the third largest watershed of the major tributaries (3.5 square miles). Shotwell Brook’s watershed has the largest percentage of developed land of the major tributaries (7%); more than two-thirds of this drainage area is used for agriculture (64%). The Shotwell Brook subwatershed is characterized by gently sloping terrain. The average slope gradient is 5%, and the average slope for the subwatershed is 3%.

Harold Brook

Harold Brook is a second order Class AA stream located in the northwest region of the lake; it enters Skaneateles Lake approximately 2.5 miles southwest of the drinking water intakes. Of the lake’s four major tributaries, Harold Brook has the smallest drainage area (two square miles), but it has the largest percentage of agricultural land (73%) (Upstate Freshwater Institute 2019). The Harold Brook subwatershed is characterized by gentle slopes; the average slope is 5.6%.

Minor Tributaries

In addition to the four major tributaries to Skaneateles Lake, there are more than 140 smaller tributaries, many of which are ephemeral (i.e., they only carry water during, and for a short period after, precipitation events). While each of the lake’s minor tributaries has a relatively small impact on total water quality, the aggregate effect of these streams’ inputs is substantial.

Prior to 2019 there was very little data on the lake’s minor tributaries, but a gap analysis conducted in 2019 indicated that water quality and flow information from six minor tributaries would be of significant value to future water quality modeling efforts (NYSDEC, 2019). The six minor tributaries

Table 2.6 – Drainage area and Land Cover of Major Tributaries

Tributary	Area (sq mi)	Pasture and Hay (%)	Cultivated Crops (%)	Forest and Grasslands (%)	Developed (%)	Wetlands (%)	Other (%)
Grout Brook	10	18	13	60	5	2	2
Bear Swamp Creek	9	7	15	62	4	10	2
Shotwell Brook	3.5	21	43	20	7	7	2
Harold Creek	2	8	65	17	4	5	1

Source: UFI Ten Tributaries Report; Area delineated from StreamStats (USGS 2016). Land cover from 2016 National Land Cover Dataset.

Table 2.7 – Drainage area and Land Cover of Six Minor Tributaries

Tributary	Area (sq. mi.)	Pasture and Hay (%)	Cultivated Crops (%)	Forest and Grasslands (%)	Developed (%)	Wetlands (%)	Other (%)
Upper Bear Swamp	2.0	3	4	76	3	11	3
Five Mile Creek	1.4	8	49	28	4	3	8
Glen Cove	1.0	26	37	26	6	3	2
Randall Gulf	1.0	20	22	53	3	0	2
Snow Brook	0.6	3	70	21	3	0	3
One Mile Creek	0.4	32	26	0	41	0	1

Source: UFI Ten Tributaries Report; Area delineated from StreamStats (USGS 2016). Land cover from 2016 National Land Cover Dataset.

selected for further study were:

- Randall Gulf,
- Snow Brook,
- One Mile Creek,
- Five Mile Brook,
- Glen Cove, and
- An upstream location of Bear Swamp Creek (Upper Bear Swamp).

The Upper Bear Swamp location was selected based on the potential for water quality differences compared to metrics downstream. The watersheds of the minor tributaries are two square miles or less in area (see Table 2.7; the drainage areas listed here are approximated as there are no USGS gauges present on any of the minor tributaries). Qualitative observations by residents suggest that some of the selected minor tributaries are ephemeral.

Upper Bear Swamp

Upper Bear Swamp is located at the southernmost end of the Bear Swamp Creek watershed. The approximately two square mile watershed is within a state-owned forest preserve and has the highest percentage of forested land relative to the other minor tributaries at 76% (Table 2.7). This upstream monitoring location (on Bear Swamp Creek, a Class AA(T) stream, as noted above), was selected because wetlands and upstream damming by beavers may affect the stream stage (depth) and water quality at the mouth delivering different upstream conditions compared to downstream (Upstate Freshwater Institute, 2019).

Five Mile Creek

Five Mile Creek is a Class AA stream that has the second largest watershed of the minor tributaries (1.4 square miles).

It is located approximately six miles south southeast of the Village of Skaneateles. More than half of this watershed is used for agricultural purposes (Table 2.7). Members of Syracuse University monitored stream stage, temperature, and water quality (i.e. phosphorus) of Five Mile Creek in 2019 as well.

Five Mile Creek runs roughly northeast to southwest through down steep slopes; 16% of the subwatershed in steep slopes. The subwatershed has an average slope of 9%.

Glen Cove

Glen Cove is a Class AA stream in the southern portion of the lake. The majority (65%) of this one-square-mile watershed is in agricultural use. Water quality in this tributary was also monitored by Syracuse University during the summer of 2019.

The Glen Cove subwatershed is on the western shore of Skaneateles Lake, where Glen Cove Creek runs through hills to its outlet. Steep slopes make up 19% of the subwatershed and the average slope is 12%.

Randall Gulf

Randall Gulf is a Class AA stream that is also located in the southern portion of the lake. This one-square-mile watershed, also known as the Spafford Brook subwatershed, is mostly forested, but also has substantial agricultural usage (Table 2.7).

Like other subwatersheds in the southern part of the lake, the Randall Gulf subwatershed is characterized by steep topography, with the average slope being 14%. More than a quarter of the subwatershed (26%) is made up of steep slopes.

Snow Brook

Snow Brook is a Class AA stream that enters the lake near the Skaneateles Sailing Club, and the mouth is 4 km from the drinking water intakes. The tributary has a drainage area of 0.6 square miles and is mostly comprised of cropland.

One Mile Creek

One Mile Creek (also known as Mile Creek) is a Class AA stream located in the northern portion of the lake at Mile Point, approximately one mile south of the Village of Skaneateles and 0.6 miles west of the drinking water intakes. Even though it has the smallest drainage area of the minor tributaries (0.4 square miles), the watershed is the most developed (41%; Table 2.7). The developed land is mostly characterized as developed open space (i.e., golf course and country club). Water quality in this tributary was also monitored by Syracuse University during the summer of 2019 (Upstate Freshwater Institute, 2019).

The northern end of Skaneateles Lake is relatively flat and the One Mile Creek subwatershed is no exception: its mean slope is 4% and it has no steep slopes.

Inflows and Outflows

Skaneateles Lake does not have one primary inlet; it has many tributaries that constitute the lake’s inflows. There is one main outflow at the lake’s northern end: Skaneateles Creek. The City of Syracuse controls outflows through a dam (NY00414) located on Skaneateles Creek. Approximately 9.0 billion gallons are discharged through the outlet of the lake annually in order to maintain water levels that satisfy many lake uses including water supply, fisheries and recreation. The rate of discharge is determined based on three criteria through the lake’s outlet for lake elevation management: current levels as compared to the drawdown guideline levels, current rates of precipitation, and the amount of water stored in the snowpack (NYSDEC, 2020).

2.6 Climate

Current Averages

The Skaneateles Lake Watershed’s weather is temperate, characterized by warm summers and cold, snowy winters as is typical to Central New York and the Finger Lakes Regions. Average annual rainfall is 45 inches and average annual snowfall exceeds 100 inches (Table 2.8). The average high temperature in July is 81 degrees Fahrenheit (°F) with an average summer temperature (over June, July, and August) of 69°F. The average low temperature in January is 15°F, and the average overall winter temperature is 26°F (National Oceanic Atmospheric Administration - National Centers for Environmental Information, 2022).

Climate Change

Anthropogenic climate change has been well documented in scientific literature for decades. As a result of increased carbon and methane emissions released into the atmosphere, the average global temperature is increasing. This warming leads to changes in weather patterns including, but not limited to, seasonal air temperatures, precipitation volumes and intensity. It has also introduced more instances of extreme storms, precipitation, and high temperature events (USGCRP, 2023).

The New York Climate Change Science Clearinghouse (NY-CCSC) is one of the best available sources of data on future climate conditions in New York State (NYSERDA, 2022). This data draws on the Coupled Model Intercomparison Project Phase 5 (CMIP5), which compiles the output of 35 climate change models to provide a range of projected future levels (maximum, minimum, and weighted average) for annual average temperature and total precipitation. This data has been downscaled to the county level; results for Onondaga County for the periods 2018 – 2022 and 2048 – 2052 are shown in Tables 2.4 and 2.5.

Table 2.8 – Average Temperatures and Precipitation Levels, Skaneateles, and Auburn, 1991 - 2020

Climate Monitoring Station	Elevation	Avg Winter Temperature	Avg Summer Temperature	Annual Average Rain	Annual Average Snowfall
Auburn	771 ft.	26.0° F	68.7° F	44.3 in.	109.4 in.
Skaneateles	875 ft.	n/a	n/a	45.64 in.	105.7 in.

Source: NOAA NCEI Climate Normals, 1991 – 2020, for Skaneateles and Auburn, <https://www.ncei.noaa.gov/access/us-climate-normals>

Table 2.9 – Annual Average Temperature – Modeled 2022 and 2052 Levels for Onondaga County

Year / Range	Modeled Min (°F)	Modeled Max (°F)	Modeled Mean (°F)
2022 / 2018 – 2022	46.9	51.9	49.5
2052 / 2048 - 2052	48.4	56.23	52.5
2022 - 2052: Total Change	1.6	4.3	3.0
2022 - 2052: Average Annual Change	0.05	0.14	0.10
2022 - 2052: Total Percent Change	3.3%	8.3%	6.1%

Source: New York Climate Change Science Clearinghouse RCP 8.5 for Onondaga County (<https://www.nyclimatescience.org/>)

Table 2.10 – Total Annual Precipitation – Modeled 2022 and 2052 Levels for Onondaga County

Year / Range	Modeled Min (in.)	Modeled Max (in.)	Modeled Mean (in.)
2022 / 2018 – 2022	33.0	53.0	41.6
2052 / 2048 - 2052	30.2	57.7	42.9
2022 - 2052: Total Change	-2.7	4.6	1.3
2022 - 2052: Average Annual Change	-0.09	0.15	0.04
2022 - 2052: Total Percent Change	-8.3%	8.8%	3.2%

Source: New York Climate Change Science Clearinghouse RCP 8.5 for Onondaga County (<https://www.nyclimatescience.org/>)

The NYCCSC climate change scenario for Onondaga County projects that, by 2052, the average annual temperature in Onondaga County will increase by a total of between 1.5° F and 4.3°F (Table 2.9). Total annual precipitation will also change, with some models showing a decrease of as much as 2.7 inches and others showing an increase as high as 4.6 inches (Table 2.10). The weighted average projected by the CMIP5 models is a 30-year annual average temperature increase of 3°F and a total precipitation increase of 1.3 inches (NYSERDA, 2022).

Extreme precipitation

Extreme weather events are also becoming more frequent. New York State has recently experienced a significant increase in the number of two-inch precipitation events. These are considered extreme precipitation events. This is demonstrated by Figure 2.9 and Table 2.11, which present data from the NOAA National Centers for Environmental Information (NCEI) NY State Climate Summary. These events lead to flooding and erosion, creating high volumes of runoff, which can carry nutrients from the landscape into the

lake. A continued increase in precipitation intensity is projected for the winter and spring seasons, while periods of drought are expected for the summer season.

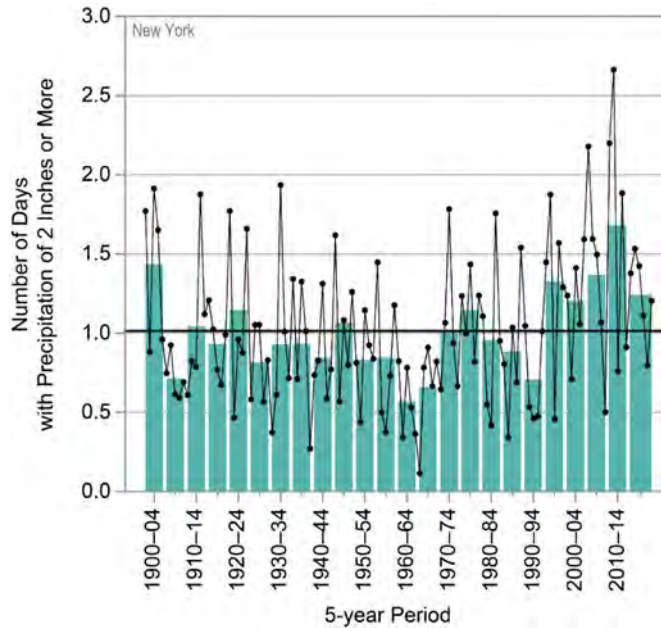
Climate Change Impacts

Research suggests that, as temperatures and precipitation increase, the amount of sediment and nutrients entering the lake's tributaries will increase (Verma, Bosch, Bhattari, & Cooke, August 2015). This will mean more flooding events like those pictured in Section 2.4 and more sediment plumes entering the lake.

As the effects of climate change are felt, it will be increasingly important to develop measures to capture stormwater on the landscape, to reduce the velocity of water in tributaries, and to reduce the impacts of flood events.

*The New York Climate Change Science Clearinghouse presents data under two future scenarios for greenhouse gas concentrations. These scenarios, known as Representative Concentration Pathways (RCP) encapsulate possible future greenhouse gas emission levels: RCP 4.5 and RCP 8.5. As California's Energy Commission reports, "RCP 4.5 is a 'medium' emissions scenario that models a future where societies attempt to reduce greenhouse gas emissions, while RCP 8.5 is more of a 'business as usual' scenario" (State of California Energy Commission, 2018). To assess potential impacts to Skaneateles Lake and its watershed, we will utilize the RCP 8.5 scenario.

Figure 2.9 – Observed Number of Two-Inch Precipitation Events for New York, 1990 – 2020



Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 1.0 days. A typical station experiences 1 event each year. Since 1995, New York has experienced an above average number of 2-inch extreme precipitation events, with the highest frequency occurring during the 2010–2014 period.

Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 16 long-term stations.

Table 2.11 – Projected Changes in Annual Frequency of Extreme Rain Events

Region 1 Rochester									
	2020s			2050s			2080s		
	low	mid	high	low	mid	high	low	mid	high
Days over 1" rainfall	4	5	6	4	5	6	4	5 to 6	7
Days over 2" rainfall	0.6	0.6 to 0.7	0.8	0.5	0.6 to 0.8	0.9	0.5	0.6 to 0.9	1
Region 6 Watertown									
	2020s			2050s			2080s		
	low	mid	high	low	mid	high	low	mid	high
Days over 1" rainfall	6	7 to 8	8	7	7 to 8	9	7	7 to 9	10
Days over 2" rainfall	0.6	0.7-1	1	0.7	0.7 to 1	1	0.7	0.8 to 1	1

Source: CISESS and NOAA National Centers for Environmental Information (NCEI)

2.7 Habitat

Fish and Wildlife

Many taxa of birds and mammals rely on Skaneateles Lake and its shoreline as high-quality foraging, roosting, and nesting habitat. While resident birds stay in the area year-round, the majority are found seasonally during breeding and migration seasons. Herons, loons, grebes, ducks, and geese are often observed utilizing the lake's resources. Mammals that depend on the lake for foraging and den habitat include muskrat, mink, beaver, and river otter.

The southern end of Skaneateles Lake is designated as an Audubon Important Bird Area due to the habitat for many species of bird provided in the wetlands and forest. At-risk bird species supported in this area include (The National Audubon Society, 2018):

- American Bittern,
- Northern Harrier,
- Sharp-shinned Hawk,
- Cooper's Hawk,
- Northern Goshawk,
- Red-shouldered Hawk,
- Broad-winged Hawk,
- American Woodcock,
- Wood Thrush,
- Golden-winged Warbler,
- Cerulean Warbler, and
- Canada Warbler.

Aquatic Life and Angling

Skaneateles Lake is designated as a Class AA water, suitable for fish propagation and survival. Despite providing habitat for salmonid species such as rainbow trout, brown trout, lake trout, and Atlantic salmon, the lake is not designated with the standard "T" (supporting naturally reproducing trout populations) and therefore specific requirements for sustaining these sensitive fisheries resources are not applicable. A variety of both warmwater and coldwater fish species are established in Skaneateles Lake. Lake trout populations have been reported to be stable in the lake; however, the cisco population has declined precipitously since the late 1980s. In 2007, an outbreak of viral hemorrhagic septicemia (VHS) killed Skaneateles Lake smallmouth bass and rock bass (NYSDEC, 2020).

Skaneateles Lake is stocked yearly with 20,000 rainbow trout and 9,000 Atlantic salmon. The DEC's online fishing guide reports that:

Smallmouth bass fishing is good throughout the lake. The south end is noted for good bullhead, panfish and pickerel fishing. Lake trout fishing is excellent, though fish are smaller than in other Finger Lakes.

Many rainbow trout and Atlantic salmon are caught by trolling on the surface during spring and fall. (DEC, 2025)

2.8 Invasive Species

Invasive species are non-native species that can cause harm to an ecosystem, the economy, or human health. Invasive species are often aggressive and crowd out or cause direct harm to existing species in the ecosystem they invade. This is one of the greatest threats to New York's biodiversity and can result in ecosystem degradation and lost ecosystem services by disrupting the existing balance. This can, in turn, have significant impacts on recreation and local economies. There are several invasive species of concern in New York State. State agencies and local partners are working to address these threats and effectively manage resources through the Regional Partnerships for Regional Invasive Species Management (PRISM) as well as through species-specific working groups. Species of particular concern to the Skaneateles Lake Watershed include hemlock woolly adelgid (HWA), Eurasian watermilfoil, zebra and quagga Mussels, walleye, and starry stonewort. Additionally, while hydrilla has not yet been detected in Skaneateles Lake, ensuring that it does not spread into this lake is critically important.

Hemlock Woolly Adelgid

Hemlock woolly adelgid (HWA) is a small, aphid-like insect originating in Asia. This invasive pest is a threat to Eastern Hemlock trees native to New York State. Hemlocks are primarily found in the Adirondacks, Tug Hill Plateau, Catskills, and in the Southern forests of the state including the Finger Lakes. Hemlocks grow best in moist, slightly acidic soils and steep, north-facing slopes. They are also often found along streams and lake shorelines. Many Finger Lakes gorges and ravines are lined with hemlocks. Hemlocks are the third most prevalent tree species in New York State.



Hemlock Woolly Adelgid Egg Masses

Source: NYS DEC (<https://www.dec.ny.gov/animals/7250.html>)

HWA stresses hemlock trees by feeding deep within the plant tissue through the underside of the base of the hemlock tree needles leading to their decline and death. When HWA feeds, it creates a wound in the tree's woody tissue. As HWA populations grow, the density of HWA individuals increases. Over time, the compounded damage of these wounds impedes the flow of water and nutrients to the ends of the twigs, killing emerging buds and preventing new growth.

HWA first arrived in New York in the 1980s and has caused considerable damage to hemlocks on Long Island, in the Lower Hudson region, and in the southern Catskills. Infestations have been found throughout the Finger Lakes region and in 2017 the first HWA sighting in the Adirondacks was reported. According to iMapInvasives, an online citizen science observation platform, there have been several sightings of HWA in the Skaneateles Highlands at the south end of the lake (iMap Invasives Network, 2023).

Hemlock trees are a keystone species in the forested uplands of the Finger Lakes, including the Skaneateles Lake Watershed. They typically grow in gullies and ravines where their roots keep soils in place, preventing erosion and reducing runoff loaded with nutrients from entering the streams and lake. Losing hemlocks will make these gullies more susceptible to erosion and contribute to nutrient loading.

The New York State Hemlock Woolly Adelgid Initiative is a partnership of statewide organizations working to address this significant threat through research, education and management of our Eastern Hemlock forests.

Numerous other agencies and organizations have been actively working to reduce HWA populations in the Skaneateles Watershed since they were first observed nearly ten years ago. The Finger Lakes Partnership for Regional Invasive Species Management (FL-PRISM), the Skaneateles Lake Association (SLA), Cornell Cooperative Extension of Onondaga, the CNY Land Trust, and the Finger Lakes Land Trust have all been engaged in public education and management activities. Activities have included pesticide application, hosting identification training walks, and using iMapInvasives, a citizen science observation recording platform, to track it. HWA can be identified year-round, but it is easiest to see in the mid-fall through winter when it is showing small cottonball-like woolly masses on hemlock twigs near the base of the needles.

Eurasian Watermilfoil

Eurasian watermilfoil is an aquatic invasive species originating from the Eurasian continent. It is a submerged perennial that looks like many native aquatic plants, including native milfoil species. Eurasian milfoil grows from the lake floor and can grow at many depths. The plant can reach lengths

of 20 feet and branches near the surface. Tiny pink flowers may occur on an emergent spike during late summer.

Eurasian watermilfoil creates problems for lakes in a variety of ways. It clogs up the shallow water zone, traps sediment in the littoral zone, and draws nutrients out of the sediments and disperses them into the water column, potentially threatening the lake's water quality.

Eurasian watermilfoil is highly invasive and competes aggressively with native aquatic plants, thereby reducing diversity. A single fragment of stem or leaves can take root and form a new colony, and plants can grow up to two inches per day. Eurasian watermilfoil can grow in many types of waterbodies, as well as on almost any substrate. Since its growth is typically dense, Eurasian watermilfoil beds are poor fish spawning areas and excessive cover may lead to populations of stunted fish. Dense surface mats can interfere with boating, fishing, swimming, and other forms of water recreation. It can also lower the value of lakefront property.

SLA and its partners have been successfully implementing and maintaining a Eurasian watermilfoil control and monitoring program since the early 2000s. The first phase of this program was to reduce the biomass and prevent spreading of milfoil. This was done through hand-pulling and, starting in 2012, benthic matting. With this method, mats were lowered into the water to cover milfoil stands and left for a minimum of eight weeks. A total of 6 acres of matting has been deployed each year. Matting has been the primary method of Eurasian watermilfoil eradication, but hand-pulling is still used at sites that are difficult to mat. Skaneateles Lake is one of the few lakes where Eurasian watermilfoil has been successfully controlled. Fifty acres had been removed as of 2014. New patches will continue to emerge, but with this program and past efforts is more manageable (Skaneateles Lake Association, 2015).

Mussels

Zebra mussels and quagga mussels were introduced into the Great Lakes in the mid- to late-1980s from freshwater ballast discharged from freighters originating in the Black and Caspian Sea region of eastern Europe and western Asia. They filter vast amounts of plankton, which increases water clarity but decreases the food source of other species (NY Sea Grant, 2015). Mussels also accumulate on rocks, piers, intake pipes, and boat hulls, which can mean expensive removal processes. Both zebra and quagga mussels inhabit Skaneateles Lake.

Mussels are of particular concern because of their possible connection to HABs. Scientific research has shown that zebra and quagga mussels are selective about the kinds of phytoplankton they will digest. Research on quagga mussels in Lake Huron's Saginaw Bay has shown that these mussels

will reject “unpalatable” particles and that they tend to find the phytoplankton associated with HABs unpalatable (Tang, Vanderploeg, Johengen, & Liebig, 2013) The influence of this feeding preference may be changing the lake’s overall phytoplankton population, favoring microcystin-producing cyanobacteria and increasing the frequency of HABs.

Starry Stonewort

Starry Stonewort was spotted in Skaneateles Lake in 2021. This is an aquatic invasive plant that was first introduced to the United States through the St. Lawrence Seaway in the 1970s. Unfortunately, starry stonewort is difficult to distinguish from closely related musk grasses and stoneworts, so there may be places where it has not yet been detected. Starry stonewort is named for its star-shaped reproductive structures, or bulbils, which can be transported in mud. Starry stonewort can also spread by fragments and is often found near docks and marinas indicating that watercraft likely transport this alga from site to site.

Starry stonewort can form dense mats on lake and river bottoms, crowding out native species and destroying habitat. These plants are also a very hospitable environment for zebra mussels, helping to compound this invasive species (Finger Lakes PRISM, 2022).

Preventive measures remain important for controlling starry stonewort. Programs such as the Watercraft Stewards are critical to this (see the information on Aquatic Invasive Species Invasive Species Management Programs, below).

Hydrilla

Currently, there are no confirmed reports of hydrilla in Skaneateles Lake, but it is present in nearby Cayuga Lake. Pre-

venting the spread of hydrilla to Skaneateles Lake is a high priority of stakeholders in this watershed.

Hydrilla, also known as water thyme, is a federally listed noxious weed that originates from Asia. The DEC’s *Hydrilla Fact Sheet* describes it as “one of the most difficult aquatic invasive plants to control and eradicate in the United States” (NYSDEC, 2020).

Hydrilla grows rapidly and forms dense mats on the surface of water bodies that can become several feet thick. These mats shade out other plants and interfere with waterfowl habitat and fish spawning sites. It can also interfere with boating and swimming.

Boats and boat trailers can spread hydrilla by carrying plant fragments from one body of water to another. The Skaneateles Lake Association’s Watercraft Stewards have been working to prevent the introduction of hydrilla for several years.

Aquatic Invasive Species Management Programs

In August 2012, the SLA instituted an Invasive Species Prevention Program. Watercraft Stewards were positioned at the New York State DEC Boat Launch on West Lake Road and the Skaneateles Town Boat Launch in Mandana. Currently the boat stewards cover three of the lake’s 9 primary boat launch sites: the DEC and Town of Skaneateles Boat Launches and Fuller Park in the Town of Scott (see Section 2.11 and Figure 2.13).

Watercraft Stewards hired by the SLA for the boating season are comprised of high school and college students and community members who receive training through SLA, the Finger Lakes Institute, and Cornell Cooperative Extension.

Stewards learn about the invasive species currently found in Skaneateles Lake and the species that have the potential to be imported from other water bodies. Stewards’ duties include asking permission from boaters to allow a visual inspection of their trailers and the exterior of their watercraft for any attached marine life. Any vegetation is then removed. Most boaters allow these inspections.

The stewards also educate recreational boaters and anglers on the value of launching a clean, drained, and dry boat. The stewards then record data on each boat as part of the New York State Watercraft Inspection Steward Program Application (WISPA).



Starry Stonewort

Source: Finger Lakes PRISM

2.9 Municipalities and Population

There are 4,158 people residing within the watershed across 2,819 dwelling units (Figure 2.10). Approximately 1,065 of these dwellings are on the lakeshore (City of Syracuse, 2022).

The watershed spans three counties:

- Onondaga County,
- Cayuga County, and
- Cortland County.

It also includes portions of seven towns:

- Niles,
- Sempronius,
- Spafford,
- Skaneateles,
- Scott,
- Owasco, and
- Marcellus.

It includes one village:

- Skaneateles.

Two of the towns, Marcellus and Owasco, account for less than 300 acres, or < 1.0% of the total watershed area. Because these towns make up such a small proportion of the watershed, and such a small proportion of these municipalities are included in the watershed, they are not included in the data summary below (see Table 2.12).

Fifty-one percent of the watershed land area is within Onondaga County, and three-quarters of the watershed's population is in Onondaga County (Table 2.13).

Thirty-four percent of the watershed's land and 10% of its population are in Cayuga County. This includes the towns of Niles and Sempronius. Twenty-nine percent of this county land area is agricultural. Most of the residential development in this county is on the lakeshore and seasonal. Much of the shoreline in Cayuga County is very steeply sloped.

A relatively small proportion, 15%, of the watershed is in Cortland County. The Town of Scott is the single town within this portion of the watershed. It has a population of 655 or approximately 16% of the total watershed population. Soil conditions and extreme topography of the area limit development (City of Syracuse, 2022).

Towns

Town of Skaneateles

The Town of Skaneateles lies along the southwestern border of Onondaga County, with a total area of 48.8 square miles. The Town is the most populous of the watershed's seven towns, with a population in 2021 of 7,191 (U.S. Cen-

sus Bureau, 2021). The Town's population has been declining slowly over the past 50 years, from a peak population of 7,825 in 1970. In addition to the Village of Skaneateles, located on the northern end of Skaneateles Lake, there are many small hamlets in the town, including Highland Way, Jones Beach (hamlet), Long Bridge (hamlet), Mandana (hamlet), Mottville (hamlet), Shepard Settlement (hamlet), Skaneateles Falls (hamlet), Thornton Grove, Thornton Heights, Wicks Corner, Willow Glen, and Winding Way (SOC-PA & OCDEM, 2019).

The median home value (as reported by the Census) in the Town of Skaneateles is more than twice what it is in the rest of Onondaga County: \$344,000 in the Town compared to \$154,000 in the County. But the Town's home value is only slightly above the statewide median of \$340,000. At \$90,700, the Town's median household income is substantially higher than either the County's (\$66,000) or State's (\$75,000).

Town of Spafford

The Town of Spafford is located on the southwest border of Onondaga County, with a total area of 39.2 square miles. The town's entire western boundary is formed by the Skaneateles Lake shoreline, and nearly half of its eastern border is shaped by Otisco Lake shoreline. State Route 41, a north-south connection between Route 20 to the north and I-81 in Homer, runs through Spafford.

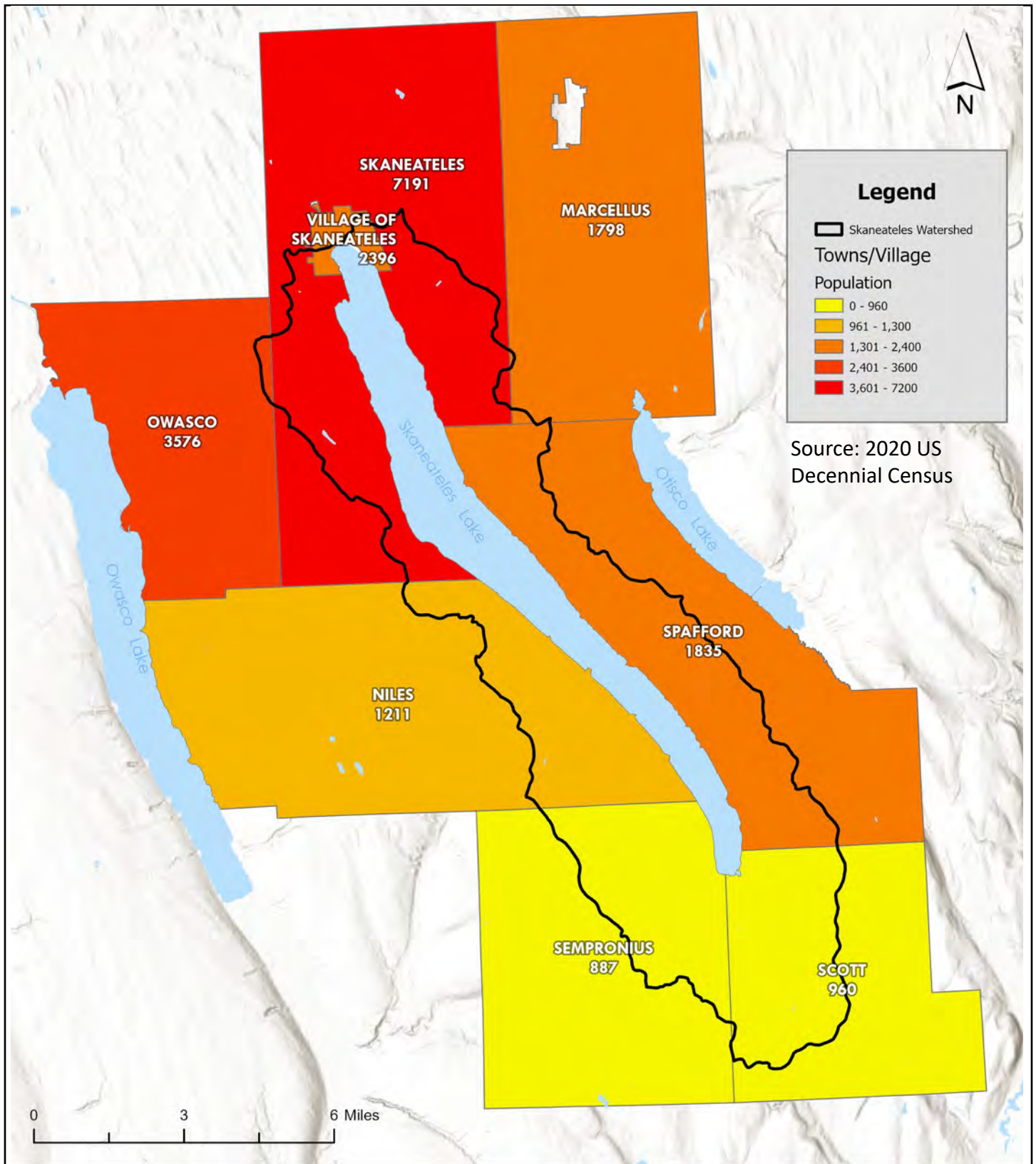
There are several communities located within the town: Borodino (hamlet), Borodino Landing (hamlet), Edgewater Park, Pine Grove (hamlet), South Spafford (hamlet), Spafford (hamlet), Spafford Valley (hamlet), and Woodland (hamlet) (SOCPA & OCDEM, 2019).

Spafford is a rural town, with a population density of 47 people per square mile (compared to nearly 150 per square mile in the Town of Skaneateles). The town's population was 1,835 in 2020, a 10% increase over the year 2000 population of 1,660. While modest, this growth is unusual for this area: none of the other municipalities in the watershed gained population in this period.

As is true in the Town and Villages of Skaneateles, Spafford's residents tend to have higher incomes than people in the rest of Onondaga County; Spafford's median household income was \$90,965 in 2020. Median home value was \$210,400 in 2020 (U.S. Census Bureau, 2020).

Town of Scott

The Town of Scott is located along the northern border of Cortland County, northwest of the City of Cortland. The Town's western border runs along the Cayuga County line, and its northern border is the Onondaga County line. State Route 41 runs north-south through the town, connecting to I-81 in the Town of Homer, just south of Scott (Cortland



Legend

- Skaneateles Watershed
- Towns/Village
- Population
 - 0 - 960
 - 961 - 1,300
 - 1,301 - 2,400
 - 2,401 - 3600
 - 3,601 - 7200

Source: 2020 US Decennial Census

Department of State

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Central New York Regional Planning & Development Board

This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 2.10 – Population of Watershed Municipalities

Basemap: Esri, CGIAR, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

Table 2.12 – Skaneateles Watershed Population Distribution and Watershed Land Area by Town

Town	Dwelling Units	Population in Watershed	Percent of Total Population	Percent of Watershed Land Area
Skaneateles	1,376	2,216	53%	26%
Spafford	689	843	20%	25%
Niles	365	371	9%	17%
Sempronius	76	73	2%	17%
Scott	313	655	16%	15%
Totals	2,819	4,158	100%	100%

Source: City of Syracuse 2022 (The Towns of Marcellus and Owasco make up less than 1% of the watershed's area)

Table 2.13 – Skaneateles Watershed Population Distribution and Watershed Land Area by County

County	Dwelling Units	County Population	Percent of Watershed Population	Percent of Watershed Land Area	Pop. /sq. mi.
Onondaga	2,065	3,059	73.6%	51%	74.3
Cayuga	441	444	10.7%	34%	20.3
Cortland	313	655	15.8%	15%	70.3
Totals	2,819	4,158	100%	100%	57.5*

Source: City of Syracuse, 2022

Table 2.14 – Population and Number of Households in Watershed Municipalities, 2000 and 2020

Municipality	Population			Households			Occupied Housing Units		
	2000	2020	Pct Change	2000	2020	Pct Change	2000	2020	Pct Change
Town of Skaneateles	7323	7191	-1.8%	2880	3056	6.1%	2881	3056	6.1%
Town of Spafford	1661	1835	10.5%	636	800	25.8%	631	800	26.8%
Village of Skaneateles	2674	2396	-10.4%	1063	1108	4.2%	1103	1108	0.5%
Town of Niles	1208	1211	0.2%	472	519	10.0%	476	519	9.0%
Town of Sempronius	893	887	-0.7%	312	347	11.2%	311	347	11.6%
Town of Scott	1193	960	-19.5%	414	375	-9.4%	417	375	-10.1%

County, 2021).

Like other towns in the watershed, Scott is rural, with a population density of 43 people per square mile. Grout Brook, one of the major tributaries to Skaneateles Lake, runs north through the Town of Scott, feeding into the lake at Fuller Park on the southern end of the lake.

The Town of Scott's population fell by nearly 20% in the past 20 years, from 1,200 in 2000 to 960 in 2020. Based on American Community Survey (ACS) data, the Town's median household income was \$75,000 in 2020 and the median home value was \$121,000.

Town of Sempronius

The Town of Sempronius is located in southeastern Cayuga County, south of the Town of Niles, and sharing its eastern border with Onondaga County. The east town line also borders the southern end of Skaneateles Lake (Cayuga County, 2021).

With a population of nearly 900, Sempronius is the least populous municipality in the watershed (U.S. Census Bureau, 2020). Its population has not changed substantially in the past 20 years. It is also a sparsely developed community, with a population density of 30 people per square mile. Population centers include the hamlets of Glen Haven, on the southwest end of Skaneateles Lake, and Sempronius, which is situated on State Route 41A, a north-south route that runs along the west side of Skaneateles Lake.

Median household income in the Town of Sempronius was \$61,500 in 2020, compared to \$58,000 in Cayuga County as a whole. The median home value in Sempronius was \$135,500, only slightly higher than the median for Cayuga County of \$131,700.

Town of Niles

The Town of Niles is located in southeast Cayuga County, sharing its western border with Owasco Lake and its eastern border with Onondaga County and Skaneateles Lake. It is bordered by the Cayuga County Towns of Sempronius to the southeast, Moravia to the southwest, Scipio to the west, and Owasco to the north (Cayuga County, 2021).

Carpenter Point, the outlet of Bear Swamp Creek into Skaneateles Lake, is located in Niles, as is Carpenter Falls Unique Area.

According to 2020 ACS data, the Town of Niles has a population of 1,200, with virtually no change in total population since the year 2000. Like other watershed communities, Niles is sparsely developed, with roughly 28 people per square mile.

Median household income was nearly \$65,000 in 2020, which is above the median income for Cayuga County. The

median home value was \$167,700 (U.S. Census Bureau, 2020).

Village

Village of Skaneateles

The Village of Skaneateles lies within the Town of Skaneateles on the northern shores of Skaneateles Lake in Onondaga County in western New York State. The Village of Skaneateles has a total area of 1.7 square miles. The Village of Skaneateles is located along the U.S. Route 20 (Genesee Street), which heads out west towards Auburn. US 20 and Skaneateles also serve as the northern terminus of New York State Route 41 and its suffixed route, New York State Route 41A. It is also the southern terminus of New York State Route 321 (SOCPA & OCDEM, 2019).

The Village of Skaneateles has a population of 2,396, which is a slight decrease from its year 2000 population of 2,674. While the Village makes up only 3% of the total land area of the Town of Skaneateles, it is home to 33% of the Town's population. Like the Town, the Village has seen a long-term decline in population: in 1990, there were 2,700 village residents.

Like the Town of Skaneateles, the Village's median household income (\$101,875) and median home value (\$428,500) are substantially higher than for the rest of Onondaga County.

2.10 Growth Trends

Towns and Counties: Past Trends and Future Projections

As Table 2.14 demonstrates, collectively the towns in the Skaneateles Lake Watershed have seen a net decline in population over the past 20 years. Only the Town of Spafford, with 10% growth, saw a meaningful increase in population. But this is offset by losses in other towns and in the Village of Skaneateles.

In 2018, the Cornell Program on Applied Demographics (CPAD) published county-level projections for New York's population, looking out to the year 2040 (Cornell Program on Applied Demographics, 2018). According to these projections, the three counties in the watershed (Cayuga, Cortland, and Onondaga) will lose population over the next 20 years. Between these three counties, CPAD projected a total population loss of more than 18,000 by 2040.

Watershed Development Activity

The City of Syracuse's Skaneateles Lake and Watershed annual reports include a summary of housing starts and building permit activity in the watershed. The most recent annual report reported that 13 building permits were issued for new dwellings in 2023.

Steep slopes, local land use regulation, the lack of water and sewer infrastructure in most of the watershed, and the productive value of farmland have suppressed large-scale residential development in the watershed. As the *Skaneateles Lake and Watershed 2021 Annual Report* states:

Demand for farmland continues to be high, as some farms expand to remain profitable or increase their land base to spread manure at state-approved rates. In this watershed, many smaller farms are purchased by larger and/or new operations at the retirement of lifelong farmers. To demonstrate this point, 62 operations met the Agriculture & Markets definition of a farm in FY 1995-96. This year only 46 operations meet that definition.

Micron and New Development

Everything else being equal, slow growth or no growth seems likely for this watershed. However, the announcement in October 2022 that Micron, Inc. would be developing large microchip fabrication facilities in the Town of Clay in Onondaga County has altered the development outlook for Central New York. The Micron semiconductor manufacturing facility is anticipated to directly create 9,000 jobs. These jobs are projected to indirectly lead to the generation of as many as 40,000 jobs in the region, primarily in Onondaga County. The resulting increase in population has been

estimated to be on the order of 125,000, requiring the addition of as many as 12,000 new housing units (Coin, 2023).

There are (as of this writing) no population projections for the Skaneateles Watershed that incorporate the Micron development and associated population increases. It is unclear to what degree the Skaneateles Watershed will be affected: the Micron facility is north of the City of Syracuse. Travel time between the Village of Skaneateles and the manufacturing site is approximately 40 minutes. This is twice the length of the median commute time in the region, 20.5 minutes. Travel time between the Micron facility and other parts of the watershed, such as Borodino on the lake's east side or Mandana on the western shore is on the order of 50 minutes. Currently, only 8% of commuters in Onondaga County travel more than 40 minutes to work (U.S. Census Bureau, 2020).

However, as the data from the City's annual report on the Skaneateles Lake Watershed suggests, demand for housing in the vicinity of the lake has been consistent, even as population in the watershed's towns has declined. It seems reasonable, therefore, to anticipate some population growth in the watershed.

Development Projection

The *New York Landscape Futures - Recent Trends (NYLF-RT) Technical Report*¹ was developed prior to the announcement of the proposed Micron development and, thus, does not take this development into account. However, it is a model-based projection that can be scaled to the level of the watershed.

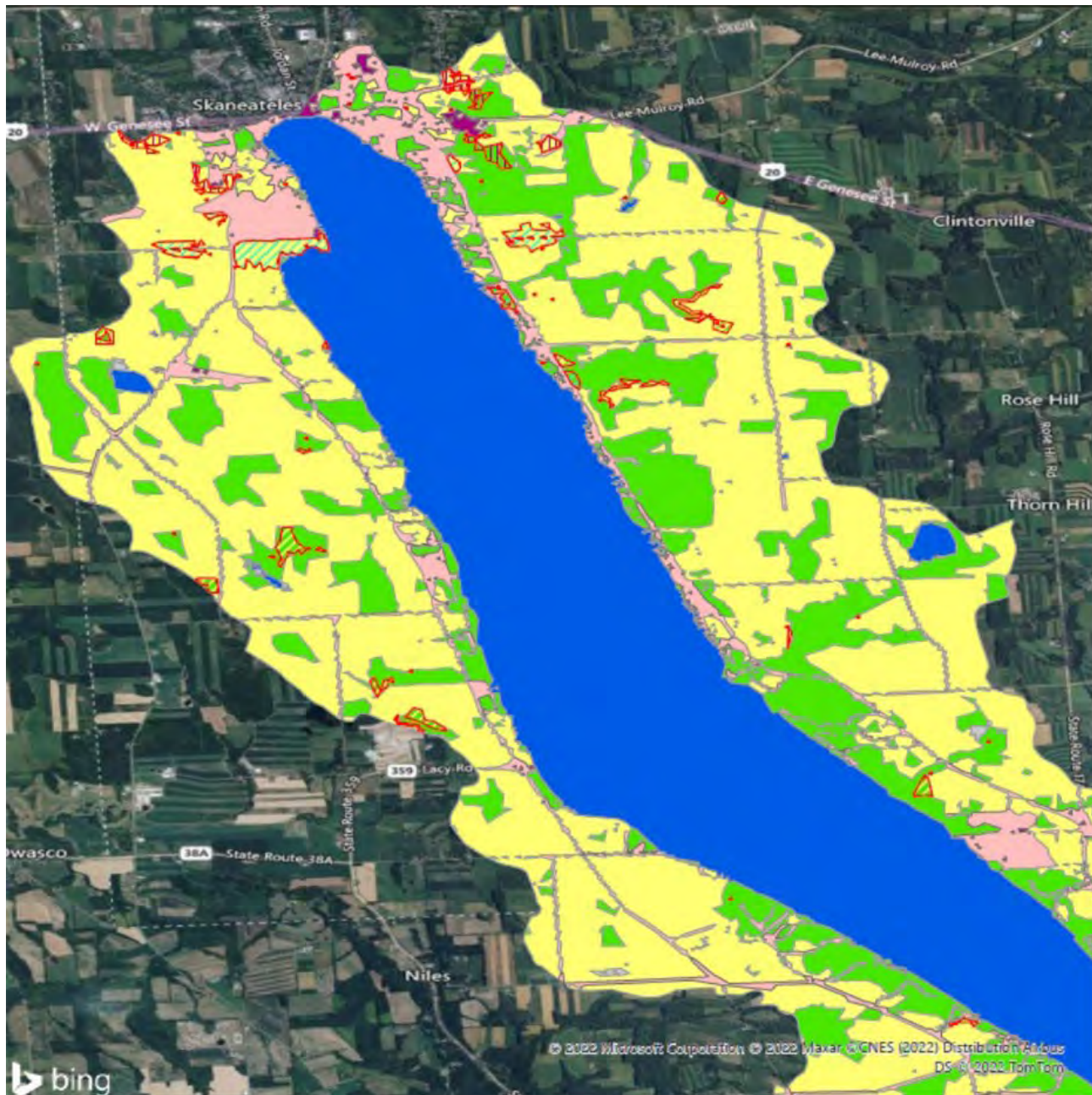
The *New York Landscape Futures* approach to land use forecasting utilizes a set of "spatial driver variables" combined with current land cover data to model an area's growth potential (Plisinski & Thompson, *New York Landscape Future - Recent Trends Technical Report*, 2021). Spatial driver variables include presence / absence of wetlands, slope, distance to highways, population density, distance from an urban edge, and other similar variables. Each geographic unit in the model (30-meter raster units) receives a score based on these variables, which the model sums to predict the likelihood of that geographic unit's conversion to a different type of development. This conversion can take a variety of forms, including:

- Low density development to high density development,
- Forest to high density development,
- Forest to low density development,
- Forest to agricultural / pasture / grassland,
- Agricultural / pasture / grassland to high density

¹ The *New York Landscape Futures - Recent Trends (NYLF-RT) Technical Report* is a project of Harvard Forest researchers Joshua Plisinski and Jonathan Thompson, who adapted the methodology used on their *New England Landscape Futures to New York State* in 2021.

- development,
- Agricultural / pasture / grassland to low density development, or
- Agricultural / pasture / grassland to forest (Plisinski & Thompson, New York Landscape Future - Recent Trends Technical Report, 2021).

Figures 2.11 and 2.12 show modeled land use change between 2020 and 2050 in the northern (Figure 2.11) and southern (Figure 2.12) portions of the watershed based on the *New York Landscape Futures Technical Report*. Areas outlined in red in these figures indicate a change in land cover depending on the color and pattern in that polygon. This model projects conversion of forest and agricultural lands to high density development in some areas around the Village of Skaneateles, as well as the conversion of agricultural land to forest in this area. The modeling also projects a pocket of development in the southern end of the watershed on its eastern side, in the vicinity of Vincent Hill Road.



2050 Projected Land Cover (Change Detection)

- High Density
- Low Density
- Forest

2020 Land Cover Type

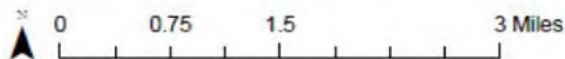
- Agriculture/Pasture/Grassland
- Other
- Water

2020 Land Cover Type

- High Density
- Low Density
- Forest

2020 Land Cover Type

- Agriculture/Pasture/Grassland
- Other
- Water



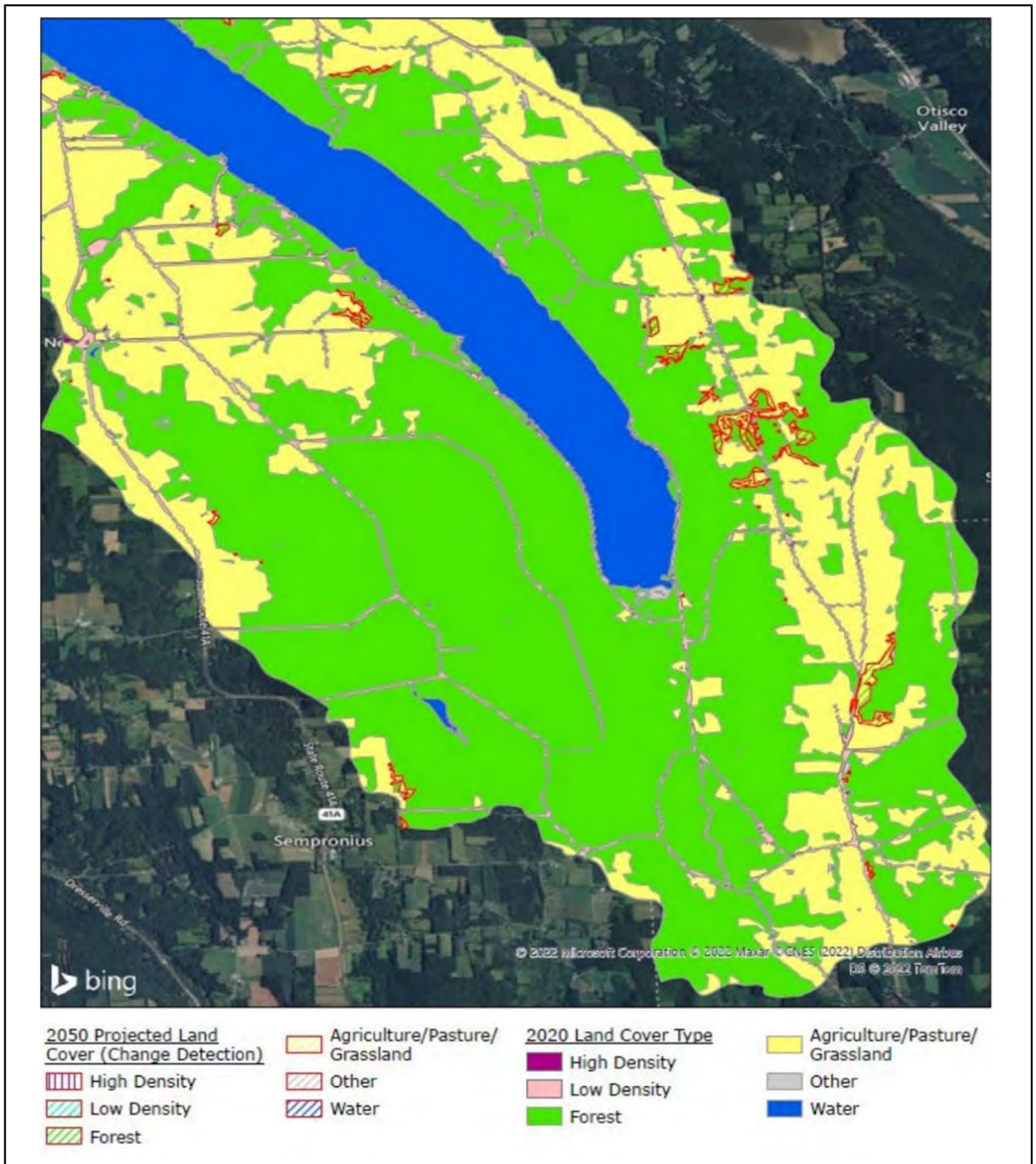
This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.



This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 2.11 – Modeled Land Use Change, 2020 – 2050, Northern Portion of the Watershed

Source: Plisinski and Thompson 2021
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N



NEW YORK STATE Department of State

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Figure 2.12 – Modeled Land Use Change, 2020 – 2050, Southern Portion of the Watershed

Source: Plisinski and Thompson 2021
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

2.11 Parks and Recreation Areas

The Skaneateles Watershed offers a variety of recreation opportunities. The Village of Skaneateles is home to public parks that provide visitors to the village immediate access to the lake – including the lake’s only public bathing beach. The rolling topography of the southern portion of the watershed makes development undesirable but is well suited to hiking and biking. State Parks and privately-owned conservation areas invite hikers to discover lake views and dramatic waterfalls (public parks are shown in Figure 2.13). The Land Trust lands mentioned below are open to the public for quiet recreation.

State Parks and Public Sites

Bear Swamp State Forest

Bear Swamp State Forest is a 3,500-acre woodland preserve that has been owned and managed by the NYSDEC since 1931. It offers a variety of recreational activities, including 12 miles of snowmobile trails, over 13 miles of hiking and equestrian trails, canoeing and kayaking, primitive camping, fishing, and hunting.

Carpenter Falls Unique Area

Carpenter Falls Unique Area is a 37-acre state-owned recreational area in the Town of Niles. Hiking and snowshoeing are permitted, and in the summer of 2022 a new ADA-accessible boardwalk was added, connecting the site’s parking lot to an observation platform. These upgrades will also protect Bear Swamp Creek and limit erosion from overuse of the area.

The 90-foot tall Carpenter Falls is formed by Bear Swamp Creek as it cuts through a steep ravine.

Grout Brook Fishing Access

Located on the southern end of Skaneateles Lake in the Town of Scott, the DEC’s 19-acre Grout Brook Fishing Access site provides parking space and fishing access along 1.9 miles of this stream. Rainbow trout enter the stream to spawn in early spring.

Hewitt State Forest

Established in 1929, Hewitt State Forest was the first of New York’s State Forests. This 938-acre site was reforested in the 1930s by the Civilian Conservation Corps, after being cleared for farming in previous decades. While there is only one formal trail in the forest, hikers are free to roam over most of this large forest.

Town and Village Parks

Andrew R Fuller Park

The Town of Scott operates a boat launch at the 20-acre Andrew R. Fuller Park on the southern end of Skaneateles Lake. Non-residents pay a fee of \$5 to launch motorized boats and \$3 for non-motorized watercraft. Annual permits can also be purchased for \$75 (Town of Scott, 2022).

Clift Park

Clift Park, located along the north shore of Skaneateles Lake, is open year-round and contains a bathing beach where swimming is permissible for swimmers when lifeguards are on duty from late-June to late-August (NYFalls.com 2018).

Thayer Park

Thayer Park is an 0.8-acre park situated between US 20 and Skaneateles Lake in the Village of Skaneateles. There is no lake access here, but park benches and a gently sloping lawn provide visitors and residents with excellent views of the lake’s northern end.

Mabel M. Reynolds Nature Preserve

The Mabel M. Reynolds Nature Preserve is located on Benson Road at Reynolds Road in the southwest part of the Town of Skaneateles. The property was given to the town by the estate of Mabel Reynolds, who asked that the family property be open to the public and used as a nature preserve. The site contains approximately 123 acres of woodland.

Privately Owned – Publicly Accessible

Bahar Preserve

Between 1998 and 2007, the Finger Lakes Land Trust (FLLT) worked with private property owners in the Bear Creek area to assemble the Bahar Preserve. In 2008, a portion of this area was conveyed to New York State to form Carpenter Falls Unique Area. The remaining area of the Bahar Preserve continues to be managed by FLLT.

Hinchcliff Family Preserve

Located in the upland area on the eastern shore of Skaneateles Lake, the 276-acre Hinchcliff Family Preserve is permanently protected by the FLLT. Hiking and bird watching are allowed in this preserve, which is situated near Spafford Landing.

High Vista Nature Preserve

Just south of, and abutting, the Hinchcliff Family Preserve is the FLLT’s 139-acre High Vista Preserve, offering 1.2 miles of hiking and cross-country skiing trails.

Cora Kampfe Dickinson Conservation Area

The FLLT's Dickinson Conservation Area, also known as Staghorn Cliffs, preserves 1,350 feet of shoreline and high bluffs. The Staghorn Cliffs of Skaneateles Lake are recognized as one of New York's premiere paleontological sites, and are well known examples of an ancient coral reef from the Devonian Period, ca. 400-350 million years ago. Tens of thousands of individual fossil horn corals are embedded in the exposed bedrock of the lakeshore here, but note that collecting these fossils is forbidden. Access to this area is by boat only.

High Hickory Wildlife Sanctuary

High Hickory Wildlife Sanctuary is a 92-acre preserve owned and managed by the Central New York Land Trust. Located on the eastern side of the watershed, High Hickory Wildlife Sanctuary is situated just east of Lourdes Camp at Ten Mile Point

Privately Owned – Not Publicly Accessible

Skaneateles Country Club

Skaneateles Country Club, on the northwest shore of Skaneateles Lake, is a private 61-acre golf course and country club with beach access.

Lourdes Camp

Catholic Charities operates a summer camp on the eastern shore of Skaneateles Lake at Ten Mile Point. Lourdes Camp has been in operation since the early 1940s. The camp offers cabins, a dining hall, and beach access to campers.



Staghorn Cliffs at the FLLT's Cora Kampfe Dickinson Conservation Area

Source: Finger Lakes Land Trust (<https://www.gofingerlakes.org/>)

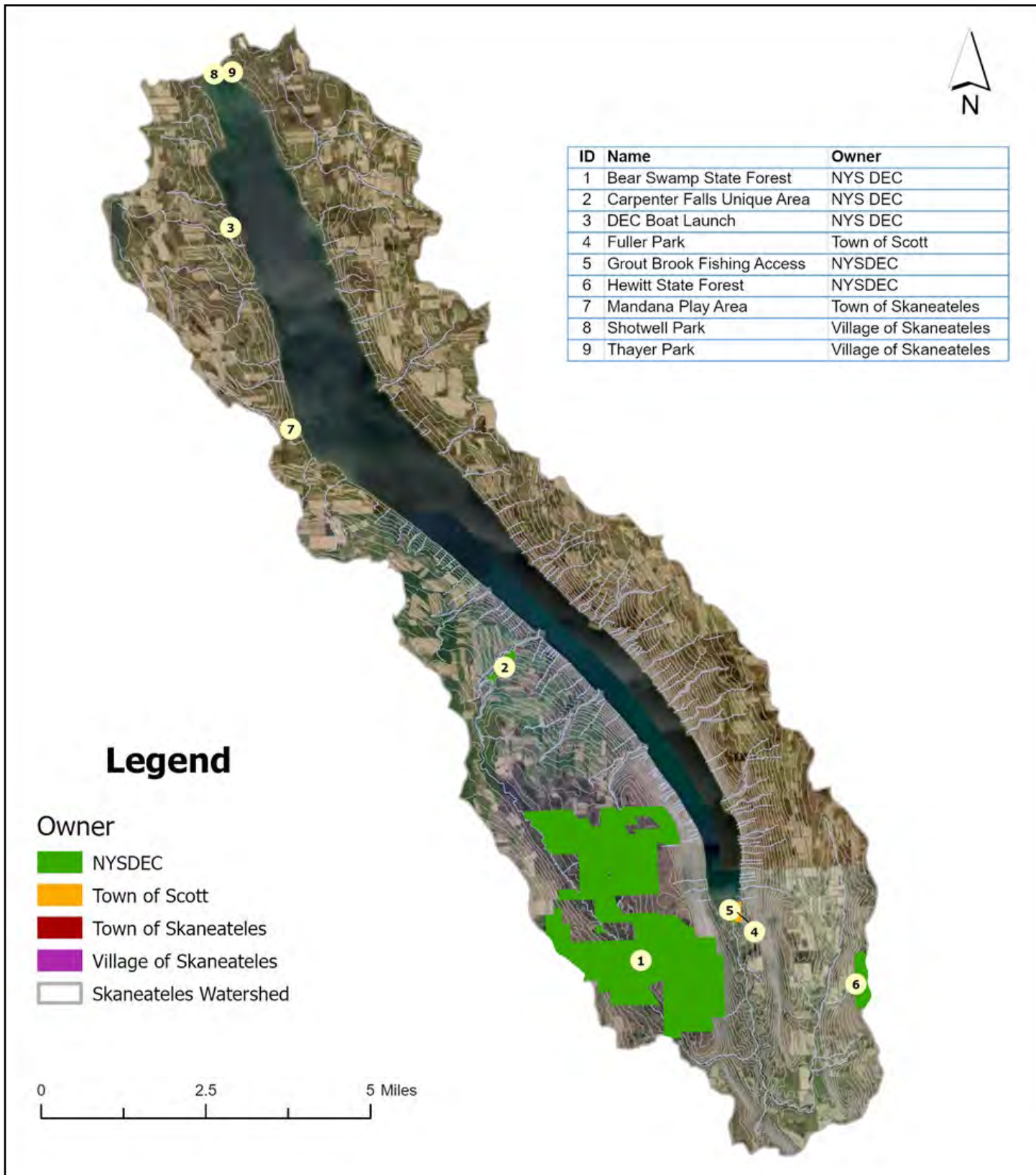


Figure 2.13 – Public Parks

Source: NYPAD Database
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA

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Boating

Boat Launches

There are five public boat launches on Skaneateles Lake (see Figure 2.14):

- A NYSDEC Boat Launch, located on Fire Lane 15 on the west side of the lake, about 2.5 miles south of the Village of Skaneateles. Use of this launch is free, but parking space is limited to 30 cars and trailers.
- The Town of Skaneateles Boat Launch, located on Fire Lane 44 in Mandana, next to Skaneateles Marina, on the west side of the lake. There is a daily parking fee of \$20 for vehicles with trailers, and \$10 for vehicles without trailers. Parking is free for Town residents.
- Borodino Boat Launch in the Town of Spafford on Bockes Road, although recreational use of this launch was effectively restricted to Town of Spafford residents by way of a local law passed in 2023.
- Fuller Park in the Town of Scott in Cortland County includes a boat launch and parking for approximately 20 vehicles. There is a \$5 fee to use this launch.
- There is a hand launch for canoes and kayaks available in the Village of Skaneateles in Cliff Park, adjacent to the gazebo. There is no dedicated parking for this launch, but there is metered on-street parking nearby.

There are four private marinas on Skaneateles Lake:

- Skaneateles Marina, located in Mandana on the western side of the lake.
- Skaneateles Country Club Marina, located on the western side of the lake near the Village of Skaneateles.
- Sevey's Boat Yard, on Glen Cove Road, on the western side of the lake.
- The Glen Haven Restaurant on the lake's southeastern end operates a small marina and boat launch.

Additionally, the Skaneateles Sailing Club, located at 2745 East Lake Road, is a launching point for sailboats.

For boaters interested in accessing the dining and retail opportunities in the Village of Skaneateles, there is a dock (but no launch for motorized boats) operated by the Chamber of Commerce in Clift Park. This dock offers 40 slips.

2.12 Infrastructure

Roads

There are 182 miles of public roads in the Skaneateles Watershed, including 36 miles of State highway (Routes 41, 41A, 321 and US 20) and 30 miles of county owned and maintained roadway (including Glen Haven Road, Pork Street, and Shamrock Road). Town-owned facilities make up the bulk of all roads in the watershed: 102.9 linear miles of road are owned and maintained by the towns in the watershed. Additionally, there are nearly seven miles of village-owned road and 5.3 miles of privately owned road in the watershed.

Wastewater

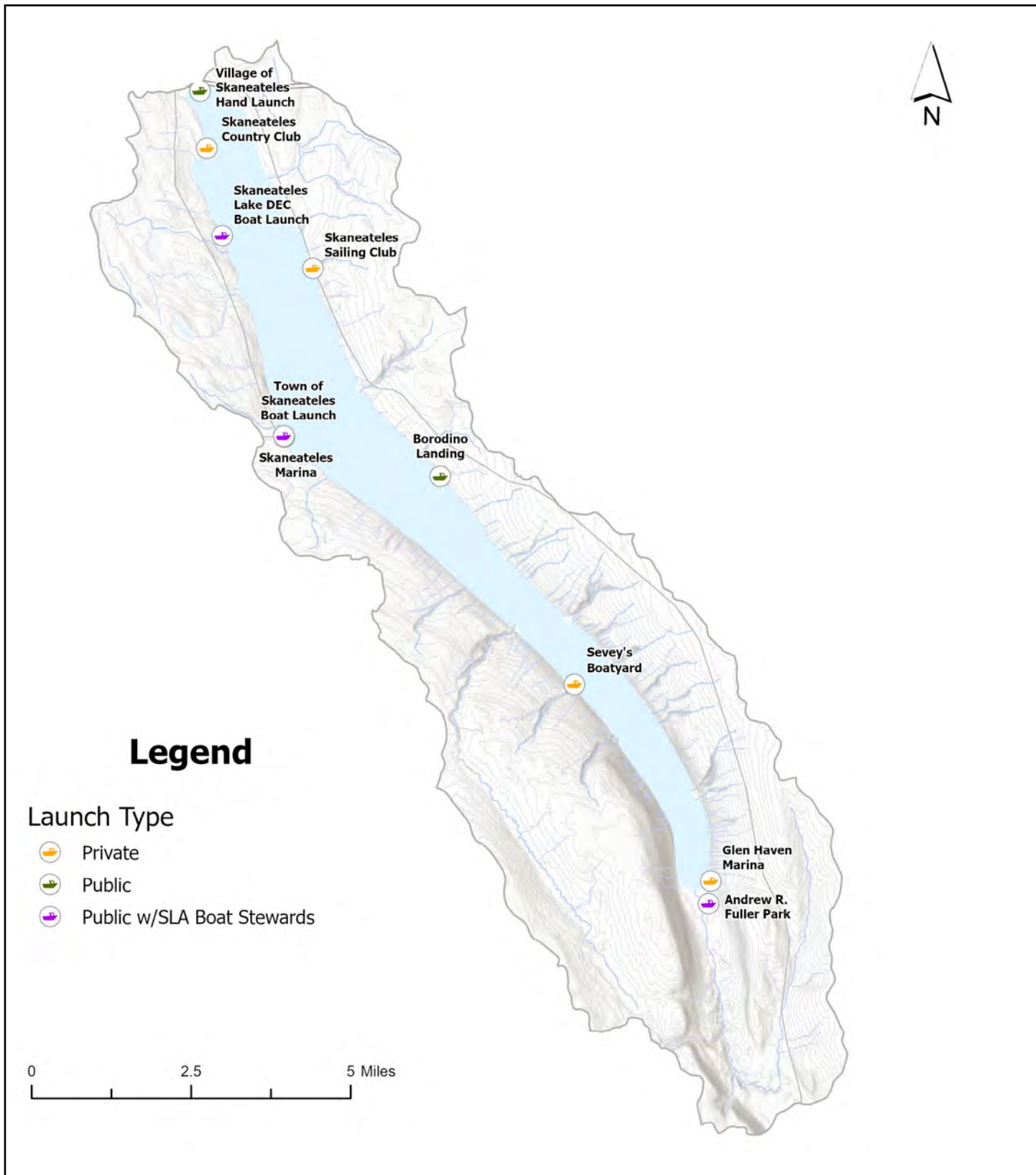
Approximately 298 dwelling units in the watershed are connected to the Village of Skaneateles sanitary sewer system. The Village is the only municipality in the watershed that has a public sewer system. The remaining watershed homes (approximately 1,850 units) use septic tanks or holding tanks for waste dispersal or collection, collectively referred to as on-site wastewater treatment systems (OWTS). Several commercial buildings located on the south side of Route 20 in the village business district are within the watershed. All are connected to the municipal sanitary sewer system. Various businesses occupy the ground level floors of these buildings, and a number of apartments/inhabitants occupy the upper stories.

Onsite sanitary sewer systems in the Skaneateles Lake Watershed are regulated under NYS Public Health Law and the Watershed Rules and Regulation, as well as by each county's individual County Sanitary Code. Under the Watershed Rules and Regulations, three full-time City of Syracuse personnel routinely patrol the lake and watershed: two Watershed Inspectors and a Water Department Sanitarian (see Section 2.16 for more information on the Watershed Inspection Program).

Under the Sanitary Code Of The Cayuga County Health District, septic systems in the Cayuga County portion of the watershed must be inspected every 7 years by an inspector certified by the Cayuga County Health Department (Cayuga County Health Department, 2006).

As described in Section 2.16, the Watershed Rules and Regulations regulate wastewater disposal in the Skaneateles Watershed. According to the *Skaneateles Lake and Watershed 2023 Annual Report*:

All proposed systems for new dwellings require a plan designed by a licensed Design Professional. Typically, property owners hire a private consultant. However, Cortland County Department of Health personnel are responsible for conventional system



This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 2.14 - Boat Launches

Source: PRISM Boat Launch Inventory; SLA
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA

design in their county. Sites requiring non-conventional systems require designs by a private consultant. Plans are submitted to the Department of Water for review and comment, and to the respective county health department for approval or rejection based on 10 NYCRR Part 75 guidelines. A total of 29 OWTS design proposals for new construction or alternative engineering design were recommended for approval. One proposal was reviewed for repair of existing septic system components. Watershed personnel also conducted backfill inspections on repairs, as well as assisted county Sanitarians and design engineers with final inspections for new construction. (City of Syracuse Department of Water, 2024)

Sixteen violations of County Sanitary Code were reported by the City in 2023. Thirteen violations were the result of failing OWTS. Two property owners were cited for illegal discharges from outdoor showers and one property owner was cited for a broken effluent pipe.

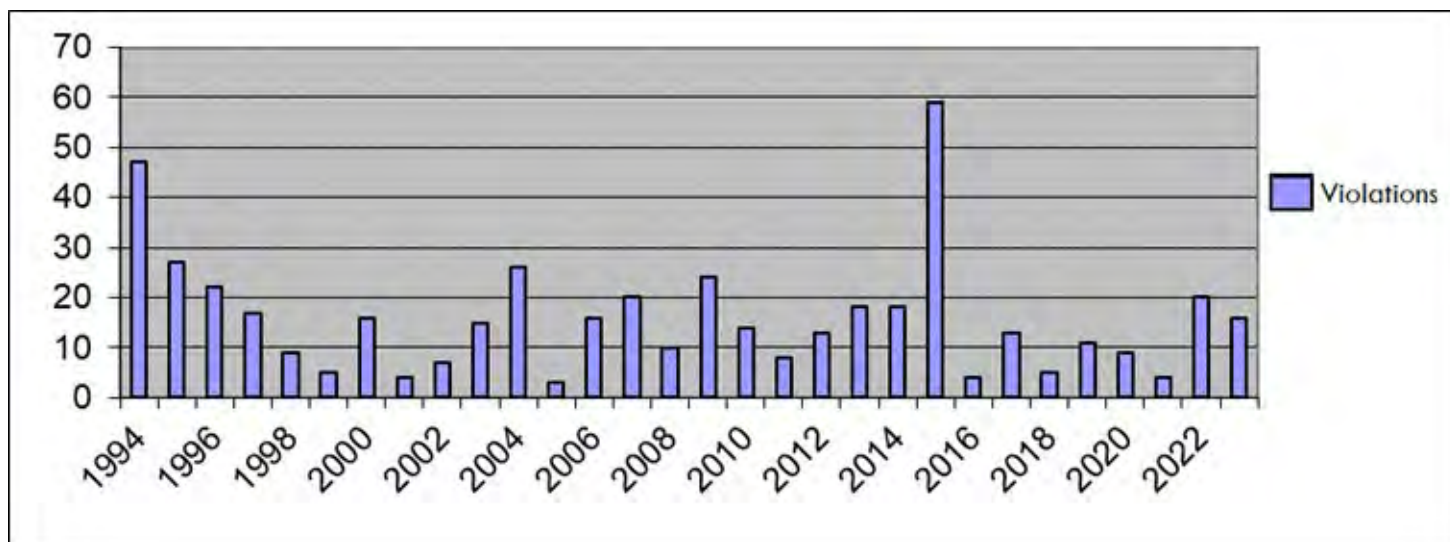
As shown in Figure 2.15, since the late 1990s, there have been very few years with more than 20 septic system failures, meaning that the rate of system failures is typically at or below one percent.

Disposing of wastewater has long been a challenge for some properties in the Skaneateles Watershed. In describing the watershed’s soils, the City’s *Skaneateles Lake and Watershed 2023 Annual Report* states that “The depth to seasonal ground water is generally <3.0 feet. All of the soils pose

a severe risk of erosion if left bare, with increasing degree of slope compounding the potential for soil loss. The use of conventional onsite wastewater treatment systems (OWTS) is severely limited due to high seasonal ground water, degree of slope, and poor permeability” (City of Syracuse Department of Water, 2024).

In the year 2000, the Skaneateles Watershed was selected to be one of a handful of watersheds in the country to be a part of the National Community Decentralized Wastewater Demonstration Project. This federal funding allocation supported innovative wastewater treatment efforts around the United States, particularly in areas where traditional septic systems face challenges. As the City of Syracuse’s 2010 report on this project says, the watershed is “comprised of very steep slopes, shallow depth to groundwater/bedrock, and poor soils for biological treatment,” all of which make septic system operation challenging in some areas (Blanco, Murdock, & Somboonlakana, 2010). In some parts of the watershed, high seasonal groundwater can lead to direct discharges into the lake. In other cases, a combination of small parcel size, proximity to the lake, and topographic, and soil conditions can make a traditional septic system ineffective. This demonstration project added enhanced treatment units (ETUs) to 19 of the most challenging sites in the watershed, establishing the effectiveness of these practices. While ETUs provide improved wastewater treatment, the technologies used were not effective at significantly reducing the phosphorus content of wastewater.

Figure 2.15 – Sanitary Code Violations in the Skaneateles Lake Watershed, 1994 - 2023



Source: (City of Syracuse Department of Water, 2024)

Water Use

Potable Water

Skaneateles Lake has been the primary source of drinking water for the City of Syracuse since 1894. Currently, it also provides drinking water to portions of the Towns of DeWitt, Onondaga, Geddes, Camillus, Salina, and Skaneateles, and to the Villages of Skaneateles, Jordan, and Elbridge. On average, precipitation adds approximately 53 billion gallons of water to Skaneateles Lake annually. Approximately 13 billion gallons is withdrawn annually to serve the City of Syracuse water system. The Village and Town of Skaneateles use approximately 0.27 billion gallons annually (City of Syracuse, 2021).

Feeder lines to the intakes convey chlorine used to prevent zebra mussel accumulations. The water is filtered only by coarse screens and treated with chlorination and fluoridation prior to reaching the City of Syracuse. Before entering the City's water system for use, the water from Skaneateles Lake is stored in two areas on the west side of the City; one area where the water is stored in two tanks (still referred to as the Westcott Reservoir for the abandoned reservoir that the tanks are located in) and the Woodland Reservoir (an open water reservoir).

For Skaneateles, withdrawn water from the lake flows from wet wells to reservoirs, where it is treated and gravity-fed to the Village and Town water systems (Village of Skaneateles 2019). The City of Syracuse has one of the lowest water rates in the state, which is related to the lower cost of treatment of water from Skaneateles Lake.

Filtration Avoidance Determination

A Filtration Avoidance Determination has been made and a filtration avoidance waiver issued for Skaneateles Lake by the NYSDOH due to the high quality of water from Skaneateles Lake and watershed protection programs. Approximately 43 million gallons daily (MGD) of unfiltered water is withdrawn from the lake via two 54-inch diameter steel intake pipes located 20 feet and 45 feet below the lake surface, which then flows 19 miles to Syracuse. (SLWAP 2018).

Maintaining the Filtration Avoidance Determination is a major factor in the City's watershed and water quality planning in the Skaneateles Lake Watershed. This waiver was originally granted by the State to the City of Syracuse in 1994, and it allows the City to withdraw water and provide it to City residents without a filtration plant, provided the City adheres to certain water quality standards.

The focus of this 9E Plan is on watershed phosphorus reduction and the expected achievement of the in-lake targets for TP and chlorophyll-a. The implementation of erosion control BMPs, particularly in the northern sub-watersheds, will reduce watershed sediment losses and provide the co-benefit

of reduced lake sediment and turbidity levels. See the Recommended Water Quality Maintenance Strategies (Section 5) and the Implementation Plan (Section 6) for more details on sub-watershed priorities and recommended BMPs.

Private Wells

The Town and Village of Skaneateles have municipal water systems. Only a small portion of the area in the Skaneateles Watershed is within the Town's water district: the majority of the roughly 2,800 homes in the watershed get their water from private wells. Water supply well construction, maintenance, and abandonment are subject to the regulations established by section 15-1502 of the Environmental Conservation Law and section 206 of the Public Health Law (New York State).

Private Surface Water

Many of the residences around the lake get their water by pumping it directly from Skaneateles Lake. Given the potential for surface water to contain blue-green algae and their toxins, the Onondaga County Division of Environmental Health recommends that no one drinks untreated surface water, whether or not HABs are visible. Young children, pregnant women, older adults, and people with health issues are at higher risk from symptoms associated with these drinking water contaminants.

2.13 Water Quality Monitoring Efforts

Lake Monitoring

City of Syracuse

Because Skaneateles Lake is the drinking water source for the City of Syracuse, the City is responsible for complying with the New York State Sanitary Code's requirements. Title 10, Part 5, Subpart 5-1 of the State's Codes, Rules and Regulations provide the Maximum Contaminant Levels (MCLs) for a variety of pollutants, including:

- Organic and inorganic chemicals
- Radionuclides
- Microbiological contaminants
- Turbidity
- Giardia and Cryptosporidium
- E. coli
- Disinfection byproducts

The City's *Skaneateles Lake and Watershed 2022 Annual Report* can be accessed online at: <https://www.syr.gov/files/sharedassets/public/v/1/2-departments/water/documents/reports/water-quality-annual-reports/quality-annual-report-2022.pdf>

CSLAP

Water quality monitoring on Skaneateles Lake has been conducted as part of the NYSDEC's Citizens Statewide Lake Assessment Program (CSLAP²) since 2017. A separate phase of CSLAP data collection took place between 1997 and 2001.

Figure 2.16 shows the two CSLAP monitoring stations on Skaneateles Lake that were active between 2017 and 2024: Station 139.1 on the northern end and Station 139.2 on the southern end. Station 139 was the monitoring station for an earlier phase of CSLAP monitoring, from 1997 to 2001.

Beginning in 2025, only Station 139.1, on the northern end of the lake, will be monitored.

Figure 2.17 provides data from the period from 1997 to 2001 (Historic data), as well as from the current period of monitoring, 2017 to 2022 (Current data).

Upstate Freshwater Institute

The Upstate Freshwater Institute (UFI) has a long history of lake monitoring activities on Skaneateles Lake. UFI conducted monitoring programs in Skaneateles Lake in 2007, 2008, 2011, 2014, and 2017 to document seasonal and long-term patterns in water quality conditions. Both in-situ and laboratory measurements were made to assess thermal stratification, trophic state, and optical characteristics. Monitoring was conducted monthly, typically from April to October, at multiple sites and depths. The monitoring efforts were funded by the Town of Skaneateles.

Cyano-HABs Advanced Monitoring Pilot

Because of increasing reports of HABs statewide, a HABs Initiative was established in 2018 that included the NYSDEC, the Department of Health (DOH), and the Department of Agriculture and Markets (AGM). The Initiative supported the development of a Cyano-HABs Advanced Monitoring Pilot in collaboration with the United States Geological Survey (USGS) in three Finger Lakes: Owasco, Seneca, and Skaneateles lakes (NYS DEC, 2024).

In Skaneateles Lake, this included an open water platform and a water quality monitoring station at the Village of Skaneateles pier. Additionally, water quality, algal composition, and cyanotoxin data were collected at multiple locations and depths on seven dates on northern Skaneateles Lake in 2019. This approach allowed for detailed characterization of open-water and nearshore water quality in Skaneateles Lake, using sensors and chemistry samples to help understand the spatial distribution of water quality and HABs. For more information on this pilot project, see: <https://dec.ny.gov/environmental-protection/water/water-quality/harmful-algal-blooms>.

2 For more information on the CSLAP program see: <https://dec.ny.gov/environmental-protection/water/water-quality/sampling-activities>

Other Data Collection

Other data collection efforts conducted in Skaneateles Lake include the NYSDEC Disinfection By-Products (DBPs) Study in 2004, and the Finger Lakes Synoptic Water Quality Investigation (SWQI) in 1996, 1997, and 1999.

Tributary Monitoring

USGS Gaging Station

A United States Geological Survey (USGS) gaging station is present on the lake's outlet stream, Skaneateles Creek, approximately six miles north (downstream) of the lake. Discharge and gage height are recorded at this station.

A USGS gaging station is also present on Grout Brook on Glen Haven Road in Cortland County. This gaging station was funded by the DEC, which continues to support its maintenance.

UFI Monitoring

The Upstate Freshwater Institute conducted extensive monitoring of Shotwell Brook, a tributary in the northeastern section of the lake's watershed, during 2016 and 2017. This was followed by another monitoring program in 2018. The goal of this monitoring was to develop a baseline characterization of Shotwell Brook's hydrology and water quality and was funded by the Skaneateles Lake Association.

UFI also conducted extensive tributary monitoring in 2019 to provide a base of data for the 9E plan. The four major tributaries to Skaneateles Lake (Bear Swamp Creek, Grout Brook, Shotwell Brook, and Harold Brook) were monitored biweekly from May to November 2019. Additional monitoring was completed at all major tributaries during or shortly after three rain events during this period. Three additional sampling events at Shotwell Brook took place prior to May 2019 with funding from the Town of Skaneateles. Each monitoring event consisted of field measurements and water quality sample collection when it was safe to do so.

In addition to the major tributaries, six minor tributaries to Skaneateles Lake were also monitored approximately bi-weekly from May to November 2019. These minor tributaries were: One Mile Creek, Snow Brook, Five Mile Creek, Glen Cove, Randall Gulf, and an upstream portion of major tributary Bear Swamp Creek.

DEC Monitoring

The DEC's Cyano-HABs Advanced Monitoring Pilot also included tributary sampling at multiple Skaneateles Lake tributaries in the summer of 2019, including Bear Swamp Creek, Grout Brook, and several smaller tributaries.³

3 DEC's Division of Water (DOW) online Monitoring Data Portal provides access to this and other monitoring data from the Bureau of Water Assessment and Management. See: <https://experience.arcgis.com/experi->

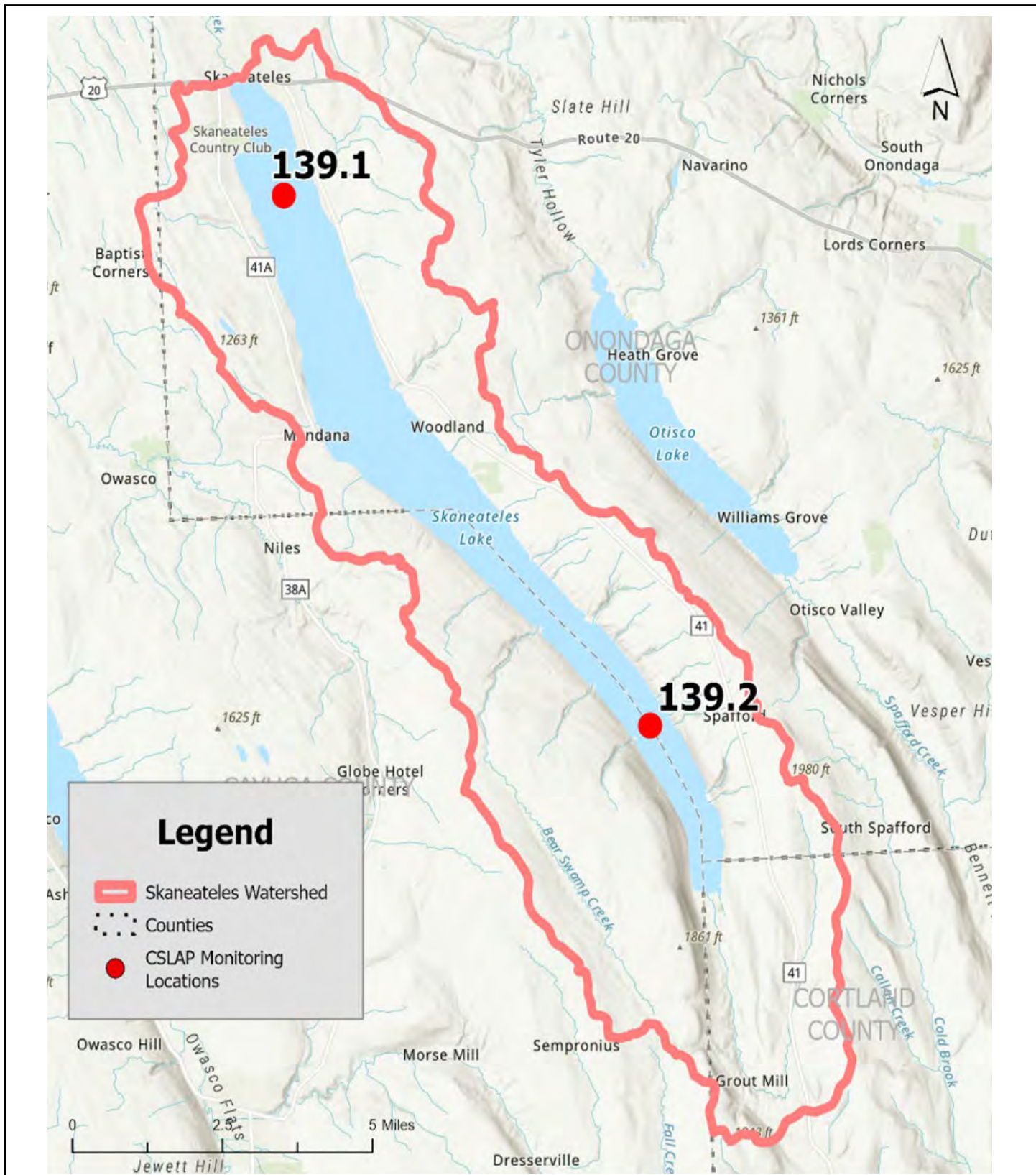


Figure 2.16 – CSLAP Monitoring Locations

Source: NYSDEC, 2020
Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
Coordinate System: NAD UTM Zone 18N

NEW YORK STATE Department of State
This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Central New York Regional Planning & Development Board
This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

2.14 Current Water Quality Conditions

Lake Trophic Status

“Trophic state” is a concept that is used for classifying the overall condition of a lake, as measured by phytoplankton production. Lakes are generally placed in one of three categories:

- Oligotrophic: clear water with low nutrient levels and very little algae / phytoplankton production
- Mesotrophic: partially clouded water with moderate nutrient levels and some phytoplankton
- Eutrophic: clouded water with high nutrient levels and very high phytoplankton production

As shown in Table 2.15, there are standards of transparency, total phosphorus, and chlorophyll-a levels that are associated with each trophic state (NYSDEC, 2019).

Skaneateles Lake is oligotrophic, with very low levels of algae and phytoplankton, and low levels of phosphorus, a nutrient that plants and all other living things depend on.

CSLAP Data: Historic vs. Current

As noted in Section 2.15, in addition to the current CSLAP data collection program on Skaneateles Lake, initiated in 2017, there is an older collection of data to draw on: data collected under the same protocols between 1997 and 2001.

For ease of reference, in the discussion below, the older CSLAP data (1997 – 2001) will be referred to as “Historic” data, and the current CSLAP data collection (2017 – 2022) will be referred to as “Current” data.

Secchi Disk Depths

A Secchi depth is a measure of a water body’s clarity or transparency. It is obtained by lowering an eight-inch disk with alternating black and white quadrants (known as a Secchi disk) into the water and measuring the depth at which it is no longer visible. Oligotrophic lakes generally have Secchi depths greater than 5 meters. The annual average of Skaneateles Lake’s Secchi depths is consistently above 5 meters and in 2001 reached an average of 10.9 meters (Table

Table 2.15 – Trophic Classification Indicators

Parameter	Oligotrophic	Mesotrophic	Eutrophic
Transparency (m)	> 5	2-5	< 2
TP (µg/L)	< 10	10.0 – 20.0	> 20.0
Chlorophyll-a	< 2 µg/L	2 – 8 µg/L	> 8 µg/L

Source: (NYSDEC, 2019)

Table 2.16 – Skaneateles Lake – Secchi Disk Depths (m)

(Historic: 1997-2004; Current: 2017-2022)

	YEAR	N	Mean	Minimum	Median	Maximum
HISTORIC DATA	1997	7	8.2	5.9	7.7	11.5
	1998	8	8.9	3.9	9.2	12.9
	1999	6	9.4	7.6	8.4	12.8
	2000	8	9.7	5.1	10.0	13.6
	2001	8	10.9	7.4	11.1	15.0
			37	9.4	3.9	9.3
CURRENT DATA	2017	16	6.9	2.8	6.8	9.6
	2018	14	9.0	6.5	7.9	11.6
	2019	22	9.2	5.8	7.1	15.5
	2020	15	8.6	6.9	8.4	11.2
	2021	15	7.2	2.0	6.1	9.5
	2022	13	7.6	6.0	7.7	10.2
			95	7.6	2.0	7.7

Source: Citizens Statewide Lake Assessment Program, NYSDEC

Table 2.17 – Skaneateles Lake – Chlorophyll-a Levels (µg/L)

(Historic: 1997-2004; Current: 2017-2022)

	YEAR	N	Mean	Minimum	Median	Maximum
HISTORIC DATA	1997	8	0.56	0.35	0.53	1.04
	1998	8	0.90	0.46	0.91	1.46
	1999	8	0.78	0.39	0.75	1.21
	2000	7	0.85	0.42	0.66	2.18
	2001	8	0.78	0.38	0.75	1.64
	2004	4	0.72	0.60	0.75	0.80
			43	0.77	0.35	0.70
CURRENT DATA	2017	15	1.21	0.50	1.00	2.30
	2018	14	0.95	0.30	0.80	1.60
	2019	15	1.60	0.52	1.45	3.21
	2020	15	0.86	0.23	0.69	1.67
	2021	14	1.39	0.10	1.48	2.60
	2022	13	0.78	0.13	0.81	1.50
			86	1.14	0.10	1.00

Source: Citizens Statewide Lake Assessment Program, NYSDEC

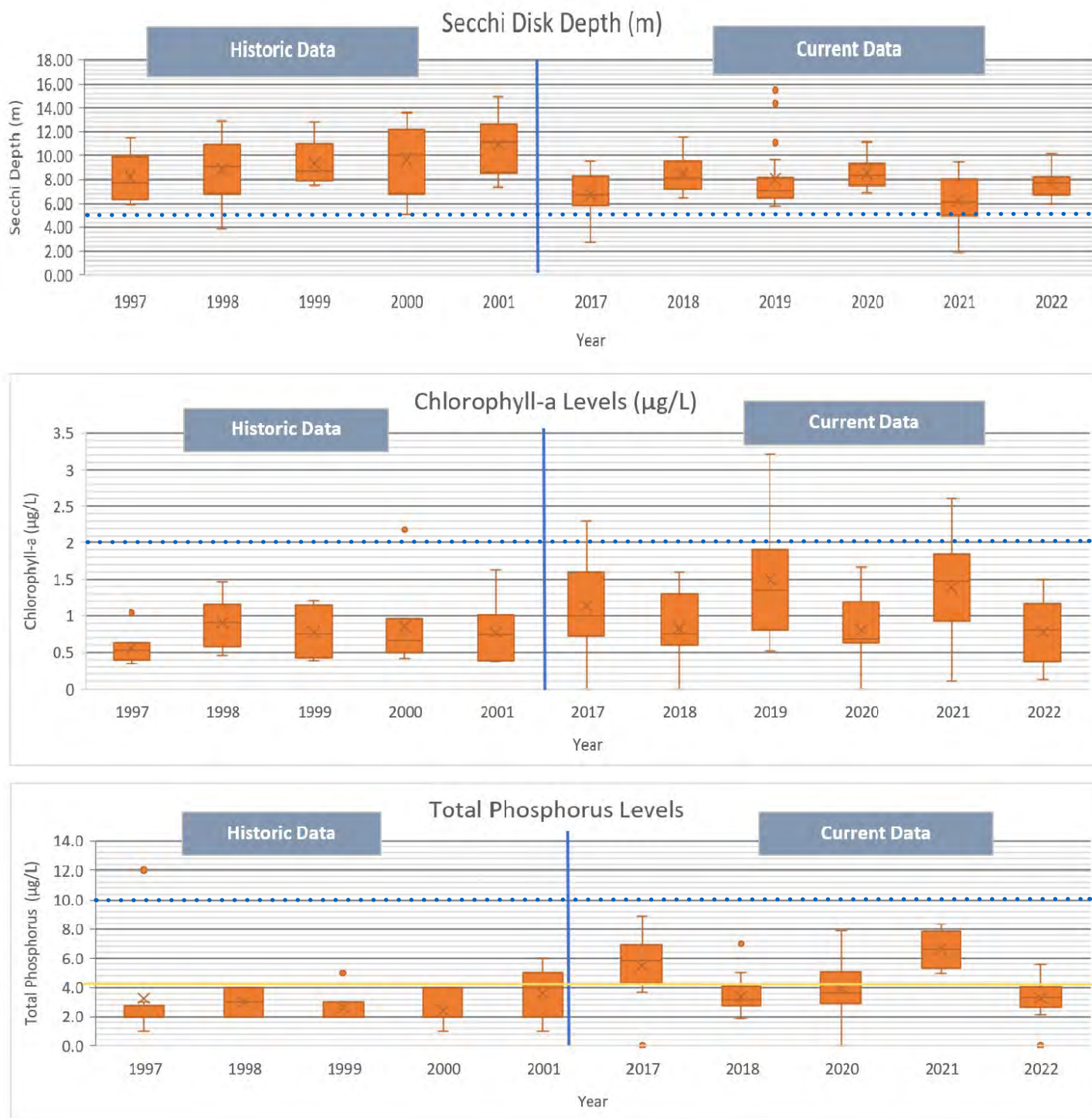
Table 2.18 – Skaneateles Lake - Total Phosphorus Data (µg/L)

(Historic: 1997-2004; Current: 2017-2022)

TP	YEAR	N	Mean	Minimum	Median	Maximum
HISTORIC DATA	1997	8	3.25	1.00	2.00	12.00
	1998	2	3.00	2.00	3.00	4.00
	1999	8	2.38	1.00	2.00	5.00
	2000	8	3.38	1.00	2.00	10.00
	2001	8	3.56	0.62	3.94	6.22
	2004	4	4.42	3.00	4.20	6.30
				3.27	0.62	2.19
CURRENT DATA	2017	15	5.87	3.70	5.90	8.90
	2018	14	3.87	1.90	3.30	7.30
	2019	2	4.74	4.36	4.74	5.11
	2020	15	4.17	2.61	3.65	7.89
	2021	10	6.16	4.91	5.73	8.35
	2022	13	3.64	2.55	3.23	5.96
				4.68	1.9	4.32

Source: Citizens Statewide Lake Assessment Program, NYSDEC

Figure 2.17 – CSLAP Data – Historic and Current



Secchi Disk Depths (top); **Chlorophyll-a Levels** (middle); **Total Phosphorus Levels** (bottom). Historic, 2017 – 2001, and Current Data, 2017 – 2022. Data from the Citizens Statewide Lake Assessment Program, measured at Station 139 (Historic Data) and Stations 139.1 and 139.2 (Current Data). Data shown are from epilimnion measurements. The yellow line on the Total Phosphorus Levels chart represents the most recent three-year average (4.5 µg/L). The blue dotted lines represent the levels associated with oligotrophic lakes (see Table 2.15).

2.16 and Figure 2.17). In the Current CSLAP period, annual averages have ranged from 6.9 to 9.2 meters, reaching a maximum of 15.5 meters in 2019. The City of Syracuse also collects Secchi depths; in 2022, the City’s measurements ranged from 6.5 to 14 meters.

Chlorophyll-a

The algae in a lake or pond is actually a highly diverse group of photosynthetic microscopic organisms known collectively as “phytoplankton”, including floating, suspended, and benthic (lake bottom) forms. Suspended phytoplankton usually represents much of the biomass in a lake or pond and forms the foundation of the aquatic food web. Phytoplankton concentrations are most frequently determined by measuring concentrations of chlorophyll-a, a photosynthetic pigment found in all freshwater plankton (NYSDEC, 2019). Lakes with large amounts of algae are often green in color because of the chlorophyll-a in the algae. Like phosphorus, chlorophyll-a is a natural part of a water body’s chemistry.

Measuring and tracking chlorophyll-a levels provides an important indicator of a water body’s overall biological productivity. As shown in Table 2.17, chlorophyll-a levels over 8 µg/L typically indicate that a water body is eutrophic, levels under 2 µg/L indicate an oligotrophic water body, and levels between 2 and 8 µg/L indicate a mesotrophic water body. Chlorophyll-a levels concentrations greater than 10 µg/L can result in reduced water clarity, degradations in aesthetic and recreational water quality, and increased frequency of open water and shoreline algal blooms (NYSDEC, 2019).

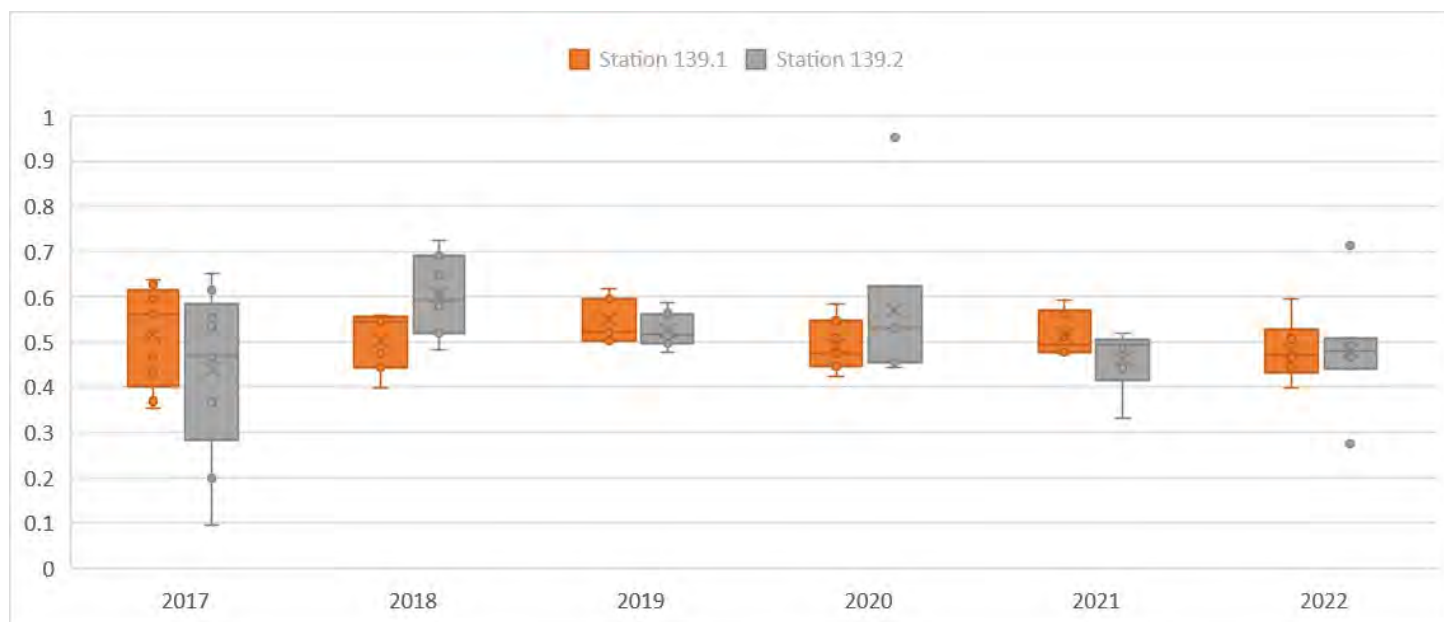
As shown in Figure 2.17, Skaneateles Lake’s chlorophyll-a levels are typically under 2 µg/L, which is consistent with Skaneateles Lake’s status as an oligotrophic lake. Measurements from the Historic CSLAP period (1997 – 2001) show annual average chlorophyll-a levels ranging from 0.56 to 0.9 µg/L. For the Current CSLAP period, annual average chlorophyll-a levels range from 0.78 to 1.6 µg/L. For the period from 2020 to 2022, the average chlorophyll-a level was .99 µg/L.

Total Phosphorus

Phosphorus, like nitrogen, is a nutrient required for all life. Phosphorus is frequently the limiting nutrient for phytoplankton in lakes, rivers and ponds, because it is the least abundant of the nutrients needed to sustain life. Phosphorus is the limiting nutrient in Skaneateles Lake: the growth rate of algae and aquatic plants is controlled by how much phosphorus is available.

Phosphorus takes several different forms in a water body: it can be organic or inorganic, and it can be dissolved in water or “suspended” (attached to particles in the water column). For the sake of simplicity, this 9E Plan will refer to total phosphorus (TP), a measurement of all forms of phosphorus in a given water sample. However, it is important to note that the dissolved forms of phosphorus – particularly “soluble reactive phosphorus” (SRP) and “dissolved organic phosphorus” (DOP) – are more readily bioavailable to phytoplankton than particulate forms (NYSDEC 2020).

Figure 2.18 – Total Nitrogen Levels



Source: Data from the Citizens Statewide Lake Assessment Program, measured at Stations 139.1 and 139.2. Data shown are from epilimnion measurements.

Total phosphorus (TP) levels are most easily understood as concentrations measured at the scale of micrograms (μg) per liter of water. A microgram is a millionth of a gram. For reference, the mass of a grain of sand is typically given as being on the order of 10 to 50 μg .

NYSDEC's 2018 *Finger Lakes Water Quality Report* provides data on TP for the 11 Finger Lakes. Based on data from 2017 and 2018, Skaneateles Lake's TP levels were the lowest among the Finger Lakes, and the Finger Lakes are, on average, well below the TP average for all lakes in New York for which CSLAP data is collected (NYSDEC, 2019).

Waterbodies with TP levels under 10 $\mu\text{g}/\text{L}$ are considered oligotrophic. As Table 2.18 shows, TP concentrations are typically less than 10 $\mu\text{g}/\text{L}$ throughout Skaneateles Lake, indicating low productivity and oligotrophic conditions.

CSLAP data from the Historic period suggest that TP levels have been increasing slightly in Skaneateles Lake. Mean and median TP levels in the Current period are slightly above those in the Historic period. Nevertheless, annual average TP levels are consistently at or below 6 $\mu\text{g}/\text{L}$, well below the 10 $\mu\text{g}/\text{L}$ threshold at which a lake is considered mesotrophic. Figure 2.17 shows CSLAP data from the Historic and Current periods.

Total Nitrogen

Like phosphorus, nitrogen is critical to the survival of all living organisms and, thus, a component of a water body's overall productivity, including the production of HABs. However, like many lakes, Skaneateles Lake has much more nitrogen than phosphorus. As shown in Figure 2.18, total nitrogen (TN) levels in Skaneateles Lake between 2018 and 2022 ranged between 0.4 mg/L and 0.7 mg/L, or more than 100 times more abundant than phosphorus.

2.15 Regulatory Context

For a complete overview of the federal, state, and local laws that pertain to protecting water quality in the Skaneateles Lake Watershed, see Appendix D, *Skaneateles Lake Watershed Institutional Framework and Assessment of Local Laws, Programs, and Practices Affecting Water Quality*. The following summary provides information on key aspects of the regulatory context in the watershed, particularly the Watershed Rules and Regulations and municipal laws.

State Laws - Statewide

State regulations that pertain to water quality and environmental protection across New York State include:

- State Environmental Quality Review Act (Article 8): SEQR requires investigation into alternative actions and the mitigation of harmful effects of proposed development. Potential nonpoint source pollution can be remediated through revised design or other measures.
- Water Resources Law: NYS State Law, Chapter 43-B, Article 15 states that the waters of the state shall be conserved and developed for all public beneficial uses and that comprehensive planning shall be undertaken for the protection, conservation, equitable and wise use and development of the water resources of the state.
- State Pollution Discharge Elimination System: (SPDES) NYS State Law, Chapter 43-B, Article 17. This water pollution control law is modeled after the National Pollution Discharge Elimination System approved by the Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Through SPDES, NYSDEC reviews permit applications to develop the limits for types and quantities of pollutants in the effluent. The permit also includes the schedules and conditions under which discharges are allowed. Owners or operators of facilities must treat wastewater to meet the limits listed in their SPDES permit.
- Prohibition against pollution (§ 17-0501)
- Prohibition against certain acts without permit (§ 17-0505)
- Concentrated Animal Feeding Operations (CAFOs) Permitting (§ 17-0105)13: The NYSDEC enforces regulations regarding CAFOs, which apply to dairy farms and other farms where animals are stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period. CAFOs are categorized as either "large" or "medium" based on the numbers of animals confined. The federal Clean Water Act (33 USC 1251) is the overarching authority governing discharges to waterways, and each state adopts its own related laws regarding permits required for operations that might discharge to waterways within that state. Stormwater

- permitting (§ 17-0808)
- Discharge of sewage into waters (§§ 17-1701, 1704, 1710,)
 - Nutrient runoff, phosphorus fertilizer (§§ 17-2101-2105)
 - Freshwater Wetlands Act (Article 24): Preserves, protects and conserves freshwater wetlands and their benefits, consistent with the general welfare and beneficial economic, social and agricultural development of the state. Protected under the Freshwater Wetlands Act are wetlands 12.4 acres or larger, and wetlands smaller than 12.4 acres if they are considered of unusual local importance. Around every wetland is an “adjacent area” of 100 feet that is also regulated to provide protection for the wetland. Note that this Act was amended in 2022, and changes in how it is administered will be rolled out between 2025 and 2028. For instance, in January 2025, any wetlands that meet the Act’s definition of and criteria for wetlands will be regulated by DEC and subject to permitting, regardless of whether they appear on the informational maps. And in January 2028, the default size threshold for regulated wetlands will decrease from 12.4 acres to 7.4 acres. Small wetlands of “unusual importance” will continue to be regulated if they meet one of the criteria listed in the new legislation. For more information see the DEC’s Freshwater Wetlands Program website: <https://dec.ny.gov/nature/waterbodies/wetlands/freshwater-wetlands-program>.

State Laws – Skaneateles Lake Watershed

Under the New York State Health Code (10 NYCRR 131.1), the City of Syracuse is responsible for inspection of the watershed and enforcement of the Skaneateles Lake Watershed Rules and Regulations (available online at: <https://www.skanelakeinfo.org/watershed-rules-regs>). The New York State Health Code includes rules and regulations that apply to the entire Skaneateles Lake watershed and are enforced and administered by the City of Syracuse Department of Water (City).

Skaneateles Lake Watershed Rules and Regulations

The Watershed Rules and Regulations regulate activities in three geographic zones in the watershed:

- Zone I: the area within a 500-foot radius of the City’s water supply intakes at the lake’s northern end,
- Zone II: the entire lake surface, excluding Zone I, and
- Zone III: the entire tributary watershed to the lake, watercourse, aquifer or aquifer recharge area.

The Watershed Rules and Regulations prohibit recreational uses in Zone I, and prohibit discharging solid or liquid wastes in this area. Similarly, the rules and regulations for Zone II

prohibit discharging “solid or liquid waste, hazardous material, herbicide, pesticide, or other material that may have a detrimental impact on water quality” to the lake. Discharges from watercraft to the lake are also prohibited.

The preponderance of the Watershed Rules and Regulations apply to Zone III, the watershed, and cover:

- wastewater treatment works (OWTS),
- animal waste storage and disposal,
- fertilizer and manure use,
- pesticide storage and use,
- sediment generation and control,
- solid waste management,
- hazardous/radioactive materials (disposal is prohibited in the watershed),
- petroleum storage,
- stockpiles (i.e., coal and salt),
- chloride salt application (use the minimum amount needed for public safety),
- the construction and closure of wells, and
- cemeteries.

The Watershed Rules and Regulations also require “regular and thorough inspections of the identified Protection Zones to enforce the rules and regulations set forth in this section”, including serving notices of violations and making annual reports to the State Commissioner of Health on the results of these inspections. Figure 2.19 shows the inspection grid used by inspectors to ensure thorough coverage of the watershed area.

Key provisions of these rules and regulations include:

- All individual household wastewater treatment works receiving domestic wastewater shall be designed, installed, and maintained in accordance with the standards established in 10 NYCRR Part 75 (Appendix 75-A), and the NYSDOH publication: ‘Individual Residential Wastewater Treatment Systems Design Handbook’.
- The absorptive component of all wastewater treatment works shall be a minimum of 100 feet linear distance from the lake or watercourse.
- Land-based holding tanks shall not be installed for new construction (i.e., full-time or part-time occupancy); land-based holding tanks may be permitted as replacements for existing failing land-based holding tanks or for those cases where a land-based holding tank is the only possible repair or replacement alternative for an existing onsite wastewater treatment system where conditions preclude the replacement of onsite wastewater treatment systems due to parcel size limitations, poor soil conditions, or insufficient depth to bedrock or groundwater.

- Land-based holding tanks shall not be placed within a 50-foot lineal distance of the lake or a watercourse.
- No new construction or alteration, addition or change of use (for example, conversion from seasonal to year-round residence) of existing dwellings or commercial buildings shall be undertaken, until such time as the supplier of water and the NYSDOH or county health department having jurisdiction has been notified, and the NYSDOH or county health department having jurisdiction has issued an approval of the wastewater treatment proposed for the site.
- Areas used for the storage, stockpiling, or disposal of non-agricultural or agricultural associated animal waste shall conform to the plan developed by the Whole Farm Planning Program.
- Open storage of fertilizers is prohibited.
- Use of fertilizers and land application of manure shall:
 - (a) be in conformance with the publication defined in subdivision (f)(3) of this section, or
 - (b) conform to the plan developed by the Whole Farm Planning Program.
- Pesticide storage and use are subject to the approval and enforcement authority of the New York State Department of Environmental Conservation.
- Farm tillage practices shall:
 - (a) be in conformance with the publication defined in subdivision (f)(3) of this section or,
 - (b) conform to the plan developed by the Whole Farm Planning Program.
- Land disturbing activities, including, but not limited to, general construction, highway construction and maintenance, and silviculture, and which expose 5,000 or more square feet of soil are prohibited within an environmentally sensitive area as defined in the Watershed Rules Regulations (this includes land within 300 feet of the lake or watercourse, areas with slopes greater than 15%, within 300 feet of areas defined as wetlands, or on highly erodible soils) except where measures have been put in place to prevent erosion and sediment production.

The City of Syracuse's Water Department prepares an annual report summarizing conditions in the lake and watershed and reporting on inspection procedures and observed violations of the rules and regulations.

As described in the most recent annual report, the City's inspection procedure consists of the following:

Two City of Syracuse personnel routinely patrol the lake and watershed: a Watershed Inspector and a Water Department Sanitarian. Typically, there is an increase in regulated activities within the watershed during the summer months (May-September). This

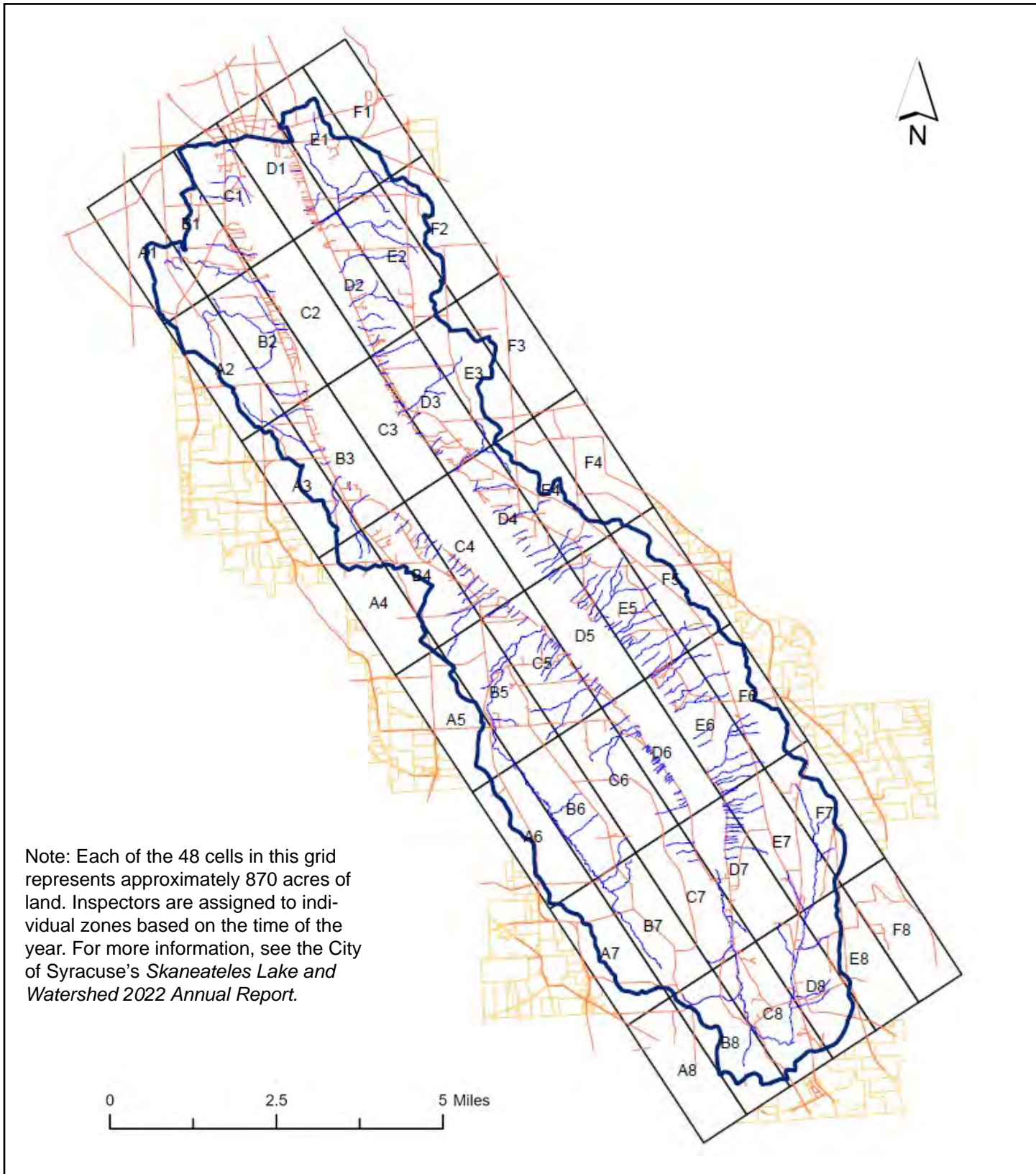
is due, in large part, to the influx of seasonal residents and non-resident recreational users (boaters, anglers, hikers, etc.). The activities include construction and/or repair of dwellings, OWTS and shoreline structures and recreation. To address this increased seasonal activity, Inspectors conduct intensive morning investigations of lakeshore properties. This includes walking properties, looking under structures, inspecting for OWTS failures, and investigating construction activities of any kind. When required, a boat detail is implemented for those areas that are difficult to access by truck or foot.

To more effectively survey the entire land area within the watershed annually, watershed zones were digitally overlaid and labeled on a GIS map in 2012 [Figure 2.19]. The zones appear on the Skaneateles Lake Watershed Map as 48 rectangular grids, each representing approximately 870 acres of land. Inspectors are assigned to individual zones based on the time of year. Zones comprising of lakefront seasonal cottages are inspected during the summer months and remote areas located off seasonal roads are typically inspected in the spring and fall. The afternoon schedule allows for flexibility, and no specific areas are selected for inspection. This affords the Inspectors the latitude to conduct general inspections, pursue compliance of outstanding violations, conduct site surveys for OWTS proposals and meet with property owners, Environmental Conservation Officers (ECOs), Building Inspectors, or County Public Health Technicians/Sanitarians. . (City of Syracuse Department of Water, 2024)

Municipal Laws

Comprehensive Plans and Zoning - Overview

A comprehensive plan is a long-term document that outlines a community's vision for growth and development over a set period, usually 10 to 20 years. It covers various aspects such as land use, transportation, housing, natural resources, and public services. The comprehensive plan provides a framework for making decisions about land use, infrastructure, and services. It sets the broad goals, objectives, and policies that guide the future development of the community. The comprehensive plan also lays the foundation for developing a community's zoning. In New York State, the state's zoning enabling acts require that zoning be undertaken in accord with a well-considered plan, such as a



Note: Each of the 48 cells in this grid represents approximately 870 acres of land. Inspectors are assigned to individual zones based on the time of the year. For more information, see the City of Syracuse's *Skaneateles Lake and Watershed 2022 Annual Report*.



This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.



This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 2.19 – City of Syracuse Watershed Inspection Grid

Source: City of Syracuse
Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA

comprehensive plan.

Zoning is the single most effective tool that towns and villages have in controlling the type, size, density, and impacts of development in their jurisdictions. The Village of Skaneateles and the Towns of Skaneateles, Otisco, Owasco, Scott, and Spafford have zoning; the Towns of Niles and Sempronius (see Figure 2.20).

Village of Skaneateles

The Village of Skaneateles has a joint comprehensive plan with the Town of Skaneateles. The Zoning Code has a Skaneateles Lake zone overlay and setback requirements related to the shoreline. The Zoning Code includes a section describing the role played by the City of Syracuse Water Department in site plan review and approval for land disturbance within the watershed. The Village has an Environmental Advisory Committee which advises the Village Board.

The Code of the Village of Skaneateles includes:

- § 95 Environmental Review
- § 190 Subdivision of Land
- § 225 Zoning Code

The Village's Zoning Code describes three overlay districts:

- Floodway Fringe (FF-O),
- Skaneateles Creek (SC-O) and
- Skaneateles Lake Watershed (SL-O).

The SL-O district is designed to control land uses that may have a detrimental effect on water quality through building permits when 500 or more square feet of land are disturbed. The zoning regulations describe landscape requirements including appropriate vegetative cover and the presence of native trees for all zones. In addition to the Skaneateles Lake Watershed overlay, the zoning code includes lakeshore specific development regulations and a 50-foot shoreline setback. Site plan review requirements were updated in 2018. The subdivision ordinance includes provision for stormwater management and drainage and cluster development strategies to preserve open space and ecological functions that support good water quality. The village does not have any stormwater regulations. Though the village is not a regulated MS4 and therefore not required to, the Village could consider implementing stormwater management ordinances. The additional two overlay districts are outside of the Skaneateles Lake Watershed.

Town of Skaneateles

The Town of Skaneateles has a joint comprehensive plan with the Village of Skaneateles, as well as zoning, subdivision regulations, and site plan review requirements. The zoning ordinance includes a Lake Watershed Overlay Dis-

trict (LWOD) that adds protection over the portions of the town that lie within the Skaneateles Lake watershed. The Town has a Conservation Committee that advises on environmental issues and implements conservation projects in the Town.

The Code of the Town of Skaneateles includes:

- §148 Zoning
- §148-21 Lake Watershed Overlay District (LWOD)
- §148-18 Site Plan Review
- §148-16 Considerations in Granting or Denying Special Permits
- §131 Subdivision of Land

Additionally, in 2024, the Town Board adopted new regulations governing the placement of onshore and offshore structures bordering, or within, Skaneateles Lake. These regulations added design and placement restrictions on the construction of docks, decks, patios, seawalls, boat houses and a variety of other structures along the Skaneateles Lake shoreline. The regulations also require site plan review and Planning Board approval prior to the construction of these facilities.

Skaneateles's codes include numerous measures that address protection of Skaneateles Lake and Skaneateles Creek. When reviewing development applications within the LWOD, the planning/reviewing board is required to ensure that the development won't harm the lake. The Town of Skaneateles code sets a maximum impermeable surface coverage limit of 10% per parcel that is reduced by half (to 5%) in the LWOD. Subdivision developers in the LWOD are required to identify site features worthy of conservation and are not eligible to receive density bonuses or transferred development rights that are allowed elsewhere in the town. In addition to the LWOD, Skaneateles's zoning code protects water quality through an erosion and stormwater control plan requirement, wetland and watercourse protections, steep slope regulations; and stormwater criteria in special permit review, site plan review, and subdivision review.

Town of Owasco

The Town of Owasco's landscape is characterized by a combination of specialty crops, pasture, dairy and other livestock farms, pockets of low-intensity development, some deciduous forest, and a significant wetland complex in the northern half of the town. The portion of the Town of Owasco in the Skaneateles Lake watershed (which is less than 300 acres) is agricultural.

The town has a comprehensive plan, and its land use controls include zoning laws with an overlay Environmental Protection Overlay District [EPOD]), subdivision regulations, and site plan review requirements.

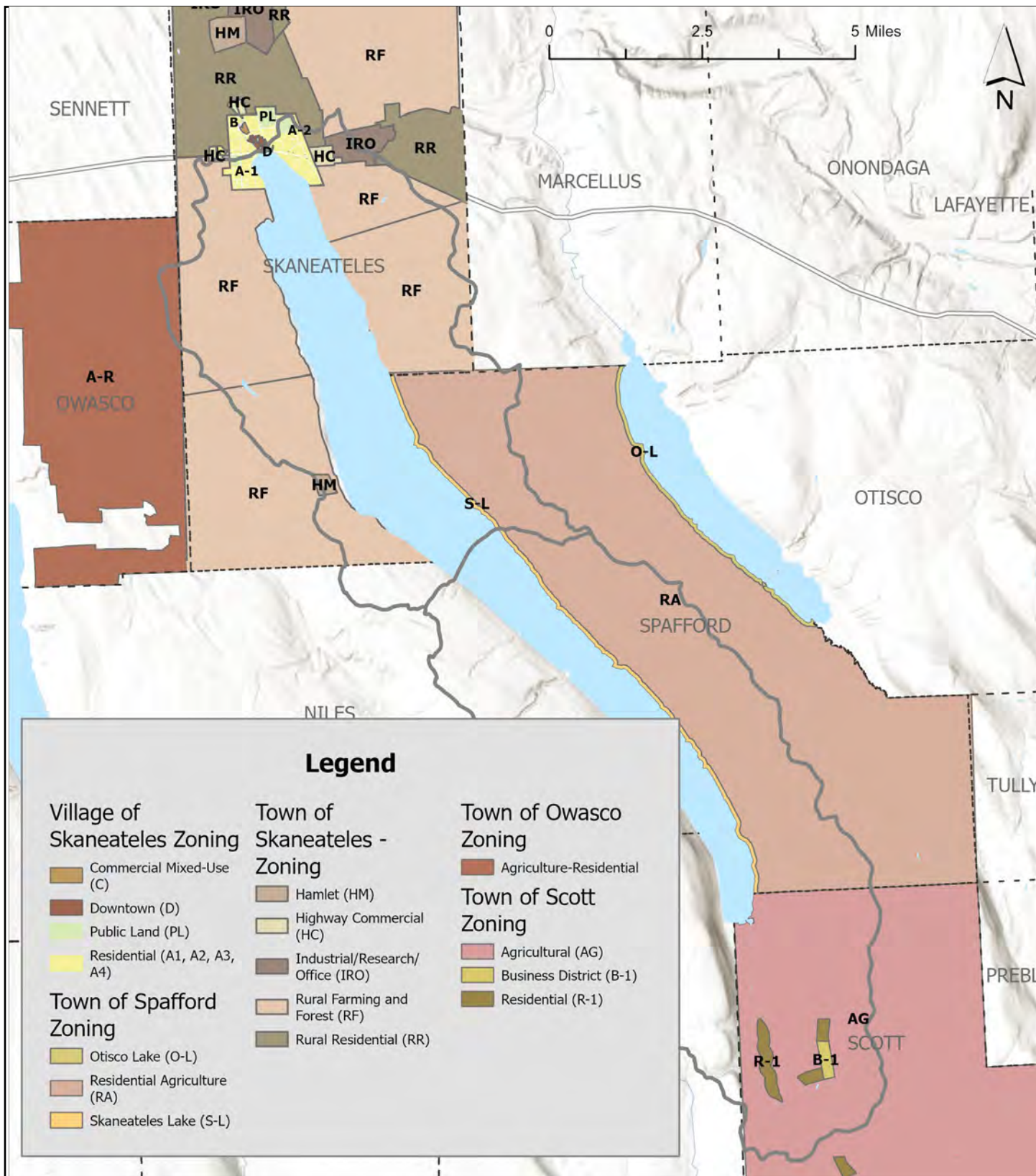




Figure 2.20 – Zoning Districts

Source: Town and Village Zoning Maps
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

 **Department of State**

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

 **Central New York Regional Planning & Development Board**

This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

The Code of the Town of Owasco, New York, July 10, 2014, includes the following sections:

- §150, Zoning (orig. 1988, amended 2004)
- §150, 9.10 - 9.20, Zoning: Environmental Protection Overlay
- §150-72, Zoning: Site Plan Review, 1988
- §126, Subdivision of Land, 2004

The Town of Owasco's local laws include numerous provisions intended to protect the Owasco Lake watershed, which have residual benefits for the Skaneateles Watershed, and could serve as useful models for other municipalities. Owasco's zoning code establishes three Environmental Protection Overlay Districts (EPODs): (1) stream corridor, lakeshore, and floodplain protection; (2) woodlot protection; and (3) steep slope protection. EPOD requirements include general provisions for review and approval of projects, and specific provisions for buffer zone areas, revegetation, and restrictions on and around slopes of 15% or more. Subdivision regulations include drainage design considerations, and site plan review addresses adequacy of stormwater and drainage facilities. In addition, the town requires that applicants comply with requirements in NYSDEC's New York Standards and Specifications for Erosion and Sediment Controls.

Town of Scott

The Town of Scott is largely agricultural and has a low density of impervious development. There is no comprehensive plan, but the Town is currently in the process of developing one. Zoning Laws were adopted in 1979 and include site plan review. There is a local law governing Manure Storage adopted in 2017 as an amendment to Section 14.

The Code of The Town of Scott, 1979, includes:

- § 8 Agricultural District
- § 11 Planned Development District
- § 14 Additional Regulations
- § 15 Application, Plans, and Approvals for Special Permit
- § 17 Floodway
- Stormwater Management
- Site Plan Review
- Manure Storage Law, 2017
- Zoning Code

The Town of Scott's local laws contain general references to septic system best management practices in the Grout Brook watershed, specifically, prohibiting septic systems within 200 feet of Grout Brook. The Town requires site plan review of liquid manure storage facilities over 100,000 cubic feet. The southern end of Skaneateles Lake at the Grout Brook inlet in the Town of Scott has one of the largest flood-

plains in the watershed; the Town's floodplain regulations require development in the floodplain to obtain a permit from the Town prior to construction. Permit requirements include ensuring that the bottom floors of buildings are above the base flood elevation and that utilities are protected from flooding.

There are no requirements related to stormwater runoff and erosion management specified, other than in the site plan review of a planned development district.

Town of Spafford

The Town of Spafford does not have a Comprehensive Plan in place. The Town does have zoning, with a Skaneateles Lake District guiding lakefront property and site plan review requirements in place for all zones. The Town recently adopted Steep Slope regulations in 2022. The amended steep slopes law establishes a Steep Slope Protection Area which applies to all lands with a slope of 15% or greater. Within the protection, there are additional requirements for site review and construction designed to protect Skaneateles water quality. For example, this includes provisions for maintaining trees of a certain size, and additional site plan review required for land disturbance.

The Code of the Town of Spafford includes:

- Article VI. Zoning District regulations
- 6-3 Skaneateles Lake district
- Article VII.
- 7-17 City of Syracuse review
- 7-24 Short term rentals
- Article XIV Site Plan Review
- Subdivision Regulations
- Local Law No. 1 of 2022 - Steep Slope Protection Law

The Spafford lakeshore district minimum lot size is just 7,500 square feet, less than 1/6th acre, and requires only a 50-foot setback from the lake. It allows up to 35% of impermeable lot coverage.

Town of Niles

The Town of Niles adopted a Comprehensive Plan in 2010 and has had subdivision regulations and site plan review since the mid-1990s. The town does not have a zoning law.

The Code of the Town of Niles, August 2013, includes the following sections:

- §190 Subdivision of Land, 1995
- §170 Site Plan Review, 1995
- §164 Setbacks and Lot Area
- §127 Lakefront Access and Rights, Conditions for a Special Permit

Stormwater management criteria exist in both Niles's subdivision regulations and its site plan review requirements. The town's subdivision standards are detailed in terms of measures that address protection of watershed resources; for example, developers must provide quantitative evaluations of storm runoff volume under pre- and post-development conditions, with proposed management practices; the planning board may require a comparison of pre- and post-development pollutant loading; and lands with slopes greater than 35% are generally to be considered unbuildable. Site plan review, although required for many land uses, does not contain specific volumetric considerations for stormwater management, but it does stipulate that development on slopes greater than 10% should minimize erosion both during and after construction, and that site drainage should not result in excessive turbidity in Skaneateles Lake. The town's subdivision law the town code (§127) prevent runoff from entering the lake through erosion and stormwater control plans or vegetated buffer strips and require modest setbacks (§164) for buildings with lake frontage.

Town of Sempronius

Development within the Town of Sempronius is of low intensity, and there are no public water or wastewater systems. Sempronius has no comprehensive plan, zoning, subdivision regulations, or site plan review requirements.

The Town of Sempronius' local laws contain general references to stormwater management, but do not include specific standards that address protection of watershed resources. For example, its Mobile Home Law states that permit applications must include a plan and provide for adequate drainage, with no specific measures required. This approach may not be consistent with the need to reduce runoff by slowing the flow of stormwater.

Town of Marcellus

The Town has a zoning ordinance, subdivision regulations and codes governing stormwater and erosion. The Town of Marcellus is a regulated MS4 operator and subject to the conditions of the New York General Permit for MS4s. The area within the Skaneateles Watershed (less than 300 acres) is zoned A-1, agricultural.

The Town's 2001 Comprehensive Plan includes an objective related to protecting surface and subsurface water bodies. It identifies septic systems as the most probable threat to groundwater in the area. The plan recommends educating homeowners of the need for septic system maintenance to reduce this threat. It also promotes erosion and sediment control during construction projects.

2.16 Ongoing Water Quality Maintenance Activities

Skaneateles Lake benefits from a set of watershed management activities carried out by the City of Syracuse, as well as a robust set of watershed improvement activities carried out by the towns and villages in the watershed and by non-profit organizations that work to protect water quality, as described below.

City of Syracuse Water Quality Maintenance Activities

Skaneateles Lake Watershed Protection Program

The City of Syracuse's Skaneateles Lake Watershed Protection Program includes several different activities to ensure high water quality, including:

- Watershed Inspection Program
- Onsite Wastewater Treatment System Review and Inspection
- Building Permit Application Review
- Erosion and Sediment Control Plan Review

Additionally, the City contracts with the Onondaga County Soil and Water Conservation District (OCSWCD) to support the District's Skaneateles Lake Watershed Agricultural Program (SLWAP). The City also contracts with Cornell Cooperative Extension of Onondaga County (CCE) to support an extensive public education program.

Watershed Inspection Program

Three full-time City of Syracuse personnel routinely patrol the lake and watershed to enforce the Watershed Rules and Regulations: two Watershed Inspectors and a Water Department Sanitarian (see Section 2.15 for a complete description of this inspection program).

Onsite Wastewater Treatment System Review and Inspection

The City of Syracuse Water Department reviews soil tests and OWTS plans in the watershed. According to the City's *Skaneateles Lake Watershed Program Annual Report 2023-2024*, the Department reviewed 29 design proposals for OWTS in 2023 (City of Syracuse Department of Water, 2024). See Sections 2.13 and 2.16 for more information on OWTS and inspections in the watershed.

Building Permit Application Review

Under the Watershed Rules and Regulations for Skaneateles Lake (10 CRR-NY 131.1), the City of Syracuse's Water Department has the opportunity to review and comment on applications for proposed building activities that involve land or shoreline disturbance within the watershed. In 2021, the Department reviewed 80 building and zoning permit applications, of which 10 were for new construction

(City of Syracuse, 2022).

Erosion and Sediment Control Plan Review

As of 2004, the Watershed Rules and Regulations require property owners proposing to disturb 5,000 square feet or greater of land in defined environmentally sensitive areas to submit a Sediment and Erosion Control Plan (SECP) to the City of Syracuse for review (City of Syracuse, 2022).

Skaneateles Lake Watershed Agricultural Program

The Skaneateles Lake Watershed Agricultural Program (SLWAP) is led by the OCSWCD, which works with farmers in the watershed to develop Whole Farm Plans. As described by the Watershed Agricultural Council, a Whole Farm Plan is “a holistic approach to farm management used to identify and prioritize environmental issues on a farm without compromising the farm business. Potential risks to the water supply are identified and addressed through careful structural planning to reduce or avoid the transport of agricultural runoff into farm streams” (Watershed Agricultural Council, n.d.).

The Whole Farm Plan approach is a voluntary, incentive-based approach that is available to all farmers in New York State through their county Soil and Water Conservation Districts. Statewide, approximately a third of farms participate in AEM. In the Skaneateles Watershed, the participation rate is much higher: 88%.

There are five tiers in the Agricultural Environmental Management (AEM) Whole Farm Planning process:

- Tier 1 – Inventory current activities, interests, and potential environmental concerns of the farmer.
- Tier 2 – Document current environmental stewardship and assess and prioritize areas of concern.
- Tier 3 – Develop conservation plans addressing concerns and opportunities tailored to farm goals.
- Tier 4 – Implement plans using available educational, technical, and financial assistance.
- Tier 5 – Evaluate practices and plans for conservation and farm viability.

Whole Farm Planning has been ongoing in the Skaneateles Watershed since the mid-1990s and, at this point, there is limited room for expanding the program. BMP checks are conducted on all farms on a rotating three-year basis. Figure 2.21 shows the geographic coverage of Whole Farm Planning in the watershed.

Table 2.19 summarizes the agricultural BMPs in place in the Skaneateles Watershed, according to the City of Syracuse’s *Skaneateles Lake Watershed Program Annual Report 2023-2024*. According to this report, these BMPs capture and/or prevent 19,524 pounds of phosphorus from entering Ska-

neateles Lake annually.

The following excerpts are drawn from the Onondaga County Soil and Water Conservation District’s SLWAP report for the period from March 2023 to February 2024, as found in the City of Syracuse’s *Skaneateles Lake Watershed Program Annual Report 2023-2024*:

The objective of SLWAP is to carry out a voluntary, cost-effective whole farm planning and implementation program for the watershed’s agricultural community that will reduce the risk of contamination of the lake from agricultural nonpoint sources. Priority agricultural nonpoint sources of pollution include pathogens, nutrients and sediment. Whole farm plans must not only meet the water quality objectives of the program; they must also meet business objectives of the farming enterprise to be successful. Plans are developed by a multi-agency team, which includes the farm manager, and utilizes a tiered approach to whole farm planning.

...

There are currently 37 farms enrolled in the program that meet the definition of a “farm”. For the purpose of the SLWAP, a farm is defined as “land used in a single farming operation for the production for sale of crops, livestock or livestock products of an average (over the past two years) gross sales of \$10,000 or more.” This represents an 88% participation rate in the SLWAP. Five (5) farms that meet the definition of a “farm” do not want to participate in the program but are visited annually to discuss any issues/opportunities for SLWAP to provide technical assistance. Two of these non-participating farms have whole farm plans developed, and two farms have chosen to self-implement Best Management Practices identified in the plan. Twenty-three (23) of the original farms are either no longer in active production or no longer meet the definition of a farm; “land used in a single farming operation for the production for sale of crops, livestock, or livestock products of an average (over the past two years) gross sales value of \$10,000 or more.” Typically, a portion (or all) of the land base associated with these farms is being utilized by other agricultural operations in the watershed and the land is included in that farm’s whole farm plan.

Table 2.19 – Agricultural Best Management Practices Constructed in the Watershed

BMP	Quantity Implemented	Units (where applicable)
Pathogen Management Systems	27	
Barnyard Runoff Management Systems	30	
Temporary Manure Nutrient Storage/Composting Systems	24	
Nutrient Management Systems (~ AEM Tier 4)	31	
Alternative Water Supply	44	
Buffer Strips	39.69	acres
Access Road Improvement Sites	74	
Diversions	29,273	feet
Fencing	140,449	feet
Milking Center Waste-Water Treatment & Disposal Systems	15	
Short Duration Grazing Systems	13	
Strip-cropping on Contour	1,375	acres
Water & Sediment Control Systems (WASCOBs)	70	
Waterways – grass, stone lined	50,427	feet
Critical Area Protection – vegetation control	394	acres
Critical Area Protection – streambank stabilization	12,483	feet
Nutrient Management Reviews (annually)	26	
Mortality Composting Systems	10	
Cover Crops (cumulative acres- 2023)	2,405	acres
Conservation Cover in Wheat, grass, hay (cumulative acres-‘23)	654	acres
Roof Water Dripline (ft)-2019	23	feet
Road Ditch Stabilization Projects w/ Heavy Armoring (#)	1	
Tire Recycling (# tires since 2019)	63,729	tires
Hydroseeded Road Ditch-Cleaned by Municipalities (‘23 Miles)	3.3	miles
TOTAL PHOSPHORUS CAPTURED ANNUALLY		19,524 lbs.

Source: (City of Syracuse Department of Water, 2024)

Of the land in the watershed in agricultural production, approximately 93% has been enrolled in the program. It is important to note that some farmers have retired and have sold or leased their land to another watershed farm. This land has stayed in agricultural production within the watershed.

Efforts will continue to enroll those farms that have yet to sign up with the program. A continued goal of the program is to eventually involve 100% of the active farm operations in the watershed.

Planning Status (Tiers I, II, III & IV)

Through February 2024:

- 36 farms have completed Tier I (farm inventory and identification

of potential water quality concerns).

- 36 of these farms have completed Tier II (verification of water quality concerns).
- 35 farms have completed whole farm plans (Tier III) for their operations (75.82 Farm Equivalents). Note: One farm equivalent is equal to 400 acres of agricultural land, which includes forested land. (Some farms have been replanned to incorporate the management of the new owners: Allan and Ronk).
- 29 farms have completed Tier IV plan implementation (66.38 Farm Equivalents). Two (2) additional farms have self-implemented portions of whole farm plan prepared

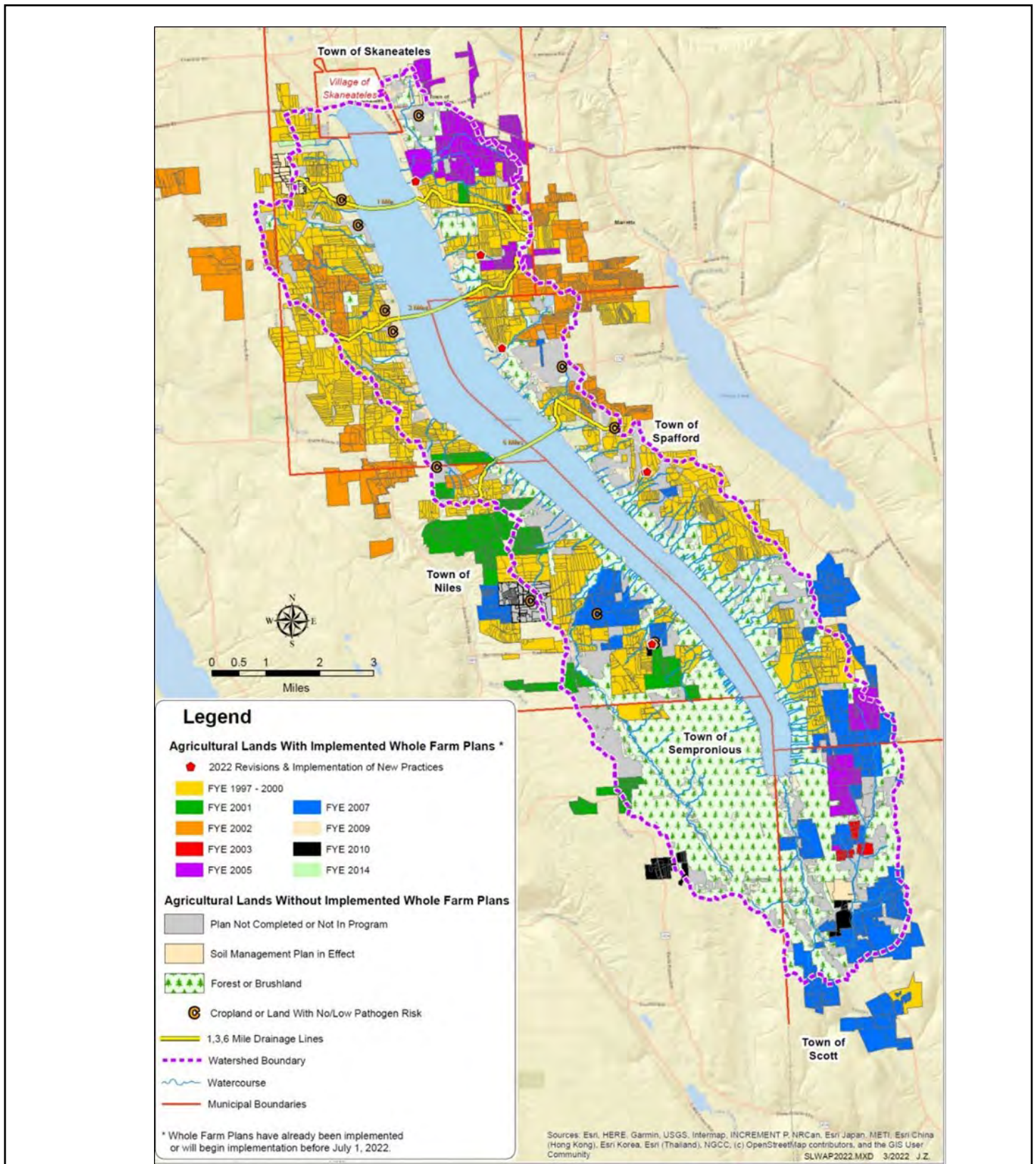


Figure 2.21 – Whole Farm Plans in the Watershed

Source: City of Syracuse, 2022
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

by SLWAP

...

Implementation Status (Tier IV)

Through February 2024, SLWAP has fully implemented whole farm plans for 29 farms (66.38 farm equivalents). During the past year revisions were planned and implemented to existing BMPs on four farms and three private landowner sites (15.14 farm equivalents). BMP implementation (survey/design/build) occurred on two new farms (2 farm equivalents). SLWAP is now primarily in a maintenance phase. Throughout the 2024 construction season, we anticipate BMP implementation to occur on at least one new farm and revisions to BMPs on four existing farms and one private landowner (stream project).

...

According to the Procedure for Estimating Agricultural Nonpoint Source Phosphorus Runoff (Lake Champlain Basin Program – USDA/NRCS and University of Vermont), BMPs implemented through the SLWAP will prevent approximately 19,525 pounds of phosphorus/year from entering Skaneateles Lake. BMPs responsible for the reduction include Barnyard Runoff Management, Milking Center Waste Water Treatment & Disposal Systems, Animal Waste Management Systems, and Short Duration Grazing Systems.

...

Whole Farm Plan Annual Evaluation (Tier V)

Tier V of the Tiered Approach to Whole Farm Planning is the annual review, evaluation, operation, maintenance, update and potential revision of completed whole farm plans. SLWAP has been developing and implementing plans since 1995, therefore the evaluation of previously completed plans is critical. It is important to determine if the plan agreed to by the farmer is effectively being followed and protecting water quality as designed. Tier V provides the opportunity to revise and update the plan as needed and reinforces the objectives of the plan with the farm manager. Most plans require revisions in crop rotations and an update to the nutrient management plans (i.e. fertilizer recommen-

dations and manure spreading schedules). Accordingly, Whole Farm Plans are “living” documents that are always changing.

In January 2013, SLWAP initiated a more-in-depth annual evaluation of whole farm plans for farms in the watershed with completed plans. Specifically, all the BMPs from the long-form of the whole farm plan were plotted on an aerial photo base GIS map. Staff went farm-to-farm to identify and evaluate BMP installations on the farm. Staff also continued to hold one-on-one meetings to collect information necessary to update the plans. In addition, this meeting allows SLWAP to determine how well the plan and the BMPs are being operated and maintained. It has helped staff to anticipate any new revision projects that will be needed to protect water quality. Reviews were conducted between January and 10 March 2019. Any new revision projects will be added to the existing data base and will be planned and implemented as revision projects are completed and removed from the existing database, subject to the availability of unencumbered funds.

The Annual Farm Consumption Reviews of the recent years have been [the] most comprehensive, stream-lined reviews ever completed in recent history of the watershed program. The data collected was extremely accurate and took into account amounts of items such as livestock housed, manure applied, fertilizer applied, etc. for land that the farms owned and/or operated both inside of and outside of the watershed. The farmers were provided with an “annual review refresher letter” as to what data was necessary to collect and present during the annual review to stream-line future annual reviews. (City of Syracuse Department of Water, 2024)

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program (CREP) is a joint project of the City of Syracuse, the SLWAP, and the United States Department of Agriculture. CREP has resulted in a total of 148.4 acres planned and 146.5 acres of sensitive areas protected around Skaneateles Lake. CREP uses federal and state resources to safeguard environmentally sensitive land through the Conservation Reserve Program (CRP). Producers enrolled in CRP remove lands from agricultural production and plant native grasses, trees, and other vegetation to improve water quality, soil, and wildlife habitat.

Cornell Cooperative Extension

Cornell Cooperative Extension (CCE) of Onondaga County runs the Skaneateles Watershed Education Program, which brings workshops, trainings, educational materials, volunteer and stewardship opportunities, and updates related to water quality protection to the watershed community. This program is funded by the City of Syracuse, with the goals of reducing non-point source pollution in the watershed, improving the watershed's health, and connecting stakeholders with information and opportunities to implement projects to protect water quality.

CCE manages the watershed's central online repository for watershed information, The Skaneateles Lake Watershed Website (www.skanlakeinfo.org), on behalf of the SLMP. The Watershed Website is a "one stop shop" for information on the lake, including contact information, lake levels, HABS reports, and other reports and activities in the watershed.

Stakeholder Groups

In addition to the City of Syracuse's Skaneateles Lake Watershed Protection Program, there are a number of groups that are active in land conservation, public education, project development and implementation, and invasive species control. The groups and organizations listed below are currently active in protecting the lake's water quality.

Skaneateles Lake Municipal Partnership

The Skaneateles Lake Municipal Partnership (SLMP) is a collaboration between the municipalities in the watershed, as well as the City of Syracuse and Cornell Cooperative Extension, to share information and coordinate activities. The SLWA meets monthly to discuss issues, research, and projects in the watershed.

Soil and Water Conservation Districts

As mentioned above, the Onondaga County SWCD is the lead agency responsible for implementing the SLWAP. The three county SWCDs in the Skaneateles Watershed are actively engaged in other water quality protections in the watershed, including:

- Hydroseeding: Onondaga County SWCD works with municipalities to hydroseed roadside ditches after they are cleaned out.
- Projects:
 - Onondaga County SWCD completed a stormwater attenuation project on Shotwell Brook in 2020; the project involved the installation of a 1.05 acre wetland in abandoned agricultural land to create a wetland with an extensive floodplain allowing for greater storage of stormwater.
 - In 2023, Cayuga County SWCD stabilized around 80 feet of highly unstable road bank and road should-

der in the Town of Sempronius along the shoreline of Skaneateles Lake, working alongside the Cayuga County Highway Department.

- Cortland County SWCD received funding through the Great Lakes Restoration Initiative (GLRI) to hold an aquatic invasive species public education event in the Skaneateles Watershed in summer 2023.

- Agricultural tire recycling: collect tractor tires for recycling.
- Stream crossing / culvert assessments: the SWCDs in the watershed have conducted culvert assessments utilizing protocols developed under the North Atlantic Aquatic Connectivity Collaborative (NAACC).
- Invasive Species Management: The Onondaga County SWCD works with SLA, NYS DEC, and land trusts in the watershed, to treat hemlocks in the area against HWA. Treated areas include ravines at Ten Mile Point and Carpenters Point.

Skaneateles Lake Association

The Skaneateles Lake Association (SLA), formed in 1969, is made up of part-time and full-time residents of the Skaneateles Lake community. The SLA is a non-profit organization dedicated to preserving the current and future integrity of the lake and its watershed.

SLA initiatives include:

- Skaneateles Lake Ecology Team: monthly meetings to discuss issues and coordinate watershed activities.
- Operating the Dr. Robert Werner Research & Education Boat ("The Bob")
- Boat Stewards (see Section 2.10.5)
- HABS education and prevention activities, including fundraising, research, and intergovernmental coordination to reduce the occurrence of HABS (Skaneateles Lake Association, 2017)
- Participation in the Lake Friendly Living campaign and educational series, which focuses on letting property owners and residents know how they can improve water quality through things like landscaping and septic system maintenance.
- Eurasian Watermilfoil removal (see Section 2.10.2)
- Hemlock Woolly Adelgid educational sessions and spraying (2.10.1)
- Water quality monitoring (see Section 4.2)

SLA has also been involved in watershed restoration projects, including the Upper Willow Creek Sediment Capture Watershed Improvement Project, completed in 2022. This project included water control structures to divert stream overflow into a detention pond, minimizing the flow of water and nutrients to the lake during major storm events

(Skaneateles Lake Association, 2022).

Nature Conservancy

The Nature Conservancy works across the globe to conserve the land and waters on which all life depends. Founded in New York, the Conservancy has a long history of protecting land and water quality in the Finger Lakes, including managing nature preserves, working with farmers, innovating in septic solutions, restoring floodplains, planting trees, and ensuring road-stream crossings are climate resilient.

Finger Lakes-Lake Ontario Watershed Protection

The Finger Lakes-Lake Ontario Watershed Protection Alliance (FL-LOWPA) is made up of 25 counties, represented by County Planning Departments, Soil and Water Conservation Districts, County Health Departments and Water Quality Management Agencies within the Finger Lakes and Lake Ontario drainage basin. FL-LOWPA has been funded through the Environmental Protection Fund and administered by DEC. Its programs are diverse and incorporate watershed management and planning, agricultural best management practices, drinking water supply monitoring and protection, erosion and stormwater control, invasive species management and eradication, habitat restoration, septic system inspections, and public education and involvement (FL-LOWPA, 2010).

In the Skaneateles Watershed, FL-LOWPA funding from Onondaga County has been used to support projects such as invasive species management including control of Eurasian watermilfoil. FL-LOWPA has also funded implementation of agricultural BMPs in the watershed.

Land Conservation Efforts

Approximately 12% of the land in the Skaneateles Watershed is under some form of protection, be it public ownership, a conservation easement or property title held by a private non-profit, or other land conservation mechanism (see Figure 2.22). Land conservation ensures that the natural features on a parcel are not disturbed and that impervious surfaces, such as rooftops and parking lots, that can cause stormwater runoff are not added to these areas. Protected lands also provide ample opportunities for habitat restoration and stormwater attenuation projects. The forests and other vegetation on protected lands also greater opportunities for nutrient uptake than land that has been cleared for development.

Finger Lakes Land Trust

The FLLT is a non-profit organization made up of members, landowners, and volunteers whose mission is "...to conserve forever the lands and waters of the Finger Lakes region, ensuring scenic vistas, local foods, clean water, and wild places for everyone" (Finger Lakes Land Trust, 2022).

The FLLT was founded in 1989 and has created four conservation preserves along the shoreline of Skaneateles Lake, including:

- Bahar Preserve, a 51-acre forested gorge-dominated parcel.
- Hinchcliff Family Preserve, a 206-acre hardwood-hemlock forested parcel used historically for agriculture and located along the southeast shoreline in Spafford.
- Dickinson Conservation Area, which protects 1,350 feet of shoreline and high bluffs that are known locally as the "Staghorn Cliffs". Access to this 21-acre preserve is currently by boat only, with no safe access to the upland forest portion of the preserve (Finger Lakes Land Trust, 2022).
- High Vista Preserve, a 139-acre forested hillside parcel located south of Hinchcliff Preserve.

Central New York Land Trust

Like the FLLT, the CNY Land Trust seeks to preserve natural areas in Central New York to ensure clean air and water and prevent the conversion of wildlife habitat to other uses. In the Skaneateles Watershed, the CNY Land Trust owns and manages two preserves:

- High Hickory Wildlife Sanctuary, a 92-acre preserve in the Town of Spafford.
- Ripley Hill Nature Preserve, a 109-acre conservation area located on Ripley Hill Road in the Town of Spafford, on one of the highest points in the Skaneateles Lake Watershed. The CNY Land Trust maintains a trail through this preserve, which connects to the FLLT's trail through the Hinchcliff Preserve.

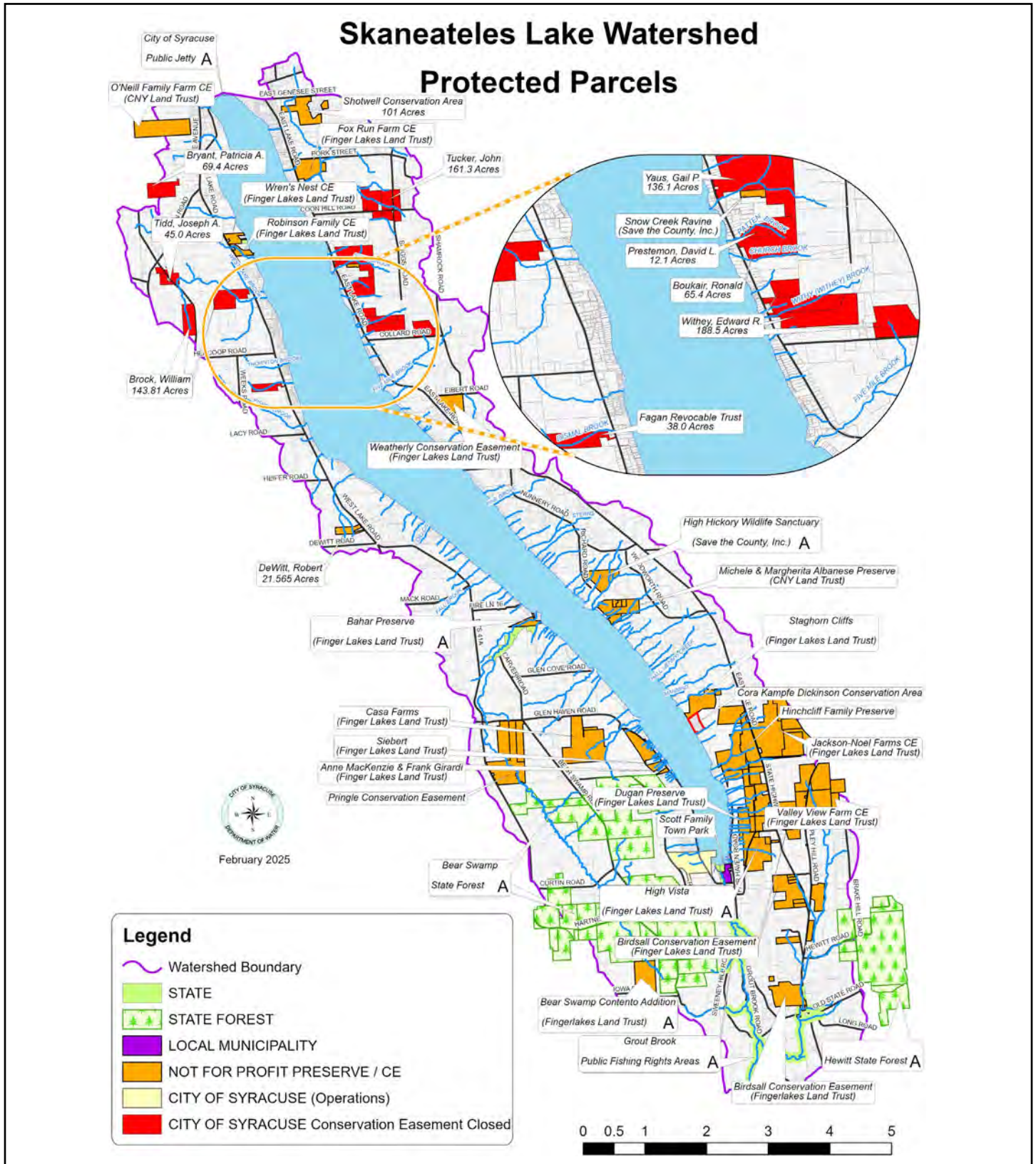


Figure 2.22 - Protected Parcels - Public Lands and Private Conservation

Source: City of Syracuse, 2025
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N



Central New York Land Trust's High Hickory Wildlife Sanctuary

Image Courtesy of Central New York Land Trust (<https://www.cnylandtrust.org/>)

3. Waterbody Impairments and Sources of Phosphorus

3.1 Known Impairments

Waterbody Inventory/Priority Waterbodies List

DEC's Waterbody Inventory / Priority Waterbodies List (WI/PWL) provides narrative assessments of New York's water bodies, based on available data and the DEC's Consolidated Assessment and Listing Methodology (CALM). WI/PWL data can be accessed through the DEC's Info Locator online mapping tool (<https://gisservices.dec.ny.gov/gis/dil/>). The WI/PWL provides the foundation for the development of the state Section 303(d) List of Impaired Waters Requiring a Total Maximum Daily Load (TMDL).

The WI/PWL listing for Skaneateles Lake identifies it as fully supported for primary and secondary contact recreation and stressed for drinking water. Skaneateles Lake and its tributaries are not included in the DEC's 303(d) list.

Public Drinking Water Intake Extension

The City of Syracuse is in the design phase of a project to extend one of its drinking water intake pipes in Skaneateles Lake to deeper water. The extension will mean that Water Intake #2 is at a depth of at least 60 feet.

Without the extension, the City water supply is more susceptible to intake closures due to turbidity and HAB events.

3.2 Skaneateles Lake Scorecard

The CSLAP program includes the development of a scorecard and summary of indicators for waterbodies. The following excerpts from the 2022 Skaneateles Lake Summary provide details on key aspects of the lake's water quality:

- Skaneateles Lake continues to be oligotrophic, or unproductive, based on high water clarity, low algae levels (chlorophyll a), and low nutrient (phosphorous) levels. Soluble nutrients were analyzed in 2022. The waterbody is highly alkaline or basic, with intermediate hardness water, low water color, and moderately low nitrogen levels.
- Water clarity, chlorophyll-a, total phosphorus, surface water temperature, deep water temperature, water quality evaluation, aquatic plant coverage and recreational evaluation in 2022 were similar to previous years.
- Compared to other New York lakes, this lake usually has higher water clarity, conductivity, and calcium. Compared to other New York lakes, this lake usually has lower chlorophyll-a, total phosphorus, color and chloride and more favorable water quality evaluation,

and aquatic plant coverage.

- Water quality conditions generally indicate a low susceptibility to HABs, however, localized, shoreline blooms have been observed and reported annually since 2017.

3.3 Sources of Phosphorus

A key component of this 9E Plan is quantifying the major sources of phosphorus in the Skaneateles Watershed. Phosphorus sources are categorized as nonpoint (diffuse) and point (associated with a defined outfall). Nonpoint sources of phosphorus within the watershed were characterized for the 9E Plan. The watershed has no point sources; under the Watershed Rules and Regulations, "Point source discharges are prohibited" in the Skaneateles Watershed (New York State).

Nonpoint source phosphorus sources include runoff from agricultural lands, forests, residential areas, commercial districts, and other developed land uses. These landscape sources of phosphorus were quantified using the SWAT model calibrated to site-specific conditions of the Skaneateles Watershed and tested using recent monitoring data collected under an approved QAPP and analyzed by a certified laboratory. Seepage from individual septic systems is also categorized as a nonpoint source of phosphorus; nutrient inputs to the watershed from septic systems were also modeled using SWAT (see Appendix H for more information on the SWAT model). Key data inputs to the SWAT model incorporate both underlying environmental conditions (soils, slope, hydrology, climate, land cover, etc.) and land management (major crops, fertilization rates and schedule, animal waste management, dates of planting and harvest, etc.).

Point Sources

There are no State Pollutant Discharge Elimination System (SPDES) permits issued to wastewater treatment plants or private industries within the Skaneateles Lake Watershed. There is a SPDES permit issued to the City of Syracuse (NY0300004) but the discharge does not contain phosphorus.

CAFOs

A CAFO is defined as a farm that meets certain animal size thresholds and that also confines those animals for 45 days or more in any 12-month period in an area that does not produce vegetation. Statewide, there are roughly 460 CAFOs, the majority of which are dairy farms with 300 or more cows and associated livestock operations. CAFOs are covered under the New York State Environmental Conservation Law CAFO SPDES general permit (<https://dec.ny.gov/regulatory/permits-licenses/wastewater-stormwater-wa>

[ter-withdrawal/spdes-permit-program/concentrated-animal-feeding-operations](#)). To obtain a permit, CAFOs must meet certain standards set by the DEC to ensure that they are not acting as point sources of TP.

Permit requirements include:

- Develop, implement, and annually update a Comprehensive Nutrient Management Plan (CNMP) prepared by an Agricultural Environmental Management (AEM) Certified Planner. CNMPs ensure that CAFOs balance their operational needs while complying with regulatory guidelines. CNMPs address items such as manure management, field crop nutrients, and storm water runoff in a coordinated manner.
- Filing an Annual Compliance Report, which provides an inventory of the CAFO's operations.
- Filing an Incident Report whenever, among other things, there is a discharge from the CAFO that causes a water quality violation or there is an overflow from a waste storage structure.

According to the DEC's online info Locator (<https://gisservices.dec.ny.gov/gis/dil/>), there is one Concentrated Animal Feeding Operation (CAFO) in the watershed and six others adjacent to the watershed. To account for the impacts of these operations in the watershed, SLWAP provided information on the manure handling practices of area CAFOs, including amount of material, nutrient content, and location of manure spreading. This information was incorporated into the SWAT model. The TP load from CAFOs is considered runoff and included in the estimates provided and in the nonpoint source Row Crops, Hay/Alfalfa, and Pasture load (Tables 3.1 and 3.2).

Nonpoint Sources

As described in Section 1.3, a SWAT model was used to derive estimates of phosphorus loading by land use and to estimate loading from septic systems. As is the case in many watersheds with agricultural influence, the primary land-side source of phosphorus loading to the lake was found to be agriculture (Table 3.1, Figure 3.1). Based on the SWAT modeling analysis, forested lands comprise roughly ten percent of the total phosphorus load per year, due primarily to the extent of forested lands within the watershed. Although only comprising approximately 5% of the modeled landscape, developed lands contributed roughly eighteen percent of the total phosphorus load. Note that any septic system contributions are not included under the 'developed' load; those are partitioned as separate loads. Model results indicate that, on average, the watershed exports approximately 13,500 pounds of total phosphorus to the lake each year.⁴

⁴ As noted in Section 2.16, according to the Onondaga County SWCD's annual SLWAP report, BMPs already being imple-

Loading by Subwatershed

The SWAT model's subbasins were aggregated into data for ten subwatersheds as shown in Table 3.2 and Figure 3.2. Based on the SWAT model, the Northwest subwatershed contributes the most to the lake's annual nutrient load, both in terms of total pounds of phosphorus (2,962) and in terms of pounds per acre (0.64 lbs./acre/year). But the developed northern end of the lake is a close second in terms of pounds per acre, with 0.53 pounds of phosphorus per acre per year. Nutrient loading from septic systems was not available at the subwatershed level; the effects of septic systems were aggregated across the entire watershed.

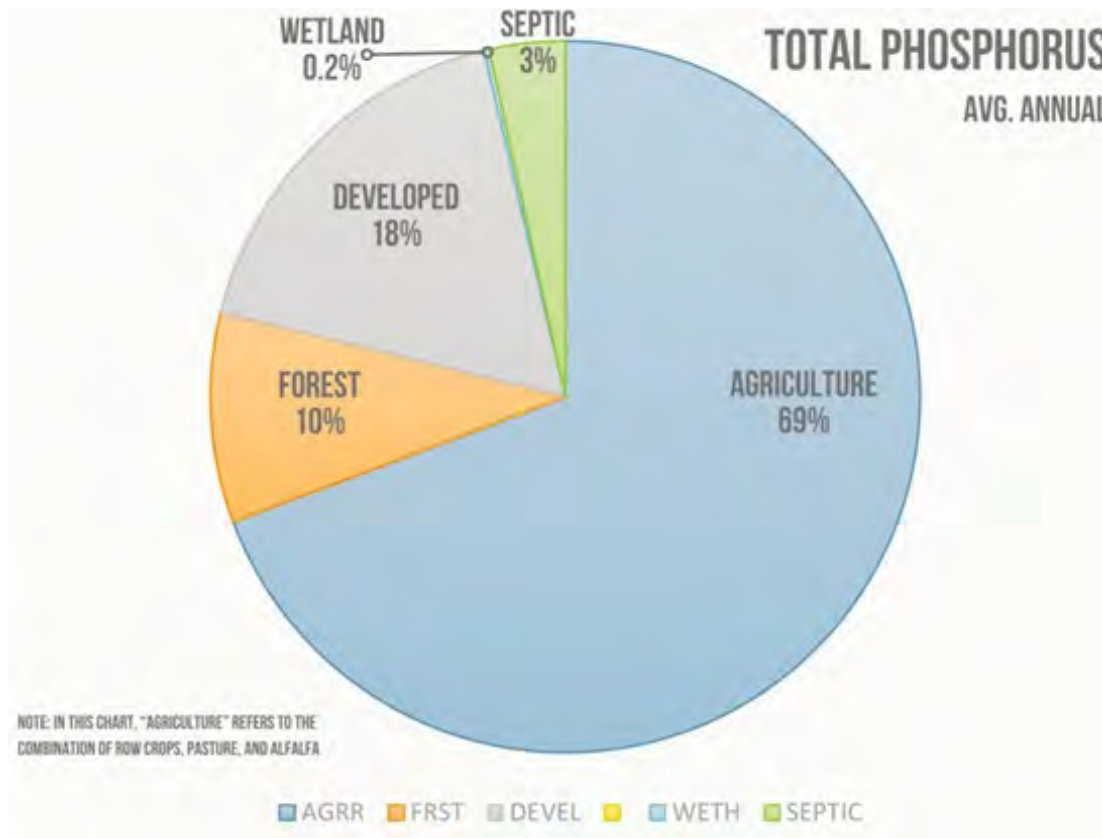
mented through SLWAP as of 2023 prevent approximately 19,525 pounds of phosphorus/year from entering Skaneateles Lake (City of Syracuse Department of Water, 2024). See Section 5.1 for more information on these BMPs.

Table 3.1 – Phosphorus Loading by Land Cover

Land Use / Source Category	Percent of Watershed	Phosphorus Loading (lbs.)	Lbs. / Acre	Percent of Total Loading
Row Crops	13%	7,859	1.60	58%
Hay / Alfalfa	6%	298	0.13	2%
Forested Land	60%	1,293	0.06	10%
Pasture	14%	1,246	0.24	9%
Developed / Urban	6%	2,376	1.12	18%
Wetlands	2%	33	0.05	0.2%
Septic Systems	N/A	467	N/A	3%
TOTAL	100%	13,573		100%

Loading by land use is based on the Soil and Water Assessment Tool estimates

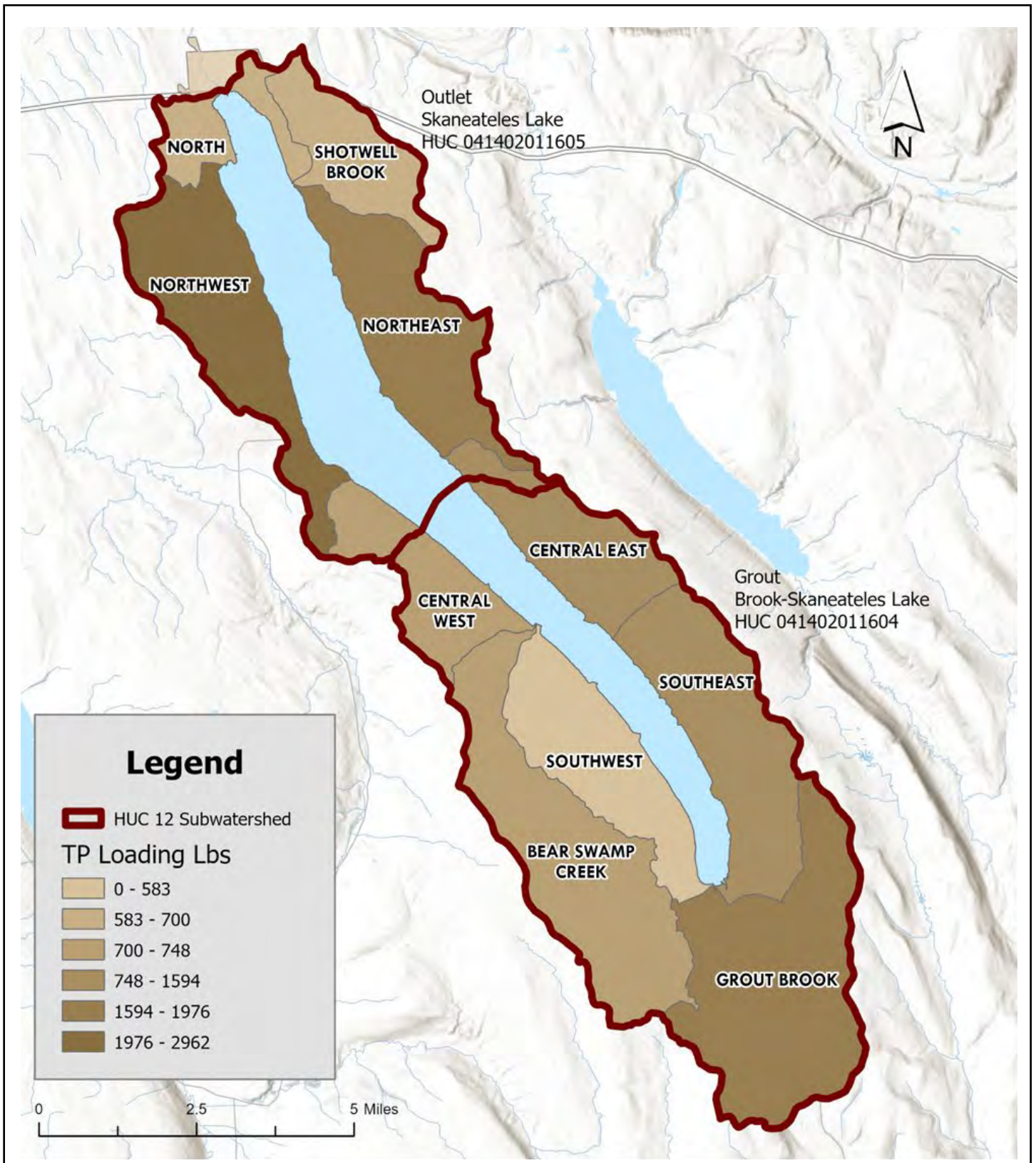
Figure 3.1 – Phosphorus Loading by Land Cover / Source (kg)





Source: SWAT Model Estimate

Table 3.2 – Subwatersheds by Land Use and Nutrient Loading


Subwatershed	Row Crops	Alfalfa	Forested Area	Pasture	Urban / Developed	Wetlands	Total Acreage	Lbs./ Acre/Yr.	Phosphorus Loading (lbs.)	Pct of Total
Northwest	29%	10%	30%	16%	11%	4%	4,643	0.638	2,962	23%
Grout Brook	7%	0%	78%	14%	1%	0%	6,591	0.2998	1,976	15%
Northeast	23%	8%	40%	18%	6%	5%	3,981	0.472	1,879	14%
Southeast	11%	5%	78%	5%	1%	0%	4,456	0.3578	1,594	12%
Central East	16%	5%	48%	17%	14%	0%	2,871	0.455	1,306	10%
Central West	18%	15%	43%	18%	6%	0%	2,450	0.305	748	6%
Bear Swamp Creek	5%	4%	82%	7%	0%	2%	5,810	0.1258	731	6%
North	2%	5%	12%	26%	55%	0%	1,326	0.526	698	5%
Shotwell Brook	18%	9%	47%	17%	0%	9%	2,230	0.2801	625	5%
Southwest	3%	9%	73%	15%	0%	0%	3,458	0.1687	583	4%
Watershed Total	13%	6%	60%	14%	6%	2%	37,816	N/A	13,102	100%







This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.



This map was created for planning purposes only. The CNY RPDB does not guarantee the accuracy or completeness of this map.

Figure 3.2 – Phosphorus Loading by Subwatershed

Source: Figure developed from data provided from SWAT modeling (Boles, 2024)
 Basemap: Esri, NASA, NGA, USGS, Garmin, GeoTechnologies, NPA, USDA
 Coordinate System: NAD UTM Zone 18N

4. Target Levels

4.1 Total Phosphorus

The development of this 9E Plan was a recommendation of the DEC's *Harmful Algal Bloom Action Plan for Skaneateles Lake*. That plan listed three Priority 1 Projects for short-term implementation, the first of which was: "Perform modeling of both in-lake conditions and the contributing watershed for use in developing a 9E Plan" (NYSDEC, 2020).

As noted in Section 1.1, HABs were first documented (with microcystin level measurements) in Skaneateles Lake in September 2017. The occurrence of HABs in Skaneateles Lake demonstrated that, even with TP levels well below 10 µg/L, there were sufficient nutrients present to support high concentrations of cyanobacteria.

The precise mechanism behind a given HAB can be difficult to determine, and the causes of HABs may vary from one location to another (see Section 1.1). But cyanobacteria thrive in a mix of warm temperatures, sunlight, and elevated nutrient levels. According to data from the New York Climate Change Science Clearinghouse, temperatures will continue to increase over the next 40 to 50 years, with the severity of rainfall events increasing (NYSERDA, 2022). With increased rainfall will come increased stormwater runoff from the land uses in the watershed. Action at the watershed level cannot alter air temperature, the amount of rain that falls, or the lake's fetch or orientation, but it can alter the amount of phosphorus making its way to the lake.

Phosphorus levels are the one factor in the development of HABs that watershed management efforts can meaningfully alter. Phosphorus levels in Skaneateles Lake are low, but CSLAP data from 1997 to 2001 (Section 2.20) demonstrate that TP levels have been slowly increasing over the last 20 years. This 9E Plan's target is to ensure that TP levels in Skaneateles Lake do not increase over the next 30 years, as climate change and weather patterns increase the potential for nutrients to make their way into the lake (USGCRP, 2023).

The current three-year average level of TP in Skaneateles Lake is 4.5 µg/L, based on CSLAP data. The 9E target is to maintain this TP level, based on a three-year rolling average of CSLAP measurements, taken during the summer months (June 1st to September 30th).

Note that this 9E Plan is not a regulatory document. This phosphorus target reflects the results of analyses and modeling and extended conversations with the stakeholder community. The 4.5 µg/L target represents a level that the WAC identified as achievable, given the anticipated increase in nutrient loading associated with climate change. A changing climate is likely to mean that, in the long-term, the effect of adding BMPs to the watershed will not be to

lower TP levels but to maintain existing levels. The TP target level represents a goal of working to offset the effects of climate change and to prevent HABs from becoming significantly more severe as a result of warmer temperatures and increased precipitation.

4.2 Chlorophyll-a

Like phosphorus, chlorophyll-a is a natural part of a water body's chemistry. Because chlorophyll-a is a measure of how much algae (phytoplankton) is present, it is often more important to stakeholders than other chemical indicators, such as phosphorus and nitrogen, which are not visible to the naked eye. Measuring and tracking chlorophyll-a levels provides an important indicator of a water body's overall biological productivity.

In 2018, NYSDEC compiled data for lakes across New York, with a focus on the Finger Lakes. In 2018, for all lakes statewide for which CSLAP data were available, the median chlorophyll-a concentration was 4.2 µg/L. Of the Finger Lakes, Skaneateles had the lowest average chlorophyll-a concentration (NYSDEC, 2019).

Chlorophyll-a levels in Skaneateles Lake for the period from 2017 to 2022 were at or slightly above 1.0 µg/L. Data from 1997 – 2001 indicate that, like TP, chlorophyll-a levels in the lake have been rising slowly over time (see Figure 2.17). This plan's target is to ensure that these levels do not continue to increase, given the effects of climate change. **In this context, the target level for chlorophyll-a is to maintain a summertime average of 1.0 µg/L.**

4.3 Development of Scenarios

Over the course of a series of WAC meetings, as well as meetings with the Soil and Water Conservation Districts in the watershed and members of the Skaneateles Watershed Agricultural Program, the WAC developed the scenarios described below, to be modeled using SWAT. The goal of this modeling exercise was to support the prioritization of projects and other investments of resources in the watershed. For additional information on the details of these alternatives and how they were simulated using digital models, see the *Skaneateles Lake Modeling Report* (Appendix H) (Boles, 2024).

Scenario 1 – Future Conditions

Scenario 1 was used to understand how phosphorus loading will change if no additional best management practices (BMPs) are implemented in the watershed, given both climate change and increased development pressure over the next 30 years.

Other BMP scenarios were compared to this scenario to measure how selected actions may reduce phosphorus

loading and decrease the impact that a changing climate and future development will have on the watershed.

Details

- Climate Scenario: based on data from New York Climate Change Science Clearinghouse (NYSERDA, 2022)
 - Temperature increase: +3° F by 2052
 - Precipitation: 10% increase by 2052
- Future Development based on supporting information from the Town of Skaneateles, City of Syracuse *New Housing Starts Report*, and the New York Landscape Futures *Recent Trends Technical Report* (Plisinski & Thompson, New York Landscape Future - Recent Trends Technical Report, 2021):
 - A 'change detection' GIS layer was developed to represent the difference between 2020 Land Cover (with no new conservation or afforestation) and the projected 2050 Land Cover with no new conservation or afforestation. This GIS layer was joined with the map unit layer of the Skaneateles SWAT model to generate a table that showed projected land use conversion by map category: a total of 600 acres.
 - The modeling team found that most of the change was concentrated in the map units designated as NE_Direct, Shotwell, and Urban North. A small amount of urbanization was shown to occur in the area of Grout Brook (approximately 5% of the total area change or 30 acres).
 - HRUs were selected at random with respect to the specific subbasin, slope, and soil type; however, the conversion was constrained by location and prior land use. In total, this scenario converted 16 HRUs spread across four map categories, with the majority of them in the Northeast subwatershed.
 - Additional converted HRUs were located in the Grout, Shotwell, and North subwatersheds.

Scenario 2 – Additional Agricultural BMPs

The Skaneateles Lake Watershed is already at the forefront of agricultural BMP implementation in Upstate New York: the Skaneateles Lake Watershed Agricultural Program (SLWAP) has been connecting farmers with funding to implement a wide variety of BMPs for over 30 years.

This scenario captures the goals of selected BMP programs, through cooperation between the Soil and Water Conservation Districts in the watershed and farmers who are interested in increasing their efficiency and further reducing nutrient runoff.

Details

- 100% adoption of manure incorporation technology

on corn silage fields, up from 67%.

- Increase in cover crops (between 930 and 1,635 acres⁵).
- Precision Agriculture: increase in the use of precision agriculture on row crops from 42% of acreage to 80% of acreage with a 10% decrease in phosphorus application.

Scenario 3 – Filter Strips

Scenario 3 proposes the addition of vegetated filter strips to the watershed along fields/open spaces that drain to Skaneateles Lake.

Filter strips, also known as vegetated buffer strips, are narrow strips of land adjacent to a water body that are planted with vegetation, typically grasses, shrubs, or even trees. Filter strips slow down, intercept, and filter out sediments, nutrients, pesticides, and other pollutants carried in surface runoff before they reach the water body. Filter strips help to protect water quality by trapping pollutants and preventing them from entering streams, rivers, lakes, or wetlands. They also provide habitat for wildlife and stabilize soil.

Within the SWAT model, this BMP is represented using a filter strip ratio that allows for one acre of buffer strip area for every twenty acres of crop fields. (The modeling team randomly selected approximately 1,000 acres of agricultural land on which to add new filter strips.) While the total amount of modeled row crop area varies from year to year, the model assumes that roughly one quarter of agricultural lands in the watershed will adopt riparian filter strips, resulting in about 50 acres of added filter strip area. (The width of filter strips will vary depending on slope and other considerations. And, in reality, filter strip acreage will be added to the watershed gradually, as opportunities become available.)

Details

Approximately a 50/50 allocation between Northern and Southern halves of the watershed.

Note: Compensation for buffers on agricultural land typically reflects fair market value, not the total cost that the farmer pays (i.e., maintenance costs for reporting / contracting). This scenario assumes that a funding mechanism can be developed that makes this BMP sufficiently attractive to farmers to incentivize its use. Farmers' costs associated with filter strips include holding costs, ownership expenses, taxes, maintenance, and reduced efficiency.

Scenario 4 – Reduce Residential Phosphorus Contributions

Scenario 4 models the effects of reducing the number of failing septic systems in the watershed.

⁵ Because of crop rotations, the acreage of cropland with cover crops varies from year to year.

Table 4.1 – Data Sources for Scenario 5 Estimate

#	Source	Brief Description	Reduction	Length needed (ft.)
1	Great Lakes Restoration Initiative - Plum & Kankapot	Initial analysis of the practices that have been installed from 2015 to 2018 indicate the following average input reductions for streambank protection projects: 82 lbs./yr. of P	82 lbs./yr. reduced over 2178 feet = 0.0376 lbs./ft/yr. TP	21,436
2	Makarewicz et al., 2015	Model simulation of stream bank stabilization	34.3% reduction in phosphorus loading was estimated	No length provided
3	Lammers & Bledsoe, 2017	Summary of bank sediment and phosphorus loading rates from 11 select studies	Median of max and min P loading rates of all reported studies = 0.12 lb./ft/year	6,889
4	Langendoen et al., 2012	Three mitigation scenarios were analyzed to determine the percent reduction in loadings that can be obtained by stabilizing streambanks	From most conservative scenario result: 34% reduction; a reduction of 14.1 kg/km/yr.	85,318
5	Chesapeake Bay Program Quick Reference Guide for BMPs: D-5 Urban Stream Restoration	Summary of stream restoration protocols for nitrogen, phosphorus, and sediment reductions	TP reduction = 0.068 (lbs./linear ft/year)	11,853

Details

This scenario is intended to simulate a hypothetical boundary case: what if nutrient contributions from on-site wastewater systems could be dramatically reduced in the watershed? While this may not be a scenario that can be achieved given existing technologies and funding sources, the model can provide insight into how effective this approach could be in reducing nutrient levels.

Scenario 5 – Streambank Stabilization

This scenario simulates the effects of implementing streambank stabilization projects in the watershed. The idea behind this scenario is to “work backward” and develop an estimate of the total number of miles of streambank stabilization work that would be needed to offset the impacts of climate change and development, as modeled in Scenario 1.

This required an estimate of the phosphorus reduction that can be expected for every foot of streambank stabilization work. There is no universally accepted measure of “pounds of phosphorus per foot of streambank stabilized”; the nutrient reduction impacts of streambank stabilization projects can vary widely from one setting to another. The Modeling Team conducted a review of the best available published studies to derive this estimate (Table 4.1)

The literature review was based on a combination of sources, including updates from watershed protection efforts on the Fox River in Wisconsin on the Plum and Kankapot Creeks (Schultz, Jessica, 2019) and reference material from the

Chesapeake Bay Program that generalizes that program’s past experience with streambank stabilization projects and assigns a TP reduction per foot for these projects: 0.068 lbs./ linear ft/year (Chesapeake Bay Program, 2022). The literature review also included data from a study of the Misisquoi River on the eastern shore of Lake Champlain, which evaluated the results of three streambank stabilization scenarios on nutrient loading (Langendoen & Simon, 2012). Also included were two articles in peer-reviewed journals: one an assessment of model criteria for a SWAT model for the Genesee River (Makarewicz, Lewis, Rea, Winslow, & Pattenski, 2015), and the other a study that compiled the results of eleven other published studies (Lammers & Bledsoe, 2017).

Based on the average of the reductions identified in these sources, the Skaneateles Lake watershed would need a total of 16,645 feet (3.15 miles) of streambank stabilization to offset the estimated 820 pounds per year of TP anticipated to result from climate change and development.

Scenario 6 – Combined Effects of Multiple Scenarios

Scenario 6 models the effect of implementing Scenarios 2, 3, and 4.

4.4 Modeling Results

Watershed and water quality models are mathematical tools that synthesize research and monitoring information to describe our best understanding of the complex relation-

ship between land use, environmental factors, and water quality outcomes. These models integrate existing data in a structured manner consistent with the best available understanding of environmental processes. While model predictions can be uncertain, they provide advantages in guiding management decisions compared to solely relying on water quality monitoring. Monitoring is still a moderately complex and expensive endeavor, and limitations exist in monitoring programs when considering a variety of confounding factors, such as coverage of crop type, geographic distribution, spatial and temporal scale, as well as outcomes associated with specific BMPs for specific crops. For this project, these model-estimated loads and concentrations were supplied to a lake model of Skaneateles Lake itself to allow for observation of the modeled changes to the in-lake concentration behaviors (Boles, 2024).

The six scenarios described in Section 4.3 were evaluated using the SWAT and CE-QUAL-W2 models. The SWAT model enabled landside analysis of changing landscapes and management actions throughout the watershed. Results of these analyses were fed into the in-lake model (CE-QUAL-W2), allowing for a linked modeling analysis of the impact of landside actions on in-lake water quality responses. The In-Lake Model evaluated and estimated three key metrics of the lake's condition under existing and future conditions: total phosphorus levels, chlorophyll-a levels, and cyanobacteria levels. This was provided for current conditions, as well as future conditions under Scenarios 1, 2, 3, 4, and 6. A calculation for Scenario 5 was not completed with the SWAT model.

Understanding the Results

Skaneateles Lake has low TP levels. Stakeholders have been implementing, and will continue to implement, BMPs across the watershed. As seen in Sections 1.0, 1.1, 2.16, and 3.2, the lake's water quality metrics indicate an oligotrophic water body that is currently meeting its best uses.

The effects of the proposed BMP scenarios are presented in the context of anticipated future conditions (climate change and increased development; Scenario 1). The object of the modeling is to answer the question: given future conditions under Scenario 1, how effective would each BMP scenario be in offsetting the anticipated *increase* in phosphorus, chlorophyll-a, and cyanobacteria that is expected to occur because of warming temperatures and increased precipitation? Will implementing these BMPs offset the effects of climate change and future development? The results of Scenarios 2, 3, 4, and 6 shown in Figure 4.1 incorporate the results of Scenario 1 and use future conditions as their starting point.

For example, the results of Scenario 2 shown in Figure 4.1 represent the effectiveness of agricultural BMPs assuming that the lake and watershed are already experiencing the

effects of Scenario 1. In Figure 4.1 (a), Total Phosphorus under Scenario 2 is shown increasing by 4%: this represents the effects of Scenario 1 *and* Scenario 2, indicating a 4% increase in TP relative to Existing Conditions. Since Scenario 1 produces a 6% increase in TP over Existing Conditions, the effect of Scenario 2 is to produce a 2% decrease in TP relative to Scenario 1.

Additionally, some of the modeled scenarios were more effective than others in reducing loading from SRP. As noted in Section 2.14, SRP is more readily available to phytoplankton, making reducing SRP a critical element in controlling cyanobacteria levels.

Existing Conditions

Under Existing Conditions, Skaneateles Lake's modeled TP level is approximately 4 µg/L, chlorophyll-a levels are approximately 1.0 µg/L, and cyanobacteria concentrations are slightly above 1 µg/L. The estimated TP load entering Skaneateles Lake is 13,973 pounds.

Scenario 1

Scenario 1 represents future conditions in the lake and watershed in 2052. Given climate change, as modeled in Scenario 1, TP concentrations increase by 6%, chlorophyll-a levels increase by 9%, and cyanobacteria concentration increases by 85%. Scenario 1 is expected to increase TP loading by 820 pounds per year, or by 6%. The increase in cyanobacteria is not proportional to the increase in nutrient loading; this disproportionate increase results from the fact that cyanobacteria are adapted to thrive in warmer water temperatures.

Scenario 2

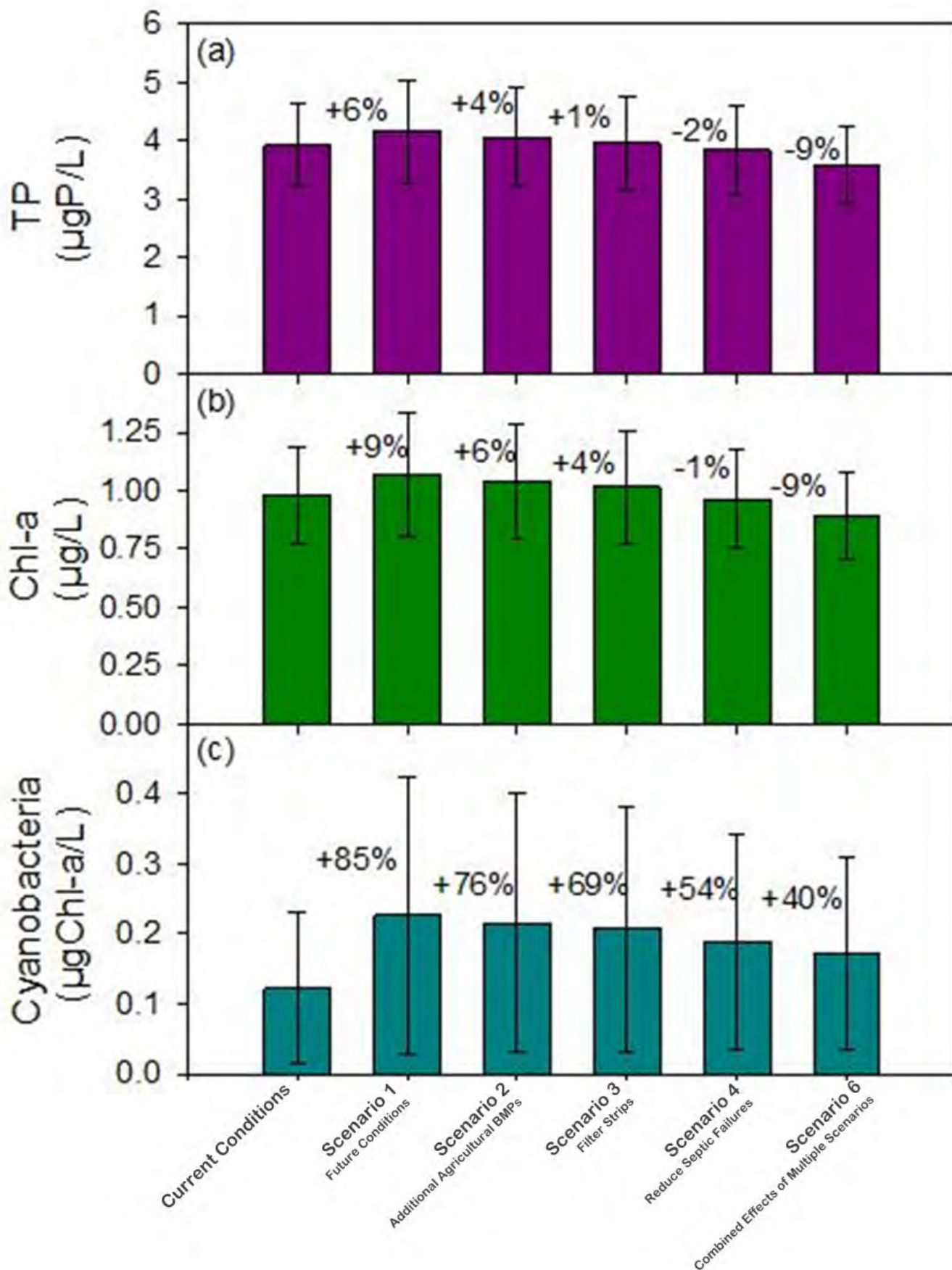
Scenario 2 anticipates increased adoption of selected agricultural BMPs in the context of climate change and development. These BMPs would reduce TP, chlorophyll-a, and cyanobacteria levels in Skaneateles Lake, relative to Scenario 1. However, this scenario does not completely offset the increases resulting from climate change. This scenario reduces TP loading by 485 pounds, less than the increase resulting from future conditions (Scenario 1). Additionally, less than half of the TP load reduction expected under this scenario is from SRP (see Table 4.2).

Relative to Existing Conditions, Scenario 2 results in a 4% increase in TP, a 6% increase in chlorophyll-a, and a 76% increase in cyanobacteria concentrations.

Scenario 3

Scenario 3, which would increase filter strip implementation across the watershed, would be more effective than Scenario 2 in reducing phosphorus loading. Adding roughly 50 acres of filter strips to the watershed would reduce

Figure 4.1 - In-Lake Model Results by Scenario



Note: Scenario 5's effects were not directly modeled – see Section 4.3

TP loading by 1,473 annually. However, only 16% of this TP load would be in the form of SRP, meaning that it would primarily be reducing particulate forms of phosphorus.

Scenario 3 offsets most, but not all, of the effects of climate change and development on TP levels. Relative to Existing Conditions, Scenario 3 would mean a 1% increase in TP, a 4% increase in chlorophyll-a levels, and a 69% increase in cyanobacteria concentrations.

Scenario 4

Scenario 4 models the result of reducing nutrient contributions from septic systems to near zero. Because the type of phosphorus that leaches out of septic systems is primarily SRP, which can be readily absorbed by phytoplankton, reducing these inputs has a very positive effect on the lake’s water quality. Scenario 4’s TP reduction is the lowest of the modeled BMP scenarios, but because 87% of the TP load reduction is in the form of SRP, it has a dramatic effect on water quality.

Scenario 4 reduces TP levels in the lake by 2% relative to Scenario 1, more than offsetting the effects of climate change.

It also reduces chlorophyll-a levels by 1%. However, the anticipated increase in cyanobacteria resulting from warmer temperatures and increased precipitation is so great that even reducing TP levels below Baseline conditions is insufficient to reduce cyanobacteria concentrations. Cyanobacteria levels are expected to increase by 54%.

Scenario 6

Scenario 6 models the effects of implementing all of the BMPs included in Scenarios 2, 3, and 4. Not surprisingly, this combination of BMPs produces the most dramatic improvement in lake conditions, with a 9% reduction in TP and chlorophyll-a relative to Scenario 1, and a relatively modest 40% increase in cyanobacteria.

Modeled Scenarios and Cyanobacteria Levels

As shown in Figure 4.1, none of the modeled BMP scenarios are anticipated to offset the effects of climate change on future cyanobacteria levels in Skaneateles Lake. All of the BMP scenarios were modeled against a backdrop of a warmer lake, and a warmer lake is anticipated to result in higher levels of cyanobacteria. As the *HABs Action Plan* states: “Most

Table 4.2 - Phosphorus Loading by Modeled Scenario

Scenario	Total Phosphorus (TP) Load (lbs.)	TP Reduction Compared to Future Conditions (lbs.)	Soluble Reactive Phosphorus (SRP) Load (lbs.)	SRP Reduction Compared to Future Conditions (lbs.)	Percent of TP Reduction from SRP
Baseline Conditions	13,973	N/A	3,818	N/A	N/A
1 - Future Conditions	14,793	N/A	3,896	N/A	N/A
2 - Additional Agricultural BMPs	14,308	485	3,668	228	47%
3 - Filter Strips	13,320	1,473	3,664	232	16%
4 - Reduce Residential Phosphorus Contributions	14,405	388	3,560	336	87%
5 - Streambank Stabilization	13,958	820	N/A	N/A	N/A
6 - Combined Effects of Scenarios 2, 3, and 4	12,542	2,251	3,131	765	34%

Source: LimnoTech, *Skaneateles Lake Watershed Modeling Report*(Appendix H)

Notes:

- Scenario 5 was not modeled using the in-lake model; the SRP reduction from this scenario is not known.
- According to the in-lake model, implementation of BMP Scenarios 4 and 6 will achieve this plan’s TP and chlorophyll-a targets in 2052. Scenario 5 is assumed to achieve these targets, based on a review of available literature (see Table 4.1).

cyanobacteria taxa grow better at higher temperatures than other phytoplankton which give them a competitive advantage at higher temperatures. (NYSDEC 2020). The result is anticipated to be such a large increase in cyanobacteria concentrations that even the very effective combination of BMPs found in Scenario 6 is insufficient to offset the effects of climate change. This result underscores the importance of managing greenhouse gas emissions to limit the deleterious effects of climate change on water quality.

However, it should be noted that the increases shown in Figure 4.1 are percentage increases on a low baseline level of cyanobacteria. According to the City of Syracuse's *Ska-neateles Lake and Watershed 2023 Annual Report*, no microcystin (the toxin produced by some cyanobacteria) was detected in any of the City's raw drinking water samples between July and October of 2023 (City of Syracuse, 2024).

Conclusion

Table 4.2 summarizes the modeled TP reduction under future conditions (Scenario 1) and under five modeled BMP scenarios. In addition to TP, this table provides results from the SWAT model for SRP reductions under each scenario (except Scenario 5, which was not modeled using the in-lake model). The two scenarios that offset the effects of climate change on in-lake TP concentrations, Scenario 4 and Scenario 6 (see Figure 4.1, Panel A), are also the two scenarios with the greatest reductions in SRP (336 and 765 lbs., respectively). While Scenario 2 provides a greater total reduction in TP, less than half of this reduction would be in the form of SRP. Scenario 4 would have a lower *overall* reduction in in-lake TP, but because almost all of this loading reduction is in the form of SRP, this scenario would achieve the in-lake TP target of 4.5 µg/L.

Because Scenario 6 achieves the greatest reduction in TP, chlorophyll-a, and cyanobacteria levels of the modeled scenarios, this is the combination of BMPs preferred by this plan. Additionally, incremental implementation of Scenario 5, 3.15 miles of streambank stabilization over the next 30 years, will ensure the maximum possible benefit to Skaneateles Lake.

5. Recommended Water Quality Maintenance Strategies

5.1 Overview

The purpose of this 9E Plan is to ensure that, over time, Skaneateles Lake continues to maintain its current high level of water quality, through coordinated and collaborative actions across the watershed. This plan's recommendations focus on measures to ensure that, as rainfall events become more severe, nutrient levels remain at their current levels. These recommendations include municipal, residential, agricultural, and state-level actions to protect Skaneateles Lake's water quality.

The following recommendations are provided in two separate tables. Table 5.2 provides strategies and actions that have been demonstrated, through the SWAT and CEQUAL-W2 models, to effectively reduce phosphorus loading.

Table 5.3 includes strategies, program ideas, and recommendations that are intended to promote water quality and watershed health, but which are not necessarily directly related to nutrient load reduction.

5.2 Subwatershed Prioritization

One goal of this 9E Plan is to develop a data-driven set of priorities for action in the watershed to reduce TP loading and maintain Skaneateles Lake's water quality. One aspect of prioritizing actions is to assess the characteristics of the area's subwatersheds, identifying basins in which BMP development will have significant benefits to nutrient load reduction or otherwise benefit water quality.

The Skaneateles Watershed is relatively compact. As described in Section 2.2, it is comprised of two HUC-12 subwatersheds: the Skaneateles Lake Outlet and Grout Brook. For the purposes of this 9E Plan, data from several smaller subbasins were aggregated into ten subwatersheds (as shown in Table 5.1).

Three of these subwatersheds represent more than half of the modeled non-point phosphorus loading to Skaneateles Lake, despite making up only 40% of the watershed's land area: the Northwest (23%), Grout Brook (15%), and Northeast (14%) subwatersheds.

However, in terms of reducing TP, some of the subwatersheds present more opportunities than others. The underlying reasons for these differences in TP reductions result from a combination of factors, including existing land use, soil types, slope, and current agricultural practices.

As a result of these differences, the subwatersheds in which the implementation of BMPs will have the greatest effects

on TP loading are slightly different from the subwatersheds with the greatest TP loading. Specifically, the three subwatersheds in which the application of the BMPs modeled under Scenario 6 are:

- Central East
- Northwest
- Grout Brook

Additionally, in its *Shotwell Brook: Resilient New York Flood, Sediment and Debris Management Plan*, the NYSDEC identifies Shotwell Brook as "a priority watershed due to confluence with Skaneateles Lake in the vicinity of the City of Syracuse's unfiltered public drinking water intake, and the brook being a major source of sediment to Skaneateles Lake" (NYSDEC, 2024a). Shotwell Brook continues to be a top priority in terms of maintaining an unfiltered drinking water source. As a result of this subwatershed's special status in the larger context of lake and watershed management, it is considered a priority area for project implementation.

Priority Subwatersheds

This plan will prioritize BMP implementation in the following four subwatersheds:

- Central East
- Northwest
- Grout Brook
- Shotwell Brook

Note that, because BMP implementation relies on the availability of funds and the willingness of private landowners to allow project development, opportunities to implement the recommendations in Tables 5.2 and 5.3 will be pursued as they become available.

Additionally, the implementation of erosion control BMPs as outlined in Recommended Water Quality Maintenance Strategies (Section 5) and the Implementation Plan (Scenario 6) will reduce sediment and turbidity loads to Skaneateles Lake.

Table 5.1 - TP Reduction by Subwatershed for BMP Scenario 6

Subwatershed	Total Acreage	Lbs./Acre/Yr.	Phosphorus Loading (lbs.)	Pct of Total	Scenario 6	
					TP Load Change (lbs.) compared to Baseline	Pct of Reduction
Central East	2,871	0.46	1,306	10%	-236	22%
Northwest	4,643	0.64	2,962	23%	-217	21%
North	1,326	0.53	698	5%	-209	20%
Grout Brook	6,591	0.30	1,976	15%	-168	16%
Central West	2,450	0.30	748	6%	-151	14%
Bear Swamp Creek	5,810	0.13	731	6%	-124	12%
Northeast	3,981	0.47	1,879	14%	-101	10%
Southwest	3,458	0.17	583	4%	33	-3%
Shotwell Brook	2,230	0.28	625	5%	41	-4%
Southeast	4,456	0.36	1,594	12%	79	-8%
Watershed Total	37,816	N/A	13,102	100%	-1,053	100%

Source: LimnoTech, Skaneateles Lake Watershed Modeling Report (Appendix H)

Table 5.2 – Best Management Practices Modeled to Achieve Reduction of Total Phosphorus

BMP Scenario	BMP	Estimated Phosphorus Load Reduction	Estimated Cost	Lead Organizations & Partners	Potential Funding Sources	Priority & Schedule
2	<ul style="list-style-type: none"> •100% adoption of manure incorporation technology on corn silage fields, up from 67% •100% increase in cover crops (double the current acreage) •Precision Agriculture: increase in the use of precision agriculture from 42% of acreage to 80% of acreage with a 10% decrease in phosphorus application. 	<p>470lbs./ year</p> <p>See 'Skaneateles Lake Watershed Modeling Report', 2024, Table 16 (comparison of Scenario 1 & Scenario 2)</p>	<p>Manure incorporation: \$200,000 (\$163/acre)</p> <p>Cover Crops: \$165,000 (\$50 - \$100 / acre)</p> <p>Precision Ag: Varies by farm size and type</p>	SWCDs, SLWAP	NYSAGM, USEPA, City of Syracuse, USDA	High Priority (1 – 5 years)
3	Filter Strips: add approximately 50 acres of filter strips (varying widths) to the watershed	<p>1,458 lbs./year</p> <p>See 'Skaneateles Lake Watershed Modeling Report', 2024, Table 16 (comparison of Scenario 1 & Scenario 3)</p>	<p>\$1.675 - \$2.35 million (\$33,500 - \$47,000/acre)</p>	SWCDs, SLWAP	NYSAGM, USEPA, City of Syracuse, USDA	High Priority (1 – 5 years)
4	Reduce nutrient contributions from residential septic systems through increased inspections, replacement of malfunctioning and failing systems, and installation of septic systems that provide enhanced nutrient treatment	<p>373 lbs./year</p> <p>See 'Skaneateles Lake Watershed Modeling Report', 2024, Table 16 (comparison of Scenario 1 & Scenario 4)</p>	\$20,000 per unit (up to \$10,000 can be subsidized)	County Health Departments, City of Syracuse / CNY RPDB	WQIP, EFC	High Priority (1 – 5 years)
5	Streambank Stabilization Projects 16,645 feet (3.15 miles) of streambank stabilization	<p>0.05 lbs./linear ft./year</p> <p>Total nutrient load reduced: 835 lbs.</p> <p>See 'Skaneateles Lake Watershed Modeling Report', 2024, Section 6.2</p>	\$50 - \$300/ft of stabilization	SWCDs, SLA, Municipalities	WQIP	High Priority (1 – 5 years, ongoing)
6	Implement Scenarios 2, 3, and 4	2,236 lbs. / year		SWCDs, SLWAP, County Health Departments, City of Syracuse / CNY RPDB	WQIP, EFC,-NYSAGM, USEPA, City of Syracuse, USDA	High Priority (1 – 5 years)
	<p>Notes:</p> <ul style="list-style-type: none"> • The increase in TP loading to Skaneateles Lake as a result of climate change and future conditions (Scenario 1) is expected to be on the order of 820 pounds. • Progress toward BMP implementation will be tracked via annual reports to identify overall trends, challenges, and opportunities in BMP implementation. See Section 6.5. • Estimated per acre cost of manure injection is from Mitchell and Tian, 2023 (2023 price indexed rate). • The costs for precision agricultural and other agricultural BMPs are estimates. According to the Agricultural Best Management Practice Systems Catalogue, prepared by the NYS Soil and Water Conservation Committee in 2024, "Each Agricultural BMP System is unique and must be customized to the situation in which it is employed resulting in a wide and variable range in cost." • Cover crops, manure incorporation, and precision agriculture are all currently being implemented in the Skaneateles Watershed. This scenario represents increased implementation of these BMPs, to be achieved in cooperation with the SLWAP. Agricultural BMP adoption is voluntary and incentive based. • Streambank stabilization projects are currently being implemented in the watershed. This BMP sets a goal for increasing the number of streambank stabilization projects. 					

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
STORMWATER & LOCAL LAND USE					
Continued AEM Tier 3A Adoption: Continue to implement AEM Tier 3A Plans for crop farmers and Nutrient Management Plans (NMPs) for livestock operations	SWCDs and SLWAP	NYSAGM	Varies from farm to farm	High Priority (1 – 5 years, ongoing)	Yes
Crop Residue Mulching: Encourage crop residue mulching on row crop lands	SWCDs and SLWAP	NYSAGM	Low Cost / No Cost ¹	High Priority (1 – 5 years, ongoing)	Yes
Conservation Reserve Enhancement Program (CREP): Producers enrolled in CREP remove lands from agricultural production and plant native grasses, trees, and other vegetation to improve water quality, soil, and wildlife habitat, in exchange for financial incentives	SWCDs and SLWAP	USDA, City of Syracuse	\$900,000 (total) has been committed by the USDA and the City of Syracuse	High Priority (1 – 5 years, ongoing)	Yes
Eastern Finger Lakes: Form a coalition of Soil and Water Conservation Districts and explore funding opportunities	DEC, SWCDs	DEC	\$42 million	Complete / In Progress	No
Enhance Natural Lands: Enhance and protect the economic, social, and health benefits of natural resources (through trail construction, habitat enhancements, trailhead development, etc.)	Land Trusts, DEC, DOS, SWCDs	Land Trusts, DEC, DOS, SWCDs, NRCS	\$50,000 - \$250,000	Low Priority (10 years +)	No
Floodplain Reconnection: Increase stormflow resilience of streams by reconnecting floodplains and/or constructing floodplain wetlands in areas frequently inundated with water.	SWCDs, SLA, Municipalities, Property Owners	DEC, DOS, EFC, USEPA, United States Department of Agriculture (USDA)	Wetland Creation – Floodplain: \$475/acre	High Priority (1 – 5 years)	No
Green Infrastructure: Implement green infrastructure practices (e.g., porous pavement, daylighting culverts) to intercept stormwater prior to entering waterways.	Town and Village of Skaneateles; NYSDOT; Local Public Works Departments	DEC, DOS, EFC, USEPA	\$2,500 - \$120,000 per project	Medium Priority (5 – 10 years)	No
Institutional Capacity: Expand the institutional capacity of the agricultural support agencies to provide technical and financial support to identify and implement best management practices appropriate for individual producers.	NYSAGM, SWCDs, DEC	NYSAGM, DEC	\$85,000 - \$110,000 per funded position	Medium Priority (5 – 10 years)	No
Land Trusts: Support the efforts of local land trusts to acquire lands in the watershed, particularly to create or protect natural buffers between development and surface waters. Conserve high value natural resources that provide resiliency to precipitation and flooding	FLLT, CNY Land Trust, DEC, DOS	DEC, DOS, USEPA, DOI, Private Conservation Program	\$1,000 to \$10,000 per acre	High Priority (1 – 5 years, ongoing)	Yes

¹ A 2017 analysis from the University of Nebraska indicates that mulching crop residue into the soil, rather than removing it, can save farmers \$18 per acre (Wortmann & Klein, 2017).

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
Nitrogen Deposition: Support measures to reduce the atmospheric deposition of nitrogen.	NYSAGM, DEC, SWCDs, SLWAP	NYSAGM, DEC, SWCDs, SLWAP	Varies by project / BMP	Low Priority (10 years +)	No
Nutrient Management Plans: Continue to prepare NMPs that include manure storage management and financial and technical assistance for both CAFO and non-CAFO farms.	SWCDs, SLWAP	NYSAGM	CNMP: \$5 - \$10/acre	High Priority (1 – 5 years, ongoing)	Yes
Tree Planting: Actively seek out opportunities for tree planting in the watershed, beyond the limitations of other programs, including to replace trees damaged by invasive species (such as elm and hemlock trees).	DEC, CNY RPDB, SWCDs, Municipalities	USFS, DEC, SWCDs	\$250/tree	High Priority (1 – 5 years, ongoing)	Yes
Upland Water Retention: Increase upland retention through implementation of water storage BMPs (retention basins, wetlands, etc.).	SWCDs, CNY RPDB, SLA, Municipalities	DEC, DOS, EFC, USEPA, USDA, Private Conservation Programs	\$2,500 - \$120,000 per project	Medium Priority (5 – 10 years)	Yes
Voluntary Buyouts: Use voluntary buyouts on improved properties that see recurring flooding. Find or develop flexible funding sources that compensate owners for the full value of their property.	SLA, CNY RPDB, Municipalities	FEMA Hazard Mitigation Grant Program, New York’s Division of Housing and Community Renewal	Varies by location / property type	Low Priority (10 years +)	No
Watershed Agricultural Program: Continue to support the Skaneateles Lake Watershed Agricultural Program.	City of Syracuse, SWCDs, SLWAP, NYSAGM	City of Syracuse, SWCDs, SLWAP, NYSAGM	\$500,000 - \$750,000 per year	High Priority (1 – 5 years, ongoing)	Yes
Wetland Enhancement / Restoration: Construct wetlands or enhance/restore existing wetlands to reduce sediment and nutrient loads.	SWCDs, SLA, Municipalities	DEC, DOS, USFWS, USEPA, City of Syracuse	Wetland Restoration / Preservation: \$8,100/acre ²	Medium Priority (5 – 10 years)	Yes
RESIDENTIAL INPUTS					
Disconnect Downspouts and Other Drainages: Connect discharges from downspouts, sump-pumps, and other sources to allow for infiltration into the watershed, reducing runoff rates.	SWCDs, CCE, SLA, Municipalities	DEC, DOS, USEPA	Site dependent: \$0 - \$11,000 / acre	High Priority (1 – 5 years, ongoing)	No
Forested Acreage – Residential: Promote forest management education for residential property owners with forested acreage.	SLA, CNY RPDB, City of Syracuse, Municipalities, Universities	SLA, CNY RPDB, City of Syracuse, Municipalities, Universities	\$15,000 - \$30,000 per year of educational programming ³	High Priority (1 – 5 years, ongoing)	No

² Dollar amount adjusted for inflation (USDA Economic Research Service, 2015).

³ Educational programming cost estimates assume 800 hours of programming and program development annually, with added costs for travel and equipment.

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
Funding for Projects on Residential Land: Develop a program to encourage conservation and water quality improvement projects on private residential property, modeled on existing septic system replacement programs.	DEC, SLA, CCE	To be determined	\$50,000 - \$100,000 (estimated program fund)	Medium Priority (5 – 10 years)	No
Impediments to Adoption: Use surveys and other tools to better understand impediments to residential BMP adoption, and ways to incentivize lake friendly living practices	SLA, CNY RPDB, City of Syracuse, Municipalities, CCE	SLA, CNY RPDB, City of Syracuse, Municipalities, CCE	\$5,000 - \$10,000 per survey	Medium Priority (5 – 10 years)	No
Residential Waste - Community Collection Events: Prevent the potential for surface water and groundwater contamination by hazardous materials through community collection programs.	Counties, Towns, Villages	NYS Environmental Protection Fund – Household Hazardous Waste Program Grants	\$32,000 per collection event	Medium Priority (5 – 10 years)	Yes
Residential Wastewater: Assess possible alternatives to OWTS, such as community systems, expanded sewer systems, and upgrades to the Village of Skaneateles' wastewater treatment plant.	Municipalities, CCE, SLA, County Health Departments	USDA, DEC, DOS, NYS EFC	\$400,000	Medium Priority (5 – 10 years)	No
Septic Systems: Continue participation in New York State's Septic System Replacement Fund program and apply for funding through DEC's WQIP program for septic system pump out funds.	County Health Departments, City of Syracuse / CNY RPDB	DEC, EFC	\$10,000 per unit	High Priority (1 – 5 years, ongoing)	Yes
Septic Systems - Innovative/Alternative Systems: Support research, testing, and adoption of pilot projects using enhanced phosphorus removal technologies in OWTS.	County Health Departments, Municipalities, Universities, City of Syracuse, SLA, CCE	DEC, EFC, SLA, CCE, Municipalities, Universities	Unknown - Research is ongoing	Low Priority (10 years+)	
Shoreline Properties: Provide educational opportunities on best practices for shoreline properties.	SLA, CNY RPDB, NYSFOLA, CCE	SLA, CNY RPDB, NYSFOLA	\$15,000 - \$30,000 per year of educational programming	High Priority (1 – 5 years, ongoing)	No
Soil Testing: Educate residents of the availability of Cornell Cooperative Extension's no-cost residential soil testing service. Soil tests can tell property owners what nutrients are in your soil and what they may or may not need to add (in the form of fertilizer) for	CCE, SLA, Municipalities	CCE, SWCD, SLA, Municipalities	\$15,000 - \$30,000 per year of educational programming	Medium Priority (5 – 10 years)	Yes
Stormwater Management – Residential: Promote education and outreach to landowners to encourage them to find ways to integrate stormwater management into their property management, through the use of rain gardens, biofilters, and ponds.	SLA, CNY RPDB, NYSFOLA, CCE	SLA, CNY RPDB, DEC	\$15,000 - \$30,000 per year of educational programming	Medium Priority (5 – 10 years)	No

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
Trees for Tribs: Promote programs that encourage riparian buffer plantings such as NYSDEC's 'Trees for Tribs' or "Buffer in a Bag" programs	SWCDs, SLA, CCE, EFC, USDA, OPRH	DEC	\$5 to \$250 per tree	High Priority (1 – 5 years, ongoing)	Yes
Turf Lawns: Encourage the conversion of residential turf lawns to meadows dominated by native species with strong root systems.	SLA, CCE, Municipalities	Private property owners	\$4,500/acre (based on 2006 cost of "well over \$3K/acre", updated to 2023)	High Priority (1 – 5 years, ongoing)	Yes
ROADWAY MAINTENANCE					
Add Cross-Drains: Conduct an analysis on the possible benefits of adding cross-drains to roadside drainage, to distribute water volumes more evenly across the landscape, and of daylighting buried drainage pipes.	Municipalities, State DOT, SWCDs, Cornell Local Roads	NYS DOT, USDOT, USFWS, Municipalities	\$100,000 - \$1 million per project	Low Priority (10 years +)	No
Culvert Assessment: Conduct a culvert assessment (using the North Atlantic Aquatic Connectivity Protocol) and right-size culverts to avoid headcuts and provide aquatic connectivity. (Already completed for Cayuga and Cortland Counties.)	SWCDs	DEC, NYSAGM	\$60,000 - \$95,000 to complete watershed assessment	Medium Priority (5 – 10 years)	Yes
Disconnect Ditches: Where feasible, disconnect roadside ditches from waterways, without causing unintended consequences of new drainage patterns on downslope areas	Municipalities, State DOT, SWCDs, Cornell Local Roads	DEC, DOS, DOT, USEPA	Site Specific	Low Priority (10 years +)	No
Ditch Inventory: Develop a digital inventory of roadside drainage ditches to support future modeling and improvement efforts.	Municipalities, City of Syracuse, CNY RPDB	DEC, SWCDs, City of Syracuse	\$95,000 - \$150,000 to develop inventory	Medium Priority (5 – 10 years)	No
Roadside Ditches: Reduce flow velocities and promote sedimentation within road ditches through installation of check dams and other facilities.	Municipalities, State DOT, SWCD	DEC, DOS, DOT, USEPA	\$50 to \$1,000 per unit	Medium Priority (5 – 10 years)	No
Salt Calibration Workshops: Continue the use of municipal salt calibration workshops.	NYS DOT, Municipalities, NYS Fair, SWCDs, CNY RPDB	NYS DOT, SWCDs	\$5,000 - \$10,000 per workshop	Medium Priority (5 – 10 years)	Yes
Snowplow Blades: Adopt practices and/or acquire equipment that can reduce the use and/or transport of road salt, such as live edge snowplow blade systems.	SWCDs, Municipalities	SWCDs, Municipalities, NYSAGM	\$3,000 - \$4,000 per blade system	High Priority (1 – 5 years, ongoing)	No

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
Hydroseeding: Ensure that roadside ditches are hydroseeded following cleanouts to reduce erosion	Municipalities, SWCDs	FLOWPA, Municipalities, City of Syracuse	\$775/acre	High Priority (1 – 5 years, ongoing)	Yes
INVASIVE SPECIES MANAGEMENT					
Boat Decontamination: Expand boat decontamination infrastructure for invasive species around the watershed	SLA, Municipalities, PRISM, DEC, SWCDs	SLA, DEC, NYS DOS, US EPA	\$20,000 - \$50,000 per station	High Priority (1 – 5 years, ongoing)	Yes
Boat Stewards: Support and expand the Boat Launch Stewards program.	SLA, DEC	SLA, DEC, City of Syracuse, SWCDs, NYS DOS	\$90,000 per season	High Priority (1 – 5 years, ongoing)	Yes
Harbormaster Training: Provide invasive species training to harbormasters throughout the watershed.	SLA, Municipalities, PRISM, Marinas, DEC	SLA, DEC, NYS DOS, US EPA	\$15,000 - \$30,000 per year of training	Medium Priority (5 – 10 years)	No
HWA: Continue surveillance for and treatment of Hemlock Woolly Adelgid (HWA) in highly erodible steep gullies. Use systemic insecticides (imidacloprid and dinotefuran) and/or introduce natural enemies such as the predatory beetle <i>Laricobius nigrinus</i> .	SLA, SWCDs, Private Landowners	SLA, DEC, NYS DOS, US EPA	\$50,000 - \$100,000 per year of treatment and surveillance	High Priority (1 – 5 years, ongoing)	Yes
Milfoil Management: Continue to use benthic matting to control the spread of Eurasian watermilfoil in Skaneateles Lake	SLA, Aquatic Invasives	DEC, SLA	\$200,000 annually	High Priority (1 – 5 years, ongoing)	Yes
Private Access Points: Expand education and outreach to encourage decontamination and inspection at various private access points, such as marinas and short-term rentals with boat launches.	SLA, Municipalities, PRISM	SLA, DEC, NYS DOS, US EPA	\$15,000 - \$30,000 per year of education and training	Medium Priority (5 – 10 years)	No
PUBLIC EDUCATION AND OUTREACH					
Demonstration Projects: Utilize public land to develop demonstration BMPs / projects with interpretive signage.	City of Syracuse, Municipalities, NYS OPRH	City of Syracuse, Municipalities, NYS Parks	\$5,000 - \$80,000 per project	Medium Priority (5 – 10 years)	Yes
Education for Professionals: Provide training / educational materials for landscapers and other service providers in the watershed whose activities can affect water quality.	SWCDs, SLA, Universities, DEC, CNY RPDB	DEC, SLA, City of Syracuse, Onondaga County	\$15,000 - \$30,000 per year of educational programming	Medium Priority (5 – 10 years)	No

Table 5.3 – Additional BMPs to be implemented within the watershed to achieve the Vision and Goals

BMP Description	Lead Organizations and Partners	Potential Funding Sources	Estimated Cost	Priority	Currently being implemented?
Educational Materials: Develop guidance manuals and other resources that can assist private landowners with implementing stormwater reduction projects.	SWCDs, SLA, Universities, DEC, CNY RPDB	DEC, SLA, City of Syracuse, Onondaga County	\$5,000 - \$15,000 per guidance manual	High Priority (1 – 5 years, ongoing)	Yes
Lake Friendly Living: Continue to participate in Lake Friendly Living program.	CCE, Lake Friendly Living partners, SLA, Municipalities	SLA, Municipalities	\$20,000 annual fee	High Priority (1 – 5 years, ongoing)	Yes
Model Homes: Work with property owners to develop a set of ‘Model Properties’ to demonstrate lake-friendly living practices.	SLA, CCE, Land Trusts	SLA, CCE, Land Trusts, Residents	\$10,000 - \$30,000 per program year	Medium Priority (5 – 10 years)	No
Municipal Employee Training: Provide / expand water quality training for municipal employees and volunteers, such as: <ul style="list-style-type: none"> • Firefighting practices • ‘Good Housekeeping’ practices for municipal facilities • Incentive programs for municipal BMPs, such as DEC’s Climate Smart Communities 	Municipalities, SWCD, DEC	Municipalities, SWCD, DEC	\$15,000 - \$30,000 per year of educational programming	Medium Priority (5 – 10 years)	No
Volunteers: Continually engage watershed stakeholders across all groups and demographics in volunteer opportunities concerning water quality protection and improvement.	DEC, SWCD, SLA, CCE, City of Syracuse, Universities	DEC, City of Syracuse, CCE, SLA	\$10,000 - \$20,000 per program year	High Priority (1 – 5 years, ongoing)	Yes
Website: Continue to update ‘skanlakeinfo.org’, the central clearinghouse for information about Skaneateles Lake and its watershed (including adding information on the 9E process).	CCE, City of Syracuse	City of Syracuse	\$5,000 - \$10,000 per year of website maintenance	High Priority (1 – 5 years, ongoing)	Yes
LOCAL LAWS					
Model Ordinances: Review New York’s Model Local Laws to Increase Resilience for specific additional provisions that could be incorporated into town and village subdivision and site plan laws to further protect water quality, enhance drainage, and reduce erosion. Consider adoption of zoning as an additional tool for protecting watershed resources.	Towns and Villages, Onondaga County, CNY RPDB, SLA	NYS DOS, County Planning Departments	\$10,000 - \$15,000 per review	Medium Priority (5 – 10 years)	No
Planning and Zoning: Promote the use of comprehensive plan development and updates, as well as zoning, to increase community resilience to flooding and erosion.	Towns and Villages	NYS DOS, County Planning Departments	\$60,000 - \$85,000 per comprehensive plan	Medium Priority (5 – 10 years)	Yes
Training: Target training on local ordinances specifically to watershed-related issues for town officials, inspectors, and personnel, as appropriate.	Towns and Villages, CCE, CNY RPDB	NYS DOS, County Planning Departments	\$15,000 - \$30,000 per year	Medium Priority (5 – 10 years)	No

6. Implementation Plan

6.1 Overview of the Implementation Plan: Adaptive Management

The 9E Plan establishes a consensus-based framework for decision-making within a given watershed. In the case of the Skaneateles Lake Watershed, multiple agencies and organizations have been actively working to protect the lake's water quality, through a range of actions, including public education, working with the agricultural community, managing invasive species, creating and enforcing local laws and regulations, and conserving land, to name only a few. The 9E Plan does not replace any of these activities, nor does its implementation in any way curb or control ongoing activities. The 9E Plan adds a measurable goal, maintaining TP and chlorophyll-a levels in the context of climate change, and a means of organizing the watershed activities that relate to this goal.

Adaptive management means that, over time, progress toward the measurable goals articulated in this plan can be tracked. As new information and issues emerge in the watershed, watershed stakeholders can work cooperatively to re-evaluate the Plan's implementation steps and adjust programs and projects accordingly.

The CNY RPDB was responsible for the development of this 9E Plan, in cooperation with the WAC. The CNY RPDB will continue to serve as the coordinator and convener of a 9E Plan Implementation Team, in conjunction with members of the WAC who wish to remain engaged in this process.

6.2 Implementation Team

Successful implementation of the 9E Plan will require the combined efforts of a range of watershed stakeholders, including many of those already represented on the existing Watershed Advisory Committee. The organizations and agencies listed below are anticipated to be members of the 9E Implementation Team. Quarterly meetings of this team will ensure that team members and watershed stakeholders can coordinate, communicate, and cooperate on projects and other initiatives to reach the 9E water quality targets.

Central New York Regional Planning and Development Board: The CNY RPDB will take the lead on coordinating and convening the 9E Implementation Team and track the Plan's success, relative to the 9E's water quality targets. The CNY RPDB is a long-standing recipient of NYSDEC's 604(b) Water Quality Planning grant funding, and was recently awarded a five-year contract under this funding source. One of the tasks under this funding source is assisting with the implementation of 9E Plans. The CNY RPDB will work collaboratively with the other members of the Implementation Team (below) to pursue implementation of the recommendations

in Tables 5.1 and 5.2.

City of Syracuse: The City of Syracuse will continue to be responsible for enforcing the Watershed Rules and Regulations in the Skaneateles Watershed, as well as providing support to Cornell Cooperative Extension's efforts in the watershed and providing funding for agricultural BMPs.

Onondaga County: Onondaga County will continue to be involved in supporting community planning in the Village of Skaneateles and the Towns of Skaneateles and Spafford. The County's Office of the Environment will be involved in water quality improvement project development and oversight, as well as in providing coordination between the Implementation Team and other County departments.

Cayuga County: The Cayuga County Department of Planning and Economic Development will continue to ensure coordination between the Implementation Team and stakeholders and resources in Cayuga County. As the coordinator of the Cayuga County Water Quality Management Agency (WQMA), the County facilitates the movement of information between the Skaneateles Watershed and Cayuga County stakeholders.

Skaneateles Municipal Partnership: The Skaneateles Municipal Partnership (SMP) is a forum that promotes the exchange of information and ideas between representatives of the towns and village in the watershed. The SMP will provide an important point of contact and coordination for funding opportunities, such as State grants, which require a municipal applicant.

New York State Department of Environmental Conservation: NYSDEC's continued involvement in this plan will be critical. DEC's Finger Lakes Hub is currently developing a Finger Lakes Action Agenda, the recommendations of which will bear directly on how this 9E is integrated into water quality efforts across the region. DEC also coordinates the CSLAP program, which is the data source to be used in determining the three-year rolling averages for TP and chlorophyll-a levels. DEC administers numerous grant programs that will be critical in funding implementation projects in the watershed, particularly the Water Quality Improvement Program (WQIP).

Soil and Water Conservation Districts: The SWCDs in Onondaga, Cayuga, and Cortland Counties will be responsible for continuing to implement agricultural BMPs, in cooperation with farmers in the watershed. The Onondaga County SWCD supports the SLWAP and its efforts to ensure that farms in the watershed adopt the latest and most effective BMPs available. The SWCDs have also taken the lead on coordinating with public works departments to integrate water quality considerations into roadway maintenance and to assess culverts in the watershed. The Cayuga County SWCD recently completed a survey of culverts in the Cayuga County portion of the Skaneateles Watershed.

Cornell Cooperative Extension: CCE will be a key resource involved with implementing BMPs related to public education and outreach. As the administrator of the watershed's online information clearinghouse (www.skanlakeinfo.org), CCE will have primary responsibility for communicating 9E Plan updates to the public.

Skaneateles Lake Association: The SLA manages a wide array of activities, including sponsoring and collecting data through the CSLAP program and managing the Eurasian watermilfoil removal program, the Watercraft Launch Stewards program, and the Hemlock Woolly Adelgid control program. Additionally, the SLA conducts and promotes scientific research on Skaneateles Lake in cooperation with colleges and universities and works with homeowners to promote water quality improvement actions at the residential level. This includes conducting streambank rehabilitation and other water quality improvements in partnership with private landowners.

The SLA is also involved with partnering with SUNY ESF's Restoration Science Center on Lawn to Meadow and other vegetative solutions, HAB monitoring and response, tributary monitoring, in-lake monitoring through the CSLAP program, the Lake Friendly Living Program, owning and operating the Dr. Robert Werner Research & Education Boat (The BOB), and the On The Water education program.

SLA has experience with both obtaining state and federal funding and with administering grants and project contracts, as well as providing seed funding for other organizations' projects.

FL-PRISM: The Finger Lakes Partnership for Regional Invasive Species Management (FL-PRISM) is the primary organization for invasive species detection, prevention, control, and education and outreach in the Finger Lakes region. The FL-PRISM will work collaboratively with its partners and the public to provide education and mitigate the impacts of invasive species in the Skaneateles Watershed.

Land Trusts: The Finger Lakes Land Trust and Central New York Land Trust will continue to work with individual property owners to ensure the conservation of private property in the watershed, either through the purchase of development rights, or through outright acquisition of parcels.

Colleges and Universities: The WAC did not include representatives of any of the region's many colleges and universities – some of which are actively engaged in research on Skaneateles Lake. Students and faculty from these schools can be instrumental in conducting research and developing projects and programs in the watershed. At a minimum, invitations to join the Implementation Team will be extended to representatives of the State University of New York College of Environmental Science and Forestry (SUNY ESF), Syracuse University (SU), and Hobart and William Smith Col-

leges, home of the Finger Lakes Institute (FLI).

6.3 Annual Work Plan

Working with the Implementation Team, the CNY RPDB will compile an annual work plan, identifying both recurring activities, new projects and programs anticipated for the upcoming year, and ongoing projects being carried over from previous years. The development of this work plan will enable watershed stakeholders to articulate their watershed / water quality priorities for the year, and enable BMP tracking over time across watershed organizations and municipalities.

6.4 Key Metrics

In addition to directly tracking annual TP and chlorophyll-a levels in the lake, there are a variety of indirect indicators that will be tracked as data become available – many of which are already compiled and reported by the City of Syracuse, DEC, the SLA, CCE, and other watershed stakeholders:

- New housing starts
- HABs occurrences
- Septic system failures
- Land use / land cover changes
- BMP adoption
- Adoption of green infrastructure practices
- HWA control efforts
- Number of beach closures
- Adoption of local laws / regulations that intersect with nutrient loading levels
- Identification of new invasive species
- Rainfall and temperature trends

Continued trophic state monitoring using the CSLAP framework will also support long-term trend analysis.

Although the impact of some preventative measures cannot be directly quantified, continued partnerships and community engagement are key to protecting the Skaneateles Lake watershed for future generations. Measures such as education and outreach, and continued surveillance for impacts of invasive species on landscape stability can help manage nutrient and sediment loading to surface waters.

6.5 Project and Program Tracking

The CNY RPDB will work with the Implementation Team to track BMP implementation across the Skaneateles Watershed. The BMP scenarios in Table 5.2 and the recommendations in Table 5.3 will be utilized as a framework

for tracking implementation over time. The CNY RPDB will prepare an annual summary of plan implementation using these tables. See Section 7.3, Monitoring Schedule, for a description of monitoring activities to be undertaken over the first ten years of plan implementation. (Note that this is not a regulatory plan and BMP implementation is driven by a combination of incentives and voluntary participation. Implementation reporting may, in some cases, include reporting on obstacles encountered to implementing a recommendation.)

6.6 Technical and Financial Assistance

Table 6.1 provides a summary of some of the federal, state, and local resources available to support the implementation of the recommendations in Tables 5.1 and 5.2.

In addition to these resources, the NYSDEC provides an online tool, the Funding Finder Tool, designed to simplify the process of finding grant opportunities. This tool allows grant seekers to filter grants based on categories including eligible applicants, project type, project phase, and regional coverage.

The Funding Finder Tool is available for download at: <https://dec.ny.gov/get-involved/grant-applications/funding-finder-tool>.

Table 6.1 – Funding Sources for Watershed BMPs

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
STATE			
New York State Department of Agriculture and Markets (NYSAGM)	Agricultural Nonpoint Source Abatement and Control Program (ANSACP)	Financial assistance program for projects led by SWCDs that involve planning, designing, and implementing priority BMPs. The program also provides cost-share funding to farmers to implement BMPs.	Stormwater & Landscape Management
	Agricultural Environmental Management (AEM) Program	SWCDs engage local partners such Cooperative Extension, NRCS, AEM Certified Planners, Certified Crop Advisors, USDA Technical Service Providers, and agri-businesses to assist farmers in farm planning to reduce runoff and erosion.	Stormwater & Landscape Management
	Climate Resiliency Farming (CRF) Program	Assistance to reduce the impact of agriculture on climate change (mitigation) and increase resiliency of NYS farms in the face of a changing climate (adaptation).	Stormwater & Landscape Management
	Community Resiliency Training Program	Provides community and municipality-based training events to increase resiliency to future flooding and outbreaks of harmful algal blooms in high-risk waterbodies.	Stormwater & Landscape Management
	County Agricultural and Farmland Protection Planning Grants	Financial assistance for the development of County Agricultural and Farmland Protection Plans and assist implementation of such plans.	Stormwater & Landscape Management
	Source Water Buffer Program	Funding to support, expand or enhance water quality protection through the purchase of conservation easements on agriculture lands that preserves or establishes buffers for surface or ground waters.	Stormwater & Landscape Management

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
New York State Department of Environmental Conservation (NYSDEC)	Clean Water, Clean Air and Green Jobs Environmental Bond Act of 2022	A wide range of environmental, recreational, and public health and safety capital projects may be eligible for Environmental Bond Act funding.	Stormwater & Landscape Management
	Finger Lakes Watershed Grants Program	Funding for water quality monitoring and research, BMP planning and implementation, environmental education and stewardship.	Stormwater & Landscape Management, Residential Inputs, Public Education and Involvement
	Water Quality Improvement Project Program (WQIP)	For projects that reduce runoff, improve water quality, and restore habitat. Eligible applicants include municipalities, municipal corporations, and Soil and Water Conservation Districts	Stormwater & Landscape Management
	Climate Smart Communities (CSC) Grants	Provides 50/50 matching grants to municipalities for eligible climate mitigation and adaptation projects. This includes projects aimed at reducing flood-risk, increasing natural resiliency, extreme-event preparation, relocation or retrofit of critical infrastructure, and improving emergency preparedness.	Stormwater & Landscape Management
	Community Forest Conservation Grant Program	Funds municipal land acquisition for community forests to protect habitat, improve air/water quality and provide for recreational opportunities	Stormwater & Landscape Management
	Non-Agricultural Non-point Source Planning and Municipal Separate Storm Sewer System (MS4) Mapping Grants	Provides up to 90/10 matching grants to local governments and Soil and Water Conservation Districts to help pay for initial planning of non-agriculture nonpoint source water quality improvement projects.	Stormwater & Landscape Management
	Invasive Species Grant Program	Designed to support projects that target both aquatic and terrestrial invasive species. The program allows applications for two new categories: Lake Management Planning and Aquatic and Terrestrial Invasive Species Research.	Invasive Species Management
	Trees for Tribs	Landowners who are the primary resident(s) of land in New York State with at least 50 feet along a stream or waterbody are eligible to receive a free bag of seedlings. Organizations or individuals with permission to plant on a given property with stream or waterbody access may also participate.	Stormwater & Landscape Management
NYS Conservation Partnership Program	Funds to enable local organizations to strengthen urban, rural, and suburban, land conservation and public outreach programs, build community partnerships and implement BMPs.	Stormwater & Landscape Management	
New York State Department of Environmental Conservation (NYSDEC)	Water Quality Management Planning Programs: Clean Water Act, Section 604(b) Funding	Funding is available to implement regional comprehensive water quality management planning activities, including tasks to determine the nature, extent and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.	9E Implementation

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
NYSDEC, NY Sea Grant	NY’s Great Lakes Basin Small Grants	Support stakeholder-driven efforts to restore and revitalize the state’s Great Lakes region and demonstrate successful application of ecosystem-based management.	Floodplain and Stormwater Management, Invasive Species Management
NYSDEC / Land Trust Alliance	Forest Conservation Easements for Land Trusts Program	Public-private partnership funding provided to increase the pace of forested land conservation to combat climate changes.	Stormwater & Landscape Management
NYSDEC / New York State Environmental Facilities Corporation (NYSEFC)	Clean Water State Revolving Fund	Provides interest-free or low-interest rate financing for wastewater and water quality improvement projects to municipalities. Eligible projects include stormwater management and habitat restoration and protection projects.	Stormwater & Landscape Management
	Wastewater Infrastructure Engineering Planning Grant	Provides grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund water quality project.	Stormwater & Landscape Management
NYSEFC	Clean Water Infrastructure Act (CWIA) Grants	Funds municipal capital projects to improve water quality. <i>Consolidated Animal Feeding Operation Waste Storage and Transfer Program Grant</i> funds SWCDs to implement comprehensive nutrient management plans through the completion of agricultural waste storage and transfer systems on larger livestock farms. <i>CWIA Source Water Protection Land Acquisition Grant Program</i> funds municipalities, municipal corporations, SWCDs and not-for-profits (land trusts) for land acquisition projects providing source water protection. This program is administered as an important part of the WQIP program.	Stormwater & Landscape Management
	Green Innovation Grant Program (GIGP)	Provides municipalities, state agencies, private entities, as well as SWCDs with funds to install transformative green stormwater infrastructure.	Stormwater & Landscape Management
	Septic Replacement Fund	Provides participating counties with funds to reimburse a property owner for up to 50% of the costs (up to a max of \$10,000) of their eligible septic system project. Eligible projects include replacement of a cesspool with a septic system; installation, replacement or upgrade of a septic system or components; installation of enhance treatment technologies.	Stormwater & Landscape Management

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
NYS Dept of State (NYSDOS)	Local Waterfront Revitalization Program (LWRP)	Beyond funding planning studies, the Local Waterfront Revitalization Program (LWRP) provides funding to improve water quality and natural areas, guide development to areas with adequate infrastructure and services and away from sensitive resources, promote public waterfront access, and provide for redevelopment of underutilized waterfronts. LWRP implementation funds can be used on public lands or lands with a permanent public interest and can fund a wide variety of waterfront revitalization and resiliency projects, from constructing parks, to culvert right-sizing, to streetscape projects, and many other project types.	Stormwater & Landscape Management
	Smart Growth Comprehensive Planning Grant Program	Provides funding for eligible villages, towns, cities, counties, regional planning entities, and not-for-profit organization to advance the preparation of municipal comprehensive plans to establish land use policies which support smart growth and clean energy principles.	Local Laws and Regulations
NYS Dept of Transportation (NYSDOT)	Transportation Alternatives Program	Provides funding for roadway improvements and culvert and bridge replacements, as well as pedestrian and bicycle paths.	Roadway Maintenance
	Bridge NY Program	Funding available for local governments to rehabilitate and replace bridges and culverts statewide.	Roadway Maintenance
NYS Office of Parks, Recreation and Historic Preservation (NYSOPHRP)	Environmental Protection Fund Municipal Grants Program	Provides funding for acquisition, preservation, planning, development, and improvement of parks, historic properties, and heritage areas. Funding is available through the following grant categories: Park Acquisition, Development and Planning Program; Historic Property Acquisition, Preservation and Planning Program; Heritage Areas System Acquisition, Development and Planning Program.	Stormwater & Landscape Management
New York State Pollution Prevention Institute	Community Grants	Funding to projects that seek to improve the health, environmental quality, and economic vitality of communities across New York State. Designed to support public awareness and understanding that lead to adoption of sustainable practices.	Public Education and Outreach
Great Lakes Research Consortium	Small Grants Program	Provides funding dedicated to collaborative research and education on the Great Lakes and Great Lakes basin within New York State.	Public Education and Outreach
Finger Lakes-Lake Ontario Watershed Protection Alliance (FLOWPA)	Funding and Technical Assistance	Provides funding to member counties for water quality improvement projects; FL-LOWPA funding has been used for a variety of purposes, including agriculture, septic systems, erosion and stormwater, invasive species, habitat protection, drinking water and more.	Stormwater & Landscape Management, Residential Inputs, Roadway Maintenance, Invasive Species Management

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
FEDERAL			
Federal Emergency Management Agency (FEMA)	Hazard Mitigation Grant Program	Helps communities implement hazard mitigation measures to protect against life and property damages.	Stormwater & Landscape Management
U.S. Department of Agriculture, Farm Service Agency (FSA)	Conservation Reserve Program (CRP)	A voluntary program for agricultural landowners that provides farmers with annual rental payments and cost-share assistance to establish long-term, resource covers on eligible farmland.	Stormwater & Landscape Management
	Farmable Wetlands Program	Voluntary program designed to restore previously farmed wetlands and wetland buffer to improve both vegetation and water flow.	Stormwater & Landscape Management
U.S. Department of Agriculture, Natural Resources Conservation Service (US-DA-NRCS)	Agricultural Conservation Easement Program (ACEP)	Provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.	Stormwater & Landscape Management
	Agricultural Management Assistance (AMA) Program	Provides financial and technical assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations.	Stormwater & Landscape Management
	Conservation Stewardship Program (CSP)	Voluntary program that provides financial and technical assistance to implement conservation practices on agricultural and forested lands.	Stormwater & Landscape Management
	Environmental Quality Incentives Program (EQIP)	Voluntary program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land.	Stormwater & Landscape Management
	Conservation Innovation Grants	Provides funding that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation or private lands.	Stormwater & Landscape Management
	Wildlife Habitat Incentive Program (WHIP)	Voluntary program that provides financial and technical assistance to help participants develop fish and wildlife habitat on private agricultural land, non-industrial private forest land, and Indian land.	Invasive Species Management
U.S. National Oceanic and Atmospheric Administration	Environmental Literacy Grants	Funds to support the education of k-12 students and the public so they are knowledgeable of the ways in which their community can become more resilient to extreme weather events and/or other environmental hazards	Public Education & Outreach
U.S. Department of Agriculture, Rural Development	Water & Waste Disposal Loan & Grant Program	Provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.	Stormwater & Landscape Management
	Community Facilities Direct Loan & Grant Program	Provides funding to develop essential community facilities in rural areas.	Stormwater & Landscape Management

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
U.S. Department of Agriculture, U.S. Forest Service	Citizen Science Competitive Funding Program	Provides funding to support innovative projects that address science and resource management information needs while connecting people to the land and one another.	Public Education and Outreach
U.S. Environmental Protection Agency (USEPA) and US Forest Service	Great Lakes Restoration Initiative Forest Restoration	Funding to implement green infrastructure projects that improve habitat and other ecosystem function in the Great Lakes are eligible for funding.	Stormwater & Landscape Management
	Great Lakes Restoration Initiative Cooperative Weed Management	Funding to detect, prevent, eradicate, and/or control invasive plant species to promote resiliency, watershed stability, and biological diversity.	Invasive Species Management
U.S. Fish and Wildlife Service (USFWS)	Partners for Fish and Wildlife Program	Assists landowners with technical and financial assistance to help protect, enhance, and restore wildlife habitat on privately owned lands. Activities include restoring wetlands, grasslands, in-stream habitats, stream banks, riparian areas, and floodplain areas.	Stormwater & Landscape Management
	North American Wetlands Conservation Act Grants	Funding to support long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitat for the benefit of all wetlands-associated migratory birds	Stormwater & Landscape Management
U.S. Environmental Protection Agency (USEPA)	Clean Water Act Section 319 Nonpoint Source Management Program	Funding to support a variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring to assess the success of specific nonpoint source implementation projects.	Stormwater & Landscape Management
	EPA Environmental Education Grants	Supports environmental education projects and promote environmental awareness and stewardship.	Public Education and Outreach
	Water Research Grants	Funding to develop and support the science and tools necessary to develop sustainable solutions to 21st century water resource problems.	Public Education and Outreach
Great Lakes Commission	Sediment and Nutrient Reduction Program	Provides funding to reduce nutrients and sediments from entering the Great Lakes.	Stormwater & Landscape Management
LOCAL, REGIONAL & PRIVATE FOUNDATIONS			
Municipalities	Municipal Budgets	Provide labor and equipment from Departments of Highways and/or Public Works to do tasks such as clean debris from streams, culverts, storm drains, etc.	All

Table 6.1 – Funding Sources for Watershed BMPs, cont.

Funding Source	Program	Description	Related Skaneateles Lake Watershed Recommendations
National Fish and Wildlife Foundation	Five Star and Urban Waters Restoration Grant Program	Provides funding to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff and degraded shorelines caused by development.	Stormwater & Landscape Management
	Sustain Our Great Lakes Program	Funding to support fish, wildlife, habitat and water quality improvement and protection within the Great Lakes Basin	Stormwater & Landscape Management
Wildlife Conservation Society	Climate Adaptation Fund	Funding to increase the pace and scale of impact in adaption for wildlife and ecosystems by increasing innovation, accelerating learning, and mainstreaming proven adaptation approaches.	Stormwater & Landscape Management
Freshwater Future	Project Grants Program	Provides financial support for activities led by community groups to promote river, lake, shoreline, wetland, groundwater, and drinking water protection in the Great Lakes basin through grassroots advocacy.	Stormwater & Landscape Management
Great Lakes Basin States	Great Lakes Protection Fund	Provides funding to project that will create and advance the next generation of actions to protect and restore the ecological health of the Great Lakes	All
Northern Borders Regional Commission	Economic Infrastructure Grants	Funding provided to support critical infrastructure pertaining to water and wastewater systems and transportation networks anchoring regional economic development.	Stormwater & Landscape Management
Finger Lakes Partnership for Invasive Species Management (FL-PRISM)	Partner Project Program	FL-PRISM provides invasive species control support, including monitoring and chemical and mechanical control.	Invasive Species Management

6.7 Implementation Timeline

This plan proposes a combination of new ideas and continued support for existing programs, notably the SLWAP. Because this plan is organized around maintaining existing water quality into the future, rather than achieving significant reductions in TP and chlorophyll-a levels in the near-term, a sustained commitment to project and program implementation is even more critical than implementing a suite of programs immediately.

The implementation priorities and timeline in this section are based on input from WAC members, as well as from members of the public. At the second public meeting (January 2024), attendees were asked to rank their preferences for BMP implementation. This input was combined with comments and suggestions from WAC members throughout the planning process to create a set of priorities for the watershed.

Short-Term (1 to 5 years)

The first five years of plan implementation will be focused on implementing the High Priority BMPs identified in Tables 5.2 and 5.3.

As noted in Section 5.2, implementation of these BMPs will be prioritized, to the extent feasible, in the Central East, Northwest, Grout Brook, and Shotwell Brook subwatersheds.

One of the Implementation Team's first objectives will be to evaluate these short term / high-priority recommendations and develop a work plan that outlines how to accomplish these goals. The CNY RPDB will prepare an annual update to track progress on implementation of the 9E Plan's recommendations and reporting on water quality metrics (see Sections 7.0).

- Continue to implement agricultural BMPs in cooperation with the SLWAP, the Soil and Water Conservation Districts, and the City of Syracuse. The BMPs modeled in Scenario 2 should be emphasized, including:
- Increased adoption of manure incorporation technology on corn silage fields,
- Increased implementation of cover crops, and
- Increased use of Precision Agriculture.
- Continue to implement other agricultural BMPs, including:
- Crop residue mulching.
- Develop and implement AEM Tier 3A Plans for crop farmers and Nutrient Management Plans (NMPs) for livestock operations.
- Seek opportunities for adding filter strips adjacent to riparian corridors, with the goal of adding 3.5 acres of buffer annually.

- Seek out opportunities for tree planting in the Skaneateles Watershed, particularly along the lake's shoreline and in riparian corridors (for example by promoting NYSDEC's 'Buffer in a Bag' program).
- Continue to advertise and implement the Environmental Facilities Corporation's Septic System Replacement Program, which can help to offset the costs of replacing aging and outdated septic systems. Note that, as of 2024, this program has been expanded in Cayuga County to include septic systems near tributaries to Skaneateles Lake.
- Implement 5,000 feet of streambank stabilization projects, including projects on Shotwell Brook and in the Winding Way subdivision.
- Continue to support the efforts of local land trusts to acquire lands in the watershed, particularly to create or protect natural buffers between development and surface waters. Conserve high value natural resources that provide resiliency to precipitation and flooding (such as steep slope forests, floodplains, wetlands, etc.) through the purchase of land and conservation easements.
- The CNY RPDB will apply for the DEC's 604(b) Water Quality Planning Grant funding to support project implementation activities.
- The CNY RPDB will compare the growth and land use cover projections in this 9E Plan to data on actual growth patterns over time, and assess the effects of growth on land use and land cover.
- Expand outreach and education of invasive species through initiatives, signage, and programs, including:
- Supporting and expanding the Boat Launch Stewards program.
- Expanding boat decontamination infrastructure for invasive species around the watershed
- Continuing surveillance for and treatment of Hemlock Woolly Adelgid (HWA) in highly erodible steep gullies.
- Continue to develop educational and outreach programs and materials to engage the community in water quality protection and improvement, including:
- Utilizing the 'skanlakeinfo.org' website as the central clearinghouse for information about Skaneateles Lake and its watershed (including adding information on the 9E process).
- Engaging watershed stakeholders across all groups and demographics in volunteer opportunities concerning water quality protection and improvement.
- Continue participation in the Lake Friendly Living Program.
- Develop educational materials specifically for owners of shoreline properties.
- Continue to work with residents in the watershed to

promote residential-scale BMPs, such as:

- Converting residential turf lawns to meadows dominated by native species with strong root systems.
- Promoting forest management education for residential property owners with forested acreage.
- Connecting discharges from downspouts, sump-pumps, and other sources to designated pervious areas to reduce runoff rates.
- Adopt practices and/or acquire equipment that can reduce the use and/or transport of road salt, such as live edge snowplow blade systems.

Mid-Term (5 – 10 years)

Assuming that progress has been made on the High Priority BMPs in the first five years of plan implementation, the mid-term period of implementation (5 to 10 years after plan completion) will see the deployment of Medium Priority BMPs.

It is expected that, with the benefit of five years of successful project development, implementation, and coordination, the 9E Implementation Team would have greater capacity to undertake more ambitious and complex efforts, such as working with public and private landowners to develop demonstration projects to educate the public on residential BMP implementation.

- Tributary monitoring: replicate the major and minor tributary modeling undertaken in 2018 and 2019 to provide a base of data for a second Skaneateles 9E Plan.
- Implement 5,000 feet of streambank stabilization projects.
- Invest in projects to increase upland stormwater retention through the implementation of water storage BMPs (retention basins, wetlands, etc.).
- Seek opportunities for adding filter strips adjacent to riparian corridors, with the goal of adding 3.5 acres of buffer annually.
- Promote the use of green infrastructure practices to intercept stormwater prior to entering waterways.
- Expand invasive species monitoring by using education and outreach to new audiences:
 - Provide invasive species training to the people who are paid by the private marinas in the watershed to oversee marina operations (harbormasters), to ensure that they are able to provide guidance on invasive species to boaters on Skaneateles Lake
 - Encourage decontamination and inspection at various private access points, such as marinas and short-term rentals with boat launches.
- Expand general water quality education to reach new

audiences, and to provide property owners with concrete examples of how to implement BMPs:

- Provide training / educational materials for landscapers and other service providers in the watershed whose activities can affect water quality.
 - Utilize public land to develop demonstration BMPs / projects with interpretive signage (e.g., the rain garden in front of the City's Water Building).
 - Work with homeowners to develop a set of 'Model Homes' to demonstrate lake-friendly living practices.
 - Educate residents of the availability of no-cost residential soil testing services from Cornell Cooperative Extension and the Onondaga County SWCD. Soil tests can tell property owners what nutrients are in your soil and what they may or may not need to add (in the form of fertilizer) for successful plant growth.
 - Promote education and outreach to homeowners to encourage them to find ways to integrate stormwater management into their property management, through the use of rain gardens, biofilters, and ponds.
- Apply for grant funding and explore other funding sources to develop a pool of resources for residential BMPs.
 - Develop a program to encourage conservation and water quality improvement projects on private residential property, modeled on existing septic system replacement programs.
 - Use surveys and other tools to better understand impediments to residential BMP adoption, and ways to incentivize lake friendly living practices.
 - Prevent the potential for surface water and groundwater contamination by hazardous materials through community collection programs.
 - Work with municipal and State partners to evaluate and, as necessary, upgrade culverts and roadside ditches to reduce nutrient and other pollutant loading. This may include:
 - Develop a digital inventory of roadside drainage ditches to support future modeling and improvement efforts.
 - Reduce flow velocities and promote sedimentation within road ditches through installation of check dams and other facilities.
 - Conduct a culvert assessment (using the North Atlantic Aquatic Connectivity Protocol) and right-size culverts to avoid headcuts and provide aquatic connectivity. (Note that this has been completed for some parts of the watershed, and the Onondaga County SWCD includes a culvert assessment when its staff provide technical assistance at a location.)

Long-term (10 – 15 years)

Table 5.3 identified several Low Priority BMPs. While these measures may produce substantial water quality improvements, these are more complex and resource-intensive measures whose benefits will need to be weighed in relation to their costs. In some cases, it may be necessary to develop feasibility studies or other analyses for these Low Priority BMPs prior to making a determination to proceed with project implementation.

A re-evaluation of the lake and watershed will likely have been completed (or be in progress) within ten years of the start of implementation of this 9E Plan (see Section 7.3). The following long-term recommendations assume that the water quality targets in this plan continue to be met and the Implementation Team has the capacity to handle more challenging projects.

- Implement 5,000 feet of streambank stabilization projects.
- Seek opportunities for adding filter strips adjacent to riparian corridors, with the goal of adding 3.5 acres of buffer annually.
- Evaluate the feasibility of using anaerobic digesters in the Skaneateles Watershed to reduce nutrient loading and odors, and to produce renewable energy.
- Support measures to reduce the atmospheric deposition of nitrogen.
- Support research, testing, and adoption of pilot projects using enhanced phosphorus removal technologies in OWTS.
- Continue to work with municipal and State partners to improve the interface between public roads and major and minor tributaries to the lake:
 - Conduct an analysis on the possible benefits of adding cross-drains to roadside drainage, to distribute water volumes more evenly across the landscape, and of daylighting buried drainage pipes.
 - Where feasible, disconnect roadside ditches from waterways, without causing unintended consequences of new drainage patterns on downslope areas.
- Use voluntary buyouts on improved properties that see recurring flooding. Find or develop flexible funding sources that compensate owners for the full value of their property.

If it is not the case that water quality targets are being met, then developing a revised 9E Plan should become the top priority for helping to define a new set of recommendations for the watershed.

7. Monitoring Plan

7.1 Existing Data Sources

Several critical metrics of the lake and watershed’s health are already separately compiled and published as part of existing program reporting practices. Collectively, these data sources form an invaluable source of information on the status of the lake and watershed.

CSLAP

NYSDEC’s CSLAP program will be the primary monitoring strategy to evaluate progress on the 9E targets, since the targets relate to Skaneateles Lake as a whole. Starting in 2025, the CSLAP program will consist of water quality sampling at one site on Skaneateles Lake with samples taken monthly by volunteers from the SLA.

More information on CSLAP, including information on past reports for Skaneateles Lake and other lakes, is available at: <https://nysfola.org/cslap-report-search/>.

Other Data Sources

Other existing data sources include, but are not limited to:

- The skanlakeinfo.org website, which is the central clearinghouse for data on the lake and watershed (including several of the data sources listed below).
- The City of Syracuse’s annual Water Quality Report and Watershed Annual Report which include:
 - Lake levels, precipitation levels, and dam discharge volumes by month,
 - Water quality analysis results,
 - Number and duration of water intake closures,
 - Analyses of algae present in the lake’s water, by phylum and genus,
 - Water temperature,
 - Secchi depth,
 - Number of septic system failures,
 - Summary of reported and confirmed HABs events,
 - Onsite wastewater treatment inspection results,
 - Number of housing starts and building permits reviewed and issued in the watershed,
 - Number of erosion and sediment control plans reviewed,
 - Number and type of violations of the Watershed Rules and Regulations recorded,
 - Results of the annual Agricultural Pesticide and Fertilizer Use Survey,
 - HWA control activities, and
 - Watershed personnel trainings, certifications, and presentations
- The SLWAP annual report, which provides information

on agricultural BMPs implemented in the watershed, including acres in cover crops and buffer strips.

- Cornell Cooperative Extension’s Wave Reviews newsletter, which provides Skaneateles Lake residents with a summary and updates on important events, projects, and issues related to water quality in the Skaneateles Lake Watershed
- Annual reports and newsletters prepared by the Soil and Water Conservation Districts, County Health Departments, and County Planning Departments in the watershed.
- SLA’s annual report, special reports, and periodic website updates.
- Website updates / press releases from other not-for-profit organizations active in the watershed, including the Finger Lakes Land Trust, the Central New York Land Trust, the Nature Conservancy, and other organizations.

The CNY RPDB will track data in these sources and provide annual updates on noteworthy trends and data points to the 9E Implementation Team.

7.2 Public Input

Development of this 9E Plan has relied on public input through formal public meetings, as well as through the ideas and information provided by the members of the Watershed Advisory Committee. No formal public meetings are proposed during the plan implementation period, however the Implementation Team will continue to represent municipalities, residents, agricultural interests, the City of Syracuse, and other watershed stakeholders. Additionally, the CNY RPDB will continue to accept input on conditions in the lake and watershed by way of email at: skan9e@cnyrpdb.org.

7.3 Proposed Monitoring Activities

In addition to ongoing monitoring, the following monitoring activities will provide data that could be used to provide supplemental information on the 9E Plan’s water quality targets:

- Major tributary sampling every five years, using the methodology in Monitoring of Streamflow and Water Quality in the Four Largest Tributaries to Skaneateles Lake, prepared by UFI for the SLA in 2019.
- Major and minor tributary sampling every 10 years, using the methodology in Water quality and flow of ten tributaries to Skaneateles Lake, prepared by UFI for the

CNY RPDB in 2019.

- As needed, upstream and downstream water sampling will be done before and after BMP implementation on tributaries.

Additionally, SLA and SUNY ESF have been collaborating in recent years to expand the use of remote sensing technologies. In 2023, a team from ESF worked with the SLA to collect lake data concurrently from the SLA's research vessel ("The Bob"), from a drone, and from an orbiting satellite. This data can be used to calibrate and validate artificial intelligence tools that may one day make it possible to accurately monitor water quality using satellite data alone (for information on a similar study on Canandaigua Lake see: Khan, Salehi, Niroumand-Jaddi, & Mahdianpari, 2024).

7.4 Monitoring Schedule

Annual Activities

Annually, the 9E Implementation Team will use CSLAP data to update the three-year average of TP and chlorophyll-a. Also, the metrics in Section 6.2 will be summarized for that year.

Note that, given the 18-year residence time of water in Skaneateles Lake, in-lake water quality indicators would not be expected to reflect significant changes in the first ten years of 9E implementation.

Five-Year Review

In 2029, the Implementation Team will undertake major tributary sampling and compare the results to previous monitoring.

Ten-Year Review

In 2034, the Implementation Team will undertake major and minor tributary sampling. This data will serve as the basis for an updated 9E Plan. At this point, a review of the annual metrics will enable the team to answer questions about the 9E's effectiveness in preserving the lake's water quality, such as:

- How many of the recommendations in Tables 5.1 and 5.2 have been implemented?
- What do the 10-year trends in TP and chlorophyll-a indicate about trends in water quality?
- How have HAB occurrences changed? How have the other Key Metrics (Section 6.2) changed?
- To what degree have changes in rainfall and temperature altered the context for water quality planning in the watershed?
- Have prevention efforts been successful in preventing the spread of invasive species to Skaneateles Lake and

its watershed?

- Are BMPs that have been installed functioning as they were intended to? Are they being maintained?
- How have local plans and laws changed in the past 10 years?
- What remote sensing capabilities have been deployed to improve water quality monitoring?

Compiling the answers to these questions will provide the Implementation Team with a picture of both how the lake and watershed have changed over time, and how well the Implementation Team has adapted to these changes.

7.5 Adaptation Measures

As of the development of this plan, the outlook for Skaneateles Lake's water quality is extremely positive. There is no reason to anticipate that, with progress on implementing the recommendations in Section 5.0 along with the ongoing projects and programs in the watershed (see Section 2.17), TP and chlorophyll-a levels will see significant increases, particularly in the short-term. The metrics for assessing the effectiveness of this plan's implementation will be in-lake measures of TP and chlorophyll-a, collected through the CSLAP program, and based on a three-year rolling average. Because the lake has an 18-year water retention time, dramatic fluctuations in these metrics are extremely unlikely.

However, in the event that the three-year average for TP and/or chlorophyll-a significantly increases over time, this plan should adapt in the following ways:

- Review BMP implementation to determine if some recommendations are not being implemented. Identify the obstacles to BMP implementation, such as funding or program limitations, and work with the Implementation Team to develop alternative approaches to achieving the goals of these measures.
- Implement a tributary monitoring program outside of / in addition to the schedule outlined in Section 7.3, and compare the results with past monitoring.
 - Isolate the subwatersheds that are seeing increases in TP levels, compared to past measurements.
 - Work with the Implementation Team to develop a suite of recommendations specific to the issues in those subwatersheds.
 - Continue monitoring tributaries in these subwatersheds.

8. Conclusion

Skaneateles Lake and its surrounding area is one of Upstate New York's most valuable assets. Aside from its importance as an unfiltered drinking water supply for Upstate's third largest city, Skaneateles Lake is a source of visual beauty, recreation, and provides habitat for fish and wildlife. It benefits from its unusual topography: a relatively small "bowl" of a watershed enclosing a long, deep lake. The result is a body of water that is fed by more than a hundred small streams. Between these topographical assets and the vigilance of the many stakeholders devoted to its protection, Skaneateles Lake has, by virtually any metric, exceptional water quality.

The purpose of the 9E Plan is to ensure that this continues to be the case going forward. Climate change, invasive species, and development pressure are constant threats to water bodies around the world, and Skaneateles Lake is no exception. The verification of a HAB outbreak in 2017 served as a reminder that even the best protected bodies of water are threatened by extreme conditions.

This 9E Plan lays out a target for nutrient loading – specifically, the limiting factor in the lake's ability to sustain algal growth: phosphorus levels. The long-term goal for the lake is to hold TP levels at their current level, as measured by three-year rolling averages. Additionally, chlorophyll-a levels will be tracked, with the goal being to prevent these levels from moving above their current average level. The 9E plan prescribes phosphorus-reducing BMPs and priority subwatershed areas to meet the plan's goals and objectives. Focusing specific BMPs to specific areas will also fulfill other important watershed priorities, such as management and reduction of watershed-based sediment and turbidity to the northern lake area.

The CNY RPDB, working with a 9E Implementation Team, will work toward the implementation of the recommendations in this plan. A wide variety of monitoring activities are already in place, and others will be added over time. This flow of information will create a feedback loop, indicating how 9E implementation is affecting the lake. Using an adaptive management plan approach, the Implementation Team will adjust the implementation strategy as needed.

Skaneateles Lake is blessed with a wealth of resources, not the least of which is a group of proactive, dedicated stakeholders. Working together, this group has the ability to, not only meet, but exceed the expectations laid out in this 9E Plan.

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APPENDICES

Appendix A – Quality Assurance Project Plan: Monitoring Skaneateles Lake Tributaries to Support Development of a Nine Element Plan

Appendix B – Quality Assurance Project Plan: A Water Quality Model for Skaneateles Lake

Appendix C – Quality Assurance Project Plan: Skaneateles Lake Watershed Modeling

Appendix D – Skaneateles Lake Watershed - Institutional Framework and Assessment of Local Laws, Programs, and Practices Affecting Water Quality

Appendix E – Public Participation Plan & Meeting Summaries

Appendix F – City of Syracuse Watershed Map (oversize)

Appendix G – A Water Quality Model For Skaneateles Lake, New York

Appendix H – Skaneateles Lake Watershed Modeling Report